

FINAL

Supplemental Watershed Plan No. 7 & Environmental Assessment

for the

Rehabilitation of Floodwater Retarding Structure No. 77

of the Upper North River Watershed

Augusta County, Virginia



PREPARED BY

USDA Natural Resources Conservation Service

IN COOPERATION WITH
Augusta County Board of Supervisors
Headwaters Soil and Water Conservation District
USDA Forest Service

July 2015

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the bases of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, or all or part of an individual's income is derived from any public assistance program, or protected genetic information in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.)

FINAL
Supplemental Watershed Plan No. 7 & Environmental Assessment
for the
Rehabilitation of Floodwater Retarding Structure No. 77
of the Upper North River Watershed
Augusta County, Virginia

Prepared By:
USDA – Natural Resources Conservation Service

In Cooperation With:
Headwaters Soil and Water Conservation District
Augusta County Board of Supervisors
U.S. Forest Service

Authority

The original watershed work plan was prepared, and the works of improvement were installed, under the authority of the Flood Control Act of 1944 (Public Law 78-534). The rehabilitation of Upper North River Dam No. 77 is authorized by Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

Abstract

Upper North River Dam No. 77, Hearthstone Lake, does not presently meet Natural Resources Conservation Service (NRCS) or Virginia safety standards for the stability and capacity of the auxiliary spillway. The recommended plan is to rehabilitate Upper North River Dam No. 77 dam to meet current safety and design criteria. The plan provides for raising the dam embankment by 2.6 feet with earthfill, widening the auxiliary spillway by 92 feet, constructing a 42 feet wide splitter dike, and installing turf reinforcement mat to enhance stability. The principal spillway riser will be upgraded to meet seismic criteria by completing a riser footer retrofit. There will be no change in the current level of flood protection downstream as a result of project activity. Project installation cost is estimated to be \$2,954,000 of which \$2,102,000 will be paid from the Small Watershed Rehabilitation funds and \$852,000 from local funds.

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the bases of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, or all or part of an individual's income is derived from any public assistance program, or protected genetic information in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.)

UPPER NORTH RIVER WATERSHED AGREEMENT

Supplemental Watershed Plan Agreement
(Supplement No. 7)

between the

Augusta County Board of Supervisors
Headwaters Soil and Water Conservation District
(herein referred to collectively as “Sponsors”)
Commonwealth of Virginia

and the

Natural Resources Conservation Service
United States Department of Agriculture
(herein referred to as “NRCS”)

Whereas, the Watershed Work Plan Agreement for the Upper North River Watershed, Commonwealth of Virginia, authorized under the Flood Control Act of 1944 (Public Law 78-534, as amended) and executed by the Sponsors named therein and the Soil Conservation Service (which is now NRCS, pursuant to section 246 of the Department of Agriculture Reorganization Act of 1994, 7 U.S.C. 6862), became effective the 11th day of August 1960; and

Whereas, Supplement No. 1, which modified the Watershed Plan Agreement, was developed through cooperative efforts of the Sponsors and the Soil Conservation Service and became effective on the 17th day of October 1961; and

Whereas, Supplement No. 2, which modified the Watershed Plan Agreement, was developed through cooperative efforts of the Sponsors and the Soil Conservation Service and became effective on the 14th day of May 1962; and

Whereas, Supplement No. 3, which modified the Watershed Plan Agreement, was developed through cooperative efforts of the Sponsors and the Soil Conservation Service and became effective on the 18th day of March 1964; and

Whereas, Supplement No. 4, which modified the Watershed Plan Agreement, was developed through cooperative efforts of the Sponsors and the Soil Conservation Service and became effective on the 8th day of June 1993; and

Whereas, Supplement No. 5, which modified the Watershed Plan Agreement, was developed through cooperative efforts of the Sponsors and NRCS and became effective on the 18th day of April 2000; and

Whereas, Supplement No. 6, which modified the Watershed Plan Agreement, was developed through the cooperative efforts of the Sponsors and NRCS and became effective on the 30th day of August 2012; and

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for rehabilitation of the works of improvement for the Upper North River Dam No. 77 located in Augusta County, Commonwealth of Virginia, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Section 1001 to 1008, 1010, and 1012); and

Whereas, the responsibility for administration of Section 13 of the Flood Control Act of 1944 has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, through the cooperative efforts of the Sponsors and NRCS, a Supplemental Watershed Plan and Environmental Assessment has been developed to rehabilitate the Upper North River Dam No. 77, Commonwealth of Virginia, hereinafter referred to as the Watershed Project Plan or Plan, which Plan is annexed to and made a part of this agreement; and

Whereas, in order to provide for rehabilitation of the Upper North River Dam No. 77, it has become necessary to modify the Supplemental Watershed Plan Agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsors hereby agree on this Supplemental Watershed 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 Supplemental Watershed Agreement and including the following:

- 1. Term.** The term of this agreement is for 70 years and does not commit the NRCS to assistance of any kind beyond the end of the agreement.
- 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 Sponsor acknowledges the potential risk of flood damages for the real property between the flowage rights elevation and the top of dam elevation.
- 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. 4601 et. seq. as further implemented through regulations in 49 C.F.R. Part 24 and 7 C.F.R. 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, it agrees that, before any Federal financial assistance is furnished; it 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 Rehabilitation Project. 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
Rehabilitation of the dam (construction costs):	65%	\$1,577,000	35%	\$836,000	\$2,413,000
Relocation, Replacement in-kind:	0%	\$0	0%	\$0	\$0
Relocation, Required Decent, Safe, Sanitary:	0%	\$0	0%	\$0	\$0
Sponsors' Planning Costs:	n/a	n/a	100%	\$5,000	\$5,000
Sponsors' Engineering Costs:	n/a	n/a	100%	\$2,000	\$2,000
Sponsors' Project Administration Costs:	n/a	n/a	100%	\$6,000	\$6,000
Landrights Acquisition Costs:	n/a	n/a	100%	\$0	\$0
Subtotals:					
Cost-Sharable Costs:	(65%)	\$1,577,000	(35%)	\$849,000	\$2,426,000
Cost-Share Percentages:^{a/}					(100%)
Non Cost-Sharable Items (per PL-83-566 and NRCS policy)^{b/}	---	---	---	---	---
NRCS Engineering and Project Administration Costs:	100%	\$525,000	n/a	n/a	\$525,000
Natural Resource Rights:	n/a	n/a	0%	\$0	\$0
Federal, State and Local Permits:	n/a	n/a	100%	\$3,000	\$3,000
Relocation, Beyond Required Decent, Safe, Sanitary	n/a	n/a	0%	\$0	\$0
Subtotals: Non-Cost-Sharable Costs:	100%	\$ 525,000	100%	\$3,000	\$528,000
Total Cost-Sharable Cost:	n/a	\$1,577,000	n/a	\$849,000	\$2,426,000
Total Installation Cost:	n/a	\$2,102,000	n/a	\$852,000	\$2,954,000

a/ The maximum NRCS cost-share is 65% of the cost-sharable items not to exceed 100% of the construction cost. Total eligible project costs include construction, landrights, relocation, project administration, and planning services provided by the Sponsors.

b/ If actual non-cost-sharable item expenditures vary from these estimates, the responsible party will bear the change in costs.

6. Land Treatment Agreements. Approximately 99% of the drainage area above Upper North River Dam No. 77 is wooded with the remaining 1% in open space, hay/pasture, and open water. It is expected to remain as such. Therefore, there is no need for additional erosion

control measures in the watershed. Thus, there is no requirement for the Sponsors to obtain agreements for protection of the upstream watershed.

- 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 rehabilitation 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 de-authorize 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 de-authorization 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 de-authorized. 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 continue for the project

life (68 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 this dam where failure may cause loss of life, as required by state and local regulations. The EAP must meet the minimum content specified in NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State dam safety requirements. An EAP is required prior to the execution of fund obligating documents for rehabilitation of the structure. The EAP must be reviewed and updated by the Sponsors annually.

16. Nondiscrimination Provisions. The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the bases of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, or all or part of an individual's income is derived from any public assistance program, or protected genetic information in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.)

By signing this agreement, the recipient assures the U.S. 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 sub-recipients 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 violation 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 will--
 - (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 ten 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 number(s) 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 employees 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 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 site(s) 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)

- 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 sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients 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 Section 1352, Title 31, of the U.S. Code. 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 three-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 three-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 Sponsor is 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 () 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 subagreement.

B. The project Sponsoring organizations signatory to this agreement agree 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 assure and certify that they are 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 specifically set forth herein.

State, Local, and Indian 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.

Augusta County Board of Supervisors
Augusta County Government Center
18 Government Center Lane
Verona, Virginia 24482

By: /S/ Patrick J. Coffield
PATRICK J. COFFIELD

Title: County Administrator

Date: July 22, 2015

The signing of this supplemental watershed agreement was authorized by the governing body of the Augusta County Board of Supervisors at a meeting held on July 22, 2015.

/S/ Rita R. Austin
Clerk or Notary

18 Government Center Lane
Verona, Virginia 24482

Date: July 22, 2015

**Headwaters Soil and Water
Conservation District**

Augusta County Government Center
USDA Building
70 Dick Huff Lane
Verona, Virginia 24482

By: /S/ Richard M. Shiflet
RICHARD M. SHIFLET

Title: Chairman

Date: July 21, 2015

The signing of this supplemental watershed agreement was authorized by the governing body of the Headwaters Soil and Water Conservation District at a meeting held on July 21, 2015.

/S/ Cathy Perry
Office Administrator

Augusta County Government Center
USDA Building
70 Dick Huff Lane
Verona, Virginia 24482

Date: July 21, 2015

**Natural Resources Conservation Service
United States Department of Agriculture**

Approved by:

/S/ John A. Bricker
JOHN A. BRICKER
State Conservationist

Date: July 24, 2015

TABLE OF CONTENTS

	<u>Page</u>
WATERSHED AGREEMENT.....	i
SUMMARY OF SUPPLEMENTAL WATERSHED PLAN.....	xv
CHANGES REQUIRING PREPARATION OF SUPPLEMENT.....	1
PURPOSE AND NEED FOR ACTION.....	1
Original Project.....	1
Watershed Problems.....	2
Watershed Opportunities.....	3
SCOPE OF THE ENVIRONMENTAL ASSESSMENT.....	4
AFFECTED ENVIRONMENT.....	7
Planning Activities.....	7
Physical Features.....	7
Land Use.....	8
Threatened and Endangered Species.....	8
Cultural Resources, Natural and Scenic Areas, and Visual Resources.....	9
Water Quality.....	10
Streams, Lakes, and Wetlands.....	10
Air Quality.....	11
Forest Resources.....	11
Fish and Wildlife Resources.....	11
Migratory Birds.....	11
Chesapeake Bay and Coastal Zone Management Areas.....	12
Social and Economic Conditions.....	12
Description of Existing Dam.....	14
General Description of How a Dam Functions.....	20
Status of Operation and Maintenance.....	22
Structural Data.....	22
Breach Analysis and Hazard Classification.....	22
Evaluation of Potential Failure Modes.....	24
Consequences of Dam Failure by a Sunny Day Breach.....	25
FORMULATION AND COMPARISON OF ALTERNATIVES.....	26
Formulation Process.....	26
Issues that Must Be Considered in Evaluation of Alternatives.....	27
Alternatives Considered But Eliminated From Detailed Study.....	28
Description of Alternative Plans Considered.....	29
National Economic Development (NED) Alternative.....	34
Comparison of Alternative Plans.....	35

	<u>Page</u>
ENVIRONMENTAL CONSEQUENCES.....	37
Soils.....	37
Water.....	37
Air.....	38
Plants.....	39
Animals.....	40
Human.....	40
Cumulative Effects.....	43
RISK AND UNCERTAINTY.....	43
CONSULTATION AND PUBLIC PARTICIPATION.....	44
PREFERRED ALTERNATIVE.....	46
Rationale for Plan Selection.....	46
Summary and Purpose.....	46
Easements and Landrights.....	47
Mitigation.....	47
Permits and Compliance.....	47
Costs.....	48
Installation and Financing.....	48
Operation, Maintenance, and Replacement.....	49
REFERENCES.....	55
REPORT PREPARERS.....	57
DISTRIBUTION LIST.....	59
INDEX OF KEY WORDS AND PHRASES.....	61

LIST OF FIGURES

<u>No.</u>	<u>Description</u>	<u>Page</u>
1	After Hurricane Fran in 1996.....	4
2	View of boat ramp at Hearthstone Lake.....	14
3	The Hearthstone Lake dam, auxiliary spillway, and pool.....	15
4	Back slope of dam and Tillman Road.....	17
5	Cross-section of the Hearthstone Dam.....	17
6	Principal spillway outlet flowing into the plunge pool.....	18
7	Principal spillway riser at Hearthstone Lake.....	18
8	Auxiliary spillway, looking downstream.....	19
9	Sediment survey, in progress.....	20
10	Installation of Turf Reinforcement Mat (TRM).....	34

LIST OF FIGURES (cont.)

<u>No.</u>	<u>Description</u>	<u>Page</u>
B1	Location Map.....	B-1
B2	Hearthstone Lake Subwatershed with Land Use.....	B-2
C1	Sunny Day Breach Inundation Map.....	C-1
C2	Plan view of site with partial decommissioning.....	C-3
C3	Plan view of Alternative 1.....	C-4
C4	Plan view of Alternative 2.....	C-5
C5	Plan view of slope flattening portion of Alternative 2A.....	C-6

LIST OF TABLES

<u>No.</u>	<u>Description</u>	<u>Page</u>
A	Scoping Meeting Results for Rehabilitation of Hearthstone Lake Dam.....	5
B	Land Use.....	8
C	Existing Structural Data for Hearthstone Lake.....	23
D	Major Components of Decommissioning the Dam.....	28
E	Summary of Rehabilitation and Estimated Construction Costs.....	32
F	Summary and Comparison of Alternative Plans.....	35
1	Estimated Installation Cost.....	51
2	Estimated Cost Distribution – Structural Measures.....	51
3	Structural Data for Rehabilitated Dam.....	52
4	Average Annual National Economic Development (NED) Costs.....	53
5	Estimated Average Annual Flood Damage Reduction Benefits.....	53
6	Comparison of NED Benefits and Costs.....	54
C1	Results of a Dam Breach Routing for Hearthstone Lake.....	C-2

APPENDICES

- Appendix A: Comments and Responses
- Appendix B: Project Maps
- Appendix C: Support Maps
- Appendix D: Investigation and Analyses Report
- Appendix E: Other Supporting Information

SUMMARY OF SUPPLEMENTAL WATERSHED PLAN NO. 7 AND ENVIRONMENTAL ASSESSMENT

for the Rehabilitation of Upper North River Watershed Dam No. 77 Augusta County, Virginia 6th Congressional District

Prepared by: United States Department of Agriculture, Natural Resources Conservation Service in cooperation with the United States Department of Agriculture, Forest Service.

Authorization: The original work plan was prepared, and the works of improvement were installed, under the authority of the Flood Control Act of 1944 (Public Law 78-534). The rehabilitation of Upper North River Dam No. 77 is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

Sponsors: Augusta County Board of Supervisors
Headwaters Soil and Water Conservation District

Proposed Action: Rehabilitate Upper North River Watershed Dam No. 77, Hearthstone Lake, to meet current NRCS safety and performance standards for a high hazard dam.

Purpose and Need for Action: The Upper North River Dam No. 77, Hearthstone Lake, does not currently meet NRCS safety and performance standards for a high hazard dam or Virginia Division of Dam Safety standards for the capacity of the vegetated earthen auxiliary spillway. There are lives and property downstream of this structure that need flood protection. The purposes for federal action are to meet current safety and performance standards for a high hazard dam and maintain flood protection for downstream properties.

Description of Preferred Alternative: The recommended plan will rehabilitate Upper North River Dam No. 77 to meet current safety and performance standards for a high hazard dam, provide sediment storage for an additional 68 years after construction, and maintain the current level of flood protection downstream. The plan provides for raising the dam embankment by 2.6 feet with earthfill, widening the auxiliary spillway by 92 feet, constructing a 42 feet wide splitter dike in the auxiliary spillway, and installing turf reinforcement mat for stability. The principal spillway riser will be upgraded to meet seismic criteria by retrofitting the footer of the riser. There will be no change in the current levels of flood protection downstream as a result of project activity.

Resource Information:

Location: Latitude: 38.3938889 Longitude: -79.1611111

8-Digit Hydrologic Unit Number: 02070005

Climate and Topography: The watershed has a continental, humid, temperate climate, and is characterized by warm to hot summers and rather cold winters. Hearthstone Lake is located in the Ridge and Valley Physiographic Province. The topography ranges from steep mountain terrain to flat to gently sloping valleys.

Watershed Size: Upper North River Watershed = 67,961 acres
Drainage Area of Hearthstone Lake = 10,131 acres

Land Use: Woodland: 10,045.2 acres, 99.2%
Open Space: 62.6 acres, 0.6%
Hay/Pasture: 2.7 acres, 0.00%
Water: 20.5 acres, 0.2%

Land Ownership: Upstream of dam: 100% public (U.S. Forest Service)
Downstream of dam: 97.5% private, 2.5% public

Population and Demographics: According to the U.S. Census Bureau, the population of Augusta County as of July 1, 2013, was 73,912. Of the total population, about 93.1% (68,628) were White and 4.1% (3,057) were Black or African American. All other racial groups individually were 0.8% of the total population or less. Together, White and Blacks made up 97.2% of the county's entire population. Hispanics of any race are the second largest minority group with 2.2%, or 1,608. "Other races" present constituted less than 1% of the Augusta County population.

The 2009-2013 Census estimates indicate that 89.3% of the 31,362 housing units within Augusta County were occupied. Of the occupied housing units, 80.9% were owner-occupied and 19.1% were renter-occupied. The state-wide occupancy rate for Virginia as a whole reported in the 2009-2013 estimates was 89.4% and the national figure was 87.5%. The state-wide and national rates for owner-occupancy were 89.4% and 87.5% respectively. Residential property values for the land and associated buildings downstream of the dam range between \$50,000 and \$400,000 with an average of about \$150,000. The total value of residential property (structures and contents only, excluding land values) at risk below the dam is an estimated \$22,195,000.

Augusta County residents are estimated to have had per capita incomes of \$25,519 for the 2009-2013 period. Virginians reported per capita income of \$33,493 for the 2009-2013 period, while the same figure for the entire United States was \$28,155 for that same period. That makes the county per capita income figure for 2009-2013 at 76% of the state's level and 91% of the national figure.

Cultural Resources: Because the dam is on land managed by the U.S. Forest Service, the U.S. Forest Service agreed to take the lead on inventories and investigations of cultural resources and other responsibilities per Section 106 of the National Historic Preservation Act. U.S. Forest Service cultural resources staff completed database searches for any known cultural resources and ground surveyed the project area for evidence of archaeological and/or historical resources that had the potential to be impacted. A pedestrian survey was conducted throughout the entire project area. Subsurface testing was implemented in areas with high potential for encountering cultural resources. Consultation with the Virginia Department of Historic Resources (VDHR) was initiated in November 2014 by the U.S. Forest Service with the submission of a cultural resources reconnaissance report pertaining to the proposed Hearthstone Lake Dam rehabilitation project. On December 8, 2014, the VDHR indicated their concurrence with the U.S. Forest Service's finding of "*no historic properties affected*" for the proposed Hearthstone Lake dam project.

Highly Erodible Cropland: None exists in the watershed.

Threatened and Endangered Species: Since the dam is located in the George Washington and Jefferson National Forest, the U.S. Forest Service took the lead on the investigations and inventories of endangered, threatened, and sensitive (TES) species and other responsibilities per the Endangered Species Act (ESA) and completed a Biological Evaluation (BE) and Biological

Assessment (BA) per U.S. Forest Service policy. The information that follows has been summarized from the BE/BA which can be found in Appendix E.

The Indiana Bat (*Myotis sodalis*) and Northern long-eared Bat (*Myotis septentrionalis*) are known to occur or could be potentially affected by the proposed project. Despite the existence of potential bat habitat, during past and recent surveys, no Indiana or Northern long-eared bats have been seen in the project area. The proposed project will have no effect on any other federally listed or proposed species or their designated or proposed critical habitat.

Wetlands: There are approximately 7.86 acres of fringe wetlands around the perimeter and 12.3 acres of open water wetlands associated with Hearthstone Lake. No additional wetlands were identified within the project area boundaries.

Resource Concerns Identified Through Scoping:

Item/Concern	Rationale
WATER	
Floodplain Management	No increase in flood levels.
Streams, Lakes, and Wetlands	The lake will be temporarily drained during construction.
Water quality	Erosion and sediment during construction, dissolved oxygen.
Water resources	Temperature and sediment during construction, anoxic layering during release.
AIR	
Air Quality	Temporary effects during construction.
PLANTS	
Forest resources	There is a proposed Wilderness Area; U.S. Forest Service does not own subsurface mineral rights. Borrow area could be affected.
Invasive species	Ensure none are introduced during implementation.
Riparian areas	Impacted during construction.
ANIMALS	
Endangered and Threatened Species	Temporary effects during construction. Temperature – existing cold water release. Dam is a migration barrier and fragments habitat. Dam is a barrier to natural nutrient and sediment transport.
Migratory birds/Bald eagles/Golden eagles	Temporary effects during construction.
HUMAN	
Costs/ National Economic Development (NED)	Net Economic Development must be considered.
Environmental Justice and Civil Rights	No disparate treatment is anticipated.
Local and Regional Economy	Temporary positive effect during construction for local and regional construction companies. Permanent negative effect if decommissioned.
Public health and safety	Dam is critical to the Town of Bridgewater. Restricted access during construction.
Public recreation	Temporary impacts for loss of use of lake and nearby trails during implementation.
Scenic beauty	Temporary impacts while lake is drawn down and unsightly construction equipment. If visual changes planned, need to meet U.S. Forest Service Forest Plan.
Social issues	How we prioritize public funds? Is it the role of government to use public funds to protect from flooding?

Alternative Plans Considered: There are two plans that were considered and evaluated in detail:

- 1) *No Federal Action (Sponsors' Rehabilitation)*
- 2) *Structural Rehabilitation with Federal Assistance – Widen auxiliary spillway by 92 feet and install a splitter dike, raise top of dam by 2.6 feet, enhance surface stability with Turf Reinforcement Matting (TRM), and retrofit the principal spillway riser (NED Alternative).*

The Sponsors have indicated that they will use the plan developed by NRCS to complete the rehabilitation of the dam in the event that Federal funding is not available. The *No Federal Action (Sponsors' Rehabilitation)* alternative would be the same or involve the same components as the *Structural Rehabilitation with Federal Assistance*. The preferred alternative maximizes net benefits with a benefit/cost ratio of 1:1, and is the rehabilitation alternative preferred by the Sponsors.

Project Costs (Dollars)

Category	PL-83-566 Funds		Other Funds		Total	
	Dollars	%	Dollars	%	Dollars	%
Construction	\$1,577,000	65%	\$836,000	35%	\$2,413,000	100%
Engineering	\$475,000	99.6%	\$2,000	0.4%	\$477,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Real Property Rights	n/a	n/a	\$0	100%	\$0	100%
Project Administration	\$50,000	89.3%	\$6,000	10.7%	\$56,000	100%
Other (permits)	\$0	0%	\$3,000	100%	\$3,000	100%
TOTAL COSTS	\$2,102,000		\$847,000		\$2,949,000	
Annual O&M (non-Federal)	n/a	n/a	\$5,000	100%	\$5,000	100%

Project Benefits: Rehabilitation reduces the potential for loss of life and maintains protection of existing infrastructure downstream of the dam as well as property values around the lake and associated recreational opportunities. Net average annual equivalent benefits between the Future with Federal Project (FWFP) and the Future without Federal Project (FWOFP) = \$0. This is due to the fact that the candidate plans to rehabilitate Hearthstone Lake are identical in scope, substantially equivalent costs and equal effects.

Number of Direct Beneficiaries: On-site – 1,800; Off-site – 630 residents and 1,000 people in vehicles daily.

Other beneficial effects:

- Minimizes the threat to loss of life to approximately 630 people that live in the 225 homes within the breach inundation zone and to an additional 1,000 people daily who are travelling on the roads.
- Provides protection for approximately 740 vehicles on a daily basis that utilize Stokesville Road (520 vehicles), Towers Road (190 vehicles), and Reeves Road (30 vehicles).
- Provides recreational benefits to approximately 1,800 people annually.
- Minimizes the threat of loss of access and loss of emergency services for residences, business structures, clubs, and churches.

- Provides downstream flood protection for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 68 years.
- Eliminates the liability associated with continuing to operate an unsafe dam.
- Maintains existing stream habitat downstream of the dam.
- Retains the existing aquatic and terrestrial habitat in and around the lake.
- Leverages federal resources to install the planned works of improvement.
- Will meet current NRCS safety and performance standards for a high hazard dam.

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

Net beneficial effects (NED): \$0

Funding Schedule: The most likely scenario is for the project to be implemented over two years including one year for development of the design and one year for construction.

Federal funds: Year 1 - \$375,000 for engineering and project administration; **Year 2** - \$150,000 for construction supervision and project administration and \$1,577,000 for construction;

Non-Federal funds: Year 1 - \$1,000 for engineering and \$3,000 for permitting costs; **Year 2** - \$7,000 for engineering and project administration and \$836,000 for construction;

Period of Analysis: 70 years (includes 1 year for design and 1 year for construction)

Project Life: 68 years

Environmental Effects/Impacts:

<u>Resource</u>	<u>Impact</u>
Air Quality	Temporary increase in particulate matter on site during construction.
Land Use Changes	No effect.
Floodplains	Current floodplain would be maintained.
Fisheries	The lake will be drained for 6-8 months during construction. After restocking, full recovery is expected in two to four years.
Forest Resources	Approximately 2.4 acres of trees will be removed and replanted to grass in auxiliary spillway. An additional 2.0 acres of trees will be removed from the borrow area which will be replanted to trees.
Wetlands	Temporary effects during construction on 12.3 acres of open water wetland and 7.86 acres of fringe wetland because lake will be drained.
Wildlife Habitat	No effect.
Prime Farmland	N/A.
Cultural Resources	No effect.
Threatened and Endangered Species	No effect.

Mitigation

No compensatory mitigation is needed.

Major Conclusions: In order to bring this dam into compliance with NRCS safety and performance standards for a high hazard dam and State safety criteria, it is necessary to raise the dam height, widen and protect the earthen auxiliary spillway, install a splitter dike in the auxiliary spillway and retrofit the riser. The majority of the environmental impacts are short-term (only during construction) and existing conditions will be restored upon completion of construction.

Areas of Controversy: None

Issues to be Resolved: None

Evidence of Unusual Congressional or Local Interest: No

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? Yes X No ___

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

This supplement only addresses Upper North River Dam No. 77, known locally as Hearthstone Lake. This dam was built in 1966 as a high hazard dam. Due to changes in evaluation criteria, this dam does not meet current USDA Natural Resources Conservation Service (NRCS) safety and performance standards for a high hazard dam or Virginia Department of Conservation and Recreation, Division of Dam Safety and Floodplain Management (referred to herein as the Virginia Division of Dam Safety) dam design, safety, and performance standards for auxiliary spillway capacity. A conditional certificate for Operation and Maintenance of the structure was issued by the Virginia Division of Dam Safety because the vegetated earthen auxiliary spillway cannot pass the Probable Maximum Flood (PMF) without overtopping the dam. For this reason, the dam does not meet the objectives of the Augusta County Board of Supervisors and the Headwaters Soil and Water Conservation District (Headwaters SWCD) (herein referred to as Sponsors), which are to continue to provide flood protection and to reduce the risk of loss of human life.

This supplemental plan documents the planning process by which NRCS provided technical assistance to the local Sponsors and the public in addressing resource issues and concerns within the Hearthstone Lake watershed. The dam is located in the George Washington and Jefferson National Forests. The plan was prepared with the assistance of the USDA Forest Service, George Washington and Jefferson National Forests, referred to herein as the U.S. Forest Service.

The recommended plan is to rehabilitate the Hearthstone Lake dam to meet current NRCS safety and performance standards for a high hazard dam. The plan provides for widening the auxiliary spillway by 92 feet and raising the top of the dam by about 2.6 feet with earthfill. The control section will be lengthened to 70 feet. An earthen splitter dike will be installed down the centerline of the auxiliary spillway to reduce the potential for concentrated flows. Turf Reinforcement Matting will be used to augment the vegetation in the auxiliary spillway. The existing principal spillway riser will be retrofitted to meet current criteria. There will be no change in the current levels of flood protection downstream as a result of project activity.

PURPOSE AND NEED FOR ACTION

The Upper North River Dam No. 77, Hearthstone Lake, does not presently meet NRCS or Virginia Division of Dam Safety standards for the stability and capacity of the vegetated earthen auxiliary spillway. There are lives and property downstream of this structure that need flood protection. The purpose of this action is to continue to provide 100-year flood protection in a manner that minimizes risk of loss of human life and is both cost effective and environmentally acceptable.

ORIGINAL PROJECT

In 1960, the original watershed work plan for flood prevention and watershed protection was prepared under the authority of the Flood Control Act of 1944 (Public Law 534). The works of improvement were subsequently installed under the same authority. The Shenandoah Valley Soil Conservation District was the sole sponsor. The original watershed work plan included the construction of three single-purpose dams designed for a 50-year life, an accelerated land treatment program for watershed protection, and 12 miles of stream channel improvement. Todd Lake (Dam

No. 10) was built in 1963 as a significant hazard structure. Elkhorn Lake (Dam No. 76) and Hearthstone Lake (Dam No. 77) were built as high hazard structures in 1965 and 1966, respectively.

In 1961, the City of Staunton became a project sponsor and in 1962, the purpose of Elkhorn Lake was revised to include municipal water supply for the City of Staunton. A fourth flood control structure, Freemason Run (Dam No. 59), was added to the project in 1964 to provide protection of 162 acres of the floodplain. The Headwaters Soil and Water Conservation District and the Augusta County Board of Supervisors became project sponsors in 1993. These two sponsors then assumed responsibility for the operation and maintenance of Todd Lake and Hearthstone Lake. The dam on Freemason Run was not built due to geological faults in the area of the proposed dam site and the cost of relocating structures, roads, and utilities in the proposed flood pool. The channel work was also deleted from the planned works of improvement. The original watershed project was closed out and considered to be completed in April 2000. In 2012, NRCS completed a plan for the rehabilitation of Todd Lake as a high hazard structure. Construction on the rehabilitation of Todd Lake began in the spring of 2015. The rehabilitation of Upper North River Dam No. 77 is authorized by the Public Law 83-566, (as amended), and as further amended by Section 313 of Public Law 106-472.

WATERSHED PROBLEMS

The Sponsors were aware of potential problems with the Hearthstone Lake dam in 2007. From 2007 to 2013, the dam was operated under a grandfathered regular permit since there were changes in the dam safety regulations in 2008. In November 2011, the Virginia Division of Dam Safety issued a conditional certificate for Hearthstone Lake because the auxiliary spillway did not have sufficient capacity to pass the PMF without overtopping the dam embankment. The auxiliary spillway of Hearthstone Lake can only pass about 75% of the PMF.

Sponsor Concerns: A conditional certificate serves as notification to the Sponsors that the dam no longer meets State requirements and must be modified to meet State law. The presence of an unresolved conditional certificate leaves the Sponsors vulnerable to liability should the dam breach and downstream damages result. In January 2012, the Sponsors requested NRCS assistance to prepare a watershed plan that would identify the improvements necessary to obtain full dam safety certification.

Soil Erodibility: In 2012, the State Division of Dam Safety commissioned Hurt and Proffitt to perform a Hazard Classification Study of Hearthstone Lake. Although the auxiliary spillway has performed satisfactorily for nearly 50 years, based upon the Hurt and Proffitt study, the capacity of the auxiliary spillway does not meet the required criteria for a high hazard dam. Further analysis indicated that the surface of the auxiliary spillway would be vulnerable to erosion in the PMF event. However, the integrity of the materials underlying the auxiliary spillway is sufficient to withstand the PMF flows.

Floodplain Management: The Sponsors have identified flooding in the floodplain downstream as a primary concern. Augusta County has participated in the National Flood Insurance Program since 1990, and realizes the value that Hearthstone Lake provides in flood protection benefits, particularly for the roads. Hearthstone Lake controls 15.83 square miles (10,131 acres) of the watershed above the affected properties and benefitted area. Rockingham County and the Town

of Bridgewater, which are located in the downstream end of the breach zone of the dam, also participate in the National Flood Insurance Program.

Erosion and Sedimentation: As of 2012, Hearthstone Lake had reached 46 years (92%) of its planned 50-year service life. The designed submerged sediment capacity was 150 acre-feet but the as-built volume was 193 acre-feet due to the removal of extra borrow removal from the pool area. As of 2012, there were 59 acre-feet of sediment in the pool area which is about 31% of the as-built sediment storage volume. This material is primarily deposited sediments plus leaf and other organic debris. The upstream watershed of this lake is almost entirely forested and the sediment delivery is less than anticipated during the original design.

Local Concerns: The dams for Todd Lake, Elkhorn Lake, and Hearthstone Lake were planned and constructed in response to the concerns of the residents after the damaging flood of 1949. The possibility of decommissioning the dam at Hearthstone Lake was mentioned at the first public meeting in April 2014 since decommissioning must be considered under the federal rehabilitation legislation. Representatives from Trout Unlimited had suggested removal of the dam to allow fish passage. Residents were adamantly opposed to decommissioning because of their concern that flooding would increase in the absence of the dam. According to a letter from the U.S. Army Corps of Engineers, dated May 1960, the North River experienced seven large floods in the period from 1870 to 1949. In 1985, the area experienced heavy rainfall from Hurricane Juan. This event was immediately followed by a tropical low that produced even higher rainfalls. These combined events caused flow in the auxiliary spillway of Hearthstone Lake to a depth of about 2 feet. Hurricane Fran, in 1996, caused over 5 feet of flow in the auxiliary spillway (Figure 1). There have been 13 other documented storm events that filled the flood pool but did not cause auxiliary spillway flow. These three dams in this watershed have performed well and provided needed flood protection for downstream residents during the floods that followed their installation.

WATERSHED OPPORTUNITIES

The following is a general list of opportunities that will be recognized through the implementation of this dam rehabilitation plan. Some quantification of these opportunities will be provided in other sections of the report, as appropriate.

- Comply with high hazard dam safety and performance standards established by NRCS and the Virginia Division of Dam Safety.
- Minimize the potential for loss of life associated with a failure of this dam.
- Reduce the sponsor liability associated with operation of an unsafe dam.
- Maintain the existing level of flood protection for downstream homes and infrastructure.
- Protect real estate values downstream from the dam.
- Maintain aquatic and terrestrial habitats around the lake.
- Preserve existing recreation opportunities.



Figure 1. (Clockwise from top left) After Hurricane Fran in 1996 - the flood pool, the damaged hillslope downstream of the auxiliary spillway, and Tillman Road below the hillslope.

SCOPE OF THE ENVIRONMENTAL ASSESSMENT

A scoping process was used to identify issues of economic, environmental, cultural, and social importance in the watershed. Watershed concerns of Sponsors, technical agencies, and local citizens were expressed in the scoping meeting and in other planning and public meetings. Factors that would affect soil, water, air, plant, animals, and human resources were identified by an interdisciplinary planning team composed of the following areas of expertise: engineering, biology, economics, resource conservation, water quality, soils, archaeology, and geology.

On April 3, 2014, a Scoping Meeting was held at the Augusta County Government Office Complex in Verona, Virginia. Table A lists the specific concerns and their relevance to the proposed action to the decision-making process. Input was provided by the Augusta County Administrator, the Headwaters SWCD, the Virginia Department of Emergency Management, Virginia Department of Health, Virginia Department of Game and Inland Fisheries, the Augusta County E-911 Emergency Communications Director, the U.S. Forest Service, the Town of Bridgewater, Trout Unlimited, and a representative from Virginia's 6th Congressional District Office.

The citizens at the first Public Meeting, also held on April 3, 2014, expressed concerns similar to those at the Scoping Meeting. After the meeting, NRCS received 43 letters of support for dam rehabilitation from residents of the Town of Bridgewater.

**Table A - Scoping Meeting Results For Rehabilitation of Hearthstone Lake Dam
April 3, 2014**

Item/Concern	Relevant to the Proposed Action		Rationale
	Yes	No	
SOILS			
Prime and Unique Farmland and farmland of statewide significance		X	None present.
Soil Resources		X	N/A
WATER			
Floodplain Management	X		No increase in flood levels.
Regional water resources plans (including coastal zone plans)		X	Watershed is in Chesapeake Bay drainage but not in a coastal zone management area. Local ordinances are in place to protect the Bay.
Sewer utilities		X	
Sole source aquifers		X	
Streams, Lakes, and Wetlands	X		The lake will be temporarily drained during construction.
Water quality	X		Erosion and sediment during construction, dissolved oxygen.
Water resources	X		Temperature and sediment during construction, anoxic layering during release
Wild & Scenic rivers		X	None present.
AIR			
Air Quality	X		Temporary effects during construction.
PLANTS			
Endangered and Threatened Species		X	None present.
Forest resources	X		There is a proposed Wilderness Area; U.S. Forest Service does not own subsurface mineral rights that could affect borrow availability for dam embankment modifications.
Invasive species	X		Ensure none are introduced during implementation.
Natural areas		X	
Riparian areas	X		Impacted during construction.

Item/Concern	Relevant to the Proposed Action		Rationale
	Yes	No	
ANIMALS			
Coral reefs		X	None present.
Ecologically critical areas		X	None present.
Endangered and Threatened Species	X		Potential habitat for Indiana Bat or Northern long-eared Bat in area. Consultation with US Fish and Wildlife Service will be conducted.
Essential fish habitat		X	None present.
Fish and wildlife	X		Temporary effects during construction. Temperature – existing cold water release. Dam is a migration barrier and fragments habitat. Dam is a barrier to natural nutrient and sediment transport.
Invasive Species		X	
Migratory birds/Bald eagles/Golden eagles	X		Temporary effects during construction.
HUMAN			
Costs/ National Economic Development (NED)/P&G	X		Net Economic Development must be considered.
Cultural resources		X	No adverse impacts to cultural resources.
Environmental Justice and Civil Rights		X	No disparate treatment is anticipated.
Land Use		X	No anticipated changes.
Local and Regional Economy	X		Temporary positive effect during construction for local and regional construction companies. Permanent negative effect if decommissioned.
Parklands		X	No parklands present.
Public health and safety	X		Dam is critical to the Town of Bridgewater. Restricted access to the lake during construction.
Public recreation	X		Temporary impacts for loss of use of lake and nearby trails during implementation.
Scenic beauty	X		Temporary impacts while lake is drawn down and unsightly construction equipment. If visual changes planned, need to meet U.S. Forest Service Forest Plan.
Scientific resources		X	There are no scientific resources identified in this area.
Social issues	X		How we prioritize public funds? Is it the role of government to use public funds to protect from flooding?

AFFECTED ENVIRONMENT

PLANNING ACTIVITIES

Geologic and engineering investigations and analyses were conducted by NRCS with assistance from the Headwaters Soil and Water Conservation District. This work included the sediment survey, the hydrologic and hydraulic analysis, and the Water Resources Site Analysis Program (SITES) analysis of the dam characteristics. Both the existing conditions and proposed rehabilitation alternatives were evaluated with these tools.

Other planning activities included a land use inventory, natural resources inventories, wetland assessments, and the identification of threatened and endangered species and fish and wildlife resources. The U.S. Forest Service conducted a Biological Assessment of the site. Cultural and historic resources were investigated and a Phase I survey completed. Potential alternatives were evaluated for cost-effectiveness and for local acceptability. Both the benefits and the costs of the alternatives were computed and analyzed.

PHYSICAL FEATURES

Project Location: The watershed for Hearthstone Lake is located in Augusta County, Virginia. The Hearthstone Lake watershed is 10,131 acres (15.83 square miles). Appendix B shows the location map for this watershed.

Topography: Hearthstone Lake is located in the Ridge and Valley Physiographic Province. The topography of the Ridge and Valley consists of long, relatively high ridges generally oriented in a northeast-southwest direction with continuous valleys in between. The elevation in the watershed ranges from about 1,880 feet at the dam to 4,351 feet at Little Bald Knob on the watershed divide.

Soils: The Hazleton-Lehew complex covers 73.0% of the watershed with 7,391 acres. Lehew soils cover 1,010 acres or 10.0% of the watershed; Hazleton soils cover 757 acres or 7.5%; Udorthents cover 488 acres or 4.8%; and Leetonia soils cover 460 acres or 4.5%. Water covers about 0.1% of the watershed (12.3 acres) and other soils account for another 0.1%. Approximately 81.2% of the soils in the watershed are on slopes greater than 25%. (For more information, see the Web Soil Survey at <http://websoilsurvey.nrcs.usda.gov/>.)

Geology: The digital representation of the 1993 Geologic Map of Virginia shows that the majority of the watershed draining into Upper North River Site No. 77 is underlain by the Devonian Age Hampshire Formation. There is an area underlain by the Chemung Formation exposed by an anticlinal structure running northeast-southwest across the watershed. That same map shows the embankment itself to be underlain by the Mississippian Age Pocono Formation. A very small area in the headwaters of the watershed is also underlain by the Pocono Formation. The Hampshire Formation is described as a sandstone and interbedded fine-grained mudstone, with some conglomeratic sandstones. The Chemung Formation is described as sandstone and shale. The sandstone is described as fine-grained, thin- to thick-bedded, and the shale is described as fissile, clay shale. The Pocono Formation is described as a quartzitic sandstone, medium- to coarse-grained, locally conglomeratic, thick-bedded, resistant, interbedded with thin shale and a few very thin coal beds.

Climate: In the Ridge and Valley Physiographic Province, the average temperature is 37° F in the winter and 74° F in the summer. The last frost of spring normally occurs in late April to early May

and the first frost in the fall occurs in mid to late October. This provides a growing season of approximately 190 to 231 days, depending on elevation. The average annual precipitation is about 41 inches. This precipitation is well distributed through the year with slightly larger amounts occurring in the summer months. The average total snowfall in the western part of Augusta County is 16.1 inches.

The prevailing winds in the watershed are southwesterly, blowing hardest from January to April, with usually a light to moderate breeze at all times of the year. Average wind speed is approximately nine miles per hour.

LAND USE

The drainage area upstream of Hearthstone Lake is 10,131 acres. This area was derived from the Augusta County 2007 Elevation data, using the ArcGIS Hydrologic Analysis Tools. The Land Cover/Land Use was extracted from the 2006 National Land Cover Dataset (NLCD). Within the drainage area, the Developed, Open Space is primarily the roads and boat landing area. Table B lists the land use upstream of the dam. This table also lists the land use in the Sunny Day Breach inundation zone below the dam. The land use in the Sunny Day Breach Zone was derived from the NLCD 2011 data set. Appendix B contains the land use map of the watershed.

Table B - Land Use

Land Cover Type	Drainage Area of Hearthstone Lake (ac.)	Percent of Total	Sunny Day Breach Inundation Zone (ac.)	Percent of Total
Barren Land	-	-	1	0.0
Cultivated Crops	-	-	944	17.6
Forest	10,045	99.2	1,459	27.2
Developed, Low Intensity	-	-	89	1.7
Developed, Medium Intensity	-	-	19	0.3
Developed, High Intensity	-	-	5	0.1
Developed, Open Space	63	0.6	260	4.9
Hay/Pasture	3	0.0	2,555	47.6
Open Water	20	0.2	33	0.6
Total	10,131	100.0	5,365	100.0

THREATENED AND ENDANGERED SPECIES

Since the dam is located in the George Washington and Jefferson National Forest, the U.S. Forest Service agreed to take the lead on inventories and investigations of threatened and endangered (T&E) species for compliance with the Endangered Species Act and take the lead on any Section

7 consultation if necessary. The U.S. Forest Service prepared a Biological Evaluation/Biological Assessment (BE/BA) for the Hearthstone Lake Dam rehabilitation project in accordance with U.S. Forest Service Policy. The objectives of the BE/BA are to: 1) ensure that NRCS and Forest Service actions do not contribute to trends toward federal listing; 2) comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of federally listed species; and 3) provide a process and standard to ensure that threatened, endangered, proposed, and sensitive (TES) species receive full consideration in the decision-making process. The best available science was used to meet these objectives. The following information is a summary of the methods, results, and conclusions of the BE/BA. The BE/BA is contained in Appendix E for detailed review and analysis.

The U.S. Forest Service performed state and federal database searches, consulted with area experts, reviewed known ranges, and completed field surveys of the entire project area for federal and state listed TES species. The BE/BA concluded that no TES species were found, nor was there habitat that would likely support TES species other than the Indiana bat (*Myotis sodalis*) or the Northern long-eared Bat (*Myotis septentrionalis*). Despite the existence of potential bat habitat, during past and recent surveys, no Indiana bats or Northern long-eared bats have been seen in the project area. Public scoping did not identify any other TES species known to occur on the project area that would be affected. Therefore, it is unlikely that any other TES species routinely occurs in the project area. For these reasons, other TES species were eliminated from further consideration.

Since there are no other T&E species or likely habitat present, the proposed project will have no effect on any other federally listed or proposed species or their designated or proposed critical habitat, regardless of the alternative selected. Likewise, since there are no sensitive species or likely habitat present, the project will have no impact to any other sensitive state and federal species of concern. NRCS concurs with the findings of the U.S. Forest Service of no effect on TES and/or its associated habitat.

Confirmed occurrence of a listed species in a project area requires consultation with the appropriate state or federal agencies. Since there are no confirmed occurrences of federal or state listed threatened or endangered species in the project area, further consultation with TES regulatory agencies is not required.

CULTURAL RESOURCES, NATURAL AND SCENIC AREAS, AND VISUAL RESOURCES

The National Register of Historic Places lists fifty sites in Augusta County. Five archaeological sites within one mile of the project area are listed in the State archaeological files. However, none will be affected by the proposed work. There are no architectural sites listed in the State architectural files within one mile of the project area.

The National Historic Landmarks Program lists 119 sites, buildings or structures in Virginia, none of which are found in Augusta County. Therefore, none will be affected by the project activities. There are three designated State Natural and Scenic Area Preserves in Augusta County. However, none are within the project vicinity.

The U.S. Forest Service agreed to take the lead on inventories and investigations of cultural resources and other responsibilities per Section 106 of the National Historic Preservation Act. In October 2014, U.S. Forest Service cultural resources staff completed database searches for any

known cultural resources and ground surveyed the project area for evidence of archaeological and/or historical resources that had the potential to be impacted. A pedestrian survey was conducted throughout the entire project area. Subsurface testing was implemented in areas having high potential of encountering cultural resources. In addition, areas of high visibility were also examined. No known cultural resources were found from the database searches and no cultural resources were encountered during the field investigation for the project area.

Consultation with the Virginia Department of Historic Resources (VDHR) was initiated in November 2014 by the U.S. Forest Service with the submission of a cultural resources reconnaissance report pertaining to the proposed Hearthstone Lake Dam rehabilitation project. On December 8, 2014, the VDHR indicated their concurrence with the U.S. Forest Service's finding of "*no historic properties affected*" for the proposed Hearthstone Lake dam project.

WATER QUALITY

Hearthstone Lake is located on Little River which conflues with North River approximately 2.3 miles downstream of the dam. The watershed for Hearthstone Lake is almost entirely forested with the exception of a few meadows. The 2012 305(b)/303(d) Integrated Water Quality Assessment and Impaired Waters Report listed Little River as Category 5 waters needing a Total Maximum Daily Load (TMDL) Study addressing both aquatic life and recreation (VDEQ 2012). The Commonwealth of Virginia currently has no plans for TMDL development within the next six years. The impaired segment mentioned above is not included on the 6-year prioritization list.

STREAMS, LAKES, AND WETLANDS

Little River is a tributary to North River. The North River drains into the South Fork Shenandoah River which joins the North Fork Shenandoah River at Front Royal to become the Shenandoah River. The Shenandoah River drains into the Potomac River at Harper's Ferry, WV. The Potomac River flows into the Chesapeake Bay. Little River has a base flow of about 15.8 cubic feet per second immediately below the dam. The stream is approximately 10 feet wide and less than two feet deep. The substrate of the streambed consists of sands and gravels. The riparian areas adjacent to Little River and Hearthstone Lake are predominately forested.

The Hearthstone Lake shoreline, inlet, and outlet were visually surveyed in April 2014 for wetlands. Approximately 7.86 acres of freshwater emergent wetlands were identified at the inflow of the lake. The 12.3 surface acres of the lake are considered to be open water wetlands. No other wetlands were identified upstream or downstream of the dam. Data found at the US Fish and Wildlife wetland mapper website: www.fws.gov/wetlands/Data/Mapper.html concurred with the field investigation.

Sediment accumulations in the upper end of the lake have reduced the surface area of the lake from 14 acres to 12.3 acres in size.

Additional documentation regarding the methods used to make the field investigation can be found in Appendix D.

AIR QUALITY

Air quality in the area is satisfactory. According to the Virginia Department of Environmental Quality, Augusta County is located within a non-attainment area for ozone. Special consideration must be given to fugitive dust or open burning during land-disturbing and construction activities.

FOREST RESOURCES

The U.S. Forest Service North River District staff completed a field vegetative survey of the project area in June and August of 2014. A summary of that survey found that oak species dominate the canopy layer. Other important species in the canopy layer include pines, maples, black gum, and tulip poplar. Common mid-story vegetation includes saplings of overstory trees, witch hazel, and serviceberry. Some of the most common understory species in the forested areas include seedlings of woody species, mountain laurel, greenbrier, blueberries, ferns, and mosses. The open areas contain a variety of flowers, grasses, sedges and shrubs. Many are alien or invasive species. This mixture of vegetation is typical of acidic soils developed over sandstone and shale bedrock in the Ridge and Valley portion of the Appalachian Mountains. Potential habitat for Sweet pinesap, a sensitive species, occurs in the project area, however none were observed during field surveys. See Appendix E for the Biological Evaluation for the Threatened, Endangered, and Sensitive Species.

FISH AND WILDLIFE RESOURCES

Hearthstone Lake is a category A stocked trout water (stocked with rainbow trout). In addition, it is stocked annually with catchable size catfish. Northern pike are stocked occasionally but that program may be phased out. Fish communities in the reservoir include the forage base of bluegill, green sunfish and yellow perch. Little River above the reservoir is a class IV wild brook trout stream. A portion of Little River below the reservoir is a class IV wild brook trout stream.

The Upper North River Watershed is considered to be part of the Blue Ridge Mountains Ecoregion according to Virginia's Comprehensive Wildlife Conservation Strategy, 2005 (VDGIF). This Strategy lists 174 Species of Greatest Conservation Need in the Blue Ridge Mountains. While completing field surveys, the U.S. Forest Service North River District staff observed many animals and animal signs commonly found in such habitats, including white-tailed deer, woodpeckers, spiders, eastern chipmunks, and many species of warblers and other songbirds. The survey found only typical aquatic animals in area streams and in Hearthstone Lake including frogs, red-spotted newt, minnows, and leeches. Species not seen during the field survey, but possibly occur in the activity area based on habitat observed during the field survey include the Indiana Bat and the Northern long-eared bat. See Appendix E for the Biological Evaluation for the Threatened, Endangered, and Sensitive Species.

MIGRATORY BIRDS

Hearthstone Lake is on 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.

CHESAPEAKE BAY AND COASTAL ZONE MANAGEMENT AREAS

The Upper North River Watershed eventually drains into the Potomac River, a major tributary to the Chesapeake Bay. As such, the dam rehabilitation efforts must consider impacts as required by the Chesapeake Bay Preservation Act. Augusta County and Rockingham County have adopted local land use plans and ordinances which incorporate water quality protection measures consistent with the Chesapeake Bay Act Regulations. The Upper North River Watershed is not located within the Virginia Coastal Zone Management Area.

SOCIAL AND ECONOMIC CONDITIONS

Hearthstone Lake has a watershed of 10,131 acres, all of which lie within the George Washington and Jefferson National Forest and Augusta County. A majority of the population at risk from a breach event live within Augusta County. Only five homes within the breach inundation zone are located within Rockingham County. There are 220 homes in Augusta County within the breach inundation zone. Less than 3% of the properties potentially affected by a breach event are within Rockingham County. Therefore, the social and economic conditions section will focus on Augusta County. The EPA's Environmental Justice website was visited but the site did not provide site specific localized information down to the small watershed level. There is no evidence of environmental justice groups in the watershed since it is almost 100% federal land upstream of the lake. The downstream benefitted areas will all be protected by the rehabilitation project so there are no planned adverse impacts to any individual or groups in the area.

Population and Race: According to the U.S. Census Bureau, the population of Augusta County as of July 1, 2013, was 73,912 (up only marginally from 73,750 according to the 2010 Census, but 12.6% higher than the 65,615 estimated in the 2000 census of the population). Of the total population in the 2009-2013 American Community Survey 5-year estimates, about 93.1% (68,628) were White and 4.1% (3,057) were Black or African American. All other racial groups individually were 0.8% of the total population or less. Together, Whites and Blacks made up 97.2% of the county's entire population. Hispanics of any race are the second largest minority group with 2.2%, or 1,608. All other races present constituted less than 1% of the Augusta County population with 1,903.

Age: The 2009-2013 Census projections from the American Community Survey (ACS) of the U.S. Census Bureau, indicate that the median age (middle point with ½ above and ½ below) of the population of Augusta County was 43.5 (up from 39 in 2000). The median age for Virginia was somewhat lower at 37.5 years (37.3 for the entire nation). Residents in Augusta County that were 65 years old or older totaled 16.8% (12,416). These statistics compare to 12.6% for the State and 13.4% for the nation. Of the County population, 79.2% was over the age of 18. The same statistic for the state as a whole was 77.1%. Both the local and the state numbers are higher than the national average estimated at 76.3%.

Education: Approximately 84.2% of the residents in the County had a high school education or higher while the state-wide and national percentages for this were 87.5% and 86% respectively. Of the residents in the county that are 25 years of age or older, 41.5% have a high school diploma or have passed an equivalency test. State-wide and nationally, 25.2% and 28.1% respectively, of the population 25 years of age or older, has a high school diploma or equivalency. About 42.6% of the County residents have some education beyond high school, including 13.2% with a

bachelor's degree or higher and 6.6% with graduate or professional degrees. An additional 17.1% in the County have completed at least some college level work with 5.7% having obtained an associate degree. All of these numbers are well above the state-wide and national averages.

Employment/Unemployment, Class of Worker and Commuter Status: There are 60,267 Augusta County residents who are 16 years of age or older according to the 2009-2013 ACS. Approximately 59.5% (35,859) of these people are considered in the labor force pool. About 94.4% of the civilian labor force in the County was employed according to the 2009-2013 ACS. About 3.3% of the civilian labor force in the County was unemployed according to the same source. The unemployment figure is lower than the unemployment rate projected from the 2009-2013 estimates for Virginia as a whole which was 7.2%, and for the nation, which was estimated to be 9.7%.

Augusta County has a diverse and productive economy. According to the 2009-2013 ACS, five sub-sectors of the local economy employ the civilian workforce: management and related professional occupations (30.0%); sales and office occupations (23.3%); production, transportation, and materials moving occupations (19.7%), service occupations (17.1%) and natural resources, construction, and maintenance occupations (9.9%). According to the same 2009-2013 American Community Survey, private wage and salary employment constitutes 76.7% of all employment in Augusta County.

Income: Median household income (householder and all others, related or not) estimated for the county for the 2009-2013 period was \$52,027. This compares to \$63,907 per year for the median household income calculated for Virginia. The national figure for median household income per year estimated for the same period was \$53,046. The median estimated household income for 2009-2013 for Augusta County was 81% of the state median and 98% of the national median household income.

Median family income (householder and all others that are related) in Augusta County for the 2009-2013 period was \$60,614 compared to \$48,579 per year for 2000¹. The current figure is significantly less, approximately 79%, than the \$76,754 in median family income for Virginia as a whole and almost 94% of the \$64,719 reported for the entire United States for 2009-2013.

With respect to per capita incomes, Augusta County residents are estimated to have had per capita incomes of \$25,519 for the 2009-2013 period. Virginians reported per capita income of \$33,493 for the 2009-2013 period, while the same figure for the entire United States was \$28,155 for same time period. That makes the county per capita income figure for 2009-2013 76% of the state's level and 91% of the national figure.

Poverty: According to the 2009-2013 Census estimates, Augusta County had 1,476 families living below the poverty level (7.2%), up from 801 families (4.2%) living below the poverty level in 2000. State-wide, 8% of Virginia's families had incomes below the poverty level during the 2009-2010 period, up from 7% in 2000. At the national level, 11.3% of the families were estimated to live below the poverty level for the period 2009-2013, up from 9.2% in 2000.

Housing: The 2009-2013 Census estimates indicate that 89.3% of the 31,362 housing units within Augusta County were occupied. Of the occupied housing units, 80.9% were owner-occupied and

¹ Median family income is consistently higher than median household income. This is because the household universe includes people who live alone. Their income would typically be lower than family income because by definition, a family must have two or more people.

19.1% renter-occupied. The state-wide occupancy rate for Virginia as a whole reported in the 2009-2013 estimates was 89.4% and the national figure was 87.5%. The state-wide rates for owner- and renter-occupancy were 67.3% and 32.7%, respectively. The national rates for owner- and renter-occupancy were 64.9% and 35.1%, respectively.

A total of 225 homes (188 single family homes, 28 mobile homes, 2 multi-family homes and 7 modular homes) are located in the projected breach inundation zone below the dam. Most of the homes are located in or near the Town of Stokesville. Most of the residential property downstream of the dam ranges between \$50,000 and \$400,000 in total value with an average of about \$150,000. The total value of residential property (structures and contents only, excluding land values) at risk below the dam is an estimated \$22,195,000.

Recreation: Hearthstone Lake provides recreation to fishermen and day visitors to the National Forest and the recreational facilities at the reservoir (Figure 2). It is highly valued by the local community. Other lake-based recreation activities associated with the reservoir include boating and bird watching. An estimated average of 7-8 visitors/day use the reservoir for recreation from March through October. Much lower visitation occurs during the remainder of the year. The total estimated usage is about 1,800 people per year.



Figure 2. View of boat ramp at Hearthstone Lake.

DESCRIPTION OF EXISTING DAM

Current Condition of the Dam: The most recent visual inspection of the dam was conducted in late summer of 2014. The dam and auxiliary spillway have been well maintained with a good stand of grass and no woody vegetation on the embankment and auxiliary spillway. No erosion was observed on either the embankment or the auxiliary spillway. The camera survey of the principal spillway pipe was completed in October 2012 and showed no material deterioration. The slide gate at the base of the riser was last activated during the camera inspection.

Potential Dam Safety Deficiencies: The Virginia Division of Dam Safety issued a conditional use certificate for Hearthstone Lake because the vegetated earthen auxiliary spillway does not have

the capacity to pass the Probable Maximum Flood (PMF) storm flow without overtopping the structure. During the planning process, NRCS verified this condition. NRCS further determined that the auxiliary spillway also does not meet the NRCS stability criteria for a vegetated spillway. The third identified concern is that the footer of the principal spillway riser does not meet the current NRCS seismic criteria.

Location and Layout: Upper North River 77 dam and reservoir are located in a narrow valley with steep ridges. It is adjacent to and upstream of an unpaved secondary road (Forest Service Road 101 – Tillman Road) (Figure 3). Earthfill was placed in the valley of Little River to create the embankment with the auxiliary spillway (ASW) excavated out of the left abutment. The existing ASW exits to a hillslope that drops about 75 feet to the valley floor on a 35 to 40% grade. The hillslope consists of sandstone, shale and siltstone. Tillman Road is located at the bottom of the hillslope and also traverses the downstream stability berm of the embankment. It presents limitations to designing any type of structure that extends beyond the downstream toe of the hillslope or dam.



Figure 3. The Hearthstone Lake dam, auxiliary spillway, and pool.

As-Built Dam Specifications: The dam was completed in 1966. The earthfill used to construct the embankment was obtained from the permanent pool area, the auxiliary spillway excavation, and nearby borrow pits. According to the original design report, the pool borrow area included

sand with fine gravel, silt, and boulders. The soils in the borrow areas were primarily silty clayey sand. The auxiliary spillway soils were fine sandy silts and silty sand.

The dam embankment is comprised of multiple zones or sections of earthfill. Section 1, the “Core” and cutoff trench material, is described as silts and clays. Section 2, the “Transition” material which wraps both the upstream side and downstream side of the core, is clayey sands and silty sand. Section 3, the “Shell,” wraps the dam and creates the outside surface that is comprised of poorly graded gravels and silty gravels. Section 4 is located on the downstream side of the dam between the upper portions of Sections 2 and 3. It is comprised of siltstone and shale. The stability berm on the downstream side of the dam also serves as the rock toe drain. This material was generated by rock excavation of the cutoff trench and auxiliary spillway. Sampling of the rock-filled toe was performed by Timmons Group and Schnabel Engineering in 2013. The investigation found that the rock toe was built as designed and there was adequate filter material incorporated into that zone during construction. Repair/re-work of the rock toe on Upper North River No. 77 is not required as part of the rehabilitation of this dam.

The top of the embankment is 28 feet wide. The downstream embankment slope is 2 feet horizontal to 1 foot vertical (2:1). A 28-foot wide stability berm is located above the rock toe drain and also acts as the road bed for Tillman Road (Figure 4). The upstream face of the dam has a 3:1 side slope from the top of the dam to the wave berm. The slope continues at 3:1 below the elevation of the 10-foot-wide wave berm (Figure 5). The crest of the dam extends approximately 705 feet from the right abutment (looking downstream) to the ASW.

The site was surveyed in 2012 using NAVD88 vertical datum. The top of dam was surveyed at elevation 1856.1 (NAVD88) which is 107.3 feet above the downstream invert of the principal spillway pipe. There is a camber leaving the abutment contacts approximately 1 foot lower than the midpoint of the dam. The top of the dam varies from 1856.1 to 1854.9 (NAVD88).

Principal Spillway: The principal spillway consists of a 576-foot long, 48-inch-diameter, reinforced concrete pipe with 20 concrete anti-seep collars and a riprap-lined plunge pool (Figure 6). The existing concrete riser is a two-stage riser with a concrete top and a high stage trash rack. The inside riser dimensions are 4' x 12' and the riser walls are from 1.0 to 2.5 feet thick. The riser is 53.75' high (Figure 7). A 24" circular slide gate located on the right side of the riser allows controlled release of stored water through the riser. The riser controls the normal pool with an orifice at elevation 1778.0 (NAVD88). The riser crest is at elevation 1801.8 (NAVD88). A cold-water release was installed to control the temperature of the water released from the structure and to allow for an extended period of release during low flow conditions. The footing for the riser is 9' by 28.8' by 24" thick with a 2' by 2.5' wide buttress supports on both sides of the riser.

In 2000, the lake was drained for repairs to the drain gate and the external concrete of the riser. At a later time, a locked manhole cover was installed in the top of the riser.

Auxiliary Spillway: A 250-foot-wide vegetated earth auxiliary spillway was constructed in the left abutment (Figure 8). The As-Built drawings show a 30-foot-long level control section approximately 12 feet below the top of dam with a 130-foot long, 2% inlet slope. The constructed outlet has a grade of 2% for 380 feet. The vegetation lining the spillway is well maintained. The existing auxiliary spillway exits to a wooded hillslope that drops about 75 feet to the valley floor on a 35-40% grade. Spillway flows will pass over Tillman Road before entering the defined channel of Little River. The as-built elevation of the control section was 1844.0 (NAVD29) and the 2012 mean surveyed elevation was 1843.4 (NAVD88).

Hurricane Juan, in November of 1985, caused approximately 2 feet of flow in the auxiliary spillway but there was no damage to the auxiliary spillway. In September 1996, there was over 5 feet of flow in the auxiliary spillway from Hurricane Fran. There was no damage to the constructed outlet; however, the hillslope below the auxiliary spillway sustained some erosion at the upper end. The small gullies were filled with rock riprap and a diversion was installed at the end of the constructed auxiliary spillway to route water into the riprap areas.

Internal Drain System: At the time of construction, a rock toe drain was installed at the downstream toe of the dam. The drain is in good condition.



Figure 4. Back slope of dam and Tillman Road.

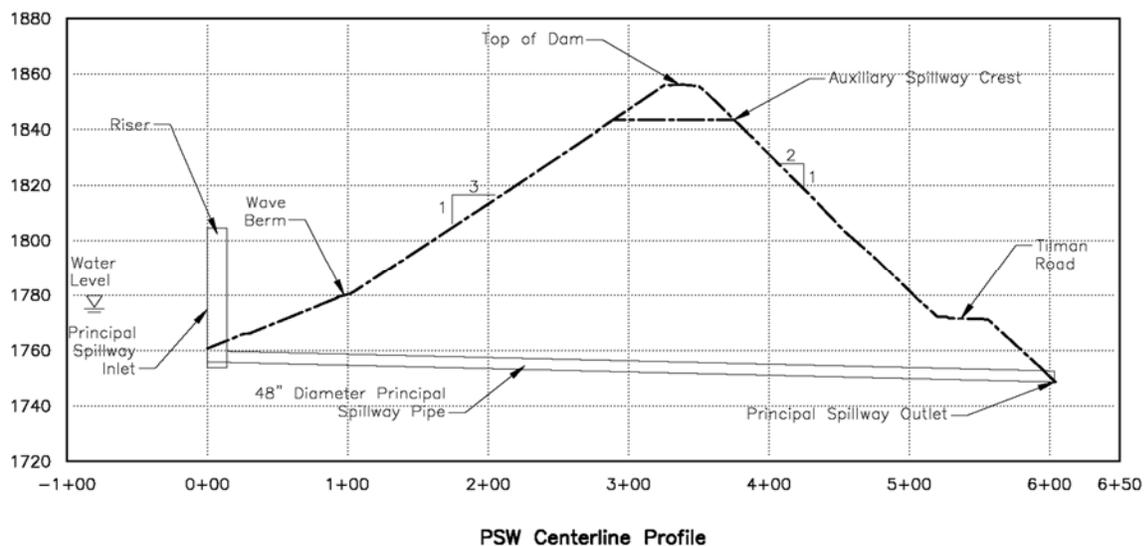


Figure 5. Cross-section of the Hearthstone Dam.



Figure 6. Principal spillway outlet flowing into the plunge pool.



Figure 7. Principal spillway riser at Hearthstone Lake.



Figure 8. Auxiliary spillway, looking downstream.

Appurtenances: An Integrated Flood Observing and Warning System (IFLOWS) gauge installed in the embankment is used by Augusta County to remotely monitor water levels in the reservoir.

Sedimentation: Hearthstone Lake was designed to store 50 years of sediment in the pool area. The designed submerged sediment storage capacity was 150 acre-feet at a planned sediment accumulation rate of 3.0 acre-feet per year. Based upon the as-built cross-sections of the pool area, the original sediment storage capacity was 193 acre-feet. The volume of submerged sediment in the pool in 2012 was 59 acre-feet. In 2000, between 20 and 30 acre-feet of sediment were removed. The total submerged sediment volume accumulated between 1966 and 2012 was approximately 84 acre-feet. The sedimentation rate for this time period was 1.83 acre-feet per year. As of 2012, the remaining capacity of the submerged sediment pool was 134 acre-feet. The land cover within the watershed is 99.2% forested and has not changed since the dam was constructed. The future sedimentation rate is projected to be the same as the historic rate. In 2012, there were 73 years of submerged sediment life remaining. Figure 9 shows the sediment survey in progress.

Due to the volume of sediment that has accumulated in the upper reaches of the pool, the surface area of the lake has decreased from 14 acres to 12.3 acres.

There were 130 acre-feet of aerated sediment storage planned. Aerated sediment is sediment that is deposited above the normal pool during high flows. The designed deposition rate for the aerated sediment was 2.6 acre-feet per year. The estimated volume of aerated sediment in the pool in 2012 was 13.8 acre-feet. This is an accumulation rate of 0.3 acre-feet per year. There is room for over 300 more years of aerated sediment deposition.

Construction Area and Construction Access

From Stokesville, Forest Service Road 95 (FR95) is paved to the intersection with FR101 (Tillman Road). From that point, Tillman Road is unpaved to the site. Access to the site can be achieved by the road that traverses the hillslope below the exit section of the auxiliary spillway. The access road can be widened for construction vehicles. Damage to Tillman Road that occurs as a result of construction will be repaired.

During construction, the contractor can stage operations within the auxiliary spillway. Additional clearing and grubbing will be required along the left side of the auxiliary spillway to accommodate the widening.

The potential construction zone is within the area included in the Special Use Permit that the U.S. Forest Service has issued to the Sponsors. If any changes to the existing Special Use Permit are required, the Sponsors will negotiate with the U.S. Forest Service to obtain it prior to construction.



Figure 9. Sediment survey, in progress.

GENERAL DESCRIPTION OF HOW A DAM FUNCTIONS

The main components of a flood control dam are the earthen embankment; the normal or sediment pool; the floodpool; the principal spillway; and the auxiliary spillway. The principal spillway riser and pipe controls the day-to-day elevation of the water in the lake and it provides a controlled release of the water in the floodpool. The floodpool, which is the water storage volume between the principal spillway crest and the auxiliary spillway crest, is designed to detain the water that would accumulate behind the dam in events equal to or smaller than an event with a 100-year

annual recurrence interval. This storm is the event that has a one percent chance of occurring in any given year. In a bigger flood event, the water level will be higher than the crest of the auxiliary spillway and the excess water will pass around the dam embankment through the auxiliary spillway.

Sediment pool. The reservoir is designed to store sediment in the area below the elevation of the lowest principal spillway inlet and to detain floodwater in the area between the lowest principal spillway inlet and the crest of the auxiliary spillway. After the dam is completed, water accumulates below the lowest principal spillway inlet to create a lake. As the lake fills with sediment, the amount of water in the lake decreases. When the sediment pool has filled to the elevation of the lowest principal spillway inlet, the pool no longer has permanent water storage, but the designed floodwater detention storage is still intact. If the actual sedimentation rate is greater than the designed sedimentation rate, the sediment storage volume will be filled before the design life of the structure has been reached. The additional sediment would begin to fill the floodwater detention volume above the lowest principal spillway inlet and reduce the available flood storage. Initially, sediment delivered to the reservoir would pass directly through the lowest principal spillway inlet. Eventually, this inlet would be blocked by debris and sediment. Water would then be impounded to the elevation of the higher second-stage principal spillway crest. If the second-stage inlet becomes blocked, the level of the water would rise to the crest of the auxiliary spillway.

As the flood pool loses storage due to sediment deposition, the auxiliary spillway operates, or has flowage, more often. For a vegetated earthen auxiliary spillway, repeated flows could erode the soil material and eventually cause the spillway to breach. Repeated flows increase the operation and maintenance costs for the Sponsor.

Principal spillway: A principal spillway has three main parts: the riser, the pipe, and the outlet. The riser is typically a concrete tower that controls the level of water in the lake. Most risers have a drain gate at the bottom of the riser that allows the lake to be completely drained. The elevation of the water in the lake is determined by the amount of sediment that has to be stored over the life of the dam. For a two-stage riser, the water flows through the first-stage inlet in the riser until the water rises to the elevation of the second-stage inlet. Then, it flows through both inlets. The water falls to the bottom of the riser before exiting through the principal spillway pipe. The principal spillway pipe conveys water through the dam safely. The water exits into an outlet structure, typically called a stilling basin. Its purpose is to slow the velocity of the water leaving the pipe so it doesn't cause erosion in the stream channel.

Auxiliary spillway: There are four parts of an auxiliary spillway. The inlet section is on the side closest to the lake. It has a gentle upward slope toward the middle of the auxiliary spillway. The water that reaches the inlet section has little or no velocity and, therefore, does not cause erosion to occur. The level center section is called the control section. The control section is usually located where the auxiliary spillway crosses the centerline of the top of the dam. The purpose of the control section is to make the water in the auxiliary spillway spread out evenly rather than concentrate into little channels. The third section is called the constructed outlet. Its purpose is to keep the water flowing out of the auxiliary spillway in a controlled manner until the water gets far enough away that it will not cause erosion on the earthen embankment itself. Once this point is reached, the water is free to go on downstream. The fourth component of an auxiliary spillway is the training dikes. Training dikes are used in conjunction with the outlet section to direct the flow

of the water away from the back side of the dam embankment. Training dikes can also be used in the inlet section to direct water into the auxiliary spillway.

STATUS OF OPERATION AND MAINTENANCE

Operation and maintenance of the structure is the responsibility of the Headwaters Soil and Water Conservation District and they have done an excellent job of operating and maintaining this structure in accordance with the operation and maintenance agreement. This has been verified through site assessments. The most recent inspection was conducted in the fall of 2014.

STRUCTURAL DATA

The structural data for the existing conditions of the dam and watershed is described in Table C. The information is based upon the 2012 sediment and topographic surveys using NAVD88 vertical datum.

BREACH ANALYSIS AND HAZARD CLASSIFICATION

Breach Analysis: To determine the downstream inundation zone due to a dam breach, a breach analysis was performed for a sunny day breach with the water level at the existing auxiliary spillway crest. The peak breach discharge criteria in Technical Release No. 60, Earth Dams and Reservoirs (TR-60) was used. A “sunny day breach” is a dam failure that occurs unexpectedly.

A maximum breach discharge of 241,300 cfs was computed using the criteria in TR-60. The depth of water at failure was about 87 feet. The computer models HEC-HMS and HEC-RAS (steady flow) were used to determine the inundation zone due to the breach of the dam. Results of the breach analyses are shown in Appendix C in Table C1 and on the Breach Inundation Map. The breach analysis terminates 30 miles downstream of the dam, where the flow from the breach would be within the regulated 100-year floodplain.

The Sponsors have current breach inundation zone maps for the dam that comply with the Virginia Impounding Structures Law and Regulations for high hazard dams. These maps show the breach inundation zone that would occur if the dam failed when the water level was at the top of the dam. The Virginia Impounding Structures Regulations requires owners of high hazard dams to provide a dam breach inundation zone map to determine hazard classification and develop the Emergency Action Plan (EAP). The purpose of an EAP is to outline appropriate actions and to designate parties responsible for those actions in the event of a potential failure of the dam. The Sponsors must update the EAP annually with assistance from local emergency response officials. The NRCS State Conservationist will ensure that a current EAP is prepared prior to initiation of construction.

Hazard Classification: Hearthstone Lake was originally constructed in 1966 for the purpose of protecting downstream lands from flooding. It was designed as a Soil Conservation Service (SCS) class C (high hazard) structure with a 50-year design life. The hazard class of the structure is high because failure may cause loss of life and serious infrastructure damage. Currently, the Virginia Division of Dam Safety has designated Hearthstone Lake as a high hazard structure. The breach analysis completed for this Watershed Plan concurs with the original and current hazard class of the structure as high.

Table C – Existing Structural Data for Hearthstone Lake

	Existing
Local Name	Hearthstone Lake
Site Number	77
Year Completed	1966
Cost	
Purpose	Flood control
Drainage Area, square miles	15.83
Dam Height, feet	107.3
Dam Type	Earthen
Dam Volume, yds ³	525,484
Dam Crest Length, ft.	705
Storage Capacity, ac-ft.	3,091
Submerged Sediment, ac-ft.	134
Aerated Sediment, ac-ft.	116
Flood Storage, ac-ft.	2,768
Surface Area, ac.	12.3
Principal Spillway	
Type	Concrete
Riser Height, ft.	53.75
Conduit Size, inches	48
Stages, no.	2
High-stage riser crest elev.	1801.8
Capacity, cfs	447
Energy Dissipater	Plunge Pool
Auxiliary Spillway	
Type	Vegetated Earth
Width, ft.	250
Capacity, % of PMF	75
Normal Pool Elev.	1778.0
Flood Pool Elev.	1,843.4
Top of Dam Elev.	1,856.1
Datum	NAVD88

Note: All existing data based on 2012 survey information.

EVALUATION OF POTENTIAL FAILURE MODES

Dams are built for the conditions that existed or could reasonably be anticipated during the time of design. Sometimes these conditions change, resulting in dam failure. Several potential modes of failure were evaluated for Hearthstone Lake.

Sedimentation: The land use in the watershed above the dam is 99.2% Forest, 0.6% Developed/Open Space, and 0.2% Water. Since the entire watershed is in the George Washington and Jefferson National Forest, these uses are not expected to change significantly. Also, the management of the lake is not expected to change. Unless there is a catastrophic event, such as a wildfire, the future sediment accumulation rate in Hearthstone Lake is expected to be the same as the historic rate. Based upon the future sediment deposition rate of 1.83 acre-feet per year, the remaining sediment storage life of Hearthstone Lake in 2015 was 70 years. Therefore, the potential for failure due to inadequate sediment storage capacity is low.

Hydrologic Capacity: Hydrologic failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and fails. Under present NRCS criteria for high hazard dams, the auxiliary spillway must have sufficient capacity and integrity to completely pass the full PMF event. The auxiliary spillway at Hearthstone Lake has sufficient integrity to withstand the flows from the PMF event but does not have the capacity to completely pass the design storm without overtopping the dam embankment. The water in the reservoir would flow over the top of the embankment and could cause it to erode and collapse. For this reason, the overall potential for hydrologic failure of Hearthstone Lake dam is considered to be high.

Seepage: Embankment and foundation seepage can contribute to failure of an embankment by removing (piping) soil material through the embankment or foundation. As the soil material is removed, the voids created allow even more 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 voided areas). Foundation and embankment drainage systems can alleviate the seepage problem by removing the water without allowing soil particles to be transported away from the dam. There are no signs of seepage at the Hearthstone Lake dam. The potential for a seepage failure of Hearthstone Lake dam is considered to be low.

Seismic: The structural integrity of an earthen embankment is dependent upon the presence of a stable foundation. Foundation movement through consolidation, compression, or lateral movement can cause the creation of voids within an embankment, separation of the principal spillway conduit joints, or in extreme cases, complete collapse of the embankment. The Upper North River watershed is not located within an area of significant seismic risk; therefore, there is low potential for seismic activity to cause failure of the dam embankment.

However, the riser of the principal spillway at Hearthstone Lake does not meet the current NRCS criteria for seismic stability. Riser failure could have two different results. If the riser fails in a way that does not block the principal spillway pipe, then all of the water would drain out of the lake. This would eliminate the pool area but the dam would continue to provide flood storage. If a riser failure blocked the principal spillway pipe, the water would fill up to the crest of the auxiliary spillway and then flow through it. There would be no stormwater detention and no downstream flood protection. If this situation is not corrected, it could result in significant erosion of the auxiliary spillway over time. Although the potential for a seismic failure of the riser is low, this problem must be addressed during rehabilitation.

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. In 2000, repairs were made to the concrete in the riser and the drain gate was replaced. A camera survey of the principal spillway pipe was conducted in October of 2012. No problems were observed with any of the material components. Therefore, there is low potential for failure due to material deterioration.

Conclusion: At the present time, the means of dam failure that is most likely to occur at Hearthstone Lake dam is erosion of the dam during an overtopping event. Water would overtop the dam as a result of insufficient hydrologic capacity in the auxiliary spillway. This type of failure could occur at any time during the remaining life of the structure. There is adequate sediment capacity, there are no signs of seepage and the site has minimal risk for failure due to material deterioration. Although the riser could be damaged in a seismic event, the risk of a dam failure in such an event is low.

CONSEQUENCES OF DAM FAILURE BY A SUNNY DAY BREACH

A sunny day breach analysis was performed in accordance with the peak breach discharge criteria in Technical Release No. 60, Earth Dams and Reservoirs (TR-60). It was assumed that structural collapse would occur with the water level at the existing auxiliary spillway crest and would result in a release of 2,970 acre-feet of water and sediment, beginning with a wall of water that is 87 feet high. A maximum breach discharge of 241,300 cfs was computed using the criteria in TR-60.

The population at risk is approximately 630 people. The properties and infrastructure potentially affected by a breach of the Hearthstone Lake Dam includes 225 homes, eight business structures, two recreational camps (Camp May Flather and a private hunt club), three churches, one steel truss bridge, two concrete deck bridges, and several culverts at two road crossings. Approximately 1.6 miles of U.S. Forest Service roads and associated culverts, 19 miles of several state roads, and 4 miles of private roads would be impacted by scour erosion damage.

Flows from a breach of Hearthstone Lake would pass through the communities of Stokesville and Mount Solon but would be within the 100-year floodplain of the North River before reaching the Town of Bridgewater. Traffic counts from the Virginia Department of Transportation (VDOT) indicate that an additional exposure to loss of life could occur as a result of the vehicles on 14 different state roads and 11 private roads. Average Daily Traffic (ADT) varies on these state roads from 190 to 920 vehicles per day. The utilities associated with the transportation routes could also be destroyed.

A breach event would cause significant economic damages to the homes, business structures, roads and bridges below the dam. In addition, the loss of the lake would result in a decrease in recreational opportunities with corresponding decreases in associated business activity. The residences and business properties at risk in the area of the floodplain subject to a breach of Hearthstone Lake have structure and content values estimated at \$22,195,000 (land values excluded). A catastrophic breach would result in an estimated \$15,785,000 in economic damages to existing buildings and their contents. The potentially impacted bridge, culvert, and road embankment infrastructure is valued at \$13,980,000. Approximately \$8,835,000 in damages to

road crossings and roadbeds/embankments could occur in this event. A catastrophic breach of the Hearthstone Lake dam would result in a total estimated \$24,620,000 in damages to homes, businesses, and infrastructure.

Other economic damages from a catastrophic breach would be associated public and private clean-up costs, damages to vehicles, lost recreation opportunities with the reservoir gone, and increased flood damages in the future for remaining properties due to the absence of the dam and its flood protection effects.

The environmental damages from a dam failure would be significant. In addition to the damage caused by the water, the sediment stored in the pool area would be flushed downstream in the event of a catastrophic breach. Approximately 11 miles of stream channel downstream of the dam would be damaged by scouring or deposition. Sediment would be deposited in the floodplain. This would constrict the floodplain and cause additional flooding in subsequent storm events. Deposition of sediment in the floodplain would also restrict normal use of the land which may cause water quality problems in the future. It is unlikely that a catastrophic breach would remove all of the fill material used to build the dam. The embankment material remaining after a breach would also eventually erode into the stream, contributing to the downstream sediment deposition. Over time, the sediment could migrate downstream from the North River into the Shenandoah River and then into the Potomac River.

There is also a potential for stream degradation upstream from the dam site. The abrupt removal of the water and sediment would cause instability in the stream feeding the reservoir. This channel could develop headcuts that would migrate upstream. If a bedrock ledge or other hardened point is encountered in the stream, the headcut would stop proceeding upstream. Downcutting and widening would continue to occur in the lake bed.

FORMULATION AND COMPARISON OF ALTERNATIVES

The stated objectives of the Sponsors for the Hearthstone Lake Rehabilitation Plan are: 1) to bring the Hearthstone Lake dam into compliance with current dam safety and design criteria; 2) to maintain the current level of flood protection provided by Hearthstone Lake; and 3) to address the local residents' concerns. These objectives can be met by installing measures which will bring the dam into compliance with State and Federal regulations. Under the Watershed Rehabilitation Provisions of the Watershed Protection and Flood Prevention Act, NRCS is required to consider the technical, social, and economic feasibility of the locally preferred solution and other alternatives identified through the planning process.

FORMULATION PROCESS

Formulation of the alternative rehabilitation plan for Hearthstone Lake followed procedures outlined in the NRCS *National Watershed Program Manual*. Other guidance incorporated into the formulation process included the NRCS *Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G)*, and the *Economics Handbook, Part II for Water Resources*, and other NRCS watershed planning policies. There was only one alternative evaluated in detail. It had a 70-year period of analysis, which included a two year design and installation

period and 68 years of expected useful life. It is anticipated that the dam will continue to be in service after that time with proper maintenance.

The formulation process began with formal discussions between the Sponsors, the Virginia Division of Dam Safety, and NRCS. The Virginia Division of Dam Safety conveyed state law and policy associated with a high hazard dam. NRCS explained agency policy associated with the Small Watershed Dam Rehabilitation Program and related alternative plans of action. 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 bringing Hearthstone Lake into compliance with current dam safety and design criteria. The National Economic Development (NED) Alternative is the federally assisted alternative with the greatest net economic benefits. The alternative plans that must be considered include:

- No Federal Action
- Decommission the Dam
- Non-Structural – Relocate or Floodproof Structures in the Breach Zone
- Rehabilitate the Dam
- National Economic Development (NED) Alternative

ISSUES THAT MUST BE CONSIDERED IN EVALUATION OF ALTERNATIVES

Issue 1. Prevent a Breach of the Dam From Lack of Capacity. The capacity of the auxiliary spillway must be sufficient to pass the volume of the PMF event without overtopping the dam embankment. There are three main techniques for preventing a failure caused by overtopping the dam embankment. One solution is to raise the top of the dam. Another solution is to widen the auxiliary spillway. The third option is a combination of raising and widening. Lowering the crest of the auxiliary spillway is an option for increasing capacity but was not considered for this site because it would decrease the available flood protection.

Issue 2. Upgrade the Principal Spillway Riser to meet current NRCS criteria for seismic stability. At the completion of rehabilitation, all components of the dam must be in compliance with current criteria. The principal spillway riser could be brought into compliance with replacement or retrofitting.

Issue 3: Flatten the backslope of the dam to increase ease of maintenance. The back slope of the Hearthstone Dam was built with a slope of 2 feet horizontal to 1 foot vertical (2:1). The steepness of the slope precludes maintenance by mowing with the equipment currently owned by the Headwaters SWCD. Control of the woody vegetation is currently done with herbicides or by hand. As part of the rehabilitation planning, the Sponsors asked NRCS to consider flattening the slope to 2.5:1 or flatter to allow mowing.

The site-specific solutions to these issues are addressed in the section on Description of Alternative Plans Considered.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Some of the alternatives considered in the planning process were eliminated from detailed consideration because these alternatives either did not meet the proposed purpose or need for federal action or they were logistically impractical to implement.

Decommission Dam: Decommissioning is a mandatory alternative that must be considered under NRCS policy for dam rehabilitation. This option describes an alternative which requires removing the flood detention capacity of the dam by cutting a 100-foot wide notch in the existing embankment down to the valley floor (Appendix C, Figure C2). If the dam is removed, the 237 homes, churches, clubs, and businesses in the breach zone will no longer be at risk from flooding caused by a breach of Hearthstone Lake. However, they would be at risk of uncontrolled flooding during storm events. Federal policy requires that induced damages be mitigated so that there would be no increase in the amount of damaged sustained during a 100-year flood event. The downstream bridges and utilities would have to be protected. The estimated cost of removing the storage capacity of the dam and all appurtenant structures is \$6,887,200. When the cost of mitigation for induced damages is added, the total cost of this alternative would have an exorbitant cost.

Notching the dam embankment would require removal of about 277,000 cubic yards of material. The submerged and aerated sediment would be stabilized or removed. The function and stability of the stream channel would be restored. The removal of the principal spillway riser and pipe would also be necessary. These unneeded materials could be buried on site or hauled to an appropriate disposal site. About 36 acres of grass would be planted over the dam, pool, and spoil site. Table D lists some of the major components of decommissioning the dam.

Table D – Major Components of Decommissioning the Dam

Items of Work	Quantities	Unit cost	Cost
Fill removal and disposal	277,000 CY	\$7.76/CY	\$2,149,500
Spoil Spreading	290,850 CY	\$9.09/CY	\$2,643,800
Topsoil Spreading	88,160 SY	\$1.43/SY	\$126,100
Pollution Control	Lump Sum	\$26,660	\$26,700
Seeding and Mulching	35.9 Acres	\$3,678/acre	\$132,000
Removal of principal spillway pipe and riser	Lump Sum	\$165,350	\$165,400
Road relocation	Lump Sum	\$206,900	\$206,900
Reservoir reclamation	Lump Sum	\$105,000	\$105,000
Surveys, Quality Assurance, and other miscellaneous items	Various		\$1,331,800
Cost of structure removal*			\$6,887,200

* Other significant costs would include mitigation for induced damages, floodproofing of bridges and utilities, loss of recreation, and reduced property values.

Non-Structural - Relocation or Floodproof Structures: Elevating, floodproofing, or relocating the 225 homes, seven businesses (eight business structures), three church buildings, and 33 miscellaneous structures (recreational buildings, social clubs and one public facility) in the breach zone of the dam would cost in excess of \$8,000,000. This alternative was eliminated from detailed study due to exorbitant cost.

Dry dam: A dry dam is a structure that is built to allow continuous stream flow through the dam during normal conditions while providing flood storage during rainfall events. This alternative was analyzed at the request of the local chapter of Trout Unlimited to investigate the potential to improve aquatic organism passage through the dam. This alternative was eliminated from detailed study due to the exorbitant cost of achieving a suitable fish passage through the embankment.

There are several considerations with the dry dam alternative:

1. The principal spillway pipe has a diameter of 4 feet and a length of 576 feet. The outlet of the pipe is several feet above the water level in the plunge pool. It would be necessary to reconfigure the outlet to allow passage of fish and other aquatic organisms. Although it would be possible for fish to travel both ways through this pipe, it is not likely that a fish would migrate from downstream to upstream due to the length of the pipe and the velocity of the water flowing through it. Increasing the size of the pipe would necessitate removal and replacement of the dam embankment.
2. There may be problems with sediment accumulation at the pipe inlet. At the present time, the sediment from the watershed is transported down Little River into the lake. The majority of this sediment drops out at the upper end of the lake when the moving water of the river meets the still water of the lake. In a dry dam situation, the sediment would be transported to the inlet of the principal spillway pipe. Although some sediment will pass through, there is the potential for sediment and debris to accumulate at the opening of the pipe. Over time, the sediment could clog the pipe opening. Also, without the installation of trash racks, any debris transported by the river could be trapped at the pipe or in the pipe. Both of these situations would create an operation and maintenance problem. The riser of the principal spillway pipe would have to be removed and a new type of structure would be installed.
3. Initially, there could be a significant amount of sediment released into Little River as the channel cuts through the sediment currently in the lake. If a dry dam is used, there may be a need to create a new, stabilized channel rather than allow the river to develop its own channel.
4. There would be a loss of lake-based recreation. To some degree, this would be offset by an increase in stream-based recreation. With the change to stream-based recreation, there may be a rise in the temperature of the water that is passed through the dam because the relatively shallow stream channel will be completely exposed to sunlight as it passes through the flood pool.
5. Since the sediment storage capacity of the lake would not be filled with water, the flood storage of the lake would be increased by the unused volume of sediment storage.
6. Although there would be additional flood storage with a dry dam, the auxiliary spillway would still need to be rehabilitated to meet the criteria for a high hazard dam. The extra cost of retrofitting the dry dam components would be in addition to the rehabilitation costs.

DESCRIPTION OF ALTERNATIVE PLANS CONSIDERED

Alternatives Without Federal Assistance

One of the alternatives that must be included in the plan is the alternative that describes the action that the sponsors will take if no federal funds are expended. Since the Hearthstone Lake dam is a high hazard dam that does not meet current safety and performance standards, the Virginia Division of Dam Safety has issued a conditional certificate of operation for the dam. It is reasonable and prudent to expect that the Virginia Division of Dam Safety will soon issue an

Administrative Order requiring the Sponsors to bring the dam up to State standards by rehabilitation of the dam or remove the hazard by removing the storage function of the reservoir. The Sponsors would be totally responsible for the cost of rehabilitation or removal of the dam. NRCS would still have the technical responsibility of approving the Sponsors' solution because the floodwater retarding structure is under an Operation & Maintenance Agreement between the local Sponsors and NRCS until 2016.

At the present time, the potential for an uncontrolled breach and resulting damages is present and will continue until the existing dam safety issues are addressed and resolved.

Without NRCS assistance, the Sponsors would have the following options:

- Hire a consultant, prepare plans to meet NRCS and Virginia standards, and rehabilitate the dam using their own resources.
- Do nothing. In this case, the Virginia Division of Dam Safety may choose to breach the dam and send the Sponsors the bill. This option is likely to be more expensive than if the Sponsors performed the breach. The end results would be the same as those for the next option. This option would not meet the Sponsors' goal of maintaining the existing level of flood protection.
- The Sponsors could remove the flood storage capacity of the dam by breaching the dam using a least cost method. This breach would be a minimum size hole in the dam from the top of the dam to the valley floor, which would eliminate the structure's ability to store water. Downstream flooding conditions would be similar to those that existed prior to the construction of the dam. The sediment would not be stabilized and would migrate downstream. This course of action would minimize the Sponsors' dam safety liability but would not eliminate all liability since it would induce flooding downstream. This option would not meet the Sponsors' goal of maintaining existing levels of flood control.

No Federal Action (Sponsor's Rehabilitation): In the absence of federal assistance, the Sponsors have indicated that they will rehabilitate the dam to meet the required dam safety and design criteria at their own expense using the same alternative as the alternative with federal assistance. For the purposes of this evaluation, the Sponsors' Rehabilitation will be the same as the No Federal Action alternative. The estimated total construction cost would be \$2,413,000. The total project cost would be \$2,949,000.

Construction Options Considered for Structural Alternative

During the formulation of alternatives, it became apparent that there were several construction options available for implementation of the structural alternative. They are briefly described below as *Dredging Existing Sediment* and *Variation 1* and *Variation 2* along with the rationale for selection of the Preferred Alternative.

Dredging Existing Sediment to Extend the Dam's Service Life to 100 Years

A sediment survey was completed in August 2012. It was determined that 73 years of sediment storage was available at that time. Using a sediment deposition rate of 1.83 acre-feet per year would require about 191.2 acre-feet of sediment storage to provide 100 years of submerged sediment storage in the Hearthstone Lake after construction. As of 2015, there is approximately

134 acre-feet of storage capacity remaining. Allowing for construction in 2017, there is a deficit of about 57.2 acre-feet of storage. To get the amount of sediment that would need to be removed to provide 100 years of sediment storage, you multiply the 57.2 acre-feet X 1,613 cubic yards/acre-foot and get 92,320 cubic yards. Using recent sediment removal costs from Fairfax County of \$68.30/cubic yard, the cost for sediment removal without including costs for disposal would be \$6,305,456. This construction option was eliminated from detailed study due to exorbitant cost.

Rehabilitation Alternative Variation 1: Widen the auxiliary spillway by 50 feet, raise the top of the dam by 2.6 feet, enhance surface stability with TRM, retrofit the principal spillway riser, and omit the installation of a splitter dike.

Capacity: Widen the auxiliary spillway from 250 feet to 300 feet and raise the top of the dam by 2.6 feet using the material excavated from the auxiliary spillway. The existing front and back slopes of the embankment would be maintained and the top of the dam would be narrowed from 28 feet wide to the minimum allowable top width of 16 feet. The length of the control section would be increased from 30 feet to 70 feet. The inlet section would have a slope of approximately 2% to the control section. The control section elevation would be maintained at 1843.4. The constructed outlet section would have a slope of 2% for an average of 300 feet. The existing exit training dike would be extended to the valley floor. The exit training dike is used to improve the hydraulic characteristics of auxiliary spillway flows by “training” the water away from the dam embankment. Approximately 2 acres of trees would be removed. See Appendix C, Figure C4.

Stability: The control section, outlet section, and splitter dike of the auxiliary spillway would be enhanced with Turf Reinforcement Matting (TRM).

Riser: The riser would be retrofitted.

Slope flattening: There would be no excess material available for use in flattening the back slope of the dam embankment from 2:1 to 2.5:1.

Rehabilitation Alternative Variation 2: Widen auxiliary spillway by 92 feet and install a splitter dike, raise top of dam by 2.6 feet, enhance surface stability with TRM, retrofit principal spillway riser, and flatten the backslope of the dam to 2.5:1.

If Variation 2 is chosen, some or all of the 32,000 cubic yards of spoil material would be available for use in flattening the back slope of the dam embankment. A total volume of 53,000 cubic yards of fill material would be needed to flatten the slope from 2:1 to 2.5:1. A minimum of 21,000 cubic yards would have to be hauled from off-site. Flattening the back slope would necessitate removal and replacement of the road located near the toe of the dam. The additional cost of flattening the back slope would be \$630,500 if all the material excavated from the auxiliary spillway is suitable for use (Appendix C, Figure C5).

The Least Cost Alternative: Table E lists the estimated construction cost of the rehabilitation alternative and the two possible variations. The least cost alternative would be Variation 1 (widen the auxiliary spillway by 50 feet, raise the top of the dam by 2.6 feet, enhance the stability of the site with TRM, and retrofit the principal spillway riser). Since two major auxiliary spillway flow events have occurred on this site without causing damage to the auxiliary spillway surface, it may

not be necessary to install a splitter dike on this site. However, NRCS guidance recommends the use of a splitter dike for an auxiliary spillway with a width greater than 200 feet. The in-depth analysis needed to omit the splitter dike is beyond the scope of this planning document. If omission of the splitter dike is determined to be feasible during the design phase of the project, there will be a cost savings of \$884,000.

Table E - Summary of Rehabilitation and Estimated Construction Costs

Action	Cost with Riser Replacement	Cost with Riser Retrofit
Rehabilitation Alternative. Widen auxiliary spillway by 92 feet and install a splitter dike, raise top of dam by 2.6 feet, enhance surface stability with TRM, and retrofit the principal spillway riser.	\$3,373,000	\$2,413,000
Rehabilitation Variation 1. Widen the auxiliary spillway by 50 feet, raise the top of the dam by 2.6 feet, enhance surface stability with TRM, and retrofit the principal spillway riser.	\$2,489,000	\$1,529,000
Rehabilitation Variation 2. Widen auxiliary spillway by 92 feet and install a splitter dike, raise top of dam by 2.6 feet, enhance surface stability with TRM, retrofit principal spillway riser, and flatten the backslope of the dam to 2.5:1.	\$4,003,000	\$3,043,000

Alternative With Federal Assistance

Rehabilitation Alternative: Widen auxiliary spillway by 92 feet and install a 42 feet wide splitter dike, raise top of dam by 2.6 feet, enhance surface stability with TRM, and retrofit the principal spillway riser.

Capacity: Widen the auxiliary spillway from 250 feet to 342 feet and raise the top of the dam by 2.6 feet using the material excavated from the auxiliary spillway. The existing front and back slopes of the embankment would be maintained and the top of the dam would be narrowed from 28 feet wide to the minimum allowable top width of 16 feet. In addition, a splitter dike would be added along the centerline of the auxiliary spillway in accordance with NRCS guidance (Appendix C, Figure C3). The typical splitter dike is an earthen structure that is placed parallel to the direction of flow to divide the auxiliary spillway into two narrow sections. The splitter dike would be 5 feet high with 2.5:1 side slopes and a 12-foot top width. An auxiliary spillway greater than 200 feet in width can be vulnerable to the development of concentrated flow channels which would then erode the auxiliary spillway surface. The splitter dike would divide the auxiliary spillway into two sections of 150’ in width. Installation of the splitter dike would increase the amount of excavation needed to achieve the required auxiliary spillway capacity. An additional 42 feet of width would be needed for an overall expansion of 92 feet. Approximately 2.4 acres of trees would be removed as part of the auxiliary spillway expansion. Some of the excavated soil material would be used to

construct the splitter dike (2,000 CY), extend the existing exit training dike to the valley floor (9,060 CY), and raise the top of the dam (3,300 CY). There would be approximately 32,000 cubic yards of disposal material that would have to be utilized on site or hauled away. The nearest potential site is the original borrow area. About 2.0 acres of trees would be removed prior to soil placement. The area will be replanted to trees.

Stability: The auxiliary spillway would still be constructed of vegetated earth. To enhance the erosion resistance of this surface and minimize the operation and maintenance, the control section and outlet section of the auxiliary spillway will be covered with a surface protection material of Turf Reinforcement Matting (TRM).

The TRM is made of fibrous material that is interwoven into a mat. For Hearthstone, the TRM will be buried under 6 inches of topsoil. The roots of the grass vegetation will interlock with the mat to provide greater erosion resistance (Figure 10).

Riser: The principal spillway riser could be completely removed and replaced for a cost of about \$1,242,000. It would still be a two-stage structure with a cold-water release. The only major change would be the footer size and configuration. However, preliminary investigations have determined that it would be feasible to keep the existing riser tower and just retrofit the footer of the structure. The cost of retrofitting the footer would be about \$282,000. Retrofitting would include enlarging the footer, replacing the gate and all appurtenances, and surface treating the concrete, as necessary.

Slope flattening: The excess material would be hauled off-site. The backslope of the dam would remain at 2:1.

Preferred Rehabilitation Alternative: The preferred alternative is to widen the auxiliary spillway by 92 feet and install a 42 feet wide splitter dike, raise the top of the dam by 2.6 feet, stabilize the site with TRM, and retrofit the principal spillway riser.



Figure 10. Installation of Turf Reinforcement Mat (TRM).

NATIONAL ECONOMIC DEVELOPMENT (NED) ALTERNATIVE

The Alternative, as described above, is the NED plan. For purposes of the rehabilitation program, the NED plan is defined as the federally assisted alternative with the greatest net economic benefits.

The Sponsors have indicated that, in the absence of federal assistance, they would rehabilitate the dam to meet the required dam safety and design criteria at their own expense using the alternative proposed by NRCS. The Sponsors' Rehabilitation is used as the No Federal Action alternative. The No Federal Action - Sponsor's Rehabilitation alternative would be the same in scope, cost, and effects as the Future with Federal Project alternative. The rehabilitation with federal assistance is the most locally acceptable alternative and best serves the Sponsors in achieving the needs and purpose of this rehabilitation. Therefore, widening the auxiliary spillway and installing a splitter dike, raising the top of dam, stabilizing the auxiliary spillway surface with TRM, and retrofitting the principal spillway riser is the NED plan and the preferred alternative. Per the Federal Principles and Guidelines document and NRCS National policy, when the Future Without Federal Project is the same as the Future With Federal Project, the local costs avoided are credited as benefits. This renders the federally assisted alternative as having zero net benefits. Net benefits are zero because, by policy, the total project cost is equal to the claimed benefits and the resulting benefit/cost ratio is 1:1. The results displayed in Table F are presented within a zero-based accounting context to highlight the costs and benefits associated with the recommended alternative alone. Within a zero-based accounting framework, the "Total Adverse Annualized" value associated with the Future Without Federal Project is displayed as the "Total Beneficial Annualized" in the Future With Federal Project column.

COMPARISON OF ALTERNATIVE PLANS

Table F summarizes the effects of each alternative considered. Refer to the Environmental Consequences section for additional information.

Table F - Summary and Comparison of Alternative Plans

Effects	Future Without Federal Project No Federal Action - Sponsors' Rehabilitation	Future With Federal Project Rehabilitation with Federal Assistance – Widen auxiliary spillway by 92' and install a splitter dike, raise the top of dam by 2.6' enhance surface stability with TRM, and retrofit the principal spillway riser. Recommended Plan – (NED Plan)
Sponsor Goals	Continue to provide flood protection; reduce liability.	Continue to provide flood protection; reduce liability.
Structural	Upgrade dam to meet dam safety and design criteria.	Upgrade dam to meet dam safety and design criteria.
Total Project Investment - Hearthstone Lake	\$2,949,000	\$2,949,000
Total Beneficial Annualized (AAEs*)	---	\$103,000
Total Adverse Annualized (AAEs*)	---	\$103,000
Net Beneficial	---	\$0
Benefit/Cost Ratio	---	1.0 to 1.0
Estimated OM&R**	---	\$5,000
Floodplain Management	No change from existing condition.	No change from existing condition.
Streams, Lakes, and Wetlands	Temporary loss of the 12.3 acre lake and temporary impact on 7.86 acres of emergent wetlands during construction.	Temporary loss of the 12.3 acre lake and temporary impact on 7.86 acres of emergent wetlands during construction.
Water quality	No long-term change; minimal short-term effect during construction.	No long-term change; minimal short-term effect during construction.
Water resources	Temporary impact on water quality during construction.	Temporary impact on water quality during construction.
Air Quality	Temporary effect during rehabilitation.	Temporary effect during rehabilitation.
Forest resources	Permanently remove 2.4 acres of trees; remove and replant 2.0 acres of trees in disposal area.	Permanently remove 2.4 acres of trees; remove and replant 2.0 acres of trees in disposal area.
Invasive plant species	Care will be taken during construction to avoid introduction of invasive species.	Care will be taken during construction to avoid introduction of invasive species.
Riparian areas	No effect.	No effect.
Endangered and Threatened Species	No effect.	No effect.
Fish and wildlife	Aquatic species recovery in 2-4 years.	Aquatic species recovery in 2-4 years.
Migratory birds	Temporary effect during construction.	Temporary effect during construction.
Environmental Justice and Civil Rights	No disparate treatment.	No disparate treatment.

Effects	Future Without Federal Project No Federal Action - Sponsors' Rehabilitation	Future With Federal Project Rehabilitation with Federal Assistance – Widen auxiliary spillway by 92’ and install a splitter dike, raise the top of dam by 2.6’ enhance surface stability with TRM, and retrofit the principal spillway riser. Recommended Plan – (NED Plan)
Local and Regional Economy	Temporary positive effect on local and/or regional construction companies. Temporary negative effect due to loss of recreation in the lake during construction.	Temporary positive effect on local and/or regional construction companies. Temporary negative effect due to loss of recreation in the lake during construction.
Public health and safety	Decrease potential for loss of life from dam breach.	Decrease potential for loss of life from dam breach.
Public recreation	Short-term loss of access during construction.	Short-term loss of access during construction.
Scenic beauty	Short-term effects only.	Short-term effects only.
Social issues	Temporary loss of access to lake during construction.	Temporary loss of access to lake during construction.

* Per 1.7.2 (a) (4) (ii) of the “Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies” (P&G), U.S. Water Resources Council, March, 1983, allowing for abbreviated procedures, damage reduction and recreation benefits have not been displayed because they are the same for both alternatives and no net change in benefits occurs when comparing the two candidate plans to each other. The federally assisted alternative is displayed within a zero-based accounting context that credits local costs avoided (Total Adverse Annualized for the Future Without Federal Project scenario) as adverse beneficial effects (Total Beneficial Annualized) consistent with P&G 1.7.2(b)(3). Although the average annual benefits of rehabilitation are \$103,000, net benefits are zero because the total project cost is equal to the claimed benefits and the resulting benefit/cost ratio is 1:1. “AAEs” stands for Average Annual Equivalents which are based on a 3.375% discount rate and a 70 year period of analysis (1 year to design, 1 year to install and a 68 year expected useful life).

** “Estimated OM&R” stands for Operation, Maintenance and Replacement Costs.

Note: Regional Economic Development account (RED) concerns were not identified during the scoping process. Therefore, the RED account information is not included.

ENVIRONMENTAL CONSEQUENCES

Alternative plans of action can result in a multitude of effects on resources upstream and downstream of Hearthstone Lake. This section describes anticipated effects on resource concerns identified by the Sponsors, the public, and agency personnel in the Scoping meeting and the public meetings. Topics are listed in the same categories as listed in Table F.

The two alternative plans below were considered and evaluated in detail. Since the structural rehabilitation alternative without the splitter dike required more analysis to determine viability, it was omitted from further analysis during planning. This splitter dike option is really just a variation of the fully evaluated structural alternative and that option will be further evaluated during the design phase of the project. The effects without the splitter dike will be the same or less than those for the structural rehabilitation alternative with a splitter dike because of the smaller footprint for the auxiliary spillway.

- 1) *No Federal Action (Sponsors' Rehabilitation)* or
- 2) *Rehabilitation with Federal Assistance (NED Alternative)*.

The Sponsors have indicated that they will use the plan developed by NRCS to complete the rehabilitation of the dam in the event that Federal funding is not available. The *No Federal Action (Sponsors' Rehabilitation)* alternative would be the same or involve the same components as the *Rehabilitation with Federal Assistance (NED Alternative)*. This alternative maximizes net benefits with a benefit/cost ratio of 1:1, and is the rehabilitation alternative preferred by the Sponsors.

SOILS

There are no identified concerns with Prime and Unique Farmlands and farmland of statewide significance or soil resources.

WATER

There are no identified concerns with regional water resources plans (including coastal zone resource plans), sewer utilities, sole source aquifers, or Wild and Scenic Rivers.

Floodplain Management

Existing Conditions: Augusta County, Rockingham County, and the Town of Bridgewater currently participate in the National Flood Insurance Program. The existing flood insurance rates for these jurisdictions are based the floodwater reduction effects of the Hearthstone Lake dam.

No Federal Action (Sponsors' Rehabilitation): Rehabilitation of the Hearthstone Lake dam will be done in accordance with all necessary requirements and restrictions. The existing level of flood protection will be maintained.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Streams, Lakes, and Wetlands

Existing Conditions: The main stream associated with Hearthstone Lake is Little River. Approximately 7.86 acres of fringe wetlands were identified along the shoreline. The 12.3 acres of the lake are considered to be open water wetlands. No wetlands were identified downstream of the outlet.

No Federal Action (Sponsors' Rehabilitation): Rehabilitation of the dam will have no permanent adverse effects on Little River or its tributaries. The lake will be drained for 6 to 8 months during rehabilitation. This will result in the temporary loss of 12.3 acres of surface water. The fringe wetlands around the lake will also be temporarily impacted during this time.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Water Quality

Existing Conditions: Little River is listed as impaired for aquatic life and recreation in the 2012 305(b)/303(d) Virginia Water Quality Assessment Report. The Commonwealth of Virginia currently has no plans for TMDL development within the next six years. The impaired segment of Little River is not included on the 6-year prioritization list.

No Federal Action (Sponsors' Rehabilitation): Rehabilitation of the dam will not alter the present water quality in the watershed. With the required erosion and sediment control measures, there should be minimal temporary impacts on water quality associated with construction. There may be a temporary reduction in dissolved oxygen in Little River downstream of the dam while the water is drained. No long-term impacts on water quality from rehabilitation activities are anticipated.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Water Resources

Existing Conditions: The primary purpose of the lake is to provide flood protection. However, it has become an important part of the community because of the recreation value that it provides.

No Federal Action (Sponsors' Rehabilitation): There may be a temporary impact on downstream water quality and temperature when the water is released prior to construction. There will be a short-term loss of recreation in the lake during construction.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

AIR

Air Quality

Existing Conditions: Air quality in the area is satisfactory. According to DEQ, Augusta County is within a non-attainment area for ozone.

No Federal Action (Sponsors' Rehabilitation): During the rehabilitation of the dam, particulate matter (dust) and smoke from open burning will increase during construction activities. Air pollution abatement actions will minimize any potential temporary dust problems during construction, and the proposed work is not expected to violate any federal, state, or local air quality standards. Open burning of vegetative debris may require a permit.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

PLANTS

There are no identified concerns with Endangered and Threatened Plant Species or Natural Areas. There is one sensitive plant species, Sweet pinesap, that has potential habitat in the project area, however none were observed during field surveys.

Forest Resources

Existing Conditions: Hearthstone Lake is located within the George Washington and Jefferson National Forest. Approximately 99.2% of the watershed above the dam is forested. The Forest boundaries extend approximately 4.35 miles below the dam. There is a proposed Wilderness Area in the watershed. The U.S. Forest Service does not own the subsurface mineral rights in the watershed. Although there currently is no mining activity, there is some potential for mining in the future. The removal of trees needed to perform this work could cause an increase in the amount of sediment transported into the reservoir. This would decrease the expected life of the structure.

No Federal Action (Sponsors' Rehabilitation): During the rehabilitation of the dam, there will be 2.4 acres of trees removed from the outlet of the auxiliary spillway and another 2.0 acres removed from the borrow area that will be used as a disposal site. The disposal area will be replanted with trees of the appropriate species. The 2.4 acres in the auxiliary spillway will be replanted to grass.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Invasive Plant Species

Existing Conditions: At the present time, there are no known invasive species on the site.

No Federal Action (Sponsors' Rehabilitation): Rehabilitation of the Hearthstone Lake dam would not change the existing conditions for invasive species. Care will be taken during construction to avoid the introduction of invasive species and comply with Executive Order 13112.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Riparian Areas

Existing Conditions: There are riparian areas around the lake and along Little River.

No Federal Action (Sponsors' Rehabilitation): There will be no long-term or short-term change to the riparian areas.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

ANIMALS

There are no identified concerns with coral reefs, ecologically critical areas, essential fish habitat, or invasive animal species.

Endangered and Threatened Species

Existing Conditions: There is habitat in the watershed for the Indiana bat and the Northern long-eared bat but there have been no confirmed sightings.

No Federal Action (Sponsors' Rehabilitation): There was no indication of the presence of Indiana bats or Northern long-eared bats in the watershed. Therefore, rehabilitation of the dam will have no effect on these populations.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Fish and Wildlife

Existing Conditions: The Virginia Department of Game and Inland Fisheries currently stocks Hearthstone Lake with Northern pike, catfish and rainbow trout annually.

No Federal Action (Sponsors' Rehabilitation): Although the lake would be completely drained during rehabilitation, the fisheries are expected to recover within two to four years after restocking.

Rehabilitation with Federal Assistance – (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Migratory Birds

Existing Conditions: Hearthstone Lake could potentially be utilized by several species of migratory birds for feeding, nesting, or resting.

No Federal Action (Sponsors' Rehabilitation): While the 12.3 acre lake is drained, it will be temporarily unavailable for migratory waterfowl. There are similarly-sized bodies of water throughout the region which could be used.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

HUMAN

There are no identified concerns with cultural resources, land use, parklands, or scientific resources.

Environmental Justice and Civil Rights

Existing Conditions: There is an estimated population of 630 people in the breach zone below the dam. The presence or absence of environmental justice groups within the watershed is not known.

No Federal Action (Sponsors' Rehabilitation): Rehabilitation of the dam will have positive economic and social effects across all residents within the floodplain and above the dam. There will be no disparate treatment. Since vehicle operators also are significant beneficiaries of the proposed rehabilitation, it is reasonable to conclude that protection of the roads and bridges will benefit all racial, ethnic, and socio-economic groups within the watershed and below the dam. Avoiding a dam breach will directly benefit all local residents and taxpayers in general within Augusta County, Rockingham County, the Town of Bridgewater and the Commonwealth of Virginia.

There are no known disparate impacts from the rehabilitation project. It was explained to local residents that rehabilitation of the dam would not enhance their downstream flood protection, but simply maintain the designed level of flood protection while reducing the risk to life and property that might occur from a dam breach.

Approximately 630 people would benefit directly from the rehabilitation of the dam. There are indirect benefits for the estimated 1,800 more people who use the area around the lake for recreation during the year.

There would also be downstream benefits to the occupants of about 740 vehicles/day along Stokesville Road and Towers Road that would be affected by a breach event. This is primarily those people affected by impacts to the roads and bridges and includes others who would lose access to emergency services or would be cut off from their residences or jobs.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Local and Regional Economy

Existing Conditions: The recreational use of the lake, the seven local businesses, the downstream farming, and the roads used for commuting to work sites contribute significantly to the local economy.

No Federal Action (Sponsors' Rehabilitation): There would be a temporary positive effect on the local economy during the construction period. This may be offset by the temporary loss of revenue associated with recreation.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Public Health and Safety

Existing Conditions: The existing vegetated earth auxiliary spillway has the integrity necessary to withstand the Probable Maximum Precipitation event but does not have the capacity. It is projected that the dam would overtop during a 6-hour precipitation event of approximately 28 inches or during a 24-hour precipitation event of about 36 inches. Overtopping the dam could

cause the dam to erode and collapse. Approximately 630 people are at risk for loss of life. There are 225 homes and seven businesses in the breach zone of this dam. The Girl Scout Camp has 30 buildings that would be at risk. Four bridges and 16 culverts could also be impacted. There are seven state roads and 16 private roads in the breach zone.

No Federal Action (Sponsors' Rehabilitation): Under this alternative, the dam would be structurally rehabilitated using current design and safety criteria in order to provide continued flood protection for 68 years after the rehabilitation period is complete. The downstream flooding levels would be the same as they are presently. The threat to loss of life from failure of the dam would be greatly reduced. Access to the site will be restricted during construction.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Public Recreation

Existing Condition: Hearthstone Lake provides opportunities for lake-based activities such as canoeing, walking, bird watching and fishing.

No Federal Action (Sponsors' Rehabilitation): There are no anticipated permanent changes to the existing recreational opportunities as a result of the planned rehabilitation activities. During the 6 to 8 month construction period, the lake will be drained and access to the lake will be lost. There are a number of other lakes in the area that could be used for fishing during the construction period.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Scenic Beauty

Existing Condition: At the present time, the dam embankment, the auxiliary spillway and training dikes are in grass. The area surrounding the rest of Hearthstone Lake is forested.

No Federal Action (Sponsors' Rehabilitation): When the rehabilitation of the auxiliary spillway is complete, the auxiliary spillway will be wider but still be in grass. The slight increase in auxiliary spillway width is not considered to be a significant change in the man-made features of the landscape. There will be temporary impacts to the scenic beauty of the area while the lake is drained and construction is underway.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

Social Issues

Existing Condition: Hearthstone Lake has provided value to the community since 1966 by providing flood protection, recreation, and scenic beauty. At the public meeting, the main concern expressed by the local citizens was the need to maintain the flood protection provided by the structure. However, there was also some concern expressed about the use of government funds to provide flood protection.

No Federal Action (Sponsors' Rehabilitation): When rehabilitation of the dam is complete, the dam will provide flood protection for an additional 68 years. Once flood control benefits have been provided, the Sponsors could face significant liability issues if flood damages are induced.

Rehabilitation with Federal Assistance (NED Alternative): Same as the No Federal Action (Sponsors' Rehabilitation).

CUMULATIVE EFFECTS

NRCS has constructed three flood control dams in this watershed; Todd Lake, Hearthstone Lake, and Elkhorn Lake. Todd Lake Dam and Hearthstone Lake Dam are currently operating under conditional certificates due to a need for rehabilitation. Todd Lake Dam is currently under construction for rehabilitation of that dam. The No Federal Action alternative for Hearthstone Lake calls for the Sponsors to rehabilitate the dam. The proposed rehabilitation alternative would have the same effect on the environment as the No Federal Action alternative. The cumulative effects of the other projects on the principal resources of concern, along with the social and economic effects, are to maintain the existing social, economic, and environmental conditions of the community. The cumulative effects of rehabilitating Hearthstone Lake would also maintain the existing social, economic and environmental conditions of the community. In both the recommended plan and the rehabilitation by the local Sponsors, all of the existing dams in the watershed stay in place, essentially the same level of flood protection is provided, and the existing emergency action plan remains in force.

RISK AND UNCERTAINTY

Assessments, considerations, and calculations in this plan are based on a 70-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 calculation of the PMP events, they could increase the occurrence of low frequency, high intensity storm events and associated flood damages.

An easement was procured to the crest of the auxiliary spillway prior to the original construction as part of the Special Use Permit issued by the U.S. Forest Service. Per NRCS policy, the local Sponsors are required to obtain any needed permits prior to construction. If any changes to the existing Special Use Permit are required, the Sponsors will negotiate with the U.S. Forest Service to obtain it prior to construction.

No long-term changes to water quality are anticipated due to this project.

The sediment rate projected for the life of the Future with Federal Assistance (Preferred Alternative) is based on the past rate of sediment accumulation in the watershed. Very large storm events or destruction of forest through wildfires could cause an increased rate of erosion,

sedimentation and deposition. At the present time, there are no known plans for land use changes in this watershed that would affect the rate of sediment deposition in the reservoir. However, since the mineral rights are not owned by the Forest Service, there is the potential for some mining to occur.

The objective of this project is to meet applicable NRCS and Virginia safety and performance standards for a high hazard dam. From a financing and administrative standpoint, the Sponsors have committed to NRCS that they are able to fund the required 35% of the total project costs to complete installation of the preferred alternative and can perform the required maintenance on the upgraded structure for 68 years after construction.

Statistically, there is a less than 0.2% chance in any given year that the auxiliary spillway would flow during the anticipated life of the rehabilitated structure. The existing and proposed auxiliary spillway crest is set for the 500-year recurrence flood level. However, it is possible for several events to occur during this time period. If an auxiliary flow event occurs that removes the topsoil and the TRM, the estimated repair cost would be \$30,000 and would take approximately one month. This would include 1,000 square yards of TRM, topsoil and seed. The estimates do not include any costs for offsite damages incurred during this event. Routine maintenance is not included in these amounts. This project plan assumes that such an event will likely occur once within the expected useful life. However, based on past experience, no auxiliary spillway damage is anticipated.

CONSULTATION AND PUBLIC PARTICIPATION

The sponsoring organizations are the Headwaters SWCD and the Augusta County Board of Supervisors. The Headwaters Soil and Water Conservation District has been responsible for the operation and maintenance of the Hearthstone Lake Dam since 1993. Interest for rehabilitating the dam began in October 2011 with the issuance of a Conditional Certificate by the Virginia Division of Dam Safety. The certificate was issued because of problems identified with the auxiliary spillway. NRCS received an application for federal assistance in January 2012 from the local sponsors for the rehabilitation of the Hearthstone Lake Dam based on the issuance of the conditional certificate. In 2012, the Virginia Division of Dam Safety contracted with a private engineering firm to conduct a detailed analysis of the auxiliary spillway. The firm identified potential problems with the capacity of the auxiliary spillway.

Local, state and federal support for the rehabilitation of the Hearthstone Lake Dam has been strong. Input and involvement of the public has been solicited throughout the planning of the project. At the initiation of the planning process, many meetings were held with representatives of the Headwaters Soil and Water Conservation District and Augusta County to ascertain their interest and concerns regarding the dam. The Sponsors have worked closely with the local landowners and residents to provide information on the planning activities and to solicit their input on the pertinent issues to be considered during planning. The Sponsors worked to provide all residents, including minorities, with information on the planning effort and intended works of improvement.

The U.S. Forest Service consulted with the U.S. Fish and Wildlife Service and with Virginia Department of Historic Resources during this planning process.

A scoping meeting was held on April 3, 2014, at the Augusta County Government Center in Verona, Virginia, to identify issues of economic, environmental, cultural, and social concerns in the watershed. Input was provided by local, regional, state and federal agencies at the meeting or through letters and emails to NRCS. There were 21 people in attendance.

The first public meeting for Hearthstone Lake was held at the Sangerville-Towers Ruritan Hall, in Mount Solon, Virginia, on April 3, 2014. Local, state and federal perspectives on the rehabilitation needs of the Hearthstone Lake Dam were provided. The attending members of public were informed of the dam rehabilitation program and potential alternative solutions to bring the dam into compliance with current dam safety and design criteria. Meeting participants provided input on their issues and concerns to be considered during the planning process. A fact sheet was developed and distributed which addressed frequently asked questions regarding rehabilitation of the dam. There were 48 people in attendance. The audience included elected officials, representatives from county and federal agencies, and watershed residents.

A second public meeting was held on January 22, 2015 at the Sangerville-Towers Ruritan Hall in Mount Solon, Virginia. Information provided to meeting attendees included a summary of the current situation of the dam, planning efforts to date, the various alternatives considered during planning, and a detailed explanation of the recommended alternative for dam rehabilitation. Attendees understood the need for the rehabilitation. There were 35 people in attendance. The audience included elected officials, representatives from county and federal agencies, and watershed residents.

A Draft Plan was distributed for interagency and public review on May 6, 2015. Copies of the document were placed in local libraries and news articles were placed in local newspapers to solicit comments from the public during the comment period. After the interagency and public review period, comments received on the draft were incorporated into the Final Plan. Letters of comment received on the draft plan and NRCS responses to the comments are included in Appendix A.

PREFERRED ALTERNATIVE

RATIONALE FOR PLAN SELECTION

The recommended plan is to rehabilitate the dam to meet current NRCS and Virginia safety and performance standards for high hazard dams. The recommended plan meets the identified purposes and needs for the project and significantly reduces the potential risk to human life. The project Sponsors, local residents, and state and local government agencies all prefer the Recommended Plan because it:

- Minimizes the threat to loss of life to approximately 630 people that live in the 225 homes within the breach inundation zone.
- Provides protection for more than 740 vehicles per day that utilize Stokesville Road (520), Towers Road (190) and Reeves Road (30 vehicles). There are no traffic numbers for Tillman Road but there are a number of residences located along the road.
- Provides onsite benefits to approximately 1,800 recreational users and offsite benefits to an additional 1,000 people (vehicle occupants) annually.
- Minimizes the threat of loss of emergency service for a significant number of residences, several businesses, and three churches.
- Provides downstream flood protection for the people living in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 68 years.
- Eliminates the liability associated with continuing to operate a non-compliant dam.
- Maintains existing stream habitat downstream of the dam.
- Retains the existing aquatic and terrestrial habitat around the lake.
- Leverages federal resources to install the planned works of improvement.

The preferred alternative meets the Sponsors' objectives of bringing this dam into compliance with current dam design and safety criteria, maintaining the current 100-year floodplain, and addressing resource concerns identified by the public. The selected plan is the NED Alternative. The plan reasonably meets the following four criteria: completeness, effectiveness, efficiency, and acceptability. NRCS and the Sponsors are in agreement on the recommended plan.

SUMMARY AND PURPOSE

The recommended plan of action for the dam is outlined below:

- Widen the auxiliary spillway to an effective width of 300 feet. The total width, with the splitter dike, will be 342 feet. Move the control section upstream and lengthen it to 70 feet.

- Install a 42-foot wide earthen splitter dike along the centerline of the auxiliary spillway. The splitter dike will be 42 feet wide at the base, 12 feet wide at the top, and 5 feet high.
- Enhance the stability of the control section and constructed outlet section with TRM and cover the TRM with topsoil and vegetation.
- Augment the earthen training dike that extends from the top of the dam to the top of the hillslope to protect the dam embankment and to contain the auxiliary spillway flows.
- Raise the dam embankment by 2.6 feet with earthfill.
- Retrofit the footer of the principal spillway riser.

After the implementation of these planned works of improvement, Hearthstone Lake will meet all current NRCS and Virginia dam safety and performance standards.

Detailed structural data for the proposed rehabilitated dam can be found in Table 3.

EASEMENTS AND LANDRIGHTS

Landrights for the structure currently exist for the floodpool at the elevation of the crest of the auxiliary spillway based on the original easement for the project. The elevation of the crest of the auxiliary spillway will not change for implementation of the recommended alternative. The structure is located in the National Forest and the planned future land does not include any development. Additional landrights are not required because there will be no development in the area between the elevation of the crest of the auxiliary spillway and the top of the dam.

MITIGATION

No compensatory mitigation has been identified. During construction, site mitigation measures will include erosion and sediment control, seeding of denuded areas, dust control, and other practices identified during the design process. The borrow area, if needed for disposal of material from the excavation, will be replanted to trees and the lake will be restocked following construction.

PERMITS AND COMPLIANCE

The Sponsors are responsible for obtaining the Special Use Permit associated with the rehabilitation project. Prior to construction, the Sponsors will be responsible for obtaining an alteration permit from the Virginia Soil and Water Conservation Board. A Nationwide 3 permit from the Army Corps of Engineers is expected to be sufficient for this dam rehabilitation project. Nothing else should be required from the Virginia Department of Environmental Quality or the Virginia Marine Resources Commission. During construction, the successful contractor is required to develop a Stormwater Pollution Prevention Plan which includes applicable erosion and sediment control measures.

If cultural resources are discovered during installation, work will cease and applicable U.S. Forest Service procedures will be implemented.

The Sponsors will be responsible for obtaining a regular O&M Certificate from the Virginia Division of Dam Safety upon completion of the project.

COSTS

As indicated in Table 2, the total installation cost of the recommended plan is \$2,949,000. Of this amount, PL-83-566 funds will bear \$2,102,000 and nonfederal funds will bear \$847,000. Table 2 shows details of the costs and cost-share amounts by category. Total annualized costs are shown in Table 4 along with the estimated costs for operation and maintenance. Table 5 displays the average annual flood damage reduction benefits by flood damage categories, and Table 6 displays a comparison of annual costs and benefits. A 2014 price base was used and amortized at 3.375 percent interest for the 70 year period of analysis (including a design and installation period of two years and an expected useful life of 68 years).

The cost projections for the proposed rehabilitation measures are estimated costs only for the purpose of 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 actually incurred by the contractor performing the work, including the cost of any necessary contract modifications.

INSTALLATION AND FINANCING

The project is planned for installation in one construction season. 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.

The NRCS will provide assistance to the Sponsors with the Hearthstone Lake Dam rehabilitation project. NRCS will be responsible for the following:

- Execute a project agreement with 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.
- Execute a Memorandum of Understanding with the Sponsors to provide a framework within which cost-share funds are accredited.
- Execute an updated Operation and Maintenance Agreement with the Sponsors that extends the O&M responsibilities for another 68 years following construction. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide financial assistance equal to 65% of total eligible project costs, not to exceed 100% of actual construction costs.
- 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.
- Certify completion of all installed measures.

The Sponsors will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for installation, operation and maintenance of the rehabilitated structure. This includes the Special Use Permit from the U.S. Forest Service. Note: Landrights for the structure currently exist for the floodpool at the elevation of the crest of the auxiliary spillway based on the original easement for the project. The elevation of the crest of the auxiliary spillway will not change for implementation of the recommended alternative. The structure is located in the National Forest and the planned future land does not include any development. Additional landrights are not required because there will be no development in the area between the elevation of the crest of the auxiliary spillway and the top of the dam.
- Prepare an updated Emergency Action Plan for the dam prior to the initiation of construction.
- 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.
- Execute a Memorandum of Understanding with NRCS to provide a framework within which cost-share funds are accredited.
- Execute a project agreement with NRCS 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.
- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of the total eligible project costs.
- Acquire a regular Operation and Maintenance certificate from the Virginia Division of Dam Safety upon completion of the planned measures.
- Participate in and comply with applicable Federal floodplain management and flood insurance programs.
- Enforce all associated easements and rights-of-way for the safe operation of the dam.

OPERATION, MAINTENANCE, AND REPLACEMENT

Measures installed as part of this plan, and previously installed measures, will be operated and maintained by the Headwaters SWCD with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new Operation and Maintenance agreement will be developed for Hearthstone Lake and will be executed prior to signing a project agreement for the construction of the project. The term of the new O&M agreement will be for 68

years following the completion of rehabilitation. The agreement will specify responsibilities of the Sponsors 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 district, state, and federal representatives to inspect all structural measures and their appurtenances at any time.

Table 1 - Estimated Installation Cost
Upper North River Dam No. 77, Virginia
(Dollars)¹

Installation Cost Items	Estimated Costs		
	PL-83-566 Funds ²	Other Funds	Total
Structural measures to rehabilitate floodwater retarding dam: Rehab. Upper North River Dam No. 77:	\$2,102,000	\$847,000	\$2,949,000
Total Project:	\$2,102,000	\$847,000	\$2,949,000

Price base: December, 2014

Prepared: December 2014

Table 2 - Estimated Cost Distribution – Structural Measures
Upper North River Dam No. 77, Virginia
(Dollars)

Installation Cost Items	Installation Cost: PL-83-566 Funds ³				Installation Cost: Other Funds ⁴						Total Project Cost ⁵
	Construction Costs	Engineering Technical Assistance Costs	Project Administration Costs	Total PL-83-566 Cost	Construction Costs	Engineering Costs	Real Property Landrights	Permits	Project Administration Costs	Total Other Funds	
Rehab. No. 77:	\$1,577,000	\$475,000	\$50,000	\$2,102,000	\$836,000	\$2,000	\$0	\$3,000	\$6,000	\$847,000	\$2,949,000
Totals:	\$1,577,000	\$475,000	\$50,000	\$2,102,000	\$836,000	\$2,000	\$0	\$3,000	\$6,000	\$847,000	\$2,949,000

Price base: December 2014.

Prepared: December 2014

¹ All tables have a price base of 2014.

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

³ 65% of total eligible project cost (The actual federal cost/share excludes technical assistance and permit costs and cannot exceed 100% of the estimated construction cost).

⁴ 35% of total project cost. Per NRCS policy, \$5,000 in local sponsor planning costs were excluded from Tables 1 and 2. These sponsor costs are included in the calculation of cost/share as shown in the watershed agreement.

⁵ Note: As per the NRCS National Watershed Manual, Part 508.44, the actual federal cost/share amount will be calculated based on a total eligible project cost that excludes federal technical assistance costs, water, mineral and other resource rights, and all federal, state and local permits. However, for the purposes of planning, all of these costs are included in the benefit/cost analysis and are displayed as part of the public record of this analysis.

Table 3 – Structural Data for Rehabilitated Dam
Upper North River Dam No. 77, Virginia

ITEM	UNIT	AMOUNT
Hazard Class of Structure	-	High
Seismic Zone	-	2
Total Drainage Area	Sq. Mi.	15.86
Time of Concentration	Hours	2.80
Antecedent Moisture Condition II Runoff Curve Number	-	58
Elevation, Top of Dam ¹	Feet, MSL	1858.7
Elevation, Auxiliary Spillway Crest ¹	Feet, MSL	1843.4
Elevation, Principal Spillway Orifice Crest ¹	Feet, MSL	1779.2
Auxiliary Spillway Type	-	Vegetated earth
Auxiliary Spillway Bottom Width	Feet	342
Auxiliary Spillway Exit Slope	%	2.02
Maximum Height of Dam	Feet	109.6
Volume of Fill (Rehabilitation)	Cu. Yd.	3,300
Total Capacity	Ac.-Ft.	3,018
Sediment Submerged ²	Ac.-Ft.	134
Sediment Aerated ²	Ac.-Ft.	116
Floodwater Retarding Pool	Ac.-Ft.	2,768
Surface Area		
Sediment Pool	Acres	12.3
Floodwater Retarding Pool	Acres	81.6
Principal Spillway Design		
Rainfall Volume (1 day)	Inches	6.67
Rainfall Volume (10 day)	Inches	9.61
Runoff Volume (10 day)	Inches	1.9
Capacity at Crest of Auxiliary Spillway	CFS	460.9
Conduit Size	Inches	48
Conduit Type	-	Concrete
Frequency of Operation, Auxiliary Spillway	Annual % chance	0.2 ³
Auxiliary Spillway Hydrograph		
Rainfall Volume	Inches	10.5
Runoff Volume	Inches	4.99
Storm Duration	Hours	6
Velocity of flow (V _e)	Ft/s	9.2
Maximum Surface Elevation	Feet, MSL	1847.7
Freeboard Hydrograph (6-hr PMP) ⁴		
Rainfall Volume	Inches	28
Runoff Volume	Inches	20.86
Storm Duration	Hours	6
Maximum Surface Elevation	Feet, MSL	1858.7
Capacity Equivalents		
Submerged Sediment	Watershed Inches	0.16
Aerated Sediment	Watershed Inches	0.14
Floodwater capacity	Watershed Inches	3.28

¹ Datum: NAVD88.

Prepared: December 2014

² Based on 2012 sediment survey.

³ The auxiliary spillway has a statistical frequency of operation of once in 500 years.

⁴ Both the 6-hour and 24-hour duration storms were evaluated. The 6-hour storm duration was the critical duration for the freeboard hydrograph.

Table 4 - Average Annual National Economic Development (NED) Costs
Upper North River Dam No. 77, Virginia
(Dollars)

	Average Annual Equivalent Cost	Annual Operation and Maintenance Costs	Total Average Annual Equivalent Cost
Rehabilitation of Upper North River Dam No. 77	\$98,000	\$5,000	\$100,000
Totals:	\$98,000	\$5,000	\$100,000

Price base: December 2014

Prepared: December 2014

Note: The average annual equivalents are based on a 3.375% discount rate and a 70 year period of analysis (2 years for project design/installation and 68 years of expected useful life).

Table 5 - Estimated Average Annual Flood Damage Reduction Benefits
Upper North River Dam No. 77, Virginia
(Dollars)

Flood Damage Category	Estimated Average Annual Equivalent Damages		Damage Reduction Benefits
	Without Federal Project	With Federal Project	Average Annual Equivalents
Agricultural damages	\$7,500	\$7,500	\$0
Major Improvements (structure and content damages)	\$30,000	\$30,000	\$0
Minor improvements	\$5,900	\$5,900	\$0
Infrastructure damages	\$40,900	\$40,900	\$0
George Washington National Forest facilities	\$2,900	\$2,900	\$0
Other (miscellaneous damages)	\$2,400	\$2,400	\$0
Totals (rounded):	\$89,600	\$89,600	\$0

Price base: December 2014

Prepared: December 2014

Note: Damage reduction benefits resulting from the recommended plan equal zero as compared to the no federal action alternative because they are the same in scope, cost and effects, and therefore yield equivalent benefits.

Table 6 - Comparison of National Economic Development (NED) Benefits and Costs
Upper North River Dam No. 77, Virginia
(Dollars)

Evaluation Unit	Average Annual Equivalent Benefits		Costs	Net Change	Benefit/ Cost Ratios
	Damage Reduction Benefits	Total Average Annual Equivalent Benefits ¹	Average Annual Equivalent Costs	Net Average Annual Equivalent Benefits	
Upper North River Dam No. 77	\$0	\$100,000	\$100,000	\$0	1.0 to 1.0
Totals:	\$0	\$100,000	\$100,000	\$0	1.0 to 1.0

Price base: December, 2014

Prepared: Dec. 2014

Note: The average annual equivalents are based on a 3.375% discount rate and a 70 year period of analysis (2 year for project design/installation and 68 years of expected minimum useful life).

¹ The costs and benefits of the Future With Project Plan are the same as those for the Future Without Project Plan. To maintain consistency with the display in Table 4, the costs associated with the No Action Alternative are tracked as a benefit of the Preferred Alternative.

REFERENCES

- Augusta County. 2007 Elevation Data.
- Census Bureau, 2010 Census, and 2009-2013 American Community Survey Projections, U.S. Department of Commerce.
- Commonwealth of Virginia, Department of Historic Resources, State Archaeological Site File, Richmond, VA.
- Commonwealth of Virginia, Department of Historic Resources, State Register of Historic Sites, Richmond, VA.
- Commonwealth of Virginia, Virginia Soil and Water Conservation Board. Dam Safety Impounding Structures Regulations, 4VAC50-20-10 et seq.
- Digital Representation of the 1993 Geologic Map of Virginia, Publication 174, 2003, Commonwealth of Virginia, Department of Mines, Minerals, and Energy, Division of Mineral Resources.
- Hurt and Proffitt. “DCR – Upper North River Dam #77, Hearthstone Lake Dam, Hazard Classification.” Revised January 9, 2013.
- National Land Cover Dataset, 2006.
- National Land Cover Dataset, 2011.
- NRCS National Engineering Handbook.
- NRCS National Engineering Manual.
- NRCS National Operation and Maintenance Manual.
- NRCS National Planning Procedures Handbook.
- NRCS Soil Survey of Augusta County, Virginia.
- NRCS Technical Release 60 – Earth Dam and Reservoirs. 2005.
- NRCS Technical Release 66 – Simplified Dam-Breach Routing Procedure.
- NRCS Technical Release 68 – Seismic Analysis of Risers, 1982. Amendment 1, 1992 and Amendment 2, 1993.
- NRCS Technical Release 70 – Hydraulic Proportioning of Two-Way Covered Baffle Inlet Riser. 1983.
- NRCS National Watershed Program Manual, 2014.
- NRCS National Watershed Program Handbook, 2014.
- NRCS Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/>.
- Timmons Group. “Report of Subsurface Exploration and Evaluation of Headcut Erodibility Indices, Hearthstone Lake Dam and Spillway Modifications, Upper North River 77, Augusta County, Virginia.” April 9, 2013. Prepared by Schnabel Engineering Consultants, Inc.
- U.S. Army Corps of Engineers – Hydraulic Engineering Center (HEC). HEC-HMS.

U.S. Army Corps of Engineers – Hydraulic Engineering Center (HEC). HEC-River Analysis System (HEC-RAS).

U.S. Army Corps of Engineers, 1987 Wetland Delineation Manual.

U.S. Department of Agriculture, Natural Resources Conservation Service. Water Resources Site Analysis Computer Program (SITES).

U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA Atlas 14. Precipitation-Frequency Atlas of the United States, Volume 2: The Ohio River Basin and Surrounding States. 2004.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA Hydrometeorological Report No. 51. Probable Maximum Precipitation Estimates, United States East of the 105th Meridian. June 1978.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA Hydrometeorological Report No. 52. Application of Probable Maximum Precipitation Estimates – United States East of the 105th Meridian. August 1982.

U.S. Department of the Interior, National Park Service, National Register of Historic Landmarks, Washington, DC.

U.S. Department of the Interior, National Park Service, National Register of Historic Places, Washington, DC.

U.S. Department of the Interior, National Park Service, National Registry of Natural Landmarks, Washington, DC.

U.S. Fish and Wildlife. Wetland mapper website:
www.fws.gov/wetlands/data/mapper.html.

U.S. Water Resources Council. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington, DC, March 10, 1983.

Virginia Department of Conservation and Recreation, Division of Planning and Recreation Resources. 2013 Virginia Outdoors Plan.

Virginia Department of Game and Inland Fisheries. 2005. Virginia's Comprehensive Wildlife Conservation Strategy. Richmond, Virginia.

Virginia Department of Environmental Quality. 2012 305(b) Virginia Water Quality Assessment Report. Richmond, Virginia.

Virginia Department of Environmental Quality. 2012 303(d) Report on Impaired Waters. Richmond, Virginia.

REPORT PREPARERS

The Upper North River Watershed Supplemental Plan and Environmental Assessment was prepared primarily by the Virginia NRCS Planning Team located in Richmond, Virginia; Verona, Virginia; and Morgantown, West Virginia. The document was reviewed and concurred in by state staff specialists having responsibility for engineering, resource conservation, soils, agronomy, biology, economics, geology, and contract administration. The in-house review was followed by a review by the NRCS National Water Management Center and project sponsors, and then an interagency and public review.

<u>Name</u>	<u>Present Title and Years in Current Position</u>	<u>Education</u>	<u>Previous Experience</u>	<u>Other</u>
Rebecca M. Evans	Civil Engineering Technician - 6	B.S. Natural Resources Recreation	Conservation Specialist – 2 yrs.	
David L. Faulkner	Natural Resource Economist - 25	M.S. Ag. Economics B.S. Ag. Education	Ag. Economist (SCS) - 2.5 yrs. Ag. Economist (U.S.A.I.D.) - 4.5 yrs. Ag. Teacher (Peace Corps) – 2 yrs.	
Fred M. Garst	GIS Specialist - 21	B.S. Geology	GIS/Soil Scientist - 7 yrs. Soil Cons. Tech. - 7 yrs. Geologist (Private) – 4 yrs.	
Jeffray Jones	State Biologist - 3	B.S. Natural Resources Management	Ecologist - 22 yrs.	
Alica J. Ketchem	Environmental Engineer - 21	B.S. Civil Engineering M.S. Agricultural Eng.	Civil Engineer – 10 yrs.	P.E.
Amanda L. Lynch	Environmental Specialist - 1	B.S. Biology M.S. Natural Resources Management	Natural Resource Specialist – 5 yrs.	
Mathew J. Lyons	State Conservation Engineer- 13	B.S. Civil Engineering	Civil Engineer – 12 yrs.	P.E.
Jeffrey D. McClure	Geologist - 10	B.A. Geology B.A. Biology B.S. Geology	NRCS Geologist – total 11.5 yrs. Geologist (WV Dept. of Env. Prot.) - 11 yrs. Geologist (Private) – 8.5 yrs.	CPG in KY, VA, DE and PA
Kelly Ramsey	Hydraulic Engineer - 9	B.S. Biological Systems Engineering	Civil Engineer – 12 yrs.	P.E.
Gerald W. Wright	Project Engineer - 8	B.S. Civil Engineering	Civil Engineer – 20 yrs.	P.E., PLS

The table 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.

Special acknowledgment goes to John Kaylor, Headwaters Soil and Water Conservation District, who spent many hours in the Upper North River Watershed surveying, collecting data, meeting with landowners, and attending public meetings, and providing technical support.

DISTRIBUTION LIST

Comments were requested on the Draft Supplemental Plan – EA from the following agencies and organizations.

<u>Federal Agencies</u>	<u>Response Received on Draft Supplemental Plan/EA</u>
Environmental Protection Agency Region III, Philadelphia	No
U.S. Army Corps of Engineers Norfolk District	No
U.S. Department of the Interior Fish and Wildlife Service Gloucester, Virginia Office	No No
Federal Emergency Management Agency Philadelphia	No
U.S. Department of Agriculture Forest Service Farm Service Agency Rural Development	No Yes No
<u>Virginia State Agencies</u>	
Virginia Department of Environmental Quality Office of Environmental Impact Review (State Clearinghouse)	Yes
Virginia Department of Conservation and Recreation	Yes
Virginia Marine Resources Commission	Yes
Virginia Department of Game and Inland Fisheries	No
Virginia Department of Historic Resources	Yes
Virginia Department of Agriculture and Consumer Services	No
Virginia Department of Health	No
Virginia Department of Forestry	Yes

<u>Other</u>	<u>Response Received on Draft Supplemental Plan/EA</u>
Virginia Association of Soil and Water Conservation Districts	No
Headwaters Soil and Water Conservation District	Yes
Shenandoah Valley Soil and Water Conservation District	No
Augusta County	Yes
Rockingham County Board of Supervisors	No
Town of Bridgewater	No
Central Shenandoah Planning District Commission	No

INDEX OF KEY WORDS AND PHRASES

<u>Key Words and Phrases</u>	<u>Pages</u>
Agreements.....	i-x, 22, 30, 46, 48, 49, 50, E-2
Air Quality.....	xii, xvii, xix, 5, 11, 35, 38, 39
Alternative(s).....	v-xv, 7, 26-46, 51, 52, C-4, C-5, C-6, D-3, D-5
Auxiliary Spillway.....	xv, xviii, xix, xx, 1-3, 14-17, 19-25, 27, 29, 31-36, 39, 41-44, 46, 47, 49, 52, D-2, D-3, E-1
Benefits.....	xviii, 2, 7, 27, 34, 36, 37, 41, 43, 46, 48, 53, 54, D-5, D-6
Benefit/Cost Ratio.....	xviii, 34-37
Breach.....	xviii, 2, 3, 8, 12, 14, 21, 22, 24-28, 30, 36, 41, 42, 46, 55, C-1, C-2, D-2, D-3, D-4, D-5
Cultural Resources.....	xvi, xix, 6, 9, 10, 40, 48, D-1
Easements.....	43, 47, 49
Emergency Action Plan.....	v, 22, 43, 48, 49, D-3
Environmental Justice.....	xvii, 6, 12, 35, 41
Fish.....	xix, 3, 4, 6, 7, 10, 14, 35, 40, 42, 44, 56, D-1, E-2, E-4, E-5, E-8, E-10, E-11, E-16
Floodplain.....	iv, xvii, xix, 1, 2, 5, 22, 25, 26, 35, 37, 41, 46, 49, D-1, D-2, D-4, E-15
Forest Resources.....	xvii, xix, 5, 11, 35, 39

<u>Key Words and Phrases</u>	<u>Pages</u>
Hazard Classification.....	2, 22, 55, D-3
Invasive Species.....	xvii, 5, 6, 11, 35, 39
Local and Regional Economy.....	xvii, 6, 41
Migratory Birds.....	xvii, 6, 11, 35, 40
Mitigation.....	xx, 28, 47
National Economic Development Plan (NED).....	xvii, 6, 27, 34, 53, 54, D-5
Permits.....	iii, iv, ix, xviii, xix, 2, 20, 39, 43, 47, 49, 51, E-1
Preferred Alternative.....	xv, xviii, 30, 33, 34, 43, 44, 46, 54
Principal Spillway.....	xv, xviii, 1, 14, 15, 16, 18, 20, 21, 23-25, 27-29, 31-35, 47, 52
Recreation.....	xvii, xviii, 1, 3, 6, 10, 14, 25, 26, 28, 29, 36, 38, 42, 46, 56, 57, D-1, D-4, E-9, E-10, E-13, E-17
Riparian Areas.....	xvii, 5, 10, 35, 39, E-12
Safety.....	v, xv, xvii, xix, xx, 1-3, 6, 14, 22, 26, 27, 29, 30, 34-36, 41, 42, 44, 45-49, 55, D-3, D-4
Scenic Beauty.....	xvii, 6, 36, 42
Social Issues.....	xvii, 6, 36, 42
Threatened and Endangered Species.....	xvi, xvii, xix, 5-9, 11, 35, 39, 40, D-1, E-1, E-2, E-9, E-10, E-11, E-16
Water Quality.....	xvii, 4, 5, 10, 12, 26, 35, 38, 43, 56, D-1

Key Words and Phrases

Pages

Water Resources..... xvii, 5, 7, 26, 35-38, 56, D-5

Wetlands..... xvii, xix, 5, 10, 35, 38, 56, D-1

Wildlife..... xix, 6, 7, 10, 11, 35, 40, 44, 56, 57, D-1, E-2, E-5, E-8, E-10 E-16

APPENDIX A

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



COUNTY OF AUGUSTA
COMMONWEALTH OF VIRGINIA
DEPARTMENT OF COMMUNITY DEVELOPMENT
P.O. BOX 590
COUNTY GOVERNMENT CENTER
VERONA, VA 24482-0590



15-571

June 15, 2015

R. Wade Biddix
Watershed Program Specialist
ACES Employee
1606 Santa Rosa Road, Suite 209
Richmond, Virginia 23229-5014

Re: Upper North River Dam #77, Hearthstone Lake, Draft Plan

Dear Mr. Biddix:

Thank you for the opportunity to review the draft plan for Upper North River Dam #77, Hearthstone Lake. We do not have any comments.

Thank you again, if you need anything further please do not hesitate to ask.

Sincerely,

Timothy K. Fitzgerald
Director of Community Development

TKF/mla



United States Department of Agriculture

July 9, 2015

Mr. Timothy K. Fitzgerald
Augusta County Department of Community Development
P. O. Box 590
Verona, VA 24482

Re: Draft Supplemental Watershed Plan-Environmental Assessment (EA) for the
Rehabilitation of Upper North River Watershed Dam No. 77 (Hearthstone Lake),
Augusta County, Virginia

Dear Mr. Fitzgerald:

Thank you for your timely response to the referenced Draft Plan/EA submitted to your office for review. We appreciate the excellent partnership we have with Augusta County and the Headwaters Soil and Water Conservation District on this project. Even though you had no comments, we appreciate the time and effort needed to review the Draft Plan/EA.

If questions or concerns arise as the project proceeds to design and construction, please direct them to David Kriz, Assistant State Conservationist for Water Resource Operations, at David.Kriz@va.usda.gov or by phone at 804-287-1646.

Sincerely,

A handwritten signature in blue ink that reads "John A. Bricker Acting". The signature is stylized and cursive.

JOHN A. BRICKER
State Conservationist

cc: Doug Wolfe, County Engineer, Augusta County, VA
Charles Ivins, District Conservationist, NRCS, Verona, VA
Barry Harris, Acting ASTC (Field Operations), NRCS, Harrisonburg, VA

From: Dunn, James - FSA, Sussex, VA
Sent: Tuesday, June 23, 2015 10:46 AM
To: Bricker, Jack - NRCS, Richmond, VA
Cc: Whitlock, Brent - FSA, Richmond, VA; Horsley, Emily - FSA, Richmond, VA
Subject: Review of Draft Plan - Upper North River

Jack,

As a follow-up to our conversation yesterday, I wanted to reiterate that the Farm Program Section in the Virginia State FSA Office had a chance to review the Draft Supplemental Watershed Plan for the Upper North River Watershed Dam project in Augusta County and had no comments to add to the plan. The plan is very thorough and we support the plan as presented.

James M. Dunn
Acting SED
Virginia State FSA



United States Department of Agriculture

July 9, 2015

Mr. James Dunn, Acting State Executive Director
USDA – Farm Service Agency
1606 Santa Rosa Road
Richmond, Virginia 23229

Re: Draft Supplemental Watershed Plan-Environmental Assessment (EA) for the
Rehabilitation of Upper North River Watershed Dam No. 77 (Hearthstone Lake),
Augusta County, Virginia

Dear Mr. Dunn:

Thank you for your timely response to the referenced Draft Plan/EA submitted to your office for review. Even though you had no significant comments, we appreciate the time and effort needed to review the Draft Plan/EA.

If questions or concerns arise as the project proceeds to design and construction, please direct them to David Kriz, Assistant State Conservationist for Water Resource Operations, at David.Kriz@va.usda.gov or by phone at 804-287-1646.

Sincerely,

A handwritten signature in blue ink that reads "John A. Bricker Acting". The signature is written in a cursive style.

JOHN A. BRICKER
State Conservationist

NATURAL RESOURCES CONSERVATION SERVICE
1606 Santa Rosa Road, Suite 209 ♦ Richmond, Virginia 23229
Phone: (804) 287-1691 ♦ Fax: (855) 627-9827

An Equal Opportunity Provider and Employer



Headwaters Soil and Water Conservation District
70 Dick Huff Lane
Verona, VA 24482
(540) 248-0148
www.headwatersswcd.org

We work with the people who work the land.

June 17, 2015

John Bricker, State Conservationist
USDA – Natural Resources Conservation Service
1606 Santa Rosa Rd., Suite 209
Richmond, VA 23219

RE: Comments - Upper North River #77 Draft Plan

Dear Mr. Bricker:

In response to the request we received on May 6, we have no significant comments to the Upper North River #77 (Hearthstone Dam) Draft Plan. We appreciate the opportunity to comment as one of the sponsors, and support the project as proposed.

Sincerely,

Richard Shiflet/cp

Richard Shiflet, Chairman



United States Department of Agriculture

July 9, 2015

Mr. Richard Shiflet, Chairman
Headwaters Soil and Water Conservation District
70 Dick Huff Lane
Verona, VA 24482

Re: Draft Supplemental Watershed Plan-Environmental Assessment (EA) for the
Rehabilitation of Upper North River Watershed Dam No. 77 (Hearthstone Lake),
Augusta County, Virginia

Dear Mr. Shiflet:

Thank you for your timely response to the referenced Draft Plan/EA submitted to your office for review. We appreciate the excellent partnership we have with Augusta County and the Headwaters Soil and Water Conservation District on this project. Even though you had no significant comments, we appreciate the time and effort needed to review the Draft Plan/EA.

If questions or concerns arise as the project proceeds to design and construction, please direct them to David Kriz, Assistant State Conservationist for Water Resource Operations, at David.Kriz@va.usda.gov or by phone at 804-287-1646.

Sincerely,

A handwritten signature in blue ink that reads "John A. Bricker - Acting". The signature is written in a cursive style.

JOHN A. BRICKER
State Conservationist

cc: John Kaylor, Conservation Specialist, Headwaters SWCD, Verona, VA
Charles Ivins, District Conservationist, NRCS, Verona, VA
Barry Harris, Acting ASTC (Field Operations), NRCS, Harrisonburg, VA



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219

Mailing address: P.O. Box 1105, Richmond, Virginia 23218

Fax: 804-698-4019 - TDD (804) 698-4021

www.deq.virginia.gov

Molly Joseph Word
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
1-800-592-5482

July 14, 2015

Mr. R. Wade Biddix
Watershed Program Specialist 1606
Santa Rosa Road, Suite 209
Richmond, Virginia 23229-5014

RE: USDA Natural Resources Conservation Service Environmental Assessment: Upper North River Watershed Agreement, Augusta County (DEQ 15-101F)

Dear Mr. Biddix:

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 participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Department of Historic Resources
Department of Forestry
Marine Resources Commission

The Department of Game and Inland Fisheries, Department of Agriculture and Consumer Services, Department of Health, Augusta County, and the Central Shenandoah Planning District Commission were also invited to comment on the project.

PROJECT DESCRIPTION

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) developed an implementation plan and EA to rehabilitate the Hearthstone Lake dam,

which is located in the George Washington and Jefferson National Forests within Augusta County. The project would enable the dam to meet current safety and performance standards for a high hazard dam. The plan indicates that the auxiliary spillway will be widened by 92 feet and the top of the dam will be raised by 2.6 feet with earth fill. The control section will be lengthened by 70 feet and an earthen splitter dike will be installed down the centerline of the auxiliary spillway. Additional improvements will also occur.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Wetlands and Water Quality. According to the EA (page 37), there may be a temporary impact on downstream water quality and temperature when the water is drained. In addition, there are approximately 7.8 acres of freshwater emergent wetlands at the inflow of the lake.

1(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations, covering a variety of permits to include Virginia Pollutant Discharge Elimination System Permit, Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit. The VWP Permit is a state permit which governs wetlands, surface water and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal Clean Water Act § 404 permits for dredge and fill activities in waters of the United States. The VWP Permit (VWPP) Program is under the Office of Wetlands and Stream Protection within the DEQ Division of Water Permitting. In addition to central office staff who 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.

1(b) Agency Findings. The DEQ Valley Regional Office (VRO) states that the disturbance of any 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.

1(c) Agency Recommendations. DEQ VRO recommends the avoidance and minimization of surface water impacts to the maximum extent practicable. Measures must be taken to avoid and minimize impacts to surface waters and wetlands during construction activities. 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 by using Best Management Practices (BMPs).

1(d) Requirement. A VWPP may be required.

1(e) Agency Recommendation. Contact DEQ VRO since construction activities will occur in or along any streams (perennial, intermittent, or ephemeral), open water or wetlands to determine the need for any permits prior to commencing work that could impact surface waters or wetlands.

2. Air Quality. The EA (page 37) indicates significant impacts to air quality are not anticipated.

2(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the Air Pollution Control Board, is responsible for developing regulations that implement Virginia's Air Pollution Control Law. 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 regional office is directly responsible for the issue of necessary permits to construct and operate all stationary sources in the region as well as to monitor emissions from these sources for compliance. As a part of this mandate, the environmental documents of new 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.

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

2(c) Requirements.

2(c)(i) Fugitive Dust. During land-disturbing 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 suitable chemicals for dust control during the proposed demolition and construction operations and from material stockpiles;

- Install and use of 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 dried sediments resulting from soil erosion.

Do not use water for dust control to the extent that it results in runoff to surface waters or wetlands.

2(c)(ii) Open Burning. If project activities include the burning of vegetative debris or use of special incineration devices in the disposal of land clearing debris, 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. Contact officials with the appropriate locality to determine what local requirements, if any, exist. No open burning shall take place in violation of the Virginia Waste Management Regulations (<http://leg1.state.va.us/OOO/reg/TOC09020.HTM>).

3. Erosion and Sediment Control and Stormwater Management. According to the EA (page 37), the project will implement erosion and sediment controls.

3(a) Agency Jurisdiction. The DEQ Office of Stormwater Management (OSM) administers the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) and the Virginia Stormwater Management Law and Regulations (VSWML&R). In addition, DEQ-OSWM 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.

3(b) Requirements. DEQ OSM did not respond to DEQ's request for comments. However, based on responses to similar projects, regulatory guidance for the control of nonpoint source pollution is presented below.

3(b)(i) Erosion and Sediment Control and Stormwater Management Plans. The applicant and its authorized agents conducting regulated land-disturbing activities on private and public lands in the state must comply with VESCL&R and VSWML&R, including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-

disturbing activities that result in the total land disturbance of equal to or greater than 10,000 square feet would be regulated by *VESCL&R*. Accordingly, the applicant must prepare and implement an erosion and sediment control (ESC) plan to ensure compliance with state law and regulations. The ESC plan is submitted to the DEQ regional office that serves the area where the project is located for review for compliance. The applicant is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy (Reference: *VESCL* 62.1-44.15 et seq.).

3(b)(ii) General Permit for Stormwater Discharges from Construction Activities (VAR10). The operator or owner of a construction project involving land-disturbing activities equal to or greater than one 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 *VSMPP Permit Regulations*. General information and registration forms for the General Permit are available on DEQ's website at <http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/WSMPPPermits/ConstructionGeneralPermit.aspx> (Reference: *VSWML* 62.1-44.15 et seq.; *VSMPP Permit Regulations* 9VAC 25-870-10 et seq.).

4. Solid and Hazardous Waste Management. The EA does not address waste issues.

4(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by DEQ, the Virginia Waste Management Board and the U.S. Environmental Protection Agency. They administer programs created by the federal Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the Virginia Waste Management Board and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use and alternative programs such as materials recycling and composting.

4(b) Database Search. DEQ's Division of Land Protection and Revitalization (DLPR) states that no waste sites were identified near the project area.

4(c) Requirement. Any soil/sediment that is suspected of contamination or wastes that are generated during construction-related activities must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations.

4(d) Agency Recommendations. DEQ encourages all projects 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.

5. Natural Heritage Resources. The EA (page 10) indicates that significant habitat will not be affected.

5(a) Agency Jurisdiction.

5(a)(i) Natural Heritage Resources. The mission of the Department of Conservation and Recreation (OCR) is to conserve Virginia's natural and recreational resources. OCR supports a variety of environmental programs organized within seven divisions including the DNH. DNH's mission is conserving Virginia's biodiversity through inventory, protection, and stewardship. The Virginia Natural Area Preserves Act, 10.1-209 through 217 of the *Code of Virginia*, was passed in 1989 and codified DCR'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).

5(a)(ii) Threatened and Endangered Plant and Insect Species. The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the *Code of Virginia*, as amended, authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to conserve, protect and manage endangered species of plants and insects. VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the FWS, OCR DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by FWS, are available, adherence to the order and tasks outlined in the plans should be followed to the extent possible. VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between the VDACS and OCR, OCR has the authority to report for VDACS on state-listed plant and insect species.

5(b) Agency Findings – Natural Heritage Resources. The Biotics Data System historically documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, OCR DNH does not anticipate that this project will adversely impact these natural heritage resources.

5(c) Agency Findings – Threatened and Endangered Plant and Insect Species. OCR states that the current activity will not affect any documented state-listed plant and insect species.

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

5(e) Agency Recommendations. Contact OCR DNH to 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.

6. Historic Structures and Architectural Resources. The EA (page 10) indicates that historic resources will not be affected by the implementation of the proposed project.

6(a) Agency Jurisdiction. The Department of Historic Resources (OHR) conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. OHR, as the designated Historic Preservation Office for the Commonwealth, ensures that federal actions comply with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulation at 36 Code of Federal Regulations Part 800. The NHPA 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. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding. OHR also provides comments to DEQ through the state environmental impact report review process.

6(b) Requirement. Consult directly with OHR, as necessary, pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations codified at 36 CFR Part 800 which require federal agencies to consider the effects of their undertakings on historic properties.

7. Dam Safety. The EA (page 1) states that the purpose of the project is to improve the safety of the dam.

7(a) Agency Jurisdiction. The purpose of the OCR Division of Dam Safety (DDS) 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 (10.1-604 *et seq.*) of the Code of Virginia and Dam Safety Impounding Structure Regulations.

7(b) Agency Findings. OCR DDS states that according to 44 CFR 60.3, a participating community in the National Flood Insurance Program must receive information on any project in the community's mapped floodplain: bridge, dam removal, or stream restoration to evaluate the project for its effect on the floodplain. If it is determined by an appropriate study by the developer that there is a change in the extent of the floodplain (the edges) or the elevation of the 1% chance flood, then a letter of map revision (LOMR) is submitted to Federal Emergency Management Agency (FEMA) by the 'developer' so the floodplain map can be up-dated. Local governments have the authority and responsibility to properly manage the mapped floodplain within the community, including submitting to FEMA new technical data on the floodplain within six months of receipt so the maps are updated for accuracy. The Division of Dam Safety issued an Alteration Permit for this project on March 31, 2015. DCR's Dam Safety has no issues with this project.

8. Forestry. The EA (page 32) states that approximately 2.4 acres of trees would be removed as part of the auxiliary spillway expansion.

B(a) Agency Jurisdiction. The Department of Forestry (DOF) reviews applications to ensure that the forest resources of the Commonwealth are managed in a sustainable manner to meet the economic, ecological, and social needs of Virginia in perpetuity. DOF is charged, pursuant to Virginia Code sections 10.1-1101, 10.1-1105, and 10.1-1106 with protecting and developing healthy, sustainable forest resources that maintain functioning forest ecosystem and improve forest health, sustaining the supply of raw materials necessary for the economic growth of Virginia's timber industry, and supporting the protection of water quality and sources of water supply within Virginia's watersheds.

B(b) Agency Findings. DOF states that the proposed action would not cause a significant impact to forest resources. The proposed action is required to comply with federal requirements for dam safety and according to the documents provided will not result in loss of forest cover which currently accounts for 99.2% of the land cover in the drainage area. Further, the forest resources are in a proposed wilderness area and are protected by the U.S. Forest Service.

9. Subaqueous Lands. According to the EA (page 48), a permit may be required for impacts to subaqueous lands.

9(a) Agency Jurisdiction. The Virginia Marine Resources Commission (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.

The VMRC serves as the clearinghouse for the Joint Permit Application (JPA) used by the:

- Corps for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a VWP permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

9(b) Agency Findings. VMRC states that a permit may be required for impacts to the natural portions of the streambed resulting from the dam rehabilitation project since the drainage area is greater than five square miles.

9(c) Requirements. Submit a JPA to VMRC to review.

10. Pollution Prevention. DEQ advocates that principles of pollution prevention be used in all projects. Effective siting, planning and on-site best management practices will help to ensure that environmental impacts are minimized. However, pollution prevention techniques also include decisions related to construction materials, design and operational procedures that will facilitate the reduction of wastes at the source.

10(a) Recommendations. We have several pollution prevention recommendations that may be helpful in the construction and operation of the facility:

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to minimizing its 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.
- 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 infrastructure and building construction and design. These could include asphalt and concrete containing recycled materials, and integrated pest management in landscaping, among other things.

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

11. Pesticides and Herbicides. In general, when pesticides or herbicides must be used, their use should be strictly in accordance with manufacturers' recommendations. In addition, to the extent feasible, DEQ recommends that the responsible agent for the project use the least toxic pesticides or herbicides effective in controlling the target species. For more information on pesticide or herbicide use, please contact the Virginia Department of Agriculture and Consumer Services at (804) 786-3501.

REGULATORY AND COORDINATION NEEDS

1. Water Quality and Wetlands. DEQ regulates impacts to waters and wetlands pursuant to 9VAC25-210 *et seq.* Contact DEQ VRO (Eire Millard at Eric.Millard@deq.virginia.gov) to ensure compliance with the Virginia Water Protection Program (VWPP).

2. Subaqueous Lands Impacts. Pursuant to section 28.2-1204 of the Code of Virginia, the VMRC has jurisdiction over any encroachments in, on or over any state-owned rivers, streams or creeks in the Commonwealth. Contact VMRC (Justine Woodward at 757-247-8027 or Justine.Woodward@mrc.virginia.gov) regarding the submittal of a JPA.

3. Erosion and Sediment Control and Stormwater Management. This project must comply with Virginia's *Erosion and Sediment Control Law* (Virginia Code § 62.1-44.15:61) and *Regulations* (9 VAC 25-840-30 *et seq.*) and *Stormwater Management Law* (Virginia Code § 62.1-44.15:31) and *Regulations* (9 VAC 25-870-210 *et seq.*) as administered by DEQ. Erosion and sediment control, and stormwater management requirements should be coordinated with the DEQ VRO (Gary Flory at Gary.Flory@deq.virginia.gov).

4. General Permit for Stormwater Discharges from Construction Activities (VAR10).

The operator or owner of a construction activity involving land disturbance of 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). Specific questions regarding

the Stormwater Management Program requirements should be directed to DEQ (Holly Sepety at 804-698-4039) (Reference: VSWML §62.1-44.15 *et seq.*).

5. Air Quality Regulations. This project may be subject to air regulations administered by DEQ. The following sections of Virginia Administrative Code are applicable:

- 9 VAC 5-50-60 *et seq.* governing fugitive dust emissions; and
- 9 VAC 5-130 *et seq.*, for open burning.

S(a) Coordination.

- Contact officials with the appropriate locality for information on any local requirements pertaining to open burning.
- Contact DEQ VRO (Janardan Pandey at Janardan.Pandey@deq.virginia.gov or 540-574-7817) for additional information on air regulations if necessary.

6. Solid and Hazardous Wastes. All solid waste, hazardous waste and hazardous materials must be managed in accordance with all applicable federal, state and local environmental regulations.

These state laws and regulations may apply:

- Virginia Waste Management Act (*Code of Virginia* Section 10.1-1400 *et seq.*);
- Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC20-60);
- Virginia Solid Waste Management Regulations (VSWMR) (9VAC20-81); and
- Virginia Regulations for the Transportation of Hazardous Materials (9VAC20-110).

These federal laws and regulations may apply:

- 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
- U.S. Department of Transportation Rules for Transportation of Hazardous materials (49 Code of Federal Regulations Part 107).

For additional information on waste management contact DEQ VRO (Graham Simmerman at 540-574-7865 or Graham.Simmerman@deq.virginia.gov).

7. Natural Heritage Resources. Contact the OCR DNH (804-371-2708) to re-submit project information and a map for an update on natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

8. Historic Resources. Coordinate with OHR (Roger Kirchen at Roger.Kirchen@dhr.virginia.gov) to ensure compliance with the National Historic Preservation Act.

Thank you for the opportunity to comment on this EA. The detailed comments of reviewers are attached. If you have questions, please do not hesitate to call me at (804) 698-4204 or Julia Wellman at (804) 698-4326.

Sincerely,



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

Enclosures

ec: Wade Biddix,
USDA Amy Ewing, DGIF
Keith Tignor, VDACS Robbie
Rhur, OCR Roy Soto, VDH
Steve Coe, DEQ DLPR Kotur
Narasimhan, DEQ Air Daniel
Carawan, DEQ
Keith Fowler, DEQ VRO Roger
Kirchen, OHR Greg Evans, DOF
Justine Woodward, VMRC
Bonnie Riedesel, Central Shenandoah PDC Patrick J.
Coffield, Augusta County



United States Department of Agriculture

July 16, 2015

Bettina Sullivan, Manager
Office of Environmental Impact Review
Commonwealth of Virginia
Department of Environmental Quality
P.O. Box 1105
Richmond, VA 23218

Re: Draft Supplemental Watershed Plan-Environmental Assessment (EA) for the
Rehabilitation of Upper North River Watershed Dam No. 77 (Hearthstone Lake),
Augusta County, Virginia

Dear Ms. Sullivan:

Thank you for providing the Commonwealth's consolidated comments on the referenced project. We also received individual comments from Augusta County and the Headwaters Soil and Water Conservation District. It is acknowledged that the Department of Environmental Quality has no objection to the proposed action provided that all applicable local, state, and federal laws and regulations are followed.

Since most of the comments address issues that are required during the implementation process, they will be addressed during the design, permitting, and/or construction phases of this project. It is very helpful to have this comprehensive listing of the State's requirements in your letter and we appreciate your support of this project.

If questions or concerns arise as the project proceeds, please contact David Kriz, Assistant State Conservationist for Water Resource Operations, at David.Kriz@va.usda.gov or by phone at 804-287-1646.

Sincerely,

A handwritten signature in black ink, appearing to read "John A. Bricker".

JOHN A. BRICKER
State Conservationist

APPENDIX B

PROJECT MAPS

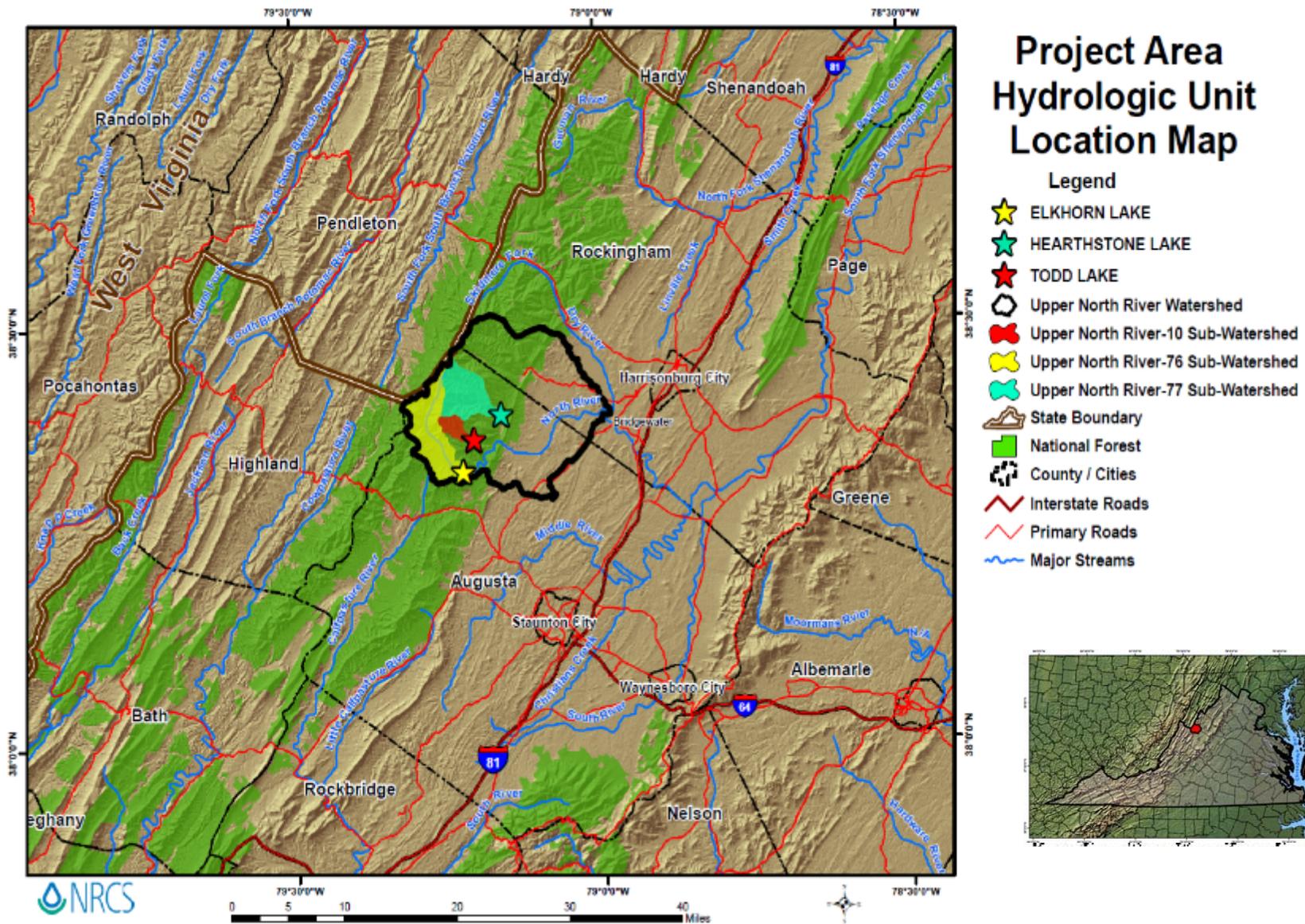


Figure B1. Location map.

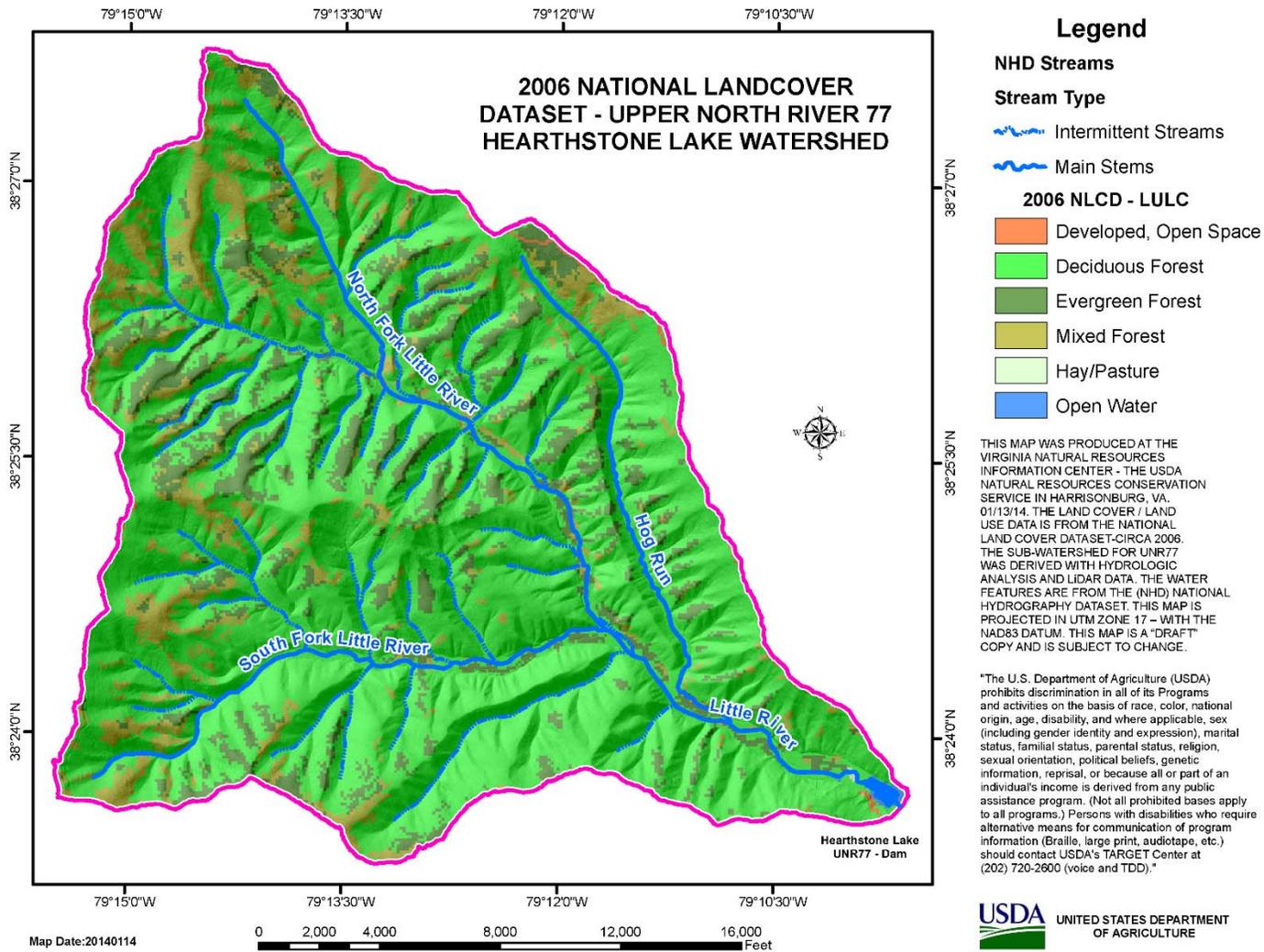


Figure B2. Hearthstone Lake Subwatershed with land use.

APPENDIX C

SUPPORT MAPS

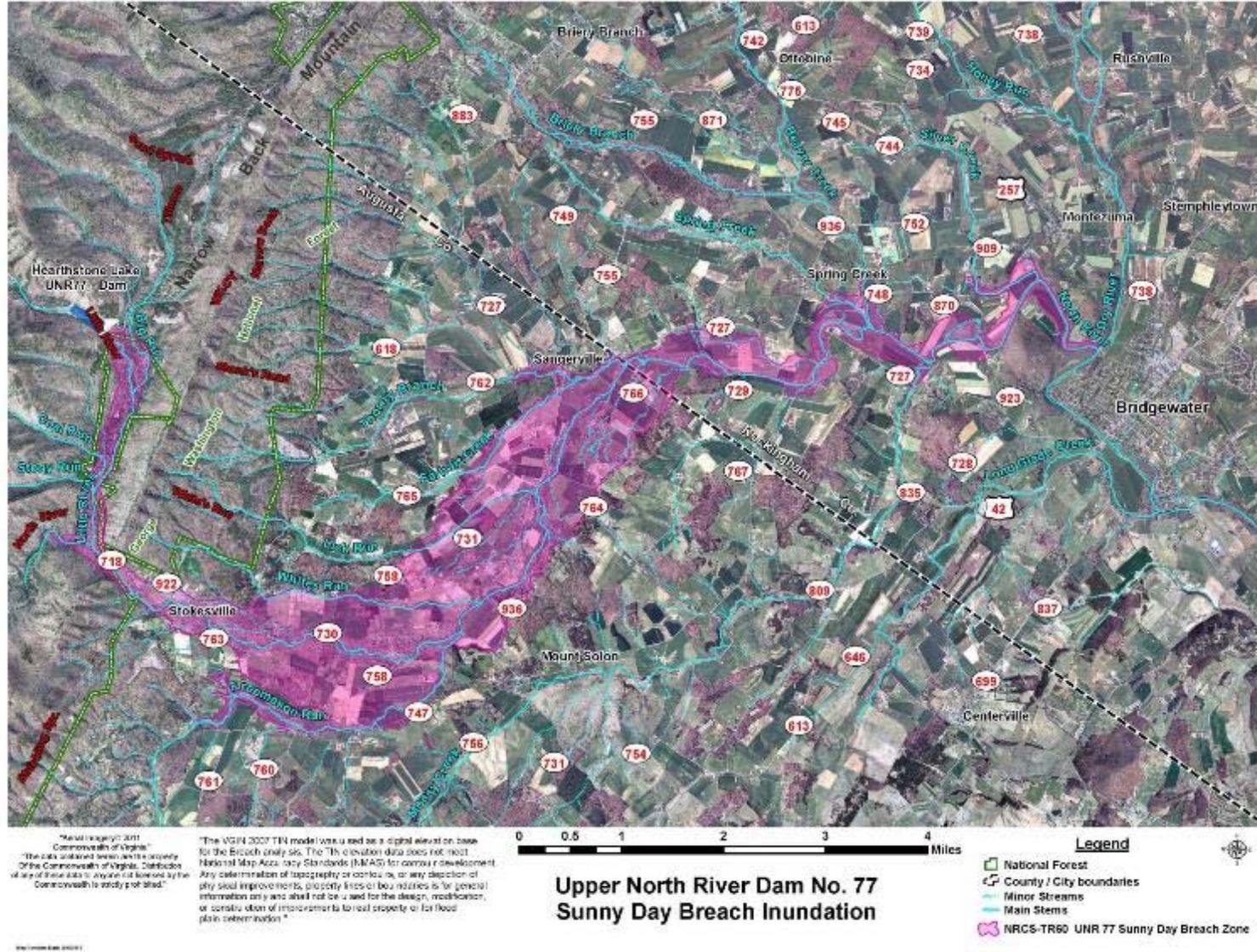


Figure C1. Sunny Day Breach Inundation Map.

Table C1 - Results of a Dam Breach Routing for Hearthstone Lake

Location Description	Drainage Area (sq. mi.)	HEC-HMS model Junctions	HEC-RAS River Station (#)	NRCS TR60 Breach - Peak Discharge (cfs)	NRCS TR60 Breach - Peak Water Surface Elevation (ft)
Hearthstone Lake	16	Hearthstone Lake	197156	241519	1779.5
Confluence of North River and Little River	65	Jct8	184767	209934	1588.2
Town of Stokesville	66	Jct10	179178	185922	1531.5
Upstream of SR 758 (near Mt. Solon)	67	JctL3A	172776	142014	1468.7
Downstream of SR 758 and upstream of SR 731 crossing (near Mt. Solon and includes Freeman Run drainage)	77	JctL3B	158045	101882	1358.6
SR 764 road crossing		JctL4A	149186	68621	1309.8
Augusta and Rockingham County line (Downstream of Sangerville and SR 766)	96	JctL4B	144167	50023	1284.3
Upstream of SR 613/SR 727	101	JctL5A	129804	33373	1239.5
Upstream of the confluence of North River and Briery Branch	105	JctL5B	127642	27170	1229.8
Downstream of confluence of Briery Branch (Does not include Mossy Creek)	155	JctL13	53520	23279	1214.0
At the county boundary at Bridgewater	174	JctL8	39791	23279	1192.8

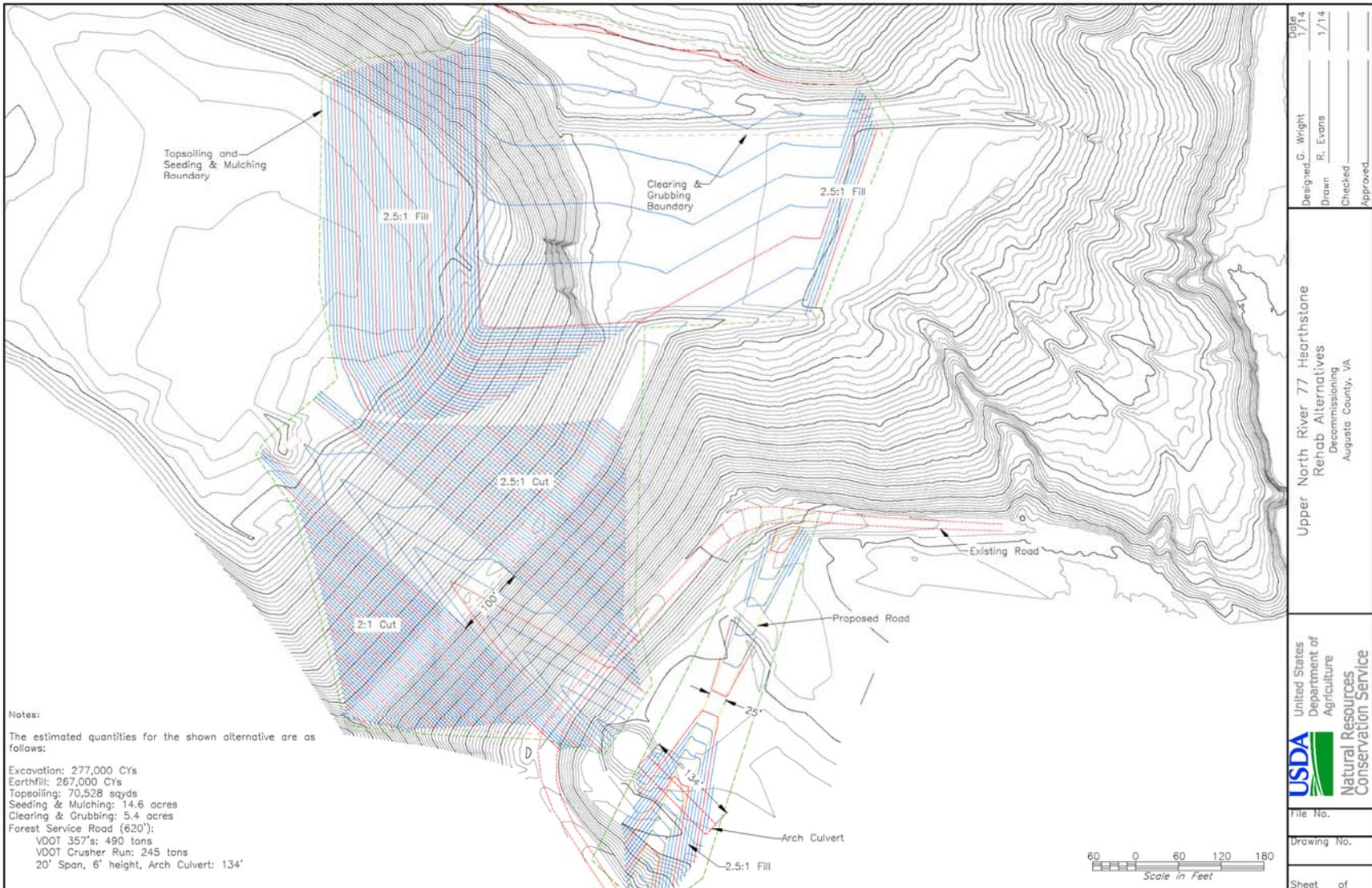


Figure C2. Plan view of site with partial decommissioning of the embankment.

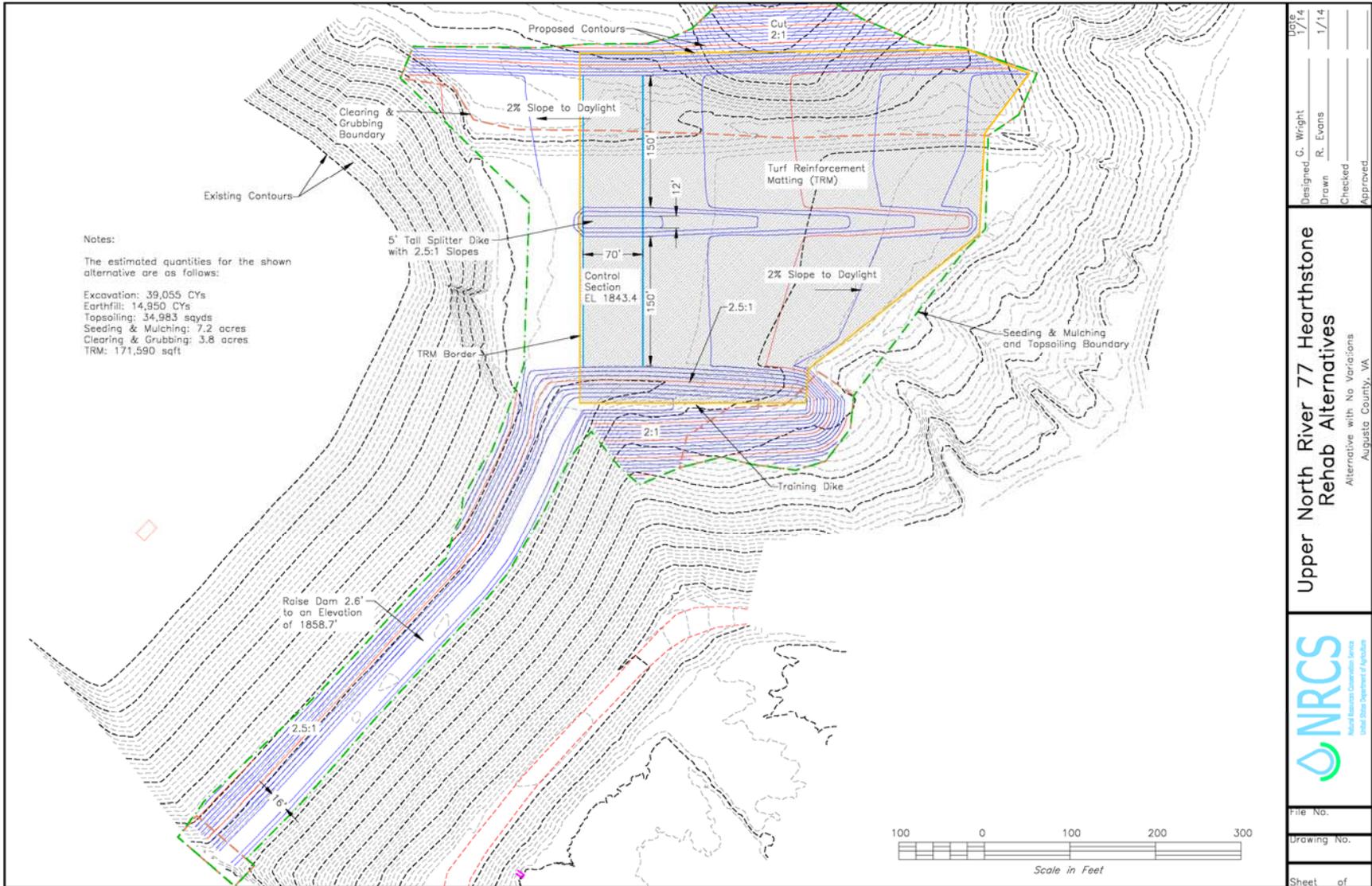


Figure C3. Plan view of Alternative.

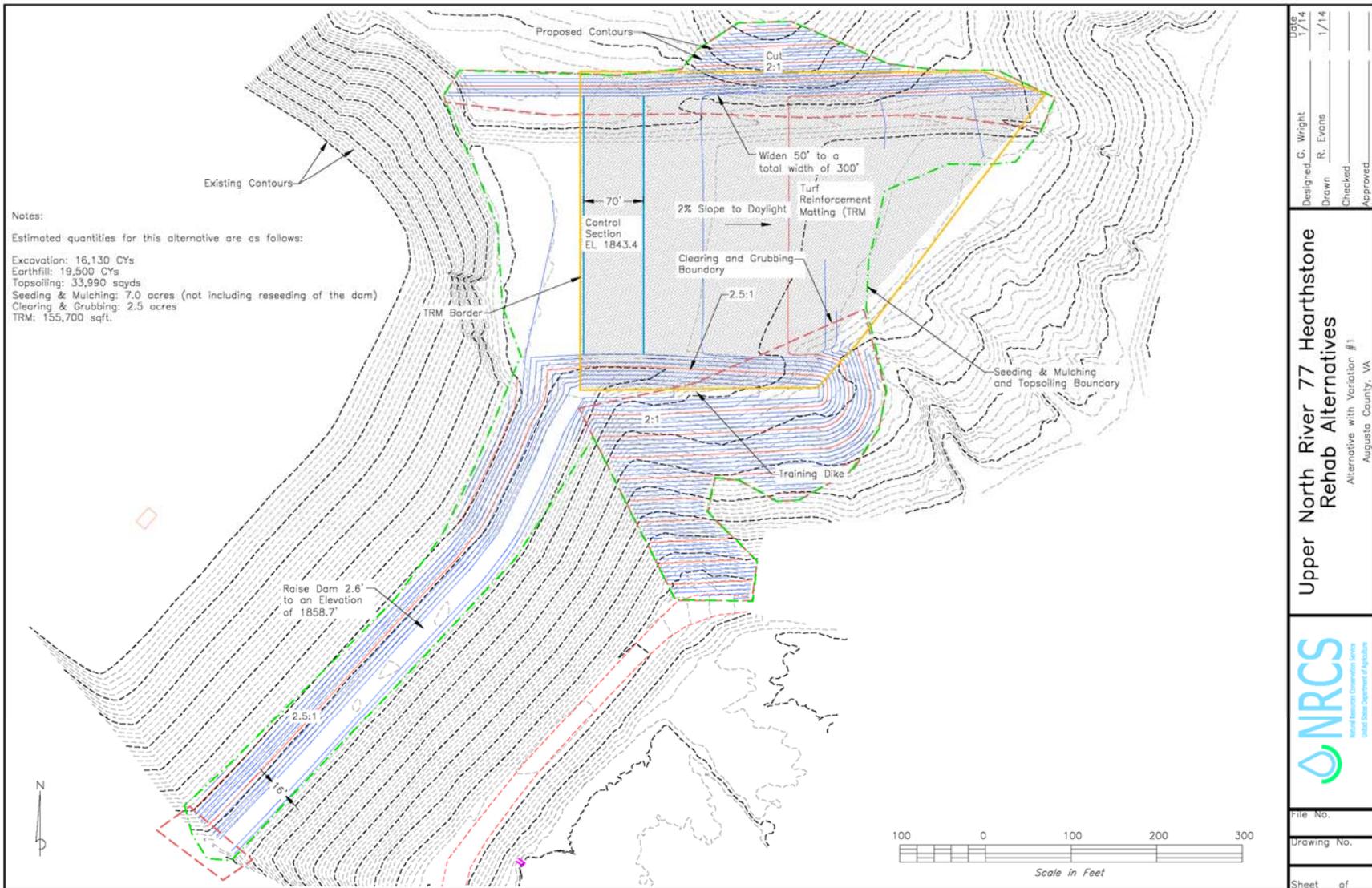


Figure C4. Plan view of Alternative with Variation 1 (no splitter dike).

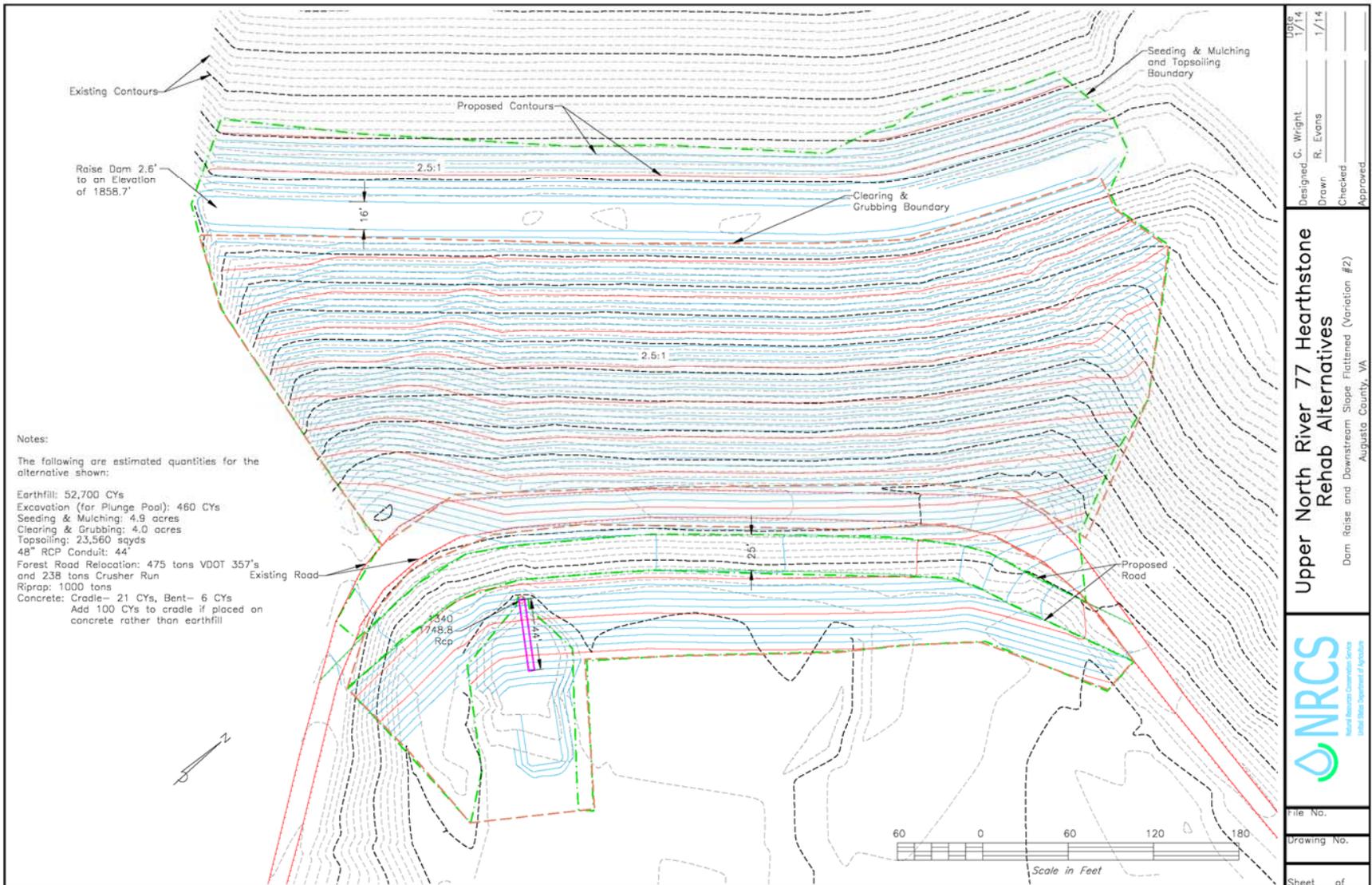


Figure C5. Plan view of Alternative with Variation 2 (with flattening of backslope).

APPENDIX D

INVESTIGATIONS AND ANALYSES REPORT

Investigation and Analysis Used in the Planning for the Rehabilitation of the Upper North River Dam Site No. 77 (Hearthstone Lake)

Threatened and Endangered Species: The U.S. Forest Service agreed to take the lead on investigations and inventories of endangered, threatened, and sensitive (TES) species and other responsibilities per the Endangered Species Act (ESA) and completed a Biological Evaluation (BE) and Biological Assessment (BA) per U.S. Forest Service policy. The U.S. Forest Service conducted database searches, field surveys, interviewed local experts, public scoping, and reviewed known locations of species known to inhabit the George Washington and Jefferson National Forest to investigate potential impacts to any TES. Additional information on methodology used for their TES investigations can be found in the BE/BA in Appendix E.

Cultural Resources, Natural and Scenic Areas, and Visual Resources: The U.S. Forest Service agreed to take the lead on inventories and investigations of cultural resources and other responsibilities per Section 106 of the National Historic Preservation Act. U.S. Forest Service cultural resources staff completed database searches for any known cultural resources and ground surveyed the project area for evidence of archaeological and/or historical resources that had the potential to be impacted in October 2014. Consultation with the Virginia Department of Historic Resources (VDHR) was initiated in November 2014 by the U.S. Forest Service with the submission of a cultural resources reconnaissance report pertaining to the proposed Todd Lake Dam rehabilitation project. On December 8, 2014, the VDHR indicated their concurrence with the U.S. Forest Service's finding of "*no historic properties affected*" for the proposed Todd Lake dam project.

The absence of Natural Heritage Resources, including Natural and Scenic Areas and Visual Resources, was determined by review of the Virginia Department of Conservation & Recreation Natural Heritage Resource Map for Augusta County and through a scoping letter received from the Virginia Department of Conservation & Recreation's Division of Natural Heritage.

Water Quality: Water quality data was taken from the Virginia DEQ 2012 305(b)/303(d) Integrated Water Quality Assessment and Impaired Waters Report.

Wetlands: A wetland investigation for Hearthstone Lake was completed during April 2014. Prior to conducting fieldwork, an off-site evaluation was completed. NRCS consulted the Stokesville USGS 7.5 minute Topographical Quadrangle Map, the National Wetlands Inventory Interactive Mapper (NWI), administered by the U.S. Fish and Wildlife Service, and soil survey information provided by NRCS. The USGS quad map shows a moderately sloping site within the floodplain of Little River. The NWI mapping depicts only the 14 acre open water wetland. Additionally, 7.86 acres of freshwater emergent wetlands were identified at the inflow of the lake. No additional wetlands were identified during the on-site investigation. Fieldwork was conducted using methods as outlined in the *1987 Corps of Engineers Wetland Delineation Manual*.

Forest and Wildlife Resources: Information on the forest and wildlife resources was obtained from field surveys and existing information from the U.S. Forest Service. Field surveys were conducted by U.S. Forest Service staff during the growing season of 2014.

Geology: Reference for this plan: The Geologic Map of Virginia, 1993, compiled by the Commonwealth of Virginia Department of Mines, Minerals, and Energy.

Sediment: NRCS performed the sediment survey in August 2012. Data was collected on a 50-foot grid across the entire surface of the lake. A total station was used to record the sediment depths. The quantity of sediment was determined by generating two surfaces in AutoCAD Civil 3D. The upper surface was defined as the top of the sediment and the lower surface was defined by the as-built cross-sections of the pool area.

It was determined that 73 years of sediment storage was available in 2012. Using a sediment deposition rate of 1.83 acre-feet per year would require about 191.2 acre-feet of sediment storage to provide 100 years of submerged sediment storage in the Hearthstone Lake after construction. As of 2015, there is approximately 134 acre feet of storage capacity remaining. Allowing for construction in 2017, there is a deficit of about 57.2 acre-feet of storage. To get the amount of sediment that would need to be removed to provide 100 years of sediment storage, you multiply the 57.2 acre-feet X 1,613 cubic yards/acre-foot and get 92,320 cubic yards. Using recent sediment removal costs from Fairfax County of \$68.30/cubic yard, the cost for sediment removal without including costs for disposal would be \$6,305,456. This construction option was eliminated from detailed study due to exorbitant cost.

HYDRAULICS AND HYDROLOGY

Background. Hydrologic and hydraulic investigations consisted of the following: an analysis of rainfall runoff relationships of the Hearthstone Lake watershed; an analysis capacity, stability and integrity of the existing dam and auxiliary spillway; and an analysis of a potential breach flood in the downstream floodplain.

Precipitation Data and Hydrologic Data. The 2004 NOAA-14, NOAA Hydrometeorological Report No. 51, and TR-60 precipitation data was used in the evaluation.

Description	Design Hydrograph	Duration (hrs)	Amount (in)	Source
100-year	PSH (rainfall)	1-day	6.67	Atlas 14
100-year	PSH (rainfall)	10-day	9.61	Atlas 14
100-year	PSH (runoff)	1-day	3.25	TR-60
100-year	PSH (runoff)	10-day	6.50	TR-60
ASW Stability (P100 & PMP)	SDH	6	10.45	Atlas 14 & HMR-51
ASW Capacity and Integrity (PMP)	FBH	6	28.0	HMR-51

ASW Capacity and Integrity (PMP)	FBH	24	36.0	HMR-51
----------------------------------	-----	----	------	--------

Land cover was determined from digital land use maps (USDA’s National Land Cover Database 2006). Soil data was generated from digital soil data maps (USDA-NRCS’ Soil Survey Geographic (SSURGO) database for Augusta County and Rockingham County, Virginia). A 2012 mosaic of LiDAR Bare Earth DEMs was used as an elevation base to derive watershed terrain information.

SITES Analysis. The SITES model was used to evaluate the capacity, stability and integrity of the existing structure and the auxiliary spillway alternatives. Geotechnical information was taken from the Timmons report. The NRCS Standard rainfall distribution was used for the 6-hour PMP. This is the dimensionless storm distribution from TR-60, Figure 2-4. The 5-point distribution was used for evaluation of the 24-hour PMP event. The 6-hour storm was found to be the critical duration for the Freeboard Hydrograph (FBH).

The existing flood storage does not meet NRCS capacity criteria. The existing vegetated auxiliary spillway does not meet NRCS stability criteria but does meet NRCS integrity criteria.

The probability of the auxiliary spillway being activated at any given moment is 1/500, or 0.2%.

Water Surface Elevation Modeling and Breach Modeling. The potential impacts to downstream structures and people due to an instantaneous breach of the dam were evaluated to assist the economist with benefit estimates and to verify the hazard class of high. Below is a summary of the analysis.

Previous Studies by Others. The Sponsors have current break inundation zone maps for the dam that complies with the Virginia Impounding Structures Law and Regulations for high hazard dams. The Virginia Impounding Structures Regulations requires owners of high hazard dams to provide a dam break inundation zone map with multiple zones represented to determine hazard classification and develop the Emergency Action Plan (EAP). The spillway design flood for High Hazard dams is the Probable Maximum Flood (PMF), consistent with NRCS Freeboard Hydrograph criteria. The zones for a High Hazard dam include a sunny day dam failure using the volume at the auxiliary spillway crest, a spillway design flood (PMF) without a dam failure, and a dam failure during the spillway design flood (PMF). The break inundation report and maps are sealed by a Virginia professional engineer.

Hearthstone Lake was originally constructed in 1966 for the purpose of protecting downstream lands from flooding. It was designed as a SCS class (c) (high hazard) structure with a 50-year design life. The hazard class of the structure is high because failure may cause loss of life and serious infrastructure damage. The Sponsors have a current EAP on file for the dam that complies with the Virginia Impounding Structures law and regulations and NRCS policy for high hazard dams. The current EAP is dated January 2013.

The break inundation zone analysis and maps were approved by the Virginia Division of Dam Safety in February 2013. The Sponsors provided the hydrologic and hydraulic models to NRCS.

The models and hydraulic data are consistent with NRCS policies and procedures for water surface modeling. These hydraulic models were used for further NRCS breach analysis, described below.

NRCS Breach Inundation Study and Maps – Water at ASW Crest. A sunny day breach analysis was performed in accordance with the peak breach discharge criteria in Technical Release No. 60, Earth Dams and Reservoirs (TR-60). It is assumed that structural collapse would occur instantaneously with the water level at the existing auxiliary spillway crest and result in a release of 2,970 acre-feet of water and sediment, beginning with a wall of water that is 60 feet high. The minimum breach discharge of 241,300 cfs was computed using the criteria in TR-60.

To determine the downstream inundation zone due to the minimum breach discharge, an analysis was performed from the dam downstream on Little River and North River to the Town of Bridgewater and Rockingham County line, more than 30 miles downstream of the dam. The breach analysis terminates 30 miles downstream of the dam, where the flow from the breach would be within the regulated 100-year floodplain.

The computer models HEC-HMS and HEC-RAS (steady flow) were used to determine the inundation zone due to the breach of the dam. The HEC-HMS rainfall-runoff model was used to route the minimum breach discharge through the existing structures and the downstream floodplain using reservoir and Muskingham-Crunge stream routing procedures. The peak flows at critical junctions, such as confluences and road crossings, were estimated and included in the HEC-RAS models.

The HEC-RAS (steady flow) water surface model developed by others and approved by the Virginia Division of Dam Safety was modified to model the TR-60 minimum breach discharge within the downstream floodplain. The breach inundation zone map was created in ArcGIS using the HEC-GeoRAS extension and using current aerial photography (VGIN 2011). The downstream structures and roads within the breach inundation zone are shown on the photography.

Identification of PAR and Impacted Structures. All of the structures in the potential breach impact zone of Hearthstone Lake were identified using GIS information provided by Augusta and Rockingham Counties. This was determined by overlaying the Sunny day breach inundation zone and the Augusta and Rockingham real estate data. This data includes current land ownership and description of associated improvements. This data includes single family dwellings, multiple family dwellings, businesses, gas stations, churches, recreational areas, and government infrastructure.

Once the type of structure was identified, the number of people that are reasonably expected in the breach inundation zone was estimated using Virginia NRCS references ACER11 and state laws and regulations. The table below describes the population at risk per structure type and the number of structures in the Sunny day breach inundation zone.

Structure	PAR (Population at Risk)	No. of Structures in the Sunny day breach inundation zone
-----------	--------------------------------	--

Business	4	8
Church	1	3
Club	1	2
Mobile Home	2.5	28
Modular Home	2.5	7
Recreational	2.5	30 ^{1/}
Single Family	2.5	188
Multi Family	10	2

^{1/} Camp May Flather has multiple buildings in the Girl Scout Camp but the camp was evaluated as a single site.

Within the NRCS Sunny day breach inundation zone, the population at risk is 630.

SOCIAL AND ECONOMIC CONDITIONS

Sources for the data included in the social and economic conditions section of this supplement include the U.S. Census Bureau, Department of Commerce, 2010 Census, and 2009-2013 Census projections.

Economic Analysis: The NRCS National Watershed Manual was used as a reference for the economic analysis along with two economic analysis guidance documents: “Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G), December, 1983, and the “Economics Handbook, Part II for Water Resources”, USDA/Natural Resources Conservation Service, July, 1998. These guidance documents were used to evaluate potential flood damages, and estimate project benefits and associated costs. P&G was 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. The basic objective of P&G is to determine whether or not benefits from project actions exceed project costs. P&G also allows for abbreviated procedures to be used (Section 1.7.2 (a) (4) (ii)), when more detailed analysis will not alter identification of the recommended National Economic Development alternative. In this case, the future without federal project and the future with federal project involve the same least-cost alternative with comparable scope, effects, benefits and costs. Therefore, no net change in benefits occurs when comparing the two candidate plans to each other.

Assessed values for all homes and other properties within the breach inundation zone were obtained from local government sources within the watershed and used to estimate damages from a possible catastrophic breach. Estimated flood damages were based on the results of the hydrology and hydraulics (H&H) simulation modeling indicating that a maximum peak discharge average depth of 3ft. would be experienced outside of the stream channel should a breach event occur. This assumed depth of flood water data was then used with water depth to damage functions developed by the Federal Emergency Management Agency (FEMA) to estimate structural damages. Content values were then estimated as a function of assessed property values.

All costs of installation, operation and maintenance were based on 2014 prices. The costs of associated with designing and implementing all structural measures were assumed to be implemented over a two-year installation period (1 year for design and 1 year for construction)

and to have a 68-year useful life. Thus, a 70 year period of analysis was used along with the mandated 3.375% discount rate for all federal water resource projects for FY15 to discount and amortize the anticipated streams of costs and benefits.

Extending the expected useful life of the project to 100-years would require dredging to establish sufficient sediment pool storage capacity. Such an action would entail significant added costs, but no added benefits. Therefore, such an alternative was considered, but not developed in detail.

APPENDIX E

OTHER SUPPORTING INFORMATION

**Biological Evaluation/Biological Assessment
for
Threatened, Endangered, and Sensitive (TES) Species**

Hearthstone Lake Rehab

**North River Ranger District
George Washington and Jefferson National Forests
Augusta County, Virginia**

Introduction

Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation (BE) and/or biological assessment (BA) for all Forest Service planned, funded, executed, or permitted programs and activities. The objectives of this BE/BA are to: 1) ensure that Forest Service actions do not contribute to trends toward federal listing, 2) comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of federally listed species, and 3) provide a process and standard to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process.

The North River Ranger District supports known occurrences and suitable habitat for several TES species, all of which were considered in this analysis. This BE/BA documents the analysis of potential effects of the proposed project to TES species and associated habitat. It also serves as biological input into the environmental analysis for project-level decision making to ensure compliance with the ESA, National Environmental Policy Act (NEPA), and National Forest Management Act (NFMA).

Proposed Management Action

The proposed project is to rehabilitate Hearthstone Dam so that it is compliance with State regulations. Currently, the dam's auxiliary spillway does not have sufficient capacity and could allow the dam to be overtopped. Also, the vegetated earthen spillway does not have the stability to pass very large flows without eroding. To address this, the auxiliary spillway needs to be enlarged. In addition, the downstream slope of the embankment needs to be flattened for safe mowing operations.

The project was designed knowing the area is potential habitat for the Indiana bat and the Northern long-eared bat. The USFS Forest Plan standards for bat management will be followed.

Project Area and Cumulative Effects Analysis Area

The geographic scope of this biological analysis for terrestrial plants and animals is the project area. The geographic scope of the analysis for the Indiana bat is the entire George Washington and Jefferson National Forests (GWJNF). The Northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species' range includes 37 states. With regard to aquatic T&E species, this project does not lie in a 6th level HUC

watershed included in the “Federally Listed Endangered and Threatened Mussel and Fish Conservation Plan”.

This project area is comprised primarily of the oak forests and woodlands and pine forest and woodlands ecosystems, and areas that have been converted to grasses and forbs.

Future Actions

The agency knows of no specific activities planned on private land in the Hearthstone Lake watershed. Activities on private land within this watershed are expected to remain the same as current for the next 10 years. Other than the proposed actions described, there are no foreseeable future projects planned on National Forest System (NFS) land within the project area that may have an effect on terrestrial or aquatic plants and animals.

Species Reviewed

Federally listed threatened and endangered species, species proposed for federal listing and Southern Region sensitive species (TES) that may potentially be affected by this project were examined using the following existing available information:

1. Reviewing the list of TES plant and animal species known or likely to occur on the George Washington and Jefferson National Forests, and their habitat preferences. This review included the U.S. Fish and Wildlife Service current list of endangered, threatened, and proposed species for the Forest, dated January 17, 2003, and the August 7, 2001 Southern Region Sensitive Species list, revised for known or possible Forest occurrences on March 1, 2004 (list attached as Appendix A) with Forest-specific updates current as of March 1, 2004.
2. Consulting element occurrence records (EOR's) for TES species as maintained by the Virginia Division of Natural Heritage (VDNH), and supplied to the Forest.
3. Consulting species information, including county occurrence records, as maintained in the online database (<http://www.vafwis.org/wis/asp/default.asp>) titled Virginia Fish and Wildlife Information Service (VAFWIS) of the Virginia Department of Game and Inland Fisheries (VDGIF).
4. Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.
5. Reviewing sources listed in the reference portion of this report.
6. Reviewing the results of past field surveys that may have been conducted in the area.

Most TES species known to occur on the Forest have unique habitat requirements, such as shale barrens, rock outcrops, bogs, caves, and natural ponds. Information gathered, analyzed, and presented in the Southern Appalachian Assessment dated July 1996 states that approximately 84% of threatened and endangered species and 74% of sensitive species are associated with rare or unique habitats, often referred to as rare communities.

Through cooperative agreements between the Forest and VDNH, Special Biological Areas have been identified and delineated on the Forest. These include rare and significant natural communities and vegetative types along with the rare species they support. These areas reflect current knowledge on the location, management, and protection needs of rare species and associated significant natural communities on the Forest. These areas are identified in the George Washington Forest Plan as Special Interest Areas/Research Natural Areas (Management Area 4)

and in a supplemental report from VDNH, dated July 2000 (Wilson, 2000), that identifies additional areas (called Conservation Sites by VDNH) for consideration as Special Biological Areas (SBAs). The Plan and these Special Biological Area reports were reviewed as part of this analysis. As a result of this review, no Special Biological Areas occur adjacent to the project area.

The need to conduct site-specific surveys of TES species for this project was assessed using direction in Forest Service Manual Supplement R8-2600-2002-2. Based on this assessment, affected potential habitat in the project area was surveyed for TES species. Appendix A of this document lists all 191 TES species currently known, or expected to occur, on or near the George Washington and Jefferson National Forests. All species on the list were considered during the analysis for this project.

A “step down” process was followed to eliminate species from future analysis and focus on those species that may be affected by proposed project activities. Species not eliminated are then analyzed in greater detail. Results of the “step down” analysis process are displayed in the Occurrence Analysis Results (OAR) column of the table in Appendix A. First, the range of a species was considered. Species’ ranges on the Forest are based on county records contained in such documents as the Atlas of the Virginia Flora, but are refined further when additional information is available, such as more recent occurrences documented in scientific literature or in Natural Heritage databases. Many times range information clearly indicates a species will not occur in the project area due to the restricted geographic distribution of most TES species. When the project area is outside a known species range, that species is eliminated from further consideration by being coded as OAR code “1” in the Appendix A table. For this project, 140 species were eliminated from future consideration because the project area is not within the species known range.

For the remaining species, after this first step, a field survey was conducted to determine if suitable habitat or the species were present in the project area.

Field Survey and Results

Since some species could not be eliminated from further consideration based on known range, and because there were no existing field surveys in the project area, a field survey was necessary to determine the presence or absence of TES species and/or habitats. Mike Donahue, Biological Technician field inspected the project area on June 3, 2014, and Mike Donahue and Fred Huber, Forest Botanist, examined the area on August 20, 2014.

The field survey did not sample every acre, but was distributed throughout all habitat types found in the project area. The survey method consisted of walking through the project area searching for different habitat types and TES species occurrences. The plant survey utilized a meander search methodologies (Goff, Dawson, and Rochow, 1982) in which new habitat variations or unique areas are constantly being searched for in order to maximize floristic variation. The animal survey consisted of searching for individuals, signs of their presence (such as scat, tracks, calls, or nests), and/or potential habitat. The survey intensity was concentrated on potential sites of greatest ground disturbance.

From the field survey, species were eliminated from further consideration because of: a) Lack of suitable habitat in the project area (OAR code “2”); b) Habitat present and the species was searched for, but was not found (OAR code “3”); c) Species occurs in project area, but outside actual area of activity where ground disturbance will occur (OAR code “4”); and d) Aquatic species or habitat

known or suspected downstream of project or activity area but outside of identified geographic bounds of water resource cumulative effects analysis area (defined as point below which sediment amounts are immeasurable and insignificant) (OAR code “7”). The results of the field survey(s) are documented in the Appendix A table. For this project, 48 species were eliminated from further consideration because of one of the above reasons.

Species Identified as Being in the Action Area or Potentially Affected by the Action:

From the field survey, those species which are analyzed and discussed further in this document are those that either: a) Field survey located species in the activity areas (OAR code “5”); b) Species not seen during the survey(s), but possibly occur in the activity area based on habitat observed during the survey(s) or field survey was not conducted when species is recognized (OAR code “6”); c) Aquatic species, known or suspected downstream of project or activity area and within identified geographic bounds of water resource cumulative effects analysis area (OAR code “8”); or d) Federally listed mussel and/or fish species know in 6th level watershed of project area. Conservation measures from USFS/FS Conservation Plan applied (OAR code “9”).

As a result of this process, the following three species are potentially affected by the Proposed Action:

<u>OAR Code</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Taxa</u>	<u>TES</u>
6	<i>Myotis septentrionalis</i>	Northern long-eared bat	Mammal	Proposed Endangered
6	<i>Myotis sodalis</i>	Indiana Bat	Mammal	Endangered
6	<i>Monotropis odorata</i>	Sweet pinesap	Vascular Plant	Sensitive

Other than potential habitat for these ten species no other TES species or potential habitats that may support TES species were found during the survey and fieldwork.

Effects of Proposed Management Action on Each Identified Species

The analysis of possible effects to species identified as known or expected to occur in the vicinity of the proposed project, or likely to be affected by the action includes the following existing information:

1. Data on species/habitat relationships.
2. Species range distribution.
3. Occurrences developed from past field surveys or field observations.
4. The amount, condition, and distribution of suitable habitat.

Effects to Species Listed or Proposed for Listing Under the Endangered Species Act

Effects to the Indiana Bat:

Effects to the federally endangered Indiana Bat (*Myotis sodalis*) were considered in this BE/BA because it is assumed the entire Forest is potential habitat for this species. See USFWS’s Biological Opinion (BO) of September 16, 1997 and this agency’s Environmental

Assessment/Decision Notice of March 12, 1998 for the “Proposed Forest Plan Amendment for Management of the Federally Endangered Indiana Bat”, herein referred to as the Bat Amendment EA (GW Amendment #6).

During past and recent surveys, no Indiana bats were seen in this part of the Forest even though potential habitat (mature forests with trees having exfoliating bark) exists across the entire Massanutten Mountain area. The project area contains tree species of the size and type known to be used by the Indiana bat. Based upon professional judgment and known cave surveys, there are no caves with winter microclimate habitat conditions suitable for Indiana bats in the project area and the area is not within either the primary or secondary cave protection areas surrounding known hibernacula. The nearest cave with Indiana bat use documented is approximately 50 miles west in Pendleton County, WV.

During this project the immediate removal of hardwood trees greater than 9” dbh is very unlikely, but if it did occur it would result in some very minor loss of potential Indiana bat roost trees, and indirectly the potential, but very unlikely, loss of individual bats. Shagbark hickory and old snags with exfoliating bark along with large hollow cavity trees will not likely be affected.

This project-level analysis has tiered to the George Washington National Forest’s Revised Forest Plan and Final Environmental Impact Statement (FEIS) as amended by the Bat Amendment EA. This project-level analysis includes, and is in addition to the entire Indiana bat effects analysis (pages 15 through 44) documented in the Bat amendment EA. Because of its length, the Bat Amendment EA’s discussion is not repeated here. However, findings of that analysis concluded that individual bats might be killed or harmed by such activities as associated with this project. Yet the U. S. Fish and Wildlife Service have determined that such take, within authorized levels, would be incidental take, and would not result in jeopardy to the Indiana bat. The acres to be impacted, 28 acres of non-native pine removal, as proposed in this project are 0.6% of the 4,500 acres allowed to be altered annually under the incidental take provisions of the Indiana bat Biological Opinion.

In implementing this project, apply on the ground Forest-wide protection and project monitoring standards #314 to #326 (inclusive), Revised Plan replacement pages 3-160 to 3-162 (equates to #13 to #25 of GW Plan Amendment #6 attached to DN).

There is potential unoccupied habitat for the Indiana bat within the project area, but with implementation of measures described in the BO under the Terms and Conditions section of the Incidental Take Statement, there will be no cumulative effects.

The U. S. Fish and Wildlife Service supported the determination for the Indiana bat as follows: In the September 16, 1997 U. S. Fish and Wildlife Service’s Biological Opinion concerning the Indiana bat on the Forest the following conclusion was reached, “After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of forest management and other activities on the GWJNFs, the Indiana Bat Recovery Strategy presented in the GWJNFs biological assessment, and the cumulative effects, it is the Service’s biological opinion that forest management and other activities authorized, funded, or carried out on the GWJNFs, are not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for this species has been designated in Kentucky, Tennessee, Illinois, Missouri, and West Virginia. However, this action does not affect those areas and no destruction or adverse modification of that critical habitat will occur as a result of GWJNFs management activities”. There are no foreseeable activities in the

area that would directly affect the Indiana bat. Therefore, there will be no cumulative effects to the Indiana bat.

Effects to the Northern long-eared Bat

This species was considered because it has been recorded as occurring throughout Virginia. It is currently proposed for listing under the Endangered Species Act mainly because of population declines caused by White Nose Syndrome (WNS). The range of the Northern long-eared bat includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. Northern long-eared bats spend winter hibernating in caves and mines. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible. During summer, Northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. Breeding begins in late summer or early fall when males begin swarming near hibernacula. After copulation, females store sperm during hibernation until spring, when they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Adult Northern long-eared bats can live up to 19 years. Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation. This bat also feeds by gleaning motionless insects from vegetation and water surfaces (USFWS Fact Sheet 2013).

The USFWS 12-month Listing Package for the Northern long-eared bat (78 Federal Register 191) states: "Predominantly due to the emergence of WNS, the Northern long-eared bat has experienced a severe and rapid decline in the Northeast, estimated at approximately 99 percent (from hibernacula data) since the disease was first discovered there in 2007. Summer survey data in the Northeast have confirmed rates of decline observed in Northern long-eared bat hibernacula data post-WNS, with rates of decline ranging from 93 to 98 percent. This disease is considered the prevailing threat to the species, as there is currently no known cure" (Federal Register 10/02/2013, 78 FR 61045 61080). In response to the WNS threat the Forest has closed all caves and mines to public use per an annually renewed Southern Region closure order that began May 21, 2009, to reduce the potential for WNS to be spread via human use of caves. Caves on the Forest that are currently gated will remain closed with gates locked year-round.

The 12-month listing also identifies prescribed burning, timber harvest, and other forest management as activities that alone do not have significant effects, but which cumulatively with

the effects of WNS, may further impact the Northern long-eared bat. Literature cited in the 12-month listing and other recently published research (Johnson et al. 2009) shows that the Northern long-eared bat responds favorably to vegetation practices that provide a range of successional stages in the forest. This response is reflected in the range of tree species preferred for day roosts where the Northern long-eared bat prefers black locust and sassafras snags and live trees with cavities (these trees are both early successional, shade intolerant species which require disturbance and open conditions to regenerate and become suppressed in the understory as forest canopies age and close with the lack of disturbances such as fire). There is also considerable evidence which shows female Northern long-eared bats choose day roosts that have increased solar radiation and are often along edges of gaps and openings in the forest canopy. Recent studies of Northern long-eared bat home range and habitat use analysis indicate Northern long-eared bat selects forest stands for foraging which have been partially harvested more so than un-cut or open areas such as fields and along road corridors. This indicates that Northern long-eared bat favors a structurally complex mosaic of closed and open forest canopy gap conditions across the landscape.

The George Washington Forest Plan and the Jefferson Forest Plan contain management direction for the protection of caves and bats. Both of these plans require that the majority of the forest remain in mature forest (stand ages greater than 70 years) and both have objectives to create early successional habitat through vegetation management to create a diversity of structure in the forest. In addition, both promote potential summer roost trees during timber harvest with requirements to protect trees such as shagbark hickory with furrowed and exfoliating bark and to leave most existing snags or cavity trees.

Effects to Sensitive Species

Sweet Pinesap:

Effects to sweet pinesap (*Monotropsis odorata*) were considered in this BE/BA because the species is known to occur in Page County and potential habitat occurs in the project area, however none were observed during field surveys. This species is known to occur in at least 20 Virginia counties and ranges from Maryland to Kentucky south to Florida. It is possible that individuals of this species may have been inadvertently missed during field surveys and past field work in the area. Sweet pinesap typically grows in well drained, dry to mesic, acidic soil in oak-heath woodlands, often with white pine and rhododendron. It flowers very early in the year (February to early April) and has been seen flowering when snow is on the ground. It is often overlooked since it grows well hidden under the leaf litter and is usually found by smell since it is quite fragrant. Historically, fires often burn in this vegetation type and fire may benefit the species by releasing nutrients and thinning understory vegetation. Since this plant flowers so early it's probable that it will have flowered by the time the prescribed burn is implemented. If not, then plants would be top killed in the leaf litter but should resprout from the root mass which is under the moist duff at the soil-leaf litter interface.

Determination of Effect

For the Indiana bat this project will be in compliance with the BO issued by the USFWS on September 16, 1997 and therefore constitutes compliance with ESA Section 7 requirements. Since implementation of this project will be in compliance with, and tiers to, the BO that was issued as a result of formal consultation and it provides both specific Plan and project level direction, plus no new information has been identified as of this date, a finding of the effect to the Indiana bat for this proposed project is: "no affect, beyond that which is already disclosed in the Biological

Assessment on Indiana bats dated April 30, 1997 and by the USFWS in the BO of September 16, 1997.” Therefore, given the project level analysis for the Indiana bat and the authorized level of incidental take, further Section 7 consultation is not necessary for the Indiana bat.

For the Northern long-eared bat, based on the positive action of closing caves and mines, the habitat objectives to maintain a variety of successional classes within a matrix of a predominantly mature forest structure, and the current standards put in place to protect cave and karst locations along with specific management standards for the Indiana bat, we do not believe there is any likelihood that the management activities implemented during the next year will jeopardize the continued existence of the Northern long-eared bat. In addition, since we are going through informal consultation on any projects that may affect the Indiana bat, the US Fish and Wildlife Service will be examining all projects that may affect the Northern long-eared bat, should something be proposed that is different than our standard practices.

Because there are no other T&E species or associated habitat present, the proposed project will have no effect on any other federally listed or proposed species.

For the sweet pinesap there will be no negative impact that would cause a loss of species viability on the Forest or cause a trend towards federal listing under the ESA.

Because there were no other sensitive species (other than the nine already addressed) or habitat present, the project will have no impact to any Southern Region sensitive species.

Persons Consulted:

Steve Croy – Forest Ecologist

Prepared by:

/s/ Fred Huber

FRED HUBER
Forest Botanist

Date: October 24, 2014

Attachments: References
Appendix A – Forest TES List

References

Belden, A. Jr., J.C. Ludwig, and N.E. VanAlstine. 1999. An Inventory of Shale Barrens on the George Washington and Jefferson National Forests in Virginia. Third Edition. Natural Heritage Technical Report 99-2. VDCR-DNH, Richmond, VA. 64 pp. + appendices.

Erdle, S.Y. and C. Hobson. 2001. Current Status and Conservation Strategy for the Eastern Small-footed Myotis (*Myotis leibii*). Technical Report #00-19. Virginia Department of Conservation and Recreation – Division of Natural Heritage. October 2001. 17pp + appendices.

Fleming, G.P. 1999. Plant Communities of Limestone, Dolomite, and Other Calcareous Substrates in the George Washington and Jefferson National Forests, Virginia. Natural Heritage Technical Report 99-4. VDCR-DNH, Richmond, VA. 218 pp. + appendices.

Fleming, G.P., P.P. Coulling, D.P. Walton, K.M. McCoy, and M.R. Parrish. 2001. The Natural Communities of Virginia: Classification of Ecological Community Groups - First Approximation. Natural Heritage Technical Report 01-1. VDCR-DNH, Richmond, VA. January 2001. 76 pp.

Fleming, G.P. and P.P. Coulling. 2001. Ecological Communities of the George Washington and Jefferson National Forests, Virginia: Preliminary Classification and Description of Vegetation Types. Natural Heritage Technical Report 01-14. VDCR-DNH, Richmond, VA. 372 pp.

Goff, G. F., G. A. Dawson, and J. J. Rochow. 1982. Site Examination for Threatened and Endangered Plant Species. Environmental Management, Vol. 6, No. 4, pp. 307-316.

Harvill, A. M., Jr., et al. 1992. Atlas of the Virginia Flora. Third Edition. Burkeville, Virginia: Virginia Botanical Association.

Kain, Teta, editor. 1987. Virginia's Birdlife - An Annotated Checklist. Virginia Avifauna Number 3. The Virginia Society of Ornithology.

Johnson, J.B., et al. 2009. Roost tree selection by northern myotis (*Myotis septentrionalis*) maternity colonies following prescribed fire in a Central Appalachian Mountains hardwood forest. Forest Ecology and Management 258: 233-242.

Linzey, D. W., ed. 1979. Endangered and Threatened Plants and Animals of Virginia. Blacksburg: Center for Environmental Studies, Virginia Polytechnic Institute and State University.

Linzey, D. W. 1998. Mammals of Virginia. The McDonald and Woodward Publishing Company. Blacksburg, VA.

NatureServe. 2004 NatureServe Explorer: An online encyclopedia of life [web application]. 2004. Version 1.8. Arlington, Virginia, USA: NatureServe. Available: <http://www.natureserve.org/explorer>.

Patrick, J., J. Evans, and J. D. Helvey. 1984. Summary of sediment yield data from forest land in the U. S. Journal of Forestry, Vol. 82, No. 2, pp. 101-104.

- Roble, S.M. 2000. Spring Amphipods of the George Washington and Jefferson National Forests, Virginia. Natural Heritage Technical Report 00-13. VDCR-DNH, Richmond, VA. 16 pp. + appendices.
- Roble, S. M. 2013. Natural Heritage Resources of Virginia: Rare Animal Species. Natural Heritage Technical Report 13-05. VDCR-DNH, Richmond, VA. 46 pp.
- Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5. Atlanta: U. S. Department of Agriculture, Forest Service, Southern Region.
- Strausbaugh, P. D., and E. L. Core. 1978. Flora of West Virginia. Second edition. Grantsville, West Virginia: Seneca Books.
- Terwilliger, Karen (coordinator). 1991. Virginia's Endangered Species: Proceedings of a Symposium. Department of Game and Inland Fisheries. McDonald and Woodward Publishing Company. Blacksburg, Virginia. 672 pp.
- Townsend, John F. 2014. Natural Heritage Resources of Virginia: Rare Plants. Natural Heritage Technical Report 14-02. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. Unpublished report. February 2014. 58 pp + appendices.
- 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern long-eared Bat as Endangered or Threatened Species; Listing the Northern long-eared Bat as an Endangered Species; Proposed Rule. 78 Federal Register 191 (2 October 2013) pp. 61046-61080.
- SAMAB. 1996. The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5. U.S.D.A. Forest Service, Southern Region., Atlanta, GA.
- U.S.D.A. Forest Service. 1993. Final Revised Land and Resource Management Plan, George Washington National Forest. Harrisonburg, Virginia.
- U.S.D.I. Fish and Wildlife Service in Cooperation with the Indiana Bat Recovery Team. 1983. Recovery Plan for the Indiana Bat. U. S. Fish and Wildlife Service, Twin Cities, Minnesota. 82 pp.
- U.S.D.I. Fish and Wildlife Service. 1996. Draft Revised Recovery Plan for the Indiana Bat. U.S.D.I. Fish and Wildlife Service, Washington, DC.
- U.S.D.I. Fish and Wildlife Service. 2013. Northern long-eared bat fact sheet. Midwest Region. Virginia Department of Game and Inland Fisheries. 2004. The Virginia Fish and Wildlife Information Service. Website: www.vafwis.org/BOVA
- Weakley, A.S., J.C. Ludwig, and J.F. Townsend. 2012. Flora of Virginia, Bland Crowder, editor. BRIT Press, Botanical Research Institute of Texas, Fort Worth, TX. 1554 pp.
- Wilson, I.T. 2000. Biological Diversity Protection on the George Washington National Forest, First Supplement. Natural Heritage Technical Report 00-10. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report submitted to the USDA Forest Service. 89 pp plus maps.

APPENDIX A
Documentation of Threatened, Endangered or Sensitive Species Occurrences for
Hearthstone Lake Rehab
Coding for Occurrence Analysis Results (OAR) for 191 species

Forest updated February 24, 2014 (based on Region 8 sensitive species list effective January 1, 2002)

OAR	GW	J	Species Name	Common Name	Range on or near GWJNFs	Habitat - Detail	TES	GRank	VA SRank	WV SRank
VERTEBRATE										
Fish										
1	-	X	<i>Ammocrypta clara</i>	Western sand darter	Clinch R, Powell R	Aquatic-rivers	S	G3	S1	-
1	-	X	<i>Cottus baileyi</i>	Black sculpin	Little R, Upper Clinch R, S Fk Holston R	Aquatic-streams	S	G4Q	S2	-
1	-	X	<i>Erimonax monachus</i>	Spotfin chub	Lower N Fk Holston R	Aquatic-streams	T	G2	S1	-
1	-	X	<i>Erimystax cahni</i>	Slender chub	Two sites - Powell R, Lee Co	Aquatic-rivers	T	G1	S1	-
1	-	X	<i>Etheostoma acuticeps</i>	Sharphead darter	S and Middle Fk Holston R	Aquatic-rivers	S	G3	S1	-
1	-	X	<i>Etheostoma susanae</i>	Cumberland Johnny darter	Endemic to Upper Cumberland R watershed near VA	Aquatic-streams	PE	G2	S1 (KY)	-
1	-	X	<i>Etheostoma osburni</i>	Candy darter	Big Stony Ck, Laurel Fork in New R watershed	Aquatic-streams	S	G3	S1	S2
1	-	X	<i>Etheostoma percunrum</i>	Duskytail darter	Copper Ck, Clinch R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Etheostoma tippecanoe</i>	Tippecanoe darter	Four sites Clinch R, lower Copper Ck	Aquatic-rivers	S	G2	S1	S2
1	-	X	<i>Icthyomyzon greeleyi</i>	Mountain brook lamprey	M, N Fk Holston R, Copper Ck, Indian Ck, Clinch R, Powell R	Aquatic-rivers	S	G3G4	S2	S1
1	-	X	<i>Notropis ariommus</i>	Popeye shiner	N Fk Holston R, Clinch R, Powell R	Aquatic-rivers	S	G3	S2S3	S2
1	X	X	<i>Notropis semperasper</i>	Roughhead shiner	Upper James R watershed above Buchanan	Aquatic-rivers	S	G2G3	S2S3	-
1	-	X	<i>Noturus flavipinnis</i>	Yellowfin madtom	Lower & Mid reaches of Copper Ck, Powell R	Aquatic-streams	T	G1	S1	-
1	X	X	<i>Noturus gilberti</i>	Orangefin madtom	S Fk Roanoke R watershed, Roanoke R above Salem, Craig Ck, Johns Ck, Cowpasture R	Aquatic-streams	S	G2	S2	-
1	-	X	<i>Percina burtoni</i>	Blotchside logperch	N Fk Holston R, Clinch R, Copper Ck, Little R	Aquatic-rivers	S	G2G3	S1	-
1	-	X	<i>Percina williamsi</i>	Sickle darter	N Fk Holston R above Saltville, lower Copper Ck	Aquatic-rivers	S	G3	S1S2	S2
1	-	X	<i>Percina rex</i>	Roanoke logperch	Upper Roanoke R watershed	Aquatic-rivers	E	G1G2	S1S2	-
1	-	X	<i>Phenacobius crassilabrum</i>	Fatlips minnow	Unimpounded lower S Fk Holston R, Whitetop Laurel Ck	Aquatic-rivers	S	G3G4	S2	-
1	-	X	<i>Phenacobius teretulus</i>	Kanawha minnow	Upper New R watershed	Aquatic-streams	S	G3G4	S2S3	S1
1	-	X	<i>Chrosomus cumberlandensis</i>	Blackside dace	Upper Cumberland R, Upper Powell R, Poor Fk Cumberland R	Aquatic-streams	T	G2	S1	S3 (KY)
1	-	X	<i>Chrosomus tennesseensis</i>	Tennessee dace	Lick Ck, N Fk Holston R, Beaverdam Ck, M Fk Holston R	Aquatic-streams	S	G3	S1	-
Amphibian										
1	-	X	<i>Plethodon hubrichti</i>	Peaks of Otter salamander	Peaks of Otter, Apple Orchard Mtn	Mixed oak, late successional with loose rocks and logs, >1800'.	S	G2	S2	-
1	X	-	<i>Plethodon punctatus</i>	Cow Knob salamander	Shenandoah Mtn, VA & WV	Mixed oak, late successional with loose rocks and logs, >2500'.	S	G3	S2	S1
1	-	-	<i>Plethodon shenandoah</i>	Shenandoah salamander	Three isolated populations in SNP: Hawksbill Mtn, The Pinnacles, Stony Man Mtn. GW occurrence questionable.	Talus slopes. Erroneous records from Three Ridges, The Priest, Pompeii on the Pedlar.	E	G1	S1	-
1	-	X	<i>Plethodon welleri</i>	Weller's salamander	Mt Rogers & Whitetop Mtn	Spruce-fir forests and adjacent northern hardwoods.	S	G3	S2	-
Bird										
2	X	X	<i>Falco peregrinus</i>	Peregrine Falcon	Hack sites late 80s and early 90s - Mt Rogers, Grayson; Cole Mtn, Amherst; Big Schloss, Shenandoah; Elliot Knob, Augusta; High Knob, Rockingham Cos. No nests, current migrant.	Nests on ledges or cliffs, buildings, bridges, quarry walls. Non-breeding sites, farmland, open country, lakeshores, broad river valleys, airports, cities. Prefers pigeons, ducks.	S	G4	S1B/S2N	S1B/S2N
2	X	-	<i>Haliaeetus leucocephalus</i>	Bald Eagle	Potomac R, James R, New R, Upper Tennessee watersheds	Feeds and nests on or near large lakes and rivers.	S	G5	S3S4B/S3S4N	S2B/S3N
2	X	-	<i>Lanius ludovicianus migrans</i>	Migrant Loggerhead Shrike	Ridge & Valley (Shenandoah Valley)	Open grasslands with trees and shrubs, fencerows.	S	G4	S2B/S3N	S1B/S2N
2	X	X	<i>Thryomanes bewickii altus</i>	Appalachian Bewick's Wren	Historical records in Botetourt, Giles, Highland Washington Cos.	Thickets, old fields, fencerows, old home sites.	S	G5T2Q	SHB/S1N	S1B/S1N
Mammal										
2	X	X	<i>Corynorhinus townsendii virginianus</i>	Virginia big-eared bat	Summer: VA - Tazewell Co (3 caves), Highland Co (1 cave); WV - Pendleton Co (4 caves); Winter: Highland, Rockingham, Bland, and Tazewell Cos (6 caves); Pendleton Co (6 caves). Largest VA population in Tazewell Co and largest WV population in Pendleton Co. Small numbers of bats (usually <10) in a few other widely scattered caves during summer months. Bath & Pulaski Co records are historic. No occupied caves currently known on Forest.	Resides in caves winter and summer. Short distance migrant (<40 miles) between winter and summer caves. Forages primarily on moths and foraging habitat is common (fields, forests, meadows, etc.). Forages within 6 miles of summer caves. USFWS Critical Habitat is 5 caves in WV (4 Pendleton Co and 1 Tucker Co). Closest Critical Habitat cave to GWJNF is ~3 miles in Pendleton Co, WV. OAR code of "2" used when project further than 6 miles from summer or winter occupied cave.	E	G3G4T2	S1	S2
1	-	X	<i>Glaucomys sabrinus coloratus</i>	Carolina northern flying squirrel	Mt Rogers & Whitetop area	Spruce-fir forests and adjacent northern hardwoods.	E	G5T2	S1	-
1	X	-	<i>Glaucomys sabrinus fuscus</i>	Virginia northern flying squirrel	Laurel Fork area, Highland Co	Spruce forests and adjacent northern hardwoods.	E	G5T2	S1	S2
1	X	-	<i>Microtus chrotorrhinus carolinensis</i>	Southern rock vole	Alleghany Mtn, Bath Co	Cool, moist, mossy talus under oaks/northern hardwoods.	S	G4T3	S1	S2
1	-	X	<i>Myotis grisescens</i>	Gray bat	Ridge & Valley, Clinch R watershed	Caves winter and summer, forages widely.	E	G3	S1	-

OAR	GW	J	Species Name	Common Name	Range on or near GWJNFs	Habitat - Detail	TES	GRank	VA SRank	WV SRank
2	X	X	<i>Myotis leibii</i>	Eastern small-footed bat	Ridge & Valley	Hibernates in caves during winter, roosts in crevices of large rock outcrops, cliffs, and under large rocks in talus & boulder-fields during summer, plus similar man-made structures like rip-rap and bridges, forages widely in all forested and open habitat types over both ridges and valleys.	S	G3	S2	S1
6	X	X	<i>Myotis septentrionalis</i>	Northern long-eared bat	Blue Ridge, Ridge & Valley, Cumberland Mtns	Hibernates in crevices and cracks of cave walls during winter (sometimes mines & tunnels), difficult to find and rarely seen. During summer, forages widely and roosts singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Also may roost in structures like barns, sheds, & houses.	PE	G2G3	S3	S3S4
6	X	X	<i>Myotis sodalis</i>	Indiana bat	Blue Ridge, Ridge & Valley, Cumberland Mtns	Caves winter, upland hardwoods summer, forages widely along riparian areas and open woodlands.	E	G2	S1	S1
1	X	-	<i>Sorex palustris punctulatus</i>	Southern water shrew	Alleghany Mtn, Bath Co; Laurel Fork, Highland Co	Riparian areas w/in spruce-fir forests and northern hardwoods.	S	G5T3	S1S2	S1
INVERTEBRATE										
Snail (Mollusk, Class Gastropoda)										
1	X	X	<i>Glyphyalinia raderi</i>	Maryland glyph	Alleghany, Montgomery Cos	Calciphile, edge of seeps within leaf litter.	S	G2	S1S2	S2
1	X	-	<i>Helicodiscus diadema</i>	Shaggy coil	Alleghany Co	Calciphile, limestone rubble and talus.	S	G1	S1	-
1	X	-	<i>Helicodiscus lirellus</i>	Rubble coil	Rockbridge Co	Calciphile, limestone rubble and rich fossiliferous shale talus.	S	G1	S1	-
1	X	X	<i>Helicodiscus triodus</i>	Talus coil	Alleghany, Botetourt, Rockbridge Cos	Calciphile, limestone rubble on wooded hillsides and near cave entrances.	S	G2	S1S2	SH
1	-	X	<i>Io fluviatilis</i>	Spiny riversnail	Clinch R, N Fk Holston R	Aquatic-rivers	S	G2	S2	-
1	-	X	<i>Paravitrea reesi</i>	Round supercoil	Monroe, WV	Calcareous woodlands and glades.	S	G3	S2	S1
Mussel (Mollusk, Class Bivalvia)										
2	X	-	<i>Alasmidonta varicosa</i>	Brook floater	Potomac drainage	Aquatic-rivers	S	G3	S1	S1
1	-	X	<i>Cumberlandia monodonta</i>	Spectaclecase	2 sites Clinch R	Aquatic-rivers	E	G3	S1	-
1	-	X	<i>Cyprogenia stegaria</i>	Fanshell	Lower Clinch R, Scott Co	Aquatic-rivers	E	G1Q	S1	S1
1	-	X	<i>Dromus dromas</i>	Dromedary pearlymussel	Clinch R, Powell R, N Fk Holston R	Aquatic-rivers	E	G1	S1	-
1	X	X	<i>Elliptio lanceolata</i>	Yellow lance	Roanoke R, James R	Aquatic-rivers	S	G2G3	S2S3	-
1	-	X	<i>Epioblasma brevidens</i>	Cumberlandian combshell	Clinch R, Powell R, N Fk Holston R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Epioblasma capsaeformis</i>	Oyster mussel	Clinch R, Powell R, N Fk Holston R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Epioblasma florentina aureola</i>	Golden riffleshell	Clinch R, M Fk Holston R, N Fk Holston R	Aquatic-rivers	E	G1T1Q	S1	-
1	-	X	<i>Epioblasma torulosa gubernaculum</i>	Green-blossom pearlymussel	Clinch R, N Fk Holston R	Aquatic-rivers	E	G2TX	SX	-
1	-	X	<i>Epioblasma triquetra</i>	Snuffbox	Clinch R, Powell R, N Fk Holston R	Aquatic-rivers	E	G3	S1	S2
1	-	X	<i>Fusconaia cor</i>	Shiny pigtoe	Clinch R, Powell R, N Fk Holston R, Copper Ck	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Fusconaia cuneolus</i>	Fine-rayed pigtoe	Clinch R, Powell R, Copper Ck, Little R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Fusconaia masoni</i>	Atlantic pigtoe	Roanoke R, Craig Ck drainage	Aquatic-rivers	S	G2	S2	-
1	-	X	<i>Hemistena lata</i>	Cracking pearlymussel	Clinch R, Powell R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Lampsilis abrupta</i>	Pink mucket	Clinch R	Aquatic-rivers	E	G2	SX	S1
1	-	X	<i>Lasmigona holstonia</i>	Tennessee heelsplitter	Upper Clinch, N and M Fk Holston R drainages; Wolf Ck, Bland Co below Burkes Garden	Aquatic-streams	S	G3	S1	-
2	X	-	<i>Lasmigona subviridis</i>	Green floater	Widely distributed in N & S Fk Shenandoah R, Pedlar R, James R	Aquatic-rivers	S	G3	S2	S2
1	-	X	<i>Lemiox rimosus</i>	Birdwing pearlymussel	Clinch R, Powell R, Copper Ck, Little R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Pegias fabula</i>	Little-winged pearlymussel	Clinch R, N Fk Holston R, S Fk Holston R, Little R	Aquatic-streams	E	G1	S1	-
1	-	X	<i>Plethobasus cyphus</i>	Sheepnose	Clinch R, Powell R	Aquatic-rivers	E	G3	S1	S1
1	X	X	<i>Pleurobema collina</i>	James spiny mussel	Potts Ck, Craig Ck, Johns Ck, Patterson Run, Pedlar R, Cowpasture R, Mill Ck (Deerfield)	Aquatic-rivers	E	G1	S1	S1
1	-	X	<i>Pleurobema cordatum</i>	Ohio pigtoe	Clinch R	Aquatic-rivers	S	G4	S1	S2
1	-	X	<i>Pleurobema oviforme</i>	Tennessee clubshell	Clinch R, Powell R, N, Middle, S Fk Holston R	Aquatic-streams	S	G2G3	S2S3	-
1	-	X	<i>Pleurobema plenum</i>	Rough pigtoe	Clinch R	Aquatic-rivers	E	G1	SH	SH
1	-	X	<i>Pleurobema rubrum</i>	Pyramid pigtoe	Upper Clinch R	Aquatic-rivers	S	G2G3	SH	-
1	-	X	<i>Pleuronaia dolabelloides</i>	Slabside pearlymussel	Clinch R, M Fk Holston, N Fk Holston R	Aquatic-rivers	E	G2	S2	-
1	-	X	<i>Pleuronaia gibberum</i>	Tennessee pigtoe	Clinch R, Powell R, N Middle, S Fk Holston R	Aquatic-rivers	S	G2G3	S2	-
1	-	X	<i>Quadrula cylindrica strigillata</i>	Rough rabbits foot	Clinch R, Powell R, N Fk Holston R, Copper Ck	Aquatic-streams	E	G3G4T2	S2	-
1	-	X	<i>Quadrula intermedia</i>	Cumberland monkeyface	Powell R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Quadrula sparsa</i>	Appalachian monkeyface	Clinch R, Powell R	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Toxolasma lividus</i>	Purple lilliput	N Fk Holston R, Clinch R	Aquatic-rivers	S	G3Q	SH	-
1	-	X	<i>Villosa perpurpurea</i>	Purple bean	Clinch R, Copper Ck	Aquatic-rivers	E	G1	S1	-
1	-	X	<i>Villosa trabalis</i>	Cumberland bean	Clinch R	Aquatic-rivers	E	G1	SX	-
Spider (Arachnid)										
1	-	X	<i>Microhexura montivaga</i>	Spruce-fir moss spider	Mt Rogers	Damp, well-drained moss and liverwort mats on boulders in mature spruce-fir forests.	E	G1	S1	-
Pseudoscorpion (Arachnid, Order Pseudoscorpiones)										
1	-	X	<i>Kleptochthonius orpheus</i>	Orpheus cave pseudoscorpion	Patton cave, Monroe Co, WV	Caves	S	G1	-	S1

OAR	GW	J	Species Name	Common Name	Range on or near GWJNFs	Habitat - Detail	TES	GRank	VA SRank	WV SRank
Amphipod (Crustacean, Order Amphipoda)										
1	-	X	<i>Stygobromus abditus</i>	James Cave amphipod	James, Sam Bells caves, Pulaski Co; Watsons cave, Wythe Co; and other New River caves	Aquatic-caves, water well	S	G2G3	S2S3	-
1	-	X	<i>Stygobromus cumberlandus</i>	Cumberland cave amphipod	Lee, Scott, Wise Cos	Aquatic-caves	S	G3G4	S1S2	-
1	-	X	<i>Stygobromus estesi</i>	Craig County cave amphipod	Caves in Upper Sinking Ck Valley and Potts Ck, Poverty Hollow seeps, Captain seeps	Aquatic-caves, seeps	S	G4	S3	-
1	-	X	<i>Stygobromus fergusonii</i>	Montgomery County cave amphipod	Botetourt, Montgomery Cos	Aquatic-caves	S	G2G3	S1	-
1	X	-	<i>Stygobromus gracilipes</i>	Shenandoah Valley cave amphipod	Frederick, Rockingham, Shenandoah, Warren Cos	Aquatic-caves	S	G3G4	S2S3	S1
1	X	-	<i>Stygobromus hoffmani</i>	Allegheny County cave amphipod	Low Moor cave, Alleghany Co	Aquatic-caves, groundwater habitats including springs and seeps	S	G2	S2	-
1	X	-	<i>Stygobromus mundus</i>	Bath County cave amphipod	Alleghany, Bath Cos	Aquatic-caves	S	G2G3	S1S2	-
Isopod (Crustacean, Order Isopoda)										
1	-	X	<i>Caecidotea incurva</i>	Incurved cave isopod	McCullin Cave, Smyth Co; Groseclose Cave No. 1, Wythe Co	Aquatic-caves	S	G2G4	S2	-
1	X	X	<i>Miktoniscus racovitzai</i>	Racovitz's terrestrial cave isopod	Alleghany, Botetourt, Page, Rockbridge, Shenandoah Cos	Aquatic-caves	S	G3G4	S2	-
Millipede (Class Diplopoda)										
1	-	X	<i>Brachoria dentata</i>	A millipede	Known only from Pennington Gap and Cave Spring Recreation Area, Lee Co.	Leaf litter, deciduous forests.	S	G1	S1	-
1	-	X	<i>Brachoria eutypa ethotela</i>	Hungry Mother millipede	Pine Mtn above Troutdale	Leaf litter, deciduous forests.	S	G2	S2	-
1	-	X	<i>Buotus carolinus</i>	A millipede	Brush Mtn, Whitetop Mtn, Apple Orchard Mtn, Tazewell Beartown	Beech leaf litter, deciduous forests.	S	G3	S3	-
1	-	X	<i>Cleidogona hoffmani</i>	Hoffman's cleidogonid millipede	Mt Rogers, Whitetop Mtn, Elk Garden; Hamilton cave (private) Bland Co	Mountaintop species, leaf litter, deciduous forests.	S	G3	S2S3	-
1	-	X	<i>Cleidogona lachesis</i>	A millipede	Mt Rogers & Whitetop Mtn	Beech leaf litter, deciduous forests.	S	G2	S1	-
1	-	X	<i>Dixioria fowleri</i>	Fowler's millipede	Walker Mtn; Comers Rock on Iron Mtn; Laurel Ck, Damascas; 1/2 mile west of NRA office; Tazewell Beartown	Leaf litter, deciduous forests.	S	G2	S2	-
1	-	X	<i>Dixioria pela coronata</i>	A millipede	Endemic to Mt Rogers	Leaf litter, northern hardwood and spruce-fir forests. Altitudinally restricted, >5000'	S	G2T2	S2	-
1	X	-	<i>Nannaria shenandoah</i>	Shenandoah Mountain xystodesmid millipede	One site: along Long Run Road, Rockingham Co.	Leaf litter, mixed oak forest.	S	G1	S1	-
1	X	-	<i>Pseudotremia alecto</i>	A millipede	Griffith Knob, Alleghany Co; near Mountain Grove Saltpetre Cave, Bath Co	Leaf litter, deciduous forests.	S	G1	S1	-
1	X	X	<i>Semionellus placidus</i>	A millipede	Hawksbill Mtn, Apple Orchard Mtn, Tomahawk Mtn	Leaf litter, deciduous forests.	S	G3	S2	-
Centipede (Insect, Order Chilopoda)										
1	X	X	<i>Escaryus cryptorobius</i>	Montane centipede	The Priest, Nelson Co; Whitetop Mtn, near junction of Grayson, Washington, Smyth Co	Upper soil horizon, spruce - birch forests.	S	G2	S2	-
1	-	X	<i>Escaryus orestes</i>	Whitetop Mountain centipede	Whitetop Mtn, near junction of Grayson, Washington, Smyth Co	Dark moist soil and litter, spruce - birch forests.	S	G1G2	S1S2	-
1	X	-	<i>Nampibus turbator</i>	A cave centipede	One known site: Low Moor cave, Alleghany Co	Caves	S	G1G2	S1	-
Springtail (Insect, Order Collembola)										
2	X	X	<i>Pygmarrhopalites carolynae</i>	A cave springtail	Augusta, Bath, Highland, Lee, Wise Cos	Caves	S	G4	S3	-
1	-	X	<i>Pygmarrhopalites commorus</i>	A cave springtail	Giles, Lee, Wise Cos	Caves	S	G2G3	S2S3	-
1	X	-	<i>Pygmarrhopalites sacer</i>	A cave springtail	Bath Co	Caves	S	G2	S2	-
Mayfly (Insect, Order Ephemeroptera)										
1	-	X	<i>Leptophlebia johnsoni</i>	Johnson's prongbill mayfly	One location: Lewis Fk north slope Mt Rogers	Aquatic-streams	S	G4	S1	-
Dragonfly, Damselfly (Insect, Order Odonata)										
1	X	X	<i>Gomphus viridifrons</i>	Green-faced clubtail	New R, Craig Ck, Pound R, Locust Spring	Aquatic-rivers	S	G3G4	S2	S2
1	-	X	<i>Ophiogomphus incurvatus alleghaniensis</i>	Allegheny snaketail	Rich Ck, Giles Co	Aquatic-streams	S	G3T2T3	S1	S1
1	-	X	<i>Acroneria koszarabi</i>	Virginia stonefly	Station Spring Ck, Tazewell Co	Aquatic-streams	S	G1G2	S1S2	-
1	-	X	<i>Isoperla major</i>	Big stripetail stonefly	Burkes Garden, Tazewell Co	Aquatic-streams	S	G1	S1	-
1	-	X	<i>Megaleuctra williamsae</i>	Smokies needlefly	Mt Rogers & Whitetop Mtn	Aquatic-streams	S	G2	S1S2	-
1	-	X	<i>Taeniopteryx nelsoni</i>	Cryptic willowfly	Lewis Fk & Grindstone Branch N of Mt Rogers	Aquatic-streams	S	G1	S1	-
Beetle (Insect, Order Coleoptera)										
1	X	X	<i>Cicindela ancocisconensis</i>	Appalachian tiger beetle	Alleghany, Bath, Highland, Lee, Rockbridge, Washington, Wise Cos	Riparian - sandy/silty edges of streams and rivers.	S	G3	S2	S3
2	X	X	<i>Cicindela patruela</i>	Northern barrens tiger beetle	Blue Ridge, Ridge & Valley	Eroded slopes of exposed sandstone and conglomerate.	S	G3	S2	S2S3
1	-	X	<i>Cyclotrachelus incisus</i>	A ground beetle	Breaks Interstate Park, Dickenson Co	Dry, well drained site, red maple, magnolia, mountain laurel.	S	G4	S1	-
2	X	X	<i>Hydraena maurenae</i>	Maureen's hydraenan minute moss beetle	Alleghany, Bath, Botetourt, Bland, Craig, Cos	Interstitial water in riparian-shale substrate along stream edge.	S	G2?	S2?	-

OAR	GW	J	Species Name	Common Name	Range on or near GWJNFs	Habitat - Detail	TES	GRank	VA SRank	WV SRank
Scorpionfly (Insect, Order Mecoptera)										
1	-	X	<i>Brachypanorpa jeffersoni</i>	Jefferson's short-nosed scorpionfly	Sugar Run Mountain, Giles Co; Whitetop Mtn, Smyth Co	Moist soil around seeps. Only known from high elevation. Larvae use short burrows in loose soil and moss.	S	G2	S1S2	-
Butterfly, Skipper, Moth (Insect, Order Lepidoptera)										
2	X	X	<i>Callophrys irus</i>	Frosted elfin	Frederick, Montgomery, Page, Roanoke Cos	Dry, open woods, clearings, and road/powerline ROWs with abundant wild indigo, <i>Baptisia tinctoria</i> .	S	G3	S2?	S1
2	X	X	<i>Speyeria diana</i>	Diana fritillary	Blue Ridge, Ridge & Valley	Grasslands-shrublands, near streams with thistles and milkweeds. Larval host plant, violets, <i>Viola</i> spp.	S	G3G4	S3	S2S3
2	X	X	<i>Speyeria idalia</i>	Regal fritillary	Blue Ridge, Ridge & Valley	Riparian, grasslands-shrublands. Larval host plant, violets, <i>Viola</i> spp.	S	G3	S1	S1
2	X	X	<i>Erynnis persius persius</i>	Persius duskywing	Blue Ridge, Ridge & Valley	Bogs, wet meadows, open seepages in boreal forests. Larval host plant, lupine, <i>Lupinus perennis</i> , wild indigo, <i>Baptisia tinctoria</i> .	S	G5T1T3	S1	-
2	X	-	<i>Pyrgus centaureae wyandot</i>	Appalachian grizzled skipper	Ridge & Valley	Shale barrens, open shaley oak woodlands. Larval host plant, cinquefoil, <i>Potentilla</i> spp, strawberry, <i>Fragaria virginiana</i> .	S	G5T1T2	S1	S1
1	X	X	<i>Catocala herodias gerhardi</i>	Herodias underwing	Bald Knob, Bath Co; Poverty Hollow, Montgomery Co; Sand Mtn, Wythe Co (non FS property)	Pitch pine/bear oak scrub woodlands, >3000'. Larval host plant oak, <i>Quercus</i> spp.	S	G3T3	S2S3	SU
2	X	-	<i>Euchlaena milnei</i>	Milne's euchlaena moth	Warm Springs Mtn, Catawba Creek Slopes, Sweet Spring Hollow, Salt Pond Mtn. (Doe Creek)	Moist, forested slopes of mixed pine hardwoods. Acidic oak woods.	S	G2G4	S2	S2
1	X	-	<i>Psectrotarsia hebardei</i>	Hebard's noctuid moth	Bath Co	Rich, mesic hardwood forest. Larvae host plant, Canada horse-balm, <i>Collinsonia canadensis</i> .	S	GU	SH	-
NON-VASCULAR PLANT										
Lichen										
1	-	X	<i>Cetradonia linearis</i>	Rock gnome lichen	Whitop Mtn	Spruce-fir forests	E	G2	S1	-
2	X	X	<i>Hydrothyrta venosa</i>	Hydrothyrta lichen	Augusta, Amherst, Alleghany, Bedford, Botetourt, Giles, Highland, Madison, Nelson, Rockbridge, Shenandoah, Smyth, Wythe Cos VA; Pendleton Co WV	Aquatic - in streams/springs/cascades.	S	G4	S1	-
1	-	X	<i>Hypotrachyna virginica</i>	Virginia hypotrachyna lichen	Mt Rogers & Whitetop Mtn	Spruce-fir forests	S	G1G2	S1	SNR
Liverwort										
1	-	X	<i>Bazzania nudicaulis</i>	A liverwort	Mt Rogers & Whitetop Mtn	Bark and rock outcrops in spruce-fir forests.	S	G2G3	S?	-
1	-	X	<i>Fruillania oakesiana</i>	A liverwort	Mt Rogers & Whitetop Mtn	Bark in spruce-fir forests.	S	G3?	S?	-
1	-	X	<i>Mertzgeria fruticulosa</i>	A liverwort	Whitetop Mtn	Bark in spruce-fir forests, >5000'.	S	G2Q	S?	-
2	-	X	<i>Nardia lescurii</i>	A liverwort	Blue Ridge, Ridge & Valley	Riparian - on peaty soil over rocks, usually in shade and associated w/ water, <3000'.	S	G3?	SU	-
1	-	X	<i>Plagiochila austinii</i>	A liverwort	Little Stony Ck - Cascades; Red Ck on Beartown Mtn	Rich, moist, densely forested ravines; shaded outcrops.	S	G3	S?	-
1	-	X	<i>Plagiochila sullivantii</i> var. <i>sullivantii</i>	A liverwort	Whitetop Mtn, Salt Pond Mtn	Moist shaded rock outcrops, under cliff ledges, in crevices.	S	G2T2	SNR	-
1	-	X	<i>Sphenolobopsis pearsonii</i>	A liverwort	Mt Rogers & Whitetop Mtn	Bark of Fraser fir, mountain ash, occasionally red spruce, >5000'.	S	G2	S?	-
Moss										
1	-	X	<i>Sphagnum flavicomans</i>	Northeastern peatmoss	Whitetop Mtn	Bogs, seeps	S	G3	SU	-
VASCULAR PLANT										
2	X	X	<i>Aconitum reclinatum</i>	Trailing white monkshood	Blue Ridge, Ridge & Valley	Rich cove sites, streambanks, seepages all with high pH.	S	G3	S3	S3
1	-	X	<i>Actaea rubifolia</i>	Appalachian black cohosh	Lower Clinch R watershed	Moist, rich wooded bluffs over limestone.	S	G3	S2	-
1	X	X	<i>Allium oxypilum</i>	Nodding onion	Monroe, Summers, Mercer, Greenbrier Cos, WV	Shale barrens, sandstone glades.	S	G2Q	S1	S2
2	X	X	<i>Arabis patens</i>	Spreading rockcress	Frederick, Lee, Page, Shenandoah, Warren Cos	Shaded, calcareous cliffs, bluffs, and talus slopes.	S	G3	S2	S2
2	X	X	<i>Berberis canadensis</i>	American barberry	Blue Ridge, Ridge & Valley	Calcareous open woods, bluffs, cliffs, and along fencerows.	S	G3	S3S4	S1
1	-	X	<i>Betula uber</i>	Virginia round-leaf birch	One location: Cressy Ck, Smyth Co	Riparian, mixed open forest, usually disturbed sites.	T	G1Q	S1	-
2	X	-	<i>Boechera serotina</i>	Shale barren rockcress	Ridge & Valley N of James R watershed	Shale barrens and adjacent open oak woods.	E	G2	S2	S2
1	X	X	<i>Buckleya distichophylla</i>	Piratebush	Blue Ridge S of Roanoke R, Ridge & Valley S of James R	Open oak and hemlock woods.	S	G3	S2	-
1	-	X	<i>Cardamine clematidis</i>	Mountain bittercress	Blue Ridge, Ridge & Valley, S of New R watershed	Riparian, spring seeps, rocky streambanks.	S	G3	S1	-
1	-	X	<i>Cardamine flagellifera</i>	Blue Ridge bittercress	Blue Ridge, Ridge & Valley, S of New R watershed	Riparian, spring seeps, rocky streambanks.	S	G3	S1	S2
3	X	X	<i>Carex polymorpha</i>	Variable sedge	Blue Ridge, Ridge & Valley, N of James R	Open acid soil, oak-heath woodlands, responds positively to fire.	S	G3	S2	S1
2	X	X	<i>Carex schweinitzii</i>	Schweinitz's sedge	Augusta, Bath, Highland, Montgomery, Pulaski, Washington Cos	Bogs, limestone fens, marl marshes.	S	G3G4	S1	-
1	-	X	<i>Chelone cuthbertii</i>	Cuthbert turtlehead	Blue Ridge Plateau, Grayson, Carroll Cos	Bogs, wet meadows, boggy woods and thickets.	S	G3	S2	-
1	-	X	<i>Cleisteslopsis bifaria</i>	Small spreading pogonia	Craig, Dickenson, Scott, Wise Cos	Well drained, rather open, scrubby hillsides, oak-pine-heath woodlands, acidic soils.	S	G4?	S2	S1
1	-	X	<i>Clematis addisonii</i>	Addison's leatherflower	Montgomery, Roanoke, Botetourt, Rockbridge Cos	Open glades & rich woods over limestone and dolostone.	S	G1?	S1?	-
1	X	X	<i>Clematis coactilis</i>	Virginia white-haired leatherflower	Ridge & Valley, Rockbridge Co, S to Wythe Co	Shale barrens, rocky calcareous woodlands.	S	G3	S3	-

OAR	GW	J	Species Name	Common Name	Range on or near GWJNFs	Habitat - Detail	TES	GRank	VA SRank	WV SRank
3	X	X	<i>Corallorhiza bentleyi</i>	Bentley's coralroot	Alleghany, Bath, Giles Cos VA; Monroe, Pocahontas Cos WV	Dry, acid woods, along roadsides, well-shaded trails.	S	G1G2	S1	S1
2	X	X	<i>Delphinium exaltatum</i>	Tall larkspur	Blue Ridge, Ridge & Valley	Dry calcareous soil in open grassy glades or thin woodlands.	S	G3	S3	S2
2	X	-	<i>Echinodorus tenellus</i>	Dwarf burhead	Pines Chapel Pond, Augusta Co; Davidson Run Pond,	Pond margins, wet depressions in sandy soil.	S	G5?	S1	-
2	X	X	<i>Echinacea laevigata</i>	Smooth coneflower	Alleghany, Montgomery Cos	Open woodlands and glades over limestone or dolomite.	E	G2G3	S2	-
2	X	X	<i>Euphorbia purpurea</i>	Glade spurge	Blue Ridge, Ridge & Valley	Rich, swampy woods, seeps and thickets.	S	G3	S2	S2
1	-	X	<i>Gentiana austromontana</i>	Appalachian gentian	Mt Rogers, Whitetop Mtn, High Knob	High elevation forests and grassy balds. Southern Appalachian endemic.	S	G3	S3	S1
1	-	X	<i>Hasteola suaveolens</i>	Sweet-scented Indian-plantain	Giles, Montgomery, Pulaski Cos	Riverbanks, wet meadows.	S	G4	S2	S3
2	X	-	<i>Helenium virginicum</i>	Virginia sneezeweed	Endemic to Augusta, Rockingham Cos	Seasonally dry meadows and sinkhole depressions.	T	G3	S2	-
2	X	-	<i>Helonias bullata</i>	Swamp-pink	Augusta, Nelson Cos	Sphagnum bogs, seeps, and streambanks.	T	G3	S2S3	-
1	X	-	<i>Heuchera alba</i>	White alumroot	Shenandoah Mtn	High elevation rocky woods and bluffs.	S	G2Q	S2?	S2
2	X	X	<i>Hypericum mitchellianum</i>	Blue Ridge St. John's-wort	Blue Ridge, Ridge & Valley	Grassy balds, forest seepages, moderate to high elevations.	S	G3	S3	S1
2	X	X	<i>Ilex collina</i>	Long-stalked holly	Blue Ridge, Ridge & Valley	Bogs, seep, shrubby streamheads, >3100'.	S	G3	S2	S2
1	-	X	<i>Iliamna corei</i>	Peter's Mountain-mallow	One location: Narrows, Peters Mountain, Giles Co.	Rich, open woods along sandstone outcrops, soil pockets, fire maintained.	E	G1Q	S1	-
1	X	X	<i>Iliamna remota</i>	Kankakee globe-mallow	Alleghany, Botetourt, Rockbridge, Bedford Cos	Open, disturbed riverbanks and roadsides.	S	G1Q	S1	-
2	X	-	<i>Isoetes virginica</i>	Virginia quillwort	Augusta Co	Summer-dry sinkhole ponds, seasonally wet upland depressions, and small, wet-weather drains, especially in moss hummocks.	S	G1	S1?	-
2	X	X	<i>Isotria medeoloides</i>	Small whorled pogonia	In mountains of VA known only from Bedford, Craig, and Lee Cos; other VA occurrences in Piedmont & Coastal Plain	Open, mixed hardwood forests on level to gently sloping terrain with north to east aspect.	T	G2	S2	S1
2	X	X	<i>Juglans cinerea</i>	Butternut	Blue Ridge, Ridge & Valley	Well-drained bottomland and floodplain, rich mesophytic forests mostly along toeslopes.	S	G4	S3?	S3
2	X	X	<i>Liatis helleri</i>	Turgid gayfeather	Blue Ridge, Ridge & Valley	Shale barrens, mountain hillside openings.	S	G3	S3	S2
1	-	X	<i>Lilium grayi</i>	Gray's lily	Blue Ridge, Mt Rogers & Whitetop Mtn (occurrences north of Floyd Co questionable)	Bogs, open seeps, wet meadows, grassy balds.	S	G3	S2	-
1	X	-	<i>Lycopodiella margueritae</i>	Marguerite's clubmoss	Bath Co	Seasonally moist soils, wet acidic ditches, borrow pits.	S	G2	NA	-
1	-	X	<i>Micranthes caroliniana</i>	Carolina saxifrage	Blue Ridge, Ridge & Valley, S of New R	Moist, shaded rocks and cliffs.	S	G3	S3	S1
6	X	X	<i>Monotropsis odorata</i>	Sweet pinesap	Blue Ridge, Ridge & Valley	Dry oak-pine-heath woodlands, soil usually sandy.	S	G3	S3	S1
1	-	X	<i>Packera millefolium</i>	Piedmont ragwort	Lee, Scott Cos	Open limestone outcrops and cedar barrens.	S	G2	S2	-
1	X	-	<i>Paxistima canbyi</i>	Canby's mountain lover	Ridge & Valley, Sarver Barrens SBA, Craig Co	Calcareous cliffs and bluffs, usually undercut by stream.	S	G2	S2	S2
3	X	X	<i>Phlox buckleyi</i>	Sword-leaf phlox	Blue Ridge, Ridge & Valley	Open, often dry oak woodlands and rocky slopes, usually over shale in humus rich soils, often along roadsides.	S	G2	S2	S2
2	X	X	<i>Poa paludigena</i>	Bog bluegrass	Blue Ridge, Ridge & Valley	Shrub swamps and seeps, usually under shade.	S	G3	S2	S1
2	X	-	<i>Potamogeton hillii</i>	Hill's pondweed	Bath Co	Clear, cold calcareous ponds.	S	G3	S1	-
2	X	-	<i>Potamogeton tennesseensis</i>	Tennessee pondweed	Ridge & Valley	Ponds, back water of streams and rivers.	S	G2G3	S1	S2
1	-	X	<i>Prenanthes roanensis</i>	Roan Mountain rattlesnake-root	Mt Rogers & Whitetop Mtn	Grassy balds, open high elevation forests and outcrops.	S	G3	S3	-
1	X	X	<i>Pycnanthemum torrei</i>	Torrey's mountain-mint	Bland, Bath, Giles, Rockbridge, Wythe Cos	Open, dry rocky woods, roadsides, and thickets near streams, heavy clay soil over calcareous rock.	S	G2	S2?	S1
1	-	X	<i>Rudbeckia triloba var. pinnatifida</i>	Pinnate-lobed coneflower	Giles, Montgomery, Smyth, Wise Cos	Dry calcareous soil of open woods and roadsides.	S	G5T3	S1	-
1	-	X	<i>Sceptridium jenmanii</i>	Alabama grapefern	Scott, Russell, Wise Cos	Open woods, old fields, pastures.	S	G3G4	SH	-
2	X	X	<i>Scirpus ancistrochaetus</i>	Northeastern bulrush	Ridge & Valley	Mountain ponds, sinkhole ponds in Shenandoah Valley.	E	G3	S2	S1
3	X	X	<i>Scutellaria saxatilis</i>	Rock skullcap	Blue Ridge, Ridge & Valley	Rich, dry to mesic ridgetop woods, 32 counties in VA, likely G4/S4.	S	G3	S3	S2
2	X	X	<i>Sida hermaphrodita</i>	Virginia mallow	Ridge & Valley, James R watersheds	Riverbank glades with loose rock or sandy soil.	S	G3	S1	S3
1	-	X	<i>Silene ovata</i>	Mountain catchfly	Dickenson, Lee, Wise Cos	Rich woodlands and forests over limestone.	S	G3	S1	-
1	-	X	<i>Spiraea virginiana</i>	Virginia spiraea	Blue Ridge, Ridge & Valley, S of New R	Scoured banks of streams, riverside or island shrub thickets.	T	G2	S1	S1
2	X	-	<i>Trillium pusillum var. monticulum</i>	Virginia least trillium	Great North Mtn & Shenandoah Mtn, VA and WV	Open oak woodlands in well drained soil and margins of thickets at higher elevations.	S	G3T2	S2	S1
1	-	X	<i>Tsuga caroliniana</i>	Carolina hemlock	Blue Ridge north to James R.	Rocky ridges and slopes, usually dry and well drained.	S	G3	S3	-
2	X	X	<i>Vitis rupestris</i>	Sand grape	Ridge & Valley	Scoured banks of rivers and streams over calcareous bedrock.	S	G3	S1?	S2

LEGEND FOR TES SPECIES LIST IN OCCURRENCE ANALYSIS RESULTS:

OAR CODES:

- 1 = Project located out of known species range.
- 2 = Lack of suitable habitat for species in project area.
- 3 = Habitat present, species was searched for during field survey, but not found.
- 4 = Species occurs in project area, but outside of activity area.
- 5 = Field survey located species in activity area.
- 6 = Species not seen during field survey, but possibly occurs in activity area based on habitat observed or Field survey not conducted when species is recognizable (time of year or time of day). Therefore assume presence and no additional surveys needed.
- 7 = Aquatic species or habitat known or suspected downstream of project/activity area, but outside identified geographic bounds of water resource cumulative effects analysis area (defined as point below which sediment amounts are immeasurable and insignificant).
- 8 = Aquatic species or habitat known or suspected downstream of project/activity area, but inside identified geographic bounds of water resource cumulative effects analysis area.
- 9 = Project occurs in a 6th level watershed included in the USFWS/FS T&E Mussel and Fish Conservation Plan (August 8, 2007 U.S. Fish & Wildlife Service concurrence on updated watersheds). Conservation measures from the USFWS/FS T&E Mussel and Fish Conservation Plan applied.

SPECIES: The term “species” includes any subspecies of fish, wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife, which interbreeds when mature (Endangered Species Act of 1973, as amended through the 100th Congress).

RANGE: The geographical distribution of a species. For use here “range” is expressed as where a species is known or expected to occur on or near the George Washington and Jefferson National Forests in terms of landform (feature name, physiographic province), political boundary (county name), or watershed (river, or stream name).

HABITAT: A place where the physical and biological elements of ecosystems provide a suitable environment and the food, cover and space resources needed for plant and animal livelihood (FSM 2605-91-8, pg. 10 of 13).

TES CODES:

- T = Federally listed as Threatened
- E = Federally listed as Endangered
- P = Federally Proposed as T or E
- S = Southern Region (R8) Sensitive species

GLOBAL RANK: Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, NatureServe and The Nature Conservancy to designate a rarity rank based on the range-wide status of a species or variety. This system was developed by The Nature Conservancy and is widely used by other agencies and organizations as the best available scientific and objective assessment of taxon rarity and level of threat to its existence. The ranks are assigned after considering a suite of factors including number of occurrences, numbers of individuals, and severity of threats.

- G1 = Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.
- G2 = Very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.
- G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.
- G4 = Common and apparently secure globally, although it may be rare in parts of its range, especially at the periphery.
- G5 = Very common and demonstrably secure globally, although it may be rare in parts of its range, especially at the periphery.
- GH = Formally part of the world’s biota with the exception that may be rediscovered.

GX = Believed extinct throughout its range with virtually no likelihood of rediscovery.

GU = Possibly rare, but status uncertain and more data needed.

G? = Unranked, or, if following a ranking, ranking uncertain (ex. G3?).

G_Q = Taxon has a questionable taxonomic assignment, such as G3Q.

G_T = Signifies the rank of a subspecies or variety. For example, a G5T1 would apply to a subspecies of a species that is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled.

STATE RANK: The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources (NHRs) are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The criterion for ranking NHRs is the number of populations or occurrences, i.e. the number of known distinct localities; the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals; the quality of the occurrences, the number of protected occurrences; and threats.

- **S1** - Extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
- **S2** - Very rare; usually between 6 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.
- **S3** - Rare to uncommon; usually between 21 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
- **S4** - Common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
- **S5** - Very common; demonstrably secure under present conditions.
- **SA** - Accidental in the state.
- **S#B** - Breeding status of an organism within the state.
- **SH** - Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
- **S#N** - Non-breeding status within the state. Usually applied to winter resident species.
- **SR** - Reported for Virginia, but without persuasive documentation that would provide a basis for either accepting or rejecting the report.
- **SU** - Status uncertain, often because of low search effort or cryptic nature of the element.
- **SX** - Apparently extirpated from the state.
- **SZ** - Long distance migrant, whose occurrences during migration are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.
- **NA** - Not Applicable- A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

These ranks should not be interpreted as legal designations.

