Supplemental Watershed Plan No. 2 and Environmental Assessment for the Rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed

Albemarle County, Virginia
February 2023

PREPARED BY

USDA Natural Resources Conservation Service

IN COOPERATION WITH

Rivanna Water and Sewer Authority

Albemarle County Board of Supervisors

Thomas Jefferson Soil and Water Conservation District

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Supplemental Watershed Plan & Environmental Assessment for the Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed Albemarle County, Virginia

Prepared By:
U.S. Department of Agriculture, Natural Resources Conservation Service

In Cooperation With:
Rivanna Water & Sewer Authority
Albemarle County Board of Supervisors
Thomas Jefferson Soil and Water Conservation District

AUTHORITY

The original watershed work plan was prepared, and the works of improvement were installed, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of the Beaver Creek Watershed Multiple-Purpose Structure No. 1 is authorized by Section 14 of Public Law 83-566 as enacted by Section 313 or Public Law 106-472, otherwise known as "The Small Watershed Rehabilitation Amendments of 2000."

ABSTRACT

The purpose of Beaver Creek Watershed Multiple-Purpose Structure No. 1 (Beaver Creek 1) is flood control and municipal and industrial (M&I) water supply for the community of Crozet, Virginia. There is a need to rehabilitate the dam to continue meeting both project purposes. Water withdrawal from the reservoir is currently limited to 1 million gallons per day (mgd) by the Virginia Department of Environmental Quality (DEQ) because the Sponsors do not currently hold a Virginia Water Protection permit. This limitation on the withdrawal capacity creates an immediate need for action based on Maximum Daily Demand (MDD) projections presented in the Crozet Drinking Water Infrastructure Plan (DWIP, 2019). The DWIP indicates that MDD will exceed 1 mgd by 2025. Additionally, Beaver Creek 1 does not meet current Virginia Department of Conservation and Recreation (DCR) or Natural Resources Conservation Service (NRCS) dam safety requirements for high hazard potential dams. As such, the structure cannot safely store and/or pass runoff resulting from the design storm event which increases the dam and auxiliary spillway's susceptibility to failure during the Probable Maximum Flood (PMF). A breach resulting from failure of the dam or spillway poses a threat to downstream life and property. The preferred alternative involves the design and construction of a new raw water pumping station, a new reinforced-concrete labyrinth and chute spillway, and other associated appurtenant structures and modifications to the embankment. The project installation cost is estimated to be **$42,822,227**, of which **$18,365,750** will be paid from the PL-566 funds and **$24,456,477** from local funds.

COMMENTS AND INQUIRIES

For further information, please contact: Edwin Martinez Martinez, Ph.D., State Conservationist USDA - Natural Resources Conservation Service, 1606 Santa Rosa Road, Richmond, Virginia 23229, Phone: (804) 287-1691.

Non-Discrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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BEAVER CREEK WATERSHED AGREEMENT

Supplemental Watershed Plan Agreement
(Supplement No. 2)

Between the

Rivanna Water and Sewer Authority
Albemarle County Board of Supervisors
Thomas Jefferson Soil and Water Conservation District
(Referred to herein as "Sponsors" or "Sponsoring Local Organizations" or "SLOs")

and the

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Formerly the Soil Conservation Service (SCS)
(Referred to herein as NRCS)

Whereas, the original Watershed Plan Agreement for the Beaver Creek Watershed, Commonwealth of Virginia, executed by the Sponsors named therein and NRCS, became effective on August 31, 1960; and

Whereas, the Watershed Plan was amended by a Supplemental Watershed Plan Agreement executed by the Sponsors and NRCS and became effective in June 1963; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for works of improvement for Structure No. 1 in the Beaver Creek Watershed, Commonwealth of Virginia, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012); and

Whereas, there has been developed through the cooperative efforts of the Sponsors and NRCS a Watershed Work Plan No. 2 – Environmental Assessment for works of improvement for the restructuring of Structure No. 1, Beaver Creek Watershed, Commonwealth of Virginia, hereinafter referred to as the Plan-EA or plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsors hereby agree on this watershed project plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this plan and including the following:

1. **Term.** The term of this agreement is for the installation period and evaluated life of the project (50 years following completion of construction) and does not commit NRCS to assistance of any kind beyond the end of the evaluated life.

2. **Costs.** The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto will be the actual costs incurred in the installation of works of improvement.

3. **Real property.** The sponsors will acquire such real property as will be needed in connection with the works of improvement. The amounts and percentages of the real property acquisition costs to be borne by the Sponsors and NRCS are as shown in the cost-share table in Section 5 hereof. The sponsors agree that all land acquired for measures, other than land treatment practices, with financial or credit assistance under this agreement will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the operation and maintenance agreement.

4. **Uniform Relocation Assistance and Real Property Acquisition Policies Act.** The sponsors hereby agree to comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. Section 4601 et seq. as further implemented through regulations in 49 CFR Part 24 and 7 CFR Part 21) when acquiring real property interests for this federally assisted project. If the sponsors are legally unable to comply with the real property acquisition requirements, they agree that, before any Federal financial assistance is furnished, they will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance.

5. **Cost-share for Watershed Project Plans.** The following table will be used to show cost-share percentages and amounts for Watershed Project Plan implementation.

Works of Improvement	**NRCS**		**Sponsors**		**Total**
	Percent	Cost	Percent	Cost	Cost
Cost-Sharable Items [1/]					
Construction: Multiple-Purpose Structure No. 1 (Flood Control)[2/]	100%	17,590,750	0%	$0	$17,590,750
Sponsor Planning Costs [4/]	0%	$0	100%	$445,602	$445,602
Subtotal - Cost Sharable Items – Flood Control		**$17,590,750**		**$445,602**	**$18,036,352**
Construction: Multiple Purpose Structure No. 1 (M&I)[3/]	0%	$0	100%	$17,850,000	$17,850,000
Subtotal - Cost Sharable Items - M&I		**$0**		**$17,850,000**	**$17,850,000**
Subtotal – Cost Sharable Items	**49.0%**	**$17,590,750**	**51.0%**	**$18,295,602**	**$35,886,352**
Non Cost-Sharable Items[6/]					
Sponsor Engineering Costs[5/]	0%	$0	100%	$2,430,000	$2,430,000
Property Acquisition[7/]	0%	$0	100%	$125,000	$125,000
NRCS Technical Assistance/Engineering[8/]	100%	$750,000	0%	$0	$750,000
Project Adminstration[9/]	NA	$25,000	NA	$50,000	$75,000
Real Property Rights[10/]	0%	$0	100%	$3,151,875	$3,151,875
Permits	0%	$0	100%	$404,000	$404,000
Subtotal: Non Cost-Sharable Items	11%	$775,000	89%	$6,160,875	$6,935,875
TOTAL:	**43%**	**$18,365,750**	**57%**	**$24,456,477**	**$42,822,227**

Works of Improvement	NRCS		Sponsors		Total
	Percent	Cost	Percent	Cost	Cost

1/ Price Base: 2022

2/ Includes rehabilitation of the dam and spillway to meet requirements for high hazard potential dams.

3/ Includes costs associated with the construction of new raw water pump station and withdrawal infrastructure.

4/ Includes costs incurred by the Sponsors prior to NRCS and Sponsor agreement, July 29, 2020.

5/ Includes engineering for raw water pump station, temporary detour route, and new spillway bridge.

6/ If actual costs incurred are greater than shown here, each party shall bear the responsibility for their costs.

7/ Includes purchase of 2.5 acres of private property for spillway rehabilitation. Assumed purchase price of $50,000 per acre.

8/ Includes engineering costs associated with the design of the new spillway structure and dam safety related measures.

9/ Includes costs associated with contract administration.

10/ Includes construction of temporary on-site detour route, permanent vehicular bridge to span spillway, relocation of power pole.

6. **Land Treatment Agreements.** The sponsors will acquire, with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the sponsors' share of the works of improvement cost. In no case will the amount of an in-kind contribution exceed the sponsors' share of the cost for the works of improvement. The maximum cost eligible for in-kind credit is the same as that for cost sharing.
7. **Floodplain Management.** Before construction of any project for flood prevention, the sponsors must agree to participate in and comply with applicable Federal floodplain management and flood insurance programs.
8. **Water and mineral rights.** The sponsors will acquire or provide assurance that landowners or resource users have acquired such water, mineral, or other natural resources rights pursuant to State law as may be needed in the installation and operation of the works of improvement. Any costs incurred must be borne by the sponsors and these costs are not eligible as part of the sponsors' cost-share.
9. **Permits.** The sponsors will obtain and bear the cost for all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement. These costs are not eligible as part of the sponsors' cost-share.
10. **NRCS assistance.** This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.
11. **Additional agreements**. A separate agreement will be entered into between NRCS and the sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
12. **Amendments.** This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the sponsors have failed to comply with the conditions of this agreement

or when the program funding or authority expires. In this case, NRCS must promptly notify the sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the sponsors or recoveries by NRCS must be in accordance with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the sponsors having specific responsibilities for the measure involved.

13. **Prohibitions.** No member of or delegate to Congress, or resident commissioner, may be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision may not be construed to extend to this agreement if made with a corporation for its general benefit.

14. **Operation and Maintenance (O&M).** The sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with an O&M Agreement. An O&M agreement will be entered into before Federal funds are obligated and will continue for the project life (50 years). Although the sponsors' responsibility to the Federal Government for O&M ends when the O&M agreement expires upon completion of the evaluated life of measures covered by the agreement, the sponsors acknowledge that continued liabilities and responsibilities associated with works of improvement may exist beyond the evaluated life.

15. **Emergency Action Plan.** Prior to construction, the sponsors must prepare an Emergency Action Plan (EAP) for the dam where failure may cause loss of life or as required by state and local regulations. The EAP must meet the minimum content specified in the NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State agency dam safety requirements. The NRCS will determine that an EAP is prepared prior to the execution of fund obligating documents for construction of the structure. EAPs must be reviewed and updated by the sponsors annually.

16. **Nondiscrimination Provisions**. In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

    Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

    To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination

Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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By signing this agreement the recipient assures the Department of Agriculture that the program or activities provided for under this agreement will be conducted in compliance with all applicable Federal civil rights laws, rules, regulations, and policies.

17. **Certification Regarding Drug-Free Workplace Requirements** (7 CFR Part 3021). By signing this Watershed Agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled substance means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. Section 812) and as further defined by regulation (21 CFR Sections 1308.11 through 1308.15);

Conviction means a finding of guilt (including a plea of *nolo contendere*) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes;

Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees' payroll; or employees of subrecipients or subcontractors in covered workplaces).

Certification:

A. The sponsors certify that they will or will continue to provide a drug-free workplace by—

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition.

(2) Establishing an ongoing drug-free awareness program to inform employees about—

(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1).

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee must—

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

(5) Notifying the NRCS in writing, within 10 calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice must include the identification numbers of each affected grant.

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4) (b), with respect to any employee who is so convicted—

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6).

B. The sponsors may provide a list of the sites for the performance of work done in connection with a specific project or other agreement.

C. Agencies will keep the original of all disclosure reports in the official files of the agency.

18. Certification Regarding Lobbying (7 CFR Part 3018) (for projects > $100,000)

A. The sponsors certify to the best of their knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of

Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned must complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The sponsors must require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients must certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by U.S. Code, Title 31, Section 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

19. Certification Regarding Debarment, Suspension, and Other Responsibility Matters—Primary Covered Transactions (7 CFR Part 3017).

A. The sponsors certify to the best of their knowledge and belief, that they and their principals:
   (1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
   (2) Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
   (3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph A(2) of this certification; and
   (4) Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

B. Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant must attach an explanation to this agreement.

20. Clean Air and Water Certification.

A. The project sponsoring organizations signatory to this agreement certify as follows:

(1) Any facility to be utilized in the performance of this proposed agreement is not listed on the Environmental Protection Agency List of Violating Facilities.
(2) To promptly notify the NRCS-State administrative officer prior to the signing of this agreement by NRCS, of the receipt of any communication from the Director, Office of Federal Activities, U.S. Environmental Protection Agency, indicating that any facility which is proposed for use under this agreement is under consideration to be listed on the Environmental Protection Agency List of Violating Facilities.
(3) To include substantially this certification, including this subparagraph, in every nonexempt sub-agreement.

B. The project sponsoring organizations signatory to this agreement agrees as follows:
(1) To comply with all the requirements of section 114 of the Clean Air Act as amended (42 U.S.C. Section 7414) and section 308 of the Federal Water Pollution Control Act (33 U.S.C. Section 1318), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, issued there under before the signing of this agreement by NRCS.
(2) That no portion of the work required by this agreement will be performed in facilities listed on the EPA List of Violating Facilities on the date when this agreement was signed by NRCS unless and until the EPA eliminates the name of such facility or facilities from such listing.
(3) To use their best efforts to comply with clean air standards and clean water standards at the facilities in which the agreement is being performed.
(4) To insert the substance of the provisions of this clause in any nonexempt subagreement.

C. The terms used in this clause have the following meanings:
(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. Section 7401 et seq.).
(2) The term "Water Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et seq.).
(3) The term "clean air standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in section 110 of the Air Act (42 U.S.C. Section 7414) or an approved implementation procedure under section 112 of the Air Act (42 U.S.C. Section 7412).
(4) The term "clean water standards" means any enforceable limitation, control, condition, prohibition, standards, or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. Section 1342), or by a local government to assure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. Section 1317).
(5) The term "facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location or site of operations, owned, leased, or supervised by a sponsor, to be utilized in the performance of an agreement or subagreement. Where a location or site of operations contains or includes more than one building,

plant, installation, or structure, the entire location will be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

21. **Assurances and Compliance.** As a condition of the grant or cooperative agreement, the sponsors assures and certifies that it is in compliance with and will comply in the course of the agreement with all applicable laws, regulations, Executive orders and other generally applicable requirements, including those set out below which are hereby incorporated in this agreement by reference, and such other statutory provisions as are specifically set forth herein.

    State, Local, and Tribal Governments: OMB Circular Nos. A-87, A-102, A-129, and A-133; and 7 CFR Parts 3015, 3016, 3017, 3018, 3021, and 3052.

    Nonprofit Organizations, Hospitals, Institutions of Higher Learning: OMB Circular Nos. A-110, A-122, A-129, and A-133; and 7 CFR Parts 3015, 3017, 3018, 3019, 3021 and 3052.

22. **Examination of Records.** The sponsors must give the NRCS or the Comptroller General, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to this agreement, and retain all records related to this agreement for a period of three years after completion of the terms of this agreement in accordance with the applicable OMB Circular.

23. **Signatures**

Rivanna Water and Sewer Authority
695 Moores Creek Lane
Charlottesville, Virginia 22902

By: _____

Title: _____

Date: _____

The signing of this supplemental watershed agreement was authorized by the governing body of the Rivanna Water and Sewer Authority at a meeting held on _____.

_____
Administrative Secretary or Notary

Rivanna Water and Sewer Authority
695 Moores Creek Lane
Charlottesville, Virginia 22902

Date: _____

Albemarle County Board of Supervisors
401 McIntire Road
Charlottesville, Virginia 22902

By: _____

Title: _____

Date: _____

The signing of this supplemental watershed agreement was authorized by the governing body of the Albemarle County Service Authority at a meeting held on _____.

_____
Administrative Secretary or Notary

Albemarle County Board of Supervisors
401 McIntire Road
Charlottesville, Virginia 22902

Date: _____

Thomas Jefferson Soil & Water Conservation District
705 Dale Ave
Charlottesville, Virginia 22903

By: _____

Title: _____

Date: _____

The signing of this supplemental watershed agreement was authorized by the governing body of the Thomas Jefferson Soil & Water Conservation District at a meeting held on _____.

_____
Administrative Secretary or Notary

Thomas Jefferson Soil & Water
Conservation District
705 Dale Ave
Charlottesville, Virginia 22903

Date: _____

USDA, Natural Resources Conservation Service

Approved by:

_____ Date: _____

Edwin Martinez Martinez, Ph.D., State Conservationist
Virginia

TABLE OF CONTENTS

LIST OF FIGURES

TABLES

COST TABLES

LIST OF APPENDICES

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SUMMARY (OFFICE OF MANAGEMENT AND BUDGET FACT SHEET)

SUPPLEMENTAL WATERSHED PLAN & ENVIRONMENTAL ASSESSMENT
for the
Multiple-Purpose Structure No. 1
of The Beaver Creek Watershed
(A.K.A. Charles Mercer Garnett Senior Dam)
Albemarle County, Virginia
5th Congressional District

Prepared By: U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

Authorization: The original watershed work plan was prepared, and the works of improvement were installed, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of Beaver Creek 1 is authorized under Public Law 83-566 as amended.

Sponsors: Rivanna Water and Sewer Authority, Albemarle County Board of Supervisors, Thomas Jefferson Soil and Water Conservation District.

Proposed Action: Upgrade and relocate raw water pump station, structural rehabilitation of dam and spillway to high hazard potential standards.

Purpose and Need for Action: The authorized purposes of Beaver Creek 1 are flood control and municipal and industrial (M&I) water supply. The need for action is to meet current community water supply needs and to bring the dam and spillway into compliance with NRCS and State dam safety standards for its current high hazard potential classification.

Description of the Preferred Alternative: The preferred alternative will involve the construction of a new raw water pump station, structural spillway over the embankment and other modifications to the earthen embankment. A temporary on-site detour route during construction will be established. The raw water pump station will be located approximately 500 feet upstream of Beaver Creek 1 dam on the western shoreline. The installation of a new pump station facility and associated improvements will address compliance issues with Virginia Department of Environmental Quality (DEQ) in order to obtain a Virginia Water Protection (VWP) Program Permit to increase allowable withdrawals beyond that required to produce 1.0 mgd of treated water from the Crozet Water Treatment Plant. The dam and spillway will be rehabilitated to comply with NRCS and Virginia requirements for high hazard potential dams. The proposed spillway is a reinforced-concrete labyrinth weir and chute spillway over the existing embankment. Other works of rehabilitation are included such as the construction of a new graded-aggregate filter drain at the toe of the dam and improved stabilization of the existing principal spillway structure.

Resource Information:

Latitude & Longitude: 38.070904, -78.651513

12-Digit Hydrological Unit Number: 020802040102

Climate and Topography: Albemarle County is located primarily in the Piedmont Physiographic Province. The average temperature is 37 degrees F in the winter and 77 degrees F in the summer. The last frost of spring normally occurs in the middle-to-late April and the first frost in the fall occurs in mid-to-late October. This provides a growing season of approximately 205 days. The average annual precipitation is about 44.4 inches. This precipitation is fairly well distributed through the year with slightly larger amounts occurring in the months of January through August. The average total snowfall is 14.4 inches.

Watershed	Size (acres)
Beaver Creek	7010
Beaver Creek Multiple purpose Structure No. 1	6110

Land Use	Land Area (acres)	Percentage of Watershed
Cropland	280.34	4.5%
Impervious	180.96	3.0%
Open Space	466.62	7.6%
Pasture	1522.77	24.9%
Shrub/Scrub	13.07	0.3%
Water	149.17	2.4%
Woods	3497.08	57.3%

	Private Land Ownership (ac)	Public Land Ownership (ac)
Upstream of Dam	23	209
Downstream of Dam	1,697	547

Upstream ownership is based on elevation 564 feet, which is the approximate full PMP flood pool based on existing conditions. Downstream ownership is based on 12-hour, full PMF breach modeling inundation limits by Schnabel Engineering, 2011.

Population and Demographics: The population of Albemarle County was most recently estimated at approximately 109,330 (U.S. Census Bureau 2019). The County is predominantly white (81.8%) and Black (9.7%). All other racial groups individually were 8.5% of the total population or less. The Census Block Groups containing Beaver Creek 1 and its drainage are also predominately white (92+%), with proportionately fewer minorities than the remainder of the county or state.

Median household incomes, average age, and educational levels are all higher in the Census Block Groups containing the project area than compared to the remainder of the county and state.

Ecosystem Services Scoping Summary

Ecosystem Services Item	Relevant to the Proposed Action		Rationale
	Yes	No	
Provisioning (tangible goods provided for direct human use and consumption)			
Food	X		Provides flood protection for approximately 36 acres of downstream cropland and provides water supply for local dairy farm.
Fiber		X	Not applicable to this project, no fiber production is present.
Water	X		Project is crucial to municipal and industrial raw water supply for the Community of Crozet.
Timber		X	Not applicable to this project. No active timbering projects are present, tree clearing will be minimized.
Biomass		X	Not applicable to this project.
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)			
Flood and Disease Control	X		Provides flood control for downstream life and property. Rehabilitation will reduce risk of dam failure during design storm event.
Water Filtration		X	Not applicable to this project.
Climate Stabilization		X	Not applicable to this project.
Crop Pollination		X	Not applicable to this project.
Supporting (underlying processes maintaining conditions for life on Earth)			
Nutrient Cycling		X	Not applicable to this project.
Soil Formation		X	Not applicable to this project.
Primary Production	X		Maintain crop and pasture production by maintaining flood control benefits and providing water to local businesses and farms.
Cultural (make the world a place in which people want to live)			
Recreational Experiences	X		Albemarle County Park space is present at the site. Beaver Creek Sculling club and Western Albemarle High School Rowing Team use lake regularly, lake provides fishing, boating, picnicking, as well as scenic views to local users and tourists. Recreational areas are a value to the sponsors and community.
Spiritual		X	Not applicable to this project. No spiritual values were expressed by stakeholders during scoping.
Aesthetic Viewsheds	X		Albemarle County park space is used by locals and recreationists because of the aesthetic view of the lake and view of Blue Ridge Mountains from the reservoir.
Tribal Values		X	The Tribal response received during early scoping expressed interest only in the case of an inadvertent discovery of remains. No other interest in the site was expressed by the Tribes during scoping.

Typical Concerns Identified Through Scoping

Item/Concern	Relevant to the Proposed Action		Rationale
	Yes	No	
SOILS			
Upland Erosion		X	No watershed problems associated with upland erosion have been identified through scoping. Sediment yield in the reservoir is less than what was projected by original plan.
Stream Bank Erosion	X		Project is in the vicinity of streambanks.
Sedimentation		X	Temporary effects during construction will be mitigated by erosion and sediment control measures; long-term sedimentation is accounted for in the reservoir design. Watershed is almost entirely outside of the Crozet development area, so extensive development in the watershed is not anticipated.
Prime and Unique Farmland and Farmland of Statewide Importance	X		There are 7.1 acres of designated Prime and Unique Farmland and 1.4 acre of designated Farmland of Statewide Importance located within the area of potential effect for all action alternatives. There are approximately 36 acres of farmland downstream of the dam that enjoy flood protection from the existing structure.
WATER			
Surface Water Quality	X		Project is a water supply reservoir.
Surface Water Quantity	X		Project is a water supply reservoir.
Ground Water Quantity		X	Ground water quantity is not relevant to the project.
Clean Water Act	X		A permit under Sections 401 and 404 of the Clean Water Act will be required due to impacts to streams, open water and wetlands.
Coastal Zone Management Areas		X	No coastal zones are present within proximity of project.
Regional Water Management Plans	X		The reservoir serves as the sole municipal and industrial water supply for the Community of Crozet. The Crozet Drinking Water Infrastructure Plan (DWIP 2019) identified increased permitted withdrawals as the preferred alternative to meet current maximum daily demand shortfalls as well as future average daily demand shortfalls.
Floodplain Management	X		Project provides flood control for downstream properties. Flood benefits will be evaluated. Revised floodplain mapping may be required.
Sole Source Aquifers		X	Not applicable to this project, since no sole source aquifers were identified in the vicinity of the project per Sole Source Aquifer maps available through the EPA.
Streams, Lakes, and Wetlands	X		There are streams, lakes and wetlands present at the project site and within the vicinity of the project.
Wild & Scenic Rivers		X	None are located in the vicinity of the project.
AIR			
Air Quality	X		Project is part of Albemarle County park space and provides scenic views. Air quality to be considered during construction. Local permits may be required for M&I upgrades.
Clean Air Act		X	No permits are required under the Clean Air Act.
PLANTS			
Endangered and Threatened Species		X	No threatened or endangered plant species were reported or observed in the project area.
Forest Resources		X	Minor tree clearing is anticipated for all structural alternatives. No significant impacts to forest resources are anticipated.
Invasive Species	X		Invasive plant species were identified in the project area.

Item/Concern	Relevant to the Proposed Action		Rationale
	Yes	No	
Natural Areas	X		There are natural areas present at the project site.
Riparian Areas	X		There are riparian areas in the vicinity of the project.
ANIMALS			
Fish and Wildlife Resources	X		There are fish and wildlife present in the vicinity of the project.
Coral Reefs		X	No coral reefs exist within proximity of project.
Endangered and Threatened Species	X		Listed species may reside in the general project area.
Essential Fish Habitat		X	None are present in the vicinity of the project.
Invasive Species		X	No invasive animal species were identified in the project area.
Migratory Birds/Bald Eagles	X		Potential nesting and foraging habitat for bald eagles exists in the project area.
HUMANS			
Cost, Sponsor	X		Sponsors have been proactive in securing project funds.
Public Benefits	X		The project provides a source of public drinking water supply, flood protection, and recreation.
Cultural Resources		X	No findings of historical significance.
Drought	X		The project provides community drinking water supply.
Environmental Justice and Civil Rights		X	No environmental justice communities were identified in the project area, nor were any Civil Rights issues or disproportionate treatment concerns identified.
Flood Damages	X		Project provides flood control benefits to downstream property. Flood protection benefits will be re-evaluated.
Historic Properties		X	After detailed studies, no sites within the project area are recommended for listing on the National Register of Historic Places.
Land Use		X	No major land use change in the watershed will result from this project. The Crozet Master Plan does not indicate appreciable development in portions of the watershed that are within the Crozet Development Area. No significant development in the rural ring is anticipated.
Local and Regional Economy	X		Browns Gap Turnpike traverses the existing dam and spillway and provides a vital thoroughfare for local residents. The project provides water supply to local businesses.
Park Lands	X		The project is part of the Albemarle County park system. There are no federal park lands in the vicinity of the reservoir.
Potable Water Supply	X		The project provides water supply to the Community of Crozet.
Public Health and Safety	X		The project does not currently meet safety standards for high hazard potential dams. The project provides a crucial source of municipal water supply to the Community of Crozet.
Recreation	X		Public and private recreation activities, including rowing and sculling club, hiking and picnicking, occur in the project area.
Scenic Areas	X		Project provides scenic and aesthetic viewscapes of the Blue Ridge Mountains and the reservoir itself for visitors and recreationists.
Scientific Resources		X	None were identified through scoping.
Significant Scientific Features		X	None were identified through scoping.
Social/Cultural Issues	X		Public meeting attendees concerned with adverse environmental impacts to natural areas and impacts to access to recreational opportunities at the project site. Public also expressed concerns with any closures of Browns Gap turnpike and preferred that planning considered an on-site detour route.

Alternative Plans Considered: The following plans were considered:

No-Action / Future Without Federal Investment (FWOFI): The FWOFI alternative represents a true no-action alternative by the sponsors. If the Sponsors continue to operate the structure as-is, the M&I infrastructure would continue to be limited to an approximate 1.1 mgd withdrawal capacity needed to provide 1.0 mgd of treated water based on not having a VWP Program Permit from DEQ, creating immediate shortfalls based on the maximum daily demand projections presented in the DWIP. Additionally, by 2040, the project will no longer be capable of meeting the average daily demand as that value eclipses the 1.0 mgd limit. The existing pump station infrastructure would remain unable to access the 7.5 percent of raw water supply below the lowest gate invert, resulting in the inability to maintain a safe yield as demand increases and reducing drought resiliency. The current release system and M&I infrastructure limit the Sponsors with inaccurate measurement of flows and lack of remote control of the gate system, thus resulting in wasted water and excessive downstream releases. The dam and spillway do not meet current requirements for high hazard potential dams, and as such pose a threat to downstream life and property if a significant hydrologic event occurs. Aside from inadequate capacity to safely store and/or pass runoff from the design storm event, the existing vegetated auxiliary spillway does not have the required erosion resistance and integrity and could experience significant damage or failure and breach in a storm event less severe than the design storm event. This alternative is required by the NEPA / PR&G process and will serve as the baseline for comparison with the action alternatives.

Decommissioning: Beaver Creek 1 could be decommissioned to remove the potential for a breach and uncontrolled release of the reservoir. However, this would only exacerbate the current water supply issues facing the Community of Crozet. A new source of raw water supply would be required, as well as the infrastructure to convey the raw water to the Crozet Water Treatment Plant. The flood protection benefits provided by the structure would no longer be available to downstream properties, so additional flood-proofing of downstream structures (roads, houses) would also be required. Downstream farmland would be at risk for increased flooding as well. Decommissioning would eliminate the need for rehabilitation, but would not meet the project purposes of municipal and industrial water supply or flood protection without incorporating a separate water supply reservoir project. Although decommissioning must be considered as an alternative per NEPA requirements, implementing a new M&I water supply project to replace Beaver Creek 1 would result in exorbitant costs and extensive environmental impacts which are unnecessary. For these reasons, decommissioning was removed from detailed study.

Alternative 1 - Rehabilitate dam, construct structural spillway over embankment, construct upgraded pump station at Site 1: This alternative consists of structural measures to upgrade the M&I water supply infrastructure, dam and spillway to meet the stated purposes of the project. An upgraded raw water pump station will be constructed approximately 500 feet upstream of the existing dam on the southern shoreline. In addition to the conflicts posed by the pump station, principal spillway conduit and minimum instream flow (MIF) interaction, the existing pump station interferes with the proposed structural spillway and will require relocation. Upgrades will be made to the principal spillway controls to satisfy minimum in-stream release requirements and

obtain a Virginia DEQ, Virginia Water Protection (VWP) permit. Obtaining the VWP permit from DEQ will allow for greater allowed withdrawal capacity. The additional permitted withdrawal capacity will allow for the intake structure and pump station to withdraw enough water to meet current maximum daily demand, which will exceed 1.0 mgd before 2025. The inadequate spillway capacity will be addressed by constructing a labyrinth-crested chute spillway over the existing embankment. Other modifications to the dam will be performed including rehabilitation of the internal filter drain system and stabilization of the riser to bring the structure into compliance with dam safety standards for high hazard potential dams. The former vegetated auxiliary spillway will be abandoned and backfilled to a uniform grade and maintained as Albemarle County park space.

Alternative 2 - Rehabilitate dam, construct structural spillway in left abutment, construct upgraded pump station near current location: This alternative consists of structural measures to upgrade the M&I water supply infrastructure, dam and spillway to meet the stated purposes of the project. An upgraded pump station will be reconstructed adjacent to the location of the existing infrastructure at the toe of the dam to decouple the pumping infrastructure from the principal spillway conduit. A new intake and suction line will be required to convey water from the reservoir to the new pump station. The new infrastructure will result in a system that can satisfy minimum instream flow (MIF) requirements and also obtain a Virginia DEQ, Virginia Water Protection (VWP) permit. Obtaining a VWP permit from DEQ will allow for greater allowed withdrawal capacity. The additional capacity will allow for the structure to meet the current maximum daily demand, which will exceed 1.0 mgd before 2025. A new access road will be required in the right abutment to access the pump station at the toe of the dam. The inadequate spillway capacity will be addressed by constructing a labyrinth-crested chute spillway in the left abutment of the dam. Other modifications to the dam will be performed including rehabilitation of the internal filter drain system and stabilization of the riser to bring the structure into compliance with dam safety standards for high hazard potential dams. The former vegetated auxiliary spillway will be abandoned and backfilled to a uniform grade and maintained as Albemarle County park space.

Non-Structural Alternatives: Consideration was given to using non-structural alternatives to meet the project purpose and need. However, based on the M&I water supply purpose of the reservoir, these alternatives could not effectively meet the purpose and need for the project. To obtain the permit from DEQ to increase withdrawals from the reservoir, structural modifications to the existing M&I infrastructure are required. The project will remain high hazard based on the M&I water supply aspect of the project, regardless of any floodproofing measures, removal of downstream hazards, or other non-structural measures used to remove or protect downstream flood hazards. Demanding conservation of the residents will not be enough to overcome the M&I water supply shortfalls that face the community. Because non-structural alternatives cannot meet the purpose and need for the project and the objectives of the sponsors, they were removed from detailed study.

Locally Preferred Alternative/Sponsors Alternative: The locally preferred/Sponsors alternative is the same or involves the same components as Alternative 1. The preferred alternative maximizes public benefits, results in a benefit/cost ratio of 0.39:1.0, and is the project alternative preferred by the Sponsors.

Works of Improvement	NRCS		Sponsors		Total
	Percent	Cost	Percent	Cost	Cost
Cost-Sharable Items [1/]					
Construction: Multiple-Purpose Structure No. 1 (Flood Control)[2/]	100%	17,590,750	0%	$0	$17,590,750
Sponsor Planning Costs [4/]	0%	$0	100%	$445,602	$445,602
Subtotal - Cost Sharable Items – Flood Control		**$17,590,750**		**$445,602**	**$18,036,352**
Construction: Multiple Purpose Structure No. 1 (M&I)[3/]	0%	$0	100%	$17,850,000	$17,850,000
Subtotal - Cost Sharable Items - M&I		**$0**		**$17,850,000**	**$17,850,000**
Subtotal – Cost Sharable Items	**49.0%**	**$17,590,750**	**51.0%**	**$18,295,602**	**$35,886,352**
Non Cost-Sharable Items[6/]					
Sponsor Engineering Costs[5/]	0%	$0	100%	$2,430,000	$2,430,000
Property Acquisition[7/]	0%	$0	100%	$125,000	$125,000
NRCS Technical Assistance/Engineering[8/]	100%	$750,000	0%	$0	$750,000
Project Adminstration[9/]	NA	$25,000	NA	$50,000	$75,000
Real Property Rights[10/]	0%	$0	100%	$3,151,875	$3,151,875
Permits	0%	$0	100%	$404,000	$404,000
Subtotal: Non Cost-Sharable Items	11%	$775,000	89%	$6,160,875	$6,935,875
TOTAL:	**43%**	**$18,365,750**	**57%**	**$24,456,477**	**$42,822,227**

1/ Price Base: 2022

2/ Includes rehabilitation of the dam and spillway to meet requirements for high hazard potential dams.

3/ Includes costs associated with the construction of new raw water pump station and withdrawal infrastructure.

4/ Includes costs incurred by the Sponsors prior to NRCS and Sponsor agreement, July 29, 2020.

5/ Includes engineering for raw water pump station, temporary detour route, and new spillway bridge.

6/ If actual costs incurred are greater than shown here, each party shall bear the responsibility for their costs.

7/ Includes purchase of 2.5 acres of private property for spillway rehabilitation. Assumed purchase price of $50,000 per acre.

8/ Includes engineering costs associated with the design of the new spillway structure and dam safety related measures.

9/ Includes costs associated with contract administration.

10/ Includes construction of temporary on-site detour route, permanent vehicular bridge to span spillway, relocation of power pole.

Project Benefits: The preferred alternative provides a total annual benefit of $730,958. The M&I Water Supply modifications will result in a current annualized benefit of $66,694 based on the immediate value of the raw water based on estimated days exceeding maximum daily withdrawal and the estimated shortfall resulting from the 1.0 mgd limitation for the unpermitted structure from completion of the project through 2040. Other beneficial effects of the proposed action include future annual benefits associated with the M&I water supply estimated as $664,405. The rehabilitation will benefit the population at risk downstream, as well as reduce the likelihood for service interruption to the M&I beneficiaries and commuters resulting from a breach or failure of the dam. The project provides flood protection benefits to approximately 36 acres of cropland adjacent to the waterway, primarily in hay and forage crops. The existing dam provides estimated annual flood protection benefits of $15,872; $2,360 from agriculture, $8,311 from avoided roadway damages, and $5,201 from avoided structure damage including 3 homes.

Number of Direct Beneficiaries: Municipal and Industrial Water Supply = 9,513 (as of 2019, per DWIP)

Flood Protection = 182 (based on PAR estimate with additional considerations for daily motorists on downstream roadways).

Total Direct Beneficiaries = 9,513 + 182 = 9,695

Other Beneficial Effects:

- Municipal and Industrial water supply upgrades will leverage the existing reservoir to meet current and future demands and avoid costs and impacts associated with establishing a new raw water supply source.
- Municipal and Industrial water supply upgrades to the pump station will result in a functional system that will be capable of obtaining a withdrawal permit from the Virginia Department of Environmental Quality.
- Rehabilitation will reduce risk and liability associated with the operation of a non-compliant high hazard potential dam and bring the dam and spillway into compliance with Virginia and NRCS requirements for high hazard potential dams.
- Rehabilitation will reduce the likelihood for loss of access by emergency service vehicles and commuters travelling on Browns Gap Turnpike as well as providing protection for an estimated 149 vehicles and their occupants daily who utilize the roads downstream of the dam.
- Rehabilitation will reduce the risk of damages to structures located within the subject dam's breach inundation zone, including 6 residences (based on 11 residences impacted by PMF with breach versus 5 impacted by PMF without breach), several outbuildings (sheds, barns, etc.), five stream crossings (bridges, culverts) and the existing pump station infrastructure itself.
- Rehabilitation reduces the likelihood of loss of access and loss of emergency services for downstream properties and property owners or those who need to traverse the dam and spillway via Browns Gap Turnpike.
- The project will continue to provide flood protection to several agricultural structures along Cow Path Lane, which would experience flooding during events with frequencies of 100 years or less if the dam were not in service.
- The project continues to provide flood damage reduction benefits to downstream roadways by avoiding inundation, damages, and subsequent repair costs to up to 1,270 feet of roadway during the two-year through 500-year storm events.
- Federal funds used for planning, design and construction represent "new money" into the area and a substantial positive economic impact to the region. As a result, the federal portion of the construction spending will be accompanied by indirect and induced economic multiplier effects.
- The project maintains the recreational value of Beaver Creek 1 by protecting the existing Albemarle County park space and boat launch structures.

- The project retains the existing aquatic and terrestrial habitat in and around the reservoir.
- The project maintains existing stream habitat downstream of the dam. A mussel survey was performed and no mussel specimens were found.

Annual Net Beneficial Effects (National Economic Development (NED) effects): $730,958

Annualized Costs: $1,364,954 for installation; $531,650 for O&M; $1,896,604 Total.

Benefit to Cost Ratio (current rate): 0.39 to 1.0

Funding Schedule: The most likely scenario is for the project to be implemented over five years including the design and construction.

Federal funds (PL-566):
Year 1 - $400,000 for engineering/technical assistance (rehab); $5,000 for project administration;
Year 2 - $350,000 for engineering services (flood control); $5,000 for project administration;
Year 3 - $2,000,000 for construction (flood control); $0 for construction (M&I); $5,000 for project administration;
Year 4 –$7,795,375 for construction (flood control); $5,000 for project administration;
Year 5 - $7,795,375 for construction (flood control); $5,000 for project administration.

Non-Federal Funds:
Year 1 - $1,500,000 for engineering (M&I); $10,000 for project administration;
Year 2 - $530,000 for engineering (M&I); $150,000 for engineering (flood control, detour); $250,000 for engineering (flood control, spillway bridge); $125,000 for property acquisition; $10,000 for project administration;
Year 3 - $0 for construction (flood control), $8,925,000 for construction (M&I);; $404,000 for permits; $500,000 for real property rights; $10,000 for project administration;
Year 4 – $0 for construction (flood control), $8,925,000 for construction (M&I); $2,000,000 for real property rights; $10,000 for project administration;
Year 5 - $0 for construction (flood control), $651,875 for real property rights; $10,000 for project administration.

Not Listed – Sponsor planning costs in the amount of $445,602 are not included in the funding schedule since those costs were incurred prior to the planning phase.

Period of Analysis: 55 years (includes 2 years for design and 3 years for construction)

Project Life: 50 years

Environmental Effects/Impacts of Preferred Alternative for the Proposed Action (EcoSystem Services):

Ecosystem Services Item	Impacts of Preferred Alternative
Provisioning (tangible goods provided for direct human use and consumption)	
Food	Provides flood protection for no less than 36 acres of downstream farmland depending on the frequency of the event as compared with the project with no dam. Minor impacts of up to 0.2 acre of prime and unique farmland are anticipated. Project will provide raw water and flood protection for Early Dawn Dairy farm located on Cow Path Lane.
Water	Project will result in Sponsors' ability to meet current and future demand for M&I water supply.
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)	
Flood and Disease Control	Provides flood control for downstream life and property. Rehabilitation will reduce risk of dam failure during the design storm event.
Supporting (underlying processes maintaining conditions for life on Earth)	
Primary Production	Maintain crop and pasture production by continuing to provide flood control benefits.
Cultural (make the world a place in which people want to live)	
Recreational Experiences	Access to the reservoir for recreation will be temporarily limited during construction; The project will preserve current recreational activity and park area at the site.
Aesthetic Viewsheds	Albemarle County park space is used by locals and tourists because of the aesthetic view of the lake and view of Blue Ridge Mountains from the reservoir. Project will maintain County park space.

Environmental Effects/Impacts of Preferred Alternative for the Proposed Action (Typical):

Typical Scoping Item/Concern	Impacts of Preferred Alternative
SOILS	
Stream Bank Erosion	Possible temporary effects during construction; will be mitigated with appropriate erosion and sediment control measures.
Prime and Unique Farmland and Farmland of Statewide Importance	Total impacts are 0.2 acre and 0.0 acre to prime and unique farmland and farmland of statewide importance currently used for agriculture, respectively. For all areas designated, regardless of current agricultural status, total impacts to Prime and Unique Farmland and Farmland of Statewide Importance, respectively are 2.8 acres and 0.9 acre of temporary impacts and 2.7 acres and 0.1 acre of permanent impacts.
WATER	
Surface Water Quality	Possible temporary impacts during construction. Effective in-reservoir turbidity curtain deployment and site-wide erosion and sediment control measures will limit temporary impacts. New pump station will provide an opportunity to draw water from preferable water

Typical Scoping Item/Concern	Impacts of Preferred Alternative
Surface Water Quality (Continued)	strata and new Hypolimnetic oxygenation (HLO) system will improve water quality by reducing likelihood for algae blooms.
Surface Water Quantity	Proposed project will temporarily reduce reservoir storage during construction when pool level is lowered by an estimated 10 feet. Surface Water quantity is sufficient to meet current maximum daily demand if a VWP permit is obtained. Project will provide access to 7.5% of the raw water volume that is currently inaccessible. Project will result in resolving the operational conflict between principal spillway conduit, pump station, and minimum instream flow (MIF) functionality, and will meet MIF requirements associated with VWP permit.
Clean Water Act	A permit under Sections 401 and 404 of the Clean Water Act will be required due to impacts to streams, open water and wetlands.
Regional Water Management Plans	The reservoir serves as the sole municipal and industrial water supply for the Community of Crozet. The Drinking Water Infrastructure Plan (DWIP) identified increased permitted withdrawals as the preferred alternative to meet current maximum daily demand shortfalls as well as future average daily demand shortfalls.
Floodplain Management	Continuation of project will maintain current downstream flood benefits through the 100-year storm. Minor changes to the 500-year floodplain may result from the proposed action. Project provides an opportunity to review and update flood maps. A CLOMR/LOMR should be applied for through FEMA during the design phase.
Streams, Lakes, and Wetlands	Minor temporary and permanent impacts to wetlands, open water, and streams are anticipated. In total, permanent impact to 240 feet of stream, 0.005 acre of wetland, and 0.05 acre of open water; and temporary impact to 75 feet of stream and 0.65 acre of open water will occur. Lake will be temporarily lowered by 10 feet during construction.
AIR	
Air Quality	Temporary effects will occur during construction. Permit will be required for the new emergency generator that will support the new pump station.
PLANTS	
Invasive Species	Invasive plant species were identified in the project area. Best management practices, such as removal and proper disposal of existing invasive species in project areas during construction, will be employed to prevent the spread of existing invasive species or introduction of invasive species. Project team will follow recommendations provided by USFS and guidance for Virginia through Forest*A*Syst program.
Natural Areas	Natural areas are part of the park space value, and disturbance to these natural areas will be minimized. There are no existing units of the Virginia Natural Area Preserves program in the project vicinity, so this program is not directly applicable to the project.
Riparian areas	Riparian areas will be temporarily and permanently impacted by the project. Disturbance from preferred spillway alternative will occur mostly in unforested riparian areas that were largely impacted by the original project and the former roadway alignment downstream.

Typical Scoping Item/Concern	Impacts of Preferred Alternative
ANIMALS	
Fish and wildlife resources	Temporary effects during construction (lowered lake elevation) for fish, aquatic organisms, and wildlife within aquatic and terrestrial portions of the project areas. Sponsor will lower the reservoir slowly to reduce potential impacts to aquatic life.
Threatened and Endangered Species	Three federally listed species, the James spinymussel, northern long-eared bat, and monarch butterfly may reside in the general project area. Protected species have not been found in the project area based on recent mussel surveys, review of Virginia DWR Winter Habitat and Roost Trees Mapper for northern long-eared bat, and habitat assessments for monarch butterfly. The proposed project is anticipated to have no effect on federally protected species.
Migratory birds/Bald eagles	Potential nesting and foraging habitat for bald eagles exists in the project area. An eagle survey was performed, and no eagles or nests were observed. A survey for bald eagles will be performed prior to construction activities commencing. If present, land disturbance activities will be limited to non-nesting periods.
HUMANS	
Public Benefits	Project will result in modifications necessary to obtain the DEQ VWP permit, which will increase the allowable potable water production to be above 1.0 mgd for M&I water supply purpose. Project will incorporate on-site detour during spillway construction to avoid temporary impacts to commuters and emergency vehicles. The detour will avoid estimated delay-related user costs of $866,970. The cost of the on-site detour is estimated to be $668,500, providing a benefit to cost ratio of 1.3. Project will be compliant with dam safety standards for high hazard potential structures; Project will continue to provide public park space and space for sculling/rowing clubs and other recreationists.
Drought	The project will result in the Sponsors' ability to meet projected safe yield requirements through 2075. Project will result in access to 7.5% of currently unusable raw water storage. Project will result in less wasted water associated with MIF by separating the principal spillway conduit and required MIF infrastructure from the pump station infrastructure.
Flood Damages	Project will result in minor reduction of flood damage benefits for the average of 200 and 500-year, 24-hour storm events. However, downstream population at risk will be better protected by rehabilitation of the dam and spillway, reducing likelihood of failure during the design storm event better protecting human life.
Local and Regional Economy	Temporary positive effect for local and regional construction companies and area businesses. Municipal and industrial water supply is critical to sustaining the local and regional economy as it supports industry. Browns Gap Turnpike traverses the existing dam and spillway and provides a vital thoroughfare for local residents. Proposed rehabilitation will result in less likelihood of travel being impeded by flooding. A temporary on-site detour for SR-680/Browns Gap Turnpike will be implemented during construction to maintain existing route to reduce impacts associated with a long detour route. The on-site detour route provides a positive benefit (see Public Benefits).
Park Lands	The existing vegetated auxiliary spillway channel and areas in the left abutment are used as County park space. There are a total of approximately 2 acres of open park space on-site that will be preserved by this action; 1.6 acres in the vegetated auxiliary spillway, and

Typical Scoping Item/Concern	Impacts of Preferred Alternative
Park Lands (Continued)	approximately 0.4 acre in the parking area in the left abutment. There are no federal park lands in the vicinity of the reservoir.
Potable Water Supply	One of the authorized purposes of the project is municipal and industrial (M&I) water supply. The project will result in adequate M&I water supply to meet immediate maximum daily demand shortfalls by obtaining a VWP permit to increase the allowed withdrawals from the reservoir. The infrastructure will be better protected by being removed as a hazard of the dam. Water quality will be improved by implementing hypolimnetic oxygenation system, which will reduce the likelihood for algal blooms. The project will result in the sponsors' ability to draw water from more desirable strata.
Public Health and Safety	Rehabilitation will bring the dam and spillway into compliance with NRCS and Virginia requirements for high hazard potential dams. The on-site detour route will allow access for emergency service vehicles during construction. Project will improve resiliency of raw water pump station infrastructure and M&I system.
Recreation	The 2 acres of Albemarle County park space present in the existing auxiliary spillway channel and the parking area located in the left abutment will be preserved. Project sponsors will continue to provide access to student athletes for rowing and sculling during construction.
Scenic Areas	Albemarle County park space is used by locals and tourists because of the aesthetic view of the lake and view of Blue Ridge Mountains from the reservoir. Project will result in continued scenic beauty.
Social/Cultural Issues	Public meeting attendees concerned with adverse environmental impacts to natural areas. Project will provide an on-site detour based on public feedback during scoping. Project results in the least private property impacts.

Major Conclusions: This project is necessary to increase the M&I water supply to meet current maximum daily water supply demand, to comply with high hazard potential dam regulations, and to continue providing flood protection to downstream life and property. The preferred alternative would result in upgraded M&I water supply infrastructure suitable for obtaining a VWP permit from the Virginia DEQ. The permit will allow the Sponsors to withdraw enough water from the reservoir to produce more than 1.0 mgd of treated water at the Crozet Water Treatment Plant, which is necessary to meet the current maximum daily demand. Additionally, the proposed spillway rehabilitation will make the structure capable of passing the freeboard hydrograph and state-mandated design storm events. In addition to the new spillway, the internal filter drain system will be rehabilitated and additional stabilization of the existing riser structure will occur. Unavoidable adverse effects would result from implementation of the proposed action. These effects are anticipated to be short-term and minor overall. Most of the adverse impacts identified in the Plan-Environmental Assessment can be mitigated prior to and during construction.

Areas of Controversy: None.
Issues to be Resolved: None.
Evidence of Unusual Congressional or Local Interest: None.
Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? Yes

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

This supplement addresses the Multiple-Purpose Structure No. 1 in the Beaver Creek Watershed (hereinafter referred to as "Beaver Creek 1", "the dam" or "the structure"). The dam was constructed in 1964 as a significant hazard potential structure for the purposes of county water supply and flood protection for downstream life and property. The project was constructed prior to the existence of the Virginia Department of Environmental Quality, (DEQ) Virginia Water Protection (VWP) Program Permitting system and is currently unpermitted. Without the VWP withdrawal Permit, the Sponsors are limited to a maximum allowable withdrawal that supports the production of 1.0 million gallons per day (mgd) of treated water at the Crozet Water Treatment Plant. The Crozet Area Drinking Water Infrastructure Plan or DWIP (Hazen Sawyer, 2019) indicates that at some time between 2020 and 2025, the projected maximum daily demand will exceed 1.0 mgd. Certain deficiencies exist with the current pump station and intake infrastructure's configuration (which are further described in the DWIP), and those deficiencies will need to be addressed before the Sponsors can be issued the VWP withdrawal permit. As such, modifications to the pump station infrastructure are required to meet the municipal and industrial (M&I) water supply purpose of the project.

Beaver Creek 1 was constructed in 1964 and was classified as a Class (b) structure using 1960's SCS classification criteria. A Class (b) structure was defined as a structure located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, or minor railroads or cause interruption of use or service of relatively important public utilities. NRCS hazard classification criteria has since been revised to designate Class (b) structures as "Significant Hazard structures." Although limited development has occurred within the breach inundation zone since the project was constructed, the primary reason for the reclassification is that interpretations of hazard classification levels have evolved to place more importance on potential consequences related to dam failure. Additionally, Virginia Dam Safety regulations did not exist at the time the project was constructed. Based on breach inundation analyses (Schnabel 2011) and the Impounding Structure Regulations of the Commonwealth of Virginia, Beaver Creek 1 was reclassified as high hazard potential by the Department of Conservation and Recreation in 2013. A failure of the dam and uncontrolled release of the reservoir would have severe consequences, including probable loss of human life downstream, interruption to the water supply infrastructure and damage to well-travelled downstream roadways, as well as interruption to Browns Gap Turnpike which traverses the dam and serves as a vital thoroughfare for the community. The dam would also be considered high hazard potential by modern NRCS standards based on the consequences identified by dam breach inundation analyses and interruption to important infrastructure. This dam does not meet current Virginia or NRCS requirements for high hazard potential dams with regards to design, safety, and performance standards. Rehabilitation is required to bring the dam and appurtenant structures into compliance with applicable standards for hydrologic and hydraulic, geotechnical and structural design elements.

The flood protection benefits were clearly identified in the original watershed work plan and first supplement. Areas downstream of the dam are still scarcely populated and no large-scale development has occurred along Beaver Creek and Mechums River from Beaver Creek 1 to the confluence with South Fork Rivanna River, nor along the South Fork Rivanna River to the South

Fork Rivanna Dam. Beaver Creek 1 has served the flood protection purpose effectively for nearly 60 years, and the sponsors intend to continue to provide that benefit to downstream stakeholders.

For these reasons, the dam does not meet the objectives of the Rivanna Water and Sewer Authority, Albemarle County Board of Supervisors, and Thomas Jefferson Soil & Water Conservation District, herein referred to as Sponsors or SLOs. This supplemental watershed plan presents the planning process by which NRCS provided technical assistance to the local Sponsors and the public in addressing resource issues and concerns within the Beaver Creek 1 watershed.

PURPOSE AND NEED FOR ACTION

The purposes of Beaver Creek 1 are flood control and M&I water supply. One need for action is that the current pump station infrastructure does not meet the community water demand. The current municipal and industrial water supply infrastructure was installed prior to the VWP permit system and is currently unpermitted. As such, the Sponsors are limited to a maximum withdrawal supporting the production of 1.0 mgd of treated water at the Crozet Water Treatment Plant. The unpermitted withdrawal limitation is insufficient to meet the current maximum daily demand as described in the Crozet Drinking Water Infrastructure Plan (DWIP, 2019). As such, an immediate need for action exists to address the deficiencies with the raw water withdrawal infrastructure in order to meet the current maximum daily demand for water supply. Another need for action is that the structure was designed to significant hazard potential standards based on 1960's dam safety standards. The structure has since been reclassified as high hazard potential by Virginia DCR. In its current configuration, the dam and spillway are not capable of safely storing and/or passing runoff associated with the design storm event based on both Virginia requirements and NRCS requirements for high hazard potential dams. The operation of this non-compliant structure places downstream life and property at risk in the event of a major hydrologic event or dam safety scenario. Other dam safety deficiencies were also identified including an inadequate internal drainage system and stability of the existing riser structure. Therefore, an immediate need exists to address the dam safety deficiencies and bring the structure into compliance with Virginia DCR and NRCS requirements for high hazard potential dams. The rehabilitation of the spillway will result in reduced likelihood of dam failure during the design storm event. No immediate need for action associated with flood protection was identified beyond rehabilitating the structure to high hazard potential standards, but the existing flood protection benefits were analyzed and opportunities for improvement were considered.

ORIGINAL PROJECT

The Beaver Creek Watershed includes approximately 7,010 acres (10.95 square miles) located in the western portion of Albemarle County, Virginia. The original watershed work plan was adopted by the Soil Conservation Service (SCS, now NRCS) and the sponsors in March 1960. The sponsors for these improvements were Albemarle County Board of Supervisors and the Thomas Jefferson Soil & Water Conservation District. The Operation and Maintenance Agreement between the Sponsors and the NRCS was first signed on March 11, 1963.

The plan included a combination of land treatments and improvements that addressed soil and plant management, water conservation, and flood prevention. Measures for flood prevention consisted of the installation of contour strip cropping, construction of waterways, and

establishment of woodland practices. Structural measures consisted of one (1) multiple-purpose structure, built for flood control and municipal and industrial (M&I) water supply. Additionally, plans to relocate Browns Gap Turnpike from the former road alignment to over the auxiliary spillway and crest of the dam were included in the original watershed plan. Beaver Creek 1, the sole impounding structure in the basin and the subject of this Plan, captures the runoff from 6,110 acres, or approximately 87.2% of the watershed.

Beaver Creek 1 was designed between 1960 and 1963 and construction was completed in 1964 at a cost of $214,827. The structure is located in Albemarle County on Beaver Creek approximately two river miles upstream of Beaver Creek's confluence with the Mechums River. The dominant land use of the watershed for this structure was historically a combination of agriculture and woodlands, which generally remains unchanged today, although much of the cropland in the watershed is now forest or open pasture.

Beaver Creek 1 is an earthen embankment dam, approximately 60 feet in height. The surface area of the existing normal pool is approximately 104 acres. The maximum surface area of impounded water at the crest of the existing dam (elevation 560 feet) is approximately 206 acres. The design sediment storage volume of the reservoir was 202 acre-feet at sediment pool elevation 515.4 feet. A topographic survey performed by Draper Aden Associates estimated the volume of sediment storage at elevation 515.4 feet to be 210 acre-feet, and the total volume at normal pool elevation 537.8 feet to be 1,742 acre-feet. The beneficial pool for water supply is approximately 1,532 acre-feet, less any storage lost from aerated sediment approximately 3 acre-feet since the project was constructed. The maximum storage volume at the crest of the dam is estimated to be on the order of 5,008 acre-feet.

The principal spillway structure consists of a reinforced-concrete riser structure (riser) located approximately 235 feet upstream of the embankment crest. The principal spillway riser has approximately 18 feet of weir length at normal pool. The riser's interior dimensions are approximately 3.5 feet by 9 feet (d by 2.57d). The riser is configured similarly to a standard NRCS covered riser, with the addition of the four (4) raw-water intake valves. A 36-inch by 36-inch low level sluice gate is also present at approximate invert elevation 498.5 feet for reservoir drawdown. Water discharging into the riser is conveyed through the dam by means of a 42-inch diameter reinforced-concrete pipe (RCP) supported by a concrete cradle. The conduit length is on the order of 465 feet and is oriented in a generally southeast/northwest direction through the earthen embankment. The principal spillway conduit discharges into a concrete channel located at the downstream toe beneath the existing pump station.

In addition to serving as the principal spillway for the dam, the riser structure provides multiple-level raw water withdrawal capability at the reservoir via the manual operation of four 10-inch by 10-inch sluice gates numbered 1 through 4 with invert elevations located at 5 feet, 10 feet, 15 feet and 20 feet below the normal pool level, respectively, that divert water to a pump station located at the toe of the dam. The pump station conveys raw water to the Crozet Water Treatment Plan (WTP) via an approximately three-quarter mile long 12-inch diameter asbestos cement pipe. The pipeline's route generally follows highway 680 (Brown's Gap Turnpike) to highway 802 (Old Three Notched Road) to highway 240 (Three Notched Road) where it enters the Crozet WTP.

Browns Gap Turnpike was included in the original watershed work plan to traverse the auxiliary spillway and crest of dam, relocated from its original location downstream.

WATERSHED PROBLEMS AND OPPORTUNITIES

Sponsor Concerns: In its current configuration, the project cannot acquire a permit from the Virginia DEQ to increase withdrawals to produce more than 1.0 mgd of treated water at the Crozet Water Treatment Plant. The DWIP indicates that the maximum daily demand will exceed 1.0 mgd between 2020 and 2025, leaving a potential water supply shortfall for the Community of Crozet during peak demand periods. The project provides the opportunity to separate the pump station infrastructure and the principal spillway conduit, and provides an opportunity for the Sponsors to construct a compliant minimum instream flow (MIF) release that does not waste the community's water. The existing dam and spillway do not meet current Virginia or NRCS requirements for high hazard potential dams. The rehabilitation will provide an opportunity to bring the structure into compliance with dam safety requirements for high hazard potential dams. Although the Sponsors are not aware of any current upstream or downstream flooding issues associated with Beaver Creek 1, the project also offers an opportunity to re-evaluate the flood protection benefits provided by the project.

Soil Erodibility: Although no visual evidence of auxiliary spillway erosion has been observed by the Sponsors or their consultants during routine and annual visual evaluations of the structure and there are no known records or eye-witness accounts of the grassed auxiliary spillway activating since the construction of the dam, it does not meet current NRCS or Virginia criteria for capacity. Further analysis indicates that the soil materials in the auxiliary spillway would be highly susceptible to erosion during the Design Storm events (stability criteria during the Spillway Design Hydrograph and Integrity criteria during the Freeboard Hydrograph). The presence of Browns Gap Turnpike / SR 680 traversing the spillway is problematic in that spillway activation and resulting erosion could temporarily render the roadway impassable or even result in an uncontrolled release of the reservoir.

Floodplain Management: Beaver Creek 1 currently provides flood protection benefits to downstream residences, properties, agricultural lands, and road crossings. The Sponsors are not aware of any issues with upstream or downstream flooding in the current configuration. Albemarle County has had a published Flood Insurance Study (FIS) since 2005. The County recognizes the value that Beaver Creek 1 provides in flood protection benefits, particularly with respect to roadways. Beaver Creek 1 controls approximately 7.5 square miles (~6,110 acres) of the watershed above the affected properties and area of beneficial effects. The project provides an opportunity to review and, if necessary, revise community flood maps using the most recent data and hydraulic models associated with Beaver Creek 1.

Erosion and Sedimentation: The original watershed work plan was designed using an estimated 4.0 acre-feet of sediment accumulation per year based on a 50 year life and a design sediment storage volume of 202 acre-feet. At the time of the original watershed work plan, the watershed was thought to be 22 percent cropland. In 1973, a sediment survey was performed as documented in a report dated 1977 (NRCS 1977). The 1977 sedimentation report estimated an annual storage loss in Beaver Creek 1 reservoir of 4.35 acre-feet. The calculations in the 1977 report were based on 50 percent of the watershed being cropland. In the condition at the time of this supplement,

much of the cropland has been converted into woodland or grassland. The significance of this is that cropland tends to produce significantly greater sediment yield as compared with forested area or even grassed pastures. Additionally, Henleys Lake Dam, the impounding structure located upstream of Beaver Creek 1 which captures runoff from approximately 2.1 square miles of the watershed, did not exist at the time. In 2017, Draper Aden Associates performed a bathymetric survey of the Beaver Creek reservoir. Based on a comparison of the designed storage volume and the 2017 sediment survey, Beaver Creek 1 reservoir has accumulated approximately 67 acre-feet of submerged sediment since its construction; approximately 1.3 acre-feet per year, and approximately 135 acre-feet less than the designed sediment storage pool volume. The difference between the measured sedimentation and the sediment yield rates calculated in the original plan and the 1977 report are likely attributed to the land cover changes in the watershed from heavily cultivated cropland to forested areas and grassy pastures today. Approximately 3 acre-feet of aerated sediment was estimated to have accumulated above normal pool since the original construction. Based on the observed rates of sedimentation estimated from the survey and sediment yield estimations derived from the Universal Soil Loss Equation (USLE), the reservoir has sufficient volume, both with respect to sediment pool storage and flood pool storage, for the remaining life of the project. Additional information can be found in the Sediment Survey Report (Schnabel 2021) in Appendix D.

Local Concerns: During the first public meeting and in meetings held prior to the Supplemental Watershed Plan-EA development, local citizens expressed great concern with any duration of closure of Browns Gap Turnpike during construction due to the route being a main thoroughfare for dairy trucks, school buses, Emergency Service vehicles and many commuters in the area. The public emphasized their concerns with off-site detour routes due to the long distance of the detour and difficulty of turns for large dairy trucks and other large vehicles based on the turning radius at intersections along the off-site detour route.

Watershed Opportunities

The following is a general list of opportunities that will be recognized through the implementation of this Plan.

- Reduces potential for loss of human life and property damage resulting from the operation of a high hazard potential dam that does not meet Virginia or NRCS standards.
- Protects real estate values downstream of the dam.
- Increases operational control of the water withdrawal system to improve water quality conditions by drawing from a wider range of depths.
- Allows access to an additional 7.5% of designated water supply volume that is currently inaccessible to the Sponsors due to the lowest gate invert being set 2.6 feet above the top of the sediment pool to improve drought resiliency and maximize beneficial effects of the project.
- Sponsors can more readily acquire a Virginia DEQ VWP program permit to increase withdrawals above the current treated water ceiling of 1.0 mgd to meet immediate withdrawal needs while also installing infrastructure that will be capable of meeting future demand with adequate safe yield.
- Addresses Sponsor concerns about the raw water pump station infrastructure, particularly with respect to the incompatible use of the principal spillway conduit to both charge the wet well and serve as the MIF release.

SCOPE OF THE ENVIRONMENTAL ASSESSMENT

A scoping process was used to identify issues of economic, environmental, cultural, and social importance in the watershed and identified area of potential affect for all possible alternatives of the proposed action. Watershed concerns of the Sponsors, technical agencies, and local residents were expressed in scoping meetings and in other planning and public meetings. An interdisciplinary planning team composed of the following areas of expertise identified factors that would affect soil, water, air, plant, animals, and human resources: engineering, biology, economics, resource conservation, water quality, soils, archaeology, and geology.

The Sponsor places a high priority on keeping the public informed on its operations and in inviting public input on plans regarding community water supply. The Sponsor has held public meetings dating back to 2011 to discuss the Beaver Creek Reservoir rehabilitation project in addition to its monthly public board meetings at which detailed operational, financial and infrastructure updates are given. There was an opportunity for public comment at each meeting. Decisions made on large projects such as the Beaver Creek 1 Reservoir received additional public input through special meetings held in the evening hours with notices published in local newspapers and letters sent to potentially impacted property owners and stakeholders.

On July 29, 2020, the Sponsor entered into an agreement with NRCS to prepare a Supplemental Watershed Plan-EA for Beaver Creek 1. On December 10, 2020 from 2:00 p.m. (EST) to 3:00 p.m. (EST), the sponsor conducted a project scoping meeting via the virtual platform Microsoft Teams. Representatives of various state and federal agencies were invited to and attended the meeting. Virginia's seven Resident Federally recognized Tribes were invited to participate in the meeting. The objective of the meeting was to present the history of the project, goals and process of the planning study. During the meeting, the project team solicited feedback from the agency representatives and attendees to identify topics and specific concerns to be investigated during the Plan-EA development. The scoping concerns identified during the agency scoping meeting were further evaluated during the preparation of this Plan-EA.

Also on December 10, 2020 from 6:00 p.m. (EST) to 8:00 p.m. (EST), The Sponsor held the first public meeting since partnering with NRCS for this supplemental watershed plan. The meeting was advertised in *The Crozet Gazette*, various Social Media platforms, and through invitations sent via e-mail and regular mail. The meeting was conducted via the virtual platform Zoom. The objective of the meeting was to present the history of the project, goals and process of the planning study. During the meeting, the project team solicited feedback from the public attendees to identify concerns regarding the project. The scoping concerns identified during the public meeting were further evaluated during the preparation of this Plan-EA. A video recording of the public meeting was uploaded to the Sponsor's website and the question and comment period was extended until December 21, 2020.

The second public meeting was held on October 6, 2021 from 6:00 p.m. (EDT) to 7:00 p.m. (EDT) via the virtual platform Zoom. The meeting was advertised using *The Crozet Gazette* message board, sponsor website, and other means. Notification letters were sent via e-mail to the agency and governmental representatives who were invited to the first scoping meeting or had taken office since then. Virginia's seven Resident Federally recognized Tribes were invited to participate in

the second public meeting. The purpose of the meeting was to present the findings of the environmental assessment and to present the results of the Alternatives Evaluation to the public. The Sponsors' preferred alternative was also presented during this meeting. The rationale for eliminating alternatives from the detailed study was provided, as well as the reasoning for selecting the preferred alternative. Opportunity for public comment and questions were also extended until October 20, 2021.

Table A – Ecosystem Services Scoping Concerns

Ecosystem Services Item	Relevant to the Proposed Action		Rationale
	Yes	No	
Provisioning (tangible goods provided for direct human use and consumption)			
Food	X		Provides flood protection for no less than 36 acres of downstream cropland and provides water supply and flood protection for one of the few remaining dairy farms in the County.
Fiber		X	Not applicable to this project, no fiber production is present.
Water	X		Project is crucial to municipal and industrial raw water supply for the Community of Crozet.
Timber		X	Not applicable to this project. No active timbering projects are present.
Biomass		X	Not applicable to this project.
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)			
Flood and Disease Control	X		Provides flood control for downstream life and property. Rehabilitation will reduce risk of dam failure during design storm event.
Water Filtration		X	Not applicable to this project.
Climate Stabilization		X	Not applicable to this project.
Crop Pollination		X	Not applicable to this project.
Supporting (underlying processes maintaining conditions for life on Earth)			
Nutrient Cycling		X	Not applicable to this project.
Soil Formation		X	Not applicable to this project.
Primary Production	X		Maintain crop and pasture production by maintaining flood control benefits and providing water to local businesses and farms.
Cultural (make the world a place in which people want to live)			
Recreational Experiences	X		Albemarle County Park space is present at the site. Beaver Creek Sculling club and Western Albemarle High School Rowing Team use lake regularly, lake provides fishing, boating, picnicking, as well as scenic views to local users and tourists. Recreational areas are a value to the sponsors and community.
Spiritual		X	Not applicable to this project. No spiritual values were expressed by stakeholders during scoping.
Aesthetic Viewsheds	X		Albemarle County park space is used by locals and tourists because of the aesthetic view of the lake and view of Blue Ridge Mountains from the reservoir.
Tribal Values		X	The Tribal response received during early scoping expressed interest only in the case of an inadvertent discovery of remains. No other interest in the site was expressed by the Tribes during scoping.

Table B – Typical Concerns Identified Through Scoping

Item/Concern	Relevant to the Proposed Action		Rationale
	Yes	No	
SOILS			
Upland Erosion		X	No effects are anticipated; Project involves modifications to MPS.
Stream Bank Erosion	X		Possible temporary effects during construction; can be mitigated with appropriate erosion and sediment control measures.
Sedimentation		X	Temporary effects during construction will be mitigated by erosion and sediment control measures; long-term sedimentation is accounted for in the reservoir design. Watershed is almost entirely outside of the Crozet development area, so extensive development in the watershed is not anticipated.
Prime and Unique Farmland and Farmland of Statewide Importance	X		There are 7.1 acres of designated Prime and Unique Farmland and 1.4 acre of designated Farmland of Statewide Importance located within the area of potential effect for all action alternatives. There are approximately 36 acres of farmland downstream of the dam within the two-year through 500-year storm events.
WATER			
Surface Water Quality	X		Project is a water supply reservoir.
Surface Water Quantity	X		Project is a water supply reservoir.
Ground Water Quantity		X	Ground water quantity is not relevant to the project.
Clean Water Act	X		A permit under Sections 401 and 404 of the Clean Water Act will be required due to impacts to streams, open water and wetlands.
Coastal Zone Management Areas		X	No coastal zones are present within proximity of the project.
Regional Water Management Plans	X		The reservoir serves as the sole municipal and industrial water supply for the Community of Crozet. The Crozet Drinking Water Infrastructure Plan (DWIP 2019) identified increased permitted withdrawals as the preferred alternative to meet current maximum daily demand shortfalls as well as future average daily demand shortfalls.
Floodplain Management	X		Project provides flood control for downstream properties. Flood benefits will be evaluated. Revised floodplain mapping may be required.
Sole Source Aquifers		X	Not applicable to this project, since no sole source aquifers were identified in the vicinity of the project per Sole Source Aquifer maps available through the EPA.
Streams, Lakes, and Wetlands	X		There are streams, lakes and wetlands present at the project site and within the vicinity of the project.
Wild & Scenic Rivers		X	None are located in the vicinity of the project.
AIR			
Air Quality	X		Project is part of Albemarle County park space and provides scenic views. Air quality to be considered during construction. Local permits may be required for M&I upgrades.
Clean Air Act		X	No permits are required under the Clean Air Act.
PLANTS			
Endangered and Threatened Species		X	No threatened or endangered plant species were reported or observed in the project area.
Forest Resources		X	Minor tree clearing is anticipated for all structural alternatives. No significant impacts to forest resources are anticipated.
Invasive Species	X		Invasive plant species were identified in the project area.
Natural Areas	X		There are natural areas present at the project site.
Riparian Areas	X		There are riparian areas in the vicinity of the project.

Item/Concern	Relevant to the Proposed Action		Rationale
ANIMALS			
Fish and Wildlife Resources	X		There are fish and wildlife present in the vicinity of the project.
Coral Reefs		X	No coral reefs exist within proximity of project.
Endangered and Threatened Species	X		Listed species potentially occur in the general project area.
Essential Fish Habitat		X	None are present in the vicinity of the project.
Invasive Species		X	No invasive animal species were identified in the project area.
Migratory birds/Bald Eagles	X		Potential nesting and foraging habitat for bald eagles exists in the project area.
HUMANS			
Cost, Sponsor	X		Sponsors have been proactive in securing project funds.
Public Benefits	X		The project provides a source of public drinking water supply, flood protection, and recreation.
Cultural Resources		X	No findings of historic significance.
Drought	X		The project provides community drinking water supply.
Environmental Justice and Civil Rights		X	No environmental justice communities were identified in the project area, nor were any Civil Rights issues or disproportionate treatment concerns identified.
Flood Damages	X		Project provides flood control benefits to downstream property. Flood protection benefits will be re-evaluated.
Historic Properties		X	After detailed studies, no sites within the project area are recommended for listing on the National Register of Historic Places.
Land Use		X	No major land use change in the watershed will result from this project. The Crozet Master Plan does not indicate appreciable development in portions of the watershed that are within the Crozet Development Area. No significant development in the rural ring is anticipated.
Local and Regional Economy	X		Browns Gap Turnpike traverses the existing dam and spillway and provides a vital thoroughfare for local residents. The project provides water supply to local farms and businesses.
Park Lands	X		The project is part of the Albemarle County park system. Park resources were analyzed as part of this plan. There are no federal park lands in the vicinity of the reservoir.
Potable Water Supply	X		The project provides water supply to the Community of Crozet.
Public Health and Safety	X		The project does not currently meet safety standards for high hazard potential dams. The project provides a crucial source of municipal and industrial water supply to the Community of Crozet.
Recreation	X		Public and private recreation activities, including rowing and sculling club, hiking and picnicking, occur in the project area.
Scenic Areas	X		Project provides scenic and aesthetic viewscapes of the Blue Ridge Mountains and the reservoir itself for visitors and recreationists.
Scientific Resources		X	None were identified through scoping.
Significant Scientific Features		X	None were identified through scoping.
Social/Cultural Issues	X		Public meeting attendees concerned with adverse environmental impacts to natural areas. Public also expressed concerns with any closures of Browns Gap turnpike and preferred that planning considered an on-site detour route.

AFFECTED ENVIRONMENT

PLANNING ACTIVITIES

As part of the planning activities for the rehabilitation of Beaver Creek 1, consultants reviewed available records for the existing structure, including construction drawings, dam inventory information, and other documentation and available resources related to the project. Several past work items, including hydrologic and hydraulic analyses, geotechnical analyses, and alternatives analyses to address the water supply issues and spillway capacity were reviewed and revised for conformance with NRCS requirements and comments received from NRCS on submissions of those pre-planning study work items. Engineering reports and analyses were performed and updated as appropriate to identify feasible alternatives that would meet the Sponsors' objectives and the purpose and need of this watershed project.

The planning activities included studies and evaluations of the project, including environmental assessments, cultural resources surveys, geologic evaluations, hydrologic and hydraulic evaluations, sediment yield evaluations and the evaluation of non-earthen structures. Economic analyses of project benefits provided by the structure were also analyzed with respect to water supply and flood protection with consideration of costs to implement the alternatives. Public meetings were conducted during the Scoping process and after formulation of alternatives to present the project and solicit feedback from the public and regulatory agencies.

PHYSICAL FEATURES

Project Location: Beaver Creek 1 is located approximately one-half mile northeast of the intersection of State Route 680 (Browns Gap Turnpike) and State Route 240 in Albemarle County, Virginia. More specifically, the subject dam is located at approximate latitude and longitude 38°04'15.5" North and 78°39'05.7" West, respectively. The crest of the dam and vegetated auxiliary spillway are traversed by Browns Gap Turnpike (State Route 680). Browns Gap Turnpike serves as an important route for residents living in the rural portions of the community to travel to State Route 250 to commute to Charlottesville or other areas for work. The Beaver Creek 1 reservoir forms the effective confluence of the Parrott Branch, Watts Branch and Beaver Creek tributaries. Figures of the site location and key project elements are presented in Appendix B and Appendix C.

Topography: The highest point in the watershed is located on Bucks Elbow Mountain at approximate elevation 2,900 feet. The northwest portion of the watershed is characterized by steep terrain varying from elevation 2,900 feet to approximate elevation 650 feet and is contained within the 2.1 square mile Henleys Lake Dam catchment. The remaining 7.5 square miles of the watershed is captured by the Beaver Creek sub-basin and is represented by more gentle slopes, gradually decreasing in elevation until reaching the Beaver Creek 1 impounding structure, which has a crest of dam at approximate elevation 560 feet. The elevation at the end of the Beaver Creek drainage basin at the confluence with the Mechums River is at approximate elevation 460 feet. A field-run topographic survey of Beaver Creek 1 was performed by Kirk Hughes & Associates (KH&A) on June 29, 2012. The survey included existing structures at and around the dam site, topography of the embankment and auxiliary spillway, and other features at the site. A bathymetric survey of the reservoir was performed in 2017 by Draper Aden

Associates (DAA) to estimate sedimentation in the reservoir and the remaining available water supply storage. The topographic survey data are contained in Appendix D.

Soils: Several different natural geologic and embankment construction material strata have been identified and are presented to characterize the subsurface stratigraphy at the dam site. These informal, project-specific strata names have distinct characteristics that are identified based on visual-manual descriptions, field testing, drilling observations, laboratory test results, and engineering properties. The selected strata delineations may not necessarily reflect actual natural and fill deposit stratifications, or the extent or continuity of strata across the site, although an effort was made to recognize the depositional history of the site. The subsurface materials encountered in the borings are characterized as Fill, Alluvium, Colluvium, Residuum, Disintegrated Rock, and Rock. Two soil types, sandy silt and silty sand, are the most prevalent. Additional information regarding soils is presented in the Geologic Investigation Report (GIR, Schnabel 2021) and the Geotechnical Engineering Report (GER, Schnabel 2021) contained in Appendix D.

Geology: Beaver Creek 1 is located in two Physiographic Provinces, with the Blue Ridge Mountains to the Northwest and the Piedmont to the Southeast. The Piedmont Physiographic Province is characterized by low, rolling hills and deeply weathered bedrock. The Blue Ridge Mountain Physiographic Province is characterized by highly deformed pre-Cambrian metamorphic rock formations. Schnabel conducted geologic investigations of the Beaver Creek 1 earthen embankment, foundation and auxiliary spillway in 2012, 2019 and 2021. The geologic investigations consisted of soil test borings and rock coring at selected locations within the existing dam, potential spillway locations and the existing vegetated auxiliary spillway channel. The field data were evaluated, and an assessment of various soil and rock samples was conducted. Geotechnical laboratory testing was performed to evaluate soil properties to be used for design and analysis. The purpose of the geologic investigation programs was to characterize the type and consistency of embankment materials, foundation materials, and the auxiliary spillway channel subgrade, which were the basis for geotechnical analyses performed in accordance with this Plan-EA. Additional details and the results of the geologic evaluation are documented in the Geologic Investigation Report (GIR, Schnabel 2021) contained in Appendix D.

NRCS soil survey data indicate that the site is underlain by alluvium derived from igneous rock as well as residuum weathered from granite and gneiss which is consistent with the findings of the site explorations. According to the SCS record drawings and Schnabel's geologic investigations, the soils above the bedrock include silty sands and gravels weathered from the underlying bedrock, and discrete shallow deposits of alluvial soils underlying the embankment footprint.

According to the Geologic Map of the Shenandoah National Park Region (USGS, 2009), the site lies within the eastern edge of the Blue Ridge Province and the bedrock formation that underlies the site is a biotite monzogranite-quartz monzodiorite (Ybg). This formation trends southwest to northeast, and is composed of very dark gray, medium- to coarse-grained, inequigranular, non-foliated to weakly foliated biotite monzogranite and quartz monzodiorite. The formation is Mesoproterozoic in age. Northwest and parallel to the monzodiorite, underlying the upstream half of the reservoir, is a belt of leucogranite gneiss (Ylg) of the Mesoproterozoic age. The

composition of this formation varies and includes alkali-feldspar granite, syenogranite, and monzogranite.

The Rockfish Valley High-Strain Zone is the northeastern continuation of the Rockfish Valley Fault Zone (RVF) which is a belt of high strain zones that strikes northeast-southwest and dips variably to the southeast. Movement along the RVF has been associated with northwest vergent thrusting of the Lovingston Massif over the Pedlar massif, during the middle Paleozoic (Bartholomew and others, 1981; Sinha and Bartholomew, 1984). Additional information and figures associated with the site geology are presented in Appendix D.

LAND USE

The 2015 Albemarle County Comprehensive Plan Update (ACCP) was originally adopted on June 10, 2015, and updated in 2018, for the purpose of guiding the county's growth. The ACCP does not indicate significant changes or development within the Beaver Creek 1 drainage basin. A review of the 2021 draft Crozet Master Plan (CCAC 2021) indicates minor community development such as improved trail ways and greenspace within the southernmost portion of the Beaver Creek 1 drainage basin. Land Use changes within the drainage basin are anticipated to be minimal based on the planning team's review of these documents. The watershed and downstream areas are primarily agricultural with sparsely populated residential dwellings in the rural areas outside of the Crozet Development Area. According to Land Use Patterns described in the Crozet Master Plan, 80 percent of the Crozet Development Area is zoned for residential uses. Moreover, these districts allow residential development at 0.5 units per acre, 1 unit per acre, and 2 units per acre, respectively. Some development, including "green" systems are anticipated in the portion of the Crozet Development area that overlaps with the Beaver Creek 1 Watershed. This area represents an extremely small portion of the watershed and is not anticipated to be significant enough to affect runoff characteristics of the watershed.

Based on the Existing Land Use Map for Albemarle County, forest is currently the predominant land cover within the watershed. Other significant land covers include agriculture, open space, and water. Additional figures and information are presented in the Hydrologic and Hydraulics Report (Schnabel 2021) contained in Appendix D.

ECOSYSTEM SERVICE SCOPING CONCERNS

Provisioning

General: Provisioning describes the tangible goods that are provided for direct human use and consumption.

Food: Cow Path Lane which is located immediately north and east of the project is home to Early Dawn Dairy Inc., one of the few remaining dairy farms within Albemarle County. The project provides protection to forage crops located along Cow Path Lane and structures associated with the Farm.

Water: The project provides a vital source of water to the Community of Crozet. M&I water users include residents, agricultural operations in the rural ring of Crozet, and businesses in the area.

Continuation of the project with improvements to the raw water withdrawal infrastructure and acquisition of VWP Program Permit for increased withdrawal capacity has been identified in regional water plans to meet the community's needs through 2075 (DWIP 2019). No other raw water reservoirs are currently being planned for in the community, since the existing reservoir is physically capable of meeting current and future demand through 2075 with a new intake structure and the VWP Program Permit. The other alternatives evaluated in the DWIP were either found to be infeasible due to uncertainty surrounding the efficacy of the alternative or would result in far greater environmental, economic and social impacts.

Regulating

General: Regulating maintains a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe.

Flood and Disease Control: This project is the sole multiple-purpose structure in the Beaver Creek Watershed. The existing dam reduces impacts from flooding for over 36 acres of downstream cropland, several roadway crossings on the Mechums River, infrastructure associated with the Early Dawn Dairy Inc. and three residential structures located close to the floodplain. The reliable source of water provided by the project promotes the general health and wellbeing of the people in the Community of Crozet and provides sufficient storage capacity to protect the public against uncertainty with respect to drought. Additionally, the dam is classified as a high hazard potential structure but, in its current configuration, does not meet all applicable hydraulic, geotechnical or structural requirements. As such, an increased risk of catastrophic failure exists in the current environment which would result in severe consequences for this community.

Supporting

General: Underlying processes maintaining conditions for life on earth.

Primary Production: The project provides protection to crop and pasture downstream by maintaining flood retarding storage. The water provided by the project supports local residents, businesses, and farms including the Early Dawn Dairy Farm, which is one of the few remaining dairy farms in the Community of Crozet.

Cultural

General: Makes the world a place in which people want to live.

Recreational Experiences: Albemarle County park space is present at the project site. The entire Beaver Creek Park is approximately 219 acres, including the 104-acre reservoir. Much of the rest of the area includes hiking trails surrounding the reservoir and nearby areas. The areas closest to the dam include such amenities as picnic tables, charcoal grills, bathrooms, a boat launch, and a 0.5-acre parking area estimated to provide about 12 parking spaces, as well as open areas for picnicking or enjoying scenic views of the Blue Ridge Mountains. The preservation and enhancement of park spaces is an initiative of the Crozet Master Plan (CCAC 2021) and is an important issue to the local residents.

Aesthetic Viewsheds: This site is located approximately 10 miles east of the Blue Ridge Mountains. A recreationist in the Beaver Creek Park area can enjoy views of the mountains from the reservoir, picnic areas, and recreational open space at the project site. In addition to views of the Blue Ridge Mountains, the reservoir itself and surrounding forested areas serve as aesthetically pleasing viewscapes to enjoy.

OTHER RESOURCE CONCERNS IDENTIFIED THROUGH SCOPING

SOILS

Stream Bank Erosion

Construction activities and new hydraulic conditions can potentially result in streambank erosion if not properly planned and designed for. The project is located on Beaver Creek, a tributary of the Mechums River. The original project provided flood reduction and has likely reduced streambank erosion since its construction. Consideration must be given to temporary effects during construction as well as long-term effects resulting from modifications to the spillway system to avoid adversely impacting the receiving waters streambanks.

Prime and Unique Farmland Soils, and Farmland Soils of Statewide Importance

There are up to 7.1 acres of designated Prime and Unique Farmland under the Farmland Protection Policy Act located within the maximum area of potential effect for all action alternatives. Additionally, there are up to 1.4 acres of soils designated as Farmland of Statewide Importance that are within the maximum area of potential effect of all action alternatives. Additionally, there are approximately 36 acres of cropland within downstream areas protected by Beaver Creek 1 through the 100-year, 24-hour storm event as compared to a without-dam condition. Figure C-5 depicts the maps of these soils. The primary agricultural products produced within the project area include hay, forage crops, and corn. Additionally, one of the County's few remaining dairy farms, Early Dawn Farm, is present on Cow Path Lane, located approximately 1.5 miles northeast of the subject project.

WATER

Surface Water Quality

The reservoir serves as M&I water supply for the Sponsors. The Sponsors routinely monitor water quality for the presence of algal blooms, pH, and other potential contaminants that could affect water quality in the reservoir. The Sponsors have a vested interest in observing and maintaining high surface water quality. The algal blooms result in increases in pH in the raw water, which reduce the effectiveness of filtration at the Crozet Water Treatment Plant.

Minimal development within the rural ring of Crozet is anticipated based on the guiding principles and information presented in the Crozet Master Plan. Therefore, heavy siltation and contamination of the reservoir are not anticipated in this watershed. The reservoir has adequate sediment storage volume for the evaluated life of the structure. The water quality conditions are not projected to change significantly based on development in the watershed.

Surface Water Quantity

The reservoir serves as municipal and industrial water supply for the Community of Crozet by providing approximately 1,527 acre-feet of raw water storage. The Drinking Water Infrastructure Plan (DWIP 2019) emphasizes the importance of the reservoir in meeting current and future water supply demands for the community. The reservoir has sufficient surface water quantity to meet the community's demand through 2075 (DWIP 2019). However, the original project was constructed prior to the existence of DEQ's VWP program, and it is currently unpermitted. As such, the Sponsors are limited to a maximum withdrawal to support the production of 1.0 mgd of treated water at the Crozet Water Treatment Plant. Although this is sufficient for the current average daily demand, it falls short of the immediate maximum daily demand needed during peak water use seasons.

The DWIP also noted that there are limitations associated with the current infrastructure with respect to water quantity. The current configuration of the pump station and the riser limit the available water supply quantity, due to 7.5 percent of the water supply volume being currently inaccessible. 7.5 percent of the 1,527 acre-foot M&I beneficial volume equates to approximately 114.5 acre-feet, or 37.3 million gallons. The installation of new raw water inlet is necessary to access this additional water volume, address issues associated with the interaction between the principal spillway conduit and the pump configuration, and provide the necessary safe yield to meet the community's demand through 2075 per the DWIP (Hazen-Sawyer 2019). Additionally, the current system limits the Sponsors' ability to regulate downstream flows, which results in excess downstream flow releases and wasted water quantity.

Clean Water Act

The Water Quality Assessment Integrated Report (DEQ, 2020) summarizes the water quality conditions in Virginia from January 1, 2013 through December 31, 2018. The Report lists no impairments of any type for Beaver Creek Reservoir or Beaver Creek within Sub-watershed JR02 – Mechums River – Beaver Creek 020802040102.

The Permits and Compliance section of the EA will identify any state or local permitting that may be required based upon the alternative carried forward for impacts analysis.

Beaver Creek, Beaver Creek 1 Reservoir, one perennial stream that discharges into Beaver Creek 1 Reservoir, and an unnamed tributary to Beaver Creek are considered waters of the U.S. (Figures C-4a and C-4b) that are within the maximum area of potential effect of all action alternatives. At approximate normal pool elevation 537.8 feet, the Beaver Creek 1 Reservoir consists of approximately 104 acres of open water area. The Permits and Compliance section of the EA will identify any state or local permitting that may be required based upon the alternatives carried forward for impacts analysis.

While the Beaver Creek 1 watershed drains to the Chesapeake Bay, Albemarle County is not among the 84 Bay Act localities subject to regulation under the Act (VAC 62.1-44.15). Accordingly, the Bay Act is not applicable to the project's affected environment and will not be carried forward for impacts analysis in the Environmental Consequences section.

Regional Water Management Plans

This project currently serves as the sole raw water drinking supply reservoir for the Community of Crozet, Virginia. The Crozet Drinking Water Infrastructure Plan (DWIP, 2019) considered several alternatives to address this community's immediate and long-term needs for raw water supply. This regional water management plan identified upgrading Beaver Creek 1's M&I water supply capabilities and obtaining a permit for increased withdrawals as the preferred alternative to address the immediate and future demand issues. The DWIP describes how future water demand was established, based on projected population growth, average home size and reviewing past usage data. The DWIP findings indicate that the Average Daily Demand (ADD) was estimated as 0.5 mgd in 2016, increases to 1.0 mgd by 2040, and reaches 1.3 mgd by 2075. The DWIP findings also indicate that the Maximum Daily Demand (MDD) would exceed 1.0 mgd before 2025, and likely exceeds 1.0 mgd presently. The M&I purpose associated with this plan is associated with the current water supply needs. However, to obtain the VWP Program Permit, the Sponsors will need to demonstrate their ability to meet future water demand through 2075 as described in the DWIP.

The planning team recognizes that the environmental concerns associated with the siting and construction of a new water supply reservoir, as well as the costs and permitting requirements would be exorbitant and recognize the value in leveraging the existing project to avoid unnecessary impacts to the environment, private property and other stakeholders. The environmental concerns associated with constructing a new reservoir are further described under the decommissioning alternative.

Floodplain Management

This project includes the authorized purpose of flood control and was originally constructed to provide flood protection to downstream property and lives in addition to County water supply. Albemarle County's county-wide Flood Insurance Study (FIS) was first completed in 2005. Once a final rehabilitation alternative is selected, coordination with FEMA should occur to determine if a Conditional Letter of Map Revision (CLOMR) and subsequent Letter of Map Revision (LOMR) should be applied for. The current floodplain immediately downstream of the structure includes areas of Zone A, with areas of Zone AE beginning near the confluence of Beaver Creek and the Mechums River. The current project provides an estimated annual flood damage reduction benefit of $15,872 based on a reduction of flooding of up to 1,270 feet of downstream roadways, the Early Dawn Dairy Farm, 3 residences and other structures as compared to a without-dam condition. Most of the ancillary structures and flood hazards downstream of Beaver Creek 1 are located along the Mechums River and its other tributaries. Development is limited in this community, particularly in the rural ring located outside of the Crozet Development Area, so significant changes to the floodplains based on development are not anticipated.

Streams, Lakes, and Wetlands

The Beaver Creek 1 reservoir forms the effective confluence of Parrotts Branch, Watts Branch, and Beaver Creek. Within the vicinity of the project, there exists one perennial stream that discharges into Beaver Creek and one unnamed tributary to Beaver Creek immediately downstream of the existing dam. Beaver Creek is a tributary to Mechums River. In Albemarle

County, Mechums River converges with Moormans River to form the South Fork Rivanna River, and the South Fork Rivanna River converges with North Fork Rivanna River to form the Rivanna River. The Rivanna River flows through Fluvanna County and discharges into the James River near the Fluvanna County, Cumberland County, and Goochland County boundaries. The James River flows generally eastward through Virginia to join the Chesapeake Bay near Virginia Beach. The Chesapeake Bay discharges to the Atlantic Ocean off the Virginia coast.

Wetland locations and boundaries were determined by reviewing the USFWS wetland mapper website in conjunction with field surveys performed in October 2018, August and September 2020, and February and May 2021. The Beaver Creek 1 Reservoir shoreline, inflows, and outflow and all areas within the maximum potential limits of disturbance were visually surveyed for wetlands. Within the maximum area of effect for all action alternatives (identified in the 2018 survey and further confirmed in 2020 survey), there are 0.005 acre of freshwater emergent wetlands and 0.015 acre of palustrine forested wetlands, both located downstream of the dam structure (Figure C-4b).

Appendix D contains additional documentation regarding the field investigation methodology.

The Permits and Compliance section of the EA will identify any state or local permitting that may be required based upon the alternative carried forward for impacts analysis.

Albemarle County's Water Protection Ordinance (WPO) also requires 100-foot stream buffers on each side of both intermittent and perennial streams in the Rural Area and within water supply watersheds. Therefore, development along the streams and within the buffers is minimal in the County and is not anticipated to change in the future based on the Community's focus on protecting the waterways and environmental features.

AIR

Air Quality

The project site is in a large, rural area dominated by undeveloped, forested areas; pastureland; and rural residential development. No air quality issues are present at the site currently. Facilities with point-source air emissions are minimal within the project area. The Crozet Master Plan indicates that the Community's industrial development has waned significantly since the 1940's and that the majority of anticipated land use within the Crozet Development Area is residential. No obvious concerns surrounding air quality are prevalent in the community. The Permits and Compliance section of the EA will identify any state or local air permitting requirements for the Preferred Alternative.

PLANTS

Invasive Species

Several common invasive plant species were found. Fescue (*Festuca* sp.) is dominant in all fields, the dam embankment, and beyond the toe of the embankment on the downstream side. Other prevalent invasive species observed downstream of the embankment included multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstigium vimineum*), Bradford pear (*Pyrus calleryana*), princess tree (*Paulownia tomentosa*), barberry (*Berbis* sp.), vinca (*Vinca* sp.), and yucca (*Yucca* sp.). Therefore,

invasive plant species will be carried forward for impacts analysis in the Environmental Consequences Section.

Natural Areas

The Beaver Creek park area is part of Albemarle County's Parks and Recreation system. There are natural areas present to the north and east of the existing dam, downstream of the existing vegetated spillway. These natural areas include forested terrain and sloping hillsides down to Beaver Creek, Beaver Creek itself, as well as several natural areas along the lake shore of the existing reservoir. The Crozet Master Plan (CCAC 2021) describes the community goals of maintaining natural areas both in the Crozet Development Area and within the rural ring.

In July 2022, a search of the Virginia Division of Natural Heritage Program's Rare Species and Natural Community database (DCR 2022) was performed. The search parameters included only plants and insects for all State Legal Status species located in Albemarle County, for the twelve-digit HUC for Mechums River – Beaver Creek 020802040102. The search results returned no insects or vascular plants. Therefore, no Virginia-listed Rare Species and Natural Communities are applicable to the project's affected environment and will not be carried forward for impacts analysis in the Environmental Consequences section.

Riparian Areas

Riparian areas are present within the project area. These riparian areas are located along the banks of the inflows and perimeter of Beaver Creek Reservoir. Minimal riparian areas are located along the banks of Beaver Creek and an unnamed tributary to Beaver Creek downstream of the dam. Most of the riparian areas along the inflows, perimeter of Beaver Creek 1 Reservoir, and the unnamed tributary to Beaver Creek are forested. The riparian area along Beaver Creek downstream of the dam is not forested.

The Crozet Master Plan (CCAC 2021) describes the community initiative of maintaining 100-foot stream buffers on all perennial and intermittent streams within the rural ring and in any water supply watershed within the Community of Crozet. Therefore, significant changes to the conditions of the riparian areas are not anticipated during the evaluated life of the project based on limited future development in the watershed and community initiatives to avoid disturbing stream buffers.

ANIMALS

Fish and Wildlife Resources

The Beaver Creek reservoir provides a habitat for fish and aquatic life, as well as other wildlife in the surrounding park areas and natural areas. The reservoir provides opportunities for fish and wildlife to thrive in natural environments. Fishing is listed as one of the suggested activities when visiting the Beaver Creek park area.

Endangered and Threatened Species

NRCS obtained the Official Species List for the project areas from the USFWS in May 2021 via the online Information, Planning and Conservation (IPaC) system (references). One federally endangered species, the James spinymussel (*Pleurobema collina*), and one federally threatened species, the northern long-eared bat (*Myotis septentrionalis),* were identified as potentially present. Per an IPaC inquiry in July 2022, the monarch butterfly was recently listed as a candidate species by USFWS for Albemarle County and may potentially be present in the project area.

Based on the IPaC results, the Virginia Department of Wildlife Resources (DWR) online NLEB Winter Habitat and Roost Trees mapper **(**DWR 2022) was consulted and no hibernaculum or known occupied maternity roost trees are mapped within the proposed action's affected environment or within a 5.5-mile radius of the affected environment. A mussel survey was performed downstream of the Beaver Creek dam and no specimens of James spinymussel were found to be present (Appendix D). Therefore, the proposed project is anticipated to have no effect on federally protected species.

The NRCS must also consult with State entities when considering impacts to species of concern protected by State laws or regulations and DWR retains legal authority for the protection of all State listed animal species**.** Early scoping with the USFWS and the DWR indicated the potential presence of the federally and state endangered James spinymussel. Subsequently, Three Oaks Engineering was contracted to complete a freshwater mussel survey. The survey of an approximately 1,000-meter reach below Beaver Creek 1 was completed during August 2020. No mussels were found within the survey area downstream of the dam outlet and only relic shells of the invasive Asian clam (*Corbicula fluminea*) were observed. The survey confirmed the lack of presence of the federally endangered James spinymussel; as well as the lack of the presence of the State endangered brook floater (*Alasmidonta varicose*); three State threatened mussel species, yellow lance (*Elliptio lanceolata*), Atlantic pigtoe (*Fusconaia masoni*), and green floater (*Lasmigona subviridis*); and two non-listed mussel species, the triangle floater (*Alasmadonta undulata*) and creeper (*Strophitus undulatas*) (VaFWIS 2022).

In April 2021, a search of the DWR's Virginia Fish and Wildlife Information Service (VaFWIS) database was performed to identify species that may be present in the affected environment for the proposed action. The VaFWIS database uses a minimum 3-mile habitat search radius from the location of the proposed action. The results of the VaFWIS database search indicated the potential presence of the DWR State listed animal species, of which eight species were determined to be present and to not be carried forward for analysis. Four species, peregrine falcon, loggerhead shrike, Appalachian grizzled skipper, and migrant loggerhead shrike are carried over for analysis. A listing of the VaFWIS database search results is provided in Appendix D.

The draft Plan-EA was submitted to the Virginia State Agency Review Clearinghouse for regulatory review. Feedback was incorporated in the Final EA, including assessment of habitat presence for each species, documented presence within the affected environment, specific species best management practice recommendations, and any time of year restrictions applicable to specific construction activities.

Although the Virginia Department of Agriculture and Consumer Services Resources (VDACS 2022) retains legal authority for the protection of all State listed plants and insects, they maintain a memorandum of agreement (MOA) with the Virginia Department of Conservation and Recreation

(VDCR) stipulating that coordination regarding these resources should be initiated through the VDCR, Division of Natural Heritage Resources (DNH).

In addition to providing official State consultation feedback for all State Listed plants and insects per the MOA with the VDACS, the Virginia Natural Area Preserves Act (10.1-209 to 217 of the *Code of Virginia)*, passed in 1989, codified VDCR's powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened, and endangered species, significant natural communities, geologic sites, and other natural features). The VDCR-DNH represents the first comprehensive attempt to identify the most significant natural areas in the Commonwealth through an intensive statewide inventory of plants, animals, natural communities, and other features that are exemplary, rare, or endangered on a global or statewide basis.

Migratory Birds/Bald Eagles

The affected environment for Beaver Creek Dam and Reservoir is located within the Atlantic Flyway, the migratory path of waterfowl, shorebirds, pelagic birds, and songbirds of the North American East Coast. Each fall the Atlantic Flyway is filled with ducks, geese, brant, swans, hawks, eagles, and other migratory birds. Waterfowl and other birds make several stops on the flyway to rest, feed, and drink before continuing their southern migration. In early spring, birds follow this path northward to their traditional nesting grounds. The USFWS Migratory Birds of Conservation Concern breeding season table is provided in Appendix D.

Bald Eagles: Although bald eagle habitat is present, no bald eagle nests were identified within the affected environment during site visit surveys in August and September 2020 and February and May 2021. Additionally, according to the Center for Conservation Biology's Bald Eagle Nest Locator (CCB 2022), the closest recorded bald eagle nest is 0.9 mile from Beaver Creek 1. Due to the potential for bald eagles to nest in the project area, bald eagles will be carried forward for impacts analysis in the Environmental Consequences section.

Golden Eagles: Eastern golden eagle migration is strongly associated with the Appalachian ridgelines. In Virginia, the birds migrate southward between October and early December, and then back northward during April and May. Wintering eagles spend the months of December through March in the Commonwealth. Within Virginia and the broader Appalachian range, wintering golden eagles are primarily associated with small forest openings along ridgelines, although they may also be seen soaring over the valleys between ridges. Although golden eagles do not nest in Virginia, the affected environment does include the habitat requirements of the golden eagle.

HUMANS

Public Benefits

The project has provided public benefit since its original construction in the early 1960's. The project provides M&I water supply for homes and businesses in the community. The current project provides an estimated annual flood damage reduction benefit of $15,872 based on a

reduction of flooding of up to 1,270 feet of downstream roadways, the Early Dawn Dairy Farm, 3 residences and other structures as compared to a without-dam condition. The existing project has provided water supply for Albemarle County since the 1960's, which has benefited residents, businesses and farms within the Community of Crozet for decades. The Beaver Creek park is part of Albemarle County's park system, providing a 219-acre amenity for local residents and recreationists (See additional discussion under Park Lands). Approximately 2 acres of the park are contained within the project area in the auxiliary spillway area and the parking area located in the left abutment of the dam.

Drought

The M&I water supply provided by the project is critical to the current and long-term regional water supply plan. The reservoir is capable of meeting immediate and future demand based on Safe Yield requirements to prevent severe water shortages during drought conditions. However, based on the limitation to the current allowable withdrawals from the reservoir due to the Sponsors not holding a VWP permit, the project can no longer meet maximum daily demand requirements. The project is the sole drinking water supply source for the Community of Crozet. In its current configuration, approximately 7.5 percent of the usable raw water storage is not accessible due to limitations of the existing pump station infrastructure. Another limitation of the current pump station infrastructure is its interdependency on the principal spillway conduit to charge the pumps. This results in unnecessary downstream releases and wastes water supply. Future drought conditions can be exacerbated by climate change or otherwise unusually dry and hot summer months.

Flood Damages

The project was originally constructed in the 1960's to provide flood protection benefits based on observed flood damages downstream of the dam site and to the agricultural resources at that time. The dam has provided a source of flood protection by retaining floodwaters from approximately 9.55 square miles of drainage basin contributing to Beaver Creek. The current project provides an estimated annual flood damage reduction benefit of $15,872 based on a reduction of flooding of up to 1,270 feet of downstream roadways, the Early Dawn Dairy Farm, 3 residences and other structures as compared to a without-dam condition.

Local and Regional Economy

Economic conditions are characterized at the county level, reflecting a mobile work force that commutes between home and business, particularly to the Charlottesville area and the University of Virginia. In contrast, social conditions are local and characterized by Census data at the Block Group level. Census Tract 101, Block Group 3 and Census Tract 111, Block Group 1 contain the areas potentially affected by Beaver Creek 1 and its drainage area. The 2019 data from the American Community Survey, provided in Appendix D, describe a project area that tends to be less diverse, older, more highly educated, and measurably more affluent than the remainder of the county and the Commonwealth. One of the County's few remaining dairy farms, Early Dawn Dairy, is located on Cow Path Lane, immediately downstream of the project.

Park Lands

The Beaver Creek Park is a part of Albemarle County's parks and recreation system. The auxiliary spillway and parking area provide approximately 2 acres of open space out of the entire 219 acre park area, about 12 parking spaces, as well as picnic tables, bathrooms and a boat launch. The park is used by hikers, picnickers, and others who want to enjoy scenic views of the Blue Ridge Mountains and the reservoir itself. The reservoir is also used for fishing and other types of non-motor boating, such as kayaking and regular use by the Western Albemarle High School sculling club for competition training. The Crozet Master Plan underscores the importance the community has placed on continuing to provide park space in both the development area and the rural ring. Maintaining the use of the park lands is in keeping with the guiding principles of the Crozet Master Plan (CCAC 2021).

Potable Water Supply

The project serves as the sole M&I water supply source to the Community of Crozet. The regional water plan (DWIP 2019) evaluated several alternatives to meet the current and future water supply needs of the community and found that leveraging the existing Beaver Creek reservoir with increased permitted withdrawals to be the most plausible, least environmentally impactful means to meet the demand of the Community through 2075.

Public Health and Safety

The project is classified as a regulated high hazard potential dam by the Commonwealth of Virginia's Administrative Code (4VAC50-20 – Impounding Structure Regulations) and is also considered high hazard by NRCS dam safety standards (Technical Release 210-60 – Earth Dams and reservoirs). In its current configuration, the project cannot safely store and/or pass runoff associated with the design storm event. This poses a threat to public health and safety given the presence of several homes, public roadways, farmlands and other structures located in the breach inundation zone. In addition to the direct threat of a breach scenario, loss of the reservoir would result in severe water shortages for the community. A breach of the structure resulting from hydraulic failure could render Browns Gap Turnpike impassable until the conditions could be assessed and emergency repairs implemented. Browns Gap Turnpike provides a vital thoroughfare for emergency service vehicles, daily commuters, and the Early Dawn Dairy Farm located on Cow Path Lane.

Recreation

The Beaver Creek Park is part of Albemarle County's park system. The project includes such amenities as a boat launch for canoe and kayaks, charcoal grills, picnic tables, access to the Albemarle County trails system and scenic views of the Blue Ridge Mountains. The Beaver Creek park is a total of 219 acres, including the 104 acre reservoir and 2 acres of open space park at the project site and 12 parking spaces available for recreationists. The remaining park area consists of trails, and the project site contains the only designated parking and picnic areas located in the park. Though gasoline motors are prohibited from the lake, electric motors are allowed. The lake also provides a training area for the West Albemarle High School sculling club. The park is connected to the Albemarle County trail system in Crozet's rural ring.

Scenic Areas

The Beaver Creek park is part of Albemarle County's park system. Although there are no designated State or National Natural and Scenic Area Preserves or river segments located within the project area, the project provides a source of scenic beauty by providing a view of the Blue Ridge Mountains and by the natural beauty of the reservoir and forested surrounding areas.

Social/Cultural Issues

Browns Gap Turnpike (SR 680) traverses the dam and emergency spillway. During the project scoping process, overwhelming feedback was received surrounding the closure of Browns Gap Turnpike during construction. Those closest to the project and affected by the closure emphasized the importance of this route for local residents, particularly those who reside along Cow Path Lane including the Early Dawn Dairy Farm. In addition, the community emphasized the importance of maintaining county park areas, natural areas and other environmental resources in the Crozet Master Plan (CCAC 2021). As such, the community tends to reject unnecessary removal of forests, trees, and other areas of recreational greenspace. This community's initiative involves maintaining these areas and improving the outdoor parks and trail systems.

Cultural Resources

National Historic Preservation Act

In 1966, Congress passed the National Historic Preservation Act (NHPA) which directed all Federal Agencies to establish a preservation program based on a framework outlined in the NHPA, as amended. It also required Federal Agencies to consider the effects of their undertakings on historic properties. Per the Advisory Council on Historic Preservation (ACHP), the Area of Potential Effects (APE) is defined as the geographic area or areas within which a project may directly or indirectly cause changes in the character or use of historic properties, if they exist.

The NRCS determined that the direct impacts APE for this undertaking is confined to the areas of potential ground disturbance (using the maximum possible extent of ground disturbance) that extend beyond the bounds of areas that were previously disturbed during the construction of the original dam and the areas that may be disturbed for the water intake, pump station, and transmission line. The indirect APE for this undertaking is the viewshed from any identified historic resource to the proposed undertaking (using the maximum possible extent of ground disturbance). Figure C-3 depicts both the extent of ground disturbance during the original dam and raw water transmission main, as well as the maximum possible extent of the APE for the project components.

Section 106 of the National Historic Preservation Act requires that Federal Agencies consult with the applicable State Historic Preservation Officer, Federally recognized Indian Tribes, and other interested parties regarding cultural resources. The NRCS searched the Virginia Department of Historic Resources (VDHR), Virginia Cultural Resource Information System (V-CRIS 2022) to identify recorded historic properties. The V-CRIS search results did not identify any recorded archaeological or architectural historic resources within the defined direct or indirect APE.

Following the V-CRIS search, the NRCS conducted a cultural resources survey of the project area in August and September 2020 and February and May 2021. The survey staff meet or exceed the respective Secretary of the Interior standards for architectural historians and archaeologists. The

survey report is summarized herein and provided as Appendix D. Background research included examination of historic maps and aerial imagery. Field testing included the excavation of 15 shovel test pits where the topography and soils were suitable for a test pit in areas of moderate to high probability located within the maximum potential limits of disturbance for all action alternatives. A substantial stone building foundation was observed during a pedestrian reconnaissance approximately 20 feet outside and uphill of the direct APE.

Three potentially eligible archaeological resources were identified: (1) a stone building foundation located outside of the direct APE in Routes 1/3 to Pump Station Sites 1/3 with sparse surface scatter was observed both uphill and downhill from the APE, (2) a linear scatter of historic artifacts with a small prehistoric component located immediately east of the Beaver Creek reservoir spillway, and (3) a small artifact scatter with precontact and historic components located along Old Three Notch'd Road. Due to the resources location and arrangement, none of the three archaeological sites meets one or more of the four criteria for NRHP listing.

The architectural fieldwork included identification of all previously recorded resources as well as any previously unidentified resources over 50 years in age located within the APE. Two previously recorded architectural resources and twelve newly recorded aboveground resources were identified in the APE. One newly recorded resource, Three Notch'd Road, is potentially eligible for listing on the NRHP under Criterion A. It is recommended that the remaining thirteen resources are not eligible for listing in the NRHP due to a lack of historic or architectural significance. The project impact areas are presented in Appendix D, Figures 8.2 and 8.3 on pages 72 and 73 respectively. The impact areas included the dam and spillway site and immediately surrounding areas, the selected pump station location, and the alignments of the potential pipelines from the pump station to the Crozet WTP.

Additional detailed information on the archaeological and architectural resources identified during the cultural resources evaluation are presented in Appendix D. Consultation with DHR is ongoing. Correspondence received from DHR relative to concurrence with the eligibility recommendations and effects assessment will be provided in an appendix of the final EA.

To identify Indian tribes, including those no longer resident to Virginia that might attach religious or cultural significance to historic properties located in the project area, the NRCS searched the Housing and Urban Development Agency's Tribal Directory Assessment Tool (TDAT 2020) This was done in accordance with 36 CFR 800.2(c)(i) of the ACHP Regulations and since this source is used for initiating Section 106 consultation under the National Historic Preservation Act, no additional sources were reviewed. The TDAT search identified the "Absentee Shawnee Indians of Oklahoma, Shawnee Oklahoma", "Catawba Indian Nation, Rock Hill, South Carolina", "Cherokee Nation, Tahlequah, Oklahoma", "Delaware Nation, Oklahoma", "Delaware Tribe of Indians, Oklahoma Headquarters, Bartlesville, Oklahoma", "Eastern Band of Cherokee Indians, Cherokee, North Carolina", "Eastern Shawnee Tribe of Oklahoma, Wyandotte, Oklahoma", "Muscogee (Creek) Nation", "Oneida Indian Nation, Oneida, New York", "Oneida Nation of Wisconsin, Oneida, Wisconsin", "Shawnee Tribe of Oklahoma, Miami, Oklahoma", "The Tuscarora Nation (of New York), Lewiston, New York", and "The United Keetoowah Band of Cherokee Indians, Tahlequah, Oklahoma" as Non-Resident Federally recognized Tribes with Interests in Virginia. The TDAT search also identified the "Chickahominy Indian Tribe, Providence Forge, Virginia", "Chickahominy Indian Tribe – Eastern Division, Providence Forge, Virginia", "Monacan Indian

Nation, Madison Heights, Virginia", "Nansemond Indian Nation, Suffolk, Virginia", "Pamunkey Indian Tribe, King William, Virginia", "Rappahannock Tribe, Indian Neck, Virginia", and the "Upper Mattaponi Indian Tribe, King William, Virginia" as Resident Federally Recognized Tribes with interests in Virginia. Lastly, a search of the Virginia Secretary of the Commonwealth identified the following tribes with State recognition only: "The Cheroenhaka (Nottoway) Indian Tribe, Courtland, Virginia", "The Mattaponi Tribe, West Point, Virginia", "The Nottoway Indian Tribe of Virginia, Capron, Virginia", and the Patawomeck Indian Tribe of Virginia, Fredericksburg, Virginia", and the "Monacan Indian Nation" as having a claimed interest or consultation contact in Albemarle County, Virginia. Tribal Consultation is ongoing. However, only two Virginia resident federally recognized tribes indicated interest; the Pamunkey Indian Tribe, who on follow-up indicated they no longer have interest, and the Monacan Indian Nation, who indicated that at this time the Nation does not wish to actively participate in this consultation project, because the project impacts are anticipated to be minimal. However, the Nation requests to be contacted if:

- Sites associated with native history may be impacted by this project;
- Adverse effects associated with this project are identified;
- Human remains are encountered during the project;
- Other tribes consulting on this project cease consultation; or
- The project size or scope becomes larger or more potentially destructive than currently described.

Non-resident federally recognized tribes with interests in Virginia were invited to review and provide feedback on the Draft Plan-EA. No comments were received from the non-resident federally recognized tribes during the formal comment review period. Correspondence with tribes associated with the review of the Draft Plan-EA are included in Appendix A of this document.

National Historic Landmarks Program

The National Parks Services National Historic Landmarks Program consists of nationally significant historic places designated by the Secretary of the Interior and listed in the National Register of Historic Places because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States. Per the National Park Service's National Historic Landmarks Program website (NPSNHLP 2022) there is one National Historic Landmark site listed in Albemarle County, which is Monticello, and three National Historic Landmark sites in the City of Charlottesville, which are Shack Mountain, University of Virginia Rotunda, and the University of Virginia Historic District. Of the four listed National Historic Landmark sites, the closest landmarks to the project site are the University of Virginia Rotunda and the University of Virginia Historic District, which are more than 8 miles east-southeast of the project site. Therefore, the National Historic Landmarks Program is not applicable to the project's affected environment and will not be carried forward for impacts analysis in the Environmental Consequences section.

Description of Existing Dam

Beaver Creek 1 is an earthen embankment located in Albemarle County, Virginia. The dam impounds a 104-acre reservoir at approximate normal pool elevation of 537.8 feet. The dam is located approximately 0.6 miles north-northwest of the intersection of U.S. Route 250 and State Route 680 in Crozet, Virginia. The Beaver Creek 1 reservoir forms the effective confluence of the Parrott Branch, Watts Branch and Beaver Creek tributaries. The dam was designed in the early

1960's by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS, formerly known as the Soil Conservation Service or SCS) as a multiple-purpose structure designated for the purposes of County water supply and flood control. Construction was completed in 1964. The dam was classified as a significant hazard potential or "Class B" structure by the SCS. As defined by the SCS, a significant hazard potential structure is a dam located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, or minor railroads or cause interruption of use or service of relatively important public utilities.

The dam is on the order of 450 feet long and on the order of 60 feet high as measured from the crest to the lowest point of the downstream toe. The crest is approximately 30 feet wide to accommodate Browns Gap Turnpike / State Road 680, which traverses the dam crest and vegetated auxiliary spillway. The downstream slope has a grade of about 2-½ horizontal to 1 vertical (2.5H:1V) with one berm. The upstream slope has a grade varying from about 3H:1V to 4H:1V. The primary spillway consists of a vertical, reinforced-concrete riser situated at the upstream toe with 18 feet of weir length at the normal pool elevation of 537.8 feet. Water discharging into the riser is transported through the dam by means of a 42-inch diameter reinforced-concrete outlet pipe. The auxiliary spillway consists of a grassed earth-cut channel located in the left abutment. The auxiliary spillway channel is 200 feet in width and has a control section elevation of 551.4 feet, approximately 14 feet above normal pool. Browns Gap Turnpike / State Road 680 also traverses the auxiliary spillway. The surveyed low-point of the existing dam crest elevation is 558.9 feet. However, most of the crest is at or above elevation 560 feet. The roadway traversing the auxiliary spillway and the crest of the dam were described in the original watershed work plan and measures were included to widen the dam crest to accommodate Browns Gap Turnpike / SR 680.

The dam, spillways, abutment areas, and impoundment are owned by Albemarle County and operated by Rivanna Water and Sewer Authority (RWSA). In general, the vegetation is maintained by Albemarle County and RWSA maintains the principal spillway, gates, pump station and other components associated with the water withdrawal and transmission system. The County owns flood easements around the reservoir that extend above the existing auxiliary spillway control section elevation and therefore the 100-year flood pool.

Identified Deficiencies: There are six (6) dam safety related engineering issues associated with the dam.

Hydraulic Capacity – The existing dam and spillway are not currently capable of safely storing and or discharging runoff associated with the design storm event.

Auxiliary Spillway Integrity – The existing vegetated auxiliary spillway does not have sufficient integrity to safely pass the design storm flood.

Embankment Drain System – The existing internal filter drain structure does not meet NRCS filter compatibility requirements. The drain outlets cannot be located.

Potential dispersive fines – Crumb testing of alluvial samples obtained near the downstream toe of the embankment indicated potentially highly dispersive (Grade 4) materials.

Riser Structure Stability – The existing riser structure does not meet seismic stability criteria.

Inundation of Browns Gap Turnpike – The control section elevation of the existing auxiliary spillway is lower than the crest of the dam. If the auxiliary spillway activates, Browns Gap turnpike will be inaccessible.

General Description of How a Dam Functions

A dam provides flood protection by storing runoff and releasing it downstream in a controlled manner. A dam that is properly designed will pass all of the required storm events without overtopping or failure of the spillway structure(s). In order to safely pass a greater storm event, a dam must either increase available flood storage, increase the discharge capacity of the spillway structure(s), or a combination thereof. Raising the height of a dam must be carefully considered, since the increased impoundment volume and depth can cause additional structures or properties to be impacted in the breach zone downstream. The discharge capacity of a dam can be improved by designing and constructing more efficient hydraulic structures, such as a non-linear weir or a gated spillway. Non-linear weirs, such as labyrinth crested weirs, provide greater discharge capacity than a straight weir under the same hydraulic head. The improved discharge capacity can reduce the likelihood of a dam failure due to overtopping the embankment or breaching, provided that the spillway structure is sized appropriately and designed and constructed with appropriate considerations for durability, energy dissipation, and stability during the full range of design storm events.

Function of Existing Raw Water Intake Structure

When the reservoir level falls below normal pool elevation 537.8 feet, one of the downstream sluice gates are operated to maintain water flow to the pump station located in the end of the principal spillway conduit at the foot of the dam. The invert of gate 4 is at 518.7 feet (NAVD 88), which corresponds to 3.3 feet above the designated sediment storage level at the riser location. This leaves approximately 37 million gallons of water supply storage, or 7.5% of the designated water supply pool capacity inaccessible under the current infrastructure arrangement.

The existing raw water pump station houses three vertical turbine pumps. The turbine pumps can operate in a duty/standby mode and are furnished with backup power generation. Water withdrawn via the riser structure flows through the 42-inch diameter principal spillway conduit to a spillway outlet chamber where it is then transferred to the pump station's wet well by two 12-inch gated and screened conduits. A weir at the downstream end of the chamber maintains a minimum depth of water in a wet well for pump operation. The screens in the spillway outlet structure are equipped with an air-burst cleaning system. The interdependency between the principal spillway conduit and the pumps is problematic for the Sponsors in that controlling minimum releases without wasting excessive raw water storage cannot be accomplished in the current configuration. Additional information and figures of the raw water intake structure can be found in the DWIP (Hazen 2019) contained in Appendix D.

Status of Operation and Maintenance

Operation and Maintenance of Beaver Creek 1 is currently the responsibility of the Rivanna Water and Sewer Authority. The specific operation and maintenance responsibilities are shared by Rivanna Water and Sewer Authority and Albemarle County. The dam is currently mowed and free of trees. The structure is well maintained by the sponsors. The Beaver Creek 1 Reservoir will continue to be owned by Albemarle County and operated by Rivanna Water and Sewer Authority, who will comply with Virginia DCR and NRCS requirements. Additional operation and maintenance agreements with the Virginia Department of Transportation regarding the proposed spillway bridge will need to be established.

Structural Data

Table C presents key structural information about the existing Beaver Creek 1 dam and spillway system.

Table C – Structural Data for Existing Beaver Creek 1 Dam

Feature	**Value**	
General		
	Record Drawings / Design Report	**2017 Bathymetric Survey, 2012 Topographic Survey and 2021 H&H Analysis**
Year Constructed	1964	
Purpose	Flood Control, Water Supply	
Hazard Classification per NRCS	Significant	High
Controlled Drainage Area	0	2.1
Uncontrolled Drainage Area	9.45	7.5
Design Normal Pool Storage, acre-ft	1,802	1,742
Normal Pool Elevation, ft	538.0	537.8[1]
Principal Spillway		
	Record Dwgs/Design Report	**2012 Topographic Survey**
Principal Spillway Structure	Reinforced-concrete riser	
Top of Concrete Riser	540.7	540.5
Normal Pool Weir Length, ft	18	-
Normal Pool Weir Invert Elevation, ft	538.0	537.8
Riser Floor Elevation, ft	498.0	-
Gate No. 1 Type	10”x10” Sluice Gate	
Gate No. 1 Invert Elevation, ft	533.0	-
Gate No. 2 Type	10”x10” Sluice Gate	

Feature	Value	
Gate No. 2 Invert Elevation, ft	528.0	-
Gate No. 3 Type	10”x10” Sluice Gate	
Gate No. 3 Invert Elevation, ft	523.0	-
Gate No. 4 Type	10”x10” Sluice Gate	
Gate No. 4 Invert Elevation, ft	518.0	-
Gate No. 5 Type	36”x36” Sluice Gate	
Gate No. 5 Invert Elevation, ft	498.5	-
Principal Spillway Conduit	42-inch I.D. reinforced concrete pipe	
Conduit Length	464.3	-
Conduit Inlet Invert Elevation, ft	497.5	-
Conduit Outlet Invert Elevation, ft	497.0	496.8
Downstream Outlet	Concrete Channel Under Pump Station into Riprap lined Plunge Pool Downstream	

[1.] The riser top slab was surveyed at elevation 540.5 feet in 2012 by Kirk Hughes & Associates and the record drawings indicate 2 feet 8 inches between the riser top slab and the principal spillway crest (see Section A-A of Record Drawings sheet 10 of 15). Therefore, the calculated principal spillway crest based on the Kirk Hughes & Associates survey and the record drawing dimensions is at approximate elevation 537.8 feet, which is 0.2 feet lower than the principal spillway crest elevation presented in the Record Drawings (converted to NAVD 88). All other elevations presented herein are based on Schnabel’s interpretation of the Record Drawings.

Breach Analysis and Hazard Classification

A Dam Breach Inundation Report (Schnabel 2011) indicated that the floodwave resulting from an uncontrolled breach of the Beaver Creek Dam would cause a probable loss of life scenario to downstream residents. As such, the Beaver Creek Dam is considered a high-hazard potential structure under Virginia Department of Conservation and Recreation (DCR) regulations and NRCS classifications alike (Class C Structure). Existing high hazard potential structures in Virginia are required to safely store and/or pass 90% of the runoff resulting from the Probable Maximum Precipitation (PMP) storm event. In its current configuration, the Beaver Creek Dam and spillway are capable of passing 60% of the runoff resulting from the Probable Maximum Precipitation (PMP). The sponsors maintain a higher standard and requested that the dam be designed to pass the full PMP. In its current configuration, the most severe, full PMP event results in the dam crest being overtopped by a depth on the order of five (5) feet during the design storm event assuming that Henleys Lake Dam breaches after reaching its peak water surface elevation.

After all analyses are completed and all rehabilitation measures to be implemented are identified, the dam breach inundation analyses should be updated to maintain an up-to-date Emergency Action Plan (EAP) for the project. Coordination with Albemarle County should take place to determine if flood hazard maps should be revised. The Dam Breach inundation analysis report is presented in Appendix D.

Evaluation of Potential Modes of Dam Failure

Dams are built for the conditions that existed, or could reasonably be anticipated, during the time of design. Sometimes these conditions change, resulting in the possibility for dam failure in the future. Several potential modes of failure were evaluated for Beaver Creek Dam No. 1.

Sedimentation: The future sediment accumulation rate is expected to be the same or less than the originally estimated or historic yield rates. Based upon the historic sediment deposition rate of 1.3 acre-feet per year, the remaining sediment storage life of Beaver Creek 1 as of 2017 is estimated to be greater than 108 years based on the water supply storage aspect of the project (sediment storage volume at elevation 515.4 feet approximately 210 acre-feet per the 2017 Draper Aden Associates bathymetric survey). The available beneficial water supply storage is estimated as 1,527 acre-feet, represented by the difference between normal pool and sediment pool. The aerated sediment was also estimated based on a comparison of topographic data and stage storage volumes. An estimated 3 acre-feet of aerated sediment is estimated to have accumulated in the flood retarding pool. The potential for failure due to inadequate sediment storage capacity is low. The sponsors will perform bathymetric surveys periodically for the life of the project to quantify sedimentation. Additional information and analyses are presented in the Sedimentation Memorandum (Schnabel 2021) presented in Appendix D.

Hydraulic Capacity and Spillway Integrity: Failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and causes failure. Under present NRCS criteria for high hazard potential dams, the auxiliary spillway must have sufficient integrity and capacity to completely pass the Freeboard Hydrograph assuming full PMP rainfall. The auxiliary spillway does not have sufficient capacity to prevent the embankment crest from overtopping. The auxiliary spillway also does not have sufficient integrity to withstand the flows from the PMP event and could breach, causing an uncontrolled release of the reservoir. For these reasons, the overall potential for failure of Beaver Creek 1 due to hydraulic inadequacy is high. Additional analyses and information are presented in the Hydrology and Hydraulics report (Appendix D).

Seepage: Embankment and foundation seepage can contribute to failure of an embankment by internal erosion of fine-grained soil material through the embankment or foundation. As the soil material is removed, the voids created allow greater volume and velocity of water flow through the embankment or foundation, until the dam collapses due to the internal erosion. Seepage that increases with a rise in pool elevation is an indication of a potential problem, as is stained or muddy water or “sand boils” (the up-welling of sediment transported by water through unfiltered areas). Foundation and embankment filter drainage systems can alleviate the seepage problem by allowing the water to drain without allowing soil particles to be transported out of the embankment or foundation. Evidence of uncontrolled seepage near the right abutment on the downstream side of the embankment has been observed. The existing internal drainage system does not meet applicable NRCS filter compatibility requirements. Additionally, the corrugated metal pipe outlets believed to be conveying the internal drain flow have not been observed and could not be located by the project team or sponsors during field reconnaissance. Although the seepage gradients are low, the potential for a seepage failure is considered moderate. Additional analyses are presented in the Geotechnical Engineering Report (Appendix D).

Seismic: The site lies just on the northwestern edge of the Central Virginia Seismic Zone (CVSZ) which is primarily located in the Piedmont physiographic province. Crystalline metamorphic and igneous rocks of the Piedmont physiographic province underly the surficial soils which are assigned to geologic terranes including the Western Piedmont, Chopawamsic and Goochland terranes, which are sutured together along ductile faults known as high strain zones. When evaluating fault zones within CVSZ, published maps (Virginia Division of Geology and Mineral Resources, 2017) show that several Mesozoic rift basins overlie crystalline rocks and are bounded on one, or both sides, by northeast striking normal faults. These faults are brittle in nature and commonly coincide with high strain zones, suggesting reactivation of the older structures.

Fault zones discussed in this section are ancient faults that are important to understanding existing geologic features at the site. However, the relationship between these faults and the modern earthquakes that contribute to the active seismicity of the site is uncertain, as no historic earthquakes in Virginia have been directly connected to a fault mapped at the surface (Virginia Division of Geology and Mineral Resources, 2017). Given the lack of evidence of these ancient faults contributing to active seismicity near the site, the seismicity section of this report (Section 2.6) focuses on acknowledgement of the CVSZ and the historic earthquakes magnitude 4.0 or greater recorded within a 100-km area of interest around the site. No quaternary faults have been mapped by the USGS within this area of interest.

The potential for a seismic failure of the embankment structure is considered low. The existing riser structure does not currently meet stability requirements during the design seismic event. Stabilization of the riser should be evaluated during the design phase and included in the rehabilitation plan. Stabilization measures will need to be performed with the reservoir in service since Beaver Creek 1 is the sole water supply for the community of Crozet. Seismic analyses of the embankment are presented in the Geotechnical Engineering Report and the seismic stability of the riser are presented in the Analysis of Non-Earthen Components Report (both reports are contained in Appendix E).

Material Deterioration: The materials used in the principal spillway system, the embankment drains, and the pool drainage system are subject to weathering and chemical reactions due to natural elements within the soil, water, and atmosphere. Concrete risers and conduits can deteriorate and crack, metal components can rust and corrode, and leaks can develop. Embankment failure can occur from internal erosion caused by these leaks. There is low potential for failure due to material deterioration of the principal spillway system based on the major components being comprised of concrete. The visual evaluation of the principal spillway conduit indicated that limited weathering or deterioration have taken place, and no inflow seeps were observed. Although the seepage gradients at the dam are low, the potential for failure of the embankment due to a collapse of the toe drain is considered low to moderate.

Slope Stability: Slope stability analyses were performed as part of the development of this Supplemental Watershed Plan. The average upstream slope of the embankment is four horizontal to one vertical (4H:1V) and the average downstream slope of the existing embankment is 2.5H:1V. Slopes of this geometry are relatively stable in the Piedmont Physiographic Province where the dam is located and, as such, the potential for failure of the embankment due to slope instability is

considered low. The slope stability analyses indicated that the existing Beaver Creek 1 earthen embankment meets the applicable factors of safety under various loading conditions. It is recommended that slope stability be reviewed and refined further during the final design phase and potentially flattened to 3H:1V in newly graded areas adjacent to the proposed spillway.

Conclusion: At the present time, the most likely means of failure for Beaver Creek 1 would be caused by an extreme hydrologic event such as the PMP. The PMP would likely result in overtopping the dam and/or breaching the auxiliary spillway. Though there is the potential for seismic-related slope failure or dam deformation, an uncontrolled breach would most likely not occur given the amount of freeboard available at normal pool. These types of failures could occur at any time during the remaining life of the structure. There is adequate sediment capacity for the remaining useful life of the project.

Consequences of Dam Failure

Sudden failure scenarios of the existing dam were performed as part of the dam breach inundation analyses (Schnabel 2011). One scenario considered a "sunny day" breach event, in which a breach initiated at normal pool elevation 538.0 feet (approximately 0.2 feet above the crest of the principal spillway riser). Another scenario included the Probable Maximum Flood (PMF) with breach, in which the breach initiated at the peak water surface elevation during the 12-hour PMF (approximate elevation 561.3 feet, 2.6 feet above the low-point on the crest of the dam). The modeled breach scenarios meet the minimum requirements described in Technical Release 210-60. The hydrographs were routed using the U.S. Army Corps of Engineers Hydraulic Engineering Center's River Analysis System (HEC-RAS) version 4.3. A peak discharge from Beaver Creek 1 on the order of 198,000 cfs was estimated for the 12-hour PMF with breach scenario described in the August 12, 2011 Breach Analysis report.

There are potentially 11 residential structures within the PMF breach inundation zone based on the 2011 dam breach inundation analyses, in addition to several roadway crossings, farmlands and the existing M&I pump station itself.

Due to the nature of the at-risk properties downstream, it is difficult to predict "population at risk" (PAR) (i.e., individuals subject to injury or even death due to a catastrophic breach of the proposed Beaver Creek Reservoir Dam). Therefore, the NRCS publication Guidance for Completion of "Evaluation of Potential Rehabilitation Projects" was utilized to estimate the PAR. Regarding urban structures, there are 11 single-family residences that would be impacted by a failure of the existing dam during the PMF breach scenario. Using an average of three (3) residents per home, it was estimated that thirty-three (33) persons in structures would be at risk in the event of a dam breach and an uncontrolled release of the reservoir. Additionally, the impacted downstream roadways could put the lives of motorists in potential danger and interrupt commuters and access for emergency service vehicles in the event of a dam breach event. If the dam were to fail, the existing raw water pumping station may be damaged or destroyed which could cause interruption to community water supply and would result in additional repair costs due to the emergency nature of a significant water supply shortage.

FORMULATION AND COMPARISON OF ALTERNATIVES

The authorized purposes of this project are as follows:

1) Bring the dam into compliance with current Virginia Division of Dam Safety and NRCS safety and performance standards for high hazard potential dams
2) Provide municipal and industrial water supply that meets the community's current water demand levels
3) Provide flood protection for downstream property and human life.

FORMULATION PROCESS

Formulation of the alternatives followed procedures outlined National Watershed Program Manual (NRCS 2014) and National Watershed Program Handbook (NRCS 2014). Other guidance incorporated into the formulation process included DM 9500-013 (USDA 2017), and other NRCS watershed planning policies and guidance documents and circulars. The planning team considered alternatives that would best meet the purpose and need of the project while limiting impacts to the affected environment. Several alternatives were considered and one useful life option (50-year) was evaluated as part of a period of analysis determination. Two federal action alternatives were carried through for detailed study. The recommended alternative that maximizes public benefits has a 55-year period of analysis, including two years for design and three years for installation and 50 years of expected useful life. This useful life was selected based upon the availability of projected M&I water supply demands and utilized a discount rate of 2.25%.

The formulation process began with formal discussions between the Sponsors and NRCS. As a result, alternative plans of action were developed based on NRCS planning requirements and the ability of the alternatives to address the initial objective of meeting the purpose and need for the project. The alternative plans that must be considered, as a minimum, include:

- No Action/Future Without Federal Investment (FWOFI)
- Future With Federal Investment (FWFI)
    - Locally Preferred Alternative
    - Non-Structural Alternatives
    - Structural Alternatives
- Decommissioning

The following sections will describe the required alternatives and alternatives that best met the stated purpose and need for the project.

No Action/Future Without Federal Investment (FWOFI)

The FWOFI alternative represents a true no-action alternative by the sponsors. If the Sponsors continue to operate the structure as-is, the M&I infrastructure would continue to be limited to 1.0 mgd withdrawal capacity based on not having a VWP Program Permit from DEQ, creating immediate shortfalls based on the maximum daily demand projections presented in the DWIP. Additionally, by 2040, the project will no longer be capable of meeting the average daily demand as that value eclipses the 1.0 mgd limit. The existing pump station infrastructure would remain

unable to access the 7.5 percent of raw water supply below the lowest gate invert, resulting in less drought resiliency. The current release system and M&I infrastructure limit the Sponsors with inaccurate measurement of flows and lack of remote control of the gate system, thus resulting in wasted water and excessive downstream releases. The dam and spillway do not meet current requirements for high hazard potential dams, and as such pose a threat to downstream life and property if a significant hydrologic event occurs. Aside from inadequate capacity to safely store and/or pass runoff from the design storm event, the existing vegetated auxiliary spillway does not have the required erosion resistance and integrity and could experience significant damage or failure and breach in a storm event less severe than the design storm event. This alternative is required by the NEPA / PR&G process and will serve as the baseline for comparison with the action alternatives.

Decommissioning

Beaver Creek 1 could be decommissioned to remove the potential for a breach and uncontrolled release of the reservoir. However, this would only exacerbate the current water supply issues facing the Community of Crozet. A new source of raw water supply would be required, as well as the infrastructure to convey the raw water to the Crozet Water Treatment Plant. The flood protection benefits provided by the structure would no longer be available to downstream properties, so additional flood-proofing of downstream structures (roads, houses) would also be required. Downstream farmland would be at risk for increased flooding as well. Decommissioning would eliminate the need for rehabilitation, but would not meet the project purposes of municipal and industrial water supply or flood protection without incorporating a separate water supply reservoir project and additional flood control protection measures. Although decommissioning must be considered as an alternative per NEPA requirements, implementing a new M&I water supply project to replace Beaver Creek 1 would result in exorbitant costs and extensive environmental impacts which are unnecessary. For these reasons, decommissioning was removed from detailed study.

Non-Structural Alternatives

Consideration was given to using non-structural alternatives to meet the project purpose and need. However, based on the multiple-purpose function of the reservoir, these alternatives could not effectively meet the purpose and need for the project. To obtain the permit from DEQ to increase withdrawals from the reservoir, structural modifications to the existing M&I infrastructure are required. The project will remain high hazard regardless of any floodproofing measures, removal of downstream hazards, or other non-structural measures based on the water supply aspect of the project being important infrastructure. Demanding conservation of the residents will not be enough to overcome the M&I water supply shortfalls that face the community. Because non-structural alternatives cannot meet the purpose and need for the project and the objectives of the sponsors, they were removed from detailed study.

Alternative 1

Rehabilitate dam, construct structural spillway over embankment, construct upgraded pump station at Site 1: This alternative consists of structural measures to upgrade the M&I water supply infrastructure, dam and spillway to meet the stated purposes of the project. An upgraded raw water

pump station will be relocated approximately 500 feet upstream of the existing dam on the southern shoreline. In addition to the conflicts posed by the pump station, principal spillway conduit and minimum instream flow (MIF) interaction, the existing pump station interferes with the proposed structural spillway and will require relocation. Upgrades will be made to the principal spillway controls to satisfy minimum in-stream release requirements and obtain a Virginia DEQ, Virginia Water Protection (VWP) permit. Obtaining the VWP permit from DEQ will allow for greater allowed withdrawal capacity. The additional permitted withdrawal capacity will allow for the intake structure and pump station to withdraw enough water to meet current maximum daily demand, which will exceed 1.0 mgd before 2025. The inadequate spillway capacity will be addressed by constructing a labyrinth-crested chute spillway over the existing embankment. Other modifications to the dam will be performed including rehabilitation of the internal filter drain system and stabilization of the riser to bring the structure into compliance with dam safety standards for high hazard potential dams. The former vegetated auxiliary spillway will be abandoned and backfilled to a uniform grade and maintained as Albemarle County park space.

Alternative 2

Rehabilitate dam, construct structural spillway in left abutment, construct upgraded pump station at current location: This alternative consists of structural measures to upgrade the M&I water supply infrastructure, dam and spillway to meet the stated purposes of the project. A new pump station adjacent to the existing pump station is constructed to separate the pumping infrastructure from the principal spillway conduit. An upgraded pump station will be reconstructed adjacent to its current location at the toe of the dam to separate the pumping infrastructure from the principal spillway conduit. A new intake and suction line will be required to convey water from the reservoir to the new pump station. This new intake would be located adjacent to the existing principal spillway riser, and a pipeline would be installed beneath the auxiliary spillway to a vertical shaft before turning towards the toe of the dam to reach the new pump station. The new infrastructure will result in a system that can satisfy minimum in-stream flow (MIF) requirements and obtain a Virginia DEQ, Virginia Water Protection (VWP) permit. Obtaining a VWP permit from DEQ will allow for greater allowed withdrawal capacity. The additional capacity will allow for the structure to meet the current maximum daily demand, which will exceed 1.0 mgd before 2025. A new access road will be required in the right abutment to access the pump station at the toe of the dam. The inadequate spillway capacity will be addressed by constructing a labyrinth-crested chute spillway in the left abutment of the dam. Other modifications to the dam will be performed including rehabilitation of the internal filter drain system and stabilization of the riser to bring the structure into compliance with dam safety standards for high hazard potential dams. The former vegetated auxiliary spillway will be abandoned and backfilled to a uniform grade and maintained as Albemarle County park space.

Locally Preferred Alternative/Sponsors Alternative

The Sponsors have indicated that they would likely proceed with the preferred alternative identified in this plan regardless of the availability of federal funding. The locally preferred/Sponsors alternative is the same or involves the same components as Alternative 1. Therefore, the Sponsors alternative will not be described in further detail and can be regarded as Alternative 1.

Structural Alternatives Considered but Removed from Detailed Analysis

Other alternatives considered but removed from detailed analysis include, but are not limited to, combinations of the following:

- Alternatives Involving different spillway rehabilitation measures:

    - Alternative 1A - *Rehabilitate dam, construct structural spillway over embankment, construct upgraded pump station at Site 1, Slipline Principal Spillway Conduit:* This alternative is identical to Alternative 1 with respect to dam and spillway rehabilitation and upgrades to the M&I infrastructure. However, Alternative 1A includes measures to slipline the existing principal spillway conduit with a smaller diameter, HDPE conduit. The intent of this alternative was to identify if flood damage reduction benefits could be improved by storing more and releasing less downstream during higher frequency storm events (two- through 100-year). This measure resulted in an annual flood damage reduction net benefit of $48. At an estimated installation cost of $100,000, this results in an annualized cost of approximately $3,188. The flood damage reduction benefit to cost ratio for this measure was estimated to be 0.015. For this reason, Alternative 1A was removed from detailed study.

    - Overtopping Protection and/or widening auxiliary spillway channel – This alternative was removed from detailed analysis due to requiring too great of a width of broad-crested weir to make it feasible given the available space at the site. Additionally, even if the hydraulic capacity of this alternative were not deficient, armoring of the auxiliary spillway, downstream areas, and the dam itself would result in significantly greater disturbance and/or removal of park land, natural areas, removal of trees, real property rights impacts, and would also render Browns Gap Turnpike impassable during a storm event that activates the spillway.

    - Gated Spillway Alternatives – These alternatives would require a wider chute and or significantly greater stilling basin footprint based on greater hydraulic head depth in the chute. The larger spillway and/or stilling basin footprint would cause greater impacts to natural areas, park space, additional tree clearing and would result in a more expensive chute spillway. This also creates additional long-term operation and maintenance costs, as well as introducing new potential failure modes associated with operation of mechanical gate structures.

- Alternatives Involving different M&I water supply sources or measures:

    - Constructing new M&I water supply infrastructure at Lake Albemarle – This alternative involved attempting to acquire rights to the raw water storage in Lake Albemarle, approximately 3 miles northeast of the Beaver Creek project site. This project would be considered supplemental to the Beaver Creek 1 M&I water supply, and so all rehabilitation measures necessary to bring Beaver Creek 1 into compliance with high hazard standards would still be necessary. Opportunities for

improving the system at Beaver Creek 1 would be unrealized. The new M&I infrastructure at Lake Albemarle would require many of the same measures as are described in Alternative 1 for Beaver Creek. However, the transmission from Lake Albemarle would result in an addition 3 miles of pipeline and all associated environmental impacts, real property rights issues and costs to convey with water to the Crozet water treatment plant. The Sponsors would also be responsible for operating and maintaining two M&I withdrawal facilities. Alternatives which involved supplementing the existing Beaver Creek 1 water supply were removed from detailed study based on the need to address the dam safety issues with Beaver Creek 1 as well as the additional costs, environmental impacts, real property right issues, and community issues involved in installing new M&I infrastructure at a new location.

- Alternate raw water supply sources were removed from detailed study because of exorbitant costs and environmental impacts associated with the permitting, planning, property rights acquisition, and construction of a new reservoir. Even if an alternate reservoir location could be identified and the land acquired for such a project, the Sponsors would still have to address the dam safety issues with Beaver Creek 1 either by rehabilitation, or by decommissioning the dam and M&I components and providing another means of flood protection for downstream properties. By inspection, the additional impacts associated with any such measure will quickly exceed the costs and impacts of leveraging the existing infrastructure and project.

Additional discussion and descriptions of alternatives considered, but removed from detailed analysis, are presented in Appendix D.

COMPARISON OF ALTERNATIVE PLANS

Tables D, E and F summarize the effects of each alternative considered for detailed study. Refer to the Environmental Consequences section for additional information.

Table D – Summary and Comparison of Alternative Plans and Associated EcoSystem Services

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Alternatives			
Locally Preferred		X	
Environmentally Preferable		X	
Non-Structural	X		
Brief Description of Major Features	No-Action	Structural Rehabilitation, Labyrinth and Chute Spillway Over Embankment, Upgrade and Relocate Raw Water Pump Station to Site 1	Structural Rehabilitation, Labyrinth and Chute Spillway in Left Abutment, Upgrade and Replace Raw Water Pump Station in Place
Total Project Investment	-	$42,822,227	$43,028,415
Annualized Project Investment	-	$1,364,954	$1,371,526
Annual O&M Costs	-	$531,650	$531,650
Total Annual Costs	-	$1,896,604	$1,903,176
Monetized Net Benefits	-	$730,958	$730,958
Benefit to Cost Ratio	-	0.39	0.38
Provisioning Services	*Provisioning services are tangible goods provided for direct human use and consumption, such as food, fiber, water, timber or biomass.*		
Food	May impact nearby farm.	Provides flood protection for nearby dairy farm.	Provides flood protection for nearby dairy farm.
Water	Project will fail to meet current community demands, Project will fail to meet future community demands.	Project will provide adequate water supply to community from present demand through 2075.	Project will provide adequate water supply to community at present demand through 2075.
Regulating Services	*Regulating services help maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe.*		
Flood and Disease Control	Project remains non-compliant with dam safety standards for high hazard.	Action will result in compliance with dam safety standards for high hazard potential dams.	Action will result in compliance with dam safety standards for high hazard potential dams.

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Flood and Disease Control (Continued)	potential dams, posing additional risk to downstream lives and property. Inadequate water supply may have indirect adverse effects on health and well-being in the community.	Sponsors will be capable of meeting immediate water supply demands as well as future demands through 2075. Action will remove raw water infrastructure as a hazard of the dam itself.	Sponsors will be capable of meeting immediate water supply demands as well as future demands through 2075.
Supporting Services	*Supporting services refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production.*		
Primary Production	Non-compliant high hazard potential dam - risk to croplands, raw water supply. Inadequate flood control may impact local dairy farm production.	Provides flood protection for nearby dairy farm.	Provides flood protection for nearby dairy farm.
Cultural Services	*Cultural services make the world a place in which people want to live – recreational use, spiritual, aesthetic viewsheds, or tribal values.*		
Recreational Experiences	Flooding in AS could damage existing park space.	Preserves all existing park space.	Permanent loss of no less than 0.5 acre of park space.
Aesthetic Viewsheds	No change.	Relocation of power pole will improve viewscapes.	Loss of an additional 1.0 acre of trees in park area and natural.

Table E – Summary and Comparison of Alternative Plans and PR&G Guiding Principles

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Healthy and Resilient Ecosystems	No effect.	No effect.	No effect.
Sustainable Economic Development	Economic Measures: Does not meet maximum daily demand for M&I water supply. Social Measures: No effect. Environmental Measures: Consequences would result from dam failure resulting from inadequate hydraulic capacity.	Economic Measures: Will meet maximum daily demand for M&I water supply. Social Measures: Will preserve park space in keeping with Crozet Master Plan guiding principles. Will require approximately 2.5 acres of permanent private property acquisition. Environmental Measures: Least impact to environment, natural areas, forest, streams, and other natural resources.	Economic Measures: Will meet maximum daily demand for M&I water supply. Social Measures: Will result in loss of no less than 0.5 acre of park space. Will require no less than 4.0 acres of permanent private property acquisition. Environmental Measures: Impacts to environment including natural areas, forest, streams.

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Floodplains	No effect. Continued risk of flooding to downstream areas based on non-compliant high hazard dam.	No significant effect on floodplains. A CLOMR/LOMR should be obtained during design phase.	No significant effect on floodplains. A CLOMR/LOMR should be obtained during design phase.
Public Safety	Continued risk of downstream flooding exists due to non-compliant high hazard dam. Pump station remains as a hazard of the dam. Public roadways threatened with non-compliant dam.	Project will comply with NRCS and Virginia requirements for high hazard potential dams reducing risk to downstream properties. Pump station will be relocated upstream and will no longer be a hazard of the dam. Public roadways will be better protected through rehabilitation.	Project will comply with NRCS and Virginia requirements for high hazard potential dams reducing risk to downstream properties. Pump station will remain at downstream toe of dam and be a hazard of the dam. Public roadways will be better protected through rehabilitation.
Environmental Justice	No effect. Environmental Justice communities not located in the vicinity of the project.	No effect. Environmental Justice communities not located in the vicinity of the project.	No effect. Environmental Justice communities not located in the vicinity of the project.
Watershed Approach	Continuation with no-action will not meet the Sponsors' purpose and need for the project.	Project will meet Sponsors' purpose and need and address present and future concerns in the watershed.	Project will meet Sponsors' purpose and need and address present and future concerns in the watershed.

Table F – Summary and Comparison of Alternative Plans and Typical Concerns Identified through Scoping

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
SOILS			
Stream Bank Erosion	Downstream stream banks vulnerable to damage if structure fails due to inadequate hydraulic capacity and/or spillway integrity.	Reduced likelihood for streambank erosion resulting from dam or spillway failure. No changes to 2- through 100-year storm event discharges. Energy dissipation structure will be designed to reduce likelihood of streambank erosion.	Reduced likelihood for streambank erosion resulting from dam or spillway failure. No changes to 2- through 100-year storm event discharges. Energy dissipation structure will be designed to reduce likelihood of streambank erosion.
Prime and Unique Farmland and Farmland of Statewide Importance	Prime and unique farmland in downstream areas vulnerable due to structure not meeting applicable dam safety standards for high hazard potential. No changes to prime and unique farmland.	2.8 acres of prime and unique farmland may be temporarily affected by the installation of this project. 2.7 acres of prime and unique farmland may be permanently affected by the installation of this project.	5.3 acres of prime and unique farmland could be temporarily affected by the installation of this project. 3.4 acres of prime and unique farmland may be permanently affected by the installation of this project.

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Prime and Unique Farmland and Farmland of Statewide Importance (Continued)		Up to 0.2 acre of designated prime and unique farmland used for agriculture could be permanently impacted.	Up to 0.9 acre of prime and unique farmland currently used for agriculture could be permanently impacted.
WATER			
Surface Water Quality	No effect.	Can include hypolimnetic oxygenation system.	Can include hypolimnetic oxygenation system.
Surface Water Quantity	No effect. Project in current configuration, unpermitted cannot meet current maximum daily demand requirements.	Project will result in meeting current maximum daily demand requirements and future average and maximum daily demand requirements.	Project will result in meeting current maximum daily demand requirements and future average and maximum daily demand requirements.
Clean Water Act	No effect.	Project will require appropriate permitting through Section 401/404.	Project will require appropriate permitting through Section 401/404.
Regional Water Management Plans	No effect, project cannot meet current maximum daily demands per DWIP, nor can it meet future demands.	Project will result in meeting current and future demand requirements described in the DWIP.	Project will result in meeting current and future demand requirements described in the DWIP.
Floodplain Management	No effect.	Project will maintain floodplain for two through 100-year storm event. Minor increases occur during the 200- and 500-year storm events.	Project will maintain floodplain for two through 100-year storm event. Minor increases occur during the 200- and 500-year storm events.
Streams, Lakes, and Wetlands	No effect.	The proposed action will result in the following impacts. <u>Streams, Permanent:</u> 230 feet to perennial, 175 feet to an unnamed tributary to Beaver Creek. <u>Streams, Temporary:</u> 75 feet to Beaver Creek, 125 feet to an unnamed tributary to Beaver Creek. <u>Lakes, Permanent:</u> 0.05 acres for pump station. <u>Lakes, Temporary:</u> 0.65 acres for spillway. <u>Wetlands, Permanent:</u> 0.005 acre freshwater emergent. <u>Wetlands, Temporary:</u> 0.015 acre palustrine forested.	The proposed action will result in the following impacts. <u>Streams, Permanent:</u> 290 feet to perennial, 90 feet to an unnamed tributary to Beaver Creek. <u>Streams, Temporary:</u> 75 feet to Beaver Creek, 125 feet to an unnamed tributary to Beaver Creek. <u>Lakes, Permanent:</u> 0.5 acres for pump station. <u>Lakes, Temporary:</u> 0.65 acres for spillway. <u>Wetlands, Permanent:</u> 0.005 acre freshwater emergent. <u>Wetlands, Temporary:</u> 0.015 acre palustrine forested.

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
AIR			
Air Quality	No effect.	No long-term effects are anticipated. Sponsors may need to acquire a permit for new pump station facility's back-up generator. Temporary effects during construction will be mitigated with dust control measures.	No long-term effects are anticipated. Sponsors may need to acquire a permit for new pump station facility's back-up generator. Temporary effects during construction will be mitigated with dust control measures.
PLANTS			
Invasive Plant Species	No effect.	No long-term effects. Invasive plant species identified in the project area will be controlled using BMPs.	No long-term effects. Invasive plant species identified in the project area will be controlled using BMPs.
Natural Areas	No effect.	Project will result in minimal disturbance of natural areas associated with pump station. Estimated 1.5 acres of tree clearing required.	Project will result in approximately 2.4 acres of natural area disturbance for new spillway, 2.5 acres of tree clearing.
Riparian Areas	No effect.	Project will result in the following impacts: Permanent alteration, spillway: 0.5 acre. Permanent conversion, raw water line: 0.1 acre. Permanent impact, raw water line traversing area between intake to pump station: 0.15 acre.	Project will result in the following impacts: Permanent alteration, spillway: 1.0 acre. Permanent conversion, raw water line: 0.1 acre. Permanent impact, raw water line traversing area between intake to pump station: 0.15 acre.
ANIMALS			
Fish and Wildlife Resources	No effect.	No effects are anticipated. Sponsors will lower the reservoir slowly during construction to avoid harming the aquatic life residing in the reservoir.	No effects are anticipated. Sponsors will lower the reservoir slowly during construction to avoid harming the aquatic life residing in the reservoir.
Threatened and Endangered Species	No effect.	No effect. James spinymussel not identified in project vicinity per 2019 mussel survey. Northern long-eared bat not identified in project vicinity.	No effect. James spinymussel not identified in project vicinity per 2019 mussel survey. Northern long-eared bat not identified in project vicinity.
Migratory Birds/Bald Eagles	No effect.	No effect. Project team will restrict clearing and ground disturbance activities during nesting periods.	No effect. Project team will restrict clearing and ground disturbance activities during nesting periods. Additional tree clearing and natural area disturbance associated with this alternative

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Migratory Birds/Bald Eagles (Continued)			may increase potential disruption to migratory bird populations or project schedule.
HUMANS			
Public Benefits	Project is not capable of meeting current maximum daily M&I water supply demand. Non-compliant high hazard potential dam puts downstream life and property at risk, including public roadways, structures and agricultural lands.	Project will result in being able to meet current maximum daily demand as well as future average daily and maximum daily demands. Project will be compliant with NRCS and Virginia dam safety standards for high hazard potential dams and reduce risk to downstream life and property. Project maintains existing park space and Beaver Creek park areas designated for parking, picnicking, grilling, and other open areas.	Project will result in being able to meet current maximum daily demand as well as future average daily and maximum daily demands. Project will be compliant with NRCS and Virginia dam safety standards for high hazard potential dams and reduce risk to downstream life and property. Project will result in loss of Beaver Creek Park parking area, picnicking area, and some open space. Project results in additional private property acquisition downstream based on spillway location.
Drought	Project is not capable of meeting current maximum daily M&I water supply demand. 7.5 percent of the raw water storage is not accessible in current configuration.	Project will result in being able to meet current maximum daily demand as well as future average daily and maximum daily demands.	Project will result in being able to meet current maximum daily demand as well as future average daily and maximum daily demands.
Flood Damages	No effect. Downstream population is at risk due to failure of the dam resulting from the design storm event or breach of the dam and/or spillway.	Project will result in a dam and spillway that are compliant with NRCS and Virginia dam safety standards for high hazard potential dams. Minor increases during the 200- and 500-year event may occur as a result of the new spillway.	Project will result in a dam and spillway that are compliant with NRCS and Virginia dam safety standards for high hazard potential dams. Minor increases during the 200- and 500-year event may occur as a result of the new spillway.
Local and Regional Economy	Future loss of dam and reservoir could have significant impacts on local economy.	Action will result in a temporary positive effect on local and /or regional construction companies. Current levels of municipal water supply will continue and	Action will result in a temporary positive effect on local and /or regional construction companies. Current levels of municipal water supply will continue and supplies

	Alternatives		
	No Action/FWOFI	**Alternative 1**	**Alternative 2**
Local and Regional Economy (Continued)	Loss of access via Browns Gap Turnpike would result in impacts to commuters.	supplies needed for immediate and future water supply demands will be secure.	needed for immediate and future water supply demands will be secure.
Park Lands	No effect.	No significant impact to park lands.	Loss of approximately 0.5 acre of park land, parking spaces, and picnic area.
Potable Water Supply	Project is not capable of meeting current maximum daily demand, or future average daily demands.	Project will result in obtaining a VWP Program Permit from Virginia DEQ, and will meet the current maximum daily demand as well as future demands.	Project will result in obtaining a VWP Program Permit from Virginia DEQ, and will meet the current maximum daily demand as well as future demands.
Public Health and Safety	Project does not meet NRCS or Virginia dam safety standards for high hazard potential dams, putting the public at risk. Project will not be capable of providing immediate M&I water supply needs to the Community of Crozet which could adversely affect public health.	Project will result in the dam and spillway meeting NRCS and Virginia dam safety standards for high hazard potential dams. Project will be capable of providing immediate M&I water supply needs to the Community of Crozet. Project will also seize opportunities to upgrade pump station infrastructure.	Project will result in the dam and spillway meeting NRCS and Virginia dam safety standards for high hazard potential dams. Project will be capable of providing immediate M&I water supply needs to the Community of Crozet. Project will also seize opportunities to upgrade pump station infrastructure.
Recreation	No effect.	Project will maintain existing recreational areas, including open spaces, parking spaces, and picnic tables.	Project will result in loss of 12 parking spaces/parking area and 0.5 acres of open park space used for parking and picnicking.
Scenic Areas	No effect.	No effect.	Approximately 2.5 acres of downstream natural areas will be disturbed by spillway and drilled shaft location.
Social/Cultural Issues	No effect.	Local population showed aversion to off-site detours around lake during construction. Project will include an on-site detour. Project requires approximately 2.5 acres of private property acquisition.	Local population showed aversion to off-site detours around lake during construction. Project will include an on-site detour. Project requires approximately 4 acres of private property acquisition. Project results in 2.5 acres of tree clearing and natural area disturbance. Project will remove park space, parking and portions of the picnic area in the left abutment.

ENVIRONMENTAL CONSEQUENCES

Water resources projects can result in several potential effects on resources upstream and downstream of a reservoir site. This section describes anticipated effects on resource concerns identified by the Sponsors, the public, and others involved in the scoping process through interagency and public meetings. Topics are listed in the same categories as listed in Tables D and F.

Three alternatives were considered and evaluated in detail:

- Future Without Federal Investment (FWOFI)/No-Action: The no-action alternative. This serves as the baseline for comparison with the other action alternatives.

- Alternative 1: Structural rehabilitation of Beaver Creek 1 dam and spillway by constructing a new reinforced-concrete labyrinth-crested chute spillway over the crest of the existing embankment; relocate and upgrade raw water pump station to Site 1, transmission line to connect to WTP. (Preferred Alternative)

- Alternative 2: Structural rehabilitation of Beaver Creek 1 dam and spillway by constructing a new reinforced-concrete labyrinth-crested chute spillway through left abutment of dam; Construct new raw water pump station near current location, a new raw water intake structure near the existing riser, drill and bore a new suction line from the reservoir to the new pump station, transmission line to connect to WTP.

The Environmental Consequences section will describe the environmental effects of the FWOFI/no-action alternative conditions, the Preferred Alternative (Alternative 1) and Alternative 2.

The Sponsor has indicated that they will use the plan developed by NRCS to complete the construction of the dam and associated measures if Federal funding is not available. The Sponsors' Alternative would be the same or involve the same components as Alternative 1.

ECOSYSTEM SERVICES CONCERNS

Food

FWOFI: Project will fail to provide flood protection to the Early Dawn Dairy Farm located immediately downstream should the dam fail and downstream croplands will be vulnerable to flooding.

Alternative 1: Project will provide flood protection for the Early Dawn Dairy Farm and downstream cropland.

Alternative 2: Same as Alternative 1.

Water

FWOFI: Project will fail to meet current community demands. Project will fail to meet future community demands.

Alternative 1: Project will provide adequate water supply to community from present demand through 2075.

Alternative 2: Identical to Alternative 1.

Flood and Disease Control

FWOFI: Project remains non-compliant with dam safety standards for high hazard potential dams, posing additional risk to downstream lives and property. Inadequate water supply may have indirect adverse effects on health and well-being in the community.

Alternative 1: Action will result in compliance with dam safety standards for high hazard potential dams. Sponsors will be capable of meeting immediate water supply demands as well as future demands through 2075. Action provides flood control for downstream life and property by protecting against flooding associated with inadequate spillway capacity. Rehabilitation will reduce risk of dam failure during the design storm event. Action will remove raw water infrastructure as a hazard of the dam itself.

Alternative 2: Action will result in compliance with dam safety standards for high hazard potential dams. Sponsors will be capable of meeting immediate water supply demands as well as future demands through 2075. Action provides flood control for downstream life and property by protecting against flooding associated with inadequate spillway capacity. Rehabilitation will reduce risk of dam failure during design storm event. Raw water pump station will continue to be a hazard of the dam itself.

Primary Production

FWOFI: Non-compliant high hazard potential dam increases risk of damage to croplands and interruption of raw water supply for community.

Alternative 1: Action will result in compliance with dam safety standards for high hazard potential dams which will reduce risk of failure and breach. Project will maintain crop and pasture production by maintaining flood control benefits and providing water to local businesses and farms.

Alternative 2: Identical to Alternative 1.

Recreational Experiences

FWOFI: Flooding in existing vegetated auxiliary spillway could damage existing picnic areas and interrupt service to the park.

Alternative 1: Action will result in preservation of existing picnic tables, parking spaces and open park space at Beaver Creek Park. Temporary access constraints may occur during construction and affect use of the lake and park space.

Alternative 2: Action will result in loss of picnic tables, parking area, and some of the open areas at the Beaver Creek Park totaling to about 0.5 acres. Temporary access constraints are likely to occur during construction and affect use of the lake and park space.

Aesthetic Viewsheds

FWOFI: No change.

Alternative 1: Action will result in improved aesthetic viewscapes by raising the existing auxiliary spillway by approximately 8 to 9 feet, providing a higher elevation for picnickers to view the Blue Ridge Mountains and Reservoir area. Temporary negative effects to portions of the viewshed are likely to occur during construction.

Alternative 2: Same as Alternative 1, except that this action will result in the loss of parking areas and picnic areas in the amount of approximately 0.5 acres and will also disturb additional natural areas and forest downstream by an additional 1.0 acre due to spillway construction, thus disrupting natural scenic beauty. Temporary negative effects to portions of the viewshed are likely to occur during construction.

TYPICAL ENVIRONMENTAL CONCERNS IDENTIFIED THROUGH SCOPING

Stream Bank Erosion

FWOFI: Downstream stream banks are vulnerable to damage if structure fails due to inadequate hydraulic capacity and/or spillway integrity.

Alternative 1: Action will result in a reduced likelihood for streambank erosion resulting from dam or spillway failure. No changes to 2- through 100-year storm event discharges. Energy dissipation structure will be designed to reduce likelihood of streambank erosion.

Alternative 2: Identical to Alternative 1.

Prime and Unique Farmland and Farmland of Statewide Importance

FWOFI: Prime and unique farmland in downstream areas vulnerable due to structure not meeting applicable dam safety standards for high hazard potential structures. No changes to prime and unique farmland.

Alternative 1: Action will result in 2.8 acres of prime and unique farmland being temporarily affected and 2.7 acres of prime and unique farmland being permanently affected by the installation of this project. Up to 0.2 acre of designated prime and unique farmland used for agriculture could be permanently impacted.

Alternative 2: Action will result in 5.3 acres of prime and unique farmland being temporarily affected and 3.4 acres of prime and unique farmland being permanently affected by the installation of this project. Up to 0.9 acre of prime and unique farmland currently used for agriculture could be permanently impacted.

Surface Water Quality

FWOFI: Lack of hypolimnetic oxygenation system limits Sponsors' ability to control algae blooms, resulting in pH spikes and increased treatment costs, lost efficiency of screens. Range of water strata available for Sponsors to withdraw is limited based on the existing system.

Alternative 1: Project provides the opportunity to install a new oxygenation device, as well as the ability to draw water from different water quality strata. There will be temporary, localized impact on water quality in the reservoir during construction of the pump station, raw water intake, and transmission main, and on Beaver Creek during dam rehabilitation activities. Turbidity levels may temporarily rise within the reservoir as a result of in-reservoir construction activity and sediment sloughing during shoreline drawdown. Reservoir water quality impacts will be minimized by deploying turbidity curtains around in-reservoir construction to contain turbidity and allowing it to settle out prior to curtain removal, and by limiting the rate of reservoir drawdown to limit sediment introduction from the shoreline to the reservoir. Turbidity levels would temporarily rise at Beaver Creek in the areas of the spillway construction as a result of construction activities. Beaver Creek water quality impacts will be minimized by implementing required erosion and sediment control measures and adhering to best management practices. Any water releases from the project area are expected to meet the appropriate water quality standards. No long-term impacts on water quality from rehabilitation activities are anticipated.

Alternative 2: Project impacts are generally the same as Alternative 1. The new intake structure may cause additional disturbance to water quality and park areas during construction and following construction.

Surface Water Quantity

FWOFI: No effect. Project in its current unpermitted condition cannot meet current maximum daily demand requirements.

Alternative 1: Project will result in meeting current maximum daily demand requirements and future average and maximum daily demand requirements.

Alternative 2: Identical to Alternative 1.

Clean Water Act

FWOFI: No effect.

Alternative 1: Project will require appropriate permitting through Section 401/404 of the Clean Water Act due to impacts to stream, open water, and wetlands.

Alternative 2: Identical to Alternative 1.

Regional Water Management Plans
FWOFI: No effect, project cannot meet current maximum daily demands per DWIP, nor can it meet future demands.

Alternative 1: Project will result in meeting the immediate need for M&I water supply as well as future demand requirements described in the DWIP.

Alternative 2: Identical to Alternative 1.

Floodplain Management
FWOFI: No effect.

Alternative 1: Project will maintain floodplain for two through 100-year, 24-hour storm events. Minor increases occur during the 200- and 500-year storm events which may not result in changes to the flood maps. Action provides flood control for downstream properties by reducing the likelihood of failure during the design storm event. Revised floodplain mapping may be required. Coordination with FEMA should occur to obtain a CLOMR/LOMR, if necessary, during the design phase of the project.

Alternative 2: Identical to Alternative 1.

Streams, Lakes, and Wetlands
FWOFI: No effect.

Alternative 1: No temporary or permanent impacts to jurisdictional open water areas/lakes will occur from the installation of the raw water line from Brown's Gap Turnpike (SR 680) to the existing water treatment plant. If needed, NRCS will mitigate impacts to waters of the U.S. via purchase of credits from an approved mitigation bank, or purchase of credits from the aquatic trust fund. The proposed action will result in the following impacts.

Streams: Action will result in permanent impact to 180 feet of perennial stream associated with Beaver Creek immediately downstream of the existing dam, 50 feet of perennial stream that discharges into Beaver Creek Reservoir for construction of an access road to the pump station, and 175 feet of an unnamed tributary to Beaver Creek that converges with Beaver Creek downstream of the existing dam structure. Action will result in temporary impact to 75 feet of Beaver Creek and 125 feet of an unnamed tributary to Beaver Creek during construction. Temporarily impacted stream channel will be restored in-place to original condition.

Lakes: Action associated with the new raw water intake structure and new spillway will result in permanent impact to 0.05 acre of open water in Beaver Creek Reservoir 1. Action will result in temporary impact to 0.65 acre of open water in Beaver Creek Reservoir 1 during construction of the new spillway structure, work associated with the existing raw water intake structure, and installation of the new raw water intake structure. Additionally, the lake will be temporarily lowered by 10 feet during construction.

Wetlands: Project area downstream of the existing dam contains 0.005 acre of freshwater emergent wetlands and 0.015 acre of palustrine forested wetlands. Removal of the existing pump station and construction of the spillway will permanently impact 0.005 acre of freshwater emergent wetlands downstream of the existing dam. Action may result in temporary impacts to 0.015 acre of palustrine forested wetlands. Temporarily impacted wetlands will be restored to pre-construction grade and seeded with an appropriate seed mixture.

Alternative 2: No temporary or permanent impacts to jurisdictional open water areas/lakes will occur from the installation of the raw water line from Brown's Gap Turnpike (SR 680) to the existing water treatment plant. Sponsors will mitigate impacts to waters of the U.S. via purchase of credits from an approved mitigation bank, or purchase of credits from the aquatic trust fund, if required. The proposed action will result in the following impacts.

Streams: Action will result in permanent impact to 240 feet of perennial stream associated with Beaver Creek immediately downstream of the existing dam, 50 feet of perennial stream that discharges into Beaver Creek Reservoir for construction of an access road to the downstream toe, and 90 feet of an unnamed tributary to Beaver Creek that converges with Beaver Creek downstream of the existing dam structure. Action will result in temporary impact to 75 feet of Beaver Creek and 125 feet of an unnamed tributary to Beaver Creek during construction. Temporarily impacted stream channel will be restored in-place to original condition.

Lakes: Action will result in permanent impact to 0.5 acre of open water in Beaver Creek Reservoir 1 associated with the new raw water intake structure and new dam structure. Action will result in temporary impact to 0.65 acre of open water in Beaver Creek Reservoir 1 during construction of the new dam structure, work associated with the existing raw water intake structure, and installation of the new raw water intake structure. Additionally, the lake will be temporarily lowered by 10 feet during construction.

Wetlands: The project area downstream of the existing dam contains 0.005 acre of freshwater emergent wetlands and 0.015 acre of palustrine forested wetlands. Action will permanently impact 0.005 acre of freshwater emergent wetlands in proximity to the existing pump station. Action may result in temporary impacts to 0.015 acre of palustrine forested wetlands. Temporarily impacted wetlands will be restored to pre-construction grade and seeded with an appropriate seed mixture.

Air Quality

FWOFI: No effect.

Alternative 1: No long-term significant effects are anticipated. Sponsors may need to acquire a permit for new pump station facility's back-up generator. Action will result in negligible emissions during monthly testing and use of emergency generator. Temporary negative air quality effects from fugitive dust, and vehicle and equipment emissions will occur during construction. The temporary increase in particulate pollution during construction is not expected to violate any federal, state, or local air quality standards. The design documents will include a requirement for Contractors' equipment operators to participate in training for operation to reduce greenhouse gas emissions.

Alternative 2: Identical to Alternative 1.

Invasive Plant Species
FWOFI: No effect.

Alternative 1: Action will create areas of disturbance and provide habitat for several invasive plant species present in the project area. During construction, invasive plant species will be managed via prevention measures, early detection, control and management, and rehabilitation and restoration. Mechanical invasive plant control measures such as washing of construction equipment and plant control via mowing will be taken to avoid the spread or introduction of invasive species. The critical areas of the dam embankment will be established to the standard NRCS seed mixture of fescue for erosion-resistance. All other disturbed areas will be vegetated with non-invasive species.

Alternative 2: Identical to Alternative 1.

Natural Areas
FWOFI: No effect.

Alternative 1: Project will result in minimal temporary and permanent disturbance of natural areas associated with pump station. Care will be taken during construction to avoid introduction of new or relocation of existing invasive plant species. Post-construction measures, including seeding of disturbed areas with appropriate seed mixtures immediately upon completion of grading activities and post-construction monitoring, will be employed to reduce the potential for invasive species to inhabit newly disturbed project areas.

Alternative 2: Project will result in additional acreage of natural area disturbance associated with the new spillway, including 2.5 acres of tree clearing for the new spillway. Project would involve the same post-construction measures as alternative 1.

Riparian Areas
FWOFI: No effect.

Alternative 1: Project will result in minor disturbance to riparian areas abutting the reservoir at the pump station site. There will be temporary negligible impacts to the riparian areas around the reservoir while the lake is drawn down ten feet during the construction period. The new spillway will extend 155 feet downstream of the current outfall, the raw water line from the new intake will traverse a riparian area, and the access road to the pump station and the raw water line will cross a perennial stream. There will be up to 0.5 acre of riparian zone permanently altered by construction of the new spillway; 0.1 acre of permanent conversion from installation of the raw water line and bridge over the perennial stream associated with the pump station access road; and 0.15 acre of permanent impact from the raw water line traversing the lake's riparian area between the intake to the pump station.

Alternative 2: Project will have temporary negligible impacts to the riparian areas around the reservoir while the lake is drawn down ten feet during the construction period. The new spillway of the preferred alternative will extend 210 feet downstream of the current outfall, the raw water

line from the new intake will traverse a riparian area, and the access road to the pump station and the raw water line will cross a perennial stream. There will be up to 1.0 acre of riparian zone permanently altered by construction of the new spillway; 0.1 acre of permanent conversion from installation of the raw water line and bridge over the perennial stream associated with the pump station access road; and 0.15 acre of permanent impact from the raw water line traversing the lake's riparian area between the intake to the pump station.

Fish and Wildlife Resources
FWOFI: No effect.

Alternative 1: Temporary effects will occur during construction in association with increased noise levels, loss of habitat or foraging area, and increased activity. Permanent effects will be negligible due to species relocating to new areas during construction. Sponsors will lower the reservoir slowly during construction to avoid harming the aquatic life residing in the reservoir.

Alternative 2: Identical to Alternative 1.

Threatened and Endangered Species
FWOFI: No effect.

Alternative 1: Terrestrial and aquatic species surveys were performed for the project areas. James spinymussel was not identified in project vicinity per 2019 mussel survey provided in Appendix D. Northern long-eared bat was not identified as being known to be present in the project vicinity. Protection of endangered and threatened species in the project area will be conducted in accordance with the appropriate mitigation actions per final consultation with regulatory agencies.

Alternative 2: Identical to Alternative 1.

Migratory Birds / Bald Eagles
FWOFI: No effect.

Alternative 1: Beaver Creek 1 Reservoir could potentially be utilized by several species of migratory birds for feeding, nesting, or resting. No bald eagle or osprey nests are located within a quarter mile of the project area. No impacts to bald eagles are expected by project action. Prior to beginning construction, a field survey will be conducted to verify no nests exist within the project area. Should bald eagle nests be found, all applicable restrictions will be implemented. Although the lake level will be lowered by ten feet during dam construction activities, there will be negligible impact in availability for use by migratory birds. Additionally, there are similarly-sized bodies of water throughout the region available for migratory bird use.

Alternative 2: Identical to Alternative 1.

Public Benefits
FWOFI: Project is not capable of meeting current maximum daily M&I water supply demand. Sponsors' operation of a non-compliant high hazard potential dam puts downstream life and property at risk, including public roadways, structures, and agricultural lands and operations.

Alternative 1: Project will result in being able to meet immediate need for current maximum daily demand as well as future average daily and maximum daily demands. Project will be compliant with NRCS and Virginia dam safety standards for high hazard potential dams and reduce risk to downstream life and property. Project maintains the existing park space and Beaver Creek park areas designated for vehicle parking, picnicking, grilling, and other open areas.

Alternative 2: Project will result in being able to meet the immediate need for current maximum daily demand as well as future average daily demands. Project will be compliant with NRCS and Virginia dam safety standards for high hazard potential dams and reduce risk to downstream life and property. Project will result in loss of Beaver Creek Park parking area, picnicking area, totaling approximately 0.4 acres. New drilled shaft for suction line from reservoir may cause additional loss of park space.

Drought

FWOFI: Project is not capable of meeting current maximum daily M&I water supply demand. 7.5 percent of the raw water storage is not accessible due to the existing configuration of the pump station infrastructure.

Alternative 1: Project will result in being able to meet current maximum daily demand as well as future average daily and maximum daily demands. Project will realize opportunity of accessing all designated raw water storage in the reservoir and meet future demand with respect to safe yield.

Alternative 2: Identical to Alternative 1.

Flood Damages

FWOFI: No effect. Downstream population is at risk due to failure of the dam resulting from the design storm event or breach of the dam and/or spillway.

Alternative 1: Project will result in a dam and spillway that are compliant with NRCS and Virginia dam safety standards for high hazard potential dams. Minor increases during the 200- and 500-year event may occur as a result of the new spillway.

Alternative 2: Identical to Alternative 1.

Local and Regional Economy

FWOFI: Future loss of dam and reservoir could have significant impacts on local economy. Loss of access via Browns Gap Turnpike would result in impacts to commuters.

Alternative 1: Action will result in a temporary positive effect on local and /or regional construction companies. Current levels of municipal water supply will continue and supplies needed for immediate and future water supply demands will be secure.

Alternative 2: Identical to Alternative 1.

Park Lands
FWOFI: No effect.

Alternative 1: Action will temporarily restrict use of portions of Beaver Creek Park during construction. No permanent loss of existing park amenities and or park area will occur from the project.

Alternative 2: Action will temporarily restrict use of portions of Beaver Creek Park during construction. Permanent loss of existing park amenities, including picnic tables and parking spaces, and loss of park area will occur from the project.

Potable Water Supply
FWOFI: Project is not capable of meeting current maximum daily demand, or future average daily demands.

Alternative 1: Project will result in obtaining a VWP Program Permit from Virginia DEQ and will meet the current maximum daily demand as well as future demands.

Alternative 2: Identical to Alternative 1.

Public Health and Safety
FWOFI: Project does not meet NRCS or Virginia dam safety standards for high hazard potential dams, putting the public at risk. Project will not be capable of providing immediate M&I water supply needs to the Community of Crozet which could adversely affect public health

Alternative 1: Project will result in the dam and spillway meeting NRCS and Virginia dam safety standards for high hazard potential dams. Project will be capable of providing immediate M&I water supply needs to the Community of Crozet. Project will also seize opportunities to upgrade pump station infrastructure. The bridge structure and abandonment of the vegetated auxiliary spillway will reduce the likelihood that Browns Gap Turnpike will close due to activation of the auxiliary spillway.

Alternative 2: Identical to Alternative 1.

Recreation
FWOFI: No effect.

Alternative 1: Project will maintain existing recreational areas, including open spaces, parking spaces, and picnic tables.

Alternative 2: Project will result in loss of parking spaces/parking area and picnic tables. New intake structure may interfere with recreational amenity/park space.

Scenic Areas
FWOFI: No effect.

Alternative 1: No effect.

Alternative 2: Downstream natural areas will be disturbed by spillway location.

Social / Cultural Issues

FWOFI: Could result in negative public perception of Sponsors operating a non-compliant high hazard potential dam.

Alternative 1: Local population showed aversion to off-site detours around lake during construction. Project will include an on-site detour. Project results in the least private property acquisition at downstream toe of the dam and proposed spillway.

Alternative 2: Local population showed aversion to off-site detours around lake during construction. Project will include an on-site detour. Project requires additional private property acquisition at toe of dam since owner would not be able to access area between spillway and dam. Project results in additional tree clearing and natural area disturbance. Project will impinge upon no less than 0.4 acres of existing park space, including picnic areas and the parking lot located in the left abutment of the dam.

CUMULATIVE EFFECTS

FWOFI: The existing dam and spillway system do not meet the hydraulic requirements for a high hazard potential dam, posing a risk to downstream life and property in the event of the design storm. The reservoir serves as the sole water supply for the Community of Crozet, so the sponsors must keep the reservoir in service.

Alternative 1 (Preferred)*:* The preferred alternative will bring the dam into compliance with safety standards and requirements for high hazard potential dams in Virginia. There are unavoidable, adverse consequences associated with the implementation of this plan, most of which are temporary in nature and can be mitigated during construction with appropriate specifications and control mechanisms. The project will result in meeting immediate M&I water supply demand shortfalls by obtaining a permit and will be capable of meeting the future water supply demand of the community with safe yield.

Alternative 2: The cumulative effects of Alternative 2 are generally the same as Alternative 1, with the following exceptions: Additional disturbance to Beaver Creek Park areas, natural area at the site and forested areas; slightly higher total installation cost; does not remove the pump station infrastructure as a hazard of the dam.

RISK AND UNCERTAINTY

Assessments, considerations, and calculations in this plan are based on a 55-year period of analysis. Associated monetary flooding impacts on downstream houses and businesses were based on the National Flood Insurance Program's Actuarial Rate Review. National averages were used to identify the value of potential damages. Actual damages occurring from each storm event could realistically be higher or lower, depending on soil moisture conditions at the time of a given event, associated debris flows, future development, and other factors such as changes in precipitation

from various storm events. Although potential climatic changes are not expected to alter the calculated PMP event flood routing results, climatic changes could increase the occurrence of low frequency, high intensity storm events and associated flood damages.

The sponsors procured easements and acquired property for the construction, operation, and maintenance of the dam and the storage of water prior to original construction. Although the easements did not refer to a specific elevation for the crest of the auxiliary spillway or the top of the dam, the record drawings and easement documents indicate that the easements are secured to the high-water mark (approximate elevation 556.0 feet NAVD 88). The Sponsors determined that the cost of obtaining additional easements above elevation 556.0 feet is greater than the risk-based consequences of a storm event that may temporarily raise the reservoir above elevation 556.0 feet.

NRCS policy regarding minimum land rights for potentially flood-pool impacted areas upstream of the dam require the local Sponsors to acquire an easement for all areas below the top of dam, unless the plan explicitly allows for a lower elevation. An economic and risk analysis was conducted to inform the Sponsors. The existing easement is set at approximately 4.6 feet above the auxiliary existing auxiliary spillway control section elevation. It provides protection up to 0.75 of the Probable Maximum Precipitation (PMP, 6-Hour Local, Virginia, assuming Henleys Lake Dam breaches immediately at overtopping) event which is greater protection than for the 1,000 year storm event which reaches a calculated peak elevation of 0.1 foot below the auxiliary spillway (Henleys Lake Dam does not breach). They have lived for over 57 years with the existing easements and have accepted their associated potential for risk of flood damages. The auxiliary spillway has never experienced a flood flow and the local Sponsors have determined that acquisition of additional easement area to meet current NRCS policy to the top of dam would require a significant added cost without an equally significant benefit. Therefore, the Sponsors acknowledge the potential risk of flood damages for the real property between the flowage rights elevation and the top of dam elevation.

The crest of the auxiliary spillway was set just above the peak water surface elevation calculated during the 24-hour, 100-year storm event. The crest of the labyrinth weir was set slightly above the 100-year storm peak water surface elevation in Beaver Creek to avoid increasing flooding downstream during the two- through 100-year, 24-hour storm events. The final spillway crest elevation will be established during the detailed design phase which results in the most cost effective / least impactful spillway construction.

The projected sediment life of the lake is 108 years (as of 2017). This information is based on a sediment survey that was conducted in 2018. Very large storm events, deforestation by fire, or increased construction of residential or commercial sites could cause an increased rate of erosion, sedimentation and deposition. There are no known plans for land use changes in this watershed that would affect the rate of sediment deposition in the reservoir. The expected useful life for the Future with Federal Assistance Alternative (preferred Alternative) is based on the project's M&I water supply purpose and the project being capable of meeting the water supply demands through 2075. Thus a 55-year period of analysis was used for this structure.

The objective of this project is to meet applicable NRCS and Virginia safety and performance standards for high hazard potential dams. From a financing and administrative standpoint, the

Sponsors have committed to NRCS that they are able to fund the required 35 percent of the total project costs to complete installation of the preferred alternative and can perform the required maintenance on the upgraded structure for 50 years after construction. After rehabilitation, the dam will continue to provide flood protection for downstream residents for at least another 50 years. The crest elevation of the auxiliary spillway will be lowered slightly, but will not activate until storm events exceeding the 100-year, 24-hour storm event. The dam and spillway will meet requirements for high hazard potential dams in Virginia and per NRCS standards.

Risks associated with any large reservoir project include: cost, land acquisition, receipt of necessary permits, acquisition of sufficient environmental mitigation, water demand (population forecasts) and funding. All of these factors are to some extent out of the Sponsor's control and therefore create some risk and uncertainty.

The Sponsors have worked toward permitting and constructing the Beaver Creek Reservoir over the past decade and have reduced or eliminated many risks. The Sponsor submitted a water withdrawal Joint Permit Application (JPA) to the Virginia DEQ in October 2022, but the Sponsor has little control over the state permit processing timetable. The Sponsors have and will continue to stay in contact with the DEQ to assist as needed. Coordination with DEQ will occur during the JPA process and as part of the consultation efforts associated with this plan.

Land acquisition risks have been reduced by the Sponsor's proactive measures to involve neighboring property owners during the planning process and keep them informed of the project status. Land acquisition will be required from the parcel located immediately downstream of the existing dam based on the planned footprint of the proposed spillway alternative. Additional easements and temporary property acquisition will be required to construct the new pump station. The Sponsors will continue to coordinate with property owners during the design phase and secure all property necessary to complete the works of improvement.

Project costs are a function of the economy at the time the project is ready to construct. There is risk and uncertainty associated with cost and the Sponsor's ability to fund a project if the cost significantly increases. The Sponsor has been proactive in securing funding for its project.

The population projections supporting the project need, and therefore determining the project size and cost, are not 100 percent certain. If the water supply demand is more than the Sponsor planned for, the Sponsors may need to increase the storage volume or provide a larger reservoir or a supplemental source. If the demand is less than what it planned for, the Sponsor may have excess resources.

While impossible to eliminate all risk, the Sponsor has taken the measures within its control to mitigate for potential risks.

CONSULTATION AND PUBLIC PARTICIPATION

The Sponsor engaged in and initiated significant consultation, coordination and public participation throughout the processing of its Environmental Assessment (EA) for the Beaver Creek Reservoir project as further described below.

U.S. ARMY CORPS OF ENGINEERS (USACE)

During the project scoping meeting on December 10, 2020, the USACE indicated that this project could likely be handled through a Nationwide Permit. Follow-up correspondence was made on October 3, 2022 by a phone conversation between representatives of Hazen Sawyer and the USACE Norfolk District and Mr. Wes Hudson. Hazen and Sawyer discussed next steps for USACE consultation, and the response with submittal of the Joint Permit Application for a Nationwide Permit unless a jurisdictional determination was required or desired or if a pre-application meeting was warranted or wanted.

U.S. FISH AND WILDLIFE SERVICE

Hazen and Sawyer communicated with the USFWS field office on October 3, 2022 and spoke with Ms. Rachael Cash. The discussion included the previous USFWS consultation and performance of the mussel survey downstream of the dam. The discussion also included the official USFWS species list generated for the project and recent submittal of the JPA with the mussel survey included in the permit package. Hazen inquired as to next steps for USFWS consultation, which included online submittal of Section 7 consultation, which has occurred, and responding to any comments or questions that the USFWS has relative to the project and its impacts. A copy of the draft Plan-EA document was provided to USFWS along with a request for review and comment. No comments were received.

ENVIRONMENTAL PROTECTION AGENCY

A copy of the draft Plan-EA was provided to the EPA. Comments were received and responded to and are presented in Appendix A.

NATIONAL MARINE FISHERIES

A copy of the draft Plan-EA was provided to the National Marine Fisheries. No comments were received on the draft Plan-EA.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

The Sponsor is engaged and preparing to submit a withdrawal permit application (JPA) to the Department of Environmental Quality. A copy of the draft Plan-EA was provided to the Virginia DEQ. Comments were received on the draft Plan-EA. The comments and responses are presented in Appendix A.

VIRGINIA DEPARTMENT OF WILDLIFE RESOURCES

The Virginia Department of Wildlife Resources (DWR) reviewed the project and requested that mussel surveys be performed as part of the project planning process. This correspondence is documented in the Beaver Creek Reservoir Mussel Report (Hazen and Sawyer 2020). A copy of the draft Plan-EA was provided to the Virginia DWR. The comments and responses are presented in Appendix A.

VIRGINIA DEPARTMENT OF HISTORIC RESOURCES (“SHPO”)

Dovetail Cultural Resources Group submitted a letter dated June 14, 2022 providing the final report on cultural resource studies associated with the project. The Virginia Cultural Resource Information System (VCRIS) packets were submitted to the Virginia Department of Historic Resources (DHR) for review of several resources which are described in further detail in Appendix

D. Additional Consultation with DHR is ongoing, and a copy of the draft Plan-EA document was submitted for review and comment. The comments and responses are presented in Appendix A. The project team will follow all requirements at the completion of consultation.

TRIBAL CONSULTATION

The NRCS conducted consultation with the Federally Recognized Indian Tribes resident to Virginia:

- Chickahominy Indian Tribe, Providence Forge, Virginia
- Chickahominy Indian Tribe - Eastern Division, Providence Forge, Virginia
- Monacan Indian Nation, Madison Heights, Virginia
- Nansemond Indian Nation, Suffolk, Virginia
- Pamunkey Indian Tribe, King William, Virginia
- Rappahannock Tribe, Indian Neck, Virginia
- Upper Mattaponi Tribe, King William, Virginia

The Virginia resident federally recognized tribes that indicated interest included the:

- Pamunkey Indian Tribe, who on follow-up, indicated they no longer have interest; and
- Monacan Indian Nation, which indicated the Nation does not wish to actively participate in this consultation project, because the project's impacts are anticipated to be minimal. However, the Nation requested to be contacted if:
  - Sites associated with native history may be impacted by this project;
  - Adverse effects associated with this project are identified;
  - Human remains are encountered during the project;
  - Other tribes consulting on this project cease consultation; or
  - The project size or scope becomes larger or more potentially destructive than currently described.

Consultation with Non-resident tribes with interests in Virginia was also conducted. A copy of the draft Plan-EA was provided to the following list of Non-resident tribes with interest in Virginia:

- Absentee Shawnee Indians of Oklahoma, Shawnee Oklahoma
- Catawba Indian Nation, Rock Hill, South Carolina
- Cherokee Nation, Tahlequah, Oklahoma
- Delaware Nation, Oklahoma
- Delaware Tribe of Indians, Oklahoma Headquarters, Bartlesville, Oklahoma
- Eastern Band of Cherokee Indians, Cherokee, North Carolina
- Eastern Shawnee Tribe of Oklahoma, Wyandotte, Oklahoma
- Muscogee (Creek) Nation
- Oneida Indian Nation, Oneida, New York
- Oneida Nation of Wisconsin, Oneida, Wisconsin
- Shawnee Tribe of Oklahoma, Miami, Oklahoma
- The Tuscarora Nation (of New York), Lewiston, New York
- The United Keetoowah Band of Cherokee Indians, Tahlequah, Oklahoma

Additionally, the Draft Plan-EA was provided to the four Tribes with State recognition only per the Virginia Secretary of the Commonwealth. The four State-recognized tribes are:

- The Cheroenhaka (Nottoway) Indian Tribe, Courtland, Virginia
- The Nottoway Indian Tribe of Virginia, Capron, Virginia
- Patawomeck Indian Tribe of Virginia, Fredericksburg, Virginia
- The Mattaponi Tribe, West Point, Virginia

The comments and responses associated with tribal consultation and the draft Plan-EA are presented in Appendix A.

NATURAL RESOURCES CONSERVATION SERVICE
The planning team coordinated technical submissions and drafts of the Plan-EA document with NRCS. Technical review comments from NRCS were incorporated into the technical submittal documents. NRCS served as the tribal liaison for the project.

Public Participation

Public Meetings for Supplemental Watershed Plan (2020-2021)
The following public meeting dates were held: December 10, 2020 – Public Meeting: Project Introduction, Goals and Purpose of Study. The project team solicited feedback from the public regarding concerns and issues with the proposed action and planning. The primary topic of concern identified by the public was the closure of Browns Gap Turnpike during construction. Numerous concerns regarding the distance of the nearest detour routes, criticality of emergency service vehicles, and other general impacts to commuters and residents associated with closure of this road were voiced and recorded by the planning team.

December 10, 2020 – Agency Scoping Meeting: Project Introduction, Goals and Purpose of Study, and to solicit feedback and concerns from regulatory agencies. Scoping concerns were identified as described in the scoping Table presented herein to steer the planning team towards items of particular concern in this locale to be evaluated during the study.

October 6, 2021 – Public Meeting: To present the results of the planning team's investigations and the alternative analysis and selection process used by the team to identify the preferred plan. Conceptual figures of the proposed plan concept were presented to the public with additional opportunities for comments and questions about the plan. The attendees responded indicating appreciation towards the project team for incorporating the concerns regarding the closure of Browns Gap Turnpike and utilizing an on-site detour to maintain traffic during construction.

PREFERRED ALTERNATIVE

Rationale for the Plan Selection

Alternative 1: Rehabilitate Dam and Spillway, Upgrade and Relocate Raw Water Pump Station.

This alternative combines structural measures needed for meeting instream flows and dam safety requirements. An improved multi-level water withdrawal infrastructure will increase withdrawal capacity from the Beaver Creek Reservoir to the Crozet Water Treatment Plant (WTP) to meet demand projections, provide withdrawal access to the entire water supply pool volume, provide remote operation capability, improve water quality withdrawal performance by providing the

capability to draw from selected reservoir stratum with desirable water quality characteristics, and provide more precise withdrawal control to maximize water storage in the reservoir when the reservoir level is at full pool. In addition, the new water withdrawal infrastructure will decouple reservoir withdrawal operations from minimum reservoir conservation releases. A four-tiered Minimum-instream-Flow (MIF) protocol will be implemented for conservation releases into Beaver Creek. The separation of these components will greatly simplify operations.

The structure currently has excluded status in the Virginia Water Protection permit system (VWP) based on being in operation prior to the permit system's implementation. However, a VWP is required to withdraw more than 1 mgd from the reservoir, limiting available usable water supply unless the structure is brought into the permit system. Along with dam improvements needed to bring the structure into compliance with Virginia and NRCS requirements for high hazard dams and meet proposed instream flows, the structure can be brought into the permit system and additional withdrawals can be made without the development of additional storage. Without this option, the Crozet community would be facing more environmentally damaging and more expensive alternatives for additional raw water supply.

Summary and Purpose

The selected plan of action is the rehabilitation of Multiple-Purpose Structure No. 1, which includes:

- Construct a 4-cycle, reinforced-concrete labyrinth and chute spillway over the existing earthen embankment.
- Construct a new raw water intake structure at Site 1 approximately 500 feet upstream of the dam and the transmission line from the new pump station to the Crozet Water Treatment Plant (See DWIP 2019).
- Install a new graded aggregate filter drain at the toe of the existing dam downstream of the existing drain and abandon the existing drain system in place.
- Abandon the existing auxiliary spillway by backfilling with earthfill and establish a uniform dam crest elevation of 560.0 feet.
- Construct a two-lane vehicular bridge to traverse the proposed reinforced-concrete spillway structure.
- Minor modifications to the existing principal spillway structure to improve the riser's stability during the design seismic event.
- Modify the downstream release to separate the pump station infrastructure from the principal spillway conduit and incorporate a minimum in-stream flow measurement and control.

After the implementation of these planned works, Beaver Creek 1 will be in compliance with the current NRCS and Virginia Dam Safety standards for high hazard potential structures. The project will also be capable of obtaining a VWP Program Permit from the Virginia DEQ to increase the permitted withdrawals from the reservoir and provide a functional withdrawal system, thus meeting the immediate demand for raw water supply in the community. Detailed structural data for the proposed dam and spillway are presented in Table 3.

Easements and Land Rights

Land rights for the structure currently exist for the flood pool to the design high water mark (556.7 feet NGVD 29 per the record drawings and 1962 H&H analyses, 556.0 feet NAVD 88). This corresponds to an elevation approximately 4.6 feet above the control section of the existing auxiliary spillway (551.4 feet NAVD 88). The elevation of the proposed auxiliary spillway will be set lower than the existing vegetated spillway control section. The elevation of 4.6 feet above the existing control section of the auxiliary spillway is approximately the same as the water surface elevation of 75 percent of the Local, 6-hour PMP flood event, and was originally established based on the 6-hour, 0.75 PMP event per the original plan and hydrologic and hydraulic analyses. Additional land rights associated with temporary flooding during extreme events will not be procured because the Sponsors accept the risk associated with any flood flows that may result above their existing easements to the elevation of the crest of the dam.

The preferred alternative will require the acquisition of private property to install the works of improvement at the proposed locations. Approximately two acres of private property will be required from an adjacent parcel to construct the proposed chute spillway, stilling basin, and provide additional area for contractor access and staging. Although no permanent acquisition of private property is anticipated to be required to complete the pump station construction, approximately one acre of temporary use of private property will be required to construct the new Pump Station and associated works. The sponsors have begun discussions with the property owners and will secure the necessary land rights and documentation for NRCS prior to initiating construction.

Mitigation

During construction, site mitigation measures will include deployment of turbidity curtains, erosion and sediment control, seeding of denuded areas, dust control, and other practices identified during the design process. If the survey for bald eagle nests within and in proximity to the project area identifies active bald eagle nests, additional mitigation measures may be required. The primary mitigation measure for the threatened and endangered species is anticipated to be time-of-year restrictions. Up to 0.005 acre of freshwater emergent wetlands may be permanently impacted by the project. Needed mitigation measures will be identified after the amount of impacted land is finalized and consultation with the U.S. Army Corps of Engineers is complete. Options for wetland mitigation include creation of a similar wetland offsite or purchase of wetland bank credits.

Permits and Compliance

Prior to construction, the Sponsors will be responsible for obtaining, as needed, a VWP Program Permit from DEQ; a Section 404 of the Clean Water permit from the Army Corps of Engineers; withdrawal, water protection, Sections 401 and 402 of the Clean Water Act and stormwater permits from DEQ; alteration permit from DCR Dam Safety Division; subaqueous lands permit from the Virginia Marine Resources Commission; land use permit from the Virginia Department of Transportation; and land disturbing activity and NPDES permits from Albemarle County. Other state or local permits may be necessary, and this determination will be made during pre-permit

application meetings with local, state and federal regulatory agencies once designs have been sufficiently developed to facilitate conversations.

The construction general permit would require the operator to implement a site-specific stormwater pollution prevention plan (SWPP). The SWPP would outline the steps that an operator must take to comply with the permit, including water quality and quantity requirements to reduce pollutants in the stormwater runoff from the construction site. The SWPP also specifies all potential pollutant sources that could enter stormwater leaving the construction site and covers methods used to reduce pollutants in stormwater runoff during and after construction. The successful contractor will be required to develop the SWPP and acquire any applicable air quality and erosion and sediment control permits.

Prior to construction, the NRCS will verify that no bald eagle nests are located within the project area. If cultural resources are discovered during installation, work will cease, and the State Historic Preservation Officer will be notified. Appropriate investigations and procedures will be initiated. If artifacts of Tribal significance or remains are discovered at the site during the design or construction of the improvements, NRCS will notify the Tribal Governments for additional consultation and appropriate investigations and procedures will be initiated. The Sponsors will be responsible for obtaining a regular O&M Certificate from the Virginia Division of Dam Safety upon completion of the project. Because there would be unavoidable wetland impacts, a Section 401 Virginia State Water Quality Certification would be required prior to application for a Section 404 Permit.

The National Flood Insurance Program regulations states: "*A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and flood plain management requirements will be based upon current data*." Implementation of the preferred alternative will have no impact on the 100-year, 24-hour and smaller flood events; the proposed spillway may increase peak discharges during the 500-year, 24-hour storm event; however, the local communities may choose to provide the results of the hydraulic analyses developed for this project to FEMA for consideration in revising the FIRMs based upon updated flood routing models and software. During the detailed design phase, the design team will obtain FEMA's hydraulic models for the reach of the Mechums river between Ivy Road/U.S. Route 250 and the South Fork Rivanna Dam. The Beaver Creek Reach will be updated with the outflow from the 100-year and 500-year, 24-hour storm events and routed to the South Fork Rivanna Dam. Comparison will be made between the existing FEMA model results and the revised results. The team will also evaluate the existing Flood Insurance Rate Map (FIRM) to determine if map revisions are necessary based on the flood routing analyses.

Costs

As indicated in Cost Table 1, the total installation cost of the selected plan is $42,822,227. Of this amount, PL-83-566 funds will bear $18,365,750 and nonfederal funds will bear $24,456,477. Cost Table 2A shows details of the costs and cost-share amounts by category. Total annualized costs are shown in Cost Table 4 along with the estimated costs for operation and maintenance. Cost

Table 5 displays the average annual flood damage protection benefits by flood damage categories, and Cost Table 6 displays a comparison of annual costs and benefits. A 2022 price base was used and amortized at 2.250 percent interest for the 55-year period of analysis (including a design and installation period of five years and an expected useful life of 50 years).

The cost projections for the proposed construction measures are estimated costs only for planning. The fact that these costs are included in this plan does not infer that they are final costs. Detailed structural designs and construction cost estimates will be prepared prior to contracting for the work to be performed. Final construction costs will be those costs incurred by the contractor performing the work, including the cost of any necessary contract modifications.

Installation and Financing

The project is planned for installation between 2025 and 2027. During construction, equipment will not be allowed to operate when conditions are such that soil erosion and water, air, and noise pollution cannot be satisfactorily controlled.

NRCS will assist the Sponsor with the Beaver Creek 1 Rehabilitation project. NRCS will be responsible for the following:

- Execute a project agreement with the Sponsor before either party initiates work involving funds of the other party. Such agreements set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
- Execute a Memorandum of Understanding with the Sponsor to provide a framework within which cost-share funds are accredited.
- Execute an updated Operation and Maintenance Agreement with the Sponsor that extends the O&M responsibilities for another 50 years following construction. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide financial assistance for the structure rehabilitation, equal to 65% of the total eligible cost share amount but not to exceed 100% of the dam and spillway rehabilitation construction cost.
- Verify that a current Emergency Action Plan is developed before construction is initiated.
- Provide consultative engineering support, technical assistance, and approval during the design and construction of the project for 100 percent of the design of the dam and spillway rehabilitation measures.
- Provide contract administration technical assistance during construction of the project.
- Provide construction management technical assistance.
- Certify completion of all installed measures.

The Sponsors will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for the installation, operation, and maintenance of the project.
- Prepare an updated Emergency Action Plan for the dam prior to the initiation of construction.
- Execute a Memorandum of Understanding with the NRCS to provide a framework for crediting in-kind services.

- Execute an updated Operation and Maintenance Agreement with NRCS for the dam. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide engineering services for the design, construction, and certification of the project.
- Provide local administrative and contract services necessary for the installation of the project including construction phase monitoring.
- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 0% of actual construction costs for the rehabilitation purpose and 100% of construction costs associated with the raw water pump station and infrastructure, other engineering services, real property rights, and permits.
- Participate in and comply with applicable Federal floodplain management and flood insurance programs.
- Restrict future construction of habitable dwellings upstream of the dam and below the planned top of dam elevation.
- Enforce all associated easements and rights-of-way for the safe operation of the dam.
- Obtain all land rights and private property associated with the project, including design and construction of the vehicular bridge that will span the proposed spillway.

Operation, Maintenance and Replacement

Measures installed as part of this plan, will be operated and maintained by the Sponsors with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new Operation and Maintenance (O&M) agreement will be developed for Beaver Creek 1 and will be executed between the Sponsors and the NRCS prior to construction of the project. The term of the new O&M agreement will be for 50 years following the completion of construction. The agreement will specify responsibilities of the Sponsor and include detailed provisions for retention, use, and disposal of property acquired or improved with PL 83-566 cost sharing. Provisions will be made for free access of state and federal representatives to inspect all structural measures and their appurtenances at any time.

COST TABLES

Table 1 - Estimated Installation Cost, Beaver Creek, Virginia, $[1/]

			Estimated Cost (Dollars) [1/]		
Works of Improvement[2/]	Unit	Value	PL-83-566 Funds	Other Funds	Total
			USDA/NRCS		
Rehabilitate Multiple-Purpose Structure No. 1	Number	1	$18,365,750	$24,456,477	$42,822,227
Total Project:			**$18,365,750**	**$24,456,477**	**$42,822,227**

1/ Price base: 2022 Prepared: October 2022

2/ All Works of improvement are being performed on Non-federal land.

Table 2 - Estimated Cost Distribution, Alternative 1, Beaver Creek, Virginia $[1/]

Works of Improve-ment	Installation Cost- Public Law 83-566 [2/]					Installation Cost - Other Funds								**Total Installation Costs**
	Construction	Engineer-ing	Property Acquisit-ion	Project Admin.	**Total PL-83-566**	Construction	Engineer-ing	Real Property Rights	Sponsor Planning Costs	Property Acquisit-ion	Permits	Project Admin.	**Total Other**	
Multiple-Purpose Structure no. 1	$17,590,750	$750,000	$0	$25,000	**$18,365,750**	$17,850,000	$2,430,000	$3,151,875	$445,602	$125,000	$404,000	$50,000	**$24,456,477**	**$42,822,227**
Totals	$17,590,750	$750,000	$0	$25,000	**$18,365,750**	$17,850,000	$2,430,000	$3,151,875	$445,602	$125,000	$404,000	$50,000	**$24,456,477**	**$42,822,227**

1/ Price base: 2022 Prepared: October 2022

[2/] Paid by the USDA/NRCS – the Federal agency responsible for assisting in installation of improvements.

Table 2a - Cost Allocation and Cost Sharing Summary, Alternative 1, Beaver Creek, Virginia $[1/]

Item	Cost Allocation			Cost Sharing[2/]					
	Purpose			Public Law 83-566			Other Funds		
Category[2/]	Flood Control	M&I Water Supply	Total	Flood Control	M&I Water Supply	Total	Flood Control	M&I Water Supply	Total
Construction	$17,590,750	$17,850,000	$35,440,750	$17,590,750	$0	$17,590,750	$0	$17,850,000	$17,850,000
Engineering	$1,150,000	$2,030,000	$3,180,000	$750,000	$0	$750,000	$400,000	$2,030,000	$2,430,000
Sponsor Planning Costs	$445,602	$0	$445,602	$0	$0	$0	$445,602	$0	$445,602
Real Property Rights	$3,151,875	$0	$3,151,875	$0	$0	$0	$3,151,875	$0	$3,151,875
Property Acquisition	$125,000	$0	$125,000	$0	$0	$0	$125,000	$0	$125,000
Project Administration	$75,000	$0	$75,000	$25,000	$0	$25,000	$50,000	$0	$50,000
Permits	$100,000	$304,000	$404,000	$0	$0	$0	$100,000	$304,000	$404,000
Total	**$22,638,227**	**$20,184,000**	**$42,822,227**	**$18,365,750**	**$0**	**$18,365,750**	**$4,272,477**	**$20,184,000**	**$24,456,477**

1/ Price base: 2022 Prepared: October 2022

2/ If actual non-cost-sharable item expenditures vary from these figures, the responsible party will bear the change.

Table 3 – Structural Data – Dams with Planned Storage Capacity, Beaver Creek, Virginia

Item	Unit	Structure Data
Class of structure		High
Total drainage area,	mi^2	9.55
Uncontrolled Drainage Area	mi^2	7.5
Controlled Drainage Area (Henleys Lake Dam)	mi^2	2.1
Runoff curve no. (1-day) (AMC II)		57
Time of concentration (T_c); uncontrolled drainage area only	hours	1.15
Elevation top dam [1/]	feet	560.0
Elevation crest auxiliary spillway	feet	550.0
Elevation crest high stage inlet	feet	537.8
Elevation crest low stage inlet	feet	537.8
Auxiliary spillway type	Material	Reinforced-Concrete
Number of Cycles	No.	4
Auxiliary spillway width	feet	126
Auxiliary spillway exit slope	H:V Slope	3H:1V
Maximum height of dam	feet	60
Volume of fill	yd^3	132,300
Total capacity [2/]	acre-feet	3,318
Sediment submerged [3/]	acre-feet	210
Sediment aerated [3/]	acre-feet	4.7
Dead storage	acre-feet	0
Beneficial use (Water Supply)	acre-feet	1,527
Floodwater retarding	acre-feet	1,571
Between high and low stage	acre-feet	0
Surface area		
Sediment pool	acres	29
Beneficial use pool (Water Supply)	acres	104
Floodwater retarding pool [2/]	acres	158.3
Principal spillway design		
Rainfall volume (1-day)	inches	7.76
Rainfall volume (10-day)	inches	13.50
Runoff volume (10-day)	inches	9.29
Capacity of low stage (max.)	$feet^3/sec$	128
Capacity of high stage (max.)	$feet^3/sec$	128
Dimensions of conduit	in	42 (diam)
Type of conduit		Reinforced Concrete Pipe
Frequency of operation-auxiliary spillway	percent chance	1%
Auxiliary spillway hydrograph[4/]		
Rainfall volume	inches	n/a
Runoff volume	inches	n/a
Storm duration	hours	n/a
Velocity of flow (V_e)	feet/sec.	n/a
Max. reservoir water surface elev.	Feet	n/a
Freeboard hydrograph		
Rainfall volume	inches	18.32
Runoff volume	inches	15.37
Storm duration	hours	6
Max. reservoir water surface elev.	Feet	559.6
Capacity equivalents		

Item	Unit	Structure Data
Sediment volume	inches	0.41
Floodwater retarding volume[2/]	inches	3.08
Beneficial Use (M&I Water Supply)	Inches	3.00

Prepared July 2022

1/ All elevations are recorded in North American Vertical Datum 1988 (NAVD 88).
2/ At auxiliary spillway control section elevation 550.0 (NAVD 88). Based on 2017 sediment survey.
3/ Based on sedimentation memorandum (Schnabel 2021)
4/ Auxiliary Spillway Hydrograph not applicable to the proposed action. The vegetated spillway will be removed from service and the proposed spillway structure is a reinforced-concrete chute spillway.

Table 4 – Estimated Average Annual NED Costs, Beaver Creek, Virginia $[1/]

Works of Improvement	Amortization of Installation Costs[2/]	Operation, Maintenance and Replacement Cost	Costs
Rehabilitate Multiple-Purpose Structure No. 1	$1,364,954	$531,650	$1,896,604
Total:	$1,364,954	**$531,650**	**$1,896,604**

1/ Price base: 2022 Prepared: July 2022
2/ The average annual equivalents are based on a 2.250% discount rate and a 55-year period of analysis (5 years for project design/installation and 50 years of expected useful life).

Table 5 – Estimated Average Annual Flood Damage Reduction Benefits, Beaver Creek, Virginia $[1/]

Item[3/]	Estimated Average Annual Damage		
	Without Project[2/]	With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	$8,073	$8,073	$0
Roadways	$40,597	$40,732	$ (135)
Residences/Structures	$7,728	$7,734	$ (6)
Subtotal	$56,398	$56,539	$(141)
Totals:	**$56,398**	**$56,539**	**$(141)**

1/ Price base: 2022 Prepared: July 2022
2/ Existing estimated average annual flood damage benefits as compared with structure removed (FWOFI versus decommissioning) estimated to be $2,360 for Crop and Pasture, $8,311 for Roadways, and $5,201 for residences.
3/ All impacts are considered agricultural based on the rural setting of the project.
4/ Additional benefits exist based on reduced risk of failure and breach during the design storm event, including monetary benefits and benefits associated with protecting human life.

Table 6 – Comparison of NED Benefits and Costs, Beaver Creek, Virginia $[1,5/]

	Flood Damage Reduction[4/]	M&I Water Supply[6/]	Other Economic Effects[2/]	Average Annual Benefits[3/]	Average Annual Costs	Benefit/ Cost Ratios
Multiple-Purpose Structure No. 1	$(141)	$66,694	$664,405	$730,958	$1,896,604	0.39
Totals:	**$(141)**	**$66,694**	**$664,405**	**$730,958**	$1,896,604	**0.39**

1/ Price base: 2022 Prepared: July 2022
2/ This includes future water supply benefits. Refer to Appendix D for economic benefits analysis.
3/ The average annual equivalents are based on a 2.250% discount rate and a 55-year period of analysis (5 years for project design/installation and 50 years of expected useful life).
4/ Additional benefits exist based on reduced risk of failure and breach during the design storm event, including monetary benefits and benefits associated with protecting human life.
5/ All impacts are considered agricultural based on the rural setting of the project.
6/ M&I refers to current water supply. Please see Appendix D for economic benefits analysis.

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HEC-HMS Hydraulic Modeling System, Multiple Versions, U.S. Army Corps of Engineers USACE, Hydrologic Engineering Center.

INDEX

REPORT PREPARERS

The Beaver Creek 1 Supplemental Watershed Plan and Environmental Assessment was prepared by Schnabel Engineering, LLC with support from Hazen and Sawyer, Dovetail Cultural Resource Group, Headwaters Corporation and other consultants, Rivanna Water and Sewer Authority, and the NRCS staff located in Richmond, Virginia. The document was reviewed and concurred with by staff specialists having responsibility for engineering, resource conservation, soils, biology, economics, geology, and contract administration. The in-house review was followed by a review by the NRCS National Water Management Center, and then an interagency and public review.

Table J identifies and lists the experience and qualifications of those individuals who were directly responsible for providing significant input to the preparation of the Supplemental Plan-EA.

Appreciation is extended to many other individuals, agencies and organizations for their input, assistance, and consultation, without which this document would not have been possible. Several agencies such as the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service and FEMA were considered as potential cooperating agencies in the development of the plan. However, none were invited to be a cooperating agency. The agencies can still be involved during the design phase of the project. There is nothing in this plan that is controversial or requires other agencies to participate as a cooperating agency.

Table J – Experience and Qualifications of Report Preparers

Name	Present Title and Years in Current Position	Education	Previous Experience in Years	Other
USDA, NRCS Virginia Office				
Mathew Lyons, P.E.	State Conservation Engineer – 18 years	B.S. in Civil Engineering	Civil Engineer – 12 years	P.E. in VA
Dana Perkins	Environmental Specialist – 5 years	B.S. in Biology	Environmental Program Specialist - 9years Ecologist– 2 years Consultant – 10 years	
Austin Hunt	Economist – 1 year	B.A. in Economics, M.S. in Agricultural Economics	0	
SPONSOR - RWSA				
Jennifer A. Whitaker, P.E.	Director of Operations and Maintenance, 2017-Present (5 years)	ME in Civil Engineering, University of Virginia, December 2020, BS in Civil Engineering, University of Virginia, May 1995	22 years	P.E. in VA

Table J – Experience and Qualifications of Report Preparers

Name	Present Title and Years in Current Position	Education	Previous Experience in Years	Other
Victoria Fort, P.E.	Senior Civil Engineer, 2015-Present (6.5 years)	BS in Civil Engineering, University of Virginia, May 2010	5 years	P.E. in VA
CONSULTANT – Schnabel Engineering, LLC (Prime)				
J Ryan Collins, P.E.	Senior Engineer – 13 years	B.S. in Civil Engineering	0	P.E. in VA, GA, and TX
Randall P. Bass, P.E.	Senior Consultant – 18 years	B.S. in Civil Engineering –M.S. in Geotechnical Engineering	Georgia SDP – 6 years Contractor – 5 years Consultant – 14 years	P.E. in VA, GA
Victoria Webber, P.E.	Project Engineer – 4 years	B.S. in Civil Engineering, M.S. in Civil Engineering	Project Engineer – 5 years	P.E. in CO, NJ, NY, TX
Chad Jones, E.I.T.	Senior Staff Engineer – 4 years	B.S. in Civil and Environmental Engineering	0	
Celine Patel, E.I.T.	Staff Engineer – < 1 Year	B.S. in Civil Engineering	0	
CONSULTANT – Hazen and Sawyer (Environmental)				
Christopher Ramo, P.E.	Associate Water Resources Engineer – 17 years	B.S in Enviornmental Engineering, M.S in Civil Engineering	0	P.E. in VA, MD, DC, NY
Linda Diebolt	Associate Environmental Scientist – 11 years	B.S. in Marine Biology	23 years	
CONSULTANT – Headwaters Corporation (Economics)				
George Oamek	Economist – 6 years	B.S., M.S. – Colorado State University; Ph.D. – Iowa State University	Agricultural Economist 28 yrs	
Julia Grabowski	Geomorphology – 2 years	B.A. – Vanderbilt University M.S. – Colorado State University	0	
CONSULTANT – Dovetail Cultural Resource Group (Cultural Resources)				
Micahel Carmody, MA RPA	Principal Architectural Investigator – 13 years	M.A. - Anthropology, B.A. -Anthroplogy and Archaeology	12 years	Secretary of Interior Standards Qualified as Architect
Heather Station, MHP	Architectural Historian - 9 years	MHP and B.A - Historic Preservation	2 years	Secretary of Interior Standards Qualified as Architectural Hstorian and Historian

DISTRIBUTION LIST

Comments were requested from the following agencies and entities on the Draft Plan-EA:

Agency Or Entity	Response Received on Draft Plan-EA		Agency Or Entity	Response Received on Draft Plan-EA
Federal Agencies			**Tribal Governments, Continued**	
Environmental Protection Agency	Yes		Nottoway Indian Tribe of Virginia, Capron, Virginia	No
U.S. Army Corps of Engineers	No		Patawomeck Indian Tribe of Virginia, Fredericksburg, Virginia	No
U.S. Department of the Interior - Fish and Wildlife Service	No		Mattaponi Tribe, West Point, Virginia	No
Federal Emergency Management Agency	No		Upper Mattaponi Tribe, King William, Virginia	No
U.S. Department of Agriculture			Absentee Shawnee Indians of Oklahoma, Shawnee Oklahoma	No
U.S. Forest Service	No		Catawba Indian Nation, Rock Hill, South Carolina	No
Farm Service Agency	No		Cherokee Nation, Tahlequah, Oklahoma	No
Rural Development	No		Delaware Nation, Oklahoma	No
Virginia State Agencies			Delaware Tribe of Indians, Oklahoma Headquarters, Bartlesville, Oklahoma	No
Department of Environmental Quality	Yes		Eastern Band of Cherokee Indians, Cherokee, North Carolina	No
Dept. of Conservation and Recreation	Yes		Eastern Shawnee Tribe of Oklahoma, Wyandotte, Oklahoma	No
Department of Wildlife Resources	Yes		**Public Stakeholders**	
Department of Health	Yes		Craig Redinger	No
Department of Historic Resources	Yes		George Johnson	No
Virginia Marine Resources Commission	Yes		Hanna Clark	No
Department of Forestry	No		Gordie Smith	No
Virginia Dept. of Emergency Mgmt.	No		Austin Riopel	No
Virginia Department of Transportation	No		David Riopel	No
Delegates			Michael Riopel	No
The Honorable Congressman Bob Good	No		Caitlin Riopel	No
The Honorable Senator Mark Warner	No		Giovanna Ledford	No
The Honorable Senator Timothy Kaine	No		Jeanette Abell	No
The Honorable Delegate Chris Runion	No		Jim Abell	No
The Honorable Senator R. Creigh Deeds	No		Paige Ragsdale	Yes
Tribal Governments			Beth Hodsdon	No
Chickahominy Indian Tribe, Providence Forge, Virginia	No		Marina Clark	No
Chickahominy Indian Tribe - Eastern Division, Providence Forge, Virginia	No		Eliora Atwell	No
Monacan Indian Nation, Madison Heights, Virginia	No		Thomas Smith	No
Nansemond Indian Nation, Suffolk, Virginia	No		Jay Lester	No
Pamunkey Indian Tribe, King William, Virginia	No		Amelia Williams	No
Rappahannock Tribe, Indian Neck, Virginia	No		Jack Luecke	No
Upper Mattaponi Tribe, King William, Virginia	No		Ali Smith	No
Absentee Shawnee Indians of Oklahoma, Shawnee Oklahoma	No		Jeff Winder	No
Catawba Indian Nation, Rock Hill, South Carolina	Yes		Miles Johnson	No
Cherokee Nation, Tahlequah, Oklahoma	No		Nancy Smith	No
Delaware Nation, Oklahoma	Yes		Richard Miksad	No
Delaware Tribe of Indians, Oklahoma Headquarters, Bartlesville, Oklahoma	No		Robin Miksad	No
Eastern Band of Cherokee Indians, Cherokee, North Carolina	No		Joe Jones	No
Eastern Shawnee Tribe of Oklahoma, Wyandotte, Oklahoma	No		Brad Cogan	No
Muscogee (Creek) Nation	No		E.N. Garnett	No
Oneida Indian Nation, Oneida, New York	Yes		Richard Fox	No
Oneida Nation of Wisconsin, Oneida, Wisconsin	No		A.J. Dalton	No
Shawnee Tribe of Oklahoma, Miami, Oklahoma	No		Anita Vere-Nicoll	No
Tuscarora Nation (of New York), Lewiston, New York	No		Ed Brooking	No
United Keetoowah Band of Cherokee Indians, Tahlequah, Oklahoma	No		Ann Mallek	No
Cheroenhaka (Nottoway) Indian Tribe, Courtland, Virginia	No		Jeff Clayton	No

APPENDIX A

LETTERS OF COMMENT AND NRCS RESPONSES TO COMMENTS RECEIVED ON DRAFT SUPPLEMENTAL PLAN-EA

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J.R. Collins

From: Deel, Justin <justin.deel@dcr.virginia.gov>
Sent: Friday, December 16, 2022 12:23 PM
To: J.R. Collins
Cc: Howard-Cooper, Wendy (DCR); Killgore, Mark (DCR)
Subject: Re: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Follow Up Flag: Follow up
Flag Status: Flagged

JR,

Below are my humble suggestions for clarity.

1. The addition and placement of "and a breach event poses a threat to life and property downstream" in the Abstract seems to imply that this will not be the case after the improvements, which is not accurate. While the spillway improvement *should* decrease the likelihood of an overtopping breach, it will not change the potential threat to downstream life and property.
2. Page xxv, Other Beneficial Effects, Bullet #5, - Again, the spillway improvements are designed to reduce the risk of an overtopping dam breach, and will not reduce the potential threat. The dam could still breach in a dozen other ways. I *think* I understand what's trying to be conveyed but I'm afraid the average reader of this document will not. The addition and placement of "based on 11 residences…" seems to imply that PMF+breach is being taken off the table. IMO this bullet should read "Rehabilitation will reduce the likelihood of an *overtopping* dam breach during the PMF, which would impact. . ."
3. The report states throughout that DCR reclassified this dam to be high hazard. I do not believe this is technically accurate. While DCR may have required an updated Dam Break Inundation Zone study, the Schnabel (2011) study made the reclassification.

Lastly, an inquiry and curiosity. This report *appears* to quote from the 2021 Schnabel subsurface investigation. Has this been provided to DCR? I do not recall reviewing it and would like to. This report, again, appearing to quote Schnabel, says that Beaver Creek Dam is in both the Blue Ridge and the Piedmont physiographic provinces. Later in the report NRCS, appearing not to quote Schnabel, mentions the Blue Ridge but does not mention Piedmont. Did Schnabel encounter typical Piedmont soils overlying Blue Ridge soils/rock? Available mapping shows it to be clearly in the Blue Ridge, albeit near the eastern edge. As someone who fashions himself a geotechnical engineer I am curious about provincial boundaries. It's not often to see thorough data so close to a boundary nor to see multiple provinces cited.

Justin Deel, P.E.
Regional Dam Safety Engineer
Department of Conservation & Recreation
804-221-0476

On Tue, Nov 1, 2022 at 5:53 PM J.R. Collins <jcollins@schnabel-eng.com> wrote:

> Good afternoon,

I am pleased to inform you that the Beaver Creek 1 Draft Supplemental Watershed Plan-EA will be available for public and agency review beginning this Friday, November 4, 2022. The attached letter further describes how you can access the document and submit comments to the planning team or ask questions about the plan.

We appreciate your involvement and input to this point, and look forward to receiving your feedback on this Draft Plan-EA.

Please do not hesitate to reach out to me.

Thank you,

-JR

J Ryan Collins, PE
Senior Engineer

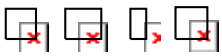
Schnabel Engineering

O: 737.236.5649 / C: 678.935.8454

12301 Research Blvd., Bldg. 4, Suite 150

Austin, TX 78759

schnabel-eng.com



USDA
United States Department of Agriculture

Natural
Resources
Conservation
Service

Virginia State Office

1606 Santa Rosa Road
Suite 209
Richmond, VA
23229

February 6, 2023

Mr. Justin Deel, P.E.
Regional Dam Safety Engineer
Department of Conservation & Recreation
900 Natural Resources Drive, Room 2028
Fontaine Research Park
Charlottesville, VA 22903

Dear Mr. Deel:

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) appreciates your recent review of the Beaver Creek 1 Plan-Environmental Document and Supplemental Watershed Plan (Plan-EA). The comments that you provided are presented herein, followed by the planning team's responses and anticipated revisions to the Plan-EA to address these comments.

Comment 1: *The addition and placement of "and a breach event poses a threat to life and property downstream" in the Abstract seems to imply that this will not be the case after the improvements, which is not accurate. While the spillway improvement should decrease the likelihood of an overtopping breach, it will not change the potential threat to downstream life and property.*

Response 1: The planning team concurs with your conclusion described above. Due to the size limitations and formatting requirements of the Plan-EA, certain descriptions under headings such as the Abstract were truncated or not explained in full detail. Significantly greater detail regarding hazard classification, breach scenarios and the associated downstream hazards is presented in the body of the Plan-EA. However, your comment provides us with the opportunity to better clarify the authors' intent. Therefore, we have struck the clause "and a breach … property downstream" per your comment and added a sentence which reads "As such, the structure cannot safely store and/or pass runoff resulting from the design storm event which increases the dam and auxiliary spillway's susceptibility to failure during the Probable Maximum Flood (PMF). A breach resulting from failure of the dam or spillway poses a threat to downstream life and property."

Comment 2: *Page xxv, Other Beneficial Effects, Bullet #5, - Again, the spillway improvements are designed to reduce the risk of an overtopping dam breach, and will not reduce the potential threat. The dam could still breach in a dozen other ways. I think I understand what's trying to be conveyed but I'm afraid the average reader of this document will not. The addition and placement of "based on 11 residences..." seems to imply that PMF+breach is being taken off the table. IMO this bullet should read "Rehabilitation will reduce the likelihood of an overtopping dam breach during the PMF, which would impact. . ."*

Response 2: Your comment is noted. The authors consider "risk" to be a function of probability (or likelihood) and consequence, and therefore are of the opinion that Bullet #5 is an accurate statement. The proposed measures will provide sufficient hydraulic capacity to safely pass the design flood event and significantly reduce the

likelihood of Beaver Creek 1 Dam overtopping during the PMF. The proposed measures will also reduce the peak water surface elevation during the design storm event by approximately four (4) feet, which will reduce downstream flooding in the event that a breach occurs during the design flood event (PMF with breach). A revised breach inundation analysis will be performed during the detailed design phase with the final design hydrology and proposed spillway structure incorporated into the flood routing.

Regarding other potential failure modes (PFMs); the dam has been analyzed for global slope stability during normal operating conditions, pseudo-static seismic loading, rapid drawdown, and flood surcharge condition during the PMF. Other failure modes such as liquefaction and internal erosion have also been analyzed during the planning phase and will be further evaluated during the detailed design phase. Measures are included in the plan to address deficiencies observed in the existing internal drainage system, including inadequate filter compatibility and obfuscation of the drain outlets. Geotechnical explorations performed during previous phases of the project (2011, 2018, 2021) did not reveal alarming embankment or foundation conditions, but further evaluation is still required during the detailed design phase of the project to better evaluate PFMs for the subject structure.

Comment 3: *The report states throughout that DCR reclassified this dam to be high hazard. I do not believe this is technically accurate. While DCR may have required an updated Dam Break Inundation Zone study, the Schnabel (2011) study made the reclassification.*

Response 3: It is the authors' understanding that the Virginia Department of Conservation and Recreation (DCR) Dam Safety Program is the entity who is legally authorized to assign a hazard classification to an impounding structure. Schnabel Engineering, LLC, provided the report to document the breach inundation analyses for Beaver Creek 1 on the owner's behalf and to recommend a hazard classification in accordance with 4VAC50-20-40.C.2, subject to "approval by the board." We are of the opinion that private consultants do not have the authority to assign hazard classifications to impounding structures.

Comment 4: *Lastly, an inquiry and curiosity. This report appears to quote from the 2021 Schnabel subsurface investigation. Has this been provided to DCR? I do not recall reviewing it and would like to. This report, again, appearing to quote Schnabel, says that Beaver Creek Dam is in both the Blue Ridge and the Piedmont physiographic provinces. Later in the report NRCS, appearing not to quote Schnabel, mentions the Blue Ridge but does not mention Piedmont. Did Schnabel encounter typical Piedmont soils overlying Blue Ridge soils/rock? Available mapping shows it to be clearly in the Blue Ridge, albeit near the eastern edge. As someone who fashions himself a geotechnical engineer, I am curious about provincial boundaries. It's not often to see thorough data so close to a boundary nor to see multiple provinces cited.*

Response 4: We appreciate this comment. Regarding *"Available Mapping"* we note that the precise location of the boundary between physiographic provinces is inconsistent among various references considered by the planning team. Additionally, there was a difference of opinion regarding the "precise" boundary between these two physiographic provinces during the National Water Management Center (NWMC) review of the Preliminary Draft Plan-EA as documented in the comment resolution. The soils encountered during Schnabel's previous geologic explorations below the thin alluvial lens included silty sands and sandy silts, disintegrated rock (DR), and were underlain by granitic-gneiss and schist rock formations. The original 1962 Soil Conservation Service (SCS, now NRCS) geology report for Beaver Creek 1 indicates that the project is located in the Piedmont Physiographic Province.

We note that inherent uncertainty may exist between two geologic provinces. For example, a project that resides at the interface between a Coastal Plain and Piedmont geology may initially exhibit soil conditions that are characteristic of Coastal Plain geology (marine sediment deposits, fat clays, clean, fine "beach sand", layering or bedding, evidence of organic oceanic material, etc.), but 50 feet below those soils, residual soils may exist acting as a "shelf" on which the coastal plain material lies. In such a case, it might be necessary to consider both geologies depending on which design conditions or failure modes are being analyzed. The planning team is of the opinion that this item should be revisited during the detailed design phase to achieve closure and agreement regarding how the geologic setting is described, and to ensure that appropriate design assumptions are made with respect to the project's geologic setting.

The report you referenced was contained in Appendix E of the Plan-EA but has not been submitted directly to DCR for review at this time. Early in the detailed design phase, the Owner, along with their consultants, NRCS and Virginia Dam Safety will conduct a meeting between their geotechnical and geologic teams to discuss the findings of all previous geologic investigations, the proposed plan for geologic investigation during the design phase, and any other potential items of concern or clarification before final analyses are conducted and design reports are submitted for agency approval (This process will also occur for other disciplines such as hydrology, hydraulics, and structural engineering, and DCR will be invited to attend to ensure they are in agreement with the design approaches set forth for each discipline). We propose discussing this item further at that time.

Closure

The planning team again appreciates your review of the Plan-EA and looks forward to continued association as the final design phase advances. We hope that these responses help to clarify the intent of the Plan-EA and are satisfactory to you and your team.

If you have any questions, please contact me or Mathew Lyons, PE, State Conservation Engineer (mathew.lyons@usda.gov or (804) 287-1653).

Sincerely,

Edwin Martinez Martinez, Ph.D.
State Conservationist

cc: Mathew Lyons, P.E. (USDA-NRCS Virginia State Conservation Engineer)
J. Ryan Collins, P.E. (Schnabel Engineering, LLC)

J.R. Collins

From: Glyn, Rebecca <GLYN.REBECCA@EPA.GOV>
Sent: Monday, December 19, 2022 5:58 PM
To: J.R. Collins
Cc: Nevshehirlian, Stepan; Witman, Timothy; Hudson, Meredith; Mazzarella, Christine
Subject: EPA Comments on Beaver Creek Draft Supplemental Watershed Plan EA - Albemarle County, VA

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Mr. Collins:

Thank you for providing EPA with notice that the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) has prepared and is accepting comments on the Draft Supplemental Watershed Plan-Environmental Document/Assessment (Draft Plan-EA) for the Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek watershed located in Albemarle County, Virginia, in accordance with the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The U.S. Environmental Protection Agency (EPA) provides the following comments and recommendations for consideration in the development of the Final EA. Given the limited time available for EPA's review, we note these comments are not comprehensive. Future notice of publications prepared under NEPA within the Mid-Atlantic region may be sent to EPA Region 3's Environmental Assessment Branch supervisor, Stepan Nevshehirlian, at Nevshehirlian.Stepan@epa.gov.

Soil Stabilization

We recommend the Final EA discuss how construction and new hydraulic conditions may affect erosion, sedimentation, and bank stabilization, identify areas that will be restored or stabilized to minimize erosion, and indicate which Best Management Practices (BMPs) (i.e., cofferdams and pumping, silt fence, etc) may be used to prevent sedimentation from activities that disturb areas in or near waterbodies. We recommend incorporating to the extent possible vegetated and other green infrastructure/bioengineered soil stabilization methods, which provide the co-benefits of improving stormwater management, flood risk, water quality, and habitat.

Vegetation

EPA recommends the Final EA provide a vegetation management approach that promotes native plant communities and supports pollinators and other fauna where possible. Native vegetation may provide a range of functions and benefits, including but not limited to soil stability, water quality improvements, aesthetic enhancement, flood attenuation, and potentially reduced maintenance costs. For example, establishing meadow communities instead of turfgrass in areas where woody vegetation is undesirable may provide habitat while reducing emissions and fuel and equipment costs by requiring less frequent mowing, fertilizer, and pesticides.

Water Resources

We recommend identifying BMPs that will be used to prevent or reduce adverse water quality impacts during construction, for example, using BMPs to prevent overspray or runoff and selecting pesticides appropriate for the proximity to drinking water supplies and aquatic environments.

EPA recommends including an evaluation of secondary effects to aquatic resources, such as modified hydrology, associated with temporarily lowering the lake.

Air Quality – Construction

We recommend the Final EA discuss measures that will be used during construction to improve energy efficiency and reduce the expected increase of pollutant emissions from the use of diesel- and gas-fueled equipment. Such strategies may include implementing BMPs and contract specifications to require advanced pollution controls and clean fuels, reducing unnecessary truck and equipment idling and strict enforcement of idling limits, engine upgrades and preventive maintenance, equipment operator training, retrofit technologies such as diesel particulate filters and diesel oxidation catalysts, and electrification. More information is available at the following link: https://www.epa.gov/verified-diesel-tech/clean-diesel-technology.

For additional guidance, we recommend accessing resources provided by EPA's Diesel Emissions Reduction Act program and employing the operational and equipment strategies detailed in the EPA publication, "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment," available at: https://www.epa.gov/dera/reducing-diesel-emissions-construction-and-agriculture.

Climate Adaptation and Mitigation

Consistent with Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad, EPA recommends the Final EA indicate what measures will be taken to ensure the project's resilience in future climate change scenarios, such as increased storm intensity, warming water temperatures, and changing patterns of flooding, sedimentation, and seasonality of rain events.

We also recommend the Final EA provide estimates of the project's expected greenhouse gas (GHG) emissions from construction and operations, and identify measures that will be taken to reduce those emissions. The CEQ lists a number of tools for estimating GHG emissions at: https://ceq.doe.gov/guidance/ghg-tools-and-resources.html, which can serve as a reasonable proxy for comparing climate impacts of alternatives.

Waste and Contamination

EPA recommends the Final EA assess the use, storage, and disposal of any hazardous materials, solid waste, fuels, and chemicals associated with the proposed action and alternatives, and any applicable rules or requirements in that regard.

Public Outreach and Community Impacts

We recommend the Final EA provide updated and additional information on the project's expected community impacts regarding construction noise, emissions, detours, or other disruptions to transportation networks, and public safety concerns posed by the Multiple Purpose Structure. Additional information may include identifying the proximity of potentially impacted populations and properties, the duration of impacts, how upcoming disruptions will be communicated to affected parties, and future opportunities for public input and how that will continue to inform the project's implementation. The Final EA should also describe any mitigation measures that will address expected community impacts, such as coordinating construction activities to mitigate noise, dust, and emissions where possible.

We recommend the community outreach strategy ensures meaningful, timely, and accessible engagement with affected communities. Notices of meetings, closures, or other informational materials should be provided at frequently visited community locations and/or distributed by community leaders. Meetings should be convenient for the community members.

We also recommend discussing in the Final EA how residual flood risk will be communicated to properties protected by the Multiple Purpose Structure. We suggest including a protocol for regular communication of flood risk, for example, by notifying all property owners in an annual mailing or including a notice in a bill. Communication should describe the floodplain area, the level of protection provided by the facility, the risk of failure, and how the proposed action seeks to address these concerns.

Environmental Justice (EJ)

The Draft Plan-EA states that no potential impacts to communities with environmental justice concern were identified and provides Figure C-13 with a map of census block groups in the project area. We note that the area of potential effect outlined in Figure C-13 represents the water line of the reservoir, and no analysis or demographic data is provided on communities that will be affected by the proposed action beyond the immediate limits of the site. As noted in the Draft Plan-EA, the project is expected to cause transportation, noise, and air quality impacts to surrounding communities, and that a breach event for the Multiple Purpose Structure would pose a threat to life and safety downstream.

The Final EA should provide demographic data on the minority and income status of those potentially impacted communities to determine whether the project may impact communities with environmental justice concerns, and if so, whether those impacts would be disproportionately high and adverse compared to the general population served by the project. This analysis should highlight any existing vulnerabilities, health disparities, and pollutant exposures that would warrant mitigation to avoid or reduce these community impacts.

Methodologies for identifying EJ concerns are discussed by several agencies including CEQ; see https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf
EPA's environmental justice screening tool, EJSCREEN (https://www.epa.gov/ejscreen), can be used to screen potential areas of EJ concern. Providing maps in the NEPA document is a highly effective means of conveying demographic data for potentially impacted communities and where they are located relative to the proposed action.

Previous NEPA Studies
We recommend indicating more clearly the dates and scopes of previous NEPA studies that have evaluated the Beaver Creek watershed plan. Where previous NEPA documents will be used to support the Final EA, EPA recommends citing specific sections and pages and linking to relevant documents where possible.

Thank you for considering our comments and feel free to contact me with any questions. We would appreciate receiving notice when the Final EA is published.

Sincerely,

Rebecca Souto-Glyn
National Environmental Policy Act (NEPA) Reviewer
Office of Communities, Tribes, & Environmental Assessment
U.S. Environmental Protection Agency
Mid-Atlantic Region 3 - Philadelphia, PA
(215) 814-2795 glyn.rebecca@epa.gov She/Her

From: J.R. Collins <jcollins@schnabel-eng.com>
Sent: Monday, December 05, 2022 12:05 PM
To: Davis, Ginny <Davis.Ginny@epa.gov>
Subject: RE: EPA Information for comment review for Albemarle County project

Ms. Davis,

Thank you for the prompt response. Attached is a PDF of the letter addressed to Mr. Servidio. Please consider the addressee "To Whom it May Concern" or to Mr. Ortiz as appropriate.

I will update our contact information for your office accordingly. If anyone should have any additional questions about this request, please do not hesitate to contact me.

Thank you,

-JR

J Ryan Collins, PE
Senior Engineer

Schnabel Engineering
O: 737.236.5649 / C: 678.935.8454
12301 Research Blvd., Bldg. 4, Suite 150
Austin, TX 78759
schnabel-eng.com

From: Davis, Ginny <Davis.Ginny@epa.gov>
Sent: Monday, December 5, 2022 10:58 AM
To: J.R. Collins <jcollins@schnabel-eng.com>
Subject: EPA Information for comment review for Albemarle County project

Mr. Collins,

I received the voicemail message that you left with my office's Hotline this morning. Please email me the information that you sent to Mr. Servidio. I will identify a person in my office who receives comment review notifications. Mr. Servidio was the former Regional Administrator of the EPA Region 3 office. Adam Ortiz is our current Regional Administrator. Please note our new office address:

US EPA Region 3 office
4 Penn Center
1600 JFK Boulevard
Philadelphia, PA 19103-2852

Ginny

Ginny Davis, M.S.Ed.
Public Information Center Specialist, SEE Program
US EPA Mid-Atlantic Region
Phone 215-814-2149
Email davis.ginny@epa.gov

USDA
United States Department of Agriculture

Natural
Resources
Conservation
Service

Virginia State Office

1606 Santa Rosa Road
Suite 209
Richmond, VA
23229

February 6, 2023

Mr. Stepan Nevshehirlian
Environmental Assessment Branch Chief
Environmental Protection Agency Region 3
Office of Communities, Tribes, and Environmental Assessment
4 Penn Center (3RA12)
Philadelphia, PA 19103-2029

Dear Mr. Nevshehirlian:

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) appreciates your recent review of the Beaver Creek 1 Plan-Environmental Document and Supplemental Watershed Plan (Plan-EA). The comments that you provided are presented herein, followed by the Planning Team's responses and anticipated revisions to the Plan-EA to address these comments.

Comment 1: *Soil Stabilization: We recommend the Final EA discuss how construction and new hydraulic conditions may affect erosion, sedimentation, and bank stabilization, identify areas that will be restored or stabilized to minimize erosion, and indicate which Best Management Practices (BMPs) (i.e., cofferdams and pumping, silt fence, etc.) may be used to prevent sedimentation from activities that disturb areas in or near waterbodies. We recommend incorporating to the extent possible vegetated and other green infrastructure/bioengineered soil stabilization methods, which provide the co-benefits of improving stormwater management, flood risk, water quality, and habitat.*

Response 1: We appreciate this comment. The topics described above are very important to the planning team as well as the Community of Crozet, Virginia. The project team will develop these items during the detailed design phase as part of the stormwater pollution prevention plan (SWPPP) in accordance with Albemarle County and Commonwealth of Virginia standards. The project's alternatives analysis weighed heavily on considerations for maintaining park areas and other greenspace present at the site.

Comment 2: *Vegetation: EPA recommends the Final EA provide a vegetation management approach that promotes native plant communities and supports pollinators and other fauna where possible. Native vegetation may provide a range of functions and benefits, including but not limited to soil stability, water quality improvements, aesthetic enhancement, flood attenuation, and potentially reduced maintenance costs. For example, establishing meadow communities instead of turfgrass in areas where woody vegetation is undesirable may provide habitat while reducing emissions and fuel and equipment costs by requiring less frequent mowing, fertilizer, and pesticides.*

Response 2: We appreciate this comment. The Owner will consider this recommendation for portions of restored park areas when the landscaping plan is developed during the design and/or construction phase.

Comment 3: *Water Resources: We recommend identifying BMPs that will be used to prevent or reduce adverse water quality impacts during construction, for example, using BMPs to prevent overspray or runoff and selecting pesticides appropriate for the proximity to drinking water supplies and aquatic environments.*

EPA recommends including an evaluation of secondary effects to aquatic resources, such as modified hydrology, associated with temporarily lowering the lake.

Response 3: The planning team concurs with this comment. The Stormwater Pollution Prevention Plan (SWPPP) will be developed in accordance with Albemarle County and Commonwealth of Virginia standards and will include BMPs that also consider the proximity of the raw water reservoir / drinking supply. Additionally, this project will require as U.S. Army Corps of Engineers permit (likely a Nationwide Permit). Some of the specific BMPs that will be incorporated include, but are not limited to, silt fence, sediment traps, sediment basins (if applicable), dust control, stream crossings, check dams, temporary and permanent seeding and stabilization, erosion control matting, and other BMPs as determined during the detailed design phase. Additionally, the engineer will specify that the Contractor routinely inspects the erosion and sediment control measures, maintains the erosion control features by repairing damaged sections, and removes and disposes of captured sediment in accordance with all local, commonwealth, and federal requirements.

Regarding the evaluation of secondary effects associated with lowering the reservoir, the planning team acknowledges that a controlled and scheduled lowering of the reservoir will be necessary to avoid causing sudden change or shock to the aquatic resources living within the lake. The specific schedule for lowering the lake will be developed during the detailed design phase in coordination with the Virginia Department of Environmental Quality (DEQ) to reduce the potential for disrupting aquatic life in the reservoir.

Comment 4: *Air Quality – Construction: We recommend the Final EA discuss measures that will be used during construction to improve energy efficiency and reduce the expected increase of pollutant emissions from the use of diesel- and gas-fueled equipment. Such strategies may include implementing BMPs and contract specifications to require advanced pollution controls and clean fuels, reducing unnecessary truck and equipment idling and strict enforcement of idling limits, engine upgrades and preventive maintenance, equipment operator training, retrofit technologies such as diesel particulate filters and diesel oxidation catalysts, and electrification. More information is available at the following link: https://www.epa.gov/verified-diesel-tech/clean-diesel-technology.*

For additional guidance, we recommend accessing resources provided by EPA's Diesel Emissions Reduction Act program and employing the operational and equipment strategies detailed in the EPA publication, "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment," available at: https://www.epa.gov/dera/reducing-diesel-emissions-construction-and-agriculture.

Response 4: The planning team appreciates this comment. We note that gas-powered equipment associated with gated spillway structures was considered during the formulation of the alternatives as an Ecosystem Service. It is possible that a gated spillway could have achieved the same hydraulic effect as the proposed labyrinth-crested spillway. However, additional fuel

consumption/greenhouse gas emissions, as well as other cost and maintenance concerns, resulted in the gate alternative being removed from detailed evaluation.

Regarding the construction standards for emissions: the planning team concurs that employing a method such as equipment operator training to reduce emissions may be appropriate to include as part of the Contractors' site orientation. A note has been added to the Plan-EA requiring the Contractors' personnel participate in training regarding reduced greenhouse gas emissions (page 50). BMPs such as dust control on haul roads and other dry work areas will also be specified to reduce the amount of airborne soil particulates produced during construction.

Lastly, during the various public meetings that were conducted to present the project to the community, a significant amount of concern was raised regarding closure of the County Road and the significantly long detour route around the reservoir. This included not only normal commuter vehicles, but also trucks carrying supplies from a local dairy farm and emergency service vehicles. The planning process resulted in the addition of an on-site detour, which will avoid a significant amount of additional travel time (20 minutes) and distance (five miles) for vehicles traveling from one end of the dam to the other. At an estimated 570 vehicles per day and for a duration of 180 days, this results in a reduction of CO_2 emissions on the order of 207.3 metric tons based on an average commuter vehicle emission of 404 grams per mile (Source: EPA https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#driving). A Maintenance of Traffic (MOT) plan will be developed during the design phase or by the Contractor prior to initiating construction to ensure that traffic is maintained through the site without excessive delays or interruptions to service. Economic analysis of the time and value of the delay are presented in Appendix D of the Plan-EA.

Comment 5: *Climate Adaptation and Mitigation: Consistent with Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad, EPA recommends the Final EA indicate what measures will be taken to ensure the project's resilience in future climate change scenarios, such as increased storm intensity, warming water temperatures, and changing patterns of flooding, sedimentation, and seasonality of rain events.*

We also recommend the Final EA provide estimates of the project's expected greenhouse gas (GHG) emissions from construction and operations and identify measures that will be taken to reduce those emissions. The CEQ lists a number of tools for estimating GHG emissions at: https://ceq.doe.gov/guidance/ghg-tools-and-resources.html, which can serve as a reasonable proxy for comparing climate impacts of alternatives.

Response 5: Representatives of NRCS and Schnabel Engineering, LLC, recently attended the 2022 National Dam Safety Conference conducted by the Association of State Dam Safety Officials (ASDSO). During the conference, a round panel discussion was conducted by state dam safety officials, a FEMA director, and other prominent figures in the dam safety community. An audience member asked the panel about how to incorporate climate change resiliency into dam design and rehabilitation projects. The panel pondered the question and discussed it, and essentially concluded that the community does not have enough data at this time to enact policy or otherwise alter the design standards specifically for climate change considerations, though no panelist denied that this topic warrants additional scrutiny in the future. The Colorado state dam safety official who attended the panel discussion shared his state's approach (increasing the rainfall by a set percentage), but admitted that this is somewhat of an assumed value and did not

place a high degree of confidence on estimating a precise value. No such regulation currently exists in the Commonwealth of Virginia or within NRCS policy.

The Rivanna Water and Sewer Authority (RWSA, Owner) puts a high level of emphasis on their internal dam safety policies and overall program. For example, to meet Virginia standards, the rehabilitation of a high hazard potential impounding structure requires the dam to safely store and/or discharge 90 percent of the runoff from the Probable Maximum Precipitation (PMP). RWSA requires their structures pass 100 percent of the PMP runoff. Therefore, an additional 10 percent of the PMP above the Commonwealth's required design flood event is included in the Beaver Creek 1 design, which results in added conservatism that could be considered a form of climate change resiliency.

Please see our response to Comment 4 regarding the GHG emissions.

Comment 6: *Public Outreach and Community Impacts: We recommend the Final EA provide updated and additional information on the project's expected community impacts regarding construction noise, emissions, detours, or other disruptions to transportation networks, and public safety concerns posed by the Multiple Purpose Structure. Additional information may include identifying the proximity of potentially impacted populations and properties, the duration of impacts, how upcoming disruptions will be communicated to affected parties, and future opportunities for public input and how that will continue to inform the project's implementation. The Final EA should also describe any mitigation measures that will address expected community impacts, such as coordinating construction activities to mitigate noise, dust, and emissions where possible.*

We recommend the community outreach strategy ensures meaningful, timely, and accessible engagement with affected communities. Notices of meetings, closures, or other informational materials should be provided at frequently visited community locations and/or distributed by community leaders. Meetings should be convenient for the community members.

We also recommend discussing in the Final EA how residual flood risk will be communicated to properties protected by the Multiple Purpose Structure. We suggest including a protocol for regular communication of flood risk, for example, by notifying all property owners in an annual mailing or including a notice in a bill. Communication should describe the floodplain area, the level of protection provided by the facility, the risk of failure, and how the proposed action seeks to address these concerns.

Response 6: The Planning Team appreciates this comment. We note that additional notices will be issued as part of obtaining the land disturbance permit and U.S. Army Corps of Engineers permits, and that the specific details of those mitigation measures will be described in the plans being developed during the design phase, including a stormwater pollution prevention plan (SWPPP), erosion, sedimentation and pollution control plans and drawings, specifications for these measures, and other requirements based on discussions with Albemarle County and NRCS. The project team does not currently anticipate working hours beyond the normal daylight hours but will continue to work with the community as the project develops if any disturbances are anticipated based on the construction activities.

Regarding public outreach: We note that the planning team has conducted a series of public outreach in the form of virtual meetings to provide information to the public, agencies, and other project stakeholders. Two scoping meeting were conducted on December 10, 2020, in which the

overall project was presented along with requirements for the NRCS Watershed Rehabilitation program, and to solicit feedback from the public and local/commonwealth/federal agencies regarding relevant scoping concerns that should be considered for this project. The planning team used the feedback from the scoping meetings and developed alternatives to address the project's purpose and need while incorporating comments received from the participants of the scoping meetings. An additional public meeting was conducted on October 6, 2021, to present the overall findings of the Plan-EA, describe the alternatives considered, and present the preferred alternative identified in the plan. Following NRCS national (National Water Management Center, National Headquarters) review and comment resolution, the Draft Plan-EA was posted for 45 days to the Owner's website. In all instances described above, the meetings and public posting of the Draft Plan-EA were advertised in local newspapers, community message boards, and notification letters sent directly to those who expressed interest during the course of the project. Additional public meetings will be held during the design phase to notify the public of the planned construction activities.

We note that the Emergency Action Plan (EAP) for the subject project will be revised and/or updated during the design phase for this project to provide Emergency Management Services (EMS) the most up-to-date information, and to allow them the opportunity to develop more strategic evacuation plans in the event of an emergency based on the proposed conditions of the project.

Comment 7: *Environmental Justice (EJ): The Draft Plan-EA states that no potential impacts to communities with environmental justice concern were identified and provides Figure C-13 with a map of census block groups in the project area. We note that the area of potential effect outlined in Figure C-13 represents the water line of the reservoir, and no analysis or demographic data is provided on communities that will be affected by the proposed action beyond the immediate limits of the site. As noted in the Draft Plan-EA, the project is expected to cause transportation, noise, and air quality impacts to surrounding communities, and that a breach event for the Multiple Purpose Structure would pose a threat to life and safety downstream.*

The Final EA should provide demographic data on the minority and income status of those potentially impacted communities to determine whether the project may impact communities with environmental justice concerns, and if so, whether those impacts would be disproportionately high and adverse compared to the general population served by the project. This analysis should highlight any existing vulnerabilities, health disparities, and pollutant exposures that would warrant mitigation to avoid or reduce these community impacts.

Methodologies for identifying EJ concerns are discussed by several agencies including CEQ; see https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf EPA's environmental justice screening tool, EJSCREEN (https://www.epa.gov/ejscreen), can be used to screen potential areas of EJ concern. Providing maps in the NEPA document is a highly effective means of conveying demographic data for potentially impacted communities and where they are located relative to the proposed action.

Response 7: Demographic and economic data are presented in the Plan-EA and in Appendix D. Please refer to the Investigations Analysis Report – Appendix D for additional information on demographics of Albemarle County and the affected community. Due to the 75-page limit on the Plan-EA and the substantial amount of information that is required to be presented in the body of the text, some detailed information or data used to support the conclusions is presented in the

Appendices. However, the planning team made no findings of disproportionate treatment towards environmental justice communities or minority populations as a result of the proposed actions.

Comment 8: *Previous NEPA Studies: We recommend indicating more clearly the dates and scopes of previous NEPA studies that have evaluated the Beaver Creek watershed plan. Where previous NEPA documents will be used to support the Final EA, EPA recommends citing specific sections and pages and linking to relevant documents where possible.*

Response 8: Thank you for this comment. There are no previous NEPA studies associated with this project.

Closure

The planning team again appreciates your review of the Plan-EA and looks forward to continued association as the final design phase advances. We hope that these responses help to clarify the intent of the Plan-EA and are satisfactory to you and your team.

If you have any questions, please contact me or Mathew Lyons, PE, State Conservation Engineer (mathew.lyons@usda.gov or (804) 287-1653).

Sincerely,

Edwin Martinez Martinez, Ph.D.
State Conservationist

cc: Mathew Lyons, P.E. (USDA-NRCS Virginia State Conservation Engineer)
J. Ryan Collins, P.E. (Schnabel Engineering, LLC)

COMMONWEALTH of VIRGINIA

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Julie V. Langan
Director
Tel: (804) 367-2323
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www.dhr.virginia.gov

December 16, 2022

Linda Diebolt
Hazen and Sawyer
4011 WestChase Blvd., Ste 500
Raleigh, NC 27607

Re: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed / RWSA Crozet Water Supply System Raw Water Infrastructure Upgrades
Albemarle County, VA
DEQ# 22-175F
DHR File No. 2022-5236

Dear Ms. Diebolt:

DHR received a review request for the RWSA Crozet Water Supply System Raw Water Infrastructure Upgrades Project, also known as the Rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed project. The undertaking consists of a raw water transmission main installation, dam rehabilitation, raw water intake installation, tunnel and pump station construction and principal spillway riser modifications. Our comments are provided as assistance to the United States Department of Agriculture (USDA)- Natural Resources Conservation Service (NRCS) in meeting their responsibilities under Section 106 of the National Historic Preservation Act.

The ePIX submission included a report titled, *Phase I Cultural Resources Survey of the Crozet Water Supply Project Area in Albemarle County, Virginia,* prepared by Dovetail Cultural Resource Group (Dovetail) on behalf of Hazen and Sawyer. The submission included a cover letter (dated June 14, 2022) stating that copy of the report was sent to the DHR Division of Survey and Register as a courtesy copy only, and no request for comments had been made at that time. The submitted report documents a cultural resources survey of approximately 3.2 acres.

According to the submitted report, during the course of the survey, one archaeological site was identified — a building foundation and artifact scatter. This archaeological site was not given a DHR ID number in the report and is only called "Site 1." According to VCRIS, "Site 1" has been recorded as 44AB0703. Additionally, according to VCRIS, two other archaeological sites were identified during this survey, 44AB0709 and 44AB0713. These sites were not included in the submitted report, nor were potential impacts to these sites discussed within the submitted report or ePIX application. It appears that an unfinished draft report has been submitted for review and comments.

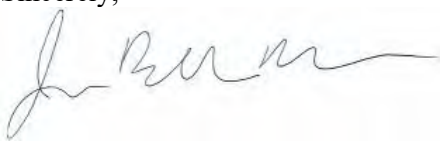
On November 1, 2022, DHR received notice that a Draft Environment Assessment (EA) for the Rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed was available for review. While the EA does include references to 44AB0703, 44AB0709, and 44AB0713, only summaries were included within the document. This information is not sufficient for review. At this time, we cannot provide any meaningful comments about the potential effects this undertaking may have on historic properties.

In order for DHR to continue its review of this undertaking and its potential effects to historic properties, please submit the following information:

- The final version of the report (one bound copy and one digital copy) that includes a discussion of all archaeological sites that have been identified within the Area of Potential Effects (APE) for this undertaking.
- An APE map that clearly shows the nearby cultural resources in relation to the project area.
- A narrative description of potential effects to historic properties (or lack thereof) located within the APE.

If you have any questions at this time, please contact me at jennifer.bellville-marrion@dhr.virginia.gov.

Sincerely,



Jenny Bellville-Marrion, Project Review Archaeologist
Review and Compliance Division

Cc:
Chelsea Jeffries, DHR
J.R. Collins, Schnabel

USDA
United States Department of Agriculture

Natural
Resources
Conservation
Service

Virginia State Office

1606 Santa Rosa Road
Suite 209
Richmond, VA
23229

February 6, 2023

Ms. Jenny Bellville-Marrion
Project Review Archaeologist
Commonwealth of Virginia
Virginia Department of Environmental Quality
Review and Compliance Division
2801 Kensington Ave
Richmond, VA 23221

RE: Draft Supplemental Watershed Plan No. 2 and Environmental Assessment for the Rehabilitation of Multipurpose Structure No. 1 Of the Beaver Creek Watershed, Albemarle County (22-175F), DHR File No. 2022-5236

Dear Ms. Bellville-Marrion:

Thank you for providing the Virginia Department of Historic Resources comments on the referenced project to meet the requirements of Section 106 of the National Historic Preservation Act. We note that a Joint Permit Application (JPA) for the subject project has been submitted to DEQ and has been under review on a separate tract.

We are in receipt of your letter addressed to Ms. Linda Diebolt of Hazen and Sawyer dated December 16, 2022. We offer the following responses to your comments.

Comment 1: "*On November 1, 2022, DHR received notice that a Draft Environmental Assessment (EA) for the rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed was available for review. While the EA does include references to 44AB0703, 44AB0709, and 44AB0713, only summaries were included within the document. This information is not sufficient for review. At this time, we cannot provide any meaningful comments about the potential effects this undertaking may have on historic properties. In order for DHR to continue its review of this undertaking and its potential effect to historic properties, please submit the following information:*

- *The final version of the report (one bound copy and one digital copy) that includes a discussion of all archaeological sites that have been identified within the Area of Potential Effects (APE) for this undertaking.*
- *An APE map that clearly shows the nearby cultural resources in relation to the project area.*
- *A narrative description of potential effects to historic properties (or lack thereof) located within the APE."*

Response 1: The planning team appreciates this comment. We note that the full report contents were provided in the Investigations and Analysis Report – Appendix D, as described in the Plan-EA. Due to the page limitations required by NEPA on the

Plan-EA, certain information cannot be presented in the body of the Plan-EA and must be described more fully in the Appendices.

We note that Hazen and Sawyer and their consultant Dovetail Cultural Resources Group have provided this report to DHR as part of the JPA process as well. Hazen and Sawyer and Dovetail Cultural Resources Group will prepare the report and re-submit the copies to your office as requested. As described in the Plan-EA and appendices, the proposed actions will have no impact on historic properties located within the APE.

Closure

The planning team again appreciates your review of the Plan-EA and looks forward to continued association as the final design phase advances. We hope that these responses help to clarify the intent of the Plan-EA and are satisfactory.

If you have any questions, please contact me or Mathew Lyons, PE, State Conservation Engineer (mathew.lyons@usda.gov or (804) 287-1653).

Sincerely,

Edwin Martinez Martinez, Ph.D.
State Conservationist

cc: Mathew Lyons, P.E. (USDA-NRCS Virginia State Conservation Engineer)
J. Ryan Collins, P.E. (Schnabel Engineering, LLC Project Manager)
Linda Diebolt (Hazen and Sawyer)

Commonwealth of Virginia

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Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Michael S. Rolband, PE, PWD, PWS Emeritus
Director
(804) 698-4020

December 13, 2022

Schnabel Engineering
Attn: JR Collins
Sent via email: jcollins@schnabel-eng.com

U.S. Department of Agriculture
Attn: Edwin Martinez
State Conservationist
Sent via email: edwin.martinez@usda.gov

RE: U.S. Department of Agriculture Natural Resources Conservation Service: Draft Supplemental Watershed Plan No. 2 and Environmental Assessment for the Rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed, Albemarle County (22-175F)

Dear Mr. Collins and Mr. Martinez:

The Commonwealth of Virginia has completed its review of the draft environmental assessment (EA) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies joined in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Department of Wildlife Resources
Department of Health
Department of Historic Resources
Virginia Marine Resources Commission

The Thomas Jefferson Planning District Commission and Albemarle County also were invited to comment.

PROJECT DESCRIPTION

The Rivanna Water and Sewer Authority, Albemarle County Board of Supervisors, and the Thomas Jefferson Soil and Water Conservation District (the sponsors) and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) are proposing to upgrade the Beaver Creek Watershed Multiple-Purpose Structure No. 1 dam or Beaver Creek 1, and associated infrastructure. The preferred alternative involves the design and construction of a new raw water pumping station, a new reinforced-concrete labyrinth and chute spillway, other associated appurtenant structures and modifications to the embankment. Beaver Creek 1 is utilized as flood control and a municipal and industrial (M&I) water supply for the community of Crozet in Virginia. There is a need to rehabilitate the dam to continue meeting both project purposes. The dam improvements would also meet current state and federal dam safety standards. The new raw water pump station will be located approximately 500 feet upstream of Beaver Creek 1 dam on the western shoreline.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Wetlands and Water Quality. The EA (page 62) states that the prior to construction, the sponsors will be responsible for obtaining state and federal permits as needed. In addition, the EA (page 1) states that the project was constructed prior to the existence of the DEQ Virginia Water Protection (VWP) Permitting Program and is currently unpermitted. Without the VWP withdrawal permit, the sponsors are limited to a maximum allowable withdrawal that supports the production of 1.0 million gallons per day (mgd) of treated water at the Crozet Water Treatment Plant. Certain deficiencies exist with the current pump station and intake infrastructure's configuration that will need to be addressed before the sponsors obtain a VWP withdrawal permit. As such, modifications to the pump station infrastructure are required to meet the municipal and industrial water supply purposes of the project. According to the EA (page 15), wetlands and other waters may be impacted by the proposed project.

1(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations covering a variety of permits to include the Virginia Pollutant Discharge Elimination System Permit regulating point source discharges to surface waters, Virginia Pollution Abatement Permit regulating sewage sludge, storage and land application of biosolids, industrial wastes (sludge and wastewater), municipal wastewater, and animal wastes, the Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit regulating impacts to streams, wetlands, and other surface waters. The VWP Permit is a state permit which governs wetlands, surface water, and surface water withdrawals and impoundments. It also serves as

§401 certification of the federal Clean Water Act §404 permits for dredge and fill activities in waters of the U.S. The VWP Permit Program is under the Office of Wetlands and Stream Protection, within the DEQ Division of Water Permitting. In addition to central office staff that review and issue VWP permits for transportation and water withdrawal projects, the six DEQ regional offices perform permit application reviews and issue permits for the covered activities:

- Clean Water Act, §401;
- Section 404(b)(i) Guidelines Mitigation Memorandum of Agreement (2/90);
- State Water Control Law, Virginia Code section 62.1-44.15:20 *et seq*.; and
- State Water Control Regulations, 9VAC25-210-10.

1(b) Agency Findings. The DEQ Office of Wetlands and Stream Protection states that minor or temporary and permanent impacts to wetlands, open water, and streams are anticipated. In total, permanent impacts to 240 feet of stream, 0.005 acre of wetland, and 0.05 acre of open water, and temporary impacts to 75 feet of stream and 0.65 acre of open water will occur. The lake will be temporarily lowered by 10 feet during construction. Riparian areas will be temporarily and permanently impacted by the project. Disturbance from preferred spillway alternative will occur mostly in unforested riparian areas that were largely impacted by the original project and the former roadway alignment downstream.

The DEQ Office of Water Withdrawal Permitting does not have any comments on the proposed project.

1(c) Requirements. Based on DEQ's review of the EA, the proposed project may require a Virginia Water Protection (VWP) individual permit or general permit coverage. The applicant may submit a Joint Permit Application (JPA) in accordance with form instructions for further evaluation and final permit need determination by DEQ. If the project qualifies for a Nationwide Permit that DEQ has provided 401 certification, then a Virginia Water Protection (VWP) permit is not necessary. If the applicant does not obtain a NWP, then a VWP permit may be necessary. The DEQ Valley Regional Office (VRO) will make the final permitting decisions for state waters.

Measures must be taken to avoid and minimize impacts to surface waters and wetlands during construction activities. The disturbance of surface waters or wetlands may require prior approval by DEQ and/or the U.S. Army Corps of Engineers (Corps). The Corps is the final authority for an official confirmation of whether there are federal jurisdictional wetlands or other surface waters that may be impacted by the proposed project. DEQ may confirm additional waters as jurisdictional beyond those under federal authority. Review of National Wetland Inventory maps or topographic maps for locating wetlands or streams may not be sufficient; there may need to be a site-specific review of the site by a qualified professional. Even if there will be no intentional placement of fill

material in jurisdictional waters, potential water quality impacts resulting from construction site surface runoff must be minimized. This can be achieved by using Best Management Practices (BMPs). If construction activities will occur in or along any streams (perennial, intermittent, or ephemeral), open water or wetlands, the applicant should contact the DEQ VRO.

1(d) Recommendations. Based upon review of the information provided, DEQ's OWSP offers the following general recommendations concerning potential surface water impacts:

1. Prior to commencing project work, all surface waters on the project site should be delineated by a qualified professional and verified by the Corps for federal jurisdictional waters and by DEQ for state jurisdictional waters.
2. Wetland and stream impacts should be avoided and minimized to the maximum extent practicable.
3. If the scope of the project changes, additional review will be necessary by one or more offices in the Commonwealth's Secretariat of Natural Resources and/or the Corps.
4. At a minimum, any required compensation for impacts to State Waters, including the compensation for permanent conversion of forested wetlands to emergent wetlands, should be in accordance with all applicable state regulations and laws. Consider mitigating impacts to forested or converted wetlands by establishing new forested wetlands within the impacted watershed.
5. Any temporary impacts to surface waters associated with this project should be restored to pre-existing conditions.
6. No activity may substantially disrupt the movement of aquatic life indigenous to the water body, including those species, which normally migrate through the area, unless the primary purpose of the activity is to impound water. Culverts placed in streams must be installed to maintain low flow conditions. No activity may cause more than minimal adverse effect on navigation. Furthermore, the activity must not impede the passage of normal or expected high flows and the structure or discharge must withstand expected high flows.
7. Erosion and sedimentation controls should be designed in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992. These controls should be placed prior to clearing and grading and maintained in good working order to minimize impacts to state waters. These controls should remain in place until the area is stabilized and should then be removed. Any exposed slopes and streambanks should be stabilized immediately upon completion of work in each permitted area. All denuded areas should be properly stabilized in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992.
8. No machinery may enter surface waters, unless authorized by a Virginia Water Protection (VWP) individual permit, general permit, or general permit coverage.

9. Heavy equipment in temporarily impacted surface waters should be placed on mats, geotextile fabric, or other suitable material, to minimize soil disturbance to the maximum extent practicable. Equipment and materials should be removed immediately upon completion of work.
10. Activities should be conducted in accordance with any Time-of-Year restriction(s) as recommended by the Department of Game and Inland Fisheries, the Department of Conservation and Recreation, or the Virginia Marine Resources Commission. The permittee should retain a copy of the agency correspondence concerning the Time-of-Year restriction(s), or the lack thereof, for the duration of the construction phase of the project.
11. All construction, construction access, and demolition activities associated with this project should be accomplished in a manner that minimizes construction materials or waste materials from entering surface waters, unless authorized by a Virginia Water Protection (VWP) individual permit, general permit, or general permit coverage. Wet, excess, or waste concrete should be prohibited from entering surface waters.
12. Herbicides used in or around any surface water should be approved for aquatic use by the United States Environmental Protection Agency (EPA) or the U.S. Fish & Wildlife Service. These herbicides should be applied according to label directions by a licensed herbicide applicator. A non-petroleum based surfactant should be used in or around any surface waters.

2. Subaqueous Lands. The EA (page 62) indicates that the applicant may need a subaqueous lands permit from the Virginia Marine Resources Commission (VMRC).

2(a) Agency Jurisdiction. VMRC regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to Virginia Code §28.2-1200 through 1400. For nontidal waterways, VMRC states that it has been the policy of the Habitat Management Division to exert jurisdiction only over the beds of perennial streams where the upstream drainage area is 5 square miles or greater. The beds of such waterways are considered public below the ordinary high water line.

2(b) Agency Finding. VMRC states that the project is within the jurisdictional areas of VMRC and may require a permit.

2(c) Requirements. Pursuant to §28.2-1200 *et seq*. of the Code of Virginia, VMRC has jurisdiction over encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks which are the property of the Commonwealth. Accordingly, if any portion of the subject project involves any encroachments channelward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than 5-square miles, a permit may be required from VMRC. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process.

3. Erosion and Sediment Control and Stormwater Management. According to the EA (page 63), the applicant would obtain a construction general permit.

3(a) Agency Jurisdiction. The DEQ Office of Stormwater Management (OSM) administers the following laws and regulations governing construction activities:

- Virginia Erosion and Sediment Control Law (VESCL) (§ 62.1-44.15:51 *et seq*.) and Regulations (VESCL&R) (9VAC25-840);
- Virginia Stormwater Management Act (VSMA) (§ 62.1-44.15:24 *et seq*.);
- Virginia Stormwater Management Program (VSMP) regulation (9VAC25-870); and
- 2014 General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities (9VAC25-880).

In addition, DEQ is responsible for the VSMP General Permit for Stormwater Discharges from Construction Activities related to Municipal Separate Storm Sewer Systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program (9VAC25-890-40).

3(b) Requirements.

3(b)(i) Erosion and Sediment Control Plan. The applicant is responsible for submitting a project-specific erosion and sediment control (ESC) plan to the locality in which the project is located for review and approval pursuant to the local ESC requirements, if the project involves a land-disturbing activity of 10,000 square feet or more. Depending on local requirements, the area of land disturbance requiring an ESC plan may be less. The ESC plan must be approved by the locality prior to any land-disturbing activity at the project site. All regulated land-disturbing activities associated with the project, including on and off site access roads, staging areas, borrow areas, stockpiles, and soil intentionally transported from the project, must be covered by the project specific ESC plan. Local ESC program requirements must be requested through the locality (Reference: *Virginia Erosion and Sediment Control Law* §62.1-44.15 *et seq*.; *Virginia Erosion and Sediment Control Regulations 9*VAC25-840-10 *et seq*.).

3(b)(ii) Stormwater Management Plan. Depending on local requirements, a stormwater management (SWM) plan may be required. Local SWM program requirements must be requested through the locality (Reference: *Virginia Stormwater Management Act* §62.1-44.15 *et seq*.; *Virginia Stormwater Management* (*VSMP*) *Permit Regulations 9*VAC25-870-10 *et seq*.).

3(b)(iii) General Permit for Stormwater Discharges from Construction Activities (VAR10). DEQ is responsible for the issuance, denial, revocation, termination and

enforcement of the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to municipal separate storm sewer systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program. The operator or owner of a construction project involving land-disturbing activities equal to or greater than 1 acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the General Permit and the SWPPP must address water quality and quantity in accordance with the *VSMP Permit Regulations* (Reference: VSWML 62.1-44.15 et seq.; VSMP Permit Regulations 9VAC 25-880 *et seq*.).

4. Air Quality. The EA (page 17) states that the proposed project area does not have air quality concerns. The EA (pages 62 and 63) also does not indicate that the project would require an air permit.

4(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that implement Virginia's Air Pollution Control Law (Virginia Code §10.1-1300 *et seq.*). DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate DEQ regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. As a part of this mandate, environmental impact reviews (EIRs) of projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

The Air Division regulates emissions of air pollutants from industries and facilities and implements programs designed to ensure that Virginia meets national air quality standards. The most common regulations associated with construction projects are:

- Open burning: 9VAC5-130 *et seq.*
- Fugitive dust control: 9VAC5-50-60 *et seq.*
- Permits for fuel-burning equipment: 9VAC5-80-1100 *et seq.*

4(b) Ozone Attainment Status. According to the DEQ Air Division, the project site is located in an ozone attainment area.

4(c) Requirements.

4(c)(i) Open Burning. If the project changes to include the burning of vegetative debris and/or construction material, this activity must meet the requirements under 9VAC5-130 *et seq*. of the regulations for open burning, and it may require a permit. The regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. The state agency should contact the locality to determine what local requirements, if any, exist. No open burning shall take place in violation of the Virginia Waste Management Regulations (http://law.lis.virginia.gov/admincode/title9/agency20/). Shredding/chipping of vegetative debris and reuse on-site is usually recommended over open burning. A copy of DEQ's open burning regulation and related information are accessible from https://www.deq.virginia.gov/permits-regulations/laws-regulations/air.

4(c)(ii) Fugitive Dust. During demolition and construction activities, fugitive dust must be kept to a minimum by using control methods outlined in 9VAC5-50-60 *et seq*. of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, water or chemicals for dust control;
- Install and use hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Cover open equipment for conveying materials; and
- Promptly remove spilled or tracked dirt or other materials from paved streets and remove dried sediments resulting from soil erosion.

The DEQ Valley Regional Office (VRO) states that fugitive dust generated during construction should be controlled by using measures such as the prompt removal of spilled or tracked dirt or other materials from paved streets, limited application of water to suppress dust, and washing of construction vehicles and paved roadways immediately adjacent to construction sites. Do not use water for dust control to the extent that it results in runoff to surface waters or wetlands. Land clearing wastes (vegetative debris) generated during construction should be properly managed in accordance with applicable regulations and local ordinances.

4(c)(iii) Fuel-Burning Equipment. Installation / operation / modification / replacement of stationary or portable fuel burning equipment (e.g., generators, wood chippers/grinders, boilers, etc.) or other sources of air pollutants, including dust, may be subject to registration and/or air permitting requirements (https://www.deq.virginia.gov/permits-regulations/permits/air).

5. Natural Heritage Resources. The EA (page 18) states the Beaver Creek reservoir provides a habitat for fish and aquatic life.

5(a)(i) The Virginia Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH): DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217), authorized DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and to protect and ecologically manage the natural heritage resources of Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

5(a)(ii) The Virginia Department of Agriculture and Consumer Services (VDACS): The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

5(b) Agency Findings – Natural Heritage Resources. According to the information currently in the Biotics Data System, natural heritage resources have not been documented within the submitted project boundary, including a 100-foot buffer. The absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources. In addition, the project boundary does not intersect any of the predictive models identifying potential habitat for natural heritage resources.

5(c) Agency Findings – State Natural Area Preserves. There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

5(d) Agency Findings – Endangered Plant and Insect Species. The current activity will not affect any documented state-listed plants or insects.

5(e) Agency Recommendations. Contact the DCR DNH and resubmit project information if the scope of the project changes and/or six months has passed before it is utilized.

6. Floodplain Management. The EA (page 16) states that significant changes to the floodplain are not anticipated.

6(a) Agency Jurisdiction. DCR is the lead coordinating agency for the Commonwealth's floodplain management program and the National Flood Insurance Program (Code of Virginia § 10.1-602).

6(b) Agency Findings. DCR states that the National Flood Insurance Program (NFIP) is administered by FEMA and communities who elect to participate in this voluntary program manage and enforce the program on the local level through that community's local floodplain ordinance. Each local floodplain ordinance must comply with the minimum standards of the NFIP, outlined in 44 CFR 60.3; however, local communities may adopt more restrictive requirements in their local floodplain ordinance, such as regulating the 0.2% annual chance flood zone (Shaded X Zone).

The DCR Floodplain Management Program does not have regulatory authority for projects in the Special Flood Hazard Area (SFHA). The applicant/developer must contact the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit. Failure to comply with the local floodplain ordinance could result in enforcement action from the locality. For federal projects, the applicant/developer is encouraged reach out to the local floodplain administrator and comply with the community's local floodplain ordinance.

6(c) Requirements.

- As applicable, all development as shown on the locality's Flood Insurance Rate Map (FIRM) must be permitted and comply with the requirements of the local floodplain ordinance.
- Projects conducted by federal agencies within the SFHA must comply with federal Executive Order 11988: Floodplain Management.

7. Wildlife Resources. The EA (page 19) states that a survey confirmed the lack of presence of the federally listed endangered James spinymussel.

7(a) Agency Jurisdiction. The Virginia DWR, as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state- or federally-listed endangered or threatened species, but excluding listed insects (Virginia Code, Title 29.1). DWR is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S. Code §661 *et seq*.) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DWR determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce or compensate for those impacts. For more information, see the DWR website at www.dwr.virginia.gov.

7(b) Agency Findings. DWR states that as documented in the draft EA, the federally listed endangered James Spinymussels from the project area. Mechums Creek, located downstream of the project site, has been designated a Threatened and Endangered Species Water due to the presence of this species. A mussel survey was performed

within a 1,000-foot section of Beaver Creek below the dam and no freshwater mussels were found (only relic shells of the invasive Asian Clam). While that survey is technically no longer valid as of August 2022, potentially making another survey necessary prior to instream work, if DWR were provided a copy of the survey report, DWR may be able to determine that impacts upon freshwater mussels are not likely to result based on the results of that survey, including descriptions of the habitat available on site. Notify DWR if the survey report has already been provided.

7(c) Agency Recommendations.

7(c)(i) Mussels. DWR states that lacking the mussel survey report to avoid impacts upon James Spinymussels, DWR recommends that a mussel survey be performed from 100 meters upstream through 400 meters downstream of impact areas located in Beaver Creek. This survey should be performed by a qualified, permitted biologist, preferably no more than six months prior to the start of construction. If mussel relocations are necessary, coordinate them with DWR (Brian Watson, DWR Region II Aquatic Resources Biologist at 434-525-7522 or Brian.Watson@dwr.virginia.gov). No federally listed species should be relocated without first coordinating with the US Fish and Wildlife Service (FWS) (804-693-6694). All survey and relocation activities should adhere to the attached guidance. In addition, DWR recommends a time-of-year restriction on all instream work (not including any mussel surveys) from May 15 through July 31 of any year.

Submit survey results to DWR (Amy Martin at Amy.Martin@dwr.virginia.gov and Brian Watson at Brian.Watson@dwr.virginia.gov). Upon review of the results, DWR will make final recommendations regarding the protection of listed species known from the area. All survey reports should reference the five-digit ESSLog# 42609. If preferred, the applicant may provide DWR with good, representative photographs of the impact area(s) for review. The photographs should clearly depict the size of the stream, the substrate type, and the banks up and downstream of the site. Upon review of the photos, DWR may be able to rule out the need for a mussel survey based on the habitat available on site.

7(c)(ii) In-Stream Activities.

- DWR recommends conducting any in-stream activities during low or no-flow conditions, using non-erodible cofferdams or turbidity curtains to isolate the construction area, blocking no more than 50% of the streamflow at any given time, stockpiling excavated material in a manner that prevents reentry into the stream, restoring original streambed and streambank contours, revegetating barren areas with native vegetation, and implementing strict erosion and sediment control measures.
- Design and perform instream work in a manner that minimizes impacts upon natural streamflow and movement of resident aquatic species.

- If a dam and pump-around must be used, use it for as limited a time as possible and ensure that water returned to the stream be free of sediment and excess turbidity.
- To minimize potential wildlife entanglements resulting from use of synthetic/plastic erosion and sediment control matting, use matting made from natural/organic materials such as coir fiber, jute, and/or burlap.
- To minimize harm to the aquatic environment and its residents resulting from use of the Tremie method to install concrete, installation of grout bags, and traditional pouring of concrete, ensure that such activities occur only in the dry, allowing all concrete to harden and cure prior to contact with open water.
- Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, construct stream crossings to be constructed via clear-span bridges. However, if this is not possible, countersink any culverts below the streambed at least 6 inches, or the use of bottomless culverts, to allow passage of aquatic organisms.
- Install floodplain culverts to carry bankfull discharges.

7(c)(iii) Wildlife and Natural Resources. To minimize overall impacts to wildlife and our natural resources, DWR offers the following comments about development activities:

- Avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable. Avoidance and minimization of impact may include relocating stream channels as opposed to filling or channelizing as well as using, and incorporating into the development plan, a natural stream channel design and forested riparian buffers.
- Maintain wooded lots to the fullest extent possible.
- Design stormwater controls for this project to replicate and maintain the hydrographic condition of the site prior to the change in landscape. This should include, but not be limited to, utilizing bioretention areas, and minimizing the use of curb and gutter in favor of grassed swales. Bioretention areas (also called rain gardens) and grass swales are components of Low Impact Development (LID). They are designed to capture stormwater runoff as close to the source as possible and allow it to infiltrate slowly into the surrounding soil. They benefit natural resources by filtering pollutants and decreasing downstream runoff volumes.
- DWR recommends adherence to erosion and sediment controls during ground disturbance.
- To minimize potential wildlife entanglements resulting from use of synthetic/plastic erosion and sediment control matting, DWR recommends the use of matting made from natural/organic materials such as coir fiber, jute, and/or burlap.

DWR generally does not support proposals to mitigate wetland impacts through the construction of stormwater management ponds or the creation of in-stream stormwater management ponds.

8. Public Water Sources. The EA (page 22) states that the project serves as the sole municipal and industrial water supply source to the community Crozet.

8(a) Agency Jurisdiction. The Virginia Department of Health (VDH) Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water sources (groundwater wells, springs and surface water intakes). VDH administers both federal and state laws governing waterworks operation.

8(b) Agency Findings. VDH states that the following public groundwater wells are located within a 1-mile radius of the project site (wells within a 1,000-foot radius are formatted in **bold):**

PWS ID Number	City/County	System Name	Facility Name
2003458	**ALBEMARLE CO**	**MECHUM`S TRESTLE**	**DRILLED WELL**
2003480	ALBEMARLE CO	MINT SPRINGS VALLEY PARK	WELL #1

The following surface water intakes are located within a 5-mile radius of the project site:

PWS ID Number	System Name	Facility Name
2003600	OBSERVATORY WTP	SUGAR HOLLOW RESERVOIR
2003250	CROZET WTP	BEAVER CREEK RESERVOIR

The project is within the watershed of the following public surface water sources (facilities where the project falls within 5 miles of the intake **and** is within the intake's watershed are formatted in **bold**):

PWS ID Number	System Name	Facility Name
2003250	**CROZET WTP**	**BEAVER CREEK RESERVOIR**
2065480	LAKE MONTICELLO	RIVANNA RIVER
2003725	SOUTH RIVANNA WTP	SOUTH FORK RIVANNA

		RESERVOIR

8(c) Agency Recommendations. VDH has the following recommendations, as applicable:

- Implement best management practices, including erosion and sedimentation controls as well as spill prevention controls and countermeasures, on the project site.
- Well(s) within a 1,000-foot radius from the project site should be field marked and protected from accidental damage during construction.

9. Pollution Prevention. DEQ advocates that principles of pollution prevention and sustainability be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention and sustainability techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source.

9(a) Recommendations. We have several pollution prevention recommendations that may be helpful for future projects:

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the the facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program (VEEP). VEEP provides recognition, annual permit fee discounts, and the possibility for alternative compliance methods.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for building construction and design.
- Integrate pollution prevention techniques into the facility maintenance and operation, to include inventory control for centralized storage of hazardous

materials. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides information and technical assistance relating to pollution prevention techniques and EMS. If interested, please contact DEQ (Meghann Quinn at 804-698-4021).

10. Solid and Hazardous Wastes. The EA does not address solid and hazardous waste impacts.

10(a) Agency Jurisdiction. On behalf of the Virginia Waste Management Board, the DEQ Division of Land Protection and Revitalization is responsible for carrying out the mandates of the Virginia Waste Management Act (Virginia Code §10.1-1400 *et seq*.), as well as meeting Virginia's federal obligations under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation Liability Act (CERCLA), commonly known as Superfund. The DEQ Division of Land Protection and Revitalization also administers those laws and regulations on behalf of the State Water Control Board governing Petroleum Storage Tanks (Virginia Code §62.1-44.34:8 *et seq*.), including Aboveground Storage Tanks (9VAC25-91 *et seq*.) and Underground Storage Tanks (9VAC25-580 *et seq*. and 9VAC25-580-370 *et seq*.), also known as Virginia Tank Regulations, and § 62.1-44.34:14 *et seq*. which covers oil spills. Virginia:

- Virginia Waste Management Act, Virginia Code § 10.1-1400 *et seq*.
- Virginia Solid Waste Management Regulations, 9VAC20-81
    - (9VAC20-81-620 applies to asbestos-containing materials)
- Virginia Hazardous Waste Management Regulations, 9VAC20-60
    - (9VAC20-60-261 applies to lead-based paints)
- Virginia Regulations for the Transportation of Hazardous Materials, 9VAC20-110.

Federal:

- Resource Conservation and Recovery Act (RCRA), 42 U.S. Code sections 6901 *et seq*.
- U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 Code of Federal Regulations, Part 107
- Applicable rules contained in Title 40, Code of Federal Regulations.

10(b) Agency Findings. The DEQ Division of Land Protection and Revitalization (DLPR) staff conducted a search (200-foot radius) of the project area of solid and hazardous waste databases (including petroleum releases) to identify waste sites in close proximity to the project area. The search did not identify any waste sites within the project area which might impact the project.

10(c) Agency Recommendations. In general, DEQ encourages all projects and facilities to implement pollution prevention principles, including:

- the reduction, reuse and recycling of all solid wastes generated; and
- the minimization and proper handling of generated hazardous wastes.

10(d) Requirements.

- Any soil/sediment that is suspected of contamination or wastes that are generated during future activities must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations.
- For any petroleum contaminated soil/groundwater that are encountered during the sub-surface phases of this project, contact the Local Fire Marshall with any personal safety concerns and report any such contamination to DEQ.
- The disposal of contaminated soils and groundwater should be done in accordance with DEQ regulatory guidelines.
- Petroleum-contaminated soils and ground water generated during implementation of this project must be properly characterized and disposed of properly.
- Conduct the installation and operation or the removal, relocation or closure of any regulated petroleum storage tanks – aboveground storage tank (AST) and underground storage tank (UST) – in accordance with the requirements of the Virginia Tank Regulations 9VAC25-91-10 *et seq*. (AST) and 9VAC25-580-10 *et seq*. (UST).
- If evidence of a petroleum release is discovered during implementation of this project, it must be reported to DEQ as authorized by Virginia Code § 62.1-44.34.8 through 9 and 9VAC25-580-10 *et seq*.
- The generation or recovery of any hazardous waste materials should be tested and removed in accordance with the Virginia Hazardous Waste Management Regulations (9VAC 20-60) and/or the Virginia Solid Waste Management Regulations (9VAC 20-81).
- It is the generator's responsibility to determine if a solid waste meets the criteria of a hazardous waste and as a result be managed as such.
- All structures being demolished or removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM and LBP are found, in addition to the federal waste-related regulations mentioned above, state regulations 9VAC20-81-640 for ACM and 9VAC20-60-261 for LBP must be followed.

11. Historic Structures and Architectural Resources. The EA (page 24) states that there are archaeological resources within the project area.

11(a) Agency Jurisdiction. The Virginia Department of Historic Resources (DHR) conducts reviews of both federal and state projects to determine their effect on historic properties. Under the federal process, DHR is the State Historic Preservation Office, and ensures that federal undertakings – including licenses, permits, or funding – comply with Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulation at 36 CFR Part 800. Section 106 requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. For state projects or activities on state lands, DHR is afforded an opportunity to review and comment on (1) the demolition of state property; (2) major state projects requiring an EIR; (3) archaeological investigations on state-controlled land; (4) projects that involve a landmark listed in the Virginia Landmarks Register; (5) the sale or lease of surplus state property; (6) exploration and recovery of underwater historic properties; and (7) excavation or removal of archaeological or historic features from caves. See DHR's website for more information about applicable state and federal laws and how to submit an application for review: http://www.dhr.virginia.gov/StateStewardship/Index.htm.

11(b) Agency Findings. On November 30, 2022, DHR received a review request for the RWSA Crozet Water Supply System Raw Water Infrastructure Upgrades project, also known as the Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed project. The undertaking is currently under review. DHR will be in direct consultation with the USDA NRCS.

11(c) Requirements. DHR request that the NRCS continue consultation pursuant Section 106 of the National Historic Preservation Act which requires federal agencies to consider the impacts of their projects on historic properties.

12. Dam Safety. The EA (page 1) indicates that there are safety concerns about the proposed dam.

12(a) Agency Jurisdiction. The purpose of the DCR Division of Dam Safety is to provide for proper and safe design, construction, operation and maintenance of dams to protect public safety pursuant to the Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 (Virginia Code, §10.1-604 *et seq.*) and Dam Safety Impounding Structure Regulations (4VAC50-20 *et seq.*).

12(b) Agency Comments. Coordinate with DCR Division of Dam Safety on any permitting requirements.

REGULATORY AND COORDINATION NEEDS

1. Water Quality and Wetlands. The proposed project may require a Virginia Water Protection (VWP) individual permit or general permit coverage. The applicant may

submit a Joint Permit Application (JPA) in accordance with form instructions for further evaluation and final permit need determination by DEQ. Coordinate with DEQ VRO (Keith Fowler at 540-217-7480 or Keith.Fowler@deq.virginia.gov).

2. Subaqueous Lands. Pursuant to §28.2-1200 *et seq*. of the Code of Virginia, VMRC has jurisdiction over encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks which are the property of the Commonwealth. Accordingly, if any portion of the subject project involves any encroachments channelward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than 5-square miles, a permit may be required from VMRC. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process. Coordinate with VMRC (Tiffany Birge at tiffany.birge@mrc.virginia.gov) as a new review may be required relative to its jurisdictional areas.

2. Erosion and Sediment Control and Stormwater Management.

2(a) Erosion and Sediment Control and Stormwater Management Plans. The applicant must submit a project-specific ESC plan to the locality if the project disturbs equal to or greater than 10,000 square feet or more. Depending on local requirements, the area of land disturbance requiring an ESC plan may be less. This construction project must comply with Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) (Virginia Code §62.1-44.15:51 *et seq*.) and the Virginia Stormwater Management Law and Regulations (9VAC25-840-30, 9VAC25-840-40). Dependent on local requirements, a SWM plan may be required. Local ESC and SWM program requirements must be requested through the locality. This construction project must comply with the VSWML (§62.1-44.15 *et seq*.) and Virginia Stormwater Management (VSMP) Permit Regulations (9VAC25-870 *et seq*.) as locally administered. If necessary, contact DEQ (Larry Gavan at Larry.Gavan@deq.virginia.gov) for additional information.

2(b) General Permit for Stormwater Discharges from Construction Activities (VAR10). For projects involving land-disturbing activities equal to or greater than 1 acre, the owner or operator of construction activities is required to apply for registration coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific SWPPP. The SWPPP must address water quality and quantity in accordance with the VSMP Permit Regulations. Contact the locality for project-specific questions and permitting needs. General questions regarding the Stormwater Management Program should be directed to DEQ (Larry Gavan at Larry.Gavan@deq.virginia.gov) (Reference: VSWML § 62.1-44.15 *et seq*.; VSMP Permit Regulations 9VAC25-880 *et seq*.).

3. Air Quality. Contact the locality for information on local requirements pertaining to open burning as applicable. Coordinate any open burning of vegetative debris with the

local fire official if applicable. Contact DEQ VRO (Janardan Pandey at 540-574-7817) if the use of fuel-burning equipment is proposed.

4. Natural Heritage Resources. Contact the DCR DNH (804-786-7951) and re-submit project information and a map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

5. Floodplain. Ensure compliance with applicable floodplain requirements. To find community NFIP participation and local floodplain administrator contact information, use DCR's Local Floodplain Management Directory: www.dcr.virginia.gov/dam-safety-and-floodplains/floodplain-directory.

6. Wildlife Resources. If mussel relocations are necessary, coordinate them with DWR (Brian Watson, DWR Region II Aquatic Resources Biologist at 434-525-7522 or Brian.Watson@dwr.virginia.gov). No federally listed species should be relocated without first coordinating with the US Fish and Wildlife Service (FWS) (804-693-6694). Submit survey results to DWR (Amy Martin at Amy.Martin@dwr.virginia.gov and Brian Watson at Brian.Watson@dwr.virginia.gov). Contact DWR (Amy Martin at Amy.Martin@dwr.virginia.gov) for additional information about its comments and recommendations if necessary.

7. Public Water Supply. Contact VDH ODW (Arlene Warren at Arlene.Warren@ vdh.virginia.gov) for additional information about its recommendations if necessary.

8. Solid Waste and Hazardous Substances. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. Contact DEQ VRO (Graham Simmerman at 540-574-7865) for additional information on waste management or if any contaminated soils are identified during construction. Contact DEQ VRO (Todd Pitsenberger at 540-574-7847 or Todd.Pitsenberger@deq.virginia.gov) for additional information on storage tanks.

8(a) Asbestos-Containing Material. It is the responsibility of the owner or operator of a renovation or demolition activity, prior to the commencement of the renovation or demolition, to thoroughly inspect the affected part of the facility where the operation will occur for the presence of asbestos, including Category I and Category II nonfriable asbestos-containing material (as applicable). Upon classification as friable or non-friable, all asbestos-containing material shall be disposed of in accordance with the Virginia Solid Waste Management Regulations (9VAC20-81-640) and transported in accordance with the Virginia regulations governing Transportation of Hazardous Materials (9VAC20-110-10 *et seq.*). Contact the DEQ Division of Land Protection and Revitalization (Carlos Martinez at 804-698-4575) and the Department of Labor and Industry (804-371- 2327) for additional information.

8(b) Lead-Based Paint. If applicable, this project must comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations and with the Virginia Lead-Based Paint Activities Rules and Regulations. For additional information regarding these requirements, contact the Department of Professional and Occupational Regulation (804-367-8500).

9. Historic Resources. NRCS should continue consultation with DHR (Jenny Bellville-Marrion at jennifer.bellville-marrion@dhr.virginia.gov) pursuant Section 106 of the National Historic Preservation Act which requires federal agencies to consider the impacts of their projects on historic properties.

10. Dam Safety. Coordinate with DCR Division of Dam Safety (dam@dcr.virginia.gov) on any permitting requirements.

Thank you for the opportunity to comment on this draft EA. If you have questions, please do not hesitate to call me at (804) 659-1915 or Julia Wellman at (804) 774-8237.

Sincerely,

Bettina Rayfield, Manager
Environmental Impact Review and Long Range Priorities Program

Enclosures

ec: Amy Martin, DWR
Allison Tillett, DCR
Arlene Warren, VDH
Roger Kirchen, DHR
Tiffany Birge, VMRC
Jeff Richardson, Albemarle County
Christine Jacobs, Thomas Jefferson PDC

MEMORANDUM

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER DIVISION

TO: Julia Wellman

Michelle Henicheck

FROM: Michelle Henicheck
Office of Wetlands and Stream Protection

DATE: November 15, 2022

SUBJECT: Draft Environmental Assessment (EA)
U.S. Dept of Agriculture
Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed
Albermarle County, Virginia, DEQ #22-175F

The DEQ's Office of Wetlands and Stream Protection (OWSP) has reviewed the information concerning the above-referenced project. According to the information provided on November 4, 2022, the purpose of the draft EA is the proposed rehabilitation of the Beaver Creek Watershed Multiple-Purpose Structure No. 1 for flood control and municipal and industrial (M&I) water supply for the community of Crozet, Virginia.

According to the EA, there is a need to rehabilitate the dam to continue meeting both project purposes. Water withdrawal from the reservoir is currently limited to 1 million gallons per day (mgd) by the Virginia Department of Environmental Quality (DEQ) because the Sponsors do not currently hold a Virginia Water Protection permit. This limitation on the withdrawal capacity creates an immediate need for action based on Maximum Daily Demand (MDD) projections presented in the Crozet Drinking Water Infrastructure Plan (DWIP, 2019). The DWIP indicates that MDD will exceed 1 mgd by 2025. Additionally, Beaver Creek 1 does not meet current Virginia Department of Conservation and Recreation (DCR) or Natural Resources Conservation Service (NRCS) dam safety requirements for high hazard potential dams, and a breach event poses a threat to life and property downstream. The preferred alternative involves the design and construction of a new raw water pumping station, a new reinforced-concrete labyrinth and chute spillway, other associated appurtenant structures and modifications to the embankment.

The preferred alternative will involve the construction of a new raw water pump station, structural spillway over the embankment and other modifications to the earthen embankment. A temporary on-site detour route during construction will be established. The raw water pump station will be located approximately 500 feet upstream of Beaver Creek 1 dam on the western shoreline. The installation of a new pump station facility and associated improvements will address compliance issues with Virginia Department of Environmental Quality (DEQ) in order to obtain a Virginia Water Protection (VWP) Program Permit to increase allowable withdrawals beyond that required to produce 1.0 mgd of treated water from the Crozet Water Treatment Plant. The dam and spillway will be rehabilitated to comply with NRCS and Virginia requirements for high hazard potential dams. The proposed spillway is a reinforced-concrete labyrinth weir and chute spillway over the existing embankment. Other works of rehabilitation are included such as the construction of a new graded-aggregate filter drain at the toe of the dam and improved stabilization of the existing principal spillway structure.

Summary of Findings
Minor temporary and permanent impacts to wetlands, open water, and streams are anticipated. In total, permanent impact to 240 feet of stream, 0.005 acre of wetland, and 0.05 acre of open water; and temporary impact to 75 feet of stream and 0.65 acre of open water will occur. Lake will be temporarily lowered by 10 feet during construction. Riparian areas will be temporarily and permanently impacted by the project. Disturbance from preferred spillway alternative will occur mostly in unforested riparian areas that were largely impacted by the original project and the former roadway alignment downstream.

Water Quality and Wetlands. Measures must be taken to avoid and minimize impacts to surface waters and wetlands during construction activities. The disturbance of surface waters or wetlands may require prior approval by DEQ and/or the U.S. Army Corps of Engineers. The Army Corps of Engineers is the final authority for an official confirmation of whether there are federal jurisdictional wetlands or other surface waters that may be impacted by the proposed project. DEQ may confirm additional waters as jurisdictional beyond those under federal authority. Review of National Wetland Inventory maps or topographic maps for locating wetlands or streams may not be sufficient; there may need to be a site-specific review of the site by a qualified professional. Even if there will be no intentional placement of fill material in jurisdictional waters, potential water quality impacts resulting from construction site surface runoff must be minimized. This can be achieved by using Best Management Practices (BMPs). If construction activities will occur in or along any streams (perennial, intermittent, or ephemeral), open water or wetlands, the applicant should contact the DEQ-VRO.

If the project qualifies for a Nationwide Permit that DEQ has provided 401 certification, then a Virginia Water Protection (VWP) permit is not necessary. If the applicant does not obtain a NWP, then a VWP permit may be necessary. The DEQ Valley Regional Office (VRO) will make the final permitting decisions for state waters.

Erosion and Sediment Control and Storm Water Management. DEQ has regulatory authority for the Virginia Pollutant Discharge Elimination System (VPDES) programs related to municipal separate storm sewer systems (MS4s) and construction activities. Erosion and sediment control measures are addressed in local ordinances and State regulations. Additional information is available at http://www.deq.virginia.gov/Programs/Water/StormwaterManagement.aspx. Non-point source pollution resulting from this project should be minimized by using effective erosion and sediment control practices and structures. Consideration should also be given to using permeable paving for parking areas and walkways where appropriate, and denuded areas should be promptly revegetated following construction work. If the total land disturbance exceeds 10,000 square feet, an erosion and sediment control plan will be required. Some localities also require an E&S plan for disturbances less than 10,000 square feet. A stormwater management plan may also be required. For any land disturbing activities equal to one acre or more, you are required to apply for coverage under the VPDES General Permit for Discharges of Storm Water from Construction Activities. The Virginia Stormwater Management Permit Authority may be DEQ or the locality.

Recommendations and Potential Permits

Based upon review of the information provided, DEQ's OWSP offers the following general recommendations concerning potential surface water impacts:

1. Prior to commencing project work, all surface waters on the project site should be delineated by a qualified professional and verified by the U.S. Army Corps of Engineers (the Corps) for federal jurisdictional waters and by DEQ for state jurisdictional waters.

2. Wetland and stream impacts should be avoided and minimized to the maximum extent practicable.
3. If the scope of the project changes, additional review will be necessary by one or more offices in the Commonwealth's Secretariat of Natural Resources and/or the Corps.
4. At a minimum, any required compensation for impacts to State Waters, including the compensation for permanent conversion of forested wetlands to emergent wetlands, should be in accordance with all applicable state regulations and laws. Consider mitigating impacts to forested or converted wetlands by establishing new forested wetlands within the impacted watershed.
5. Any temporary impacts to surface waters associated with this project should be restored to pre-existing conditions.
6. No activity may substantially disrupt the movement of aquatic life indigenous to the water body, including those species, which normally migrate through the area, unless the primary purpose of the activity is to impound water. Culverts placed in streams must be installed to maintain low flow conditions. No activity may cause more than minimal adverse effect on navigation. Furthermore the activity must not impede the passage of normal or expected high flows and the structure or discharge must withstand expected high flows.
7. Erosion and sedimentation controls should be designed in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992. These controls should be placed prior to clearing and grading and maintained in good working order to minimize impacts to state waters. These controls should remain in place until the area is stabilized and should then be removed. Any exposed slopes and streambanks should be stabilized immediately upon completion of work in each permitted area. All denuded areas should be properly stabilized in accordance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992.
8. No machinery may enter surface waters, unless authorized by a Virginia Water Protection (VWP) individual permit, general permit, or general permit coverage.
9. Heavy equipment in temporarily impacted surface waters should be placed on mats, geotextile fabric, or other suitable material, to minimize soil disturbance to the maximum extent practicable. Equipment and materials should be removed immediately upon completion of work.
10. Activities should be conducted in accordance with any Time-of-Year restriction(s) as recommended by the Department of Game and Inland Fisheries, the Department of Conservation and Recreation, or the Virginia Marine Resources Commission. The permittee should retain a copy of the agency correspondence concerning the Time-of-Year restriction(s), or the lack thereof, for the duration of the construction phase of the project.
11. All construction, construction access, and demolition activities associated with this project should be accomplished in a manner that minimizes construction materials or waste materials from entering surface waters, unless authorized by a Virginia Water Protection (VWP) individual permit, general permit, or general permit coverage. Wet, excess, or waste concrete should be prohibited from entering surface waters.
12. Herbicides used in or around any surface water should be approved for aquatic use by the United States Environmental Protection Agency (EPA) or the U.S. Fish & Wildlife Service. These herbicides should be applied according to label directions by a licensed herbicide applicator. A non-petroleum based surfactant should be used in or around any surface waters.

Permits:

Based on DEQ's review of the Environmental Assessment information dated August 2022 provided by the USDA Natural Resources Conservation Service, the proposed project <u>may</u> require a Virginia

Water Protection (VWP) individual permit or general permit coverage. The applicant may submit a Joint Permit Application (JPA) in accordance with form instructions for further evaluation and final permit need determination by DEQ.

Commonwealth of Virginia

Wellman, Julia <julia.wellman@deq.virginia.gov>

Re: NEW PROJECT USDA Beaver Creek Watershed, DEQ 22-175F

1 message

Dobbie, Kathryne <kathryne.dobbie@deq.virginia.gov> Thu, Dec 1, 2022 at 4:36 PM
To: "Wellman, Julia" <julia.wellman@deq.virginia.gov>

Hi Julia,

Not at this time, thank you.

Kathy Dobbie

Water Withdrawal Permit Writer
Department of Environmental Quality
1111 East Main Street
Suite 1400
Richmond, Virginia
23219

Phone: 804-659-1727

E-mail: kathryne.dobbie@deq.virginia.gov

On Thu, Dec 1, 2022 at 11:08 AM Wellman, Julia <julia.wellman@deq.virginia.gov> wrote:

> Hi Kathy,
>
> Do you plan to have comments on this one?
>
> On Wed, Nov 16, 2022 at 9:29 AM Dobbie, Kathryne <kathryne.dobbie@deq.virginia.gov> wrote:
>
> > Morning Julia,
> >
> > Thank you for the clarification!
> >
> > Kathy Dobbie
> >
> > Water Withdrawal Permit Writer
> > Department of Environmental Quality
> > 1111 East Main Street
> > Suite 1400
> > Richmond, Virginia
> > 23219
> >
> > Phone: 804-659-1727
> >
> > E-mail: kathryne.dobbie@deq.virginia.gov
> >
> > On Wed, Nov 16, 2022 at 8:51 AM Wellman, Julia <julia.wellman@deq.virginia.gov> wrote:
> >
> > > Good morning Kathy,
> > >
> > > Please send your comments to me by November 28. However, if you need more time, just let me know. You do not need to respond to the consultant.
> > >
> > > One of the responsibilities of our office is to respond to NEPA documents on behalf of the Commonwealth. We distribute the EA/EIS to state agencies and the affected locality and planning district commission, and incorporate all comments into one response.

COMMONWEALTH of VIRGINIA

Marine Resources Commission
380 Fenwick Road
Bldg 96
Fort Monroe, VA 23651-1064

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Jamie L. Green
Commissioner

December 5, 2022

Department of Environmental Quality
Attn: Julia Wellman
1111 East Main Street
Richmond, VA 23219

Re: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed DEQ #22-175F

Dear Ms. Wellman,

This will respond to the request for comments regarding the Draft Environmental Assessment for the Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed Project (DEQ #22-175F), prepared by U.S. Department of Agriculture, Natural Resources Conservation Service in cooperation with the Rivanna Water & Sewer Authority, Albemarle County Board of Supervisors, and the Thomas Jefferson Soil and Water Conservation District. Specifically, the applicants have proposed the construction of a new raw water pumping station, a new reinforced-concrete labyrinth and chute spillway, and other associated appurtenant structures and modifications to the embankment of the Beaver Creek Watershed Multiple-Purpose Structure in Albemarle County, Virginia.

We reviewed the provided project documents and found the proposed project is within the jurisdictional areas of the Virginia Marine Resources Commission (VMRC) and may require a permit from this agency.

Please be advised that the VMRC, pursuant to §28.2-1200 et seq of the Code of Virginia, has jurisdiction over encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks which are the property of the Commonwealth. Accordingly, if any portion of the subject project involves any encroachments channelward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than 5-square miles, a permit may be required from our agency. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process.

Please contact me at (757) 247-8028 or by email at mark.eversole@mrc.virginia.gov if you have questions. Thank you for the opportunity to comment.

Sincerely,

Mark Eversole
Environmental Engineer, Habitat Management

ME/cg
HM

Commonwealth of Virginia

Wellman, Julia <julia.wellman@deq.virginia.gov>

Re: NEW PROJECT USDA Beaver Creek Watershed, DEQ 22-175F

1 message

Gavan, Lawrence <larry.gavan@deq.virginia.gov> Wed, Nov 9, 2022 at 9:37 AM
To: "Wellman, Julia" <julia.wellman@deq.virginia.gov>

(a) Agency Jurisdiction. The DEQ administers the nonpoint source pollution control enforceable policy of the VCP through the *Virginia Erosion and Sediment Control Law and Regulations* (*VESCL&R*) and *Virginia Stormwater Management Law and Regulations* (*VSWML&R*).

(b) Erosion and Sediment Control Plan. The Applicant is responsible for submitting a project-specific erosion and sediment control (ESC) plan to the locality in which the project is located for review and approval pursuant to the local ESC requirements, if the project involves a land-disturbing activity of 10,000 square feet or more (2,500 square feet or more in a Chesapeake Bay Preservation Area). Depending on local requirements the area of land disturbance requiring an ESC plan may be less. The ESC plan must be approved by the locality prior to any land-disturbing activity at the project site. All regulated land-disturbing activities associated with the project, including on and off site access roads, staging areas, borrow areas, stockpiles, and soil intentionally transported from the project must be covered by the project specific ESC plan. Local ESC program requirements must be requested through the locality. [Reference: *Virginia Erosion and Sediment Control Law* §62.1-44.15 et seq.; *Virginia Erosion and Sediment Control Regulations 9*VAC25-840-10 et seq.]

(c) Stormwater Management Plan. Depending on local requirements, a Stormwater Management (SWM) plan may be required. Local SWM program requirements must be requested through the locality. [Reference: *Virginia Stormwater Management Act* §62.1-44.15 et seq.; *Virginia Stormwater Management* (*VSMP*) *Permit Regulations 9*VAC25-870-10 et seq.]

(d) General Permit for Stormwater Discharges from Construction Activities (VAR10). DEQ is responsible for the issuance, denial, revocation, termination and enforcement of the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to municipal separate storm sewer systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program.

The operator or owner of a construction project involving land-disturbing activities equal to or greater than 1 acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the General Permit and the SWPPP must address water quality and quantity in accordance with the *VSMP Permit Regulations*.
(Reference: VSWML 62.1-44.15 et seq.; VSMP Permit Regulations 9VAC 25-880 et seq.)

Larry Gavan
Work Number (804) 965-3320
larry.gavan@deq.virginia.gov

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY

TO: Julia Wellman

We thank **OEIR** for providing DEQ-AIR an opportunity to review the following project:
Accordingly, I am providing following comments for consideration.

Document Type: Draft Environmental Assessment
Project Sponsor: U.S. Department of Agriculture
Project Title: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed
Location: Albemarle County
Project Number: DEQ #22-175F

PROJECT LOCATION: **X OZONE ATTAINMENT AREA**

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: **X CONSTRUCTION**
☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-45-760 et seq. – Asphalt Paving operations
3. **X 9 VAC 5-130 et seq. – Open Burning**
4. **X 9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
5. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to_____
6. ☐ 9 VAC 5-60-300 et seq. – Standards of Performance for Toxic Pollutants
7. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the_____
8. ☐ 9 VAC 5-80-1100 et seq. of the regulations – Permits for Stationary Sources
9. ☐ 9 VAC 5-80-1605 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the _____
10. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
11. ☐ 9 VAC 5-80-800 et seq. Of the regulations – State Operating Permits. This rule may be applicable to _____

COMMENTS SPECIFIC TO THE PROJECT:

(Kotur S. Narasimhan)
Office of Air Data Analysis **DATE: November 4, 2022**

Matthew S. Wells
Director

Frank N. Stovall
Deputy Director

Darryl Glover
Deputy Director

Dam Safety, Floodplain

Soil and Water

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION
Conservation

MEMORANDUM

DATE: November 22, 2022

TO: Julia Wellman

FROM: Allison Tillett, Environmental Impact Review Coordinator

SUBJECT: DEQ 22-175F, Rehabilitation of Multi-Purpose Structure No. 1 of the Beaver Creek Watershed

Division of Planning and Recreation Resources

The Department of Conservation and Recreation (DCR), Division of Planning and Recreational Resources (PRR), develops the *Virginia Outdoors Plan* and coordinates a broad range of recreational and environmental programs throughout Virginia. These include the Virginia Scenic Rivers program; Trails, Greenways, and Blueways; Virginia State Park Master Planning and State Park Design and Construction. PRR also administers the Land & Water Conservation Fund (LWCF) program in Virginia.

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in Biotics, natural heritage resources have not been documented within the submitted project boundary including a 100 foot buffer. The absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources. In addition, the project boundary does not intersect any of the predictive models identifying potential habitat for natural heritage resources.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The VDWR maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Amy Martin at 804-367-2211 or amy.martin@dwr.virginia.gov.

Division of State Parks

DCR's Division of State Parks is responsible for acquiring and managing, state parks. Park development and master planning are managed by the Division of Planning and Recreation Resources. Master plans are required prior to a parks opening and are updated every ten years (Virginia Code § 10.1-200 *et seq.*).

Division of Dam Safety and Floodplain Management

Dam Safety Program:
The Dam Safety program was established to provide proper and safe design, construction, operation and maintenance of dams to protect public safety. Authority is bestowed upon the program according to *The Virginia Dam Safety Act*, Article 2, Chapter 6, Title 10.1 (10.1-604 et seq) of the Code of Virginia and Dam Safety Impounding Structure Regulations (Dam Safety Regulations), established and published by the Virginia Soil and Water Conservation Board (VSWCB).

Floodplain Management Program:
The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA), and communities who elect to participate in this voluntary program manage and enforce the program on the local level through that community's local floodplain ordinance. Each local floodplain ordinance must comply with the minimum standards of the NFIP, outlined in 44 CFR 60.3; however, local communities may adopt more restrictive requirements in their local floodplain ordinance, such as regulating the 0.2% annual chance flood zone (Shaded X Zone).

All development within a Special Flood Hazard Area (SFHA), as shown on the locality's Flood Insurance Rate Map (FIRM), must be permitted and comply with the requirements of the local floodplain ordinance.

State Agency Projects Only
Executive Order 45, signed by Governor Northam and effective on November 15, 2019, establishes mandatory standards for development of state-owned properties in Flood-Prone Areas, which include Special Flood Hazard Areas, Shaded X Zones, and the Sea Level Rise Inundation Area. These standards shall apply to all state agencies.

1. Development in Special Flood Hazard Areas and Shaded X Zones
    A. All development, including buildings, on state-owned property shall comply with the locally-adopted floodplain management ordinance of the community in which the state-owned property is located and any flood-related standards identified in the Virginia Uniform Statewide Building Code.
    B. If any state-owned property is located in a community that does not participate in the NFIP, all development, including buildings, on such state-owned property shall comply with the NFIP

requirements as defined in 44 CFR §§ 60.3, 60.4, and 60.5 and any flood-related standards identified in the Virginia Uniform Statewide Building Code.

(1) These projects shall be submitted to the Department of General Services (DGS), for review and approval.
(2) DGS shall not approve any project until the State NFIP Coordinator has reviewed and approved the application for NFIP compliance.
(3) DGS shall provide a written determination on project requests to the applicant and the State NFIP Coordinator. The State NFIP Coordinator shall maintain all documentation associated with the project in perpetuity.

C. No new state-owned buildings, or buildings constructed on state-owned property, shall be constructed, reconstructed, purchased, or acquired by the Commonwealth within a Special Flood Hazard Area or Shaded X Zone in any community unless a variance is granted by the Director of DGS, as outlined in this Order.

The following definitions are from Executive Order 45:

Development for NFIP purposes is defined in 44 CFR § 59.1 as "Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials."

The Special Flood Hazard Area may also be referred to as the 1% annual chance floodplain or the 100-year floodplain, as identified on the effective Flood Insurance Rate Map and Flood Insurance Study. This includes the following flood zones: A, AO, AH, AE, A99, AR, AR/AE, AR/AO, AR/AH, AR/A, VO, VE, or V.

The Shaded X Zone may also be referred to as the 0.2% annual chance floodplain or the 500- year floodplain, as identified on the effective Flood Insurance Rate Map and Flood Insurance Study.

The Sea Level Rise Inundation Area referenced in this Order shall be mapped based on the National Oceanic and Atmospheric Administration Intermediate-High scenario curve for 2100, last updated in 2017, and is intended to denote the maximum inland boundary of anticipated sea level rise.

"State agency" shall mean all entities in the executive branch, including agencies, offices, authorities, commissions, departments, and all institutions of higher education.

"Reconstructed" means a building that has been substantially damaged or substantially improved, as defined by the NFIP and the Virginia Uniform Statewide Building Code.

<u>Federal Agency Projects Only</u>

Projects conducted by federal agencies within the SFHA must comply with federal Executive Order 11988: Floodplain Management.

DCR's Floodplain Management Program does not have regulatory authority for projects in the SFHA. The applicant/developer must reach out to the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit. Failure to comply with the local floodplain ordinance could result in enforcement action from the locality. For state projects, DCR recommends that compliance documentation be provided prior to the project

being funded. For federal projects, the applicant/developer is encouraged reach out to the local floodplain administrator and comply with the community's local floodplain ordinance.

To find flood zone information, use the Virginia Flood Risk Information System (VFRIS): www.dcr.virginia.gov/vfris

To find community NFIP participation and local floodplain administrator contact information, use DCR's Local Floodplain Management Directory: www.dcr.virginia.gov/dam-safety-and-floodplains/floodplain-directory

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

Commonwealth of Virginia

Wellman, Julia <julia.wellman@deq.virginia.gov>

ESSLog# 42609_22-175F_Beaver Creek Dam upgrades_DWR_AEM20221205

1 message

Martin, Amy (DWR) <Amy.Martin@dwr.virginia.gov> Mon, Dec 5, 2022 at 2:23 PM
To: "Wellman, Julia (DEQ)" <Julia.Wellman@deq.virginia.gov>
Cc: "Watson, Brian (DWR)" <Brian.Watson@dwr.virginia.gov>

Julia,

We have reviewed the subject project that proposes to perform “design and construction of a new raw water pumping station, a new reinforced-concrete labyrinth and chute spillway, other associated appurtenant structures and modifications to the embankment” located on Beaver Creek in Albemarle County, VA. As noted in the Draft Supplemental Environmental Assessment for the project, we document federal Endangered James Spinymussels from the project area. Mechums Creek, located downstream of the project site, has been designated a Threatened and Endangered Species Water due to the presence of this species. A mussel survey was performed within a 1000’ foot section of Beaver Creek below the dam and no freshwater mussels were found., only relic shells of the invasive Asian Clam. While that survey is technically no longer valid as of August 2022, potentially making another survey necessary prior to instream work, if we were provided a copy of the survey report, we may be able to determine that impacts upon freshwater mussels are not likely to result based on the results of that survey, including descriptions of the habitat available on site. If I missed the survey report in the documents provided, please let me know where to find it.

Lacking the mussel survey report, to avoid impacts upon James Spinymussels, we recommend that a mussel survey be performed from 100 meters upstream through 400 meters downstream of impact areas located in Beaver Creek. This survey should be performed by a qualified, permitted biologist, preferably no more than six months prior to the start of construction. If mussel relocations are necessary, they should be coordinated with Brian Watson, DWR Region II Aquatic Resources Biologist at 434-525-7522 or Brian.Watson@dwr.virginia.gov, and no federally listed species should be relocated without first coordinating with the USFWS (804-693-6694). All survey and relocation activities should adhere to the attached guidance. In addition, we recommend a time of year restriction on all instream work (not including any mussel surveys) from May 15 through July 31 of any year.

Survey results should be made available to Amy Martin at Amy.Martin@dwr.virginia.gov and Brian Watson at Brian.Watson@dwr.virginia.gov. Upon review of the results, we will make final recommendations regarding the protection of listed species known from the area. All survey reports should reference the five-digit ESSLog# displayed in the subject line of this email.

If the applicant prefers, they may provide us with good, representative photographs of the impact area(s) for our review. The photos should clearly depict the size of the stream, the substrate type, and the banks up and downstream of the site. Upon review of the photos, we may be able to rule out the need for a mussel survey based on the habitat available on site.

In addition, we recommend conducting any in-stream activities during low or no-flow conditions, using non-erodible cofferdams or turbidity curtains to isolate the construction area, blocking no more than 50% of the streamflow at any given time (minimal overlap of construction footprint notwithstanding), stockpiling excavated material in a manner that prevents reentry into the stream, restoring original streambed and streambank contours, revegetating barren areas with native vegetation, and implementing strict erosion and sediment control measures. We recommend that instream work be designed and performed in a manner that minimizes impacts upon natural streamflow and movement of resident aquatic species. If a dam and pump-around must be used, we recommend it be used for as limited a time as possible and that water returned to the stream be free of sediment and excess turbidity. To minimize potential wildlife entanglements resulting from use of synthetic/plastic erosion and sediment control matting, we recommend use of matting made from natural/organic materials such as coir fiber, jute, and/or burlap. To minimize harm to the aquatic environment and its residents resulting from use of the Tremie method to install concrete, installation of grout bags, and traditional pouring of concrete, we recommend that such activities occur only in the dry, allowing all concrete to harden prior to contact with open water. Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, we prefer stream crossings to be constructed via clear-span bridges. However, if this is not possible, we recommend countersinking any culverts below the streambed at least 6 inches, or the use of bottomless culverts, to allow passage of aquatic organisms. We also recommend the installation of floodplain culverts to carry bankfull discharges.

To minimize impacts upon aquatic species from impingement and entrainment, we recommend that the intake be fitted with a 1mm mesh screen and that the intake velocity not exceed 0.25 fps. In addition, to ensure continued access to necessary instream habitats by resident aquatic species, we recommend that the intake not withdraw more than 10% instantaneous flow. For additional information, please reference the document found at the following link: https://dwr.virginia.gov/wp-content/uploads/media/Surface-Water-Intake-Design-Operation-Standards.pdf

To minimize overall impacts to wildlife and our natural resources, we offer the following comments about development activities: we recommend that the applicant avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable. Avoidance and minimization of impact may include relocating stream channels as opposed to filling or channelizing as well as using, and incorporating into the development plan, a natural stream channel design and forested riparian buffers. We recommend maintaining undisturbed naturally vegetated buffers of at least 100 feet in width around all on-site wetlands and on both sides of all perennial and intermittent streams. We recommend maintaining wooded lots to the fullest extent possible. We generally do not support proposals to mitigate wetland impacts through the construction of stormwater management ponds, nor do we support the creation of in-stream stormwater management ponds.

We recommend that the stormwater controls for this project be designed to replicate and maintain the hydrographic condition of the site prior to the change in landscape. This should include, but not be limited to, utilizing bioretention areas, and minimizing the use of curb and gutter in favor of grassed swales. Bioretention areas (also called rain gardens) and grass swales are components of Low Impact Development (LID). They are designed to capture stormwater runoff as close to the source as possible and allow it to slowly infiltrate into the surrounding soil. They benefit natural resources by filtering pollutants and decreasing downstream runoff volumes.

We recommend that all tree removal and ground clearing adhere to a time of year restriction (TOYR) protective of resident and migratory songbird nesting from March 15 through August 15 of any year.

We recommend adherence to erosion and sediment controls during ground disturbance. To minimize potential wildlife entanglements resulting from use of synthetic/plastic erosion and sediment control matting, we recommend use of matting made from natural/organic materials such as coir fiber, jute, and/or burlap.

Thanks, Amy

Amy Martin

(she/her/hers)

Manager, Wildlife Information and Environmental Services

P 804.481.5296

Virginia Department of Wildlife

CONSERVE. CONNECT. PROTECT.

A 7870 Villa Park Drive, P.O. Box 90778, Henrico, VA 23228-0778

www.dwr.virginia.gov

20181116_MusselGuidelines_Finaldraft.pdf
220K

COMMONWEALTH of VIRGINIA

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director
Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

November 30, 2022

Julia Wellman
Dept. of Environmental Quality
Office of Environmental Impact Review
P.O. Box 1105
Richmond, VA 23218

Re: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed / RWSA Crozet Water Supply System Raw Water Infrastructure Upgrades
Albemarle County, VA
DEQ# 22-175F
DHR File No. 2022-5236

Dear Ms. Wellman:

We have received your request for comments on the project referenced above. Our comments are provided as assistance to the Dept. of Environmental Quality (DEQ) and the United States Department of Agriculture (USDA).

On November 30, 2022, DHR received a review request for the RWSA Crozet Water Supply System Raw Water Infrastructure Upgrades project, also known as the Rehabilitation of Multiple-Purpose Structure No. 1 Of the Beaver Creek Watershed project. The undertaking is currently under review. DHR will be in direct consultation with the United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS). We request that the NRCS continue consultation with our office pursuant Section 106 of the National Historic Preservation Act which requires federal agencies to consider the impacts of their projects on historic properties.

If you have any questions at this time, please contact me at jennifer.bellville-marrion@dhr.virginia.gov.

Sincerely,

Jenny Bellville-Marrion, Project Review Archaeologist
Review and Compliance Division

Western Region Office
962 Kime Lane
Salem, VA 24153
Tel: (540) 387-5443
Fax: (540) 387-5446

Northern Region Office
5357 Main Street
PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033

Eastern Region Office
2801 Kensington Avenue
Richmond, VA 23221
Tel: (804) 367-2323
Fax: (804) 367-2391

Commonwealth of Virginia

Wellman, Julia <julia.wellman@deq.virginia.gov>

Re: NEW PROJECT USDA Beaver Creek Watershed, DEQ 22-175F

1 message

Warren, Arlene <arlene.warren@vdh.virginia.gov> Mon, Nov 28, 2022 at 8:59 AM
To: Julia Wellman <julia.wellman@deq.virginia.gov>
Cc: rr Environmental Impact Review <eir@deq.virginia.gov>

Project Name: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed
Project #: 22-175 F
UPC #: N/A
Location: Albemarle County

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

The following public groundwater wells are located within a 1-mile radius of the project site (wells within a 1,000-foot radius are formatted in **bold):**

PWS ID Number	City/County	System Name	Facility Name
2003458	**ALBEMARLE CO**	**MECHUM`S TRESTLE**	**DRILLED WELL**
2003480	ALBEMARLE CO	MINT SPRINGS VALLEY PARK	WELL #1

The following surface water intakes are located within a 5-mile radius of the project site:

PWS ID Number	System Name	Facility Name
2003600	OBSERVATORY WTP	SUGAR HOLLOW RESERVOIR
2003250	CROZET WTP	BEAVER CREEK RESERVOIR

The project is within the watershed of the following public surface water sources (facilities where the project falls within 5 miles of the intake **and** is within the intake's watershed are formatted in **bold**):

PWS ID Number	System Name	Facility Name
2003250	**CROZET WTP**	**BEAVER CREEK RESERVOIR**
2065480	LAKE MONTICELLO	RIVANNA RIVER
2003725	SOUTH RIVANNA WTP	SOUTH FORK RIVANNA RESERVOIR

Best Management Practices should be employed, including Erosion & Sedimentation Controls and Spill Prevention Controls & Countermeasures on the project site.

Well(s) within a 1,000-foot radius from the project site should be field marked and protected from accidental damage during construction.

Materials should be managed while on site and during transport to prevent impacts to nearby surface water.
The Virginia Department of Health – Office of Drinking Water appreciates the opportunity to provide comments. If you have any questions, please let me know.

Best Regards,

Arlene F. Warren
GIS Program Support Technician
Virginia Department of Health, Office of Drinking Water

109 Governor Street, 6th Floor
Richmond, VA 23219
804-356-6658 (office/cell/text)

On Fri, Nov 4, 2022 at 11:32 AM Fulcher, Valerie <valerie.fulcher@deq.virginia.gov> wrote:

Good morning - this is a new OEIR review request/project:

Document Type: Draft Environmental Assessment
Project Sponsor: U.S. Department of Agriculture
Project Title: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed
Location: Albemarle County
Project Number: DEQ #22-175F

The document is available at https://public.deq.virginia.gov/OEIR/ in the USDA folder.

The due date for comments is NOVEMBER 28, 2022. You can send your comments either directly to JULIA WELLMAN by email (Julia.Wellman@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, P.O. Box 1105, Richmond, VA 23218.

If you cannot meet the deadline, please notify the project coordinator prior to the comment due date. Arrangements may be made to extend the deadline for comments if possible. An agency will be considered to have no concerns if comments are not received (or contact is made) within the review period. However, it is important that agencies consistently participate in accordance with Virginia Code Section 10.1-1192.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been previously reviewed (e.g. as a draft EIS or a Part 1 EIR), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency (agency stationary or email) and include the project number on all correspondence.

If you have any questions, please email Julia.

Thanks!

Valerie

--

Valerie A. Fulcher, CAP, OM, Admin/Data Coordinator Senior

Department of Environmental Quality

Environmental Enhancement - Office of Environmental Impact Review

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Julia Wellman, Environmental Program Planner

FROM: Carlos A. Martinez, Division of Land Protection & Revitalization Review Coordinator

DATE: November 23, 2022

COPIES: Sanjay Thirunagari, Division of Land Protection & Revitalization Review Manager; file

SUBJECT: Environmental Impact Review: EIR Project 22-175F Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed in Albemarle County, Virginia.

The Division of Land Protection & Revitalization (DLPR) has completed its review of the U.S. Department of Agriculture's November 4, 2022 EIR for Rehabilitation of Multiple-Purpose Structure No 1 of the Beaver Creek Watershed in Albemarle County, Virginia.

DLPR staff conducted a search (200 ft. radius) of the project area of solid and hazardous waste databases (including petroleum releases) to identify waste sites in close proximity to the project area. DLPR search did not identify any waste sites within the project area which might impact the project.

DLPR staff has reviewed the submittal and offers the following comments:

***Hazardous Waste/RCRA Facilities* – none in close proximity to the project area**

***CERCLA Sites* – none in close proximity to the project area**

***Formerly Used Defense Sites (FUDS)* – none in close proximity to the project area**

***Solid Waste* – none in close proximity to the project area**

***Virginia Remediation Program (VRP)* – none in close proximity to the project area**

***Petroleum Releases* – none in close proximity to the project area**

PROJECT SPECIFIC COMMENTS

None

GENERAL COMMENTS

Soil, Sediment, Groundwater, and Waste Management

Any soil, sediment or groundwater that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Part 107.

Asbestos and/or Lead-based Paint

All structures being demolished/renovated/removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed. Questions may be directed to the DEQ's Valley Regional Office at (540) 574-7800.

Pollution Prevention – Reuse - Recycling

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Carlos A. Martinez by phone at (804) 350-9962 or email Carlos.Martinez@DEQ.Virginia.Gov.

Commonwealth of Virginia

Wellman, Julia <julia.wellman@deq.virginia.gov>

RE: NEW PROJECT USDA Beaver Creek Watershed, DEQ 22-175F

1 message

Keith Fowler <keith.fowler@deq.virginia.gov> Mon, Nov 7, 2022 at 2:17 PM
To: Julia.Wellman@deq.virginia.gov

Hi Julia. Below are DEQ Valley Regional Office review comments for the subject project. Please let me know if you need any additional information.

1. Water Quality and Wetlands. Measures must be taken to avoid and minimize impacts to surface waters and wetlands during construction activities. The disturbance of surface waters or wetlands may require prior approval by DEQ and/or the U.S. Army Corps of Engineers. The Army Corps of Engineers is the final authority for an official confirmation of whether there are federal jurisdictional wetlands or other surface waters that may be impacted by the proposed project. DEQ may confirm additional waters as jurisdictional beyond those under federal authority. Review of National Wetland Inventory maps or topographic maps for locating wetlands or streams may not be sufficient; there may need to be a site-specific review of the site by a qualified professional. Even if there will be no intentional placement of fill material in jurisdictional waters, potential water quality impacts resulting from construction site surface runoff must be minimized. This can be achieved by using Best Management Practices (BMPs). If construction activities will occur in or along any streams (perennial, intermittent, or ephemeral), open water or wetlands, the applicant should contact Keith Fowler at DEQ-VRO (540-217-7480, Keith.Fowler@deq.virginia.gov) to determine the need for any permits prior to commencing work that could impact surface waters or wetlands.

I believe this project is already under review under DEQ's Office of Water Supply and Office of Wetlands & Stream Protection as VWP project #06-1574.

2. Erosion and Sediment Control and Storm Water Management. DEQ has regulatory authority for the Virginia Pollutant Discharge Elimination System (VPDES) programs related to municipal separate storm sewer systems (MS4s) and construction activities. Erosion and sediment control measures are addressed in local ordinances and State regulations. Additional information is available at https://www.deq.virginia.gov/water/stormwater. Non-point source pollution resulting from this project should be minimized by using effective erosion and sediment control practices and structures. Consideration should also be given to using permeable paving for parking areas and walkways where appropriate, and denuded areas should be promptly revegetated following construction work. If the total land disturbance exceeds 10,000 square feet, an erosion and sediment control plan will be required. Some localities also require an E&S plan for disturbances less than 10,000 square feet. A stormwater management plan may also be required. For any land disturbing activities equal to one acre or more, you are required to apply for coverage under the VPDES General Permit for Discharges of Storm Water from Construction Activities. The Virginia Stormwater Management Permit Authority may be DEQ or the locality. Specific questions regarding the Stormwater Management Program requirements should be directed to Gary Flory at DEQ-VRO (804-212-7018, Gary.Flory@deq.virginia.gov).

3. Other Site Development Considerations. Fugitive dust generated during construction should be controlled by using measures such as the prompt removal of spilled or tracked dirt or other materials from paved streets, limited application of water to suppress dust, and washing of construction vehicles and paved roadways immediately adjacent to construction sites. Do not use water for dust control to the extent that it results in runoff to surface waters or wetlands. Land clearing wastes (vegetative debris) generated during construction should be properly managed in accordance with applicable regulations and local ordinances. Shredding/chipping of vegetative debris and reuse on-site is usually recommended over open burning. Any open burning of vegetative debris must be performed in accordance with the Open Burning Regulation and coordinated with the local fire official to ensure that all local ordinances are met. A copy of DEQ's open burning regulation and related information are accessible from https://www.deq.virginia.gov/permits-regulations/laws-regulations/air. Also, no open burning should take place in violation of the Virginia Waste Management Regulations, https://www.deq.virginia.gov/land-waste/solid-hazardous-

waste. Contact Keith Fowler at DEQ-VRO (540-217-7480, Keith.Fowler@deq.virginia.gov) for any questions related to the proper control of fugitive dust, or open burning requirements and prohibitions.

4. Potable Water. Installation of potable water lines and appurtenances must comply with the State's Waterworks Regulations. The Virginia Department of Health (VDH), https://www.vdh.virginia.gov/drinking-water/, administers both federal and state laws governing waterworks operation. For more information, contact the VDH's Lexington Office of Water Programs at (540) 463-7136.

5. Wastewaters. DEQ has approval authority over wastewater discharges per the State Water Control Law and corresponding regulations. This includes discharges or land application of any wastewaters generated from washing of materials, products, or vehicles, or other practices relevant to this project, including water contaminated by chemicals used on-site. DEQ also has approval authority over plans and specifications for sewage collection systems and treatment works (except drainfields and other on-site systems approved by the local health department), per the Sewage Collection and Treatment (SCAT) Regulations, http://law.lis.virginia.gov/admincode/title9/agency25/chapter790/. Any wastewaters generated by this project must be properly managed and disposed. For additional information and assistance, contact Brandon Kiracofe at DEQ-VRO (540-217-7479, Brandon.Kiracofe@deq.virginia.gov).

6. Air Quality. Installation / operation / modification / replacement of stationary or portable fuel burning equipment (e.g., generators, wood chippers/grinders, boilers, etc.) or other sources of air pollutants, including dust, may be subject to registration and/or air permitting requirements (https://www.deq.virginia.gov/permits-regulations/permits/air); for questions regarding this, please contact Janardan Pandey at DEQ-VRO (540-830-8833, Janardan.Pandey@deq.virginia.gov).

7. Petroleum Storage Tanks. Installation / operation / modification of tanks used for the storage of petroleum and CERCLA substances may be subject to registration and/or other regulatory requirements (https://www.deq.virginia.gov/land-waste/petroleum-tanks). If petroleum-contaminated soils or water are encountered during excavation work, or if old petroleum tanks need to be removed or replaced, contact DEQ. For questions regarding any of this, please contact Todd Pitsenberger at DEQ-VRO (540-830-8857, Todd.Pitsenberger@deq.virginia.gov).

8. **Solid and Hazardous Wastes, and Hazardous Substances.** DEQ administers the Virginia Waste Management Regulations, http://law.lis.virginia.gov/admincode/title9/agency20/. All solid wastes, hazardous wastes, and hazardous materials, including construction and demolition (C&D) wastes and universal wastes (batteries, fluorescent lights, refrigerants, mercury switches, mercury thermostats, etc.), must be managed in accordance with all applicable federal, state, and local environmental regulations. The generation of hazardous wastes should be minimized and solid wastes generated at the site should be reduced at the source, reused, or recycled. DEQ encourages the management of certain organic wastes by on-site composting or reuse as animal feed or soil amendment. Also, if you encounter any improperly disposed solid or hazardous wastes, or petroleum contaminated soils, you should contact DEQ-VRO. You may wish to refer to the web link for "What's in My Back Yard?", https://geohub-vadeq.hub.arcgis.com/, to help you determine areas where residual contamination may be more likely. Contact Graham Simmerman at DEQ-VRO (540-830-8786, Graham.Simmerman@deq.virginia.gov) for any questions related to waste management / disposal, including any questions related to open burning requirements and prohibitions. Manage / dispose of any asbestos-containing materials (ACMs) in accordance with Virginia Department of Labor and Industry (DOLI) regulations. Contact Doug Wiggins at DOLI (Richard.Wiggins@doli.virginia.gov, 540-562-3580, ext. 131) for any questions related to management / disposal of ACMs.

9. Pesticides and Herbicides. DEQ recommends that herbicides or pesticides for construction or landscape maintenance, when necessary, be used in accordance with the principles of integrated pest management, and that the least toxic pesticides that are effective in controlling the target species be used. Please contact the Department of Agriculture and Consumer Services at (804) 786-3501 for more information. If applying aquatic pesticides to surface waters, the applicant must comply with the DEQ's Pesticide General Permit, https://law.lis.virginia.gov/admincode/title9/agency25/chapter800/.

10. Natural Heritage Resources. The Virginia Department of Conservation and Recreation (DCR) Division of Natural Heritage (DNH) can search its Biotics Data System for occurrences of natural heritage resources from the area indicated on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered animal and plant species, unique or exemplary natural communities, and significant geologic communities. We recommend that the DNH be contacted at (804) 786-7951 to secure updated information on natural heritage resources before commencing the project.

11. Wildlife Resources. The Virginia Department of Wildlife Resources (DWR) exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state or federally listed endangered or threatened species. DWR determines likely impacts on fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce, or compensate for those impacts. For more information, see the DWR website at https://dwr.virginia.gov/wies/contact-wies/ or contact Ray Fernald at (804) 367-8364.

12. Historic and Archaeological Resources. *Section 106 of the National Historic and Preservation Act of 1966*, as amended, requires that activities that receive federal funding must consider effects to properties that are listed or eligible for listing on the National Register of Historic Places. The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources. If applicable, contact DHR, https://www.dhr.virginia.gov/environmental-review/. In the event that archaeological resources are encountered during construction, immediately contact the appropriate staff from https://www.dhr.virginia.gov/environmental-review/staff-directory/.

13. Pollution Prevention. DEQ recommends that construction projects incorporate the principles of pollution prevention including the following recommendations:

- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content and toxicity level should be considered.
- Consider contractors' commitment to the environment when choosing contractors. Also, specifications regarding raw material selection (alternative fuels and energy sources) and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable practices and materials in infrastructure and construction and design. These could include asphalt and concrete containing recycled materials and integrated pest management in landscaping.
- Integrate pollution prevention techniques into maintenance and operation activities to include source reduction (fixing leaks, energy efficient products).

Pollution prevention measures are likely to reduce potential environmental impacts and reduce costs for material purchasing and waste disposal. DEQ's Office of Pollution of Prevention hosts a number of programs and initiatives that provide non-regulatory assistance to businesses, institutions, and communities including the Virginia Environmental Excellence Program and Virginia Green. For more information, please visit our web site at https://www.deq.virginia.gov/get-involved/pollution-prevention.

14. **Energy Conservation**. Any structures should be planned and designed to comply with state and federal guidelines and industry standards for energy conservation and efficiency. For example, energy efficiency of the structures can be enhanced by maximizing the use of the following:

- thermally-efficient building shell components (roof, wall, floor, and insulation);
- high efficiency heating, ventilation, air conditioning systems; and
- high efficiency lighting systems.

Matt Heller at the Department of Mines, Minerals and Energy, (434) 951-6351, may be contacted for assistance in meeting this challenge.

B. Keith Fowler | Deputy Regional Director | DEQ-Valley Regional Office | 4411 Early Road | P. O. Box 3000 | Harrisonburg, VA 22801 | 540-217-7480 | Keith.Fowler@deq.virginia.gov

From: Fulcher, Valerie <valerie.fulcher@deq.virginia.gov>
Sent: Friday, November 4, 2022 11:32 AM
To: rr dgif-ESS Projects <essprojects@dwr.virginia.gov>; rr DCR-PRR Environmental Review <envreview@dcr.virginia.gov>; odwreview (VDH) <odwreview@vdh.virginia.gov>; Carlos Martinez <carlos.martinez@deq.virginia.gov>; Kotur Narasimhan <kotur.narasimhan@deq.virginia.gov>; Lawrence Gavan <larry.gavan@deq.virginia.gov>; Michelle Henicheck <michelle.henicheck@deq.virginia.gov>; Keith Fowler <keith.fowler@deq.virginia.gov>; Roger Kirchen <roger.kirchen@dhr.virginia.gov>; rr MRC - Scoping <scoping@mrc.virginia.gov>; cjacobs@tjpdc.org; jrichardson3@albemarle.org
Cc: Wellman, Julia <julia.wellman@deq.virginia.gov>
Subject: NEW PROJECT USDA Beaver Creek Watershed, DEQ 22-175F

Good morning - this is a new OEIR review request/project:

Document Type: Draft Environmental Assessment

Project Sponsor: U.S. Department of Agriculture

Project Title: Rehabilitation of Multiple-Purpose Structure No. 1 of the Beaver Creek Watershed

Location: Albemarle County

Project Number: DEQ #22-175F

The document is available at https://public.deq.virginia.gov/OEIR/ in the USDA folder.

The due date for comments is NOVEMBER 28, 2022. You can send your comments either directly to JULIA WELLMAN by email (Julia.Wellman@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, P.O. Box 1105, Richmond, VA 23218.

If you cannot meet the deadline, please notify the project coordinator prior to the comment due date. Arrangements may be made to extend the deadline for comments if possible. An agency will be considered to have no concerns if comments are not received (or contact is made) within the review period. However, it is important that agencies consistently participate in accordance with Virginia Code Section 10.1-1192.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been previously reviewed (e.g. as a draft EIS or a Part 1 EIR), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency (agency stationary or email) and include the project number on all correspondence.

USDA
United States Department of Agriculture

Natural
Resources
Conservation
Service

Virginia State Office

1606 Santa Rosa Road
Suite 209
Richmond, VA
23229

February 6, 2023

Ms. Bettina Rayfield
Program Manager
Environmental Impact Review and Long-Range Priorities Program
Commonwealth of Virginia
Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, VA 23218

RE: Draft Supplemental Watershed Plan No. 2 and Environmental Assessment for the Rehabilitation of Multipurpose Structure No. 1 Of the Beaver Creek Watershed, Albemarle County (22-175F)

Dear Ms. Rayfield:

Thank you for providing the Commonwealth's consolidated comments on the referenced project. It appears that for many of the topics presented in the comment letter, the Commonwealth generally concurs with the findings and conclusions presented in the Draft Plan-EA.

The project is currently scheduled to begin the design phase in earnest in early 2023. During the design phase, NRCS, as well as the Sponsors and their consultants will begin to develop detailed construction plans and specifications for the rehabilitation work. NRCS and the Sponsors' team will work closely with the various local, commonwealth, and federal agencies responsible for protection of environmental resources to ensure that the project is executed in accordance with applicable laws and standards and maintains the community values of Albemarle County.

Since most of the comments, including minimizing impacts to surface waters and wetlands, erosion and sediment control, stormwater management, and time of year restrictions focus on issues that are required during project implementation, they will be addressed during the design, Joint Permit Application process, and/or construction phases of the project. Based upon our review of the comments, NRCS and the project team acknowledge and generally concur with the recommendations provided in the comments. However, it is our opinion that some of the comments that were provided elicit further discussion or response from the project team and are presented herein:

Comment 1: (1(c), page 3) *"There may need to be a site-specific review of the site by qualified personnel."*

Response 1: A wetlands survey was performed as part of the planning process. The information is presented in the Appendices and will be included as part of the JPA submittal process, as well as during subsequent coordination with the U.S. Army Corps of Engineers (USACE) for the 401/404 permit application.

Comment 2: (4(c),i-iii, Page 8) Regarding *Open Burning, Fugitive Dust, Fuel-Burning Equipment.*

Response 2: No open burning will be allowed at the site. The Contractor will be required to maintain dust at the site by means of appropriate BMPs for dust control, such as water or chemicals. These requirements will be developed as part of the erosion and sedimentation control plans developed during the detailed design phase. Fuel-burning equipment shall be performed in compliance with local ordinances and the Contractor will be required to obtain all required local, state, and federal permits associated with construction emissions.

Comment 3: (6(b), Page 10) Regarding Floodplain management: *The applicant/developer must contact the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit."*

Response 3: The project team will coordinate with the local floodplain administrator (Albemarle County) during the design phase and comply with the floodplain ordinance. The project team will review the existing and proposed floodplain and determine if a Conditional Letter of Map Revision (CLOMR) will be required based on the proposed actions.

Comment 4: (7(b), Page 11) Regarding mussel survey report: "*...if DWR were provided a copy of the survey report, DWR may be able to determine that impacts upon freshwater mussels are not likely to result based on the results of that survey, including descriptions of the habitat available on site. Notify DWR if the survey report has already been provided."*

Response 4: Thank you for this comment. The Mussel Survey Report was included in Appendix D – Investigations and Analyses Report, which supported the findings presented in the Plan-EA. The project team would be pleased to provide you with the report if you did not download it previously. The team also looks forward to further discussion regarding the validity of the mussel survey or if a re-survey will be required.

Comment 5: (7(c)(ii), Page 12) Regarding In-Stream Activities. *"To minimize harm to the aquatic environment and its residents resulting from use of the Tremie method to install concrete, installation of grout bags, and traditional pouring of concrete, ensure that such activities occur only in the dry, allowing all concrete to harden and cure prior to contact with open water."*

Response 5: Thank you for this comment. Most of the concrete proposed for this project is associated with construction of the chute spillway. Uncured concrete and concrete truck washout will not be permitted to enter the waterways and shall be disposed of at a designated on-site concrete cleanout location, to be determined during the design phase. The potential may exist for the subaqueous or underwater concrete placement to facilitate stabilization of the existing riser tower. Methods for stabilizing the riser will be further evaluated during the design phase. If such a method were proposed, the contractor would have to demonstrate that their means and methods will not result in contamination of the reservoir. We assume the methodology for such a placement will need to be submitted to and approved by USACE and DEQ in order to receive permits.

Comment 6: (11(b), Page 17) Regarding DHR Findings. *"...The undertaking is currently under review. DHR will be in direct consultation with the USDA NRCS."*

Response 6: The planning team has received separate correspondence dated December 16, 2022, from Virginia DHR. Responses to those comments have been addressed under separate cover.

Comment 7: (12, Page 17) Regarding Dam Safety Program review. *"The EA (page 1) indicates that there are safety concerns about the proposed dam."*

Response 7: The EA describes the safety concerns with the existing dam. This is one of the catalysts for the proposed action; to rehabilitate the dam and remove the safety concerns. After rehabilitation, the dam and spillway will comply with Virginia Impounding Structure regulations and NRCS requirements for high hazard potential dams.

The planning team notes that additional correspondence was received from representatives of the DCR Dam Safety Program and has responded to those comments under separate cover. The design team will continue to coordinate with the Regional Dam Safety Engineer Justin Deel, P.E. and his team to submit all necessary reports, plans, drawings, and specifications for review to facilitate issuance of the Alteration Permit for the proposed measures.

Closure

The planning team again appreciates your review of the Plan-EA and looks forward to continued association as the final design phase advances. We hope that these responses help to clarify the intent of the Plan-EA and are satisfactory.

If you have any questions, please contact me or Mathew Lyons, PE, State Conservation Engineer (mathew.lyons@usda.gov or (804) 287-1653).

Sincerely,

Edwin Martinez Martinez, Ph.D.
State Conservationist

cc: Mathew Lyons, P.E. (USDA-NRCS Virginia State Conservation Engineer)
J. Ryan Collins, P.E. (Schnabel Engineering, LLC Project Manager)
Chris Ramo, P.E. (Hazen and Sawyer Project Manager)

J.R. Collins

From: Caitlin Rogers <caitlin.rogers@catawba.com>
Sent: Monday, November 7, 2022 8:39 AM
To: J.R. Collins
Subject: Re: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Follow Up Flag: Follow up
Flag Status: Completed

Mr. Collins,

We require hard copies of project information. Our mailing address is 1536 Tom Steven Road, Rock Hill, SC 29730.

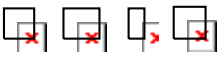
From: J.R. Collins <jcollins@schnabel-eng.com>
Sent: Friday, November 4, 2022 1:05 PM
To: Bill Harris <bill.harris@catawba.com>
Cc: Wenonah Haire <wenonah.haire@catawba.com>; Caitlin Rogers <caitlin.rogers@catawba.com>
Subject: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Good afternoon,
I am pleased to inform you that the Beaver Creek 1 Draft Supplemental Watershed Plan-EA will be available for public and agency review beginning today, Friday, November 4, 2022. The attached letter further describes how you can access the document and submit comments to the planning team or ask questions about the plan.
We appreciate your involvement and input to this point, and look forward to receiving your feedback on this Draft Plan-EA.
Please do not hesitate to reach out to me.
Thank you,
-JR

J Ryan Collins, PE
Senior Engineer

Schnabel Engineering
O: 737.236.5649 / C: 678.935.8454
12301 Research Blvd., Bldg. 4, Suite 150
Austin, TX 78759

schnabel-eng.com



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- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Caitlin Rogers
Catawba Indian Nation
1536 Tom Steven Road
Rock Hill, SC 29730

9590 9402 6990 1225 7289 40

2. Article Number *(Transfer from service label)*

7021 2720 0001 8248 0082

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X *

☐ Agent
☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery

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If YES, enter delivery address below: ☐ No

* Sent Binder w/Hard Copy of 2 Attachments Sent 11/10/22. Rec'd 11/22/22. cc

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PS Form 3811, July 2020 PSN 7530-02-000-9053 Domestic Return Receipt

J.R. Collins

From: Carissa Speck <cspeck@delawarenation-nsn.gov>
Sent: Thursday, December 15, 2022 9:48 AM
To: J.R. Collins
Subject: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Greetings.

My name is Carissa Speck, I am the new historic preservation director for Delaware Nation. Erin Paden is no longer with Delaware Nation, please remove her from your contact lists and direct future correspondence to me. I have no further comments or concerns with the Draft Plan-EA. Thank you.

Wanìshi,

Carissa Speck
Delaware Nation
Historic Preservation Director
405-247-2448 Ext. 1403
cspeck@delawarenation-nsn.gov

J.R. Collins

From: Jesse Bergevin <jbergevin@oneida-nation.org>
Sent: Monday, November 14, 2022 9:01 AM
To: J.R. Collins
Subject: RE: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Mr. Collins,

The Oneida Indian Nation does not have any comments to offer regarding this draft plan-EA.

Please let me know if there are any questions.

Best Regards,

JESSE BERGEVIN
Historical Resources Specialist

ONEIDA INDIAN NATION

P: 315.829.8463
2037 Dream Catcher Plaza
Oneida, NY 13421

From: J.R. Collins [mailto:jcollins@schnabel-eng.com]
Sent: Friday, November 04, 2022 1:36 PM
To: hbritter@oneida-nation.org
Cc: Jesse Bergevin <jbergevin@oneida-nation.org>
Subject: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Good afternoon,

I am pleased to inform you that the Beaver Creek 1 Draft Supplemental Watershed Plan-EA will be available for public and agency review beginning today, Friday, November 4, 2022. The attached letter further describes how you can access the document and submit comments to the planning team or ask questions about the plan.

We appreciate your involvement and input to this point, and look forward to receiving your feedback on this Draft Plan-EA.

Please do not hesitate to reach out to me.

Thank you,

-JR

J.R. Collins

From: Stacie M. Cutbank <sdanfor3@oneidanation.org>
Sent: Monday, November 7, 2022 4:26 PM
To: J.R. Collins
Cc: Nicholas A. Metoxen
Subject: Re: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Follow Up Flag: Follow up
Flag Status: Completed

Hello Mr. Collins,
I appreciate you sending the following notification regarding the Beaver Creek 1 Draft Supplemental Watershed Plan-EA. I wanted to let you know that I no longer am the THPO for the Oneida Nation. I have included Nick Metoxen, Cultural Heritage Turtle Clan Manager, as he will be fielding notifications from your agency I have included him on this email. Please make the appropriate arrangements to remove me as the point of contact regarding Section 106.

Yaw^ko, (thank you)

Stacie Cutbank

From: J.R. Collins <jcollins@schnabel-eng.com>
Sent: Friday, November 4, 2022 12:36 PM
To: Tehassi Tasi Hill <thill7@oneidanation.org>
Cc: Stacie M. Cutbank <sdanfor3@oneidanation.org>
Subject: Request for Review - Beaver Creek 1 Plan-EA - Albemarle Co., Virginia

Good afternoon,
I am pleased to inform you that the Beaver Creek 1 Draft Supplemental Watershed Plan-EA will be available for public and agency review beginning today, Friday, November 4, 2022. The attached letter further describes how you can access the document and submit comments to the planning team or ask questions about the plan.
We appreciate your involvement and input to this point, and look forward to receiving your feedback on this Draft Plan-EA.
Please do not hesitate to reach out to me.
Thank you,
-JR

J Ryan Collins, PE
Senior Engineer

Schnabel Engineering
O: 737.236.5649 / C: 678.935.8454
12301 Research Blvd., Bldg. 4, Suite 150
Austin, TX 78759

APPENDIX B

PROJECT MAP

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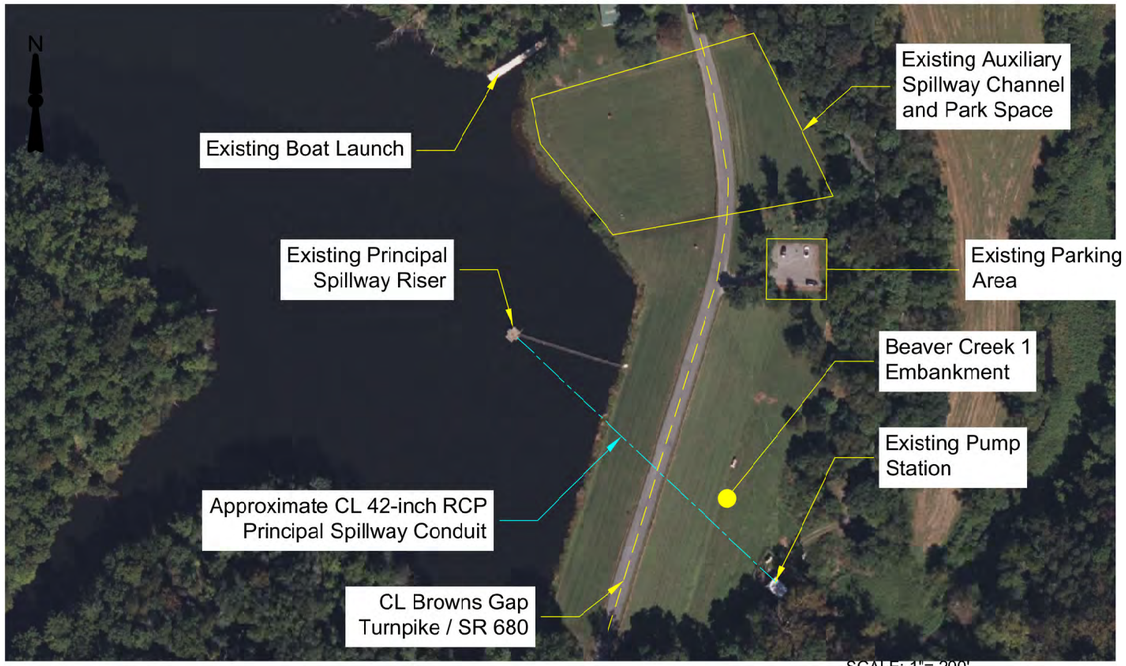
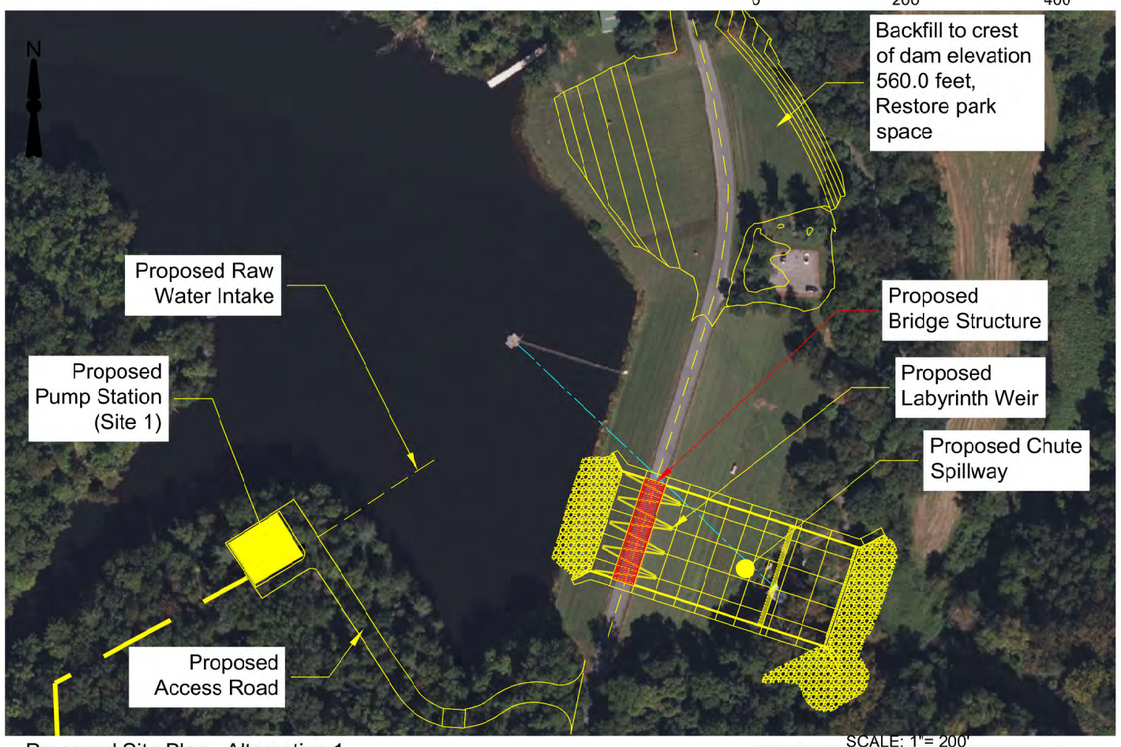


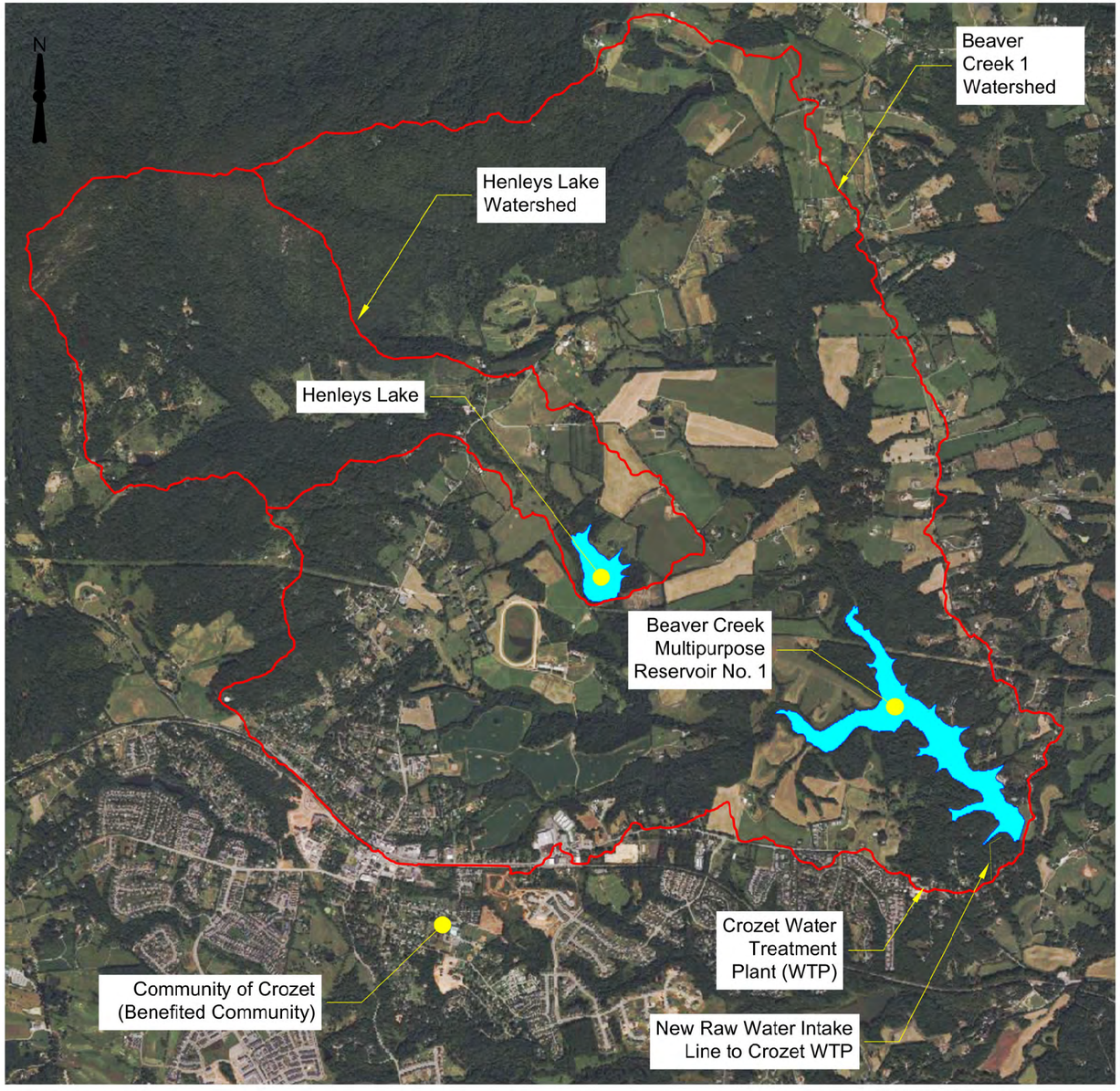
Existing Site Plan

SCALE: 1"= 200'
0 200' 400'



Proposed Site Plan - Alternative 1

SCALE: 1"= 200'
0 200' 400'



Project Map

SCALE: 1"= 3000'
0 3000' 6000'

Notes:
1. Aerial imagery obtained from Microsoft Corporation, Maxar, CNES, Distribution Airbus DS 2022
2. Limits shown are considered approximate.

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

Figure B
Project Map and Site Plan

Appendix B

G:\2018\ALPH\18C17111.001 BEAVER CREEK 1 PLAN-EA\03-SE PRODUCTS\08-CAD\DRAWINGS\06-WORKING\BC1_FIGURE B.DWG

APPENDIX C

SUPPORT MAPS

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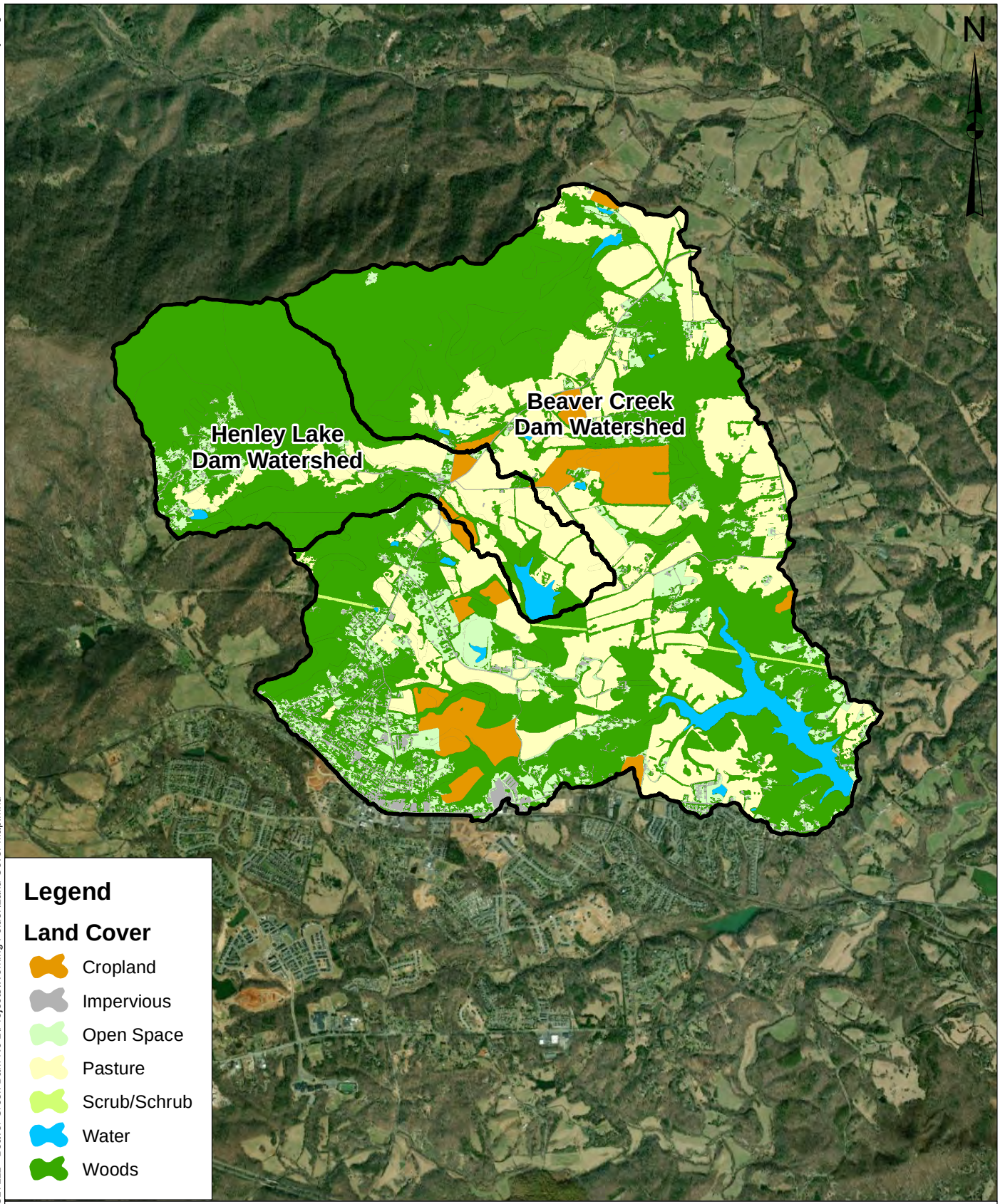


Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Projection: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

4,000 2,000 0 4,000 Feet

Scale: 1 in = 4,000 ft

Schnabel ENGINEERING

BEAVER CREEK WATERSHED
RIVIANNA WATER & SEWER AUTHORITY
ALBEMARLE, VIRGINIA
PROJECT NO.18C17111.00

LAND COVER
MAP

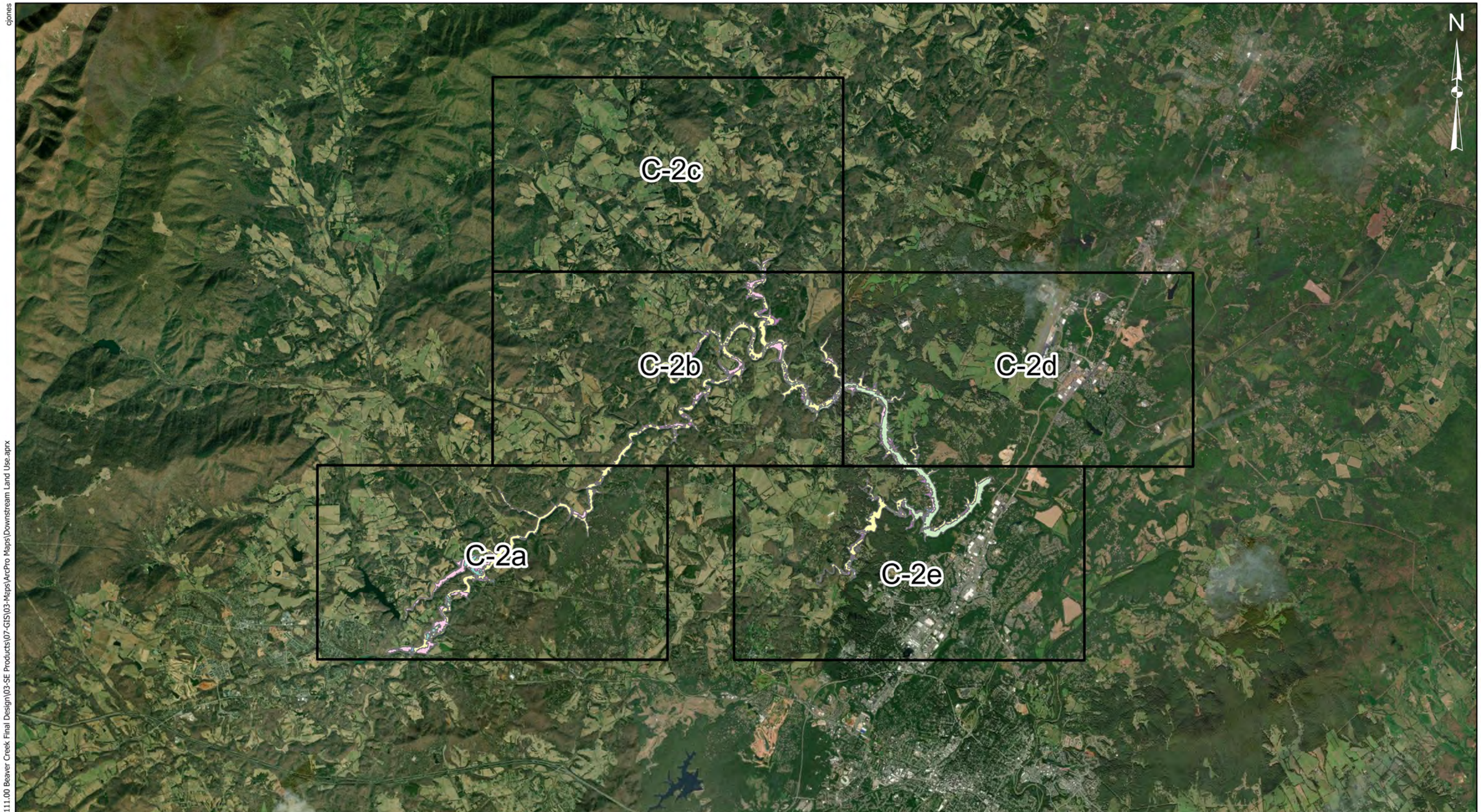
FIGURE C-1

jhalligan

3/11/2021 B:\GIS_Data\2018\18C17111 - Beaver Creek Dam No 1\Projects\Working Folder\Land Cover Map.mxd

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Downstream Land Use.aprx



NLCD_Land

- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>
- Sheet Index

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 4,000 8,000 16,000 US Feet

Scale: 1:100,000 1 inch equals 8,333 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Downstream Land Use.aprx

N

BEAVER CREEK 1
RESERVOIR

NLCD_Land

- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2a

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Downstream Land Use.aprx

N

NLCD_Land

- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
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- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2b

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Downstream Land Use.aprx

NLCD_Land

- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
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- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2c

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Downstream Land Use.aprx

Earthstar Geographics

NLCD_Land

- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
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- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>

Schnabel ENGINEERING

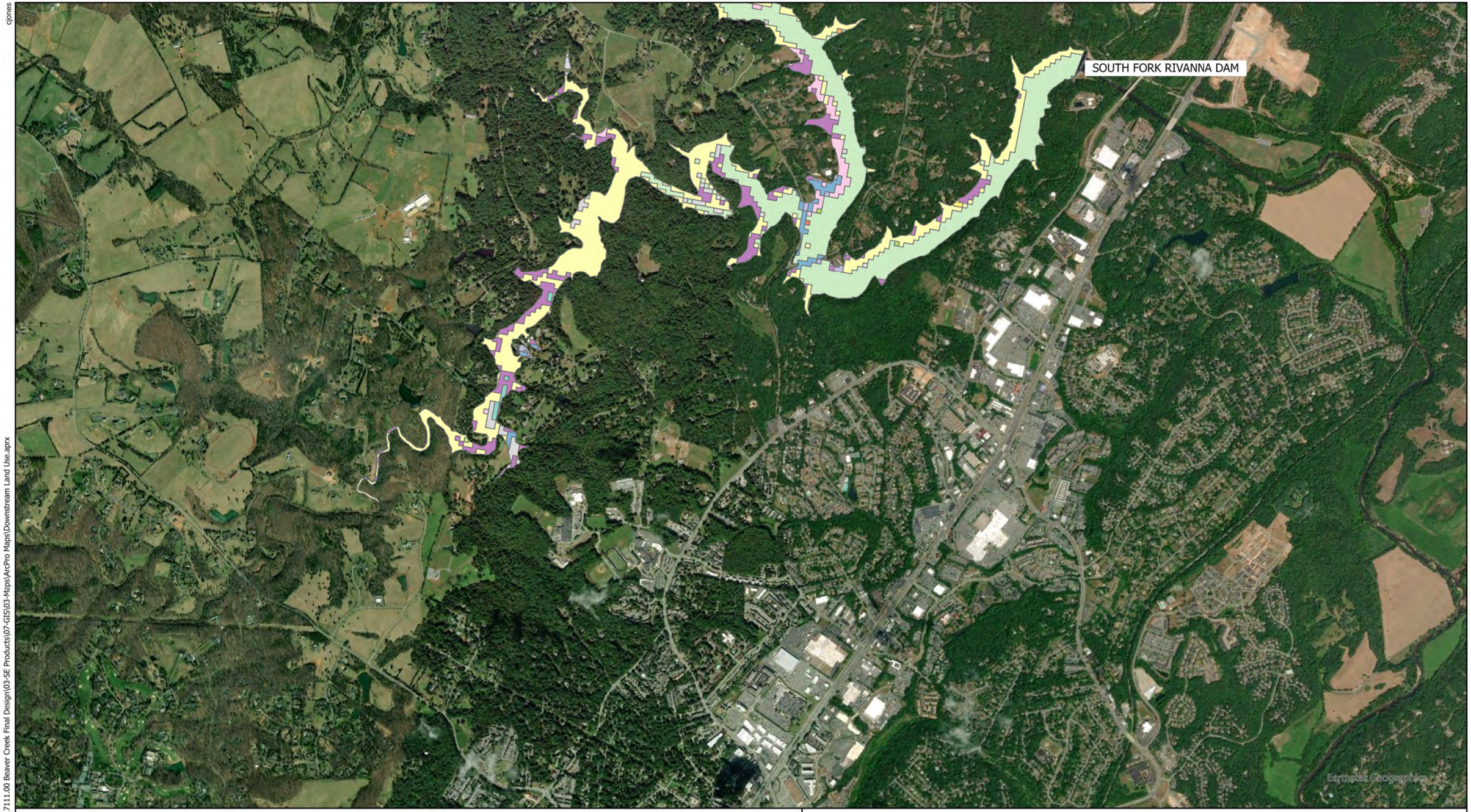
BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2d

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Downstream Land Use.aprx



NLCD_Land

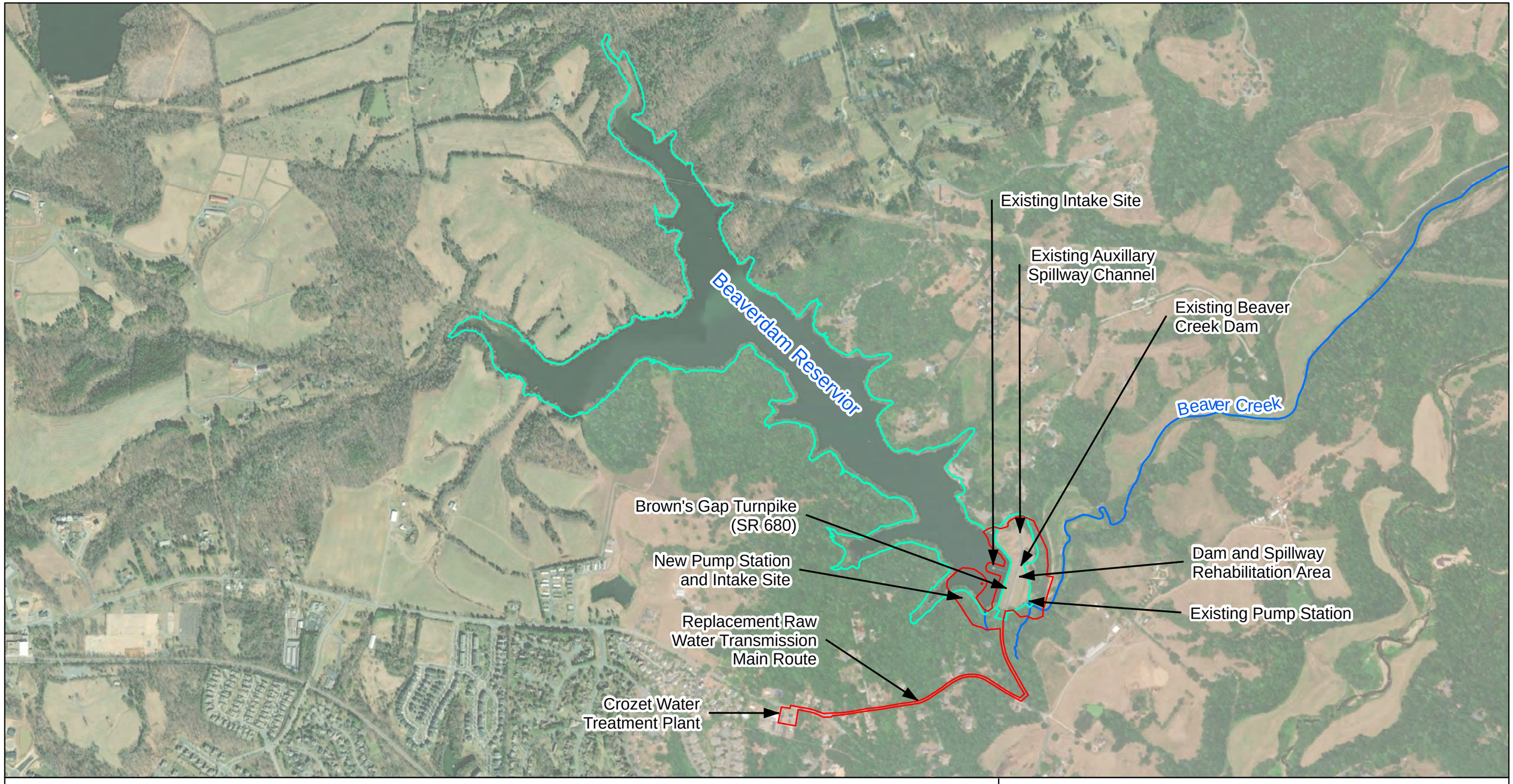
- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceuous
- Mixed Forest
- Open Water
- Shrub/Scrub
- Woody Wetlands
- <all other values>

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

LAND USE WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-2e



Area of Original Disturbance

Project Areas

Stream

N

0 450 900 1,800

Feet

Figure C-3: Project Map and Original Disturbance

RIVANNA WATER AND SEWER AUTHORITY

Hazen

Exact location of pump station and intake to be finalized during design

Beaver Creek Reservoir

Existing Intake

Proposed New Intake Location

Pump Station

Permanent Access Road

Brown's Gap Turnpike (SR 680)

Bridge

Perennial Stream

Limits of Disturbance (LOD)

Approximate Location of Disturbance During Original Construction

Pump Station

New Intake and Pipe

Permanent Access Road

Bridge

Stream

N

0 50 100 200

Feet

Figure C-4a: Aerial View of Project with Limits of Disturbance, Streams and Wetlands

RIVANNA WATER AND SEWER AUTHORITY

Hazen

Temporary Roadway Diversion/Cofferdam

Temporary Staging and Laydown Area

Existing Access Road

Existing Parking Area

Beaver Creek Reservoir

Brown's Gap Turnpike (SR 608)

Bridge

Rip-rap Lined Inlet Channel

Labyrinth Crested Chute Spillway

Rip-rap Lined Apron

Beaver Creek

Unnamed Tributary to Beaver Creek

Limits of Disturbance (LOD)

Approximate Location of Disturbance During Original Construction

Permanent Grading

Permanent Riprap

Permanent Spillway

Permanent Bridge

Streams

Palustrine Emergent (PEM) Wetland

Palustrine Forested (PFO) Wetland

N

0 50 100 200

Feet

Figure C-4b: Aerial View of Project with Limits of Disturbance, Streams, and Wetlands

RIVANNA WATER AND SEWER AUTHORITY

Hazen

cjones

C-2c

C-2b

C-2d

C-2a

C-2e

N

100-Year Flood Inundation Boundary

Sheet Index

Hydric

Water

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 4,000 8,000 16,000 US Feet

Scale: 1:100,000 1 inch equals 8,333 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN 100-YEAR INUNDATION BOUNDARY

FIGURE C-5

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Hydric Soils.aprx

cjones

N

BEAVER CREEK 1
RESERVOIR

100-Year Flood Inundation Boundary

Hydric

Water

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN
100-YEAR INUNDATION
BOUNDARY

FIGURE C-5a

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Hydric Soils.aprx

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\Hydric Soils.aprx

N

100-Year Flood Inundation Boundary

Hydric

Water

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN 100-YEAR INUNDATION BOUNDARY

FIGURE C-5b

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Hydric Soils.aprx

100-Year Flood Inundation Boundary

Hydric

Water

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN 100-YEAR INUNDATION BOUNDARY

FIGURE C-5c

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Hydric Soils.aprx

100-Year Flood Inundation Boundary

Hydric

Water

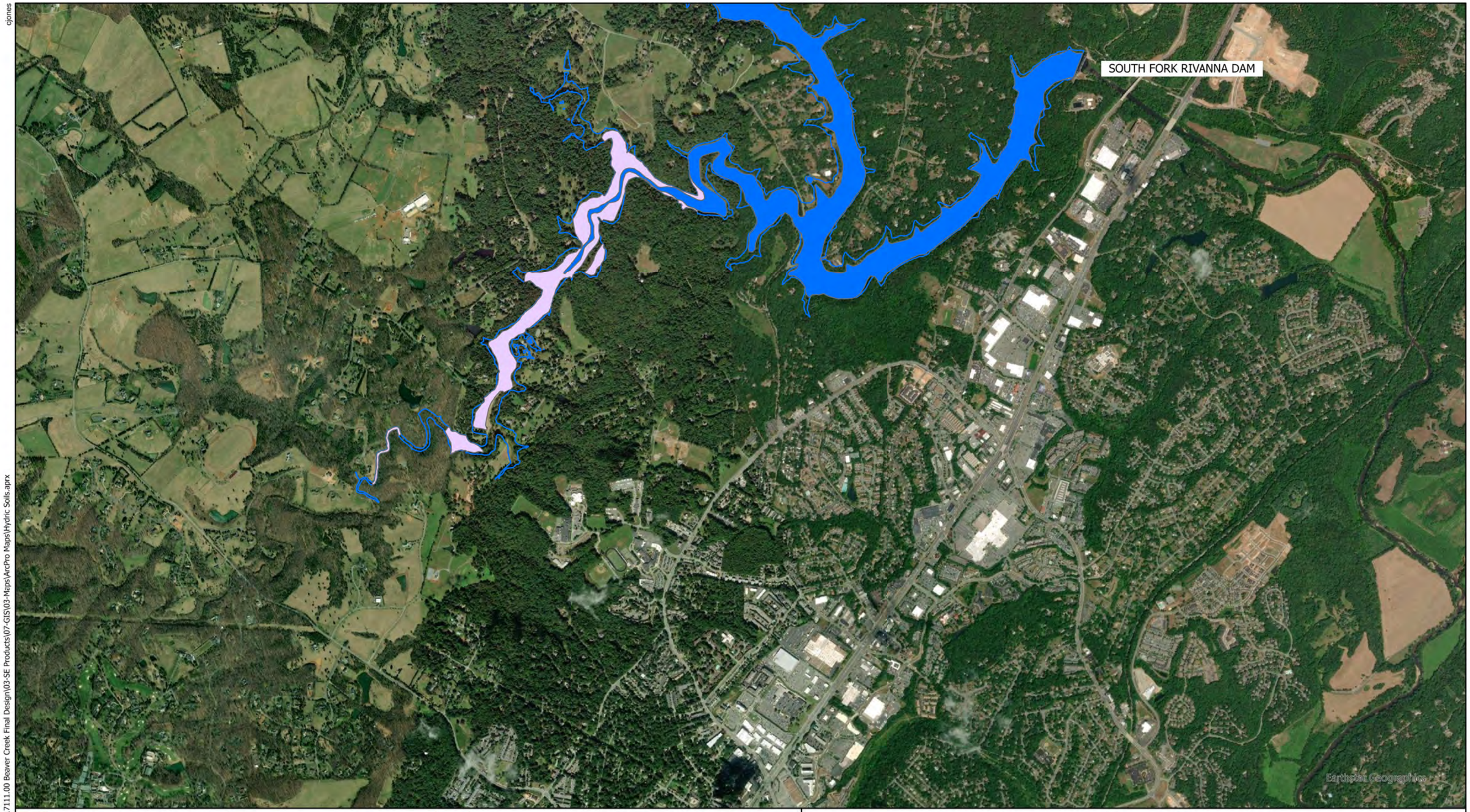
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN 100-YEAR INUNDATION BOUNDARY

FIGURE C-5d

cjones



100-Year Flood Inundation Boundary
Hydric
Water

Schnabel ENGINEERING

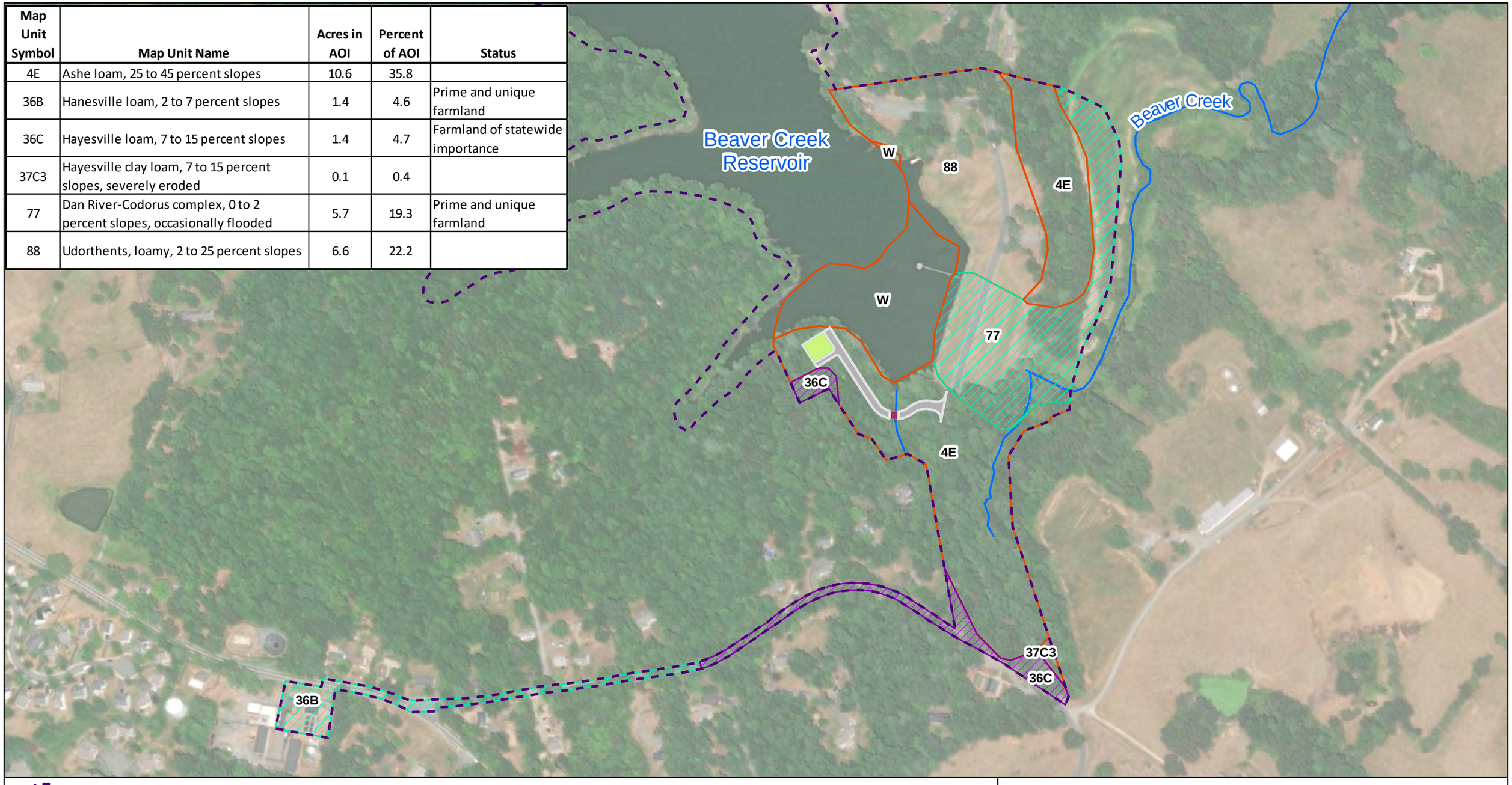
BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

HYDRIC SOILS WITHIN 100-YEAR INUNDATION BOUNDARY

FIGURE C-5e

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\Hydric Soils.aprx

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	Status
4E	Ashe loam, 25 to 45 percent slopes	10.6	35.8	
36B	Hanesville loam, 2 to 7 percent slopes	1.4	4.6	Prime and unique farmland
36C	Hayesville loam, 7 to 15 percent slopes	1.4	4.7	Farmland of statewide importance
37C3	Hayesville clay loam, 7 to 15 percent slopes, severely eroded	0.1	0.4	
77	Dan River-Codorus complex, 0 to 2 percent slopes, occasionally flooded	5.7	19.3	Prime and unique farmland
88	Udorthents, loamy, 2 to 25 percent slopes	6.6	22.2	



Area of Potential Effect (APE)
Stream
Farmland of Statewide Importance
Prime and Unique Farmland
Non-Prime or Other Important Farmlands

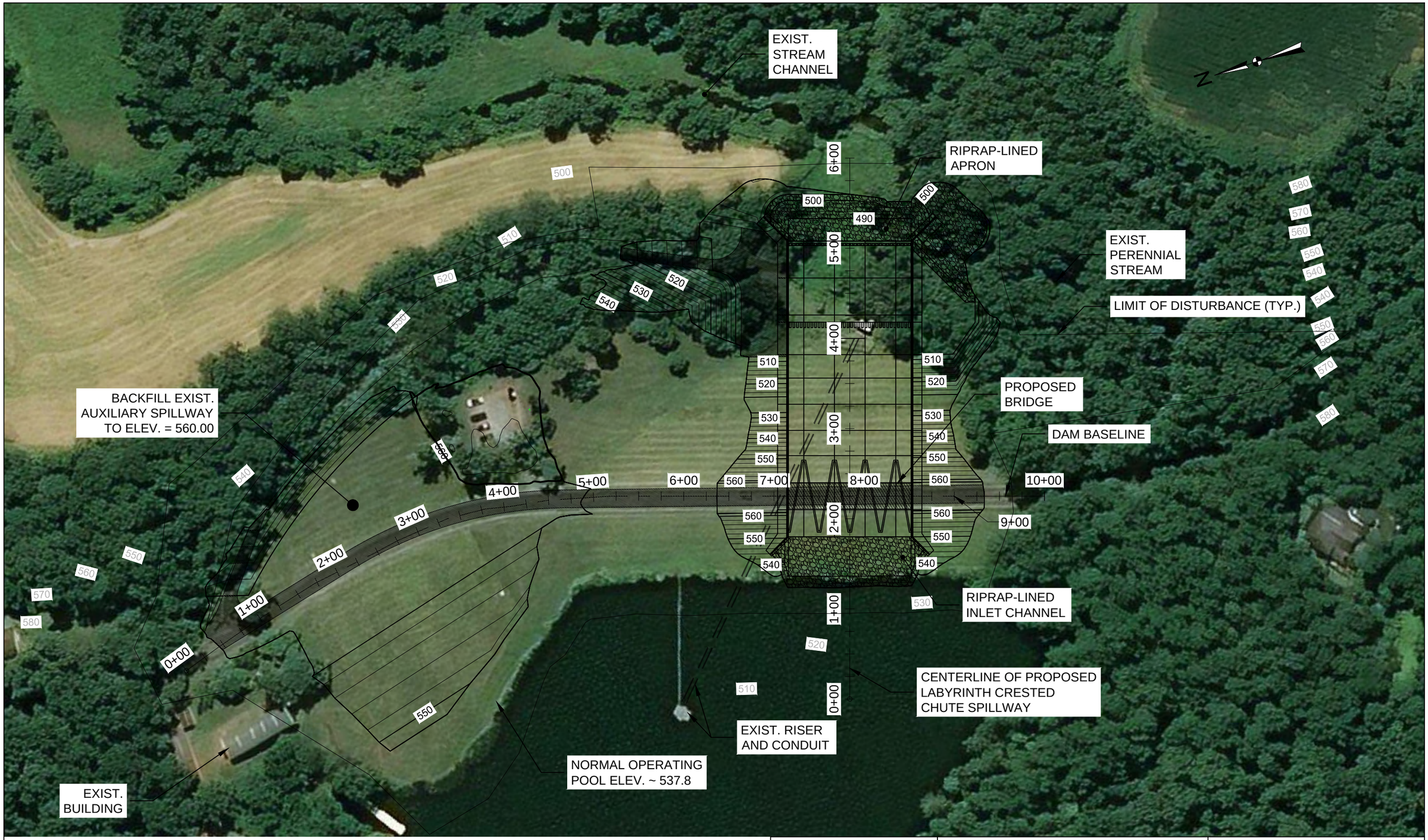
N

0 200 400 800
Feet

Figure C-5f: Prime and Unique Farmland

RIVANNA WATER AND SEWER AUTHORITY

Hazen



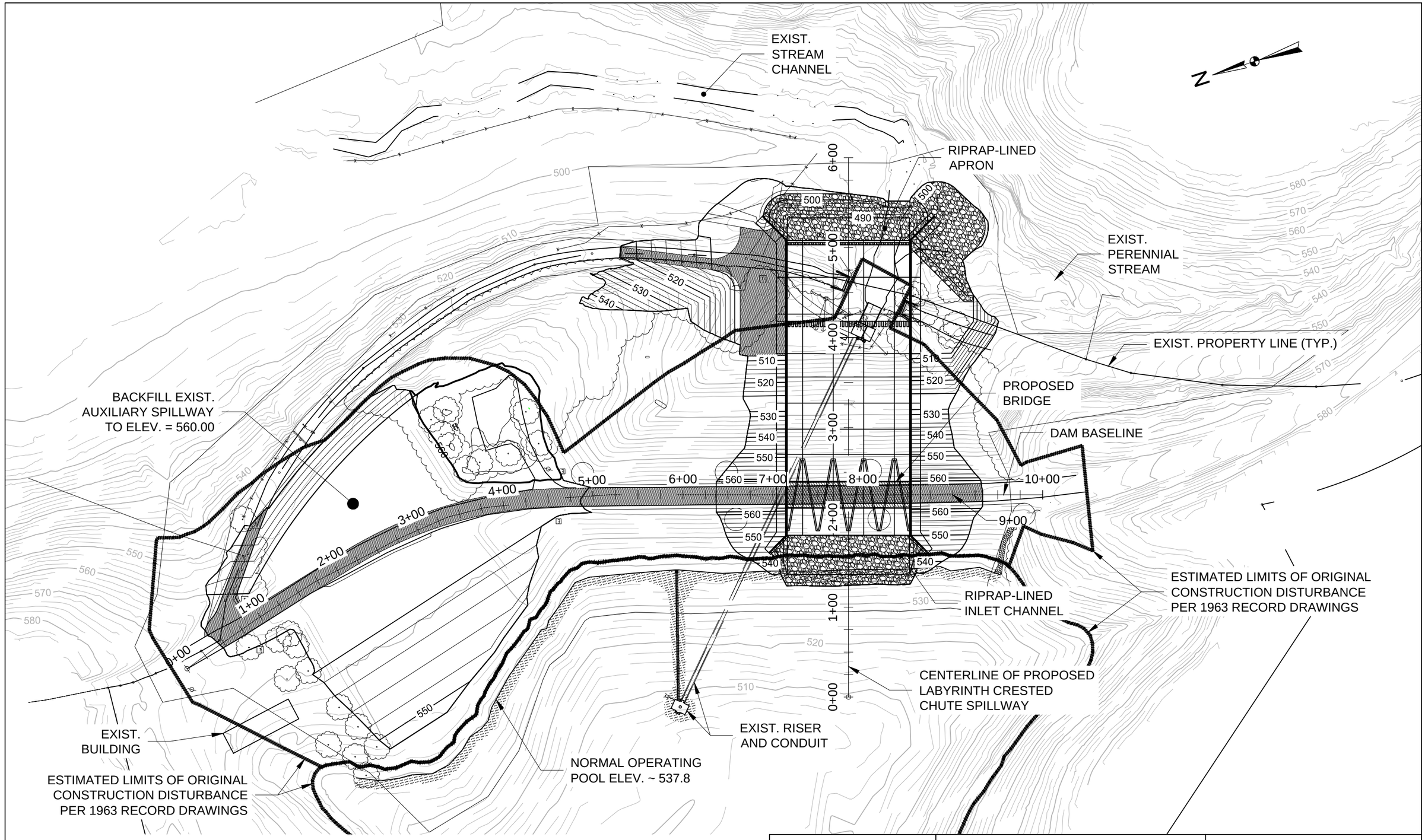
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

CONCEPTUAL
PROPOSED SITE PLAN
ALTERNATIVE 1

FIGURE C-6

H:\2018\ALPH\18C17111.00 BEAVER CREEK FINAL DESIGN\03-SE PRODUCTS\08-CAD\DRAWINGS\06-WORKING\BC1_ALT 1.DWG



Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

CONCEPTUAL
PROPOSED SITE PLAN
ALTERNATIVE 1

FIGURE 7a

EXIST. STREAM CHANNEL

EXIST. PROPERTY LINE (TYP.)

EXIST. ACCESS ROAD TO BE USED DURING CONSTRUCTION AND REPLACED UPON COMPLETION OF WORK

TEMPORARY STAGING AND LAYDOWN AREA

EXIST. ROADWAY TO BE RAISED IN EXIST. AUXILIARY SPILLWAY AREA AND REPLACED AFTER BRIDGE IS IN OPERATION

EXIST. PERENNIAL STREAM

PROPOSED BRIDGE AND SPILLWAY CONSTRUCTED FROM SPILLWAY CENTERLINE STATION 2+10 TO 5+50 PRIOR TO REMOVAL OF ROADWAY DIVERSION / COFFERDAM AND CONSTRUCTION OF REMAINDER OF SPILLWAY AND INLET CHANNEL

ESTIMATED LIMITS OF ORIGINAL CONSTRUCTION DISTURBANCE PER 1963 RECORD DRAWINGS

CENTERLINE OF ROADWAY DIVERSION / COFFERDAM

CENTERLINE OF PROPOSED LABYRINTH CRESTED CHUTE SPILLWAY

EXIST. RISER AND CONDUIT

ASSUMED TEMPORARY CONSTRUCTION RESERVOIR LEVEL ~ 528.0

EXIST. BUILDING

ESTIMATED LIMITS OF ORIGINAL CONSTRUCTION DISTURBANCE PER 1963 RECORD DRAWINGS

NOTE:

1. ALL DETOUR ALIGNMENT AND STRUCTURE INFORMATION IS CONSIDERED CONCEPTUAL AND IS SUITABLE FOR PLANNING PURPOSES ONLY. FINAL DETOUR ROUTES, STRUCTURES, AND TRAFFIC CONTROL MEASURES SHALL BE DETERMINED FOR THE SELECTED ALTERNATIVE DURING THE DESIGN PHASE AND SHALL BE COORDINATED WITH VDOT.

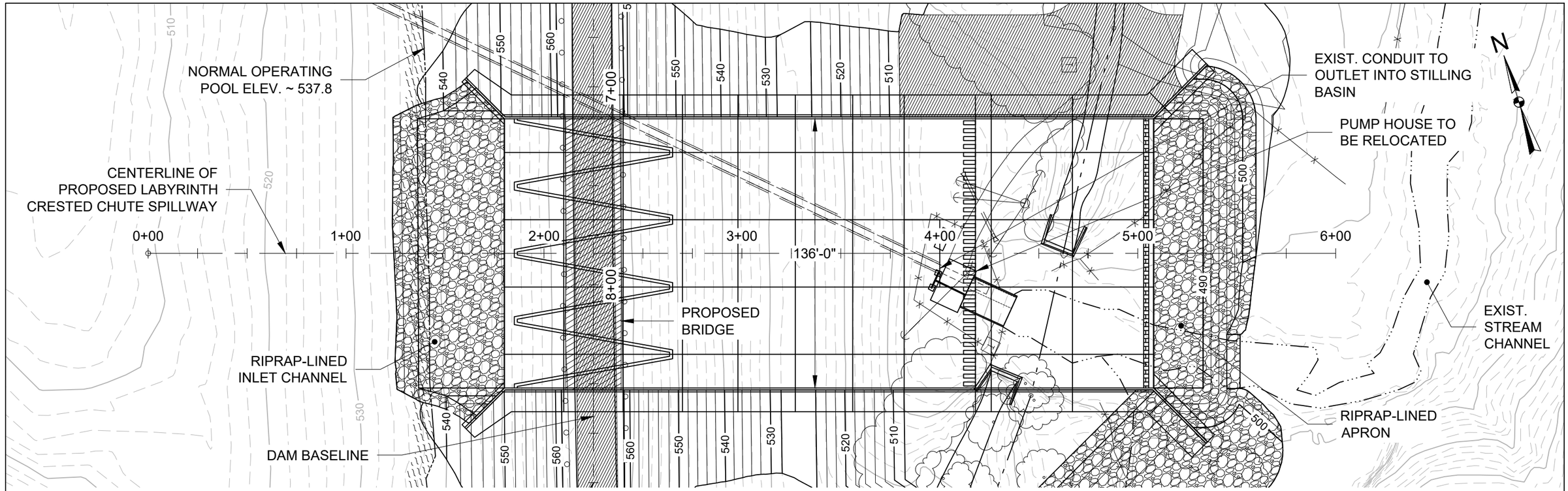
0 100' 200'

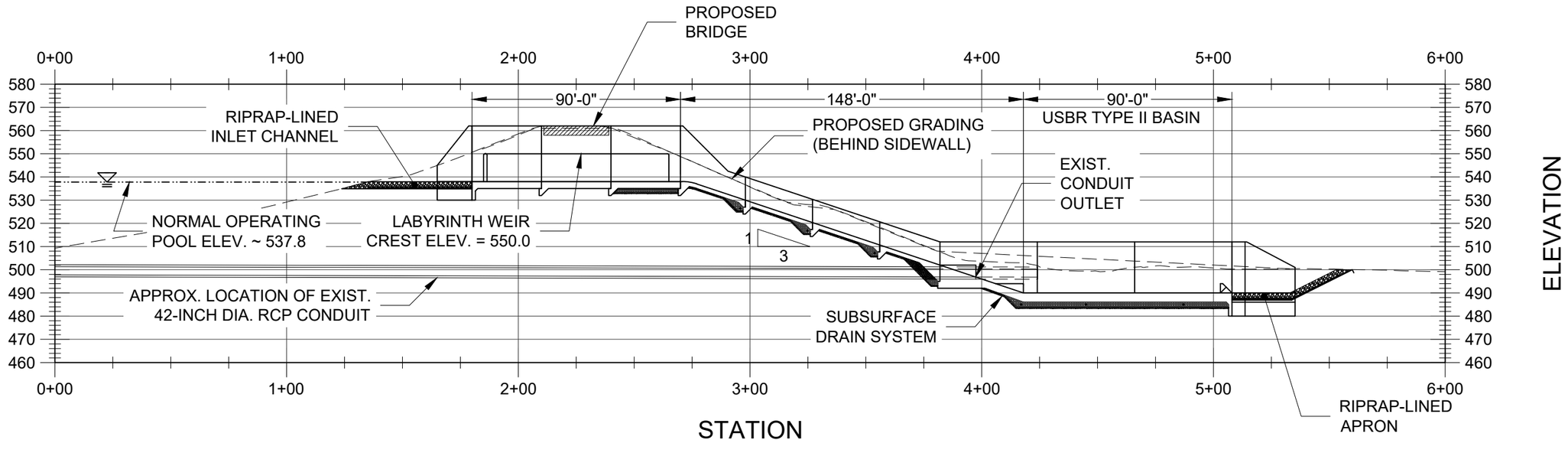
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

CONCEPTUAL
COFFERDAM / TRAFFIC
DIVERSION PLAN
ALTERNATIVE 1

FIGURE 7b





0 50' 100'

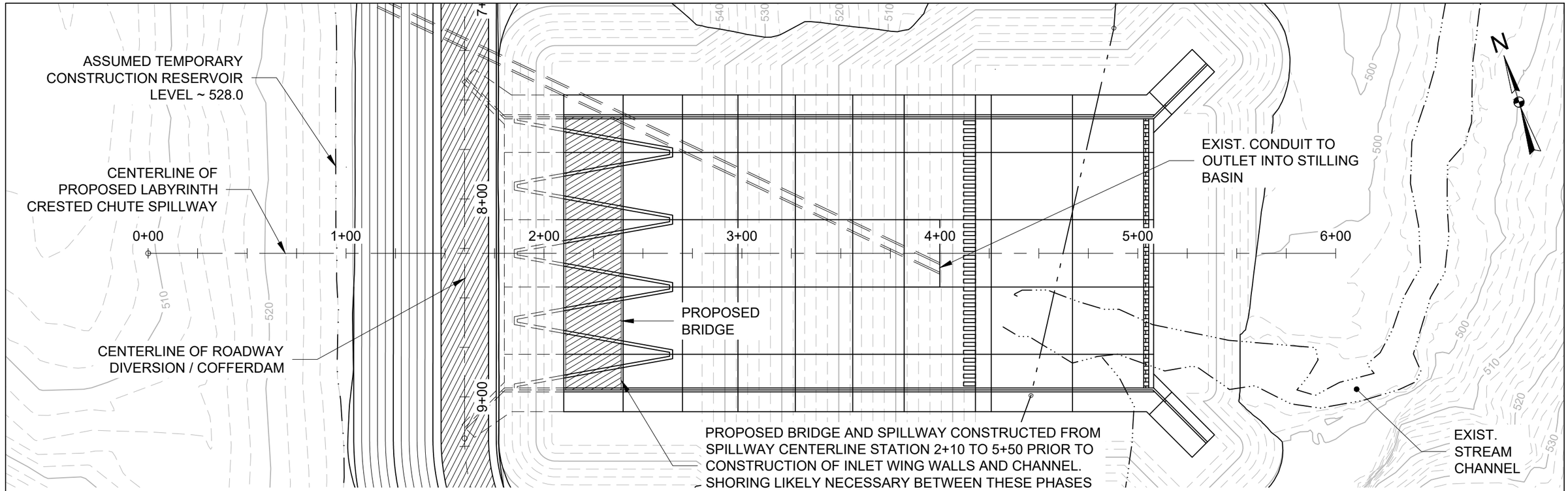
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

CONCEPTUAL
SPILLWAY PLAN AND PROFILE
ALTERNATIVE 1

Figure 8a

G:\2018 PROJECTS\18C17111.00 BEAVER CREEK FINAL DESIGN\03-SE PRODUCTS\08-CAD\DRAWINGS\06-WORKING\BC1_ALT 1.DWG

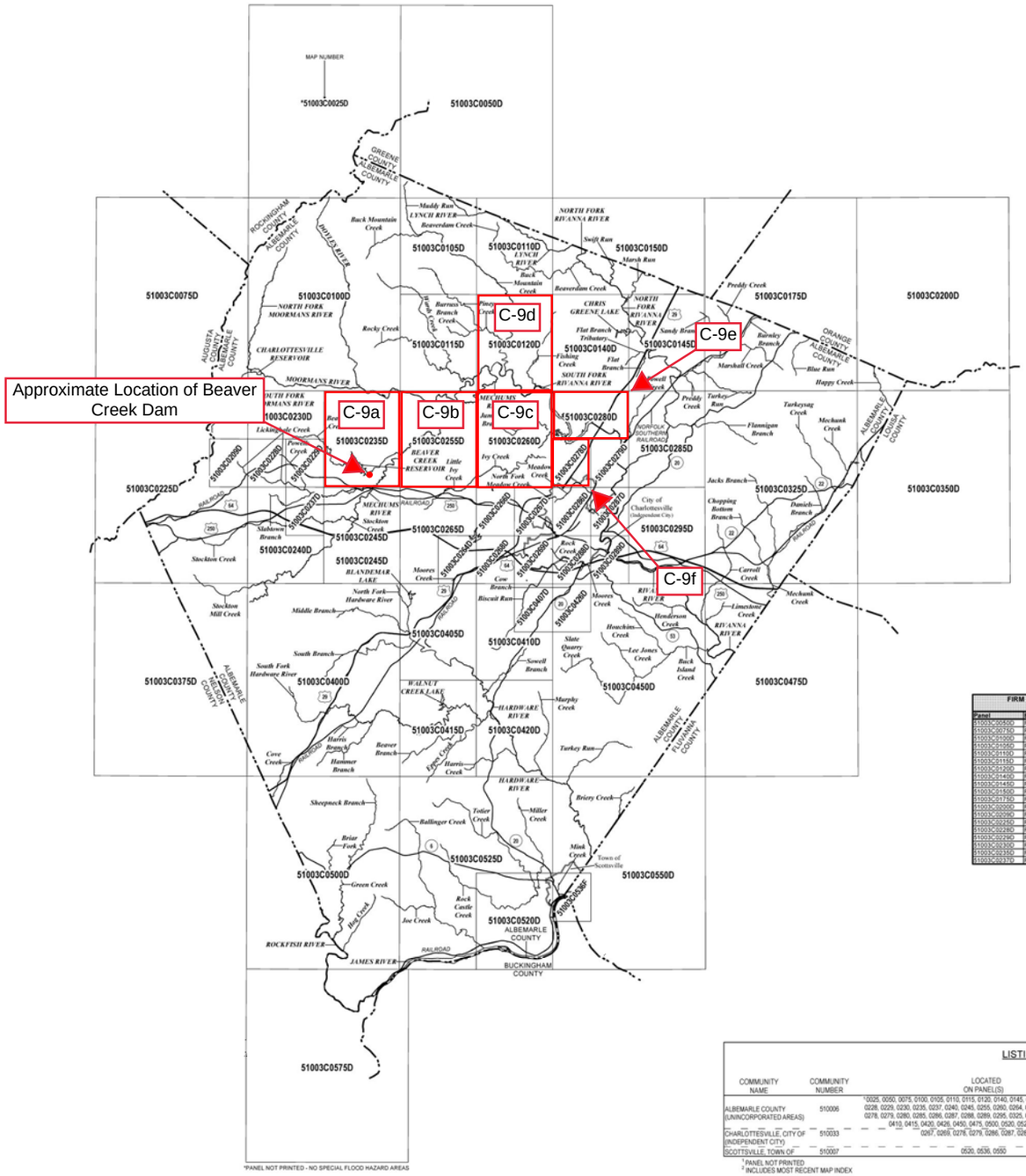


Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

CONCEPTUAL SPILLWAY PLAN AND PROFILE SHOWING COFFERDAM / DIVERSION ALTERNATIVE 1 Figure 8b

G:\2018 PROJECTS\18C17111.00 BEAVER CREEK FINAL DESIGN\03-SE PRODUCTS\08-CAD\DRAWINGS\06-WORKING\BC1_ALT 1_CONSTRUCTION_DIVERSION.DWG



MAP DATES

This FIRM Index displays the map date for each FIRM panel at the time that this Index was printed. Because this Index may not be distributed to unaffected communities in subsequent revisions, users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website at http://msc.fema.gov, or by calling the FEMA Map Information eXchange (FMIX) at 1-877-336-2627.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

NOTE TO USER

Future revisions to this FIRM Index will only be issued to communities that are located on FIRM panels being revised. This FIRM Index therefore remains valid for FIRM panels dated May 16, 2016 or earlier. Please refer to the "MOST RECENT FIRM PANEL DATE" column in the Listing of Communities table to determine the most recent FIRM Index date for each community.

MAP REPOSITORIES

(Maps available for reference only, not for distribution.)

ALBEMARLE COUNTY
(UNINCORPORATED AREAS):
Department of Community Development
401 McIntire Road
Charlottesville, Virginia 22902

CHARLOTTESVILLE, CITY OF
(INDEPENDENT CITY):
Charlottesville City Hall
Neighborhood Development Services
Fourth Street, Northwest
Charlottesville, Virginia 22902

SCOTTSVILLE, TOWN OF:
Scottsville Town Office
Victory Hall, 2nd Floor
401 Valley Street
Scottsville, Virginia 24590

FIRM Panel Dates For Printed Panels Of Albemarle County, Virginia And Incorporated Areas And The Independent City of Charlottesville

Panel	Effective Date	Panel	Effective Date	Panel	Effective Date
51003C0050D	February 04, 2005	51003C0240D	February 04, 2005	51003C0325D	February 04, 2005
51003C0075D	February 04, 2005	51003C0245D	February 04, 2005	51003C0350D	February 04, 2005
51003C0100D	February 04, 2005	51003C0255D	February 04, 2005	51003C0375D	February 04, 2005
51003C0105D	February 04, 2005	51003C0260D	February 04, 2005	51003C0400D	February 04, 2005
51003C0110D	February 04, 2005	51003C0265D	February 04, 2005	51003C0405D	February 04, 2005
51003C0115D	February 04, 2005	51003C0280D	February 04, 2005	51003C0407D	February 04, 2005
51003C0120D	February 04, 2005	51003C0285D	February 04, 2005	51003C0410D	February 04, 2005
51003C0140D	February 04, 2005	51003C0295D	February 04, 2005	51003C0415D	February 04, 2005
51003C0145D	February 04, 2005	51003C0268D	February 04, 2005	51003C0420D	February 04, 2005
51003C0150D	February 04, 2005	51003C0269D	February 04, 2005	51003C0426D	February 04, 2005
51003C0175D	February 04, 2005	51003C0278D	February 04, 2005	51003C0450D	February 04, 2005
51003C0200D	February 04, 2005	51003C0279D	February 04, 2005	51003C0475D	February 04, 2005
51003C0225D	February 04, 2005	51003C0282D	February 04, 2005	51003C0500D	February 04, 2005
51003C0226D	February 04, 2005	51003C0285D	February 04, 2005	51003C0525D	February 04, 2005
51003C0228D	February 04, 2005	51003C0286D	February 04, 2005	51003C0526D	February 04, 2005
51003C0229D	February 04, 2005	51003C0287D	February 04, 2005	51003C0536F	May 16, 2016
51003C0230D	February 04, 2005	51003C0288D	February 04, 2005	51003C0550D	February 04, 2005
51003C0235D	February 04, 2005	51003C0289D	February 04, 2005	51003C0575D	February 04, 2005
51003C0237D	February 04, 2005	51003C0295D	February 04, 2005		

LISTING OF COMMUNITIES

COMMUNITY NAME	COMMUNITY NUMBER	LOCATED ON PANEL(S)	INITIAL ID DATE	INITIAL NFIP MAP DATE	INITIAL FIRM DATE	[2]MOST RECENT FIRM PANEL DATE
ALBEMARLE COUNTY (UNINCORPORATED AREAS)	510006	[1]0025, 0050, 0075, 0100, 0105, 0110, 0115, 0120, 0140, 0145, 0150, 0175, 0200, 0209, 0225 0228, 0229, 0230, 0235, 0237, 0240, 0245, 0255, 0260, 0264, 0265, 0266, 0267, 0268, 0269 0278, 0279, 0280, 0285, 0286, 0287, 0288, 0289, 0295, 0325, 0350, 0375, 0400, 0405, 0407 0410, 0415, 0420, 0426, 0450, 0475, 0500, 0520, 0525, 0536, 0550, 0575	AUGUST 25, 1978	AUGUST 25, 1978	DECEMBER 16, 1980	MAY 16, 2016
CHARLOTTESVILLE, CITY OF (INDEPENDENT CITY)	510033	0267, 0269, 0278, 0279, 0286, 0287, 0288, 0289	MAY 24, 1974	MAY 24, 1974	JUNE 15, 1979	FEBRUARY 4, 2005
SCOTTSVILLE, TOWN OF	510007	0520, 0536, 0550	SEPTEMBER 10, 1976	SEPTEMBER 10, 1976	SEPTEMBER 5, 1979	MAY 16, 2016

[1] PANEL NOT PRINTED
[2] INCLUDES MOST RECENT MAP INDEX

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

ALBEMARLE COUNTY, VIRGINIA AND INCORPORATED AREAS AND THE INDEPENDENT CITY OF CHARLOTTESVILLE

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

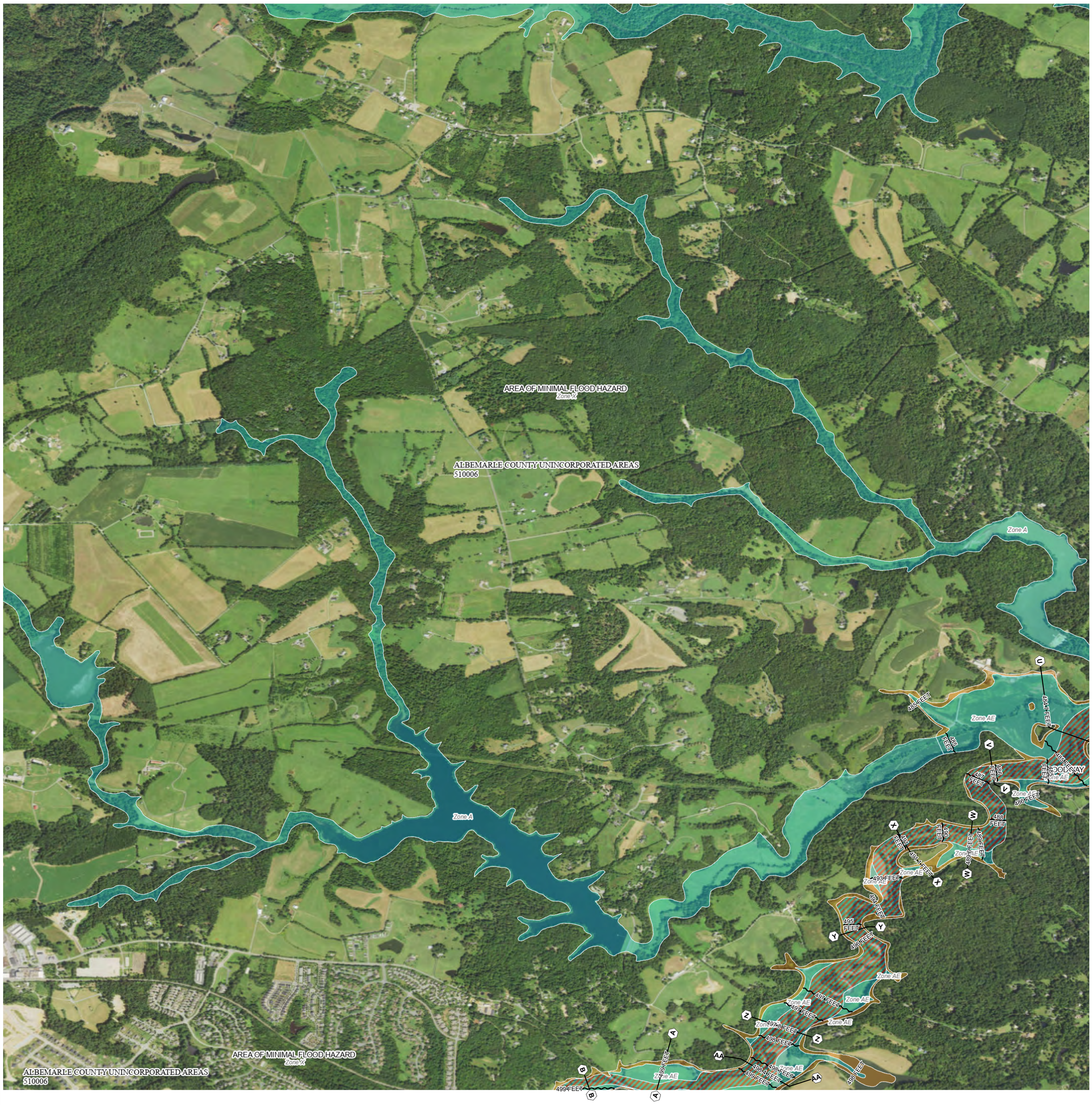
PANELS PRINTED: 50, 75, 100, 105, 110, 115, 120, 140, 145, 150, 175, 200, 209, 225, 228, 229, 230, 235, 237, 240, 245, 255, 260, 264, 265, 266, 267, 268, 269, 278, 279, 280, 285, 286, 287, 288, 289, 295, 325, 350, 375, 400, 405, 407, 410, 415, 420, 426, 450, 475, 500, 520, 525, 536, 550, 575

MAP NUMBER
51003CINDOC
MAP REVISED
MAY 16, 2016

Federal Emergency Management Agency

78°41'15.87"W 38°7'43.2"N

Figure C-9a



78°37'29.15"W 38°3'31.85"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **11/8/2021 4:02 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **235** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0235

MAP NUMBER
51003C0235D
EFFECTIVE DATE
February 04, 2005

78°37'30.87"W 38°7'43.2"N

Figure C-9b

78°33'44.15"W 38°3'31.85"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

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SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
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N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **255** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0255

MAP NUMBER
51003C0255D
EFFECTIVE DATE
February 04, 2005

78°33'45.87"W 38°7'43.2"N

Figure C-9c

78°29'59.15"W 38°3'31.85"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

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This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **11/8/2021 4:07 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

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SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
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N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **260** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0260

MAP NUMBER
51003C0260D
EFFECTIVE DATE
February 04, 2005

78°33'45.87"W 38°11'28.2"N

Figure C-9d

78°29'59.15"W 38°7'16.85"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

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This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **11/8/2021 4:08 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

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SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **120** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0120

MAP NUMBER
51003C0120D
EFFECTIVE DATE
February 04, 2005

78°30'W 38°8'39.45"N

Figure C-9e

78°26'14.15"W 38°4'28.1"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

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SCALE

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Vertical Datum: NAVD88
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N

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 3,000 4,000 Feet

0 105 210 420 630 840 Meters

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **280** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0280

MAP NUMBER
51003C0280D
EFFECTIVE DATE
February 04, 2005

78°30'W 38°5'44.12"N

Figure C-9f

78°28'7.08"W 38°3'38.44"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	(B) 20.2 Cross Sections with 1% Annual Chance
	17.5 Water Surface Elevation
	(8) Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

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To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **11/8/2021 4:09 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 500 feet 1:6,000

0 250 500 1,000 1,500 2,000 Feet

0 50 100 200 300 400 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **278** OF **575**

Panel Contains:

COMMUNITY	NUMBER	PANEL
CITY OF CHARLOTTESVILLE	510033	0278
ALBEMARLE COUNTY UNINCORPORATED AREAS	510006	0278

MAP NUMBER
51003C0278D
EFFECTIVE DATE
February 04, 2005

Figure C-10

Beaver Creek Dam																			
Inundation Summary with Elevations																			
Location Description	Distance from Dam (miles)	Stream Bed Elevation (NAVD 88, feet)	Minimum Roadway Elevation (NAVD 88, feet)	Observed Water Surface Elevation 5/12/2010 (NAVD 88, feet)	Standard Design Flood (Probable Maximum Flood)										Sunny Day Failure				
					Dam Failure						No Dam Failure								
					Time of Arrival of Flood Wave* (hours)	Time of Arrival of Peak Flood* (hours)	Maximum Discharge (cfs)	Maximum Water Surface Elevation (NAVD 88,	Depth to Stream Bottom (feet)	Depth above Roadway (feet)	Maximum Discharge (cfs)	Maximum Water Surface Elevation (NAVD 88,	Depth to Stream Bottom (feet)	Depth above Roadway (feet)	Time of Arrival of Flood Wave* (hours)	Time of Arrival of Peak Flood* (hours)	Maximum Discharge (cfs)	Maximum Water Surface Elevation (NAVD 88,	Depth to Stream Bottom (feet)	Depth above Roadway (feet)
Decca Lane	4.5	434.2	459.5	409.0	0.2	1.0	90,500	487.8	53.7	78.9	46,900	474.6	40.4	65.7	0.5	1.2	23,000	463.7	29.5	54.8
Garth Road	5.4	434.0	467.1	402.4	0.4	1.0	90,200	481.9	47.9	79.5	47,100	468.2	35.2	66.8	0.5	1.4	21,400	457.8	23.8	---
Free Union Road	9.6	398.8	426.6	374.8	0.7	1.8	83,300	440.9	42.1	66.1	48,100	435.8	37.0	61.0	0.7	2.3	19,000	420.4	21.6	---
Reas Ford Road	14.5	367.0	403.0	381.3	1.0	2.5	89,700	412.7	45.7	31.4	61,100	407.1	40.1	25.8	1.3	3.2	17,400	392.0	25.0	---
Co Rd 743	18.2	347.4	399.0	381.3	1.5	3.2	85,300	401.2	53.9	19.9	60,200	397.2	49.8	---	1.7	4.1	14,300	387.0	39.7	---
South Fork Rivanna River Dam**	19.9	338.7	399.3	381.3	1.6	3.4	85,000	393.5	54.8	---	60,100	391.2	52.5	---	1.8	4.5	14,000	385.3	46.6	---

*Time from the initiation of the breach.

** The primary spillway crest elevation of South Fork Rivanna River Dam is 381.3 feet, NAVD 88. The top of dam elevation is 399.3 feet, NAVD 88.

Since the plotted inundation limits are based upon interpolations and significant assumptions, it is considered prudent for emergency warnings and evacuations to include populated areas outside of, but adjacent to, the inundation limits shown.
The information contained in this map is prepared for use in notification of downstream property owners by emergency management personnel.

BEAVER CREEK DAM

LIMIT OF STUDY

SOUTH RIVANNA DAM

Legend

- SUNNY DAY BREACH
- PMF NO BREACH
- PMF BREACH
- 0.5 PMF NO BREACH
- 0.5 PMF BREACH

AFFECTED BUILDINGS

- AFFECTED NON-RESIDENTIAL BUILDING
- AFFECTED RESIDENTIAL BUILDING
- RIVER

Notes:

1. The information contained in this map is prepared for use in notification of downstream property owners by emergency management personnel.
2. Mapping of flooded areas and floodwave travel times are approximate. Timing and extent of actual inundation may differ from information presented on this map.
3. It is prudent to assume that areas outside, but adjacent to, the inundation limits shown could also be flooded.
4. Due to the topography, floodwave similarities, and map scale, inundation lines may obscure other inundation lines at some locations on the map.
5. Hazard Potential Classification: **HIGH**
6. Spillway Design Flood: **Probable Maximum Flood**
7. The dam's hazard potential classification information shown in this map documents the conditions at the time the map is signed and printed.
8. The impacted addresses shown on the map are a result of the Spillway Design Flood with Breach.
9. Dam break inundation zone maps shall be provided by the owner to the local government for use in review of proposed development plans and zoning.

1:24,000

0 325650 1,300 1,950 2,600 3,250 3,900 4,550 5,200 5,850 6,500 7,150 7,800 8,450 9,100 9,750 10,400 Feet

Projection: NAD 1983, State Plane [Feet] Virginia, North (FIPS 4501)
Sources: Virginia Geographic Information Network (2009)
Aerial Imagery Copyright Commonwealth of Virginia (2009)

DESIGNED BY: PIW	DRAWN BY: JTH	CHECKED BY: PIW	REV	DESCRIPTION	DATE
PAUL I. WELLE DATE: 8/11/2011 VIRGINIA PROFESSIONAL ENGINEER NUMBER 0402044190					

COMMONWEALTH OF VIRGINIA REGISTERED PROFESSIONAL ENGINEER PAUL I WELLE Lic. No. 44190

Schnabel ENGINEERING
1380 WILMINGTON PIKE, SUITE 100 WEST CHESTER, PA / 19382
T/ 610-696-3066 F/ 610-696-7777 / SCHNABEL-ENG.COM

BEAVER CREEK DAM
RIVANNA WATER & SEWER AUTHORITY
ALBEMARLE COUNTY, VIRGINIA

DAM BREACH INUNDATION MAP

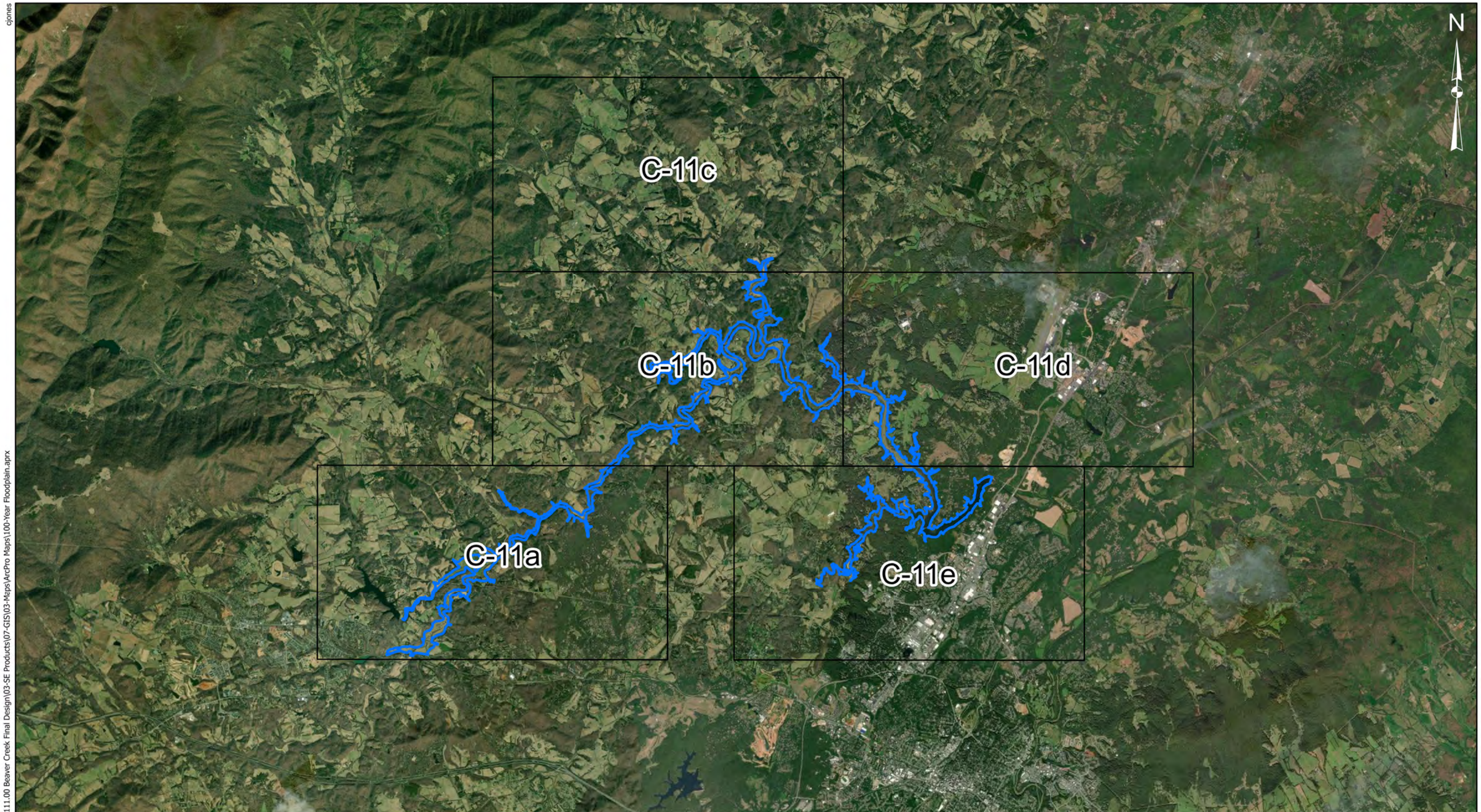
DRAWING NO: 10215011.00

SHEET: 1 OF 1

11/19/2021 B:\GIS_Data\2010\10215011 - RWSA Dam Certification\Projects\Beaver Creek\Beaver Creek.aprx

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\100-Year Floodplain.aprx



Sheet Index

100-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 4,000 8,000 16,000 US Feet

Scale: 1:100,000 1 inch equals 8,333 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\100-Year Floodplain.aprx

N

BEAVER CREEK 1
RESERVOIR

100-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11a

cjones

N

100-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

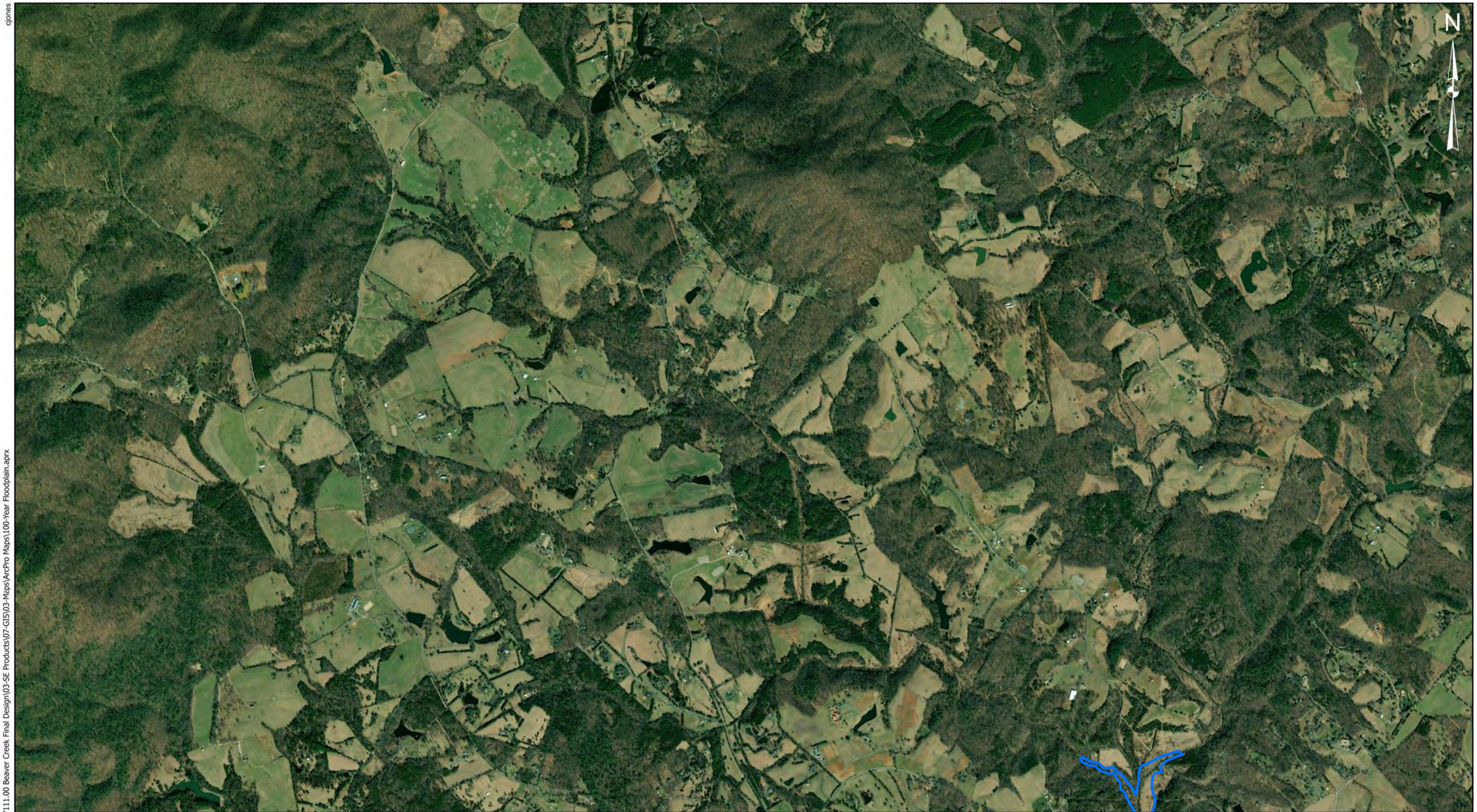
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11b

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\100-Year Floodplain.aprx



100-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11c

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\100-Year Floodplain.aprx cjones

cjones

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Mxds\ArcPro Maps\100-Year Floodplain.aprx

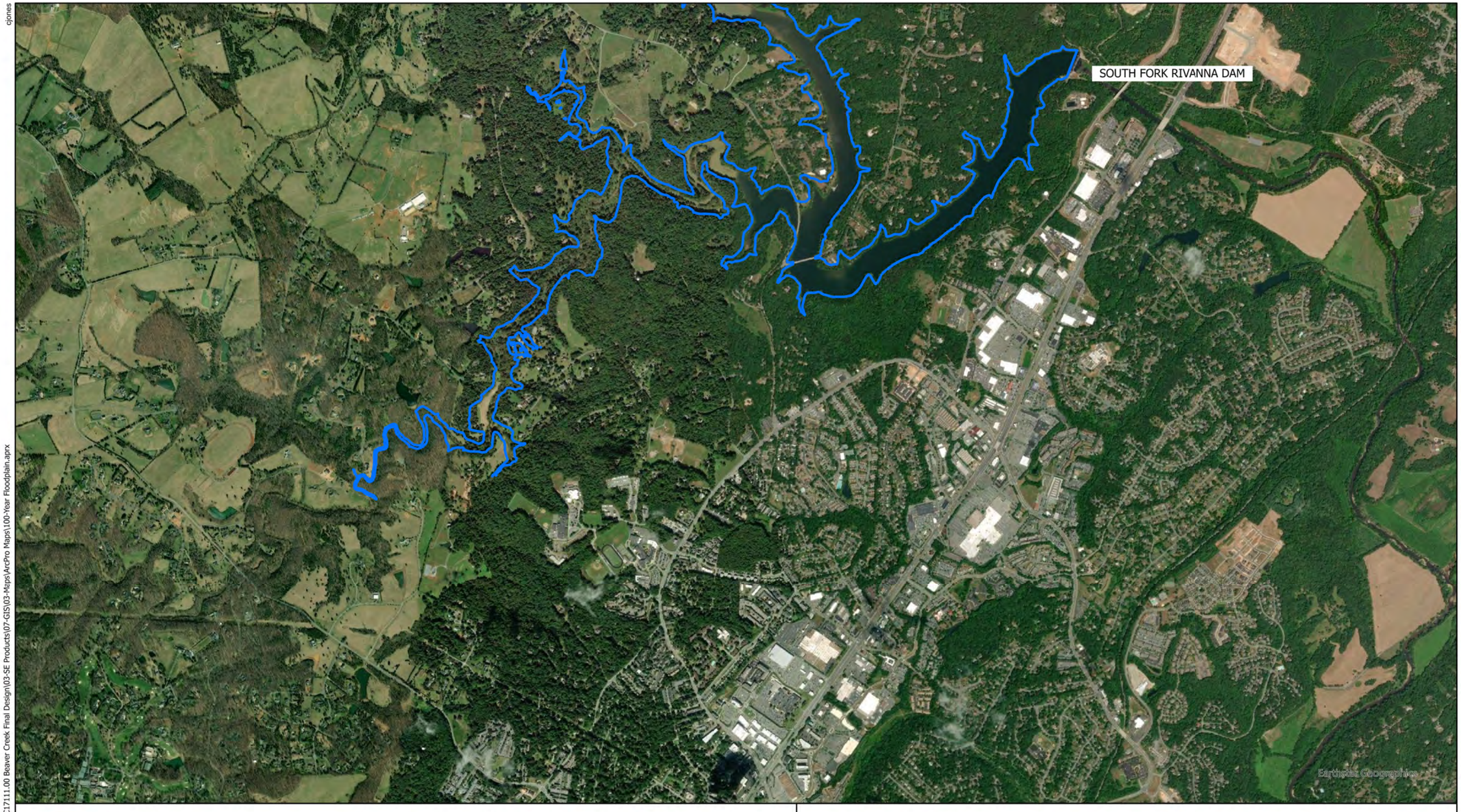
100-Year Flood Inundation Boundary

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11d



100-Year Flood Inundation Boundary

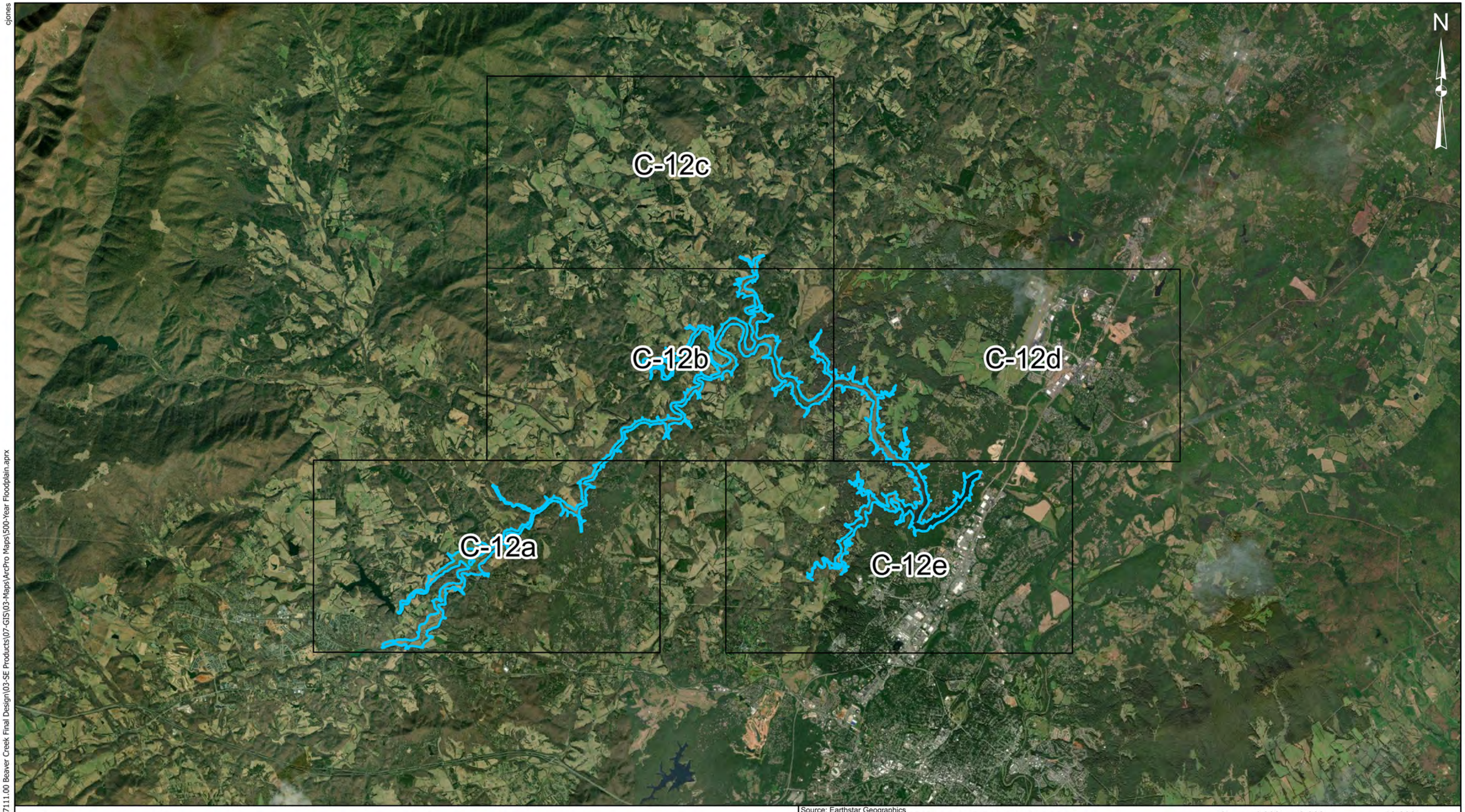
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

100-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-11e

11/19/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\100-Year Floodplain.aprx cjones



Sheet Index

500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 4,000 8,000 16,000 US Feet

Scale: 1:100,000 1 inch equals 8,333 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12

11/9/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\500-Year Floodplain.aprx

cjones

11/9/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\500-Year Floodplain.aprx

N

BEAVER CREEK 1
RESERVOIR

500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12a

cjones

11/9/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\500-Year Floodplain.aprx

N

500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12b

500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12c

11/9/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\500-Year Floodplain.aprx cjones

cjones

11/9/2021 H:\2018\ALPH\18C17111.00 Beaver Creek Final Design\03-SE Products\07-GIS\03-Maps\ArcPro Maps\500-Year Floodplain.aprx

N

500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

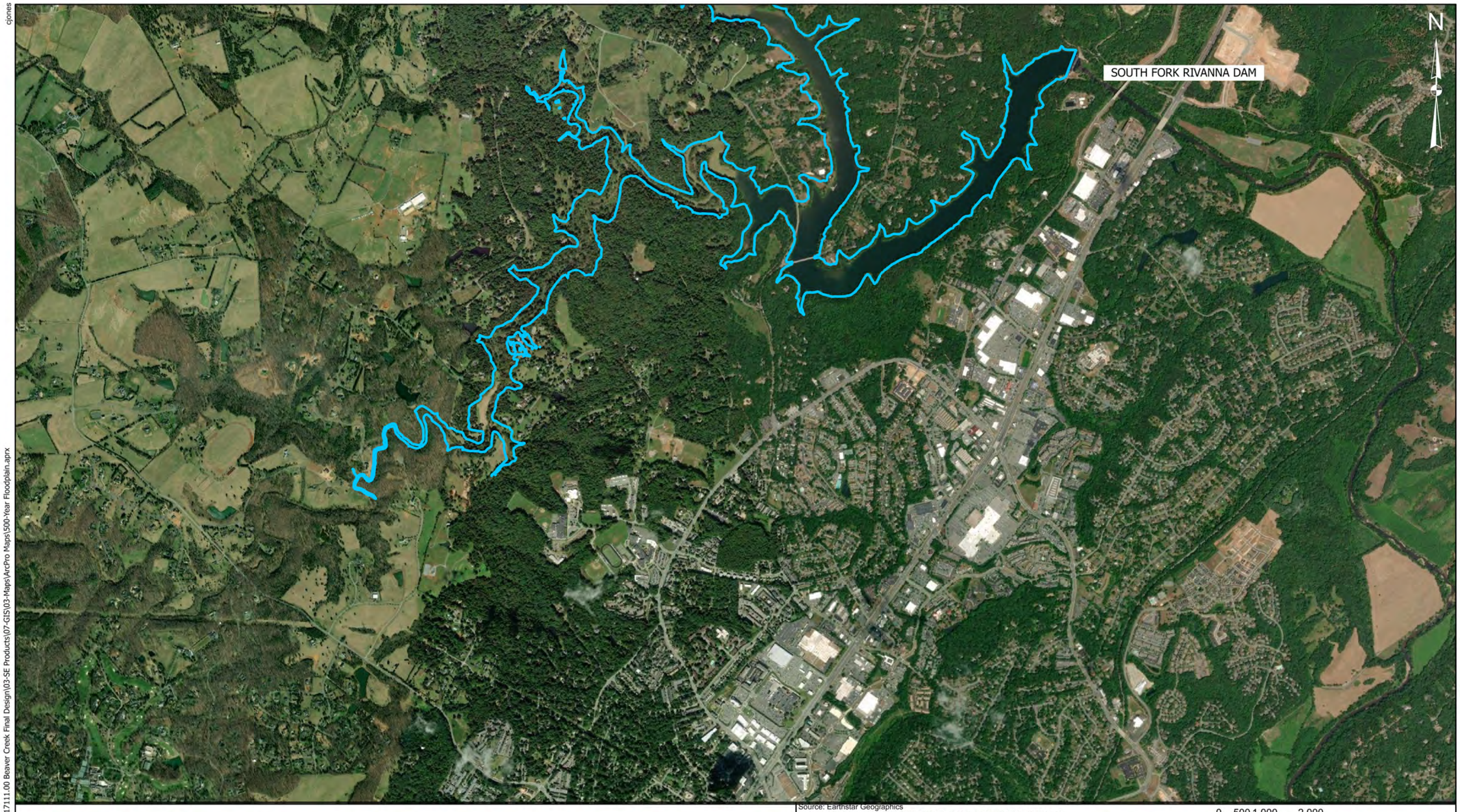
0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12d



500-Year Flood Inundation Boundary

Source: Earthstar Geographics
Spatial Reference PCS: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

0 500 1,000 2,000
US Feet
Scale: 1:24,000 1 inch equals 2,000 feet

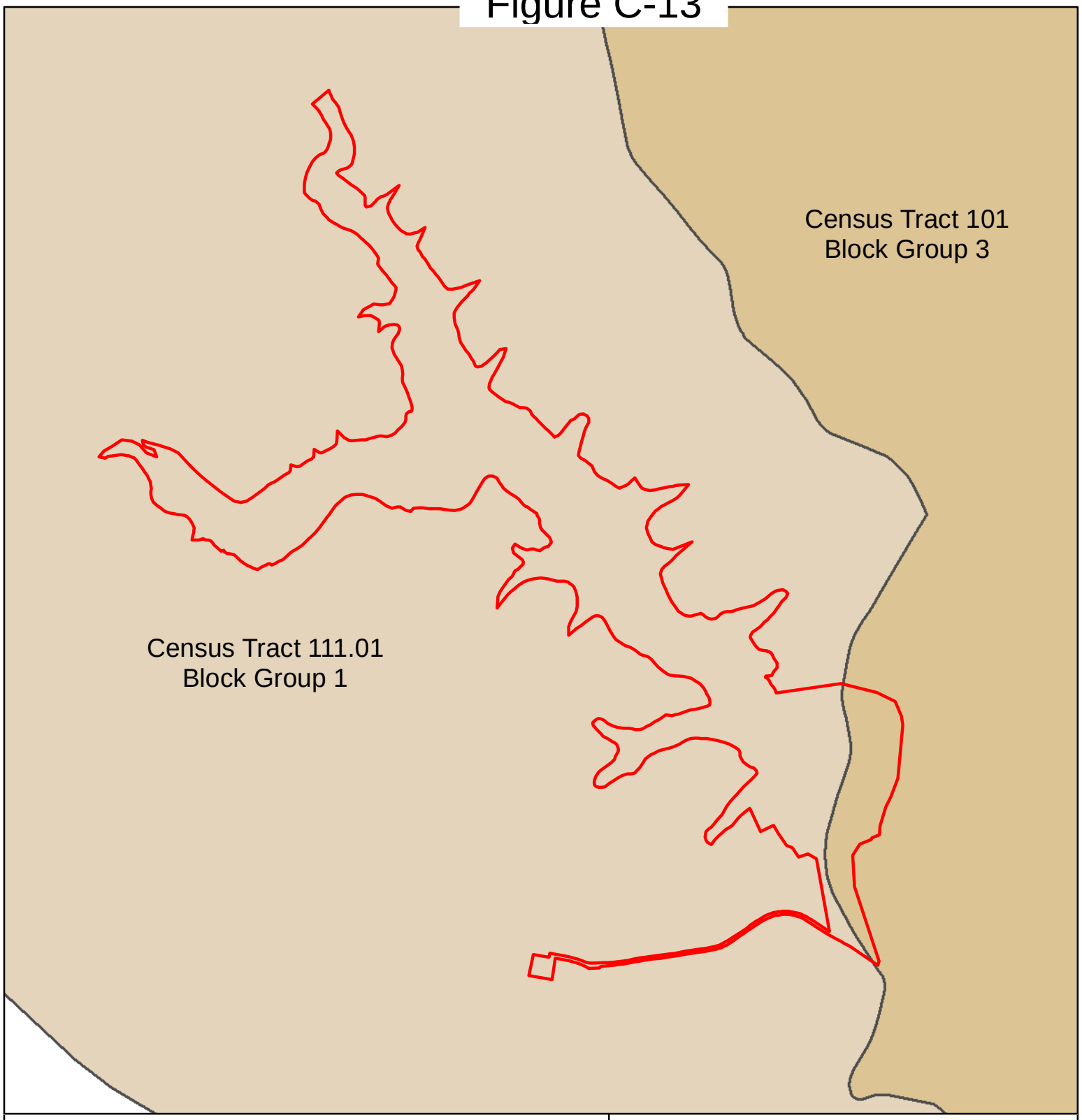
Schnabel ENGINEERING

BEAVER CREEK DAM NO. 1
RWSA - ALBEMARLE COUNTY, VIRGINIA
PROJECT NO. 18C17111.00

500-YEAR INUNDATION BOUNDARY - WITH DAM

FIGURE C-12e

Figure C-13



Area of Potential Effect

0 500 1,000 2,000 Feet

N

FIGURE C-13:
ENVIRONMENTAL
JUSTICE ANALYSIS

RIVANNA WATER
AND SEWER AUTHORITY

Hazen

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APPENDIX D

INVESTIGATION AND ANALYSES REPORT

Appendix D:
Investigations and Analyses Used in the Planning for the Rehabilitation of Beaver Creek Multiple-Purpose Structure No. 1

1.0 INTRODUCTION

This report will present relevant information related to the development of Supplemental Watershed Plan No. 2 for Beaver Creek in Albemarle County, Virginia. The following headings are provided:

CONTENTS

1.1 Project Background

Beaver Creek 1 is the sole planned multiple-purpose structure in the Beaver Creek Watershed in Albemarle County, Virginia. The project was constructed by SCS in 1964 for the purposes of county water supply and flood control. The dam is currently owned by Albemarle County and operated by the Rivanna Water and Sewer Authority (RWSA). The original project was designed and constructed as a Significant hazard potential dam per SCS classification criteria at that time and the rural character of the watershed and downstream areas.

In 2011, Schnabel Engineering, LLC (Schnabel) performed a dam breach inundation analysis as part of the Virginia Department of Conservation and Recreation Dam Safety operations permit requirements to confirm the hazard classification. DCR determined that the project was high hazard potential per the Virginia Impounding Structure Regulations. As such, the project does not meet current requirements in Virginia for high hazard potential impounding structures based on inadequate spillway capacity. Since that time, RWSA and the Sponsors have been working towards rehabilitating the project to bring it into compliance with Commonwealth requirements for high hazard potential dams.

Spillway alternatives to safely pass discharge associated with the design storm event were developed and evaluated in 2012. In 2015, Virginia DCR released a Virginia-specific Probable Maximum Precipitation (PMP) study which provided GIS utilities and other resources to estimate site-specific PMP rainfall amounts for local, tropical, and general storm distributions. (Applied Weather Associated 2015). The Sponsors decided to revise the Beaver Creek 1 spillway alternative evaluation by incorporating the Commonwealth's new PMP study to evaluate whether other spillway alternatives would be more cost effective.

The VA Impounding Structure Regulations (4VAC20-50) require that existing dams being rehabilitated to high hazard potential standards must safely store and/or discharge runoff associated with 90% of the PMP. RWSA maintains a higher standard and requires that consultants provide spillway designs that are capable of passing runoff associated with the full PMP. The flood routing results indicated that a significant amount of additional discharge capacity during the design storm event was required to meet the project requirements.

The alternatives developed in 2012 were re-evaluated and revised based on the revised hydrologic analyses and a preferred alternative was selected by RWSA and the sponsors in 2018. Based on evaluations of cost, impacts to the local community, publicly held meetings with the

Crozet Community Advisory Committee, considerations of closing Browns Gap Turnpike, the character of the existing park and the needs of the community, the Sponsors selected to construct a reinforced-concrete labyrinth-crested chute spillway over the existing embankment structure as the preferred dam safety alternative. RWSA's consultant developed a Preliminary Engineering Report (PER) to re-frame the alternatives evaluation and present additional detail for the proposed alternative. The PER is a required submittal to DCR for obtaining an Operations Permit. The Beaver Creek 1 PER was developed and RWSA established an agreement with Schnabel to perform detailed design of the selected alternative in 2018. The proposed spillway alternative was a reinforced-concrete, 3 ½ cycle labyrinth crested chute spillway over the embankment, with the existing vegetated auxiliary spillway raised, but maintained as an auxiliary spillway. The purpose of this measure was to reduce width of the labyrinth and chute to conserve cost. This resulted in the labyrinth weir having ½ less cycle while still maintaining park area.

In addition to the concerns surrounding the dam safety compliance issues, the original project was constructed prior to Virginia's Water Protection Permit requirements, and so is limited to a maximum withdrawal need to produce 1.0 MGD of treated water. (Approximately 1.1 MGD raw water). The reservoir is the sole raw water reservoir serving the Community of Crozet. As such, RWSA and the Sponsors recognize the importance of the project to supplying the community with adequate water supply both in the present and in the future.

RWSA and the Sponsors have been active in addressing the issues around permitting due to their observation of marked increases in finished water production at the Crozet Water Treatment Plant between 2007 and 2016. (124 MG in 2007 to 188 MG in 2016). This increase has resulted in several days where plant production approached the 1 MGD permit limit. As such, RWSA engaged Hazen and Sawyer to develop a Drinking Water Infrastructure Plan (DWIP) to answer the question of projected demands and infrastructure capacity. The DWIP (June 2019) is based on a series of finished water demand projections, estimated using with considerations for historical planning documents, current zoning, finished water production records and billing data from Albemarle County Service Authority (ACSA) through the year 2075.

The preferred alternative identified in the DWIP was to increase the permitted withdrawal capacity from Beaver Creek, which would require filing a Joint Permit Application (JPA) to move Beaver Creek 1 from excluded status in the Virginia Water Protection (VWP) permit system into the VWP permit system. The measures for the preferred alternative involved separating the principal spillway conduit from the pumping station infrastructure to improve the minimum in-stream flow (MIF) protocol without wasting water supply. The concept of the preferred alternative involved constructing a new raw water intake and pump station to withdraw raw water and to modify the existing principal spillway gates to address DEQ requirements associated with MIF.

RWSA hired Hazen and Sawyer to conduct a site selection study to identify a location that would satisfy as many goals and requirements as possible, including:

- Access to deep water.
- Proximity to the Crozet Water Treatment Plant.
- Placing critical infrastructure above flood elevation.
- Minimizing environmental impact.
- Minimizing impacts to private property.
- Aesthetic factors.
- Minimizing impacts to other uses of the reservoir, including recreation.
- Minimizing the cost to build the intake.

Hazen and Sawyer conducted the site selection alternatives analysis to identify several sites that could meet the objectives of RWSA. The process and results are documented in the Crozet Raw Water Pump Station and Intake Site Selection technical memorandum dated May 2020. The Site Selection Memorandum describes the sites considered, the advantages and disadvantages and/or feasibility of the alternative to meet the goals of RWSA, and a recommendation for the pump station and raw water intake site.

1.2 Watershed Plan Supplement No. 2

Since the project was originally installed by SCS in the 1960's under PL-566, the Sponsors decided to submit the project to NRCS for consideration of being accepted into the Watershed Rehabilitation Program (PL-566). The project was accepted into the program, and on July 29, 2020, the Sponsors entered into an agreement with NRCS to develop a Sponsor-led Supplemental Watershed Plan-Environmental Assessment (Plan-EA) document. The following sections will describe the specific information used to develop Watershed Supplement No. 2.

2.0 LAND USE

Existing land use in the watershed was estimated by a combination of reviewing recent aerial photography, historic aerial photography, and other utilities through GIS software to estimate land cover in the basin today. The land use has changed since the original construction, in that much of the farmland (22% of the basin in original design) has been converted (now an estimated 5% farmland remains in the watershed) to forested areas or grassed pastures.

There is one other significant impounding structure in the watershed known as Henleys Lake Dam. Henleys Lake Dam is located on Beaver Creek and captures runoff from approximately 2.1 square miles of the 9.55 square mile watershed (controlled drainage area). The remaining 7.5 square miles of uncontrolled drainage area are captured by Beaver Creek 1.

To estimate possible future changes in the watershed, the planning team reviewed Albemarle County's Master Plan, which includes the Draft Crozet Master Plan (CCAC 2021). The Crozet Master Plan describes the distinction between development within the development area and maintaining the character of the rural ring.

The future development described within the Crozet Development Area is primarily residential. The development of the area of the watershed that overlaps with the watershed is minimal and does not represent enough area to alter the hydrologic character of the watershed. The small portion of the watershed that overlaps the Crozet Development area appears to already be developed, and the only indications of development on the future land use maps include improvements to trailways and green areas.

The vast majority of the watershed is outside the Crozet Development Area. The Draft Crozet Master Plan emphasizes the importance of maintaining the setting and natural character of the rural ring. As such, no development is currently planned within the rural ring.

3.0 GEOLOGY

3.1 Geologic Setting

The planning team reviewed several past reports, documents, and resources during the development of this plan. The results of the geologic investigation are described in the Geologic Investigation Report (GIR) (Schnabel 2021). The report described past investigations and results and characterized the site for the purposes of the rehabilitation.

The site lies within the eastern edge of the Blue Ridge Province, with bedrock underlying the site classified as biotite monzogranite-quartz monzodiorite (Ybg). The formation is composed of non-foliated to weakly foliated biotite monzogranite and quartz monzodiorite. This formation is Mesoproterozoic in age. A band of leucogranite gneiss (Ylg) of the Mesoproterozoic age underlies the upstream half of the reservoir, northwest of and parallel to the monzodiorite. The site lies on the northwestern edge of the Central Virginia Seismic Zone (CVSZ) which is primarily located in the Piedmont Province. Crystalline metamorphic and igneous rocks of the Piedmont underlie the surficial soils. Inactive fault zones were identified that have not been directly connected to recent seismicity (VA Division of Geology and Mineral Resources, 2017).

3.2 Sedimentation

The results of Draper Aden Associates 2017 bathymetric survey and comparison with original storage volumes indicates that significantly less submerged sediment yield has accumulated over the life of the project than was originally planned for. An estimated 67 acre-feet of submerged sediment has accumulated versus the 202 acre-feet of storage included in the design. Based on the 53-year period between the completion of construction and the 2017 Draper Aden Associates

survey, this results in an average of 1.3 acre-feet per year actual yield versus 4.0 acre-feet per year as designed. The planning team's comparison of similar data to estimate aerated sediment yield indicate that a total of 3 acre-feet may have accumulated in the flood retarding pool area since the original construction, which translates to an annual sediment yield of 0.06 acre-feet. The planning team also reviewed procedures in National Engineering Handbook Part 632, Section 3 and applied the Universal Soil Loss Equation to the watershed to estimate future sedimentation. Sedimentation in the watershed has been reduced since the original planned projections by the presence of Henleys Lake Dam and the reduced amount of farmland in the watershed. The results indicate that the reservoir has sufficient sediment storage for the remaining life of the project. Additional detail and information can be found in the Sedimentation Survey Report (Schnabel 2021).

Table 3.1 - Beaver Creek 1 Sediment Capacity and Projected Sediment Yield

	Sediment Type	**Available Storage[1/] (acre-feet)**	**At elevation (ft, NGVD 29)**	**Estimated Existing Sediment Yield, (ac-ft, 1964 to 2017)**	**Annual Rate of Sediment Yield (ac-ft / year)**	**Estimated Sediment Yield after 58 years* (ac-ft, 2017-2075)**	**Estimated Total Sediment in 2075 (acre-ft, 2075)**
Floodwater Retarding Pool[1/]	Aerated	1,571	538.7	3	0.06	3.5	6.5
Sediment Pool	Submerged	210	515.4	67	1.3	70.2	137.2

1/ Estimated storage between normal pool elevation 538.7 feet and proposed auxiliary spillway crest 550.7 feet (NGVD 29) per Draper Aden Associates bathymetric survey.

At the time the sedimentation memorandum was prepared, an evaluated life of 100-years was used. The project's evaluated life was revised to 50 years based on incorporation of the M&I purpose and availability of Water Supply Data.

Based on the estimated future sediment yield, the existing impoundment has sufficient sediment storage for the design life of the project. The projected future storage volumes should be incorporated into the hydrologic and hydraulic analyses during the detailed design phase for posterity. All elevations will be converted to a consistent datum as part of the detailed design phase.

3.3 Geologic Investigations

A subsurface geotechnical investigation was performed by the Soil Conservation Service (SCS) in the early 1960's during the original design of the dam. This investigation consisted of a mix of test pits and borings at the project site to evaluate the subsurface conditions and identify borrow material to construct the embankment. The 1962 Geology and Soils Report by SCS indicated that soil test borings were performed at the 1962 design location of the embankment centerline and other locations within the embankment footprint, the footprint of the auxiliary spillway, potential borrow areas, toe drains, and the principal spillway riser structure.

Schnabel conducted geologic investigations of the Beaver Creek 1 embankment, foundation and auxiliary spillway channel in 2012. The geologic investigation programs consisted of soil test borings and rock coring within the existing dam and earth-cut auxiliary spillway footprints for the purpose of characterizing the type and consistency of embankment materials, foundation materials, and the auxiliary spillway channel subgrade. Soil test borings were performed and samples were collected for laboratory testing.

Schnabel conducted a second geologic investigation of the Beaver Creek 1 embankment, foundation and auxiliary spillway in 2019 to further characterize the type and consistency of embankment materials, foundations materials, and the auxiliary spillway channel subgrade and obtain additional samples for laboratory testing. The geologic investigation consisted of soil test borings and rock corings at selected locations within the existing dam and earth-cut auxiliary spillway footprints. These investigations formed the basis for geotechnical analyses performed during this Plan-EA.

The combined geologic investigation programs included the following thirty-six soil test borings and five straight-auger borings drilled at various locations on and around the dam.

- Six borings on the embankment crest (B-101, B-102, B-102A, B-103, B-103A, B-104)
- Six borings on the downstream embankment bench (B-601, B-602, B-603, B-606, B-607, B-609)
- Five borings along the downstream embankment toe (B-604, B-605, B-606A, B-608, B-610)
- Nineteen borings within the auxiliary spillway (B-204, B-204A, B-205, B-206, B-206A, B-207, B-208, B-208A, B-209, B-210, B-211, B-212, B-213, B-214, B-215, B-216, B-217, B-218, B-219)
- Five straight-auger borings advanced in the vicinity of the downstream toe/possible future stilling basin location to identify the depth to bedrock (AB-1 through AB-5)

Detailed accounts of the geologic investigations are presented in the Geologic Investigation Report (GIR) (Schnabel 2021).

4.0 ENGINEERING

4.1 Surveying

Project surveys have been performed at various stages of the project. The original project record drawings and design documentation is based on National Geodetic Vertical Datum of 1929 (NGVD 29). Site survey performed by Kirk Hughes and Associates during the first spillway rehabilitation alternatives analysis performed in 2012 references elevations to the North American Vertical Datum of 1988 (NAVD 88). Draper Aden Associates, who performed the bathymetric survey of the reservoir in 2017, referenced their storage volume data to NGVD 29. In comparison of elevations presented in the SCS record drawings, an apparent discrepancy exists between the dimensions of the principal spillway riser tower crest and top of dam. Despite being on different datums, the difference between the top of the riser and the crest of the principal spillway should be the same. However, a difference of 0.2 feet was identified. For the purposes of planning, the value associated with the 2012 survey was used as the principal spillway weir elevation (537.8, NAVD 88). It is recommended that all relevant elevations be converted to a single datum to avoid confusion during the detailed design phase, permit applications and final approval through DEQ, DCR, and NRCS of all finished engineering products. It is also recommended that the discrepancy identified during the planning phase be resolved during the detailed design phase by an additional confirmatory survey.

4.2 Geotechnical

Schnabel performed geotechnical analyses of the existing dam. The analyses and relevant corresponding results are listed below.

- Standard Penetration Test (SPT) Data Corrections.
- SITES Headcut Erodibility Index and Soils Parameters were developed.
- Dispersive Soils. The embankment fill soils were found to be nondispersive, while one sample of alluvium was found to be highly dispersive.
- Filter Compatibility. ASTM C-33 Fine Aggregate is a compatible filter material for the embankment and foundation soils. The existing materials do not appear to meet filter criteria per NEH Chapter 26.
- Seepage and Static Slope Stability. Schnabel analyzed the embankment stability under the following conditions: normal pool steady seepage, normal pool rapid drawdown, and flood surcharge. The embankment satisfies minimum NRCS criteria for static slope stability for each load case considered with a fully functioning drain.
- Seismic Performance. See below.
- Bearing Capacity for the Principal Spillway Riser and Concrete Chute Spillway Structure. The bearing capacities of the foundation soils underlying the existing riser structure and the proposed chute spillway exceed the applied stresses.

- Borrow Area Feasibility. Previously identified borrow areas and proposed excavation required for the construction of the proposed chute spillway will both furnish soil suitable for use as structural fill. Moisture conditioning and removal of deleterious materials will be required.

4.2.1 SITES Headcut Erodibility

Schnabel calculated recommended parameters for the NRCS SITES analysis to evaluate stability and integrity of the existing auxiliary spillway. Following procedures in the *NEH Part 628,* Chapter 52, "Field Procedures Guide for the Headcut Erodibility Index," and using data from the field investigation and laboratory testing of samples from the borings and test pits in the auxiliary spillway, Schnabel recommends the following parameters in Table 4.1 be used in the SITES analysis.

Table 4.1: Recommended Parameters for Auxiliary Spillway SITES Erodibility Analysis

Material	Fill	Residuum	Disintegrated Rock	Rock
USCS Description (Majority of Soils Encountered)	ML, SM	ML	ML, SM	Rock (Mylonitic Gneiss)
Plasticity Index (%)	5	5	5	0
Dry Density (pcf)	115	120	125	130
Percent Clay (%)	2	2	2	0
Rep. Diam., D_{75} (mm)	0.01	0.01	2	3
Headcut Erodibility Index, K_h	0.02	0.05	0.2	1.3

4.2.2 Seepage Analyses

Schnabel used the finite-element analysis program SEEP/W (GeoStudio, 2018 R2) to develop a steady-state seepage model for the approximate maximum height section of the earthen embankment. The seepage model was developed to estimate the phreatic surface and seepage conditions through the embankment and its foundation, and to estimate pore-water pressures for use in the slope stability analyses. No piezometric data was available to measure groundwater levels at the site at the time the analyses were conducted and therefore groundwater measurements observed during drilling were utilized to estimate the phreatic surface within the embankment and foundation. Groundwater measurements from two piezometers installed in the embankment and foundation during the planning phase will be reviewed and considered during the design phase.

Schnabel selected preliminary seepage input parameters for each stratum based on applicable published soil type correlations, soil classifications from the geologic investigation and testing programs, and our experience with similar materials and conditions.

The normal pool and surcharge pool seepage conditions were modeled. The normal pool was assumed to be at elevation 537.8 feet, which is the elevation of the principal spillway riser weir. The surcharge pool was modeled at the dam crest elevation 560.0 feet. The principal spillway conduit outlet has an approximate invert elevation at 496.8 feet. The downstream tailwater for normal pool steady-state analyses was based on the water surface elevation recorded as elevation 494 feet on the 2012 KH&A Survey within the stilling basin pool downstream of the pumphouse structure. The downstream tailwater for maximum surcharge pool steady-state analyses was estimated as elevation 500 feet, which is 6 ft higher than the normal pool tailwater condition. The elevated tailwater level during the maximum surcharge pool condition was selected to account for potentially elevated pore-water pressures in the embankment during the design storm event.

Table 4.2: Summary of Hydraulic Parameters for Seepage Analyses

Material	USCS Soil Classifications	Saturated Hydraulic Conductivity K_x, ft/s	Anisotropy Ratio K_y/K_x
Embankment Shell Fill	SM, SC, ML, MH	1×10^{-6}	1
Embankment Core Fill	SM, SC, ML, CL, CH	6.5×10^{-7}	1
Alluvium	SM, SP, SC-SM, SP-SC, ML, OL	6.5×10^{-5}	1
Residuum/Disintegrated Rock	SM, SP-SM, ML	1×10^{-7}	1
Bedrock	Gneiss	1×10^{-8}	1
Toe Drain	SP	0.03	1

4.2.3 Slope Stability Analyses

Schnabel performed static slope stability analyses in accordance with Section 5 of *TR 210-60*. The analyses considered the following load cases:

- **Steady Seepage:** Normal pool EL 537.8, steady-state seepage conditions
  - Downstream slope only

- **Rapid Drawdown**: Drawdown from normal pool level to the reservoir base (reservoir base is approximately EL 503 in the maximum section; the invert of principal spillway pipe is approximately EL 497.5 feet)

- Upstream slope only

- **Flood Surcharge:** Surcharge pool EL 560.0 (elevation of crest of dam), steady-state seepage conditions.
  - Downstream slope only

Table 4.3: Summary of Material and Strength Properties for Stability Analyses

Material	Moist Unit Weight, γ (pcf)	Drained Strength Properties	Undrained Strength Properties
Embankment Shell Fill	125	ϕ' = 31º, c' = 0 psf	ϕ = 24º, c = 0 psf
Embankment Core Fill	125	ϕ' = 33º, c' = 0 psf	ϕ = 23º, c = 0 psf
Alluvium	120	ϕ' = 28º, c' = 0 psf	ϕ = 24º, c = 0 psf
Residuum	130	ϕ' = 35º, c' = 0 psf	ϕ = 30º, c = 0 psf
Toe Drain	115	ϕ' = 32º, c' = 0 psf	ϕ = 32º, c = 0 psf
Rock	140	ϕ' = 40º, c' = 0 psf	ϕ = 40º, c = 0 psf

The resulting factors of safety resulting from the slope stability models are presented in the following table:

Table 4.4: Static Slope Stability Calculated Factors of Safety

Load Condition	Calculated Factor of Safety		NRCS *TR 210-60* Minimum Required Factor of Safety
	Upstream Slope	Downstream Slope	
Normal Pool Steady Seepage	n/a	1.6 1.5 (Near Surface)	*1.5* *1.3 (Near Surface)*
Normal Pool Rapid Drawdown	1.2 1.1 (Near Surface)	n/a	*1.2* *1.1 (Near Surface)*
Flood Surcharge	n/a	1.5 1.5 (Near Surface)	*1.4* *1.2 (Near Surface)*

4.2.4 Seismic Analysis of the Embankment

Schnabel analyzed the embankment side slopes for probable behavior during seismic loading. Schnabel modeled slope stability of the embankment using the GeoStudio 2018 software. Using a pseudo-static analysis, the yield accelerations for the upstream and downstream slopes were both estimated to be 0.2g, where "g" is the acceleration due to gravity, approximately 32.2 feet per second per second). The site-modified 10,000-year return period PGA value is 0.35g. Vertical deformations during the 10,000-year event were estimated as being less than or equal to 0.33 feet. The embankment is expected to perform adequately during a design seismic event up to the 10,000-year return-period earthquake.

4.2.5 Liquefaction Potential

The potential for the Beaver Creek Dam embankment and foundation materials to experience seismically-induced liquefaction and cyclic softening was evaluated using the simplified procedure in accordance with the NRCS *Seismic Analysis Manual for Dams* (2014). The simplified procedure compares the seismic demand on the soil layers, expressed in terms of the cyclic stress ratio (CSR), to the capacity of the soil to resist liquefaction, expressed in terms of the cyclic resistance ratio (CRR). Soils with a ratio of CRR to CSR (referred to as a Factor of Safety against liquefaction or strain softening) lower than 1.1 have the potential to liquefy.

Based on the analysis outlined above, the embankment, alluvium, and residuum are not expected to liquefy due to the high silt contents, dense soils, and low water content (Wc) to liquid limit (LL) ratios (Wc/LL). The simplified procedure for evaluating liquefaction triggering potential requires that materials below the water table have fines contents less than 35%. The materials encountered (with the exceptions of samples B-605, 6-8 feet and B-608, 8-10 feet) had fine contents greater than 35%. The noted exceptions were observed to have fines contents below 35% but the simplified procedure indicated that these materials are not susceptible to liquefaction. Sample B-608, 4-8 feet in the alluvial stratum was observed to have an estimated fines content of 35.1% based on geotechnical laboratory testing. The results of the simplified liquefaction triggering procedure indicated that this sample has some susceptibility to liquefaction. However, Schnabel is of the opinion that this condition is isolated and not ubiquitous within the dam foundation.

Seed *et al*. in 2003 (Figure 6.2 of the NRCS *Seismic Analysis Manual for Dams*) uses the ratio of water content to liquid limit ratios (Wc/LL) to screen soils that may cyclically soften, but are not expected to liquefy. Based on the soil laboratory testing for moisture content and Atterberg Limits, all of the samples tested with fines content greater than 50% had Wc/LL ratios less than 0.8, even when an extra 5% was artificially added to the moisture content. This indicates that the samples are not susceptible to liquefaction based on Seed *et al*. in 2003 (Figure 6.2 of the NRCS

Seismic Analysis Manual for Dams) and Bray and Sancio in 2006 (Figure 6.3 in the NRCS *Seismic Analysis Manual for Dams*).

No soft, normally consolidated clays that would be at risk for cyclic softening were observed at the site. Therefore, the analysis for cyclic softening was not performed as part of these geotechnical analyses.

Due to the presence of alluvial deposits located beneath the downstream slope of the embankment, Schnabel assumed that these alluvial soils are present along the entire upstream to downstream ends of the embankment, except for where penetrated by the keyway cutoff trench. Provided that the selected alternative does not involve constructing a structural spillway over the existing embankment, Schnabel notes that two piezometers were installed within the embankment and its foundation to acquire more accurate groundwater measurements and to identify which soils are below groundwater and potentially susceptible to liquefaction. The piezometer data will be incorporated into the detailed design phase. For the purposes of the liquefaction analyses performed herein, conservative, high groundwater observations from the soil test borings were used for modeling and calculations. Inconsistencies in the groundwater readings presented in the boring logs are due to readings only being possible when groundwater was encountered during drilling, and the groundwater levels measured at the completion of drilling. Schnabel notes that groundwater conditions observed at the site represent the groundwater only at those specific locations and times observed, and that all other representations of groundwater level in the geotechnical analyses and calculations are considered assumed.

4.2.6 Conclusions

- Previous visual evaluation reports have not documented significant dam safety concerns regarding seepage or slope stability at the subject dam. However, the downstream pump station intake structure covers the area immediately downstream of the embankment toe and the outlets of the internal drain system cannot be visually observed at the time of this report.

- Per *NEH Part 633,* Chapter 26 requirements, the existing filter is too coarse to properly filter the embankment fill, alluvial, and residual materials. Replace the existing internal drain system with a new graded aggregate filter and PVC collector/outlet conduits. A diaphragm filter should be constructed around the existing principal spillway conduit. Based on the existing filter material not meeting compatibility requirements, the corrugated metal pipe collector and outlet conduits, the lack of drain cleanouts and the inability to observe the outlets of the internal drain,

abandonment of the existing system and construction of a new graded aggregate filter system is recommended.

- Schnabel performed a static and pseudo-static slope stability analyses in accordance with Section 5 of *TR 210-60* which considers the load cases of steady seepage along the downstream slope, rapid draw along the upstream slope, flood surcharge along the downstream slope, and pseudo-static slope stability along the upstream and downstream slope. The slope stability results demonstrate that the existing embankment satisfies minimum NRCS criteria for static slope stability for each load case considered with a fully functioning drain as well as a partially functioning drain.

- Topsoil from the existing embankment can be stripped and re-used following the embankment modifications to establish vegetation on newly graded areas.

- As required in the Statement of Work, Schnabel evaluated the feasibility of using previously identified borrow areas as possible sources of material for rehabilitation alternatives. Although it is not expected that a borrow source will be required for rehabilitation of the embankment, if required, excavated material from the embankment could be re-used at the site for earthworks provided that the materials are moisture controlled and free of deleterious materials.

- No piezometers were installed in the embankment during the 2012 and 2019 geologic investigations. The installation of piezometers should be considered during construction at both the embankment crest and the embankment toe in the fill and foundation materials to more accurately measure and observe groundwater conditions at the site.

- Alluvial soils were encountered underneath the embankment downstream slope in the borings drilled from the downstream embankment bench and toe. Although the alluvial soil altogether does have an average field N-Value of 15, there were a few occurrences where there were weight-of-hammer (WOH) penetration resistances in the stratum. Given that no borings were drilled along the upstream slope of the dam it is unclear if this alluvial stratum exists beneath the upstream slope as well. Schnabel's geotechnical analyses assumed the stratum of alluvial soils remained beneath the earth fill above the residual and disintegrated rock materials.

- Given the presence of soft alluvial soils within the foundation of the dam and the immediate downstream areas, Schnabel recommends undercutting of alluvial deposits

immediately downstream of the toe of the dam and replacement with compacted structural earth fill. If the selected alternative is a structural spillway over the existing embankment, it is anticipated that most of this material will require excavation.

- While Schnabel's screening analyses indicate that the potential for failure or large deformation due to liquefaction is low, consideration of a retaining wall or extended cutoff along the downstream toe of the embankment to bedrock should be considered during the design phase to reduce the potential for liquefiable soils (i.e. loose, soft alluvial materials) to spread during a seismic event.

- When evaluating conceptual spillway alternatives for this structure to meet spillway capacity requirements, bearing capacity of the foundations soils was evaluated with a conceptual footing depth and dimensions considering two structural spillway alternatives. The bearing capacities of the anticipated foundation soils exceed the anticipated bearing pressures from a reinforced-concrete chute spillway constructed either over the existing embankment (Alternative 1) or over residual soils in the left abutment of the dam. Furthermore, it is expected that a decrease in net bearing pressure will result between the excavation of the existing soils and the construction of a new structural spillway. Therefore, negligible settlement is anticipated as a result of the proposed spillway alternatives.

- Per *TR 210-60*, instrumentation should be installed for significant and high hazard potential dams to allow for comparison of performance to design assumptions and for evaluating dam safety. Schnabel recommends, at a minimum, instrumentation to monitor surface movement of the embankment and any structure built into the embankment and piezometers to measure pore pressures within the embankment.

4.3 Hydrology any Hydraulics

4.3.1 Hydrologic and Hydraulic Analyses

Schnabel performed hydrologic and hydraulic flood routing of the Beaver Creek 1 watershed and impoundment using a HEC-HMS watershed model to develop inflow and outflow hydrographs for various storm events using available soils and land use maps, drainage area delineations, time of concentration estimates, and precipitation data. Delineation of the watershed was based on topographic data obtained from the Virginia Geographic Information Network (VGIN). The watershed was divided into two sub-watersheds; the Henleys Lake Dam sub-watershed, which captures approximately 2.1 square miles (approximately 22 percent of the total watershed) and

the Beaver Creek 1 sub-watershed, which captures approximately 7.5 square miles (approximately 78 percent of the total watershed). The total watershed is approximately 4.8 miles long and approximately 3.7 miles wide.

The Henleys Lake Dam sub-watershed is approximately 3.1 miles long and approximately 1.5 miles wide at its widest point. The Runoff Curve Numbers (CN) for the two sub-watersheds were computed with Microsoft Excel, using a tabulation of land cover-hydrologic soil group complexes within each sub-watershed. The delineations of the land cover-soil complexes were performed using ArcMap software. Digital Hydrologic Soil Group (HSG) data were obtained from the USGS Web Soil Survey (WSS) website. Land cover data were obtained from the Virginia Base Mapping Program (VBMP, 2013 through 2015). The corresponding HSG was assigned to each land cover type within the watershed. The soil and land cover data were tabulated, and CN values were assigned to each combination of unique HSG and land cover presented in the National Engineering Handbook (NEH), Part 630, Chapter 9. The time of concentrations for each sub-watershed were estimated using guidance provided in NEH Part 630, Chapter 15. Precipitation data were obtained from Virginia's Probable Maximum Precipitation (PMP) Study and associated PMP Evaluation Tool (Applied Weather Associates, LLC, November 2015). Point precipitation frequency estimate data were obtained from the National Oceanic and Atmospheric Administration (NOAA)'s National Weather Service, Atlas 14.

4.3.2 Hydraulic Analyses

Schnabel performed hydraulic flood routing analyses of Beaver Creek 1 to assess whether the existing dam and spillway could safely pass the design storm event without overtopping. Reservoir stage storage volumes were based on a bathymetric sonar scan survey performed by Draper Aden Associates (DAA) in 2017 and topographic data obtained from VGIN. Hydraulic rating curves for the principal spillway structure and auxiliary spillway structure were developed using information from the 1964 Record Drawings and in-house spreadsheet tools to tabulate the hydraulic ratings.

Henleys Lake Dam was modeled as a sub-watershed in the Beaver Creek 1 watershed model. Stage storage and rating curve data for Henleys Lake Dam were estimated from *Henley's Lake Dam Failure Analysis* (Timmons Group, September 2018, Revised August 2020). The peak water surface elevation in Henleys Lake Dam for each PMP event was estimated using HEC-HMS flood routing software. In the Beaver Creek 1 flood routing models, Henleys Lake Dam was assumed to initiate a breach when the reservoir reached its peak water surface elevation. For conservatism during the Planning phase, the floodwave was assumed to discharge directly into the Beaver Creek Reservoir with no accounting for flood attenuation or lag in the channel. This assumption caused the peaks of the Henley's Lake Dam breach flow hydrograph and the Beaver

Creek 1 inflow hydrograph to more closely align, which in turn produced a conservative peak inflow into Beaver Creek 1 Reservoir.

The flood routing results indicate that the existing dam and spillway are capable of passing only about 60 percent of the PMP runoff before overtopping, and the embankment was found to overtop by approximately five feet during the six-hour Local PMP event. The hydraulic routing model was set up such that Henleys Lake Dam (upstream impoundment) must reach its peak water surface elevation before initiating a breach. Additionally, channel storage and attenuation were ignored for the breach flows from Henleys Lake Dam and breach flows were routed directly in to Beaver Creek 1. These assumptions lead to conservative inflow hydrograph modeled into Beaver Creek 1 and represent a "worst-case" condition with respect to breaching the upstream impoundment. Additional hydrologic and hydraulic analyses are recommended during the design phase with particular emphasis on the controlling storm events.

A SITES model was developed to evaluate the capacity of the existing principal spillway, and the capacity and integrity of the existing vegetated auxiliary spillway. Headcut erodibility indices were estimated based on calculations performed using information and procedures presented in NEH Part 628, Chapter 52 and data obtained from the subsurface investigations described previously. The SITES models indicate that the existing auxiliary spillway does not meet integrity requirements during the six-hour, 12-hour or 24-hour design storm events.

4.3.3 Spillway Rating Curves

A hydraulic rating curve was developed for the existing principal spillway riser and conduit using spreadsheet tools to calculate hydraulic ratings based on the dimensioning and configuration of the principal spillway structure (See PER, Schnabel 2020, and Hydrology & Hydraulics Report, Schnabel 2021).

The proposed labyrinth spillway rating curve (Alternative 1) was developed using spreadsheet tools to calculate hydraulic ratings based on user-input labyrinth weir properties. Limitations to wall height to design head ratio, sidewall angles, and other parameters were established based on information presented in Labyrinth Weirs *(*Crookston, 2010). Additional hydraulic modeling should be performed during the detailed design phase to improve the layout and dimensioning based on detailed hydraulic analyses.

Chute spillway hydraulics were evaluated using planning level detail and analyses. Information provided in NEH 634, Section 14 was used to estimate velocities using dynamic similitude based on the estimated flow per unit width. The velocities calculated at the terminus of the chute (e.g. d_1) were found to be in excess of 60 feet per second. A Saint Anthony Falls (SAF) stilling basin may experience cavitation or damage at velocities exceeding 60 feet per second. For this reason, a U.S. Bureau of Reclamation (USBR) Type II stilling basin was selected for the planning phase.

Additional analyses and modeling should be performed during the design phase to improve and finalize the configuration of the chute and stilling basin. Schnabel performed preliminary hydraulic calculations to size the two structural alternatives described above. The preliminary calculations were used to estimate the proportions of the proposed conceptual spillway alternatives and develop inflow and outflow hydrographs based on the proposed spillway configuration. The existing principal spillway riser and conduit were assumed to remain in service with minor modifications.

4.3.4 Proposed Flood Routing Results

The proposed alternative will bring the subject dam and spillway into compliance with NRCS and Virginia requirements for high hazard dam spillway capacity and make the structure capable of safely passing the respective design storm events (VAPMP, FBH). The following tables present the results of the flood routing analyses with the Alternative 1 spillway configuration incorporated and the existing vegetated auxiliary spillway removed from service. Note that the results from Henleys Lake Dam are not included here, are presented in the Hydrology and Hydraulics Report (Schnabel 2021).

Table 4.5: Beaver Creek Dam
- Max WSE
(Alternative 1, Preferred)

Beaver Creek Dam - Maximum Water Surface Elevation									
Duration	6hr			12hr			24hr		
		Maximum Water Surface Elevation			Maximum Water Surface Elevation			Maximum Water Surface Elevation	
Storm Type	PMP (in)	NRCS Std Dist (ft)	VA Temporal Dist (ft)	PMP (in)	NRCS Std Dist (ft)	VA Temporal Dist (ft)	PMP (in)	NRCS 5pt Dist (ft)	VA Temporal Dist (ft)
General	16.0	553.6	554.3	18.6	553.7	553.6	21.7	554.5	553.6
Local	25.8	558.8	559.6	28.3	558.1	556.7	28.8	557.5	556.7
Tropical	19.9	555.8	556.4	31.3	559.1	556.4	31.3	554.8	556.4

Based on the above information, the highest peak water surface elevations for the six-, 12- and 24- hour storms were:

- 6-Hour: Virginia PMP, Local, VA Distribution: Peak WSE = 559.6 feet
- 12-Hour: Virginia PMP, Tropical, NRCS Std Distribution: Peak WSE = 559.1 feet
- 24-Hour: Virginia PMP, Local, NRCS 5-Pt Distribution: Peak WSE = 557.5 feet

As described previously, the results are based on the assumption that the breach of Henleys Lake Dam initiates at its peak water surface, which in most PMP events implies several feet of

overtopping depth above the crest of Henleys Lake Dam. A conservative modeling assumption that breach flows are conveyed directly into Beaver Creek 1 reservoir was used to estimate a worst case flooding scenario at Beaver Creek 1 Reservoir. There is an approximately one-mile long reach between the outfall of Henleys Lake Dam and the western finger of Beaver Creek 1 reservoir. Considerations for flood storage and attenuation provided by this channel should be incorporated to the hydraulic models during the detailed design phase. The assumption of direct inflow from Henleys Lake into Beaver Creek 1 reservoir is conservative and considered appropriate for the planning phase.

4.4 Structural

4.4.1 Seismic Evaluation of the Principal Spillway Riser

A seismic stability analysis of the existing principal spillway riser was performed. The results of the analysis indicate that in its current configuration, the riser does not meet required factors of safety for overturning during the design seismic event with the reservoir in service at normal pool. Because the reservoir serves as the sole water supply for the community, the reservoir cannot be drained to construct a new riser or make modifications in a dry environment. Plans to stabilize the safely stabilize the riser with the reservoir in service should be developed during the design phase of the project to achieve required safety factors per TR 210-60 Earth Dams and Reservoirs (NRCS 2019).

5.0 BIOLOGY

5.1 State Listed Threatened and Endangered Species

The reservoir was reviewed for occurrence of federally protected species or habitat and reported occurrences of state protected species. The USFWS Environmental Conservation Online System (ECOS) Information for Planning and Consultation (IPaC) was queried for trust resources known or expected to near the project site. One federally endangered species, the James spinymussel (Pleurobema collina), and one federally threatened species, the northern long-eared bat (Myotis septentrionalis), were identified as potentially present.

In April 2021, a search of the DWR's Virginia Fish and Wildlife Information Service (VaFWIS) database was performed to identify species that may be present in the affected environment for the proposed action. The VaFWIS database uses a minimum 3-mile habitat search radius from the location of the proposed action. Twelve state threatened species were identified within the search radius.

The planning team contacted the USFWS Virginia Ecological Services Field Office on October 3, 2022 and spoke with Rachael Cash. The discussion included the previous USFWS consultation and performance of a mussel survey downstream of the dam. The discussion also

included the official USFWS species list generated for the project and recent submittal of the JPA with the mussel survey included in the permit package.

Hazen inquired as to next steps for USFWS consultation, which included online submittal of Section 7 consultation, which has occurred, and responding to any comments or questions that the USFWS has relative to the project and its impacts.

The Virginia Department of Wildlife Resources (DWR) reviewed the project and requested that mussel surveys be performed as part of the project planning process. This correspondence is documented in the Beaver Creek Reservoir Mussel Report (Hazen and Sawyer 2020).

The existing dam already creates an impediment to fish and other aquatic species. The project will have negligible impact to fish and wildlife. Impacts are anticipated to be minor and temporary in nature, and many of the impacts can be mitigated by appropriate erosion, sediment and pollution control measures and ongoing consultation with regional expertise in fish and wildlife.

The following list comprises the State listed and endangered species known to reside within this area.

Status (Regulatory Purview)	**Common Name**	**Scientific Name**	**Findings**	**Not Present / Not Carried Forward for Analysis**
State Endangered (DWR)	Brook floater	*Alasmidonta varicose*	Per Biota of Virginia (BOVA) report, indicated as known or likely to occur within Albemarle County, but not known or likely to occur within the Rappahannock watershed. 2020 NRCS survey did not indicate presence downstream of Dam.	**X**
State Endangered (DWR)	Little brown bat	*Myotis lucifugus*	No known occupied maternity roost or hibernaculum 5.5-mile buffer-DWR	**X**

Status (Regulatory Purview)	Common Name	Scientific Name	Findings	Not Present / Not Carried Forward for Analysis
State Endangered	James spinymussel	*Parvaspina collina*	Per BOVA report, indicated as known within Albemarle County and JR02. 2020 NRCS survey did not indicate presence downstream of Dam.	**X**
State Endangered (DWR)	Tri-colored bat	*Perimyotis subflavus*	No known occupied maternity roost or hibernaculum 5.5-mile buffer-DWR	**X**
State Threatened	Northern long-eared bat	*Myotis Septentrionalis*	No known occupied maternity roost or hibernaculum 5.5-mile buffer-DWR	**X**
State Threatened	Yellow lance	*Elliptio lanceolata*	Per BOVA report, indicated as known to occur within Albemarle County, but not JR02. 2020 NRCS survey did not indicate presence downstream of Dam.	**X**
State Threatened (DWR)	Peregrine falcon	*Falco peregrinus*	Per BOVA report, indicated as likely to occur within Albemarle County and JR02 during spring/summer. It is not known if confirmed observations have occurred.	
State Threatened (DWR)	Loggerhead shrike	*Lanius Ludovicianus*	Per BOVA report, indicated as known to occur within Albemarle County and JR02. It is not known if confirmed observations have occurred.	
State Threatened (DWR)	Atlantic pigtoe	*Fusconaia masoni*	Per BOVA report, indicated as known to occur within Albemarle County, but not in	**X**

Status (Regulatory Purview)	Common Name	Scientific Name	Findings	Not Present / Not Carried Forward for Analysis
			JR02. 2020 NRCS survey did not indicate presence downstream of Dam.	
State Threatened (DWR)	Appalachian grizzled skipper	*Pyrgus wyandot*	Per BOVA, indicated as known to occur within Albemarle County and JR02. It is not known if confirmed observations have occurred.	
State Threatened (DWR)	Green floater	*Lasmigona subviridis*	Per BOVA report, indicated as known to occur within JR02 and Albemarle County. 2020 NRCS survey did not indicate presence downstream of Dam.	**X**
State Threatened (DWR)	Migrant logger-head shrike	*Lanius ludovicianus migrans*	Per BOVA report, indicated as known to occur within Albemarle County. It is not known if confirmed observations have occurred.	

5.2 Migratory Birds

The following migratory bird species were identified from the USFWS database review:

Common Name	Scientific Name	Breeding Season
Bald eagle	*Haliaeetus leucocephalus*	Sep 1- Aug 31
Black-billed cuckoo	*Coccyzus erythropthalmus*	May 15 – Oct 10
Black-capped chickadee	*Poecile atricapillus practicus*	Apr 10 – Jul 31
Blue-winged warbler	*Vermivora pinus*	May 1 – Jun 30
Bobolink	*Dolichonyx oryzivorus*	May 20 – Jul 31

Canada warbler	*Cardellina canadensis*	May 20 – Aug 10
Cerulean warbler	*Dendroica cerulea*	Apr 27 – Jul 20
Eastern whip-poor-will	*Anstrostomus vociferus*	May 1 – Aug 20
Golden eagle	*Aquila chrysaetos*	Breeds elsewhere
Golden-winged warbler	*Vermivora chrysaetos*	May 1 – Aug 20
Kentucky warbler	*Oporomis formosus*	Apr 20- Aug 20
King rail	*Rallus elegans*	May 1 – Sep 5
Northern saw-whet owl	*Aeoolius acadicus acadicus*	Mar 1 – Jul 31
Prairie warbler	*Dendroica Discolor*	May 1 – Jul 31
Prothonotary warbler	*Protonotaria citrea*	Apr 1 – Jul 31
Red-headed woodpecker	*Melanerpes erythrocephalus*	May 10 – Sep 10
Rusty blackbird	*Euphagus carolinus*	Breeds elsewhere
Wood thrush	*Hylocichla mustelina*	May 10 – Aug 31
Yellow-bellied sapsucker	*Sphyraicus varius*	May 10 – Jul 15

5.3 Eagle Survey

On May 12, 2022, Hazen biologists, Linda Diebolt and Katelyn Cox, performed an eagle nest survey within the survey area shown on the map below. The survey area extends 660 feet from limits of disturbance associated with RWSA proposed construction activities. The survey consisted of visual observation of individual trees within the survey area to ascertain the presence or absence of a raptor stick nest. The survey also included identification of birds seen flying over or perched on trees within or immediately surrounding the survey area to document use of the area by bald eagles (*Haliaeetus leucocephalus*).

The survey area includes mixed hardwood forests, actively maintained roadway, and maintained lawn. The mixed hardwood forested areas are located along the southern edge of the proposed limits of disturbance. The maintained roadway, Brown's Gap Turnpike (SR 680), is located directly east of the Beaver Creek Reservoir and directly west of the existing intake structure. There are actively maintained lawn areas on either side of SR 680.

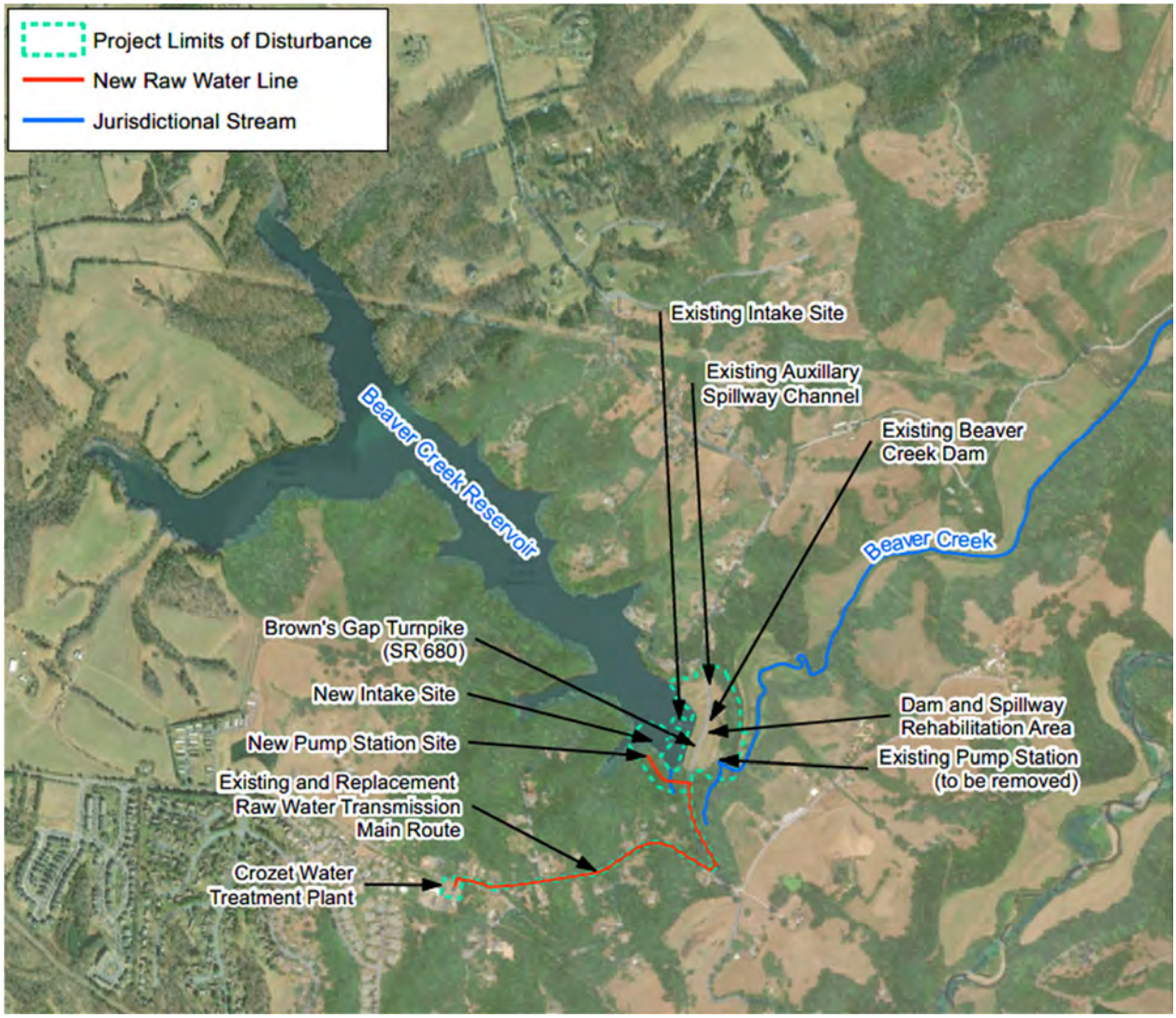
No evidence of bald eagle nesting sites was identified within the survey area during field review. The closest documented bald eagle nest is approximately one mile southwest of proposed limits of disturbance according to The Center for Conservation Biology. No bald eagles were observed during the May 12, 2022 survey. Beaver Creek Reservoir is commonly used for recreational activities by residents. Hazen biologists utilized social media platforms to further investigate any recent bald eagle sightings. No bald eagle sightings have been recorded by the public within or surrounding the survey area.

RWSA proposed construction may proceed per the locations shown on the map below. The proposed limits of disturbance will not occur within a 660-foot radius of a bald eagle nest. Additionally, no self-certification of no effect or authorization of a potential take permit is

required for the proposed construction activities at the Beaver Creek Reservoir dam site, new intake structure, new pump station, or existing intake structure.

5.4 Mussel Survey

The following is the Freshwater Mussel Survey Final Report prepared by Three Oaks Engineering.



Freshwater Mussel Survey Final Report

Beaver Creek below Beaver Creek Reservoir

Albermarle County, Virginia

Beaver Creek in Survey Reach

Prepared For:

Hazen

Hazen and Sawyer
4011 Westchase Blvd., Suite 500
Raleigh, NC 27607

September 18, 2020

Prepared by:

324 Blackwell Street, Suite 1200
Durham, NC 27701

Table of Contents

1.0 INTRODUCTION

The Rivanna Water and Sewer Authority (RWSA) is proposing the Beaver Creek Reservoir Dam Rehabilitation Project. The project will involve modification and improvements to the existing spillway on Beaver Creek Reservoir in Albemarle County, Virginia near the town of Crozet. Beaver Creek is a tributary to the Mechums River of the greater James River Basin. The Virginia Department of Wildlife Resources (VDWR) reviewed the project and requested mussel surveys as part of the project planning process. Further, the Fish and Wildlife Service (USFWS) Information, Planning, and Consultation (IPaC) system lists the Federally Endangered James Spinymussel (*Parvaspina collina*, JSM) as a species that could potentially be affected by activities in this location (USFWS IPaC 2020).

As such, Hazen and Sawyer, the primary consultant for the project, contracted with Three Oaks Engineering (Three Oaks) to conduct surveys and evaluate potential presence of freshwater mussels in Beaver Creek.

2.0 WATERS IMPACTED

Beaver Creek is located in the Middle James Buffalo Watershed sub-basin (HUC# 02080203). Beaver Creek flows into Mechums River approximately 2.0 river miles (RM) downstream of the site which in turn joins the Moormans River near Free Union, VA where it forms the South Fork Rivanna River. The Rivanna River flows into the mainstem James River in Columbia, VA.

3.0 TARGET FEDERALLY PROTECTED SPECIES DESCRIPTION

3.1. ***Parvaspina collina* (James Spinymussel)**

3.1.1. Characteristics

The James Spinymussel was discovered in the Calfpasture River (of the James River Basin) by T. A. Conrad and originally described as *Unio collinus* (Conrad 1837). Various people (See USFWS 1990 for synonyms) have subsequently placed this species in a number of different genera. Turgeon *et al.* (1988) placed the JSM in the genus *Parvaspina*. The taxonomic history of this species is described fully in Clarke and Neves (1984).

The JSM is a small mussel that is reported to reach a maximum size of 70 mm. The shells of small individuals (<40 mm) are subrhomboidal in shape with an obliquely subtruncated posterior with widely spaced concentric striations. The periostracum is shiny and straw yellow with prominent growth rings. Faint brownish rays are rarely present. One to three short, but prominent spines are occasionally present on each valve. With age, the shell becomes more ovate or even arcuate, the periostracum becomes brownish to black and any spines that were once present are lost. Their beaks are typically eroded and only slightly elevated above the hinge line, if at all. The nacre is white with occasional bluish suffusions. The foot and mantle of live specimens are light orange in color (USFWS 1990, Clarke and Neves 1984, Johnson 1970). Internal anatomy is detailed in Clarke and Neves (1984).

The JSM and the Tar spinymussel (TSM) share many morphological traits, but are clearly distinct species. The TSM has been described as having intermediate characteristics between the small, short-spined JSM and the large, long-spined Altamaha spinymussel (*Elliptio spinosa*) (USFWS, 1992a; USFWS, 1990). Internal anatomical differences between the two species are described in Clarke and Neves (1984). Tar River spinymussels can have up to 12 spines (USFWS 1992a) and tend to have spines more often than JSMs. Clarke and Neves (1984) state most specimens of JSM "never develop spines".

Knowledge of the reproductive biology of the JSM is limited to thesis research at Virginia Polytechnic Institute and State University (Hove 1990; Hove and Neves 1989). Like nearly all freshwater mussel species, the reproductive strategy of the JSM involves a glochidium that becomes a temporary obligate parasite on a fish. Many mussel species have specific fish hosts that must be present to complete their life cycle. Based upon laboratory infestation experiments, Hove (1990) identified seven fish species, all in the family Cyprinidae (minnows), as potential fish hosts for the JSM. McMahon and Bogan (2001) and Pennak (1989) provide a general overview of freshwater mussel reproductive biology.

3.1.2. Distribution and Habitat Requirements

The JSM was originally believed to be endemic to the James River system, with a widespread distribution within the basin (USFWS, 1990, Clarke and Neves, 1984). It has since been documented in the Roanoke River basin. When the Recovery Plan for this species was adopted, it was believed to have been extirpated from 90% of its historic distribution.

A description of chemical and physical conditions at sites currently and historically supporting the JSM is given in Clarke and Neves (1984) and Boss and Clench (1967). The habitat is generally described as runs with moderate current, with sand, gravel, and cobble substrata. Individuals have been found in a variety of substrates that range from silt/sand, to sand, gravel, cobble, bedrock crevices, and sand surrounded by boulders, and in a variety of flow patterns that range from slack pools to runs with moderate to swift currents (personal observations). The hardness of the water is believed to be a significant requirement for this species, with a minimum hardness value of >50 ppm $CaCO_3$ (Clarke and Neves, 1984).

3.1.3. Threats to Species

The cumulative effects of several factors, including sedimentation, point and non-point discharge, stream modification (e.g., impoundment, channelization), coupled with the apparent restricted range, are believed to have contributed to the decline of this species throughout its range (USFWS 1990). When mussel populations are reduced to a small number of individuals and are restricted to short reaches of isolated streams, they are extremely vulnerable to extirpation from a single catastrophic event or activity (Strayer et al. 1996). Catastrophic events may consist of natural events such as flooding or drought, as well as human influenced events, such as toxic spills.

Siltation resulting from improper erosion control of various land usage, including agriculture, silviculture, and development activities, has been recognized as a major contributing factor to

degradation of mussel populations (USFWS 1996). Siltation has been documented to be extremely detrimental to mussel populations by degrading substrate and water quality, increasing potential exposure to other pollutants, and by directly smothering mussels (Ellis 1936, Marking and Bills 1979). Sediment accumulations of less than 1 inch have been shown to cause high mortality in most mussel species (Ellis 1936).

Sewage treatment effluent has been documented to significantly affect the diversity and abundance of mussel fauna (Goudreau et al. 1988). Goudreau et al. (1988) found that recovery of mussel populations might not occur for up to two miles below points of chlorinated sewage effluent. Clarke and Neves (1984) suggested that sewage and industrial pollution might have contributed to the extirpation of the James Spinymussel from the North River in Virginia. The impact of impoundments on freshwater mussels has been well-documented (USFWS 1992b, Neves 1993). Construction of dams transforms lotic habitats into lentic habitats, which results in changes with aquatic community composition. These changes associated with inundation adversely affect both adult and juvenile mussels as well as fish community structure, which could eliminate possible fish hosts for glochidia (Fuller 1974).

The introduction of exotic species, such as the Asian Clam (*Corbicula fluminea*) and Zebra Mussel (*Dreissena polymorpha*), has also been shown to pose significant threats to native freshwater mussels. The Asian clam is now established in most of the major river systems in the United States (Fuller and Powell 1973) including those streams still supporting surviving populations of the James Spinymussel. Concern has been raised over competitive interactions for space, food, and oxygen between this species and native mussels, possibly at the juvenile stages (Neves and Widlak 1987, Alderman 1997). The Asian clam is common to abundant within the James River Basin. The zebra mussel, native to the drainage basins of the Black, Caspian, and Aral Seas, is an exotic freshwater mussel that was introduced into the Great Lakes in the 1980s and has rapidly expanded its range into the surrounding river basins, including those of the South Atlantic Slope (O'Neill and MacNeill 1991). This species competes for food resources and space with native mussels, and is expected to contribute to the extinction of at least 20 freshwater mussel species if it becomes established throughout most of the eastern United States (USFWS 1992b). This species has not been recorded in the James River Basin.

4.0 SURVEY EFFORTS

Surveys were conducted by Three Oaks personnel Tom Dickinson (VDWR Permit # 68760) and Nathan Howell on August 11, 2020, with assistance from VDWR state malacologist Brian Watson. The nearest USGS stream gage (Mechums River near White Hall, VA, USGS-020331000) was flowing at approximately 30 cubic feet per second at 4.5 feet of height, a level near the median daily statistic.

4.1. Methodology

Mussel surveys were conducted from approximately 1,000 meters (m) downstream to the dam outlet structure as depicted in Appendix A, Figure 1.

Areas of appropriate habitat were searched, concentrating on the stable habitats preferred by the target species. The survey team spread out across the creek into survey lanes. Visual surveys were conducted using glass bottom view buckets (bathyscopes). Tactile methods were also employed in finer substrates (silt and sand). All freshwater bivalves were recorded and returned to the substrate. Timed survey efforts provided Catch Per Unit Effort (CPUE) data.

4.2. Stream Conditions at Time of Survey: Beaver Creek

Within the surveyed reach, habitat consisted of shallow riffle, run, and pool sequences. The wetted stream channel ranged from five to ten meters wide with stream banks up to one-meter high that varied from stable to eroded. Substrate consisted primarily of cobble and gravel, with sand and silt accumulations in depositional areas. Root mats stabilized the stream banks in many areas. A mature forested buffer surrounded the upper reach, and little to no buffer was present on the lower reach in the areas surrounded by active pasture. Several drainage pipes with flow joined the stream in the lower reach. A layer of algae covered substrates in many areas. Water levels were low, clear, and warm (29 degrees Celsius) during the efforts.

5.0 RESULTS/CONCLUSIONS

A total of 6.5 person hours of survey time were spent in the reach, during which, no evidence of mussel species was located. The only aquatic mollusk evidence observed were shells of the invasive Asian Clam, most of which were relics. The naturalized Ozark Crayfish (*Faxonius ozarkae*) was present in the stream, and although searches were cursory, few benthic macroinvertebrates were observed under rocks in riffle and run habitats.

Based on these survey results, impacts to the James Spinymussel and other freshwater mussel species are very unlikely to result from dam rehabilitation. Strict adherence to erosion control standards should minimize the potential for any adverse impacts to aquatic fauna present in Beaver Creek.

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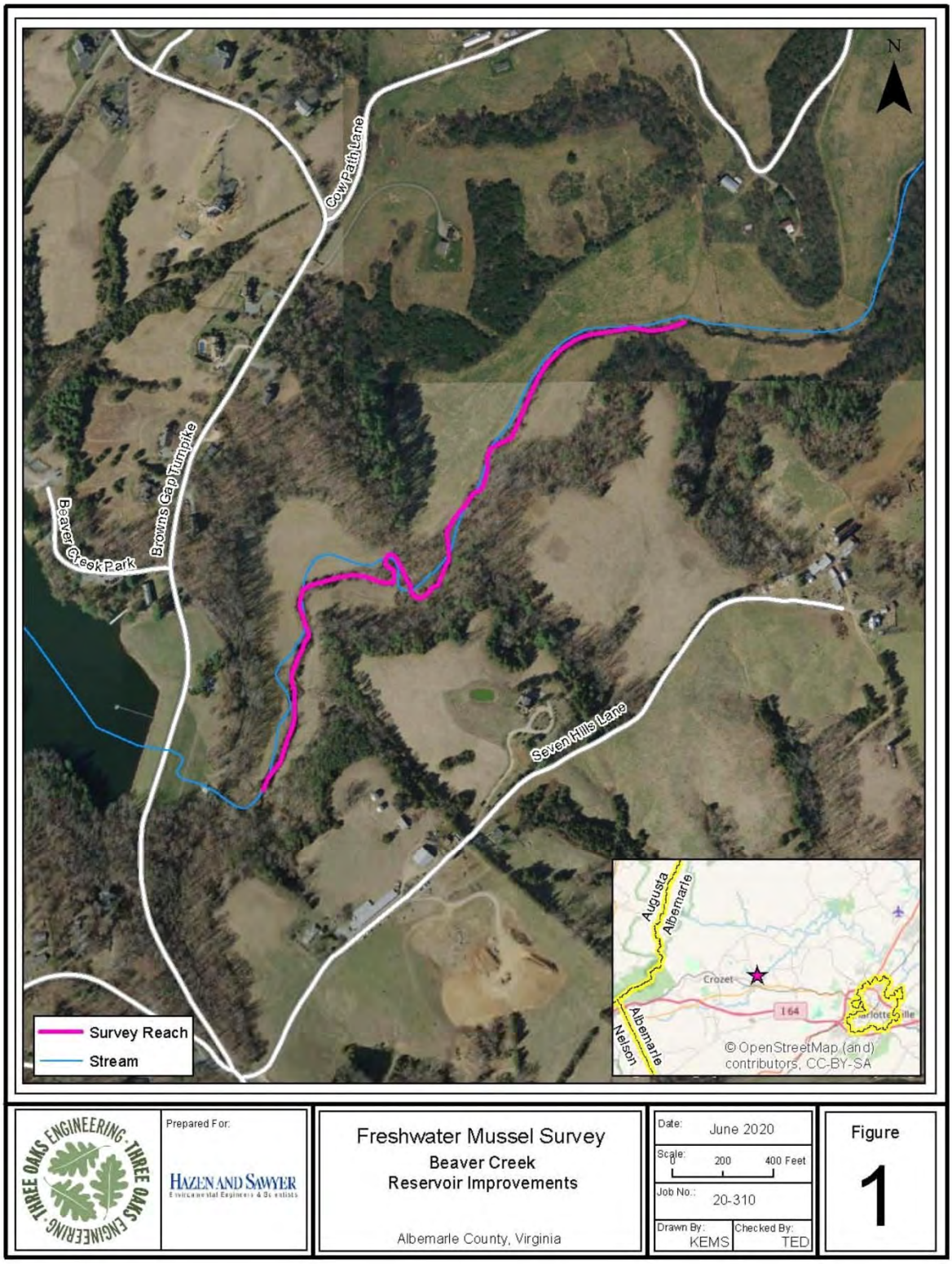
Appendix A: Figure 1



THREE OAKS ENGINEERING · THREE OAKS ENGINEERING

Prepared For:

HAZEN AND SAWYER
Environmental Engineers & Scientists

Freshwater Mussel Survey

Beaver Creek Reservoir Improvements

Albemarle County, Virginia

Date:	June 2020
Scale:	0 200 400 Feet
Job No.:	20-310
Drawn By:	KEMS
Checked By:	TED

Figure

1

Appendix B: Select Photographs

Photo 1: Beaver Creek Pool Habitat Lower Reach

Photo 2: Lower Beaver Creek Pasture Drainage

Photo 3: Beaver Creek Upper Reach Riffle Habitat

Photo 4: Beaver Creek Upper Reach Bank Scour

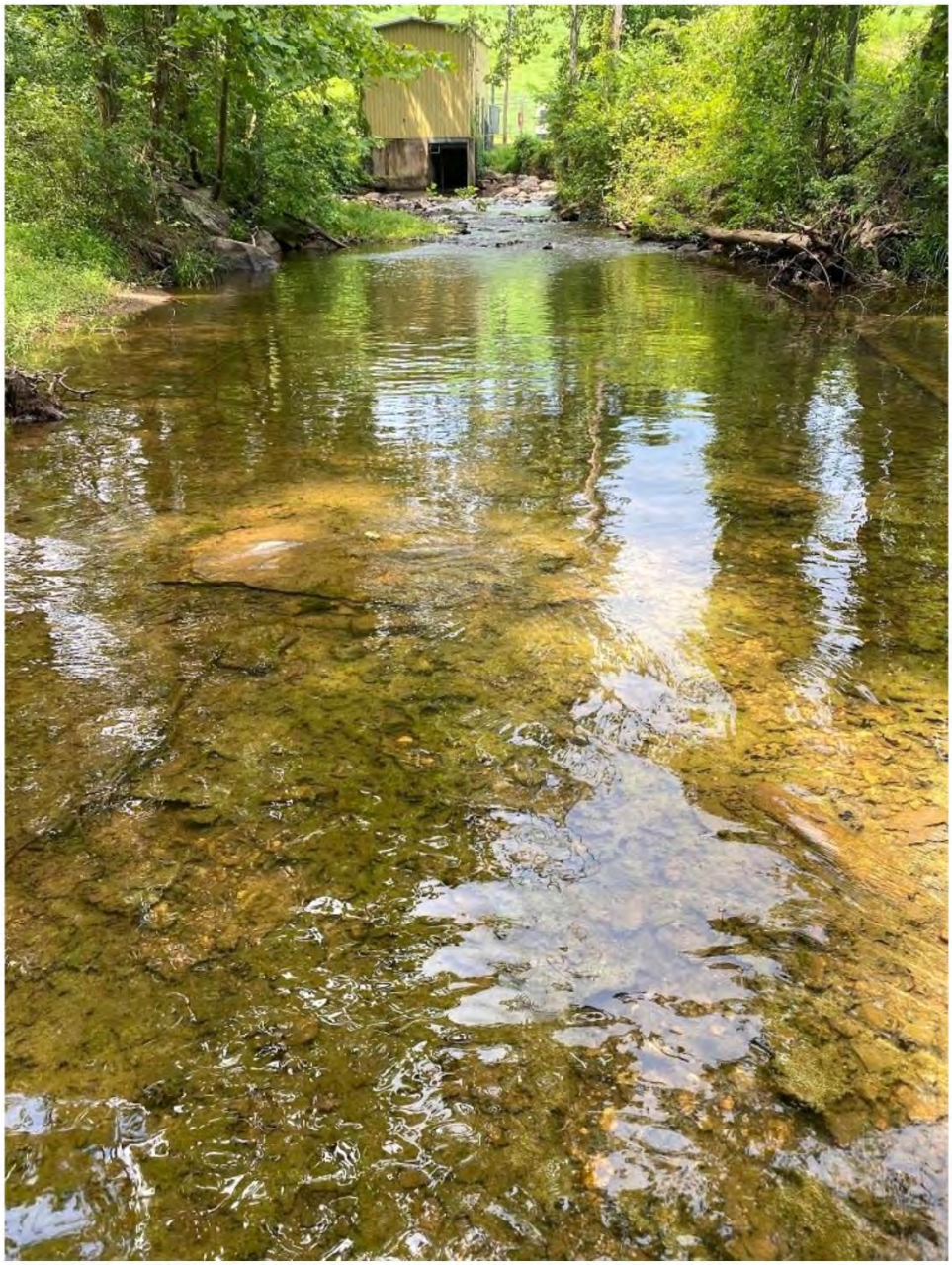


Photo 5: Beaver Creek Dam Outlet

Photo 6: Beaver Creek Reservoir view from Dam

6.0 ECONOMICS

6.1 General

The NRCS National Watershed Program Manual (NWPM) was used as a reference for the economic analysis along with two other documents: the *National Resource Economics Handbook, Part 611 Water Resources Handbook for Economics*, USDA/Natural Resources Conservation Service, July 1998; and *Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (PR&G), DM 9500-013*. The latter includes requirements set forth in the Council on Environmental Quality (CEQ) *Principles and Requirements for Federal Investments in Water Resources (P&R)* and *Interagency Guidelines (IAG)*. DM 9500-013 provides guidance on completing a PR&G analysis, including steps in the planning and evaluation process, differences between project- and programmatic-level evaluations, direction on incorporating an ecosystem services framework, and techniques for economic analyses.

P&G and PR&G were developed to define a consistent set of project formulation and evaluation instructions for all federal agencies that carry out water and related land resource implementation studies. These guidance documents direct how to evaluate alternative project actions and determine whether benefits from the proposed actions exceed project costs.

6.2 Flood damage

6.2.1 Modeling

Assessed values for all homes and other properties within the two- through 500-year flood zones were obtained from the Albemarle County Appraisal District and used to estimate damages from downstream flooding during the frequency storm events. These flood damages were evaluated under existing conditions and under conditions assuming the absence of the dam. A two-dimensional HEC-RAS flood routing model was prepared to model the frequency storm (two through 500-year, 24-hour) events and develop downstream flood rasters for the aforementioned conditions. The following events and conditions were analyzed in general accordance with the Statement of Work for the project:

Table 6.1: Agricultural Flood Damage Scenarios (2, 5, 10, 25, 50, 100-year)

Condition	2-year, 24-hour	5-year, 24-hour	10-year, 24-hour	25-year, 24-hour	50-year, 24-hour	100-year, 24-hour	200-year, 24-hour	500-year, 24-hour
FWOFI (existing conditions)	X	X	X	X	X	X		
Alternative 1								
Alternative 1A	X	X	X	X	X	X		
Alternative 2								
Decommissioning	X	X	X	X	X	X		

Alternatives 1 and 2 were not analyzed for the two through 100-year storm events because the proposed actions would have no impact on the discharge during these hydrologic events. By inspection, the difference to flood damages are $0 for agriculture. Alternative 1A included a revised rating curve with the identical labyrinth spillway, but incorporating a 31.5 inch inside diameter HDPE conduit slipline to be grouted within the existing principal spillway conduit.

The purpose of the slipline alternative was to identify if flood damage benefits could be improved by releasing less / storing more water in Beaver Creek 1 during the two- through 100-year storm events to reduce the effects on downstream farmlands. (see Section 6.2.2)
The planning team assumed that roadways and structures would be considered urban damages, and performed the following flood routing simulations to analyze the flood damage effects on residences and other structures downstream.

Urban Flood Damage Scenarios (10, 50, 100, 200, 500-year)

Condition	2-year, 24-hour	5-year, 24-hour	10-year, 24-hour	25-year, 24-hour	50-year, 24-hour	100-year, 24-hour	200-year, 24-hour	500-year, 24-hour
FWOFI (existing conditions)			X		X	X	X	X
Alternative 1							X	X
Alternative 1A			X		X	X	X	X
Alternative 2							X	X
Decommissioning			X		X	X	X	X

Alternatives 1 and 2 were not analyzed for the 10-year or 50-year storm events because the proposed actions would have no impact on the discharge during these hydrologic events. Alternative 2 was not run because the two auxiliary spillway elevations are set at the same crest elevation, and so differences between 500-year peak discharges would be negligible with respect to impacts to downstream areas.

The depth of flood water data estimated by the two-dimensional HEC-RAS flood routing analyses were then used with water depth-to-damage functions developed by USDA to estimate structural damages. Content values were then estimated as a function of assessed property values.

6.2.2 Flood Damage Results

The estimated flood damages by category are presented in the following tables:

Agricultural, Existing Damages (Table 6.3):

Estimated economic impact, $/acre: $ 200.00

Recurrence (years)	No Action/existing conditions				Decommissioning				Alt 1a			
	< 1ft	>= 1ft	Total	Damages	< 1ft	>= 1ft	Total	Damages	< 1ft	>= 1ft	Total	
2	9.7	-	9.7	$ 1,940.00	14.0	8.4	22.4	$ 4,480.00	9.7	3.1	12.8	$ 2,552.00
5	42.4	51.0	93.4	$ 18,674.00	51.9	68.9	120.8	$ 24,160.00	42.0	50.3	92.3	$ 18,452.00
10	43.6	52.7	96.3	$ 19,256.00	46.6	86.4	133.0	$ 26,600.00	42.0	50.3	92.3	$ 18,468.00
25	18.5	187.2	205.7	$ 41,142.00	16.7	212.6	229.3	$ 45,860.00	17.5	185.8	203.3	$ 40,662.00
50	18.4	187.5	205.9	$ 41,176.00	15.3	218.7	234.0	$ 46,800.00	17.5	185.9	203.4	$ 40,678.00
100	10.3	233.1	243.4	$ 48,680.00	7.8	256.3	264.1	$ 52,820.00	10.0	231.9	241.9	$ 48,376.00
200			-									
500			-									

Agricultural, Damages Annualized (Table 6.4):

FWOFI

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occurrence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)
100	1%	---	$ 48,680.00	---	---
---	---	0.01		$44,928	$449
50	2%	---	$ 41,176.00	---	---
---	---	0.02		$41,159	$823
25	4%	---	$ 41,142.00	---	---
---	---	0.06		$30,199	$1,812
10	10%	---	$ 19,256.00	---	---
---	---	0.10		$18,965	$1,897
5	20%	---	$ 18,674.00	---	---
---	---	0.30		$10,307	$3,092
2	50%	---	$ 1,940.00	---	---
Total Estimated Direct Average Annual Damages:					$8,073

Decommissioned

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occurrence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)
100	1%	---	$ 52,820.00	---	---
---	---	0.01		$49,810	$498
50	2%	---	$ 46,800.00	---	---
---	---	0.02		$46,330	$927
25	4%	---	$ 45,860.00	---	---
---	---	0.06		$36,230	$2,174
10	10%	---	$ 26,600.00	---	---
---	---	0.10		$25,380	$2,538
5	20%	---	$ 24,160.00	---	---
---	---	0.30		$14,320	$4,296
2	50%	---	$ 4,480.00	---	---
Total Estimated Direct Average Annual Damages:					$10,433

1A

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occurrence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)
100	1%	---	$ 48,376.00	---	---
---	---	0.01		$44,527	$445
50	2%	---	$ 40,678.00	---	---
---	---	0.02		$40,670	$813
25	4%	---	$ 40,662.00	---	---
---	---	0.06		$29,565	$1,774
10	10%	---	$ 18,468.00	---	---
---	---	0.10		$18,460	$1,846
5	20%	---	$ 18,452.00	---	---
---	---	0.30		$10,502	$3,151
2	50%	---	$ 2,552.00	---	---
Total Estimated Direct Average Annual Damages:					$8,029

Roadways, Existing Damages (Table 6.5):

Damage estimate, $/foot $ 142.00

	Current conditions			Without dam			Alt 1			Alt 1a		
Recurrence	Number of roadways flooded	Total length of roadway flooded (ft)	Impact	Number of roadways flooded	Total length of roadway flooded (ft)	Impact	Number of roadways flooded	Total length of roadway flooded (ft)	Impact	Number of roadways flooded	Total length of roadway flooded (ft)	Impact
10	4	424	$ 60,208	4	431	$ 61,202	4	424	$ 60,208	4	424	$ 60,208
50	14	3,265	$ 463,630	15	4,252	$ 603,784	14	3,265	$ 463,630	14	3,246	$ 460,932
100	21	9,348	$ 1,327,416	21	10,295	$ 1,461,890	21	9,348	$ 1,327,416	21	9,329	$ 1,324,718
200	21	9,359	$ 1,328,978	21	10,566	$ 1,500,372	21	9,490	$ 1,347,580	21	9,493	$ 1,348,006
500	21	9,642	$ 1,369,164	21	10,912	$ 1,549,504	21	9,926	$ 1,409,492	21	9,930	$ 1,410,060

Roadways, Damages Annualized (Table 6.6):

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Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 1,369,164		
---		0.30%		$1,349,071	$ 4,047
200	0.50%		$ 1,328,978		
---		0.50%		$1,328,197	$ 6,641
100	1.00%	---	$ 1,327,416	---	---
---	---	1.00%		$895,523	$ 8,955
50	2.00%	---	$ 463,630	---	---
---	---	8.00%		$261,919	$ 20,954
10	10.00%	---	$ 60,208	---	---
Total Estimated Direct Average Annual Damages:					$ 40,597

Decommissioned

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 1,549,504		
---		0.30%		$1,524,938	$ 4,575
200	0.50%		$ 1,500,372		
---		0.50%		$1,481,131	$ 7,406
100	1.00%	---	$ 1,461,890	---	---
---	---	1.00%		$1,032,837	$ 10,328
50	2.00%	---	$ 603,784	---	---
---	---	8.00%		$332,493	$ 26,599
10	10.00%	---	$ 61,202	---	---
Total Estimated Direct Average Annual Damages:					$ 48,908

Alt 1

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 1,409,492		
---		0.30%		$1,378,536	$ 4,136
200	0.50%		$ 1,347,580		
---		0.50%		$1,337,498	$ 6,687
100	1.00%	---	$ 1,327,416	---	---
---	---	1.00%		$895,523	$ 8,955
50	2.00%	---	$ 463,630	---	---
---	---	8.00%		$261,919	$ 20,954
10	10.00%	---	$ 60,208	---	---
Total Estimated Direct Average Annual Damages:					$ 40,732

Alt 1A

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 1,410,060		
---		0.30%		$1,379,033	$ 4,137
200	0.50%		$ 1,348,006		
---		0.50%		$1,336,362	$ 6,682
100	1.00%	---	$ 1,324,718	---	---
---	---	1.00%		$892,825	$ 8,928
50	2.00%	---	$ 460,932	---	---
---	---	8.00%		$260,570	$ 20,846
10	10.00%	---	$ 60,208	---	---
Total Estimated Direct Average Annual Damages:					$ 40,593

Structures, Damages Current (Table 6.7):

House 6, 3401 Free Union
Structure value $ 80,500

	Current conditions				Without dam				Alt 1				Alt 1a			
Recurrence	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage
10	-	0%	0%	$ -	-	0%	0%	$ -	-	0%	0%	$ -	-	0%	0%	$ -
50	3.46	28%	42%	$ 56,350	4.37	29%	45%	$ 59,570	3.46	28%	42%	$ 56,350	3.42	28%	42%	$ 56,350
100	8.80	39%	50%	$ 71,645	9.63	42%	51%	$ 74,865	8.80	39%	50%	$ 71,645	8.76	38%	50%	$ 70,840
200	8.81	39%	50%	$ 71,645	9.90	43%	51%	$ 75,670	8.98	40%	50%	$ 72,450	8.98	40%	50%	$ 72,450
500	9.15	40%	50%	$ 72,450	10.28	43%	58%	$ 81,305	9.35	42%	50%	$ 74,060	9.35	42%	50%	$ 74,060

House 9, 290 Ipswich Pl
Structure value $ 300,000

	Current conditions				Without dam				Alt 1				Alt 1a			
Recurrence	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage
10	-			$ -	-			$ -	-			$ -	-			$ -
50	0.10	5%	15%	$ 60,000	0.12	7%	15%	$ 66,000	0.10	5%	15%	$ 60,000	0.10	5%	15%	$ 60,000
100	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$120,000
200	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$120,000
500	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$ 120,000	0.61	20%	20%	$120,000

House 2, 3793 Cow Path
Structure value $ 800,000

	Current conditions				Without dam				Alt 1				Alt 1a			
Recurrence	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage	Depth of flooding	% damage structure	% damage contents	Damage
10	-			$ -	-	0%	0%	$ -	-			$ -	-			$ -
50	-			$ -	-	0%	0%	$ -	-			$ -	-			$ -
100	-			$ -	0.42	20%	20%	$ 320,000	-			$ -	-			$ -
200	-			$ -	0.88	25%	25%	$ 400,000	-			$ -	-			$ -
500	-			$ -	1.55	31%	30%	$ 488,000	-			$ -	-			$ -

Structures, Damages Annualized (Table 6.8):

FWOFI

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 192,450		
---		0.30%		$192,048	$ 576
200	0.50%		$ 191,645		
---		0.50%		$191,645	$ 958
100	1.00%	---	$ 191,645	---	---
---	---	1.00%		$153,998	$ 1,540
50	2.00%	---	$ 116,350	---	---
---	---	8.00%		$58,175	$ 4,654
10	10.00%	---	$ 0	---	---
Total Estimated Direct Average Annual Damages:					$ 7,728

Decommissioned

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 689,305		
---		0.30%		$642,488	$ 1,927
200	0.50%		$ 595,670		
---		0.50%		$555,268	$ 2,776
100	1.00%	---	$ 514,865	---	---
---	---	1.00%		$320,218	$ 3,202
50	2.00%	---	$ 125,570	---	---
---	---	8.00%		$62,785	$ 5,023
10	10.00%	---	$ 0	---	---
Total Estimated Direct Average Annual Damages:					$ 12,929

Alt 1

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 194,060		
---		0.30%		$193,255	$ 580
200	0.50%		$ 192,450		
---		0.50%		$192,048	$ 960
100	1.00%	---	$ 191,645	---	---
---	---	1.00%		$153,998	$ 1,540
50	2.00%	---	$ 116,350	---	---
---	---	8.00%		$58,175	$ 4,654
10	10.00%	---	$ 0	---	---
Total Estimated Direct Average Annual Damages:					$ 7,734

Alt 1A

Storm Event Definition (Years)	Frequency of each Storm - % Chance of Occur-rence	Change in Frequency (Probability)	Damages in Present Values ($)	Average Damages in Present Values ($)	Contribution to Average Annual Damages ($)

500	0.20%		$ 194,060		
---		0.30%		$193,255	$ 580
200	0.50%		$ 192,450		
---		0.50%		$191,645	$ 958
100	1.00%	---	$ 190,840	---	---
---	---	1.00%		$153,595	$ 1,536
50	2.00%	---	$ 116,350	---	---
---	---	8.00%		$58,175	$ 4,654
10	10.00%	---	$ -	---	---
Total Estimated Direct Average Annual Damages:					$ 7,728

6.3 Valuation of Beaver Creek Reservoir Raw Water

Raw water in Beaver Creek 1 is pumped to the Crozet Water Treatment Plant and distributed by Albemarle County Service Authority (ACSA) to customers in the community of Crozet, Virginia. In June 2022, ACSA had 3,859 water accounts in Crozet; 96% were single family residential. From a total usage perspective, 79% of total water went to single family residential accounts, and the remainder when to multi-family residential accounts (7%), commercial accounts (6%), institutional accounts (5.8%), and industrial accounts (2%).

The prices that Crozet utility customers pay include the value of raw water (subsequently referred to as the "at-source" water value) in addition to costs related to the treatment and distribution to households (subsequently referred to as the "on-site" water value). The proposed alternatives involve upgrading the Beaver Creek 1 pump station in order to supply the water treatment plant with additional raw water beyond the current 1.1 million gallons per day (MGD) unpermitted limit. The following valuation method is employed to estimate customer willingness to pay (WTP) for the additional "on-site" raw water withdrawals available with the pump station upgrades.

The "on-site" water demand is estimated using a method called "point expansion," which is described in Chapter 7 of *Determining the Economic Value of Water* (Young and Loomis, 2014). The "point expansion" valuation method requires a price-quantity point on the "on-site" water demand function and an assumed price elasticity of "on-site" water demand. Next, one can assume a quantity change and integrate the area under the demand curve to determine gross economic value. This analysis uses a 30% reduction as the quantity change.

Equation 1: Total or Gross WTP for Change in Water

$$V = \left[\frac{P_1 * Q_1^{\frac{1}{\varepsilon}}}{1 - \frac{1}{\varepsilon}}\right] * \left[\left(Q_1^{1-\frac{1}{\varepsilon}}\right) - \left(Q_2^{1-\frac{1}{\varepsilon}}\right)\right]$$

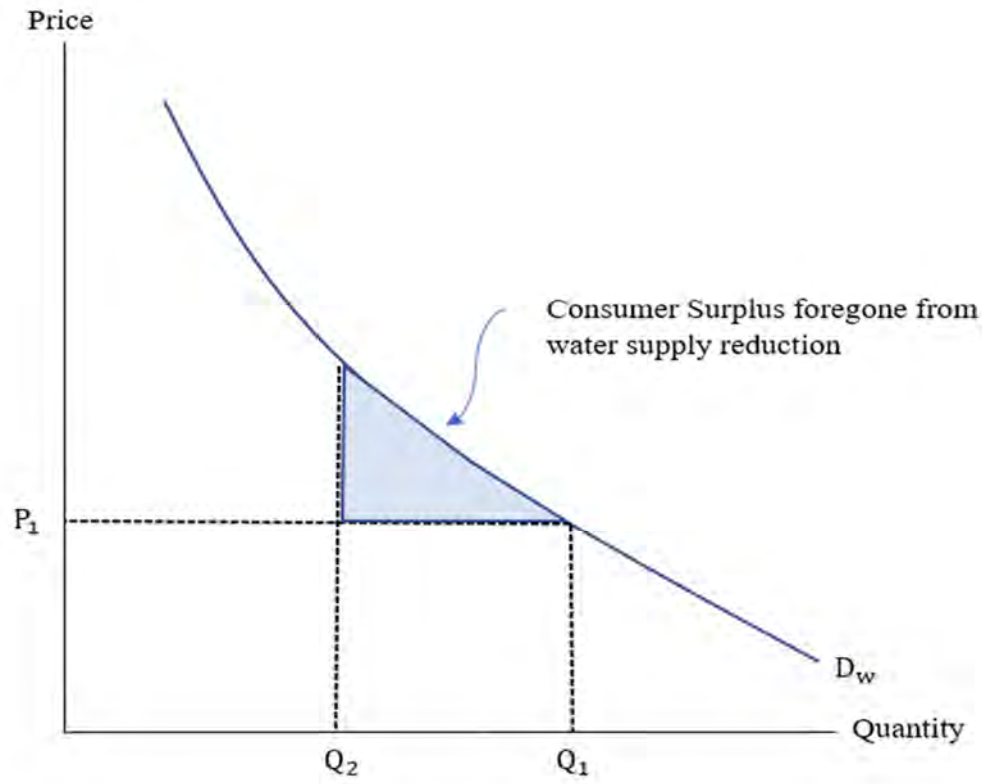
V = Total or Gross WTP (per household)
P = Average price
Q = Quantity
ε = Price elasticity

Equation 2: Net WTP for "On-Site" Raw Water

$$CS = V - [(P_1)(Q_1 - Q_2)]$$

Cost of supply (which is assumed to be average price per gallon paid by customers; full cost pricing with no producer surplus) is subtracted to derive an estimate of consumer surplus (CS) for the quantity change. The quantity change can be divided by number of gallons to get a WTP for a gallon of "at-source" raw water. Since this value is assumed to hold for the average Crozet rate payer, the average WTP is scaled up and used as an aggregate WTP for "at-source" raw water (in this case, millions of gallons).

Figure Illustration of "Point Expansion" Water Valuation Method



Several data sources were used for parameter estimates. The price elasticity of demand parameter estimates come from "Effectiveness of Residential Water-Use Restrictions under Varying Levels of Municipal Effort" (Halich and Stephenson 2009). This paper estimates price elasticity of demand for residential water in 21 localities across Virginia using billing data in the 1990s and 2000s. They found seasonal price elasticities of -0.26 (summer), -0.23 (spring/fall), and -0.16 (winter). Because the price elasticity of demand parameter is for residential water use, the average price and quantity estimates used are for single-family residential accounts in Crozet (96% of accounts and 80% of water usage). The average gallons per month for single family residential accounts in Crozet is 3,628.7 gallons. The average water only bill for single family residential accounts is $29.03 per month, resulting in an average water price per gallon of $0.08. Using the parameter estimates and the "point expansion" method described above, I estimate the value of 1,000,000 gallons (1 MG) to be $11,407 using an average of the three seasonal price elasticity estimates, and a value of $8,489 for 1 MG using the summer price elasticity estimate.

Current Water Supply Benefits

The M&I authorized project purpose provides cost share funds to meet current water supply demands. For the purposes of this analysis, current water supply demand is defined as maximum daily demand over the 1.1 MGD limit between 2023 and 2040. 2040 is selected as the cutoff point for current water supply demand because at that point, the average daily demand is projected to be above the 1.1 MGD unpermitted limit (DWIP 2019). Table 6.9 describes the number of days a year where peak withdrawal is above the 1.1 MGD limit and the total annual volume of this water.

Table 6.9: Current Water Supply Demand (2023-2039)

Year	No. Days Annually Where Withdrawal ≥ 1.1 MGD	Total Annual Volume of Water Withdrawn in Excess of 1.1 MGD (MG)
2023	5	0.41
2024	5	0.54
2025	6	0.67
2026	6	0.81
2027	7	0.97
2028	8	1.14
2029	9	1.33
2030	11	1.55
2031	12	1.81
2032	21	2.17
2033	31	2.71
2034	37	3.37
2035	42	4.31
2036	53	5.47
2037	77	7.05
2038	102	9.13
2039[1]	133	11.94

Since peak water demand is assumed to take place during the summer, the water value estimate using the summer price elasticity was used. Current water supply benefits are valued at $8,488 per 1 MG. To get the total current water value, the benefits over the 55-year evaluation period[2] are discounted at 2.25%. The total sum of present values for the current water supply benefits is estimated to be $2.1 million, and the average annual equivalent value is $66,700.

[1] To estimate a total current water supply value, the 2039 value is carried through the remainder of the 55-year evaluation period.

[2] The 55-year evaluation period includes 2 years of design and three years of construction. The new pump station is assumed to be completed in year 4. Benefits begin year 5 and onward.

Future Water Supply Benefits

Although the M&I authorized purpose only provides cost share funding to meet current water supply demands, an evaluation of future water supply demand was still relevant to this project. First, the Virginia DEQ permitting process requires the sponsor to upgrade the pump station infrastructure to meet projected future demand. The sponsors did this by conducting a demand forecast using historical usage data and projected population growth through the year 2075 (DWIP 2019).

Future water supply benefits are also used to evaluate alternatives using an ecosystem service framework. In this plan EA, alternative 1 involves moving the pump station because its current location is in the way of the dam rehabilitation. Alternative 2 involves a dam rehabilitation that leaves the existing pump station location in place. If the pump station remains in the existing location (alternative 2), the lowest intake gate is 3 feet above the sediment pool and does not have access to approximately 7.5% of the total raw water supply in the reservoir. In the new location (alternative 1), the lowest intake gate can be placed at the top of the sediment pool and access water that is currently inaccessible.

Table 6.10 describes the projected average daily demand based on the sponsor's projections in DWIP 2019. Future water supply demand is defined as average daily demand over the 1.1 MGD limit, and this begins in the year 2040 and continues through the evaluation period.

Table 6.10: Future Water Supply Demand (2040-2077)

Year	Annualized Average Daily Reservoir Withdrawal (MGD)	Deficit (Reservoir Withdrawal over 1.1 MGD)
2040	1.11	-0.01
2041	1.13	-0.03
2042	1.15	-0.05
2043	1.17	-0.07
2044	1.19	-0.09
2045	1.22	-0.12
2046	1.24	-0.14
2047	1.26	-0.16
2048	1.28	-0.18
2049	1.30	-0.20
2050	1.33	-0.23
2051	1.34	-0.24
2052	1.35	-0.25
2053	1.37	-0.27
2054	1.38	-0.28
2055	1.39	-0.29

2056	1.41	-0.31
2057	1.42	-0.32
2058	1.43	-0.33
2059	1.45	-0.35
2060	1.46	-0.36
2061	1.48	-0.38
2062	1.49	-0.39
2063	1.50	-0.40
2064	1.52	-0.42
2065	1.53	-0.43
2066	1.54	-0.44
2067[3]	1.56	-0.46
2068	1.57	-0.47
2069	1.58	-0.48
2070	1.60	-0.50
2071	1.61	-0.51
2072	1.62	-0.52
2073	1.64	-0.54
2074	1.65	-0.55
2075	1.66	-0.56
2076[4]	1.66	-0.56
2077	1.66	-0.56

Future water supply benefits are valued at $11,406 per 1 MG using the average of the seasonal price elasticity demand estimates. To get the total future water value, benefits (beginning in 2040) are discounted at 2.25%. The total sum of present values for the future water supply benefits is estimated to be $20.84 million for alternative 1. The average annual equivalent value is $664,400. The 7.5% of water that is accessible with the new pump station location (alternative 1) but not in the existing location (alternative 2) is valued at $1.1 million. This is because the maximum safe yield ADD withdrawal at the current location is 1.56 MGD, and this is projected to take place in 2067. With the new pump station, withdrawals can increase to 1.66 MGD. The $1.1 million valuation for this difference between alternatives should be thought of as a lower bound of the estimate because maximum daily demand during peak seasons may require the use of the currently inaccessible water below the lowest intake gate.

References

[3] 1.56 MGD is the maximum withdrawal allowable with alternative 2 (pump station remains in place). In evaluating future water supply benefits for alternative 2, 1.56 ADD is carried forward from 2067 to the end of the evaluation period.

[4] DWIP estimate goes through 2075. For the purposes of this analysis, 2075 values are carried forward for last two years

Halich, Greg, and Kurt Stephenson. "Effectiveness of residential water-use restrictions under varying levels of municipal effort." *Land Economics* 85, no. 4 (2009): 614-626.
Hazen and Sawyer. *Drinking Water Infrastructure Plan – Crozet Area,* 2019
Young, Robert A., and John B. Loomis. *Determining the economic value of water: concepts and methods*. Routledge, 2014.

6.4 Economic Evaluation of Temporary on-site Detour Route

An economic analysis of the temporary detour route was performed. The estimated cost of lost time associated with an off-site detour route. The public expressed concern with an off-site detour route during the initial Scoping process.

During dam rehabilitation, traffic on Brown's Gap Turnpike will use a temporary road constructed adjacent to the current site which should result in no change to current traffic patterns and commute times, with the exception of a slight slowdown on the temporary road. A concern is whether the cost of this temporary road exceeds the benefit it provides in avoided travel costs.

As part of project cost estimates, Schnabel Engineering estimated a temporary road cost of $668,500. Avoided travel costs are estimated using an NRCS-developed template of travel costs, shown as Table 4. Required assumptions include distance and time associated with a detour route. There is no single detour route, so an average additional distance of 5 miles was assumed to account for the range of alternative routes.
Other assumptions include:

- The Virginia Department of Transportation estimated a 2020 annual average daily traffic (AADT) of 570 vehicles.
- It was assumed the temporary road will be in place for approximately 6 months.
- The value of motorists' time is assumed to be $16.64, which is the 2021 SSA estimate of median wage levels.

The value of reduced travel time is estimated to be $866,970, shown at the bottom of Table 6.11, significantly greater than the cost of the temporary road. The resulting B:C is 1.3.

Table 6.11 - Delay-Related User Costs for Off-Site Detour

Delay-Related User Costs		
Get actual numbers for length (miles) and time (minutes) to travel the original route and detour route both to and from place of business. The original and detour route distance and time will be automatically subtracted. The **Average User Wage** is the median hourly wage × difference in time between original and detour route. The **Cost Per Vehicle** is the standard cost of driving × difference in miles between original and detour route. The resulting is Average User Wage ($) + Cost Per Vehicle ($) is the **Cost of Detour Per Vehicle**. Then enter the **Estimated Number of Vehicles on Detour Route Per Day** and the **Estimated Cost of Detour Per Day** will be calculated automatically. Estimate the life of the detour route, or how long the detour route will be used and the **Total Delay-Related User Costs or Total Detour Traffic Costs** will be calculated automatically.		
Item	**Unit**	**Quantity**
Original Route (Round Trip)	Miles	5.0
	Minutes	10.00
Detour Route (Round Trip)	Miles	10.0
Assumes detour will take longer than the original route.	Minutes	30.00
Difference in Original and Detour Routes	**Miles**	**5.0**
	Hrs.	**0.33**
Average User Wage	Hr.	$16.64
$ Spent in Detour (Hours × Average User Wage)		**$5.55**
Cost Per Vehicle	Mi.	$0.58
$ Spent in Detour (Miles × Cost Per Vehicle)		**$2.90**
Cost of Detour	**Per Vehicle**	**$8.45**
Delay-Related User Costs		
Item	**Unit**	**Quantity**
Estimated Number of Vehicles on Detour	Per Day	570
Estimated Cost of Detour	Per Day	$4,816.50
Estimated Life of Detour	Days	180
Total Delay-Related User Costs (or Total Detour Traffic Costs)		**$866,970.00**

** **Average User Wage** is highly dependent on the area upon which the detour is located. The **$14.68** hourly rate is based upon the Social Security Administration's median wage level. The median wage, which is $30,533.13, is the salary that falls in the middle of the sample size. In other words, half of the workers earn below this level, and the other half above - it is not an average. The median wage is substantially less than the average wage, which is $46,640.94. Because jobs and skill levels are so highly diversified, there is a huge difference between median wage and average wage levels. If $46,640.94 was used, estimates would probably be exaggerated. Accessed at: http://www.ssa.gov/OACT/COLA/central.html. For comparison, according to the U.S. Census Bureau, the median average wage rate in Florida in 2017 was $16.07. Accessed at: https://www.bls.gov/oes/current/oes_fl.htm#00-0000. At this time, the median and average wages from both the SSA and the U.S. Census Bureau has not been updated.*

** **Cost Per Vehicle** is based upon IRS Standard Mileage Rates for business miles driven, which is $0.58 per mile. The standard mileage rate for business is based on an annual study of the fixed and variable costs of operating an automobile. Accessed at https://www.irs.gov/newsroom/irs-issues-standard-mileage-rates-for-2019.*

6.5 Economic Evaluation of Obtaining Additional Easements in Floodpool

An economic analysis was performed to estimate the B:C ratio for obtaining easements in the floodpool based on the design storm events. An incremental analysis was performed to estimate the resulting damages and compared with costs assumed to obtain the easements.

Table 6.12 Beaver Creek 1
Flood Pool Risk Assessment:

Built in 1964; the flood pool easement was established to elevation 556.0 feet. New calculated peak water surface elevation of PMP floodpool, Alternative 1 (6-hour Local, Virginia PMP, with breach of Henleys occurring when it is overtopped) is 559.6; this is 3.6 feet above the existing easement. The difference results in a 225 acre discrepancy between the top of dam and the easement elevation set at 556.0 feet if the designed PMP storm event occurs; existing top of dam is 560.0 feet.

Item	Item Description
4	assumed flood depth (differ. between floodpool easement elevation & Dam Crest.)
1.0	assumed 1 acre lots if built out
22	acres of added easements needed
22.0	≈ 22 residential parcels/lots if developed/built-out
$500,000	assumed average value of improvements
$11,000,000	assumed total property value at risk if built out
PMP event	approx. 10,000 yr storm; 0.01% chance of occurring
33.77%	assumed average structure damages in % from 4ft. of floodwater
19.83%	assumed average content damages in % from 4ft. of floodwater
$3,714,333	assumed structure damages from PMP event (4ft. deep)
$2,181,667	assumed content damages from PMP event (4ft. deep)
$5,896,000	assumed total damages from PMP event (4ft. deep)
0.01%	percent chance of occurrence for PMP event (1/10,000 expressed as a %)
$589.60	estimated average annual damages from PMP event
$5,000	assumed cost/parcel for floodpool easement to avoid damages (Chris Hively/ MR-50)
$5,000	assumed cost/parcel for legal: title, deed search & recordation fees (also Chris H.)
$10,000	assumed total cost/parcel for floodpool easement
$220,000	assumed total cost for floodpool easement for 225 acres (1,120 parcels)
0.0225	amortization factor for perpetuity (1,000 years) at 2.25%
$4,950	amortized average annual cost of the easements
0.119	B/C ratio comparing AAC for PMP damages vs. AAC of obtaining flood easements.

Table 6.13: Beaver Creek 1 Dam with Proposed Labyrinth Spillway
Peak Reservoir Elevation (Henleys Lake Dam assumed to breach at WSEL 648.6 feet)

Auxiliary Spillway EL =	551.4	ft, NAVD 88

Storm	Rainfall (inches)	Storm Type	Storm Duration (hrs)	Peak EL (ft, NAVD 88)	Auxiliary Spillway Flow Depth (ft)	Depth Above Easement (ft)
PMP	25.8	VAPMP, Local Dist	6	558.9	7.5	2.9
0.9 PMP	23.2	VAPMP, Local Dist	6	557.7	6.3	1.7
0.8 PMP	20.6	VAPMP, Local Dist	6	556.6	5.2	0.6
0.7 PMP	18.1	VAPMP, Local Dist	6	555.5	4.1	0.0
0.6 PMP	15.5	VAPMP, Local Dist	6	554.3	2.9	0.0
0.5 PMP	12.9	VAPMP, Local Dist	6	553.1	1.7	0.0
1000-yr	14.0	Frequency (Atlas14)	24	551.3	0.0	0.0
500-yr	12.3	Frequency (Atlas14)	24	550.9	0.0	0.0
100-yr	9.04	Frequency (Atlas 14)	24	548.9	0	0

6.6 Project Installation Costs

Construction cost estimates were developed for the works of improvement at the dam and proposed spillway and the pump station and intake sites, respectively.

The following tables present the cost estimation for construction cost for implementation of the detailed alternatives (Detailed descriptions of all alternatives can be found in Section 10 of this report). The construction costs include a 25 percent contingency. These costs are considered estimates, and final costs will not be known until detailed design documents are prepared and qualified Contractors submit bids to perform the work. The construction costs presented herein were used as the basis for the estimation of the project installation cost.

6.6.1 Pump Station Installation Costs

6.6.2 Cost Sharing

Based on discussions with NRCS, the costs associated with the pump station were not considered applicable under the PL-566 Rehabilitation Construction, as these funds are primarily for dam and spillway rehabilitation and construction measures. However, NRCS did consider the costs associated with the pump station construction eligible as in-kind contribution under the cost

share total. Costs associated with the pump station replacement will be borne by the Sponsors but are included as part of the cost-share computation. Dam and Spillway Installation Costs

The costs for installing the dam and spillway rehabilitation measures have been separated by measures specific to the dam and spillway construction. These measures include construction of the proposed spillway, site work associated with the dam and spillway, installation of a new filter drain, stabilization of the riser, and other measures necessary to meet applicable requirements for high hazard potential dams in Virginia. Other measures, such as the vehicular spillway bridge construction and temporary on-site detour route, which would be considered real property rights, and are not included in the PL-566 construction cost estimate. These costs will be borne by the Sponsors and are not considered as part of the cost-share computation.

6.6.3 Other Installation Costs

Other costs such as preliminary estimates for construction phase monitoring/engineering, permitting, design engineering, project administration, and sponsor planning costs are presented in the total installation cost table 6.20 and 6.26.

6.6.4 Alternative 1 Installation Cost

The following tables present the individual and total estimated installation costs associated with Alternative 1.

Table 6.14 – Functionally Equivalent Pump Station Installation Cost at Site 1

Description		Pump Station	Shaft/ Microtunnel	Site work	Generator	Access Road	Raw Water Line - Three Notched Road	Raw Water Line	Total
General Conditions/Indirect Costs		$ 228,858	$ -	$ 143,649	$ 12,571	$ 86,468	$ 114,185	$ 19,490	$ 605,221
Scope of work		$ 1,525,717	$ -	$ 957,662	$ 83,809	$ 576,453	$ 761,233	$ 129,932	$ 4,034,806
Subtotal		$ 1,754,575	$ -	$ 1,101,311	$ 96,381	$ 662,921	$ 875,418	$ 149,422	$ 4,640,027
Value of Subcontracted Work		$ 350,915	$ 5,185,050	$ 220,262	$ 96,381	$ 132,584	$ 175,084	$ 29,884	$ 6,190,160
Subcontractor Overhead & Profit	*15.0%*	$ 52,637	$ -	$ 33,039	$ 14,457	$ 19,888	$ 26,263	$ 4,483	$ 150,766
Subtotal		$ 1,807,212	$ 5,185,050	$ 1,134,351	$ 110,838	$ 682,808	$ 901,680	$ 153,904	$ 9,975,843
Labor Escalation at 3.5% annually	*11.51%*	$ 25,502	$ 596,763	$ 40,318	$ 1,362	$ 29,968	$ 4,997	$ 419	$ 699,330
Material/Equipment Escalation at 5% annually	*16.71%*	$ 217,891	$ -	$ 101,475	$ 12,025	$ 52,808	$ 92,837	$ 21,101	$ 498,136
Subtotal		$ 2,050,605	$ 5,781,813	$ 1,276,143	$ 124,225	$ 765,584	$ 999,514	$ 175,424	$ 11,173,309
Prime Contractor Overhead	*7.5%*	$ 127,477	$ -	$ 79,191	$ 2,088	$ 47,475	$ 61,832	$ 10,915	$ 328,979
Subtotal		$ 2,178,082	$ 5,781,813	$ 1,355,335	$ 126,313	$ 813,059	$ 1,061,346	$ 186,339	$ 11,502,288
Prime Contractor Profit	*7.5%*	$ 137,038	$ -	$ 85,130	$ 2,245	$ 51,036	$ 66,470	$ 11,734	$ 353,652
Subtotal		$ 2,315,120	$ 5,781,813	$ 1,440,465	$ 128,558	$ 864,095	$ 1,127,816	$ 198,073	$ 11,855,940
Prime Contractor Profit On Subcontracted Work	*5.0%*	$ 20,178	$ 259,253	$ 12,665	$ 5,542	$ 7,624	$ 10,067	$ 1,718	$ 317,046
Subtotal		$ 2,335,297	$ 6,041,066	$ 1,453,130	$ 134,100	$ 871,718	$ 1,137,883	$ 199,792	$ 12,172,987
Bond and Insurance	*3.0%*	$ 70,059	$ 181,232	$ 43,594	$ 4,023	$ 26,152	$ 34,136	$ 5,994	$ 365,190
Subtotal		$ 2,405,356	$ 6,222,298	$ 1,496,724	$ 138,123	$ 897,870	$ 1,172,019	$ 205,786	$ 12,538,176
Design Contingency	*varies*	$ 721,607	$ 933,345	$ 598,690	$ 27,625	$ 359,148	$ 234,404	$ 41,157	$ 2,915,975
Subtotal		$ 3,126,963	$ 7,155,643	$ 2,095,413	$ 165,748	$ 1,257,018	$ 1,406,423	$ 246,943	$ 15,454,151
Design Contingency		*30.0%*	*15.0%*	*40.0%*	*20.0%*	*40.0%*	*20.0%*	*20.0%*	
Electrical to site									$ 200,000
Easement						$ -			$ -
Total:		$ 3,127,000	$ 7,156,000	$ 2,095,000	$ 166,000	$ 1,257,000	$ 1,406,424	$ 247,000	$ 15,655,000

Table 6.15 – Upgraded Pump Station Installation Cost at Site 1 – Alt 1

Description		Pump Station	Shaft/ Microtunnel	Site work	Generator	Access Road	Raw Water Line - Three Notched Road	Raw Water Line	Total
General Conditions/Indirect Costs		$ 283,974	$ -	$ 143,649	$ 12,571	$ 86,468	$ 136,105	$ 19,490	$ 682,258
Scope of work		$ 1,893,159	$ -	$ 957,662	$ 83,809	$ 576,453	$ 907,369	$ 129,932	$ 4,548,384
	Subtotal	$ 2,177,133	$ -	$ 1,101,311	$ 96,381	$ 662,921	$ 1,043,475	$ 149,422	$ 5,230,642
Value of Subcontracted Work		$ 435,427	$ 5,185,050	$ 220,262	$ 96,381	$ 132,584	$ 208,695	$ 29,884	$ 6,308,283
Subcontractor Overhead & Profit	15.0%	$ 65,314	$ -	$ 33,039	$ 14,457	$ 19,888	$ 31,304	$ 4,483	$ 168,485
	Subtotal	$ 2,242,447	$ 5,185,050	$ 1,134,351	$ 110,838	$ 682,808	$ 1,074,779	$ 153,904	$ 10,584,177
Labor Escalation at 3.5% annually	11.51%	$ 25,439	$ 596,763	$ 40,318	$ 1,362	$ 29,968	$ 4,997	$ 419	$ 699,266
Material/Equipment Escalation at 5% annually	16.71%	$ 279,374	$ -	$ 101,475	$ 12,025	$ 52,808	$ 98,797	$ 21,101	$ 565,579
	Subtotal	$ 2,547,260	$ 5,781,813	$ 1,276,143	$ 124,225	$ 765,584	$ 1,178,572	$ 175,424	$ 11,849,022
Prime Contractor Overhead	7.5%	$ 158,388	$ -	$ 79,191	$ 2,088	$ 47,475	$ 72,741	$ 10,915	$ 370,798
	Subtotal	$ 2,705,648	$ 5,781,813	$ 1,355,335	$ 126,313	$ 813,059	$ 1,251,313	$ 186,339	$ 12,219,821
Prime Contractor Profit	7.5%	$ 170,267	$ -	$ 85,130	$ 2,245	$ 51,036	$ 78,196	$ 11,754	$ 398,608
	Subtotal	$ 2,875,914	$ 5,781,813	$ 1,440,465	$ 128,558	$ 864,095	$ 1,329,510	$ 198,073	$ 12,618,429
Prime Contractor Profit On Subcontracted Work	5.0%	$ 25,037	$ 259,253	$ 12,665	$ 5,542	$ 7,624	$ 12,000	$ 1,718	$ 323,838
	Subtotal	$ 2,900,951	$ 6,041,066	$ 1,453,130	$ 134,100	$ 871,718	$ 1,341,509	$ 199,792	$ 12,942,267
Bond and Insurance	3.0%	$ 87,029	$ 181,232	$ 43,594	$ 4,023	$ 26,152	$ 40,245	$ 5,994	$ 388,268
	Subtotal	$ 2,987,980	$ 6,222,298	$ 1,496,724	$ 138,123	$ 897,870	$ 1,381,755	$ 205,786	$ 13,330,535
Design Contingency	varies	$ 896,394	$ 933,345	$ 598,690	$ 27,625	$ 359,148	$ 276,351	$ 41,157	$ 3,132,709
	Subtotal	$ 3,884,374	$ 7,155,643	$ 2,095,413	$ 165,748	$ 1,257,018	$ 1,658,106	$ 246,943	$ 16,463,244
Design Contingency		30.0%	15.0%	40.0%	20.0%	40.0%	20.0%	20.0%	
Electrical to site									$ 200,000
Easement						$ -			$ -
	Total:	$ 3,884,000	$ 7,156,000	$ 2,095,000	$ 166,000	$ 1,257,000	$ 1,658,106	$ 247,000	$ 16,650,000

Table 6.16: Dam and Spillway Estimated Installation Costs – Alt 1

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	L.S.	$894,600	$894,600
2	Erosion and Sediment Control	1	L.S.	$500,000	$500,000
3	Control of Water	1	L.S.	$650,000	$650,000
4	Clearing and Grubbing	3	Acre	$15,000	$45,000
5	Stripping	5	Acre	$5,000	$25,000
6	Earth Fill	45,000	Cu. Yd.	$ 8	$360,000
7	Coarse Drain Fill	1,900	Cu. Yd.	$85	$161,500
8	Fine Drain Fill	2,100	Cu. Yd.	$100	$210,000
9	Common Excavation	55,000	Cu. Yd.	$6	$330,000
10	Rock Excavation	5,000	Cu. Yd.	$40	$200,000
11	Riprap	3,500	Ton	$65	$227,500
12	Bedding Stone	1,200	Ton	$50	$60,000
13	PVC Pipe - 6-inch diameter (perforated and non-perforated)	1,800	L.F.	$35	$63,000
14	Chain-Link Fence	1,000	L.F.	$100	$100,000
15	Topsoil	10,000	Sq. Yd.	$15	$150,000

16	Permanent Turf Establishment	3	Acre	$7,000	$21,000
17	Structural Concrete Class 4500 - Chute Spillway	8,500	Cu. Yd.	$1,000	$8,500,000
18	Instrumentation	1	L.S.	$25,000	$25,000
19	Demolition of Existing Pump House	1	L.S.	$50,000	$50,000
20	Haul-off and/or spoil Excess Earth and Rock Materials	15,000	Cu. Yd.	$10	$150,000
21	Modifications to existing principal spillway conduit and chute interface	1	L.S.	$100,000	$100,000
				TOTAL	**$ 12,822,600**

Table 6.17: Property Acquisition – Alt 1

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Property Acquisition and Temporary Easements	2.5	Acre	$50,000	$125,000
				TOTAL	**$125,000**

Table 6.18: Road and Bridge over Spillway – Alt 1

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Highway Bridge (136 foot span, H-25 Loading, additional Pedestrian Access)	1	L.S.	$1,250,000	$1,250,000
2	Storm Drainage System	1	L.S.	$100,000	$100,000
3	Pavement - State Road	35,000	Sq. Ft.	$10	$350,000
4	Guardrail	2,600	L.F.	$30	$78,000
5	Re-establish Right Abutment Access Road for Maintenance	0	L.S.	$0	$0
				TOTAL	**$1,778,000**

Table 6.19: Temporary Detour Installation and Removal – Alt 1

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Stripping	1.5	Acre	$15,000	$22,500
2	Earth Fill	8,500	Cu. Yd.	$6	$51,000
3	Pavement	26,000	Sq. Ft.	$10	$260,000
4	Misc. Items & Maintenance of Traffic	1	L.S.	$250,000	$250,000
5	Remove Detour - Excavation	8,500	Cu. Yd.	$10	$85,000
				Total	**$668,500**

Table 6.20: Total Installation Cost – Alt 1

Measures	Total	Purpose (Cost Share Eligible only)	Category	PL-566		Sponsors	
Construction:							
Dam and Spillway Alt 1	$ 12,822,600	Flood Control	Dam and Spillway	X	0	X	0
Dam and Spillway Construction Monitoring/Eng.	$ 1,250,000	Flood Control	Dam and Spillway	X	0	X	0
Dam and Spillway Alt 1 + 25%	$ 17,590,750	Flood Control	Dam and Spillway	100.0%	$ 17,590,750	0.0%	$ -
Pump Station FE with Upgrades + 25%	$ 16,650,000	In-Kind	Pump Station	X	0	X	0
Pump Station Construction Monitoring/Eng. +25%	$ 1,200,000	In-Kind	Pump Station	X	0	X	0
Pump Station FE with Upgrades Total + 25%	$ 17,850,000	In-Kind	Pump Station	X	0	X	$ 17,850,000
Subtotal Construction Alt 1 + 25%	$ 35,440,750	N/A	Dam, Spillway, Pump Statio	100.0%	$ 17,590,750	0.0%	$ 17,850,000
Engineering:							
Engineering Dam and Spillway	$ 750,000	Flood Control	Dam and Spillway	100%	$ 750,000	0%	$ -
Engineering Detour	$ 150,000	In-Kind	Detour	X	$ -	100%	$ 150,000
Engineering Bridge	$ 250,000	In-Kind	Spillway Bridge	X	$ -	100%	$ 250,000
Engineering Pump Station (functionally equivalent)	$ 1,930,000	In-Kind	Pump Station	X	$ -	X	$ 1,930,000
Engineering Pump Station (Upgraded)	$ 2,030,000	In-Kind	Pump Station	X	$ -	100%	$ 2,030,000
Subtotal Engineering	**$ 3,180,000**			X	**$ 750,000**	X	**$ 2,430,000**
Property Acquisition:							
Purchase 2.5 acres downstream of dam/spillway	$ 125,000	Rehab	Property Acquisition	0%	$ -	100%	$ 125,000
Subtotal Property Acquisition	**$ 125,000**	Rehab	Property Acquisition	0%	**$ -**	100%	**$ 125,000**
Real Property Rights:							
Detour Alt 1	$ 668,500	Not Shared	Real Property Rights	0%	$ -	100%	$ 668,500
Bridge Alt 1	$ 1,778,000	Not Shared	Real Property Rights	0%	$ -	100%	$ 1,778,000
Relocate Power Pole Alt 1	$ 75,000	Not shared	Real Property Rights	0%	$ -	100%	$ 75,000
Subtotal Real Property Rights Alt 1	$ 2,521,500	Not shared	Real Property Rights	0%	$ -	100%	$ 2,521,500
Subtotal Real Property Rights Alt 1 + 25%	**$ 3,151,875**	Not shared	Real Property Rights	0%	**$ -**	100%	**$ 3,151,875**
Permits:							
Raw Water Pump Station	$ 304,000	Not Shared	Permits	0%	$ -	100%	$ 304,000
Modification DCR	$ 50,000	Not Shared	Permits	0%	$ -	100%	$ 50,000
Land Disturbance	$ 50,000	Not Shared	Permits	0%	$ -	100%	$ 50,000
Subtotal Permits	**$ 404,000**	Not Shared	Permits	0%	**$ -**	100%	**$ 404,000**
Project Administration:							
	$ 75,000	Not Shared	Dam and Spillway	X	$ 25,000	X	$ 50,000
Subtotal Project Administration	**$ 75,000**	Not Shared		X	**$ 25,000**	X	**$ 50,000**
Sponsor Planning Costs:							
Breach Analysis (2011)	$ 90,000	In-Kind	Dam and Spillway	0%	$ -	100%	$ 90,000
Alternatives Analysis - Dam and Spillway(2012)	$ 133,500	In-Kind	Dam and Spillway	0%	$ -	100%	$ 133,500
Alternatives Analysis/PER- Dam and Spillway (2018)	$ 150,000	In-Kind	Dam and Spillway	0%	$ -	100%	$ 150,000
Pre-Agreement Planning Costs (Prior to July 29, 2020)	$ 72,102	In-Kind	Dam and Spillway	0%	$ -	100%	$ 72,102
Subtotal Sponsor Planning Costs	**$ 445,602**	In-Kind	Dam and Spillway	0%	**$ -**	100%	**$ 445,602**
TOTAL:							
TOTAL INSTALLATION COST	**$ 42,822,227**				**$ 18,365,750**		**$ 24,456,477**
					TOTAL PL-566		TOTAL SPONSORS

6.6.5 Alternative 2 Installation Cost

Table 6.21 – Upgraded Pump Station Installation Cost, Toe of Dam – Alt 2

Description		Pump Station	Shaft/ Microtunnel	Site work	Generator	Access Road	Raw Water Line - Three Notched Road	Raw Water Line	Total
General Conditions/Indirect Costs		*$ 301,643*	*$ -*	*$ 4,463*	*$ 12,571*	*$ 1,705*	*$ 138,456*	*$ 30,635*	*$ 489,474*
Scope of work		*$ 2,010,956*	*$ -*	*$ 29,754*	*$ 83,809*	*$ 11,369*	*$ 923,037*	*$ 204,232*	*$ 3,263,157*
	Subtotal	$ 2,312,599	$ -	$ 34,217	$ 96,381	$ 13,074	$ 1,061,492	$ 234,867	$ 3,752,630
Value of Subcontracted Work		*$ 462,520*	$ 6,090,225	*$ 6,843*	*$ 96,381*	*$ 2,615*	*$ 212,298*	*$ 46,973*	*$ 6,917,856*
Subcontractor Overhead & Profit	*15.0%*	*$ 69,378*	*$ -*	*$ 1,027*	*$ 14,457*	*$ 392*	*$ 31,845*	*$ 7,046*	*$ 124,145*
	Subtotal	$ 2,381,977	$ 6,090,225	$ 35,244	$ 110,838	$ 13,467	$ 1,093,337	$ 241,913	$ 9,967,000
Labor Escalation at 3.5% annually	*11.51%*	*$ 26,983*	*$ 700,943*	*$ 744*	*$ 1,362*	*$ 146*	*$ 5,071*	*$ 30,822*	*$ 766,070*
Material/Equipment Escalation at 5% annually	*16.71%*	*$ 296,814*	*$ -*	*$ 3,891*	*$ 12,025*	*$ 1,688*	*$ 119,169*	*$ 155,057*	*$ 588,644*
	Subtotal	$ 2,705,774	$ 6,791,168	$ 39,879	$ 124,225	$ 15,300	$ 1,217,577	$ 427,791	$ 11,321,714
Prime Contractor Overhead	*7.5%*	*$ 168,244*	*$ -*	*$ 2,478*	*$ 2,088*	*$ 951*	*$ 75,396*	*$ 28,561*	*$ 277,719*
	Subtotal	$ 2,874,018	$ 6,791,168	$ 42,357	$ 126,313	$ 16,252	$ 1,292,973	$ 456,353	$ 11,599,433
Prime Contractor Profit	*7.5%*	*$ 180,862*	*$ -*	*$ 2,664*	*$ 2,245*	*$ 1,023*	*$ 81,051*	*$ 30,703*	*$ 298,548*
	Subtotal	$ 3,054,880	$ 6,791,168	$ 45,020	$ 128,558	$ 17,275	$ 1,374,023	$ 487,056	$ 11,897,980
Prime Contractor Profit On Subcontracted Work	*5.0%*	*$ 26,595*	*$ 304,511*	*$ 394*	*$ 5,542*	*$ 150*	*$ 12,207*	*$ 2,701*	*$ 352,100*
	Subtotal	$ 3,081,475	$ 7,095,679	$ 45,414	$ 134,100	$ 17,425	$ 1,386,230	$ 489,757	$ 12,250,080
Bond and Insurance	*3.0%*	*$ 92,444*	*$ 212,870*	*$ 1,362*	*$ 4,023*	*$ 523*	*$ 41,587*	*$ 14,693*	*$ 367,502*
	Subtotal	$ 3,173,919	$ 7,308,549	$ 46,776	$ 138,123	$ 17,948	$ 1,427,817	$ 504,450	$ 12,617,583
Design Contingency	*varies*	*$ 952,176*	*$ 1,096,282*	*$ 18,711*	*$ 27,625*	*$ 7,179*	*$ 285,563*	*$ 100,890*	*$ 2,488,426*
	Subtotal	$ 4,126,095	$ 8,404,832	$ 65,487	$ 165,748	$ 25,127	$ 1,713,381	$ 605,340	$ 15,106,009
Design Contingency		*30.0%*	*15.0%*	*40.0%*	*20.0%*	*40.0%*	*20.0%*	*20.0%*	
Electrical to site									*$ 200,000*
Easement						*$ -*			*$ -*
	Total:	$ 4,126,000	$ 8,405,000	$ 65,000	$ 166,000	$ 25,000	$ 1,713,381	$ 605,000	$ 15,300,000

Table 6.22 – Dam and Spillway Installation Cost – Alt 2

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	L.S.	7.5% all other items	$1,032,000
2	Erosion and Sediment Control	1	L.S.	$500,000	$500,000
3	Control of Water	1	L.S.	$450,000	$450,000
4	Clearing and Grubbing	2.5	Acre	$15,000	$37,500
5	Stripping	6	Acre	$5,000	$30,000
6	Earth Fill	64,000	Cu. Yd.	$12	$768,000
7	Coarse Drain Fill	1,900	Cu. Yd.	$85	$161,500
8	Fine Drain Fill	1,900	Cu. Yd.	$100	$190,000
9	Common Excavation	45,000	Cu. Yd.	$6	$270,000
10	Rock Excavation	19,000	Cu. Yd.	$35	$665,000
11	Riprap	1,250	Ton	$75	$93,750
12	Bedding Stone	400	Ton	$50	$20,000
13	PVC Pipe - 6-inch diameter (perforated and non-perforated)	1,100	L.F.	$35	$38,500
14	Chain-Link Fence	1,100	L.F.	$100	$110,000
15	Topsoil	16,000	Sq. Yd.	$15	$240,000

16	Permanent Turf Establishment	4	Acre	$7,000	$28,000
17	Structural Concrete Class 4500 - Chute Spillway	10,000	Cu. Yd.	$1,000	$10,000,000
18	Instrumentation	1	L.S.	$25,000	$25,000
19	Demolition of Existing Pump House	1	L.S.	$0	$0
20	Haul-off and/or spoil Excess Earth and Rock Materials	12,800	Cu. Yd.	$10	$128,000
				Total	**$14,787,250**

Table 6.23: Property Acquisition – Alt 2

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Property Acquisition and Temporary Easements	4.0	Acre	$50,000	$200,000
				TOTAL	**$200,000**

Table 6.24: Road and Bridge over Spillway – Alt 2

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Bridge (119 foot span, H-25 Loading, Pedestrian Access)	1	L.S.	$1,000,000	$1,000,000
2	Storm Drainage System	1	L.S.	$100,000	$100,000
3	Pavement - State Road	12,000	Sq. Ft.	$10	$120,000
4	Guardrail	1,200	L.F.	$30	$36,000
5	Re-establish Right Abutment Access Road for Maintenance	1	L.S.	$100,000	$100,000
				TOTAL	**$1,356,000**

Table 6.25: Temporary Detour Installation and Removal – Alt 2

Item. No.	Description of Work	Quantity	Unit	Unit Price	Amount
1	Stripping	1	Acre	$15,000	$15,000
2	Earth Fill	1,300	Cu. Yd.	$6	$7,800
3	Pavement	20,000	Sq. Ft	$10	$200,000
4	Misc. Items & Maintenance of Traffic	1	L.S.	$150,000	$150,000
5	Remove Detour - Excavation	1,300	Cu. Yd.	$10	$13,000
				Total	**$385,800**

Table 6.20: Total Installation Cost – Alt 2

Measures		Total
Construction:		
Dam and Spillway Alt 2	$	14,787,250.00
Dam and Spillway Construction Monitoring/Eng.	$	1,250,000.00
Dam and Spillway Alt 2 + 25%	$	20,046,562.50
NA	$	15,300,000.00
Pump Station FE with Upgrades + 25%	$	15,300,000.00
Pump Station Construction Monitoring/Eng. +25%	$	1,200,000.00
Difference for M&I	$	-
Subtotal Construction Alt 2 + 25%	$	36,546,562.50
Subtotal Construction Alt 2 + 25%	**$**	**36,546,562.50**
Engineering:		
Engineering Dam and Spillway	$	750,000.00
Engineering Detour	$	150,000.00
Engineering Bridge	$	250,000.00
Engineering Pump Station (functionally equivalent)	$	1,930,000.00
Engineering Pump Station (Upgraded)	$	2,030,000.00
Subtotal Engineering	**$**	**3,180,000.00**
Property Acquisition:		
Purchase 2.5 acres downstream of dam/spillway	$	200,000.00
Subtotal Property Acquisition	**$**	**200,000.00**
Real Property Rights:		
Detour Alt 2	$	385,800.00
Bridge Alt 2	$	1,356,000.00
	$	-
Subtotal Real Property Rights Alt 2	$	1,741,800.00
Subtotal Real Property Rights Alt 1 + 25%	**$**	**2,177,250.00**
Permits:		
Raw Water Pump Station	$	304,000.00
Modification DCR	$	50,000.00
Land Disturbance	$	50,000.00
Subtotal Permits	**$**	**404,000.00**
Project Administration:		
Subtotal Project Administration	**$**	**25,000.00**
Sponsor Planning Costs:		
Breach Analysis (2011)	$	90,000.00
Alternatives Analysis - Dam and Spillway(2012)	$	133,500.00
Alternatives Analysis/PER- Dam and Spillway (2018)	$	150,000.00
Pre-Agreement Planning Costs (Prior to July 29, 2020)	$	72,102.00
Subtotal Sponsor Planning Costs	**$**	**445,602.00**
TOTAL: **TOTAL INSTALLATION COST**	**$**	**43,028,414.50**

7.0 COST ALLOCATION

The project cost allocation for the preferred alternative was estimated based on the cost share guidance provide in the NWPM and communications with NRCS. The costs for various measures and categories associated with the installation of the project were tabulated. The cost share items consisted of Construction of the rehabilitation for the dam and spillway (cost share eligible), Construction of the new raw water pump station (not cost share eligible, paid for by Sponsors, but included as in-kind contribution), and Sponsors' estimated planning costs consisting of engineering studies and evaluations performed since 2011 associated with the dam and spillway rehabilitation, prior to the project's acceptance into the Watershed Rehabilitation Program. (in-kind contributions) The cost share for PL-566 Watershed rehabilitation projects is 65% of eligible charges paid for by PL-566, up to 100% of the dam and spillway rehabilitation construction cost.

Other non-sharable items were included as part of the total project installation cost. These included NRCS technical assistance and engineering for detailed design ($750,000 from PL-566), Real Property Rights by the sponsors of $3.2 million (includes temporary on-site detour route construction and removal, vehicular spillway bridge, relocation of the power pole at the toe of the dam, and other associated fees), Sponsors' Engineering costs associated with the temporary detour, bridge design, and new pump station infrastructure, property acquisition costs associated with 2.5 acres of private property downstream of the spillway, and project administration costs ($25,000 for NRCS and $50,000 for the Sponsors, assumed).

Cost Table 2a in the Plan-EA document shows the cost allocation and cost sharing summary.

8.0 CULTURAL RESOURCES

The following sections summarize methodologies and findings of cultural resource evaluation associated with the watershed plan. For additional information, refer to the full draft report Phase I Cultural Resource Survey of the Crozet Water Supply Project Area in Albemarle County, Virginia (Dovetail, 2022).

8.1 Cultural Resources Survey

On behalf of Hazen and Sawyer, Dovetail Cultural Resource Group (Dovetail) conducted a Phase I cultural resource survey of the Crozet Water Supply project area in Albemarle County, Virginia, in 2020, with supplementary efforts occurring in 2021 and 2022. The survey was completed in accordance with the Virginia Department of Historic Resources (DHR) guidelines and included an examination of approximately 3.2 miles (5.2 km) of waterline corridor, three possible pump station locations, and the dams and spillways portion of the project area, altogether encompassing approximately 39.6 acres (16 ha). The goal of the survey was to identify archaeological sites within the project area, identify architectural resources located within the architectural project area, and

to make recommendations on the eligibility of any identified resources for inclusion in the National Register of Historic Places (NRHP). For the purposes of this project, the architectural project area is defined as the project area plus any area where alterations to a resource's setting and feeling may occur.

The archaeological survey consisted of a pedestrian survey followed by a shovel test pit (STP) survey of suitable areas. Pedestrian reconnaissance indicated that large portions of the project area were not suitable for STP survey. A stone building foundation was observed immediately outside of the boundaries of Area 1, a proposed pipeline corridor. Although no artifacts were recovered from STPs near this foundation, a sparse surface scatter was observed. As a result, archaeological site 44AB0703 was identified, consisting of the ruin and the artifact scatter. The majority of the site lies outside of the project area and no artifacts associated with it were recovered from the project area. As such, **Dovetail recommends that 44AB0703 remains unevaluated for NRHP listing, and that the portion of the site lying within the project area does not contribute to its potential eligibility.** Following the pedestrian survey, 186 STPs were excavated within the project area. The recovery of 28 artifacts from the STPs and a single artifact from surface collection resulted in the identification of two additional sites (44AB0709 and Site 3) and three isolated finds (IF 1–IF 3). **Isolated finds are not considered to be eligible for inclusion in the NRHP**. Site 44AB0709 consists of a linear scatter of historic and precontact artifacts at the bottom of a steep slope below the spillway of the dam. It is likely that the site represents a secondary deposit of artifacts washed across the spillway, possibly from areas disturbed during the dam construction. Site 3 is a small multicomponent artifact scatter recorded in a narrow portion of the project area along Old Three Notch'd Road. Given the conditions within these sites **Dovetail recommends that 44AB0709 is not eligible for NRHP listing, and that Site 3 remains unevaluated for NRHP listing and that the portion of the site lying within the project area does not contribute to its potential eligibility.**

The architectural fieldwork included the identification of all previously recorded resources and previously unidentified resources over 50 years in age located within the architectural project area. Dovetail identified 14 above-ground resources within the architectural project area. **Dovetail recommends that one resource, Three Notch'd Road (002-5379), is potentially eligible for the NRHP under Criterion A.** As a result of this investigation, **Dovetail recommends that the remaining 13 resources (002-0161, 002-0259, 002-5327–002-5332, 002-5335, 002-5336, and 002-5340–002-5342) are not eligible for listing in the NRHP.**

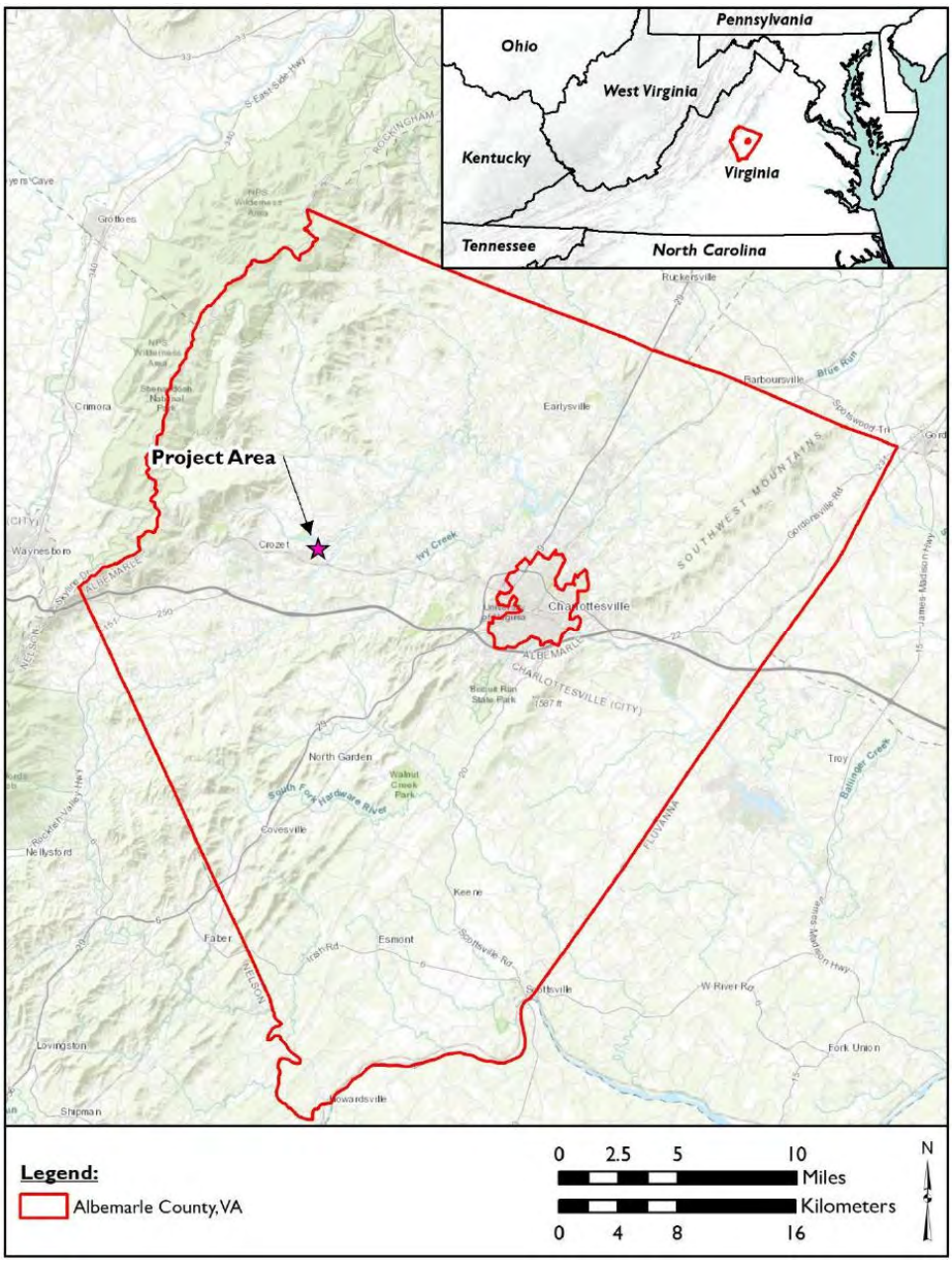


Figure 8.1: Location of Project Area and Albemarle County (Esri 2020).

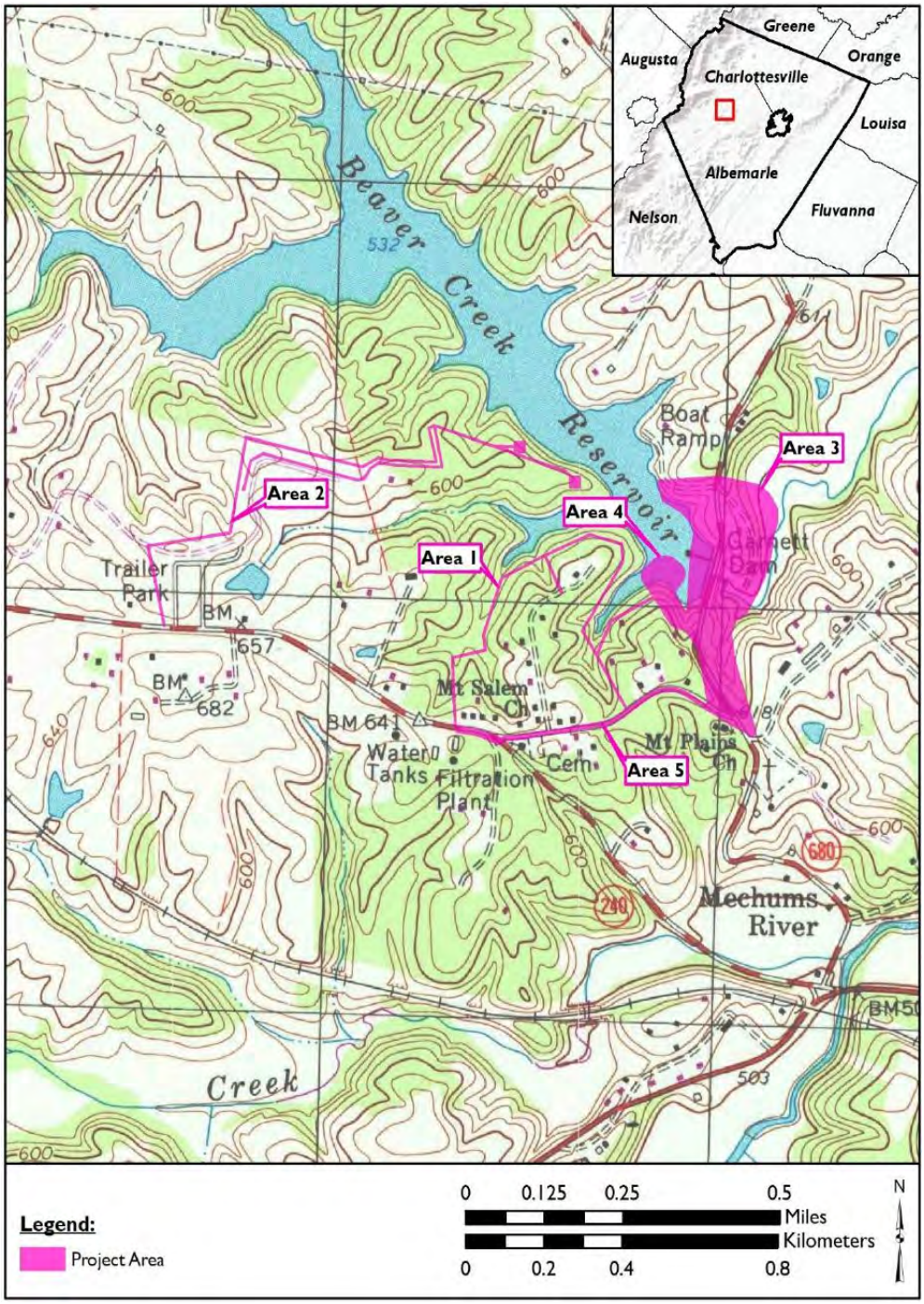


Figure 8.2: Location of Project Area on Topographic Map (United States Geological Survey [USGS] 1999).

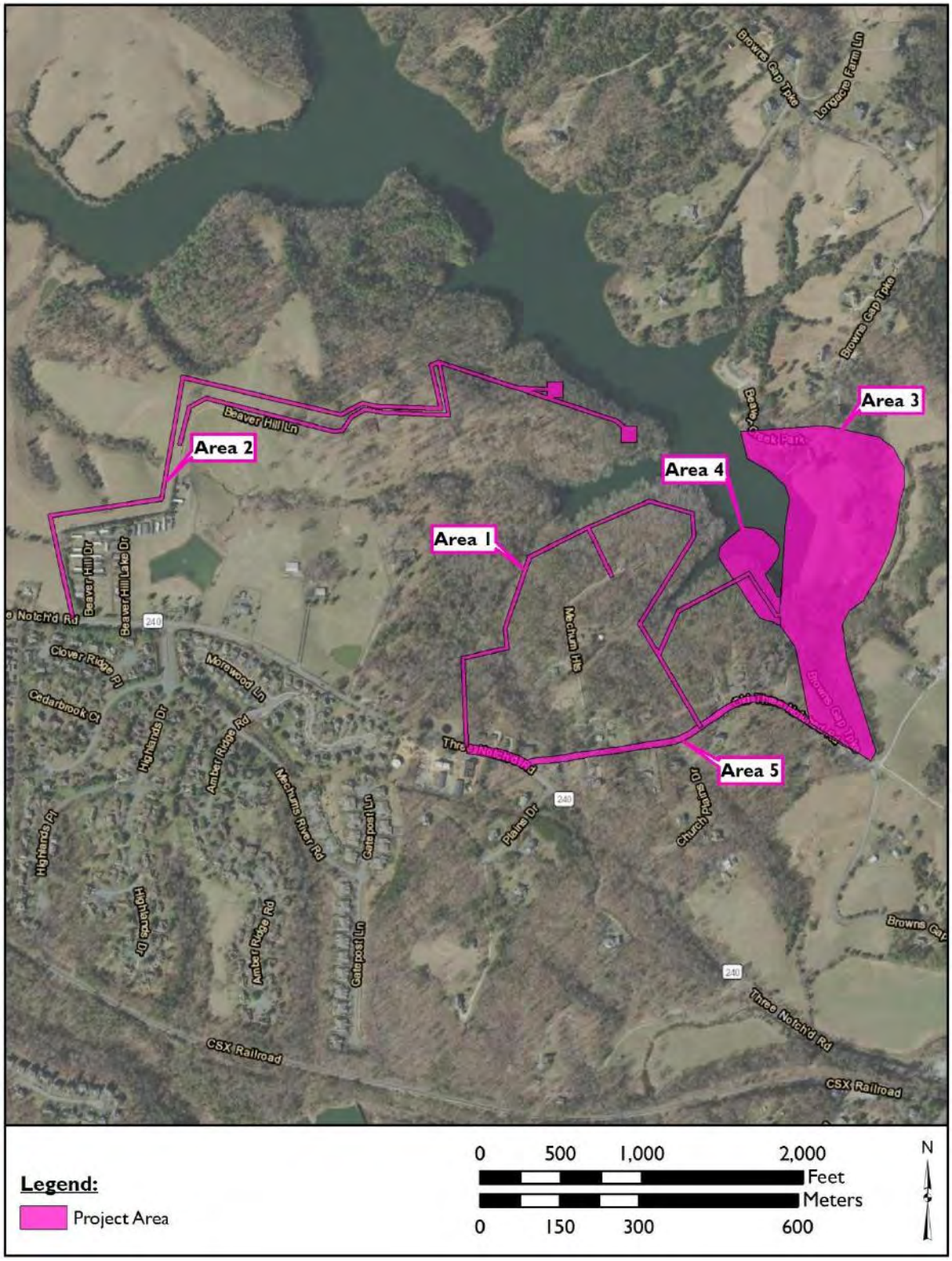


Figure 8.3: Project Area on Aerial Imagery (Esri 2019).

8.1.1 Survey Methodology

The goal of the archaeological survey was to identify cultural resources more than 50 years old within the project area and to make recommendations on the eligibility of any identified resources for the NRHP. The survey methods employed to meet these goals were chosen with regard to the project's scope (i.e., the project's potential to affect significant resources, should they be present), the potential of the project area to contain significant archaeological resources, and local field conditions.

8.1.2 Phase I Archaeological Survey

The archaeological survey consisted of a pedestrian survey of the entire project area followed by a shovel test pit (STP) survey. The pedestrian survey consisted of examining and photo-documenting the project area. Results of this examination, as well as a review of historic mapping and aerial imagery, were used to determine areas suitable and unsuitable for subsurface survey. Based on the environmental setting of the project area and the previously recorded archaeological sites and architectural resources within 1 mile (1.6 km), the probability of discovering historic archaeological resources within the project area was thought to be moderate.

Subsurface investigations comprised the excavation of STPs throughout the portion of the project area determined by the pedestrian reconnaissance to have the potential for containing archaeological sites. STPs were excavated at 50-foot (15.2-m) intervals along transects. The provenience information for each STP was coded using a trinomial system which consisted of the area number, a transect designation, and a numerical designation for the STP (e.g., STP 2B-5 is the fifth shovel test on transect B in Area 2). STPs were not excavated in areas of obvious modern disturbance including roads and driveways, graded areas, and marked utilities; in drainage ditches, delineated wetlands, or areas of standing water; or in areas of excessive slope (exceeding 15 percent). STPs measured approximately 1.25 feet (38.1 cm) in diameter and were excavated to penetrate at least 0.3 feet (9.1 cm) into sterile subsoil where possible. All soil excavated from STPs was passed through 0.25-inch (0.6-cm) hardware mesh cloth. Each natural stratum was given a stratum designation (e.g., I, II, III) in order to delineate stratigraphic relationships. Soil conditions, weather information, and notations on disturbances were recorded within field notes.

8.1.3 Architectural Reconnaissance Survey

The architectural survey was conducted to identify any historic buildings, structures, objects, or districts previously recorded with the DHR or that were over 50 years in age and are newly identified as part of this effort within the architectural project area, defined as the project area plus any area where alterations to a resource's setting and feeling may occur. Any previously recorded

resource that has received a formal NRHP eligibility evaluation from DHR staff and was surveyed within the last five years was not resurveyed during the current project (DHR 2017). The architectural project area was first reviewed through an architectural and historical background literature and records search at the DHR to identify any previously recorded properties in the project vicinity. The architectural project area was then visually inspected through a vehicular and pedestrian reconnaissance to identify these resources. The resources were documented through written notes and digital photographs. The information obtained during the survey was then used to update or generate a new DHR Virginia Cultural Resource Information System (VCRIS) form and to make recommendations on each resource's NRHP potential.

Once identified, the historic significance and integrity of each resource was assessed and the property's NRHP eligibility examined. Each resource was evaluated with regard to Criterion A, for any associations with events that have made a significant contribution to the broad patterns of our history; Criterion B, for any associations with people significant in our nation's history; and Criterion C, for embodiment of distinctive characteristics of a type, period, method of construction, or that represent the work of a master and possess high artistic values. As part of the current survey, these architectural resources were not evaluated under Criterion D for its potential to yield information important in history. Criteria considerations were taken into account only where necessary.

8.1.4 Background Research

Prior to conducting fieldwork, the potential of the project area to contain significant archaeological resources and NRHP-eligible architectural properties was assessed by searching the DHR site and survey file records, as well as examining the CWSAC maps for the area. The project area is not located within or near any Civil War battlefield as Albemarle County was largely spared any skirmishes. However, it is located approximately 7.68 miles (12.36 km) west of the City of Charlottesville, which was targeted for a small Union military operation, part of the Kilpatrick-Dahlgren Raid, in 1864.

Dovetail conducted a background record review to locate earlier surveys, previously identified archaeological sites near the project area, and previously recorded historic architectural properties. Three previous cultural resources, three archaeological sites, and 30 previously recorded architectural resources are located within 1 mile (1.6 km) of the project area. The goal of this research was to provide data on previously recorded resources to aid in the evaluation of properties identified during the current survey. The background review does not serve as the results of the cultural resource survey.

8.1.5 Previous Surveys

Three previous cultural resource surveys have occurred within 1 mile (1.6 km) of the current project area. In 1985, the Department of Anthropology from the University of Virginia conducted Phase I and Phase II archaeological surveys of approximately 340 acres (137.6 ha) across Albemarle County. This work examined 10 archaeological sites, none of which have been evaluated for inclusion in the NRHP by DHR staff (Hantman 1985). Cultural Resource Analysts, Inc. conducted a Phase I archaeological survey associated with the proposed roundabout project at the intersection of Routes 240, 250, and 680 which covered approximately 11.5 acres (4.7 ha) (Arnhold 2018). No archaeological resources were found during that investigation.

8.1.6 Previously Recorded Archaeological Sites

A total of three previously recorded archaeological sites is located within a 1-mile (1.6-km) radius of the project area (Table 8.2). Two of the sites (44AB0188 and 44AB0189) are multicomponent sites of unknown type. Site 44AB0188 has an unknown historic component and a Middle Archaic precontact component. The site has not yet been evaluated by the DHR. The other multicomponent site, 44AB0189, has an unknown historic component and a Middle Woodland precontact component. It has not been evaluated by the DHR. The final site within 1 mile (1.6 km) of the project area, 44AB0416, is a precontact site with components in the Middle Archaic and Woodland periods. Site 44AB0416 has been determined not eligible by the DHR.

Table 8.2: Previously Recorded Archaeological Resources Located within a 1-Mile (1.6-km) Radius of the Project Area.

DHR #	Type	Period	Evaluation Status
44AB0188	No data	Historic/Unknown, Middle Archaic	Not Evaluated
44AB0189	No data	Historic/Unknown, Middle Woodland	Not Evaluated
44AB0416	No data	Middle Archaic, Woodland	DHR Staff: Not Eligible (1992)

8.1.7 Previously Recorded Architectural Resources

There are 30 previously recorded architectural resources within 1 mile (1.6 km) of the project area (Table 8.3). One of the previously recorded resources, the Price's Hotel (002-0265), was determined eligible for listing in the NRHP under Criteria A and C in 2018 by DHR staff. The resource is a circa-1850, Greek Revival-style former tavern and hotel located at the intersection of Three Notch'd Road and Rockfish Gap Turnpike. Three of the resources have been determined by the DHR to be not eligible for inclusion in the NRHP: Mount Salem Baptist Church (002-0798), Bridge #1050 (002-1826), and Bridge #1042 (002-2056). All three of the ineligible

resources were constructed between 1911 and 1921. Twenty-six of the 30 previously recorded architectural resources within 1 mile (1.6 km) of the project area have not been formally evaluated by DHR staff. These resources were constructed between 1795 and 1932 and include 16 single-family dwellings, five farms, three commercial buildings, a school, and a church.

DHR #	Name/Location of Property	Date of Construction	Evaluation Status
002-0161	Mountain Plain Church, Route 682 and Route 680	1850	Not Evaluated
002-0232	Jarman/Harris Miller's House, 1207 Browns Gap	1825	Not Evaluated
002-0233	Brugger House, 1248 Browns Gap Turnpike	1810	Not Evaluated
002-0234	Harris Mill, Jarman-Harris Mill Site, Mechums River Mill, Browns Gap Turnpike	1795	Not Evaluated
002-0235	Brown-Parrott House, Route 680	1800	Not Evaluated
002-0255	Jarman-Cree Farm, Walton House, Three Notch'd	1855	Not Evaluated
002-0256	White Gate Farm, 5055 Three Notch'd Road (Route 240)	1875	Not Evaluated
002-0257	Powell-Ballard House, 5068 Three Notch'd Road	1890	Not Evaluated
002-0258	Pierremont, Route 240	1900	Not Evaluated
002-0259	McCue-Sprouse House, Route 240	1880	Not Evaluated
002-0260	Abell-Garnett House, Route 680	1860	Not Evaluated
002-0261	Ballard-Abell House, Route 680	1850	Not Evaluated
002-0262	Humphrey-Abell House, Route 680	1880	Not Evaluated
002-0265	Price's Hotel, River House, 4330 Mechums Depot Lane	1850	DHR Staff: Eligible (2018)
002-0266	Oldham, James, Farm/House, North of Route 250	1825	Not Evaluated
002-0798	Mount Salem Baptist Church, Route 240 And Route 680	1920	DHR Staff: Not Eligible (2003)
002-0799	Evans Log House (Site), West of Route 676	1800	Not Evaluated
002-1094	Harris Mill Store, 1210 Browns Gap Turnpike	1890	Not Evaluated
002-1096	Gentry, Jones F., House, Brown's Gap Turnpike	1890	Not Evaluated

DHR #	Name/Location of Property	Date of Construction	Evaluation Status
002-1097	House, Brown's Gap Turnpike	1875	Not Evaluated
002-1098	Ballard-Carr House, Brown's Gap Turnpike	1850	Not Evaluated
002-1164	Head House, Route 250	1860	Not Evaluated
002-1165	Windyhill, House, 4457 Rockfish Gap Turnpike	1904	Not Evaluated
002-1182	Clayton, John, Farm Supply Building, Commercial Building, Mechums Depot Lane	N/A	Not Evaluated
002-1489	Mechum's River School, 4832 Mechums School Hill	N/A	Not Evaluated
002-1501	Mechums River Depot Site, 4332 Mechums Depot	1850	Not Evaluated
002-1826	Bridge #1050, Buckingham Branch Railroad over Rockfish Gap Turnpike (Route 250), C&O Bridge	1911	DHR Staff: Not Eligible (2018)
002-2033	Woodroffe House, Route 250	1881	Not Evaluated
002-2056	Bridge #1042¸ Route 240	1921	DHR Staff: Not Eligible (1994)
002-5049	Last Nickel Farm, Wickham Pond, Three Notch'd	1932	Not Evaluated

8.1.8 Results of the Archaeological Field Work

The archaeological survey of the Crozet Water Supply project area comprised pedestrian inspection of the entire project area for above-ground features or deposits of artifacts visible on the surface, followed by STP survey. The survey was conducted over the course of three field sessions which covered different potential alignments for the proposed water lines and associated access roads, as well as pump station locations. The portion of the project area surveyed during the first field effort is referred to below as Area 1, while the area covered during the second field session is designated Area 2. Area 3, the dams and spillways portion of the project area, was surveyed during a third visit. An alternate pump station and access road as well as an alternate waterline route were surveyed in 2022, and designated Area 4 and Area 5 respectively. The survey areas are discussed separately below.

Area 1

Description

Area 1 consists of approximately 1.1 miles (1.8 km) of proposed potential pipeline corridor. The area is entirely wooded and primarily traverses the relatively steep slopes above Beaver Creek Reservoir but also ties into existing waterlines located along Three Notch'd Road, Mechum Heights Road, Old Three Notch'd Road, and Browns Gap Turnpike.

Pedestrian Reconnaissance

Prior to conducting the STP survey, a pedestrian reconnaissance of Area 1 was performed. This consisted of examining and photo-documenting the entirety of the proposed waterline corridor to determine areas suitable and unsuitable for STP survey. Area 1 in general lay on slopes well in excess of 15 percent, and as such was unsuitable for subsurface surveying. The majority of Area 1 was free of apparent ground disturbance aside from a portion where a spur extends toward Mechum Heights Road. In this location, a property owner built what can best be described as a massive "wall" of tree trunks near the top of a ridge. This structure was predominantly located on an excessive slope (exceeding 15 percent) and therefore not suitable for STP survey. However, the structure did preclude STP survey on some level ground that may have been otherwise suitable for subsurface surveying and the activity associated with creation of the structure caused extensive disturbance to the area in its immediate vicinity.

During the pedestrian reconnaissance at the edge of a ridge above a drainage to the reservoir, a substantial but ruinous stone foundation was seen just outside of Area 1. These ruins were recorded as architectural resource 002-5332. Surface artifacts were noted to both sides of the project area where it passed by this foundation and, though the corridor was situated on a steep slope, several STPs were excavated. Newly recorded archaeological site 44AB0703 was identified fanning down the slope from the ruin. STP results and a site description can be found below.

Shovel Test Pit Survey

In addition to the STPs excavated near the ruins, a number of small areas of level ground suitable for subsurface survey were encountered in the otherwise steeply sloping Area 1. Some of these were placed on ridgetops or in the floodplains of the drainages running toward the reservoir. STPs were excavated in five separate locations across Area 1. Because of the narrow waterline corridor, a single transect was placed in each of these areas. Transect A was placed on the relatively steep slope adjacent to the ruins discussed above, Transect B was placed in the floodplain of one of the drainages flowing into Beaver Creek Reservoir, and transects C, D, and E were placed on level areas near ridge tops. A total of 15 STPs was excavated on these five transects during the STP survey.

Soil profiles within Area 1 were generally shallow showing the eroded soils that could be expected along steeply sloping drainages above the reservoir. STPs in Area 1 reached an average depth of 1.1 feet (33.5 cm), with the deepest STP extending to a depth of 1.9 feet (57.9 cm). A horizon soils averaged 0.2 feet (6.1 cm) in depth and extended to a maximum of 0.5 feet (15.2 cm). An illustrative soil profile for Area 1 consisted of dark yellowish brown (10YR 3/4) silty loam topsoil overlying yellowish brown (10YR 5/4) clay loam subsoil. No artifacts were recovered from STPs nor were any subsurface archaeological features observed.

Site 44AB0703

Site Description

Site 44AB0703 consists of a ruinous stone foundation and a surface artifact scatter spreading downhill from that ruin. The site was identified during pedestrian reconnaissance when the foundation was observed lying immediately to the east of the Area 1 (Photo 14). During further visual inspection of the project area near the site and the surrounding vicinity, no artifacts or additional features were identified within the project boundaries. However, artifacts were noted on the surface outside the project area and a site boundary, encompassing 0.3 acres (0.1 ha), was determined based on the extent of the surface scatter (Figure 9, p. 38). The site lies entirely within the mixed forest setting that typifies the project area as a whole. The ruins are located at the very edge of a relatively level ridgetop and the remainder of the site extends west down the steeply sloping side of a drainage leading towards Beaver Creek Reservoir. Site 44AB0703 varies in elevation from approximately 610 feet (185.9 m) to 570 feet (173.7 m) AMSL.

The project area near the ruin is located on a steep side slope of the drainage and was considered unlikely to contain well preserved archaeological deposits. Though this setting would not generally be considered suitable for STP survey, a transect of STPs was placed to examine soil conditions in the site as mapped. STPs within the site had a uniform profile. Stratum I consisted of thin dark brown (10YR 3/3) silty loam topsoil extending to a depth of 0.1 feet (3 cm). Stratum II was a brown (7.5YR 5/4) clay loam, extending to a depth of 0.5 feet (15.2 cm), which in turn transitioned into Stratum III, a reddish brown (5YR 5/4) clay. Both of these lower soil strata appeared to be B horizon soils (Figure 10). STPs reached a total depth of 0.9 feet (27.4 cm). No artifacts were recovered from these STPs.

No artifacts were collected from 44AB0703, as the ruins and observed surface artifacts were located outside the boundaries of the present survey and no artifacts were recovered from the STPs within or immediately adjacent to the site. Observed artifacts at the site included solarized glass and mason jar fragments consistent with a late-nineteenth or early-twentieth century occupation. A building is present in this approximate location in topographic maps from the 1980s and 1990s, but nothing is present on earlier maps or on historic aerial photographs of the area.

Evaluation and Significance

Because the bulk of 44AB0703 is located outside the current project area and artifacts were observed only in the field and not collected or analyzed, potential for interpretation and evaluation of the site is limited. Within those limitations, portions of 44AB0703 within the project area were evaluated in regards to Criterion A, for its association with events that have made a significant

contribution to the broad patterns of our history; Criterion B, for its association with people significant in our nation's history; Criterion C, for its embodiment of distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values; and Criterion D, for its potential to yield information important in history.

There are no significant associations between these deposits and a significant historical event or pattern of events (Criterion A). There are no associations with significant persons (Criterion B), and the deposits do not illustrate the distinctive characteristics of a type, period, or method of construction (Criterion C). Therefore, the potential eligibility of the site rests entirely upon Criterion D. The majority of the site lies outside the current project area, but STPs within the site produced no artifacts, and the steeply sloped setting of the site within the project area is unlikely to provide for preservation of subsurface archaeological deposits. As a result, the portion of 44AB0703 lying within the project area is unlikely to yield further information about the site, or about the nineteenth or twentieth centuries in Albemarle County. As such, **Dovetail recommends that 44AB0703 remains unevaluated for NRHP listing, but the portion of 44AB0703 within the project area is recommended to not contribute to potential eligibility.**

Area 2

Description

Area 2 consists of approximately 1.5 miles (2.4 km) of proposed potential pipeline corridor as well as two 100 x 100-foot (30.5 x 30.5-m) possible pump station locations. Although the pump station footprints will likely be smaller, these dimensions were chosen for the survey to ensure adequate coverage of the final location choice. The western portion of Area 2 is open pasture land while the eastern portion traverses the wooded slopes above Beaver Creek Reservoir. Area 2 contains two potential routes for the proposed waterline. One of these ties into an existing waterline located along Three Notch'd Road, while the other ties into an existing line near the northern terminus of Beaver Hill Lane. The Dovetail survey team was asked by the property owners to cease work before STP survey was conducted on the latter corridor, although it was inspected during the pedestrian survey.

Pedestrian Reconnaissance

Prior to conducting subsurface survey, a pedestrian reconnaissance of the area was performed to determine areas suitable and unsuitable for subsurface survey and to locate any archaeological deposits or features that might be present at the surface. As in Area 1, this consisted of examining and photo-documenting the entirety of the proposed waterline corridor, as well as the possible pump station locations. The majority of Area 2 was free of apparent ground disturbance, with the exception of minimal localized disturbances caused by the installation of drainage culverts under

the access road leading through the area from Three Notch'd Road. Shovel testing was primarily constrained due to portions of Area 2 sloping in excess of 15 percent, making such sloped areas unsuitable for STP survey.

A cattle barn is located just south of the eastern half of Transect D. Although the Dovetail survey team was asked by the property owners to cease work on the parcel before the barn could be closely examined or photo-documented, it appears to have been constructed in the latter half of the twentieth century.

A single artifact was found during the pedestrian survey and designated IF 1. It consisted of a quartz flake found in an area of exposed subsoil adjacent to the access road running parallel to Transect A. No artifacts were recovered from nearby STPs, and the area has been partially disturbed by the construction of the access road. As isolated finds are generally taken to represent casual discard or extremely ephemeral occupations rather than habitation sites or intensively-used activity areas, they are not considered eligible for inclusion in the NRHP.

Shovel Test Pit Survey

A total of 106 STPs was excavated along 10 transects in Area 2. As in Area 1, the proposed corridor was STP surveyed with a single transect down the center. Each transect ran along generally straight portions of the corridor, with the next transect starting at areas where directional changes in the corridor alignment exceeded approximately 45 degrees. Transects A, B, C, and D ran across open fields. Transect E ran partially across an open field before entering a wooded area for a short distance. Transects F and G were located entirely in wooded areas and were located on opposite sides of a large drainage. Transects H, I, and J were used to test proposed pump station locations. The proposed pump station locations occupy 100 x 100-foot (30.5 x 30.5-m) footprints; however, subsurface survey was not conducted across the entirety of these footprints due to sloping in excess of 15 percent. An alternate pipeline corridor is located east of Transect C and E and south of Transect D. The Dovetail survey team was asked by the property owners to cease work before this alternate corridor could be tested with STPs, although it was inspected during the pedestrian survey.

Due to the length of the corridor and variety of topographic setting traversing it, soil profiles within Area 2 varied somewhat. However, as in Area 1, STPs were relatively shallow, again suggesting that eroded soils could also be expected along the steeply sloping drainages that were not subjected to subsurface survey. STPs in Area 2 reached an average depth of 0.9 feet (27.4 cm), with the deepest STP extending to a depth of 1.7 feet (51.8 cm). A horizon soils averaged 0.5 feet (15.2 cm) in depth and extended to a maximum of 1.1 feet (33.5 cm). Soils in the western portion of Area 2, which is characterized by open fields, generally consisted of a dark yellowish brown (10YR 4/4) silty loam plow zone overlying a strong brown (7.5YR 5/8) silty clay to yellowish brown (10YR

5/8) silty clay B horizon. In the wooded eastern portion of Area 2, typical soil profiles comprised a grayish brown (10YR 5/2) silty clay loam to very dark grayish brown (10YR 3/2) A horizon overlying a yellowish brown (10YR 5/6) silty clay to dark yellowish brown (10YR 4/6) sandy clay loam B horizon. No archaeological features or buried ground surfaces were identified in any of the STPs.

A single artifact, IF 2, was recovered during the STP survey. IF 2 consisted of a quartz flake found in STP 2-D-30. No artifacts were recovered from nearby STPs. As isolated finds are generally taken to represent casual discard or extremely ephemeral occupations rather than habitation sites or intensively-used activity areas, they are not considered eligible for inclusion in the NRHP.

Area 3

Description

Area 3 consists of the dams and spillways portions of the project area, totaling approximately 24.5 acres (9.9 ha). This area includes the dam, the parking lots, the portion of Browns Gap Turnpike that leads to the lots, the spillways, boathouse and boat-ramps for Beaver Creek Reservoir Park, as well as areas of private property. All proposed modifications along Brown's Gap Turnpike lie within this area. Aerial photography and historic mapping indicate that the majority of this area was heavily modified during the construction of the dam. To the south, along either side of Browns Gap Turnpike, the area is dominated by the steep natural slopes of the ridges surrounding the reservoir and dam. The central portion of the area consists primarily of the constructed dam and spillways. To the northwest, the parking lots for the boathouse and boat-ramp occupy the only level ground. Along the eastern edge of the area, from Beaver Creek's outlet beneath the dam northward, Area 3 runs through a plowed field that occupies relatively level terrain in comparison to the rest of the area.

Pedestrian Reconnaissance

Prior to conducting the STP survey, a pedestrian reconnaissance of Area 3 was performed. This consisted of examining and photo-documenting the entirety of Area 3. Results of this examination, as well as a review of historic mapping and aerial imagery, were used to determine areas suitable and unsuitable for subsurface survey. The substantial majority of Area 3 lies within the artificially graded dam and spillway, an area heavily modified during the construction of the dam in the early 1960s. To the south of the dam and spillway, the project area lay either within the road or within the steep slopes along either side of it. To the north of the dam and spillway where the road turns from Browns Gap Turnpike onto Beaver Creek Park Drive, there are paved parking lots and roads as well as extremely steep natural slopes descending into the reservoir below. The only area free of steep slope, paving, or extensive modern disturbance is the farm field lying along the northeastern

edge of Area 3. This farm field was bounded on the west by Browns Gap Turnpike and an extremely steep slope up to the spillway. To the east, the portion of the farm field within Area 3 was bound roughly by Beaver Creek before Area 3 curved to the west at the project area's northern end. No artifacts or features were noted during the pedestrian survey.

Shovel Test Pit Survey

The STP survey consisted of the excavations of STPs along four transects within Area 3. All STPs were within the farm field, discussed above, or within a small grassy area immediately to the south of that field. Transect A was placed following the bottom of the steep slope that bounded the field to the east. The STPs on the remaining transects were placed at 50–foot (15.2–m) intervals east of Transect A, where feasible, to fill the remainder of the testable area within the field. A total of 61 STPs were excavated, including 45 primary STPs and 16 radial STPs used to delineate the boundaries of archaeological finds.

STPs in Area 3 reached an average depth of 1.4 feet (42.7 cm), with the deepest STP extending to a depth of 3 feet (91.4 cm). A horizon soils averaged 0.9 feet (27.4 cm) in depth with the deepest A horizon extending to 2 feet (61.0 cm). STPs within Area 3 had relatively consistent soil profiles. As the testable portion of Area 3 was primarily within a plowed field, STPs generally consisted of a well-formed plow zone overlying clay subsoil. An illustrative soil profile in Area 3 consisted of dark yellowish brown (10YR 4/4) silty loam topsoil overlying reddish yellow (7.5YR 6/8) silty clay subsoil (Figure 18, p. 52).

Twenty artifacts were recovered from seven positive STPs, resulting in the identification of one new archaeological site (44AB0709) and one isolated find (IF 3). Site 44AB0709 is discussed in detail below. The isolated find consisted of a single fragment of precontact lithic debitage located near the project border along Beaver Creek. All radial STPs around this find were negative. As isolated finds are generally taken to represent casual discard or extremely ephemeral occupations rather than habitation sites or intensively-used activity areas, they are not considered eligible for inclusion in the NRHP.

Site 44AB0709

Site Description

Site 44AB0709 consists of a linear scatter of historic artifacts with a small precontact component that follows the bottom of a steep slope lying immediately to the east of the Beaver Creek Reservoir spillway. The site was identified via the excavation of six positive STPs, including five primary STPs and one radial STP. The site is bounded by negative STPs to the south, east, and north, and by a nearly vertical slope to the west. The site, which encompasses 0.2 acres (0.08 ha), measures

approximately 275 feet (83.8 m) north to south and 25 feet (7.6 m) east to west. It lies entirely within a recently plowed field, with mixed forest dominating the slope immediately to the west. Although the field is not as steeply sloped as the hills to the north and west, it does slope noticeably down towards Beaver Creek, which lies approximately 200 feet (61.0 m) to the east. The site lies at an elevation of approximately 500 feet (152.4 m) AMSL.

A total of 10 STPs was excavated within 44AB0709. The STPs all had similar profiles consistent with the site's location in a plowed field. The STPs reached an average depth of 1.4 feet (42.7 cm), with the deepest STP reaching a depth of 2.4 feet (73.2 cm). The plowzone that made up the topsoil layer reached an average depth of 0.9 feet (27.43 cm), with the deepest topsoil horizon recorded as 2 feet (61.0 cm) deep. A typical STP profile in 44AB0709, consisted of dark yellowish brown (10YR 4/4) loam overlying reddish yellow (7.5YR 6/8) silty clay (Figure 19). A total of 19 artifacts were recovered from six positive STPs. All artifacts were recovered from Stratum I.

The assemblage recovered from 44AB0709 (n=19) included both historic (n=14) and precontact artifacts (n=5). Precontact artifacts were all quartz debitage. The historic assemblage included bottle glass (n=12) and ceramic fragments (n=2). Glass was all either machine made (n=11) or of indeterminate manufacture (n=1), and notably included a fragment of solarized glass indicative of early twentieth century occupation. The ceramic assemblage included a single fragment of iron glazed redware, which was used throughout the historic period in Virginia from as early as 1700 to as late as 1900, and a fragment of transfer printed whiteware, which has remained in use from the early-nineteenth century to the present day.

Evaluation and Significance

Site 44AB0709 was evaluated in regards to Criterion A, for its association with events that have made a significant contribution to the broad patterns of our history; Criterion B, for its association with people significant in our nation's history; Criterion C, for its embodiment of distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values; and Criterion D, for its potential to yield information important in history.

There are no significant associations between these deposits and a significant historical event or pattern of events (Criterion A). There are no associations with significant persons (Criterion B), and the deposits do not illustrate the distinctive characteristics of a type, period, or method of construction (Criterion C). Therefore, the potential eligibility of the site rests entirely upon Criterion D. Although 44AB0709 represents a notable concentration of artifacts within its narrow bounds, the linear nature of the site, lying along the bottom of an extremely steep slope, indicates that the artifact concentration is likely the result of a secondary deposit. This is particularly likely given the location

of the site immediately to the east of the dam's spillway. Given this likelihood, and the lack of any artifacts to the east of this narrow linear scatter, it is unlikely that the site will yield any significant information about the historic or precontact periods in the area. As such, **Dovetail recommends that 44AB0709 is not eligible for NRHP listing.**

Area 4

Area 4 consists of a proposed pump station and a proposed access road leading to that station from Brown's Gap Turnpike. The majority of Area 4 overlaps Area 1 or Area 3, which were discussed previously. However, small sections of Area 4 extend beyond the boundaries of those other areas. The entirety of Area 4 lies on the steep slopes of a hill extending into the reservoir, or within the reservoir itself. As such, no subsurface survey was appropriate within this area.

Area 5

Description

Area 5 consists of areas of planned work primarily along Old Three Notch'd Road but also extends slightly onto Three Notch'd Road and Browns Gap Turnpike. Area 5 typically extends to a width reaching approximately 10 feet (3.1 m) from the edge of the existing roadways. The area includes the route of the planned raw water line, beginning on Three Notch'd Road, approximately 350 feet (106.7 m) west of its intersection with Old Three Notch'd Road, continuing along Old Three Notch'd Road for another 2,200 feet (670.6 m) to Browns Gap Turnpike. Area 5 intersects Area 1 in two places, at the far eastern end of Area 5 and in the central part of Area 5. The planned work along Browns Gap Turnpike is also entirely within the dams and spillways area, which is within Area 3.

Pedestrian Reconnaissance

Prior to conducting the STP survey, a pedestrian reconnaissance of Area 5 was performed. This consisted of examining and photo-documenting the entirety of Area 5. Results of this examination, as well as a review of historic mapping and aerial imagery, were used to determine areas suitable and unsuitable for subsurface survey. Area 5 lies mainly in the grading and slope along Three Notch'd and Old Three Notch'd Road. Much of this area is clearly disturbed by grading associated with those roads, or with buried utilities lying along those roads. Much of the rest lies within the steep natural slopes that dominate much of the project area as a whole. As such, a significant majority of this area was unsuitable for subsurface survey. However, a small level area was found between the road grade along the north side of Old Three Notch'd Road and the project boundary (Photo 26, p. 58). This area is located on an apparently undisturbed saddle

on the side of one of the ridges crossing the project area, immediately adjacent to the Transect C of Area 1. No artifacts or features were noted during the pedestrian survey.

Shovel Test Pit Survey

Subsurface survey in Area 5 consisted of the excavation of three primary STPs aligned along a single transect and a single radial STP excavated when artifacts were recovered in two of the primary STPs. Radial STPs were limited by the small area of testable land within Area 5, as the locations for additional radials would have been in the existing road, in steep slope, or outside of the project area. STPs within Area 5 reached an average depth of 1.1 feet (33.5 cm) with the deepest STP extending to 1.3 feet (39.6 cm). A-horizon soils within Area 5 averaged 0.6 feet (18.3 cm) in depth, with the deepest measuring 0.7 feet (21.3 cm). STP profiles in Area 5 consisted of a humic topsoil immediately overlying clay subsoil. A typical profile for Area 5 consisted of dark brown (10YR 3/3) silty loam overlying reddish yellow (7.5YR 6/8) silty clay.

Site 3

Site Description

Site 3 is a small artifact scatter consisting of both historic and precontact components identified in a narrow strip of ground that was suitable for testing between the grading along Old Three Notch'd Road and the project area boundary. The site was identified when two positive STPs yielded a total of seven artifacts. The site, which measures approximately 25 feet (7.6 m) wide and 75 feet (22.9 m) long, and encompasses 0.04 acres (0.02 ha), is bounded by negative STPs to the west, Old Three Notch'd Road and the southern project boundary to the south, a paved driveway immediately bounded by steep slope to the east, and by the project boundary to the north. Because of the constrictions of the project boundary, it is possible that the site extends beyond the currently defined boundaries, particularly into the level areas to the north and to the southwest (across Old Three Notch'd Road) of its current boundaries. The site is generally level and occupied by young deciduous growth, though the steep slopes that typify the project area lie nearby to both the east and northwest.

Two STPs were excavated within Site 3. One STP reached a depth of 1 foot (30.5 cm) while the other reached a depth of 1.1 feet (33.5 cm). Humic topsoils were 0.7 feet (21.3 cm) and 0.6 feet (18.3 cm) thick. Both profiles consisted of dark brown (10YR 3/3) silty loam overlying reddish yellow (7.5YR 6/8) silty clay (Figure 23, p. 61). Although there was no obvious sign of disturbance, the location immediately adjacent to a road, and lying adjacent to numerous steep slopes indicate that the soils are unlikely to be well preserved, and both precontact and historic artifacts, including relatively modern bottle glass, were recovered from topsoil.

A total of seven artifacts was recovered. This included four precontact lithic artifacts and three historic artifacts. The lithic assemblage included two fragments of quartz debitage, and two tools: a quartz Stage 1 Biface, and a Chalcedony Stage 4 Biface. Neither tool was considered temporally diagnostic. The historic assemblage included a fragment of modern brown bottle glass and two ceramic fragments: one ironstone and one pearlware. Pearlware is generally dated to the late eighteenth or early nineteenth century, while ironstone was most commonly used in the mid-nineteenth century, though its production continued to the twentieth century. Given the small assemblages and apparent lack of site integrity, the site's type(s) and function(s) cannot be reasonably interpreted.

Evaluation and Significance

Site 3 was evaluated in regards to Criterion A, for its association with events that have made a significant contribution to the broad patterns of our history; Criterion B, for its association with people significant in our nation's history; Criterion C, for its embodiment of distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or possess high artistic values; and Criterion D, for its potential to yield information important in history.

There are no significant associations between these deposits and a significant historical event or pattern of events (Criterion A). There are no associations with significant persons (Criterion B), and the deposits do not illustrate the distinctive characteristics of a type, period, or method of construction (Criterion C). Therefore, the potential eligibility of the site rests entirely upon Criterion D. Site 3 consists of small precontact and historic artifact assemblages found in a narrow band of the project area that was likely subject to disturbance and erosion given its location. As such, the site as currently mapped and defined within the project area is unlikely to provide significant information about the area in historic or precontact periods. However, the narrow project area precluded testing of the entire landform on which the site is located, and, therefore, the site may extend into areas with greater soil integrity or artifact density. As such, **Dovetail recommends that Site 3 remains unevaluated for NRHP listing, but the portion of Site 3 within the project area does not contribute to potential eligibility.** However, given the setting so high above the original creek and near so many steep slopes draining into the reservoir, it is unlikely that a significant precontact occupation would be found in the area, or that any deposits nearby would be well preserved.

8.1.9 Results of the Architectural Field Work

The architectural survey was conducted to identify any historic buildings, structures, objects, or districts over 50 years in age, either previously recorded with the DHR or unrecorded, within the architectural project area and make recommendations on their NRHP eligibility. The architectural

project area is defined as the project footprint plus any area where alterations to a resource's setting and feeling may occur. There are two previously recorded resources and 12 newly recorded resources within the architectural project area; they are detailed below.

Previously Recorded Architectural Resources

Dovetail identified two previously recorded resources within the architectural project area and surveyed during the course of this project (Table 4; Figure 24, p. 64). The Mountain Plain Baptist Church (002-0161) is a two-story religious building at 4281 Old Three Notch'd Road. Dating to the mid-nineteenth century, the building's brick structural system is laid in a five-to-one American bond with a Flemish variant with a Flemish-bond configuration on the façade (north elevation). The church is covered by a front-gabled roof sheathed in metal and accessed by two single-leaf doors. Other fenestration includes nine-over-nine, wood-framed windows. According to the previous survey, this building was heavily damaged by a tornado in 1959. Associated with the church are: a pre-fabricated shed, a cemetery, and a secondary building that likely houses classrooms and offices.

Table 8.4: Previously Recorded Resource Surveyed During the Current Project.

DHR #	Resource	Built	Previous Eligibility Determination	Current Eligibility Recommendation
002-0161	Mountain Plain Baptist Church, 4281 Old Three Notch'd Road	ca. 1850	Not Evaluated	Not Eligible
002-0259	McCue-Sprouse House, 4806 Three Notch'd Road	Ca. 1880	Not Evaluated	Not Eligible

The McCue-Sprouse House at 4806 Three Notch'd Road (002-0259) is a two-story, three-bay, single-family dwelling constructed around 1880 in the Greek Revival style. Set on a stone foundation, the structural system is clad in aluminum siding and covered by a moderately pitched, asphalt-shingled, side-gabled roof. Although it appears that most of the original windows have been replaced with one-over-one, double-hung-sash units, two two-over-two (vertical muntins), wood-framed windows were observed. Added in the early-twentieth century, a one-story, three-bay, Craftsman-styled porch spans the façade (south elevation). It has a hipped roof supported by tapered, square, wood columns set on poured-concrete bases. From the north (rear) elevation extends a two-story, gable-roofed rear ell.

The Mountain Plain Baptist Church (002-0161) and McCue-Sprouse House (002-0259) are not known to be the work of a master nor do they possess sufficient architectural significance to be considered eligible for the NRHP. They are not outstanding representatives of an architectural style or property type and, furthermore, both have undergone modifications such as replacement materials, additions, and, according to information in VCRIS, interior remodeling, diminishing their integrity of materials, design, and workmanship. As such, these resources are recommended not eligible for individual listing under Criterion C. The Mountain Plain Baptist Church and McCue-Sprouse House do not have a known association with a significant event or person and, as such, they are recommended not eligible for individual listing under Criteria A and B. As architectural resources, these properties were not evaluated under Criterion D. In sum, these two resources are **recommended not eligible for listing in the NRHP under Criteria A-C.**

8.1.10 Newly Recorded Architectural Resources

Twelve newly recorded above-ground resources were identified in the architectural project area and surveyed during the course of this project (Table 5 p. 66; Figure 25–Figure 28, pp. 69–72). One resource, Three Notch'd Road (002-5379), is a historic road that traverses Albemarle County in an east/west direction. The segment surveyed as part of this project comprises portions of Three Notch'd Road (Route 240), Old Three Notch'd Road (Route 802), and Browns Gap Turnpike (Route 680) and extends east from the town of Crozet and terminates at the intersection of Three Notch'd Road, Browns Gap Turnpike, and Rockfish Gap Turnpike (Route 250) (Photo 29–Photo 31, p. 73). It was one of the major east/west thoroughfares in this region of Virginia in the eighteenth, nineteenth, and early-twentieth centuries, as it spanned from Augusta County in the Shenandoah Valley to the City of Richmond (Pawlett and Newlon 1976). Preliminary research completed during this phase of work suggests that Three Notch'd Road was very important in Albemarle County and the Commonwealth of Virginia's history and portions of the corridor have remained fairly unchanged. Additional historical research is **recommended to provide a NRHP recommendation for this resource, as well as to further confirm its boundaries.**

Table 8.5: Newly Recorded Resources Surveyed During the Current Project.

DHR #	Resource	Built	Current Eligibility Recommendation
002-5327	House, 4624 Three Notch'd Road	ca. 1958	Not Eligible
002-5328	House, 1069 Mechums Heights	ca. 1940	Not Eligible
002-5329	House, 1010 Mechums Heights	ca. 1960	Not Eligible
002-5330	Garett Dam/ Beaver Creek Reservoir	ca. 1964	Not Eligible
002-5331	Crozet Water Treatment Plant, 4673 Three Notch'd Road	1966	Not Eligible
002-5332/ 44AB0703	Building Ruins, Old Three Notch'd Road	pre-1963	Not Eligible

DHR #	Resource	Built	Current Eligibility Recommendation
002-5335	House, 4874 Three Notch'd Road	ca. 1963	Not Eligible
002-5336	Beaver Hill Village, Beaver Hill Lane	ca. 1967	Not Eligible
002-5340	Farm, 5068 Notch'd Road	ca. 1930	Not Eligible
002-5341	Farm, 4260 Seven Hills Lane	ca. 1940	Not Eligible
002-5342	House, 4297 Old Three Notch' Road	ca. 1966	Not Eligible
002-5379	Three Notch'd Road	ca. 1930	Potentially Eligible, Criterion A

The House at 4624 Three Notch'd Road (002-5327) is a one-story, three-bay, single-family dwelling built around 1958 in a square form with elements of the Colonial Revival. The building is clad in cementitious fiberboard siding and covered by a hipped roof sheathed in asphalt shingles with a central faux-hipped cupola. Fenestration includes a single-leaf door and one-over-one, vinyl-framed, double-hung-sash windows. A one-story, three-bay, partial-width, front-gabled porch is centered on the façade. The roof that covers the poured-concrete porch is supported by Tuscan-style columns and a large arched opening at the center which features a keystone, molding, and bullseye rosette detailing. The resource has been heavily modified through exterior renovation and an addition.

Constructed around 1940 is a one-story, four-bay, rectangular-form, single-family dwelling located at 1069 Mechum Heights (002-5328). The continuous concrete-block foundation and structural system are covered by a moderately pitched, side-gabled roof sheathed in standing-seam metal. An interior-slope, concrete-block chimney and a metal flue pierce the roof in the southeast side of the ridge. The building is accessed by a plywood ramp and features replacement fenestration. Outbuildings associated with the dwelling include two sheds and one workshop.

A one-story, three-bay, single-family dwelling built around 1960 in a rectangular form is situated at 1010 Mechum Heights (002-5329). The building appears to be vacant and is surrounded by overgrown vegetation. It rests on a continuous concrete-block foundation supporting a structural system clad in plywood board. Covered by a side-gabled roof, the building features an interior-slope chimney and fenestration openings that are not filled.

Between 1959 and 1964, the Charles Mercer Garett, Sr. Dam/Beaver Creek Reservoir Park (002-5330) located off of Browns Gap Turnpike was constructed. It features an artificial embankment dam, the crest of which carries Browns Gap Turnpike; an approximately 104-acre (42.1-ha) water reservoir; an outlet channel; a circa-1964 filter plant; a circa-2009 boat house; parking areas; a circa-1975 check-in/refreshment stand; a circa-2005 boat ramp and dock; circa-1975-bathroom

facilities; and circa-2000 signage. It is unclear what the embankment dam may be filled with; however, the principal concrete spillway is located on the west side of the dam (in the reservoir portion) and the filter plant is located on the east side (in the outlet channel portion). A poured-concrete retaining wall extends from the north side of the outlet channel and provides direction for an emergency spillway over the dam.

The Crozet Water Treatment Plant at 4673 Three Notch'd Road (002-5331) is a complex constructed in 1966 and consists of a water treatment plant building built in the Industrial Commercial style, a multi-column storage tank, storage building, access points, raw water pumping facility, storage facility, steel water tank, machine shed, outbuilding, and two underground water storage pools, all of which were constructed between 1966 and 2015. The primary resource, the water treatment plant building, is clad in a stretcher-bonded brick veneer with concrete paneling located horizontally between window openings. Windows consist of metal-framed hopper/awning units combined with fixed units. A group of concrete water treatment chambers traversed by elevated steel walkways extends south from the core of the building.

Located on the north side of Old Three Notch'd Road in a heavily wooded area and south of the Charles Mercer Garett, Sr. Dam/Beaver Creek Reservoir Park are building ruins (002-5332/44AB0703) that comprise a pre-1963 random rubble stone foundation. A below-ground component was discussed in the previous chapter in this report (p. 37). There does not appear to be any mortar left between the stone. Remnants of brick and pressed metal sheeting were also observed on the site. There were no other above-ground elements observed associated with this resource.

The House at 4874 Three Notch'd Road (002-5335) was constructed around 1963. This one-story, L-plan building comprises the main east-west core with an ell that extends from the north elevation. Set on a concrete-block foundation, the structural system is clad in vinyl siding and covered by a moderately pitched, side-gabled roof sheathed in asphalt shingles. Projecting from the façade (south elevation) is a one-story enclosed porch, which covers the original primary entrance. Other fenestration includes replacement one-over-one, double-hung-sash windows, and a single-leaf metal door. Two one-story additions extend from the ell's north and east elevations.

Extending north from Three Notch'd Road is Beaver Hill Village (002-5336), a mobile home park established around 1967. The buildings line three roads on the north side of Three Notch'd Road: Beaver Hill Drive, Beaver Hill Lane, and Beaver Hill Lake Drive. The earliest mobile homes are concentrated on the westernmost side of the resource, along Beaver Hill Drive. Once containing over 40 buildings, today there are only just over 30 buildings, a portion of which seem to date to the last two decades.

The Farm at 5068 Three Notch'd Road (002-5340) is an agricultural complex centered around a two-story, circa-1930 dwelling that is clad in flat-bottomed, asbestos shingles and covered by a side-gabled roof sheathed in standing-seam metal. A central, front-gabled peak with diamond-shaped wood shingles embellishes the façade (south elevation). The central bay on the south elevation contains a single-leaf wood door with square wood, half-glazed door fills; other visible fenestration includes two-over-two (vertical muntins), double-hung-sash, wood-framed windows. A one-story, three-bay porch spans much of the façade. Its standing-seam-metal-sheathed hipped roof is supported by slender, round, Tuscan columns made of wood. While not visible from the right-of-way, current aerials show that a two-story ell and one-story addition project from the rear (north) elevation. Only four associated outbuildings were visible from the public right-of-way, but aerials suggest that it is possible that more, possibly three, are extant.

Located north of the intersection of Browns Gap Turnpike and Old Three Notch'd Road, the Farm at 4260 Seven Hills Lane (002-5341) comprises over 31 acres (12.5 ha) and approximately 10 buildings and structures. While the current primary resource is a circa-1960, one-story, Ranch-style house, the oldest known building on the farm is a one-story, concrete-block building located at the northeasternmost corner of the property that dates to the 1940s. Other secondary resources include granaries, barns, sheds, and workshops.

The House at 4297 Old Three Notch'd Road (002-5342) is a one-story, five-bay, Ranch-style, single-family dwelling that dates to circa 1966. Covered by a side-gabled roof, the building is accessed by a single-leaf door on the north elevation (façade) and features replacement vinyl windows. An attached carport extends from the east elevation.

These 11 newly recorded resources are not known to be the work of a master or do not possess sufficient architectural significance to be considered eligible for the NRHP. They are not good representatives of an architectural style, property type, or engineering feat. Several resources are also vacant and suffer from neglect or have been heavily altered. As such, the 11 architectural resources are recommended not eligible for individual listing under Criterion C. None of the 11 architectural resources have a known association with a significant event or person and, as such, they are recommended not eligible for individual listing under Criteria A and B. As architectural resources, these properties were not evaluated under Criterion D. In sum, these 11 resources (002-5327–002-5332, 002-5335, 002-5336, and 002-5340–002-5342) are **recommended not eligible for listing in the NRHP under Criteria A–C.**

8.1.11 Summary

On behalf of Hazen and Sawyer, Dovetail conducted a Phase I cultural resource survey of the Crozet Water Supply project area in Albemarle County, Virginia, in August and September, 2020, with supplementary efforts occurring in February and April, 2021 and March 2022. The survey

was completed in accordance with DHR guidelines and included an examination of approximately 2.6 miles (4.2 km) of waterline corridor, two 100 x 100-foot (30.5 x 30.5-m) possible pump station locations, and the dams and spillways portion of the project area, altogether encompassing approximately 39.6 acres (16.02 ha). The goal of the survey was to identify archaeological sites and architectural resources located within the architectural project area and to make recommendations on the eligibility of any identified resources for inclusion in the NRHP.

The archaeological survey consisted of a pedestrian survey followed by a STP survey of those areas determined suitable. Pedestrian reconnaissance indicated that large portions of the project area were not suitable for STP survey due to excessive slope. A single artifact was recovered from the surface during the pedestrian survey and is considered an isolated find (IF 1, in Area 2). A substantial stone building foundation was also observed approximately 20 feet (6.1 m) outside of the project area, uphill and to the west of Area 1. No artifacts were recovered from STPs near this foundation, although a sparse surface scatter was observed both uphill and downhill from the project area. These materials were identified as archaeological site 44AB0703, consisting of the ruin and the area of artifact scatter downhill from it. The majority of the site lies outside of the project area, and no artifacts associated with it were recovered from within the project area. As such, **Dovetail recommends that 44AB0703 remains unevaluated for NRHP listing, but that the portion of the site lying within the project area does not contribute to its potential eligibility**.

One hundred and eighty-six STPs were excavated within the project area. The recovery of 28 artifacts from the STPs resulted in the identification of two additional sites (44AB0709 in Area 3 and Site 3 in Area 5), and two additional isolated finds (IF 2 in Area 2 and IF 3 in Area 3). **Isolated finds are, by definition, not considered to be eligible for inclusion in the NRHP.** Site 44AB0709 consists of a linear scatter of historic and precontact artifacts at the bottom of a steep slope below the spillway of the dam. Given this location and distribution, it is likely that the site represents a secondary deposit of artifacts washed across the spillway, possibly from areas disturbed during the dam construction. As such, 44AB0709 is unlikely to yield further data about historic or precontact life in Albemarle County, and **Dovetail recommends that 44AB0709 is not eligible for listing in the NRHP**. Site 3 is a small multicomponent artifact scatter that was identified within a narrow strip of land within the project area along Old Three Notch'd Road. The recovery of precontact, historic, and modern artifacts from the same context, and the disturbance of the road and buried utilities immediately adjacent to the STPs indicates that the site as identified is unlikely to yield further data about historic or precontact life in Albemarle County. However, since the site's limits are defined by project area boundaries and it may, in fact, extend outside of the project area, **Dovetail recommends that Site 3 remains unevaluated for NRHP listing, but that the portion of the site lying within the project area does not contribute to its potential eligibility.**

The architectural fieldwork included the identification of all previously recorded resources as well as any previously unidentified resources over 50 years in age located within the architectural project area. Dovetail identified two previously recorded resources and 12 newly recorded above-ground resources within the architectural project area (Table 6). One resource, Three Notch'd Road (002-5379), requires additional information to place this road within the context of early transportation in Albemarle County and make recommendations on its NRHP eligibility. For this reason, it is **recommended potentially eligible for the NRHP under Criterion A**. As a result of this investigation, **Dovetail recommends that the 13 resources (002-0161, 002-0259, 002-5327–002-5332, 002-5335, 002-5336, and 002-5340–002-5342) are not eligible for listing in the NRHP.**

Table 8.6: Summary of Identified Resources and Recommendations.

DHR #	Resource	Current Eligibility Recommendation
44AB0709	Multicomponent Scatter	Not Eligible.
Site 3	Multicomponent Scatter	Portion in Project Area Non-Contributing
002-0161	Mountain Plain Baptist Church, 4281 Old Three Notch'd Road	Not Eligible
002-0259	McCue-Sprouse House, 4806 Three Notch'd Road	Not Eligible
002-5327	House, 4624 Three Notch'd Road	Not Eligible
002-5328	House, 1069 Mechums Heights	Not Eligible
002-5329	House, 1010 Mechums Heights	Not Eligible
002-5330	Garett Dam/ Beaver Creek Reservoir	Not Eligible
002-5331	Crozet Water Treatment Plant, 4673 Three Notch'd Road	Not Eligible
002-5332/ 44AB0703	Building Ruins, Old Three Notch'd Road/ Building Ruins and Surface Scatter	Not Eligible/ Portion in Project Area Non-Contributing
002-5335	House, 4874 Three Notch'd Road	Not Eligible
002-5336	Beaver Hill Village, Beaver Hill Lane	Not Eligible
002-5340	Farm, 5068 Three Notch'd Road	Not Eligible
002-5341	Farm, 4260 Seven Hills Lane	Not Eligible
002-5342	House, 4297 Old Three Notch'd Road	Not Eligible
002-5379	Three Notch'd Road	Potentially Eligible

Dovetail Cultural Resources Group submitted a letter dated June 14, 2022 providing the final report on cultural resource studies associated with the project. The Virginia Cultural Resource Information System (VCRIS) packets were submitted to the Virginia Department of Historic Resources (DHR) for review of several resources which are described in further detail in Appendix D. Additional Consultation with DHR is ongoing, and a copy of the draft Plan-EA document will be submitted along with a request for review and comment. The project team has not received a response to the June 14, 2022 letter as of the date of this Plan-EA.

8.2 Social and Economic Conditions

8.2.1 Regional 2019 Social Data from American Community Survey

Table 8.7 and Table 8.8 summarize the region's median age, number of households, per capita income, median household income and the percentage of the population living below the poverty line. The data is for 2019 and its source is the American Community Survey (ACS), which provides annual updates to selected Census data in intervening years. It is apparent that the affected area tends to be more affluent at the household level compared to the rest of the county and state, especially Census Tract 101, Block Group 3.

Table 8.7. Household Age and Income; Persons Below Poverty Line

	Median age	Number of households	Per capita income	Median household income	Persons below poverty line (%)
Commonwealth of Virginia	38.5	3,151,045	$40,645	$74,222	10.6%
Albemarle County	39.1	41,496	$44,799	$79,880	9.1%
Census Tract 101, Block Group 3	50.8	725	$73,067	$120,625	--
Census Tract 111, Block Group 1	43.8	629	$42,206	$85,078	--

Table 8.8. Per Capita and Median Household Income

	Per capita income	Median household income (MHI)	MHI less than $50,000	MHI $50,000 - $100,000	MHI $100,000 - $200,00	MHI greater than $200,000
Commonwealth of Virginia	$40,635	$74,222	32%	29%	26%	12%
Albemarle County	$44,799	$79,880	31%	30%	27%	13%
Census Tract 101, Block Group 3	$73,067	$120,625	19%	26%	28%	27%
Census Tract 111, Block Group 1	$42,206	$85,078	23%	40%	26%	11%

Education-wise, a higher proportion of individuals within the affected area have advanced degrees than those in the remainder of Albemarle County and the Commonwealth of Virginia (Table 8.9).

Table 8.9. Educational Attainment

	Population	High School degree or higher	Bachelors degree or higher
Commonwealth of Virginia	5,776,886	90%	46%

Albemarle County	72,937	92%	60%
Census Tract 101, Block Group 3	1,456	98%	63%
Census Tract 111, Block Group 1	1,103	94%	71%

Housing: Table 8.10 shows that the housing occupancy in the project area is high and generally mirrors that of the rest of the county and Commonwealth. The majority of housing is owner-occupied.

Table 8.10. Occupied Housing Units by Tenure

	Households	Percent occupied	Owner occupied	Renter occupied
Commonwealth of Virginia	3,562,258	90%	66%	34%
Albemarle County	45,520	91%	63%	37%
Census Tract 101, Block Group 3	725	92%	72%	28%
Census Tract 111, Block Group 1	702	90%	78%	22%

Population and Race: Table 8.11 shows the estimated population of the project area and its racial and ethnic composition relative to the surrounding area and the Commonwealth. Overall, the region is predominately white compared to the remainder of the county and the Commonwealth.

Table 8.11. Racial and Ethnic Composition

	Population	White	Black	Hispanic	Other
Commonwealth of Virginia	8,454,463	61%	19%	10%	10%
Albemarle County	107,405	77%	9.5%	5.8%	
Census Tract 101, Block Group 3	1,827	89%	7%	2%	2%
Census Tract 111, Block Group 1	1,472	97%	2%	<1%	1%

Age: Table 8.12 shows median age and the distribution around this median for the project area. The median in the project area, represented by the Census Block Groups, appears to be higher with proportionately more aged 65 or greater, than the surrounding area.

Table 8.12. Age Distribution

	Median age	Age 0 - 18 years old	Age 18+	Age 65 years and older
Commonwealth of Virginia	38.5	-	-	-
Albemarle County	39.1	20%	62%	18%
Census Tract 101, Block Group 3	50.8	18%	64%	18%
Census Tract 111, Block Group 1	43.8	22%	51%	27%

Summary: The 2019 data from the ACS describe a project area that tends to be less diverse, older, more highly educated, and measurably more affluent that the remainder of the county and the Commonwealth. There do not appear to be any areas near the dam or in its drainage that would raise Environmental Justice concerns. Accordingly, Environment Justice will not be carried forward for impacts analysis in the Environmental Consequences section.

8.2.2 Environmental Justice

Executive Order 12898 – Environmental Justice overview:

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each Federal agency to make environmental justice a part of its mission. Agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations, low-income populations, and Indian Tribes. The primary means to attain compliance with environmental justice considerations is: 1) Assessing the presence of environmental justice communities in a project area that may experience disproportionately high and adverse human health or environmental effects, and 2) The inclusion of low-income minority, Tribal, or other specified populations in the planning process. Additionally, E.O. 12898, established an Interagency Working Group (IWG) on environmental justice chaired by the EPA Administrator and comprised of the heads of 11 departments or agencies, including the U.S. Department of Agriculture.

United States Department of Agriculture Departmental Regulation 5600-002 – Environmental Justice overview:

> The USDA Departmental Regulation (DR) 5600-002 provides detailed determination procedures for NEPA and non-NEPA activities and suggests social and economic effects to consider when assessing whether there are disproportionately high and adverse human health or environmental effects to environmental justice communities in a project area.

An environmental justice data review was conducted to identify environmental justice communities in or abutting the project area. Population data was collected from the American Community Survey and represents the 2015-2019 population estimates based on the 2010 US Census tracts and block groups as well as the latest population data available (Tables 8.13 and 8.14) and environmental indicator data was collected from the EPA's "EJSCREEN" online tool (Table 8.15). The project is located within two block groups: census tract 111.01, block group 1 and census tract 101, block group 3. The estimated population of the two block groups combined is 3,198 persons.

The minority population count includes individuals who reported race as any race other than white alone. The minority population is estimated to be 71 persons of census tract 111.01, block group 1, representing 5.2 percent of the total population, and 184 persons of census tract 101,

block group 3, representing 10.1 percent of the total population (Table 8.13). The minority population of the block groups are a lower percentage of the population than is present in Albemarle County (20.6 percent) or throughout Virginia (32.4 percent).

Table 8.13: Minority Populations for the Project Area per the 2019 American Community Survey

Geography	Total Population	Minority Population	
		Number of Persons	Percent of Population
Census Tract 101, Block Group 3	1,827	71	5.2%
Census Tract 111.01, Block Group 1	1,371	184	10.1%
Albemarle County	106,355	21,861	20.6%
Virginia	8,454,463	2,736,846	32.4%

Source: US Census Bureau, American Community Survey 5-year Estimates (2015-2019), Table B02001, "Race."

The low-income population includes all individuals who reported income below two times the poverty level. The low-income population is estimated to be 179 persons of the block group 1 of census tract 111.01, representing 13.1 percent of the total population, and 131 persons of block group 3 of census tract 101, representing 7.2 percent of the total population (Table 8.14). The low-income population of the block groups are a lower percentage of the population than is present in Albemarle County (21.9 percent). The percentage of the population of Virginia that is low-income is 10.6 percent, which is higher than that of block group 3 of census tract 101 and lower than that of block group 1 of census tract 111.01. However, neither block group's low-income population represents a population that is protected under Executive Order 12898.

Table 8.14: Low-Income Populations for the Project Area per the 2019 American Community Survey

Geography	Population for whom Poverty Status is Determined	Below Poverty Level	
		Number of Persons	Percent of Population
Census Tract 101, Block Group 3	1,827	179	13.1%
Census Tract 111.01, Block Group 1	1,371	131	7.2%
Albemarle County	98,891	21,693	21.9%
Virginia	8,201,608	865,691	10.6%

Source: US Census Bureau, American Community Survey 5-year Estimates (2015-2019), Table C17002, "Ratio of Income to Poverty Level in the Past 12 Months."

With respect to the assessed environmental indicators, the EJSCREEN tool provided quantitative estimates for all environmental stressor variables that were below the state, regional and national averages excepting proximity to Risk Management Plan (RMP) Facilities, which is slightly higher than the state average, but still below regional and national averages (Table 8.15). These statistics indicate that the presence of individuals with environmental justice concerns in the project area is unlikely. Fortunately for all populations, rehabilitation of a dam provides benefits to all socioeconomic groups below and above the dam without disparate treatment to any individuals or social groups.

Table 8.15 – Indications and Groups from EPA's Environmental Justice Tool

Report from EJSCREEN Tool (Version 2020)

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Selected Variables	Value	State		EPA Region		USA	
		Avg.	%tile	Avg.	%tile	Avg.	%tile
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m³)	7.24	7.87	9	8.63	4	8.55	16
Ozone (ppb)	41.5	42.4	22	43.2	17	42.9	39
NATA* Diesel PM (µg/m³)	0.171	0.425	11	0.477	<50th	0.478	<50th
NATA* Air Toxics Cancer Risk (risk per MM)	25	31	9	31	<50th	32	<50th
NATA* Respiratory Hazard Index	0.32	0.41	8	0.4	<50th	0.44	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	59	570	31	650	26	750	27
Lead Paint Indicator (% pre-1960s housing)	0.2	0.21	63	0.36	41	0.28	52
Superfund Proximity (site count/km distance)	0.088	0.11	65	0.15	53	0.13	62
RMP Proximity (facility count/km distance)	0.59	0.38	81	0.62	69	0.74	64
Hazardous Waste Proximity (facility count/km distance)	0.085	1.6	10	2	8	5	11
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	N/A	3.1	N/A	34	N/A	9.4	N/A
Demographic Indicators							
Demographic Index	9%	32%	4	30%	8	36%	6
People of Color Population	6%	38%	9	33%	22	39%	14
Low Income Population	12%	25%	28	27%	24	33%	17
Linguistically Isolated Population	0%	3%	52	3%	55	4%	45
Population with Less Than High School Education	7%	11%	42	10%	42	13%	38
Population under Age 5	5%	6%	44	6%	48	6%	44
Population over Age 64	24%	15%	86	16%	84	15%	86

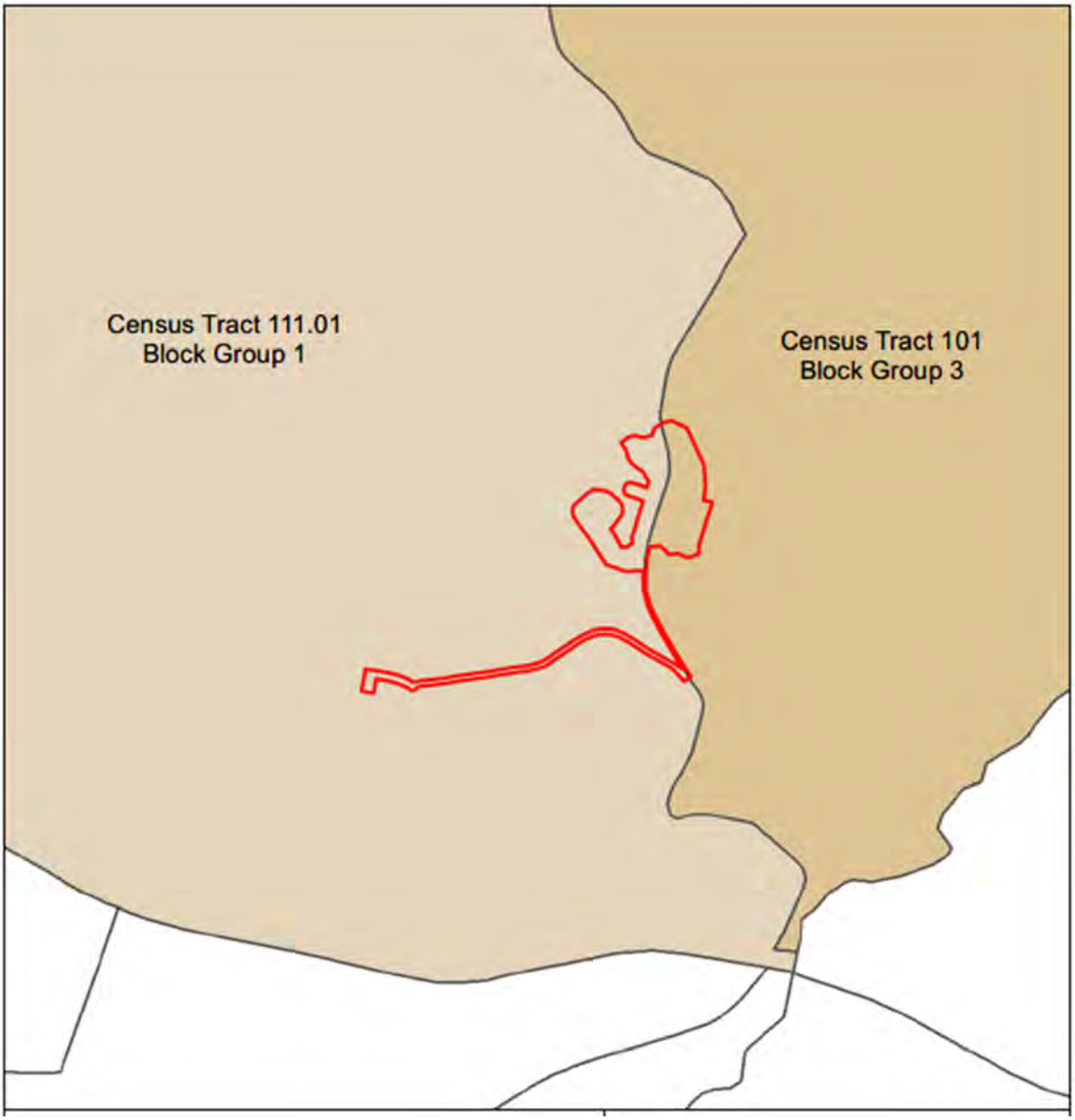


Figure 8.4 – Census Tract Block Groups

9.0 ENVIRONMENTAL CONDITIONS

9.1 Water Quality

Water quality in the Mechums River – Beaver Creek watershed was assessed by the Virginia Department of Environmental Quality in 2020, and no impairments of any type were listed. The Beaver Creek 1 reservoir serves as the sole water supply for the Community of Crozet. As such, RWSA monitors the water quality regularly as part of their treatment and distribution procedures. No known water quality issues exist in the subject raw water impoundment. Temporary impacts to water quality can be mitigated by incorporating appropriate erosion and sedimentation control measures during construction, such as silt fence around exposed reservoir surfaces and a turbidity curtain to protect the existing riser/intake structure.

9.2 Fish and Wildlife

The required lowering of the lake level by approximately 10 feet will be performed slowly to reduce sediment introduction and impacts to aquatic life in the reservoir. Minor, temporary impacts to fish and wildlife will occur during construction within the project area aquatic and terrestrial communities. The planning team contacted the USFWS Virginia Ecological Services Field Office on October 3, 2022 and spoke with Rachael Cash. The discussion included the previous USFWS consultation and performance of a mussel survey downstream of the dam. The discussion also included the official USFWS species list generated for the project and recent submittal of the JPA with the mussel survey included in the permit package.

Hazen inquired as to next steps for USFWS consultation, which included online submittal of Section 7 consultation, which has occurred, and responding to any comments or questions that the USFWS has relative to the project and its impacts.

9.3 Forest Resources

The project will avoid unnecessary tree clearing, but minor clearing (less than 2 acres) is expected. The project team will continue to consult with agencies, the public, and tribal governments to identify appropriate BMPs that will reduce the spread of invasive species resulting from tree clearing activities.

9.4 Waters of the U.S.

The project area associated with the existing and proposed pump stations consists of open water associated with Beaver Creek Reservoir. The project areas associated with the proposed pump station consist of undeveloped, forested land traversed by a perennial stream. The project areas associated with the dam consist of maintained grass; farm field; undeveloped, forested areas; Beaver Creek; an unnamed tributary to Beaver Creek; and two small wetland areas. Assessment of the project areas was performed to determine if jurisdictional areas were present. A small palustrine emergent (PEM) wetland was found to abut the existing pump station at the toe of the

existing dam abutting Beaver Creek. A portion of a palustrine forested (PFO) wetland was identified along an unnamed tributary to Beaver Creek in the southeasternmost portion of the dam project area. Based on site reconnaissance, three jurisdictional streams, two jurisdictional wetlands, and an open water area, Beaverdam Reservoir, are present within the proposed project areas. The jurisdictional areas are depicted on the Jurisdictional Features Maps.

The proposed project areas are located mainly within undeveloped wooded or maintained areas and developed areas that consist of a dam and its associated infrastructure. Wetland and stream delineations were performed to identify and mark the boundaries of waters of the U.S. within and abutting the proposed project areas. Two unnamed perennial streams, one that discharges into the reservoir and one that discharges into Beaver Creek Reservoir, one herbaceous wetland, and one forested wetland are within and abut the project areas. No jurisdictional features are in proximity to or traverse the raw water transmission main corridor.

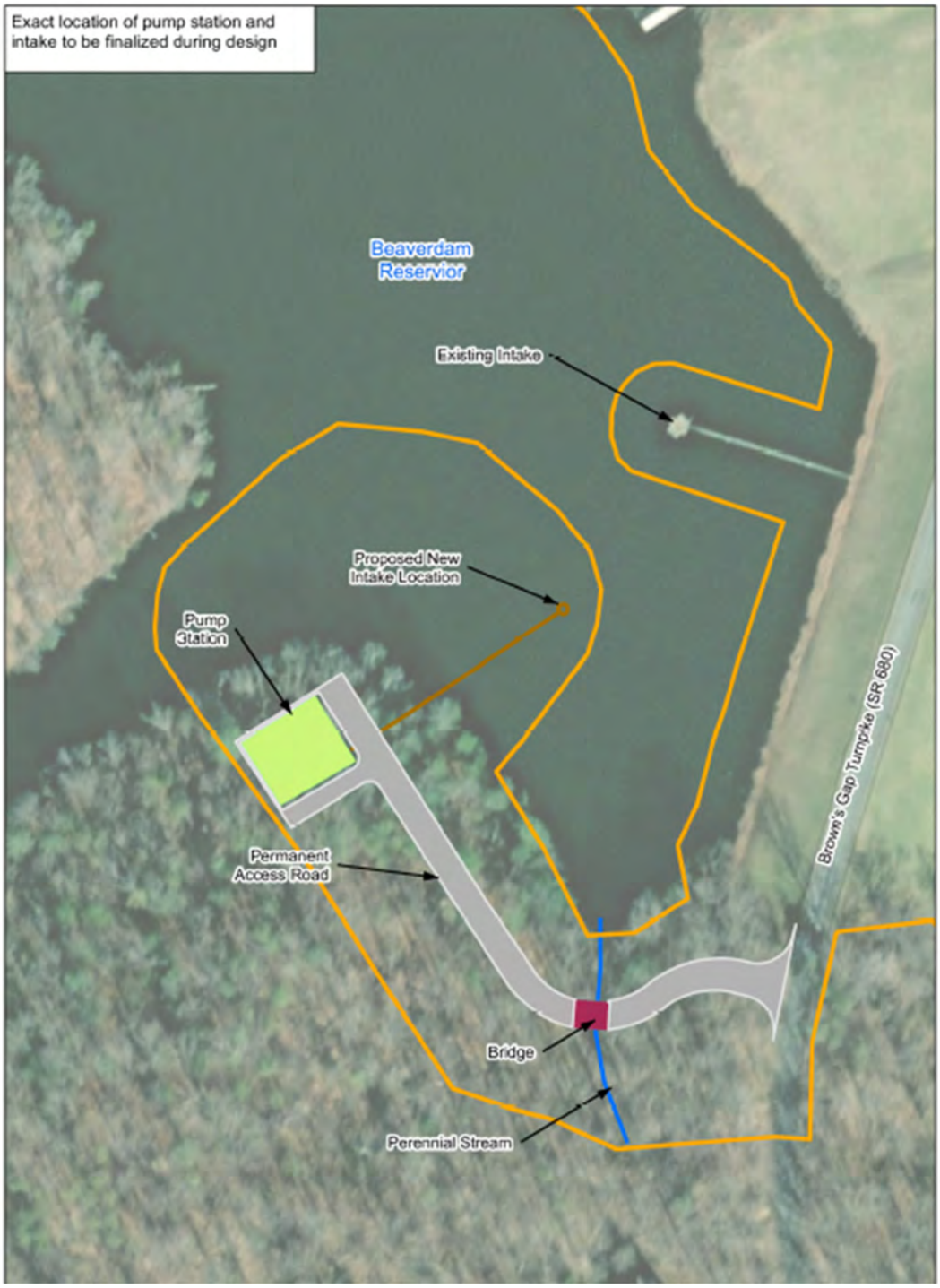


Figure 9.1 – Maximum Limits of Disturbance – Pump Station

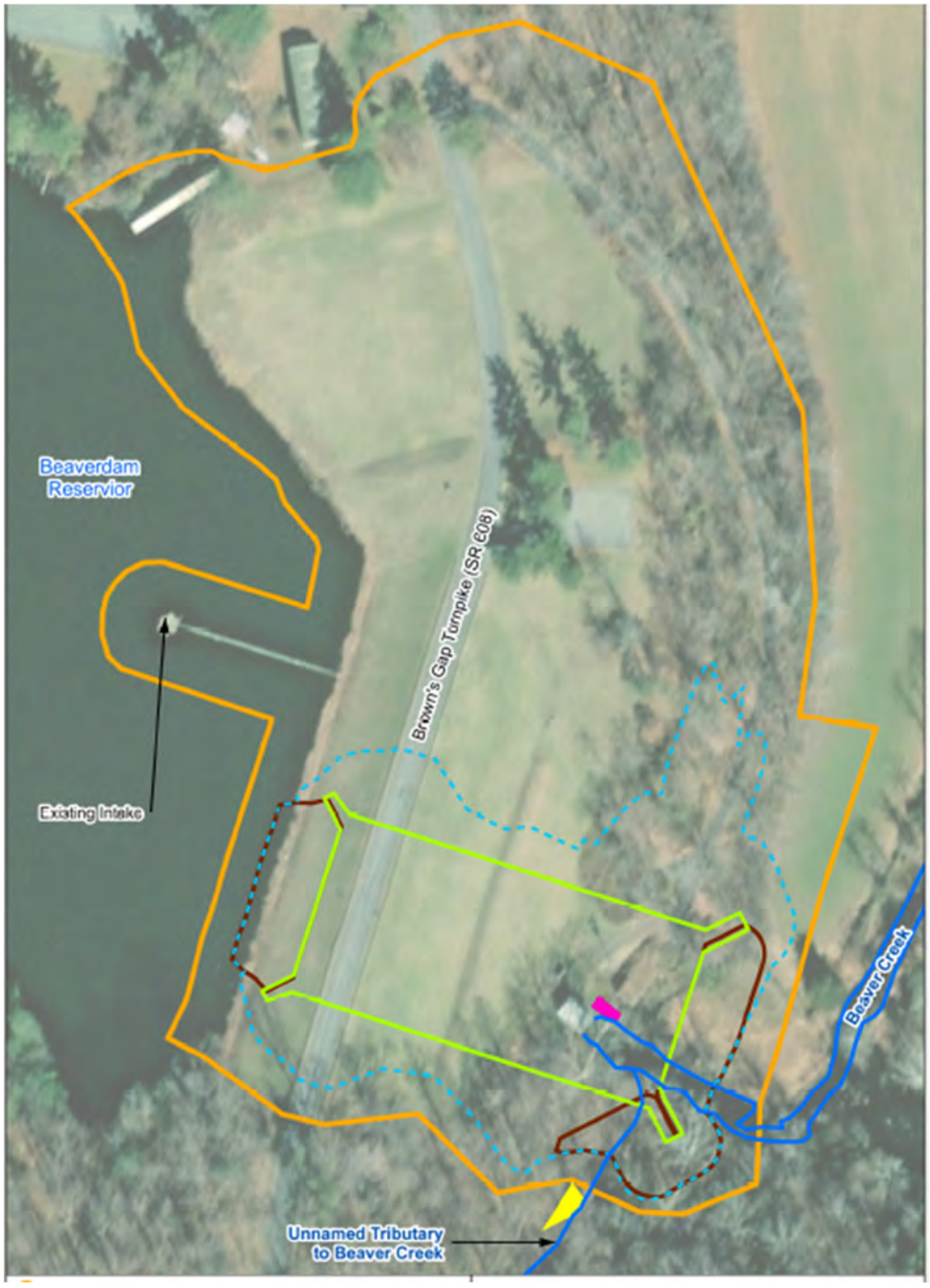


Figure 9.2 – Limits of Disturbance Dam and Spillway

9.5 Invasive Species

Various common invasive plant species were observed during environmental evaluation within the maximum potential limits of disturbance. Best management practices will be employed to prevent the spread of existing invasive plant species and the introduction of new invasive plant species. The planning team will consult with the U.S. Forest Service to request feedback on

BMPs to avoid the spread of invasive species as a result of clearing activities for the proposed action.

9.6 Mitigation

Compensatory mitigation for impacts to jurisdictional waters of the U.S. may be required. Based on the results of the wetlands survey and evaluation by the project team, impacts to wetlands appear to be less than the minimum threshold requiring mitigation. Consultation with the United States Army Corps of Engineers is ongoing regarding wetlands mitigation but for the purposes of planning, it is assumed that no mitigation will be required to install the proposed rehabilitation measures.

Consultation occurred during the scoping process with the USACE Norfolk District. The planning team followed up with USACE in a phone call October 3, 2022. Wes Hudson reviewed the project and acknowledged presence at a project kick-off meeting and conversation relative to permitting requirements had occurred. A note was made for the project indicating that a Nationwide Permit was anticipated to be required.

10.0 PROJECT FORMULATION

10.1 General

The project was formulated based on the Statement of Work provided by NRCS, applicable policies and regulations, including NEPA, Federal Principles, Requirements and Guidelines (PR&G), and information presented in the National Watershed Planning Manual (NWPM) and National Planning Procedures Handbook (NPPH). As described in Section 1.1, the Sponsors have been working with consultants for over 10 years regarding upgrading the project with respect to dam safety (rehabilitation) and municipal and industrial water supply (M&I). These elements are the basis of the purpose and need for the project.

10.2 Alternatives

The planning process involved a review of the alternatives analyses performed by Schnabel Engineering and Hazen and Sawyer for dam safety rehabilitation and water supply infrastructure rehabilitation, respectively. During the planning process, the feasibility of each of these alternatives was reviewed and considered based on their ability to meet the Sponsors' purpose and need for the project. The following sections will describe the alternatives that were considered in each of those studies, as well as any that were added during the planning phase, to identify alternatives recommended for detailed study.

10.3 Dam Rehabilitation Alternatives

Several dam rehabilitation alternatives were considered to bring the subject dam and spillway into compliance with regulations and standards for high hazard potential structures. The following table describes the alternatives that were considered to address the dam safety aspect of the rehabilitation project.

Table 10.1 - Dam Rehabilitation Alternatives

Alternative	Alternative Description	Carried Through	Rationale
FWOFI	No-Action	Yes	• The No-action alternative formed the basis for detailed alternative • Leaves dam out of compliance with Virginia and NRCS requirements for high hazard potential dams. • This does not resolve the unmitigated risk to downstream property during the design storm event.
Decommiss-ioning	Decommission the dam and construct a new reservoir.	No	• Decommissioning the dam would remove the need to rehabilitate the dam, however by inspection, this is cost-prohibitive. The reservoir is the sole water supply for the Community of Crozet and cannot be taken out of service without serious repercussions to the community water supply. • Constructing a new reservoir involves substantial environmental impacts, costs, property rights issues, and time required to obtain the necessary permits, which makes this alternative unfeasible.
Non-Structural	Flood-proofing of downstream structures. (Businesses, residences, roadways)	No	• Even if all downstream roadways, structures, and residences could be floodproofed for reasonable cost, the dam would still be high hazard potential based on the water supply purpose and SR 680 traversing the dam crest and auxiliary spillway. Therefore, floodproofing of downstream structures does not result in reverting the dam to Significant hazard and spillway rehabilitation would not meet the Sponsors purpose and need.
1	Structural Alternative – Labyrinth crested chute spillway over embankment	Yes	• Provides sufficient spillway capacity to meet the FBH and VAPMP runoff volumes and will meet NRCS and VA high hazard potential standards.

Alternative	Alternative Description	Carried Through	Rationale
2	Structural Alternative – Labyrinth crested chute spillway in left abutment	Yes	• Provides sufficient spillway capacity to meet the FBH and VAPMP runoff volumes and will meet NRCS and VA high hazard potential standards.
3	Structural Alternative – earthen auxiliary spillway	No	• There is not enough abutment area to meet the discharge requirement within a reasonable depth of head for a vegetated auxiliary spillway. • Peak discharge must be capable of passing on the order of 32,000 cfs. This translates to a length of broad-crested straight weir (C = 2.8, H = 5 feet) of approximately 1,000 feet ($Q = CLH^{3/2}$, $32,000 = (2.8)(L)(5^{3/2})$, L = 1,022 feet. Based on the geometry of the site and impacts this would cause at the site, this alternative was considered not feasible. There simply is not enough space at the site to make this alternative feasible. • Overtops a critical roadway during the design storm event and other frequency events, which is not acceptable per NRCS policy. Even if the argument could be made that this is feasible, additional costs associated with installing longer bridges or raising the roadway would then be incurred.
4	Structural Alternative – RCC overtopping/ armoring	No	• The same rationale from Alternative 3 regarding peak discharge applies to Alternative 4. Even if the overtopping protection hydraulic head depth could be increased to, say, 10 feet and an ogee weir incorporated (C_{avg}= 3.6), the weir length required would be 266 feet ($Q = CLH^{3/2}$, $32,000 = (3.6)(L)(10^{3/2})$, L = 266 feet. This is substantially wider than the total available space in the auxiliary spillway, and would require the entire park area in the auxiliary spillway and parking lot to be lost to install this measure. • This alternative would require substantial impacts to tree clearing, stream buffer disturbance to install the stilling basin, requires additional private property acquisition from the downstream owner, requires a 266 foot wide span of bridge to be installed (multiple span) to maintain traffic over SR 680 since flooding an existing roadway is not permitted by NRCS policy.
5	Structural Alternative – gated spillway	No	• Considered cost-prohibitive based on wider chute required, initial cost to construct gates, and lifetime maintenance cost.

Alternative	Alternative Description	Carried Through	Rationale
			• There is substantial freeboard available to generate discharge capacity over a static weir at the site. • The cost to install the gate would be very similar to the labyrinth weir, which would make the overall project cost similar since the gated spillway would still require a similarly sized chute and stilling basin to convey the water downstream. • Sponsors prefer non-mechanical spillway function as this will add to O&M costs and additional risk associated with moving parts. • No advantages over labyrinth spillway options were identified, but several disadvantages were identified by the Sponsors. For these reasons, this alternative was found not to meet the Sponsors' purpose and need.
6	Structural Alternative – labyrinth-crested chute spillway through existing auxiliary spillway	No	• This alternative is essentially a variation of spillway Alternative 2 and provides no benefits over Alternative 2. • The construction cost of Alternative 6 was estimated to be greater than Alternative 2 based on a longer spillway length, additional rock excavation and grading. • During the formulation process, the Sponsors indicated that they would not accept Alternative 6 due to complete loss of the 2 acre park space in the existing vegetated auxiliary spillway, impacts to the boat launch area, additional private property acquisition, disturbance to natural areas, and cost of the spillway.

10.4 Water Supply Alternatives

Several water supply alternatives were considered as presented in the DWIP (Hazen and Sawyer 2020). The following alternatives and rationales for carrying to detailed study or not are presented in the following table.

Table 10.2 - Water Supply Alternatives

Alternative	Alternative Description	Carried Through	Rationale
FWOFI	No-Action	Yes	• The Sponsors fail to meet immediate maximum daily demands for M&I water supply and will fail to meet longterm average and maximum daily demands for M&I water supply.

Alternative	Alternative Description	Carried Through	Rationale
			• The sponsors do not realize opportunities for obtaining a VWP permit, gaining access to 7.5% of currently unusable storage in the reservoir, installing a hypolimnetic oxygenation system to improve water quality in the reservoir, replacing a segment of asbestos-cement lined transmission pipe. • The sponsors will continue to waste safe yield storage by operating a pump station that is dependent on the principal spillway discharge for function.
1	Increase permitted withdrawals from reservoir and construct new pump station at an off-site location.	Yes	• Meets the Sponsors' purpose and need for the project by obtaining a DEQ VWP permit to provide greater than 1.0 mgd of treated water. • Leverages existing reservoir to avoid costs and environmental impacts associated with developing a new raw water supply source and transmission line to the Crozet Water Treatment Plant.
2	Raise Beaver Creek Dam and Reservoir	No	• Project would still require permit for increased withdrawals, so this does not alleviate the Sponsors problems. • A new intake structure would still be required to access the entire beneficial pool volume for safe yield. • The pump station infrastructure and the principal spillway conduit still need to be decoupled to install adequate MIF infrastructure. • The surface water quantity is sufficient to meet the immediate maximum daily demand with increased withdrawals. Raising the dam will result in additional environmental impacts that are not necessary to meet the purpose and need for the project. • A new spillway would still be required to pass the FBH and VAPMP design storm events. • New downstream hazards may be introduced and the inundation limits and impacts of a breach would increase.
3	Transfer Water from Sugar Hollow to Beaver Creek	No	• This alternative is considered supplementary to the 1.0 mgd currently provided by Beaver Creek 1. Therefore, the rehabilitation of the dam would still be required. • Additional pipeline would be required to connect Sugar Hollow to Beaver Creek to provide storage

Alternative	Alternative Description	Carried Through	Rationale
			• The project Sponsors would still be limited to the unpermitted 1.0 mgd cap on treated water production from the reservoir, so this would not meet the project purpose and need.
4	Connect to Charlottesville Urban Water System	No	• This measure was not determinately feasible. It would likely still require the 1.0 mgd from Beaver Creek 1, which in turn means that spillway rehabilitation at a minimum would be required. • An additional 5 mile long segment of pipeline would be required to connect the system. • This alternative would cause Sponsors to miss opportunities to install a hypolimnetic oxygenation system at Beaver Creek 1 reservoir, or to modify the intake so that all beneficial water supply pool strata can be accessed. • Would continue to waste water downstream based on interoperability of pump station and principal spillway structure. • Treated water supply alternatives are excluded from the watershed rehabilitation program.
5	Develop Groundwater wells	No	• This alternative is considered supplementary to the 1.0 mgd currently provided by Beaver Creek 1. Therefore, the rehabilitation of the dam would still be required. • This is a high risk option based on uncertainty with the efficacy of groundwater wells in this area. • Even if well locations could be found, a significant amount of wetlands, streams, private property and new infrastructure would be required. • This alternative would cause Sponsors to miss opportunities to install a hypolimnetic oxygenation system at Beaver Creek 1 reservoir, or to modify the intake so that all beneficial water supply pool strata can be accessed.
6	Divert from Lake Albemarle	No	• This alternative is considered supplementary to the 1.0 mgd currently provided by Beaver Creek 1. Therefore, the rehabilitation of the dam would still be required. • Lake Albemarle is owned by others, and the Sponsors would face significant and complicated challenges regarding meeting safe yield requirements while also meeting DGIF's recreational and environmental goals. • This alternative would require a new intake and pumping station at Lake Albemarle, which would

Alternative	Alternative Description	Carried Through	Rationale
			likely disturb more areas, property not owned by the Sponsors, and would be a less fruitful investment since infrastructure installed would have access to a smaller reservoir with less storage, when Beaver Creek 1 has sufficient storage to meet the Sponsors' needs with increased permitted withdrawals. • This alternative would require an additional 2.3 miles of new pipeline from Lake Albemarle to connect to the system to reach the Crozet Water Treatment Plant. • This alternative would cause Sponsors to miss opportunities to install a hypolimnetic oxygenation system at Beaver Creek 1 reservoir, or to modify the intake so that all beneficial water supply pool strata can be accessed.
7	Construct a New Reservoir	No	• Constructing a new reservoir involves substantial environmental impacts, costs, property rights issues, and time required to obtain the necessary permits, which makes this alternative unfeasible to the Sponsors.
8	Demand Conservation	No	• This alternative is considered supplementary to the 1.0 mgd currently provided by Beaver Creek 1. Therefore, the rehabilitation of the dam would still be required. • Conservation requirements are presented in the MIF protocol in the DWIP. • Enacting various conservation measures to reduce demand may temporarily reduce some immediate concerns, but will quickly fall short of the maximum daily demand and will not meet the Sponsors' purpose and need to provide community water supply. • This alternative would cause Sponsors to miss opportunities to install a hypolimnetic oxygenation system at Beaver Creek 1 reservoir, or to modify the intake so that all beneficial water supply pool strata can be accessed.

10.5 Supplemental Watershed Plan-EA Alternatives

The viable alternatives from the dam safety rehabilitation studies were combined with the water supply alternatives to formulate alternatives for the multiple purpose structure that would meet the Sponsors' objectives and the purpose and need for the project. The following table presents the alternatives considered for detailed study this watershed plan supplement.

Table 10.3 - Plan-EA Alternatives studied in Detail

Alternative	Alternative Description	Summary of Major Effects
FWOFI	No-Action	• Leaves dam out of compliance with Virginia and NRCS requirements for high hazard potential dams. • This does not resolve the unmitigated risk to downstream property during the design storm event. • Sponsors fail to meet immediate maximum M&I water supply maximum daily demand (MDD) and cannot obtain a DEQ permit. • Sponsors fail to meet future average daily demand requirements and miss opportunities to remove the pump station infrastructure as a hazard of the dam. • The Sponsors fail to meet immediate maximum daily demands for M&I water supply and will fail to meet long-term average and maximum daily demands for M&I water supply. • The sponsors do not realize opportunities for obtaining a VWP permit, gaining access to 7.5% of currently unusable storage in the reservoir, installing a hypolimnetic oxygenation system to improve water quality in the reservoir, replacing a segment of asbestos-cement lined transmission pipe. • The sponsors will continue to waste safe yield storage by operating a pump station that is dependent on the principal spillway discharge for function.
1	Construct a labyrinth-crested chute spillway over the embankment, construct a new raw water pump station and intake line at Site 1 and new pipeline to connect to WTP.	• Provides sufficient spillway capacity to meet the FBH and VAPMP runoff volumes and will meet NRCS and VA high hazard potential standards. • Will meet Sponsors immediate and future (2075) M&I Water supply objectives and this purpose of the project. • Provides opportunity for Sponsors to install hypolimnetic oxygenation at new intake tower. • This is the NED alternative. • Results in no adverse impacts to existing Beaver Creek park space.

		• Estimated 2.5 acres of private property acquisition are required for the spillway. • This is the Sponsors' preferred alternative. • Benefit Cost ratio of 0.39.
1A	Identical to Alternative 1, but includes sliplining the existing principal spillway conduit to identify if flood damage reduction benefits could be realized.	• Action resulted in a net average annual flood damage reduction benefit of $48 • Assumed cost of incorporating the slipline construction into the project was $100,000. Annualized for an evaluation period of 55 years at 2.25% discount rate, this amounted to an annualized cost of $3,187. • Action resulted in a benefit to cost ratio of 0.015. Due to the extremely low benefit of this activity, Alternative 1A was removed from detailed study.
2	Construct a labyrinth-crested chute spillway through the left abutment, construct a new raw water pump station adjacent to the existing pump station, construct a new intake tower and suction line under auxiliary spillway, install new pipeline to connect to WTP.	• Provides sufficient spillway capacity to meet the FBH and VAPMP runoff volumes and will meet NRCS and VA high hazard potential standards. • Will meet Sponsors immediate and future (2075) M&I Water supply objectives and this purpose of the project. • Higher cost than Alternative 1. • Greater impacts to park space and natural areas due to spillway construction as compared with Alternative 1. (Approximately 0.5 acre of park space lost, additional tree clearing). • Estimated 4.0 acres of private property acquisition are required for the spillway. • Missed opportunity to remove the pump station infrastructure as a hazard of the dam itself. • Benefit Cost ratio of 0.38

10.6 Summary of Principles, Requirements and Guidelines

The NRCS National Watershed Program Manual (NWPM) was used as a reference for the economic analysis along with two other documents: the *National Resource Economics Handbook, Part 611 Water Resources Handbook for Economics*, USDA/Natural Resources Conservation Service, July 1998; and *Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (PR&G), DM 9500-013*. The latter includes

requirements set forth in the Council on Environmental Quality (CEQ) *Principles and Requirements for Federal Investments in Water Resources (P&R)* and *Interagency Guidelines (IAG)*. DM 9500-013 provides guidance on completing a PR&G analysis, including steps in the planning and evaluation process, differences between project- and programmatic-level evaluations, direction on incorporating an ecosystem services framework, and techniques for economic analysis.

PR&G requires that public benefits be maximized relative to cost. Furthermore, there is not a hierarchal relationship among the economic, social, or environmental goals. In general, the economic, social, and environmental impacts presented in this plan were developed based on PR&G utilizing methods of evaluating rural community flood reduction damages and related impacts. In order to estimate annual benefits of Beaver Creek 1, average annual floodwater damages and impacts as the result of no-dam-in-place were compared to average annual floodwater damages and impacts with the dam-in-place.

In cooperation with local interests that have oversight or implementation authorities and responsibilities, a "locally preferred" alternative was identified. This alternative was fully considered and carried forward into the final array of solutions and given full and equal consideration in the decision-making process.

PR&G allows a wide range of alternatives to illustrate the range of potential tradeoffs among environmental, economic, and social goals. Alternatives considered included the Future Without Federal Investment (FWOFI) Alternative, nonstructural alternatives, the locally preferred alternative, and the National Efficiency Evaluation (NEE) Alternative. Alternatives were compared against the FWOFI Alternative which involved projecting existing resources and conditions into the future to establish a benchmark against which alternatives were evaluated. Tradeoffs between alternatives with respect to environmental, economic, and social goals were identified.

The Federal Objective, as set forth in the Water Resources Development Act of 2007, specifies that Federal water resources investments shall reflect national priorities, encourage economic development, and protect the environment by: (1) seeking to maximize sustainable economic development; (2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and (3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

The Guiding Principles constitute the concepts that should consider when analyzing Federal investments in water resources and the General Requirements are topics that agencies must consider when analyzing Federal investments in water resources. The following Principles

constitute the overarching concepts the Federal government seeks to promote through Federal investments in water resources now and into the foreseeable future.

A. Healthy and Resilient Ecosystems. Federal investments in water resources should protect and restore the functions of ecosystems and mitigate any unavoidable damage to these natural systems.

B. Sustainable Economic Development. Federal investments in water resources should encourage sustainable economic development.

C. Floodplains. Federal investments in water resources should avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used.

D. Public Safety. Threats to people, including both loss of life and injury, from natural events should be assessed in the determination of existing and future conditions, and ultimately, in the decision-making process.

E. Environmental Justice. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Agencies should ensure that Federal actions identify any disproportionately high and adverse public safety, human health, or environmental burdens of projects on minority, Tribal, and low-income populations.

F. Watershed Approach. A watershed approach to analysis and decision-making facilitates evaluation of a more complete range of potential solutions and is more likely to identify the best means to achieve multiple goals over the entire watershed.

According to PR&G, after preliminary consideration agencies may remove from detailed study those alternatives that do not achieve the Federal Objective and Guiding Principles. In addition, alternatives that may at first appear reasonable but clearly become unreasonable because of cost, logistics, existing technology, social, or environmental reasons may also be eliminated from further analysis. These alternatives should be briefly discussed to indicate that they were considered, and the analysis should document the reason(s) why they were eliminated (e.g., they do not achieve the Federal Objective and Guiding Principles).

For this plan, several non-structural and structural alternatives were eliminated from detailed study due to them being unable to meet the Sponsors' purpose and need without keeping Beaver Creek 1 in service (therefore still requiring installation of rehabilitated spillway), would not

provide adequate supply of water, excessive environmental impacts or excessive costs with no discernable advantages.

10.7 Ecosystem Services Framework

An EcoSystem Services framework was incorporated into the plan formulation process. This generally followed guidance described in DM 9500-013. The EcoSystem Services scoping concerns were considered in the formulation of the alternatives and tradeoffs described.

Particular emphasis was placed on the value of the Primary production of water supply and food, flood protection based on rehabilitating a non-compliant high hazard dam, with considerations of natural areas, aesthetic viewspaces, and other recreational benefits provided by the project.

APPENDIX E

OTHER SUPPORTING INFORMATION (DIGITAL ONLY)