FINAL
Supplemental Watershed Plan No. 4 and Environmental Assessment for the Rehabilitation of Blakes Creek-Armour Creek Watershed Dam No. 7 (known locally as Ridenour Lake Dam) Kanawha County, West Virginia



PREPARED BY
USDA Natural Resources Conservation Service

IN COOPERATION WITH

City of Nitro

August 2025

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FINAL Supplemental Watershed Plan No. 4 and Environmental Assessment for the Rehabilitation of Blakes Creek-Armour Creek Watershed Site 7 (Ridenour Lake Dam)

Kanawha County, West Virginia

Prepared By:
USDA – Natural Resources Conservation Service

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City of Nitro

AUTHORITY

The original watershed work plan was prepared, and the works of improvement were installed in 1966 under the authority of the Watershed Protection and Flood Prevention Act of 1954. The rehabilitation of Blakes Creek–Armour Creek Site 7 is authorized by Section 14 of the Watershed Protection and Flood Prevention Act (Public Law 83-566) as enacted by Section 313 of Public Law 106-472, otherwise known as "The Small Watershed Rehabilitation Amendments of 2000."

ABSTRACT

The Blakes Creek–Armour Creek Watershed is located in western Kanawha County and southeastern Putman County. The watershed contains 3,680 acres and includes all of the drainage area of Blakes Creek and Armour Creek to the backwater of the Kanawha River. The Blakes Creek-Armour Creek Site 7 (as referred to in the 1969 as built map) is classified as a high hazard potential dam that does not presently meet WV and NRCS dam safety and performance standards. A section of the Blakes Creek-Armour Creek Site 7 is slightly overtopped during a 6-hour freeboard hydrograph (FBH) storm. Analysis indicated that headcutting erosion would occur for both the 6- and 24-hour FBH storms and would cause failure of the control section of the auxiliary spillway for the existing dam. The Sponsor's objective is to provide flood damage reduction and maintain the current recreational benefits derived from the reservoir. The Locally Preferred Alternative involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (ASW). A stilling basin and rock riprap at the outlet of the ASW will stabilize flows down to Blakes Creek. The ASW will be re-aligned to move it further away from the existing hillside and will prevent high flows from undermining and breaching the auxiliary spillway crest due to headcut erosion. The ASW will have robust concrete sidewalls to reduce the potential of a landslide blockage. A new principal spillway riser will be constructed after removing the existing riser and extending the 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit. The upstream dam slope will be flattened with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the auxiliary spillway. This will be a project cost. A safe and sanitary facility will be installed

in the form of a septic system facility. Project installation cost is estimated to be $21,311,000 of which $14,848,300 will be paid from the Small Watershed Rehabilitation funds and $6,462,700 will be provided by local funds.

COMMENTS AND INQUIRIES

For further information, please contact: Jon Bourdon, State Conservationist, USDA – Natural Resources Conservation Service, 1550 Earl L. Core Road, Suite 200, Morgantown, WV 26505; Phone: (304) 284-7543.

Non-Discrimination Statement

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

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

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BLAKES CREEK – ARMOUR CREEK WATERSHED

Supplemental Watershed Plan Agreement
(Supplement No. 4)

Between the

City of Nitro
(Referred to herein as Sponsor)

and the

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
(Referred to herein as NRCS)

Whereas, the original Watershed Plan Agreement for the Blakes Creek-Armour Creek Watershed, State of West Virginia, executed by the Sponsor named therein and NRCS, became effective on the 7th day of March 1966; and

Whereas, said Watershed Work Plan Agreement was modified by Supplemental Watershed Plan Agreements dated the 27th day of February 1969; the 22nd day of June 1971; and the 20th day of August 1971; and

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsor for assistance in preparing a plan for works of improvement for the Blakes Creek-Armour Creek Watershed, State of West Virginia, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012); and

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

Whereas, there has been developed through the cooperative efforts of the Sponsor and NRCS a watershed project plan and environmental assessment for works of improvement for the Blakes Creek-Armour Creek Watershed, State of West Virginia, hereinafter referred to as the watershed project plan or plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsor 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 plan and including the following:

1. **Term.** The term of this agreement is for the installation period and evaluated life of the project (104 years) and does not commit NRCS to assistance of any kind beyond the end of the evaluated life.

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

3. **Real property.** The Sponsor will acquire such real property as will be needed in connection with the works of improvement according to the NRCS minimum land rights policy, a level at the 24-hour, 100-year storm. After discussions with the City of Nitro (Sponsor) it was concluded that the Sponsor will seek to acquire an additional 0.1 ac to meet NRCS policy requirements. Additional land rights may be acquired by the City of Nitro at a later date in excess of the policy requirement. The Sponsor and landowners accept the potential risk of, and liability associated with, flood damages that would occur in events between their flowage easement elevation and the elevation of the top of dam. They also recognize that the land rights must include a prohibition on future construction of habitable dwellings upstream from the dam below the elevation of the acquired landrights. The amounts and percentages of the real property acquisition costs to be borne by the Sponsor and NRCS are as shown in the Cost-share table in item 5 hereof.

   The Sponsor agree that all land acquired for measures, other than land treatment practices, with financial or credit assistance under this agreement will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement

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

5. **Cost-share for Watershed Work Plan.** The following table shows cost-share percentages and amounts for Watershed Work Plan implementation.

Cost-share Table for Blakes Creek-Armour Creek Watershed Rehabilitation Project

	NRCS		Sponsor		Total
	Percent	Cost	Percent	Cost	Cost
Cost-Sharable Items [1/]					
Rehabilitation of dam construction	65%	$11,194,300	35%	$6,027,700	$17,222,000
AE Construction Phase Costs	65%	$650,000	35%	$350,000	$1,000,000
Sponsor Project Administration Costs	65%	$13,000	35%	$7,000	$20,000
Sponsor Planning and Engineering Costs	65%	$13,000	35%	$7,000	$20,000
Real Property Land Rights	65%	$9,800	35%	$5,200	$15,000
Relocation payments (replacement-in-kind and required safe and sanitary payments)	65%	$0	35%	$0	$0
In-Kind Contributions		$0		$0	$0
Subtotal: Cost-Sharable Costs	**65.0%**	**$11,880,100**	**35.0%**	**$6,396,900**	**$18,277,000**
Non-Cost-Sharable Items [2/]					
NRCS Project Administration [1/]	100%	$1,378,000		Not allowable (NA)	$1,378,000
NRCS Technical Assistance/Engineering	100%	$1,400,000		NA	$1,400,000
Geotechnical Investigation	100%	$200,000		NA	$200,000
Natural Resource Rights		NA	100%	$0	
Permits		NA	100%	$56,000	$6,000
Relocation, Beyond Required Decent, Safe, Sanitary [3/]	0%	$0	0%	$0	
Subtotal: Non-Cost-Share Costs	**100.0%**	**$2,978,000**	**0.0%**	**$56,000**	**$3,034,000**
Total [4/]**:**	70%	$14,858,100	30%	$6,452,900	$21,311,000

[1/] The Sponsor and NRCS will each bear the costs of project administration that each incurs.

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

[3/] Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost-shared in accordance with the percentages shown. Relocation payments for the cost of improvements beyond decent, safe, and sanitary requirements are a non-project cost ineligible for assistance under the act. The Sponsor will acquire, with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the Sponsor' share of the works of improvement costs. In no case will the amount of an in-kind contribution exceed the Sponsor' share of the cost for the works of improvement. The maximum cost eligible for in-kind credit is the same as that for cost sharing.

[4/] NRCS cost-share is 65% of the total project cost, not to exceed 100% of construction costs.

6. **Land treatment agreements.** The Sponsor will obtain agreements from owners of not less than 50 percent of the land above each multiple-purpose and floodwater-retarding structure. These agreements must provide that the owners will carry out farm or ranch conservation plans on their land. The Sponsor will ensure that 50 percent of the land upstream of any retention reservoir site is adequately protected before construction of the dam. The Sponsor will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the watershed project plan. The Sponsor will encourage landowners and operators to continue to operate and maintain the land treatment measures after the long-term contracts expire, for the protection and improvement of the watershed.

7. **Floodplain Management.** Before construction of any project for flood prevention, the Sponsor must agree to participate in and comply with applicable Federal floodplain management and flood insurance programs. The Sponsor are required to have development controls in place below low and significant hazard dams prior to NRCS or the Sponsor entering into a construction contract.

8. **Water and mineral rights.** The Sponsor 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 Sponsor and these costs are not eligible as part of the Sponsor' cost-share.

9. **Permits.** The Sponsor 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 Sponsor' cost-share.

10. **NRCS assistance.** This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

11. **Additional agreements**. A separate agreement will be entered into between NRCS and the Sponsor before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. **Amendments.** This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the Sponsor 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 Sponsor in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the Sponsor or recoveries by NRCS must be in accordance with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the Sponsor 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 Sponsor 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 for construction and will continue for the project life (100 years). Although the Sponsor' 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 Sponsor 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 Sponsor must prepare an Emergency Action Plan (EAP) for each dam or similar structure where failure may cause loss of life or as required by state and local regulations. The EAP must meet the minimum content specified in the NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State agency dam safety requirements. The NRCS will determine that an EAP is prepared prior to the execution of fund obligating documents for construction of the structure. EAPs must be reviewed and updated by the Sponsor annually.

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

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

    To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue,

SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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

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

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

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

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

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

Certification:

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

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

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

(a) The danger of drug abuse in the workplace;
(b) The grantee's policy of maintaining a drug-free workplace;
(c) Any available drug counseling, rehabilitation, and employee assistance programs; and
(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace

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

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee must—
(a) Abide by the terms of the statement; and
(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

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

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4) (b), with respect to any employee who is so convicted—
(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

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

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

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

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

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

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

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

A. The Sponsor certify to the best of their knowledge and belief, that they and their principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(2) Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph A(2) of this certification; and

(4) (4) Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

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

20. **Clean Air and Water Certification.**

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

(1) Any facility to be utilized in the performance of this proposed agreement is not listed on the Environmental Protection Agency List of Violating Facilities.

(2) To promptly notify the NRCS-State administrative officer prior to the signing of this agreement by NRCS, of the receipt of any communication from the Director, Office of Federal Activities, U.S. Environmental Protection Agency, indicating that any facility which is proposed for use under this agreement is under consideration to be listed on the Environmental Protection Agency List of Violating Facilities.

(3) To include substantially this certification, including this subparagraph, in every nonexempt sub-agreement.

B. The project Sponsoring organizations signatory to this agreement 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 Sponsor 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 a 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 Sponsor must give the NRCS or the Comptroller General, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to this agreement, and retain all records related to this agreement for a period of three years after completion of the terms of this agreement in accordance with the applicable OMB Circular.

23. Signatures.

CITY OF NITRO
2009 20th Street
Nitro, WV 25143

By: Dave Casebolt
DAVE CASEBOLT
Title: Mayor

The signing of this plan was authorized by a resolution by the City of Nitro and adopted at an official meeting held on May 6, 2025 in Nitro, West Virginia.

Nicole Hill
Secretary or Notary Public

2009 20th Street
Nitro, WV 25143

Date: 05/06/25

NATURAL RESOURCES CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Approved by:

JON BOURDON

Digitally signed by JON BOURDON
Date: 2025.07.14 14:36:14 -04'00'

JON BOURBON
State Conservationist

Date: _____

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APPENDIX E

SUMMARY OMB FACT SHEET

Summary of Supplemental Watershed Plan No. 4 and Environmental Assessment for the Rehabilitation of Blakes Creek-Armour Creek Watershed Site 7 Kanawha County, West Virginia 2nd Congressional District

Authorization: Public Law 83-566 Stat. 666 as amended (16 U.SC. 1001 et. Seq.) 1954

Sponsor: City of Nitro.

Proposed Action: Rehabilitation of the dam to meet West Virginia and NRCS dam safety and performance standards.

Purpose and Need for Action:
The project shall provide flood protection (flood damage reduction), public recreation benefits, and watershed structure rehabilitation insuring the water based recreation opportunities provided by the current structure will exist for the life of the structure. This purpose is synonymous with the Sponsors' project objectives. The current structure does not meet current West Virginia and NRCS dam safety and performance standards. Action is needed to reduce the risk of flood damage to homes, commercial facilities, and an expanded infrastructure as well as to reduce the risk of loss of life due to a flood event.

Approximately 298 structures would be affected by a dam breach. Approximately 255 of these structures would experience flood water of one foot or greater.

There is a potential for loss of life from a catastrophic dam failure due to people living and/or working in the breach zone which includes 263 residences, one mobile home, 9 duplexes, 10 multi-family structures, 14 commercial buildings, and 1 public property. Additionally, one stream crossing (bridge) and 4 roadways downstream of this structure are within the breach inundation zone.

The dam currently provides floodwater damage reduction for flood events with a recurrence interval of up to and including the 500-year flood for 51 single family residences, 4 multi-family buildings accounting for up to 14 units, 2 commercial properties, 1 public property, and 4 roadways.

The continuation of flood damage reduction is needed to protect the downstream properties and infrastructure. The Sponsors want to continue to provide flood protection and recreation in a manner that reduces risk of loss of human life and is administratively responsible and environmentally acceptable. Federal action is required to assist the Sponsors and to assure that the Federal government's interest is protected for the designed 100-year life which will end in 2071.

The reservoir provides a significant water-based recreation asset to the community.

Description of the preferred alternative/ plan:
The preferred alternative involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (ASW). The ASW will have robust concrete sidewalls to reduce the potential of a landslide blocking the auxiliary spillway. A new principal spillway riser will be constructed, the upstream dam slope will be flattened with rock riprap, the downstream slope will be flattened with earth and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability and meet regulatory stability requirements. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the ASW.

Resource Information:
The structure coordinates are 38°25'2.51"N, 81°49'53.82"W.

The Hydrologic Unit Number for the structure is: 05050008.

The climate is moderate with no extremes in either the summer or winter temperatures. Rainfall is about average for the state and is distributed throughout the year. The average growing season is approximately 160 days.

The area exhibits mature topography with narrow relatively flat valleys, steep slopes, and narrow divides.

Watershed size (acres): 3,680

Land uses in Area of Initial Analysis (AIA) (acres):

Cropland	Pasture	Woodland	Urban & Build-up	Water & Wetlands
0	13.4	242	67.5	19.56

Land ownership in AIA (acres):

Private	State-Local	Federal
160	182.5	0

Economic and Demographics: Economic and demographic characteristics in the project area are consistent with those of the surrounding community, Nitro, West Virginia, the surrounding counties, Kanawha County and Putnam County, and the State of West Virginia. Income levels, age, and racial and ethnic composition reflect a slightly less affluent and less diverse population here than in in other parts of the State, with fewer advanced academic degrees. Poverty levels in Nitro are slightly higher than the surrounding counties and the State.

The relevant resource concerns that have been identified through scoping, including Ecosystem Services are as follows:

RESOURCE CONCERN	**RESOURCE CONCERN**
SOIL - Prime and unique farmland, and farmland of statewide significance	ANIMALS - Fish and wildlife (including coordination requirements)
WATER -Water resources	Endangered and threatened species

Water quality	Invasive species
Regional water resource plans	Migratory birds
Floodplain management	HUMANS - Public health and safety
Streams, Lakes and Wetlands	Scenic beauty
Wild and Scenic Rivers	Social / Cultural Issues
AIR - Air quality	Historic Properties
PLANTS - Endangered and threatened species	Environmental justice and civil rights
Invasive species	Local and Regional Economy
Riparian areas	Recreation
ECOSYSTEM SERVICES	**ECOSYSTEM SERVICES**
Regulating: Flood and Disease Control	Cultural: Recreational Use Aesthetic Viewsheds
Supporting: Nutrient Cycling Soil Formation	

Alternative plans considered, components, and mitigation measures:

Alternative No. 1 (Preferred/Proposed Action Alternative) involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (ASW). A stilling basin and rock riprap at the outlet of the ASW would stabilize flows down to Blakes Creek. The ASW will be re-aligned to move it further away from the existing hillside and will prevent high flows from undermining and breaching the spillway crest due to headcut erosion. The ASW will have robust concrete sidewalls to reduce the potential of a landslide blockage. A new principal spillway riser will be constructed after removing all or part of the existing riser and extending the 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit. The upstream dam slope will be flattened with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the ASW. Figures C-22 through C-30 in Appendix C describe the proposed improvements.

Alternative No. 2 involves re-grading and leveling the dam crest to EL 648 ft and constructing a 120-ft wide articulated concrete block auxiliary spillway (ASW) with a secant pile cutoff wall to valley floor. The ASW will be located in the existing auxiliary spillway location. A new principal spillway riser will be constructed after removing the existing riser and extending the 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit. The upstream dam slope will be flattened with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the ASW.

Alternative No. 3 involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (ASW) located over the existing embankment left of the principal spillway. A vehicle bridge (HL-93 loading) with a pedestrian lane will be installed over the ASW to provide access to the recreational area. A new principal spillway riser will be constructed after removing the existing riser and extending the 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit. The upstream dam slope will be flattened with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. The existing ASW will be filled in with the excess excavated soils from the construction of the ASW. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the ASW.

Alternative No. 1 Future Without Federal Investment (FWOFI)
For the purposes of the rehabilitation program, the FWOFI alternative describes the action that the Sponsors will take if no federal funds are provided for implementation. The Sponsors would be responsible for the total cost of rehabilitation to WV dam safety and performance standards or removal of the dam.

The FWOFI alternative, barring any contribution of federal funds to rehabilitate the Blakes Armour Site 7 dam the City of Nitro would pursue development of an alternative that meets both State and Federal Standards without this funding source. The FWOFI alternative would be identical to the Locally Preferred/Proposed Alternative (Alternative 2) and involves a 140-ft wide roller compacted concrete (RCC) auxiliary spillway (ASW) located in the existing auxiliary spillway. The RCC chute would be realigned slightly to minimize excavation and stay away from the potentially unstable hillside. Refer to the Alternatives with Federal Assistance section below for a detailed description of the rehabilitation measures. There will be no change in the current levels of flood protection downstream as a result of this project activity.

Project Costs of Preferred/Proposed Alternative 2:

	PL 83-566 funds		Other Funds		Total	
	$	%	$	%	$	%
Construction	$11,194,300	65%	$6,027,700	35%	$17,222,000	100%
Geotechnical Investigation	$200,000	100%	$0	0%	$200,000	100%
Real Property Land Rights	$9,800	65%	$5,200	35%	$15,000	100%
Project Administration	$1,391,000	99%	$7,000	1%	$1,398,000	100%
AE Construction Phase Cost	$650,000	65%	$350,000	35%	$1,000,000	100%
Permits	$0	0%	$56,000	100%	$56,000	100%
NRCS Engineering & Technical Assistance	$1,400,000	100%	$0	0%	$1,400,000	100%
Sponsors Engineering Cost	$13,000	65%	$7,000	35%	$20,000	100%
TOTAL COST	$14,858,100	70.0%	$6,452,900	30.0%	$21,311,000	100%
Annual O&M (non-Fed)			$9,160	100%	$9,160	100%

Project benefits:
The planning policy used for this plan/environmental document (Principles, Requirements, and Guidelines, or PR&G) states that federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits (i.e., positive ecosystem services) encompass environmental, economic, and social goals; include monetary and non-monetary effects and allow for the consideration of both quantified and unquantified measures.

The preferred alternative will allow the Sponsors to comply with applicable dam safety and performance standards, to reduce the potential for loss of life, and to continue protection of existing property and infrastructure downstream of the dam. It will also maintain recreation availability and usage stemming from Lake Ridenour. The preferred alternative maximizes public benefits. For economics, average annual monetary benefits are estimated to be $672,000 which includes $121,200 flood damage reduction benefits and $550,800 in recreation benefits. Average annual cost is estimated at $556,460 resulting in net benefits of $115,540. The Probable Maximum Precipitation (PMP) storm event will be detained without embankment overtopping, thus reducing the threat of a catastrophic dam failure (breach), and recreation after completion of the construction will continue. Environmentally adverse impacts will be minimized during construction. Long term there would be adverse, although negligible, environmental impacts.

Number of direct beneficiaries (Onsite – Offsite):
Population at Risk of dam breach = 1,038
Recreation usage = 51,000 annual visitation

Describe other beneficial effects:

- Reduces the threat of loss of life for 1,038 people identified as Population at Risk.
- Reduction in the threat of loss of access to emergency services for downstream properties and property owners in the event of a flood. For a 100-year storm event, the dam eliminates damages to 30 structures and reduces damages to 27 additional structures. The dam attenuates floods with a recurrence interval up to and including 500 years; i.e., the ASW does not flow during the 500-yr event.
- Eliminates flooding on 0.55 miles of roadway and reduces flood damages to 0.34 miles of roadways, during a 100-year event.
- Maintains recreation benefits to over 51,000 residents and non-residents annually.
- Eliminates the liability associated with continuing to operate a dam that does not meet current West Virginia and NRCS safety and performance standards.
- Leverages federal resources to install the planned works of improvement.
- Will meet West Virginia and NRCS safety and performance standards for a High Hazard potential dam.

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

Net beneficial effects $90,000

Funding Schedule (budget year +4):

The most likely scenario is for the project to be implemented over 4 years, with project authorization being Year 0, design and preconstruction activities in years 1 and 2, and construction in years 3 and 4. Funding by source and by year is shown below.

Annual Expenditure by Year and Source

	Year 1	Year 2	Year 3	Year 4		Total
Federal Funds						
Engineering services	$592,900	$592,900				$1,185,800
Geotechnical services	$200,000					$200,000
Project administration	$344,500	$344,500	$344,500	$344,500		$1,378,000
Construction			$5,597,150	$5,597,150		$11,194,300
AE construction phase costs			$325,000	$325,000		$650,000
Quality control testing			$125,000	$125,000		$250,000
Federal funds subtotal	$1,137,400	$937,400	$6,391,650	$6,391,650		$14,858,100
Non-federal Funds						
Project administration	$1,750	$1,750	$1,750	$1,750		$7,000
Engineering services	$3,500	$3,500				$7,000
Real Property Land rights	$5,200					$5,200
Permits	$56,000					$56,000
Construction			$3,013,850	$3,013,850		$6,027,700
AE construction phase costs			$175,000	$175,000		$350,000
Non-federal funds subtotal	$66,450	$5,250	$3,190,600	$3,190,600		$6,452,900
Total federal and non-federal	**$1,203,850**	**$942,650**	**$9,582,250**	**$9,582,250**		**$21,311,000**

Period of Analysis: 104 years (100 year evaluated life plus a four-year installation period.)

Project life: 100 years

Environmental effects:

Soils: Short-term, direct, minor, adverse; long-term, direct, negligible, adverse

Waters of the U.S.: Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Water Quality: Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial

Water Quantity: Short-term, direct, minor, adverse; long-term, direct, negligible, adverse

Wetlands: Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Floodplain Management: Short-term, direct, negligible, adverse; no long-term effects

Climate: No effect

Air Quality: Short-term, direct, negligible, adverse; no long-term effects

Plants: Dominant Vegetation Communities: Short-term, direct, minor, adverse; long-term, direct, minor, adverse; Endangered or Threatened plants: No effect; Invasive plants: No effect

Riparian Areas: Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Animals: Fish: Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Wildlife: Short-term, direct, minor, adverse; long-term, direct, negligible, adverse; Threatened and Endangered: No effect; Migratory birds: Short-term, direct, negligible, adverse; no long-term effects

Human: Cultural & Historic Properties: No effect; Recreation: Short-term, direct, moderate, adverse; long-term, direct, minor, adverse; Scenic Beauty: Short-term, direct, moderate, adverse; long-term, direct, minor, adverse

Ecosystem Services: Regulating: No effect; Supporting: Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse; Cultural: Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Consultation, Coordination and Public Participation
NRCS requested consultation from 18 entities. The West Virginia State Historic Preservation Officer (SHPO), Catawba Indian Nation, Cayuga Nation, Chickahominy Indian Tribe, Delaware Nation, Eastern Chickahominy, Eastern Shawnee Tribe of Oklahoma, Eastern Band of Cherokee Indians, Monacan Nation, Pamunkey Indian Tribe, Rappahannock Tribe, Saint Regis Mohawk Tribe, Seneca-Cayuga Nation, Shawnee Tribe, Tonawanda Band of Seneca, Tuscarora Band of Seneca, United Keetoowah Band of Cherokee Indians and the Upper Mattaponi Indian Tribe were contacted seeking their review and comment. SHPO expressed their satisfaction with the undertaking and that no further consultation would be necessary. The Catawba Indian Nation and Shawnee Tribe requested further consultation *only* if artifacts or human skeletal remains were discovered. All other sovereign Native American governments did not respond to NRCS' request for consultation. See *Consultation, Coordination, and Public Participation* section for detailed information.

Major conclusions (if not already covered elsewhere in the Summary):
Unavoidable adverse effects would result from implementation of the Alternatives. These effects are anticipated to be short-term and minor overall, and the majority of long-term effects are anticipated to be negligible. Most of the adverse impacts identified in this assessment can be

mitigated with the use of BMPs during the construction process. BMPs will be identified during the design of this project and consultation with regulators during the permitting process.

Areas of controversy Controversial Issues: None

Issues to be resolved: None

Evidence of Unusual Congressional or Local Interest: None

Is this report in compliance with executive orders, public laws, and other statues governing the formulation of water resource projects? Yes

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

The present dam does not meet current WV and NRCS dam safety and performance standards, thus posing a risk of a breach and loss of life. Therefore a "Change in Major Project Features" is needed to address structure deficiencies. These types of changes require the preparation of a Supplemental Watershed Plan. All aspects of the Plan-EA that have changed or will be impacted will be updated according to current policy.

FEDERAL OBJECTIVE

Investments in this proposed action reflect national priorities, encourage economic development, and protect the environment by:

(1) seeking to maximize sustainable economic development;

(2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and

(3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

PURPOSE AND NEED FOR ACTION

Purpose and Need for Action:
The project shall provide flood protection (flood damage reduction), public recreation benefits, and watershed structure rehabilitation insuring the water based recreation opportunities provided by the current structure will exist for the life of the structure. This purpose is synonymous with the Sponsors' project objectives. The current structure does not meet current West Virginia and NRCS dam safety and performance standards. Action is needed to reduce the risk of flood damage to homes, commercial facilities, and an expanded infrastructure as well as to reduce the risk of loss of life due to a flood event.

There is a potential for loss of life from a catastrophic dam failure due to the existence of one stream crossing (bridge) and 4 roadways downstream of this structure within the breach inundation zone. In addition, people living and/or working in 272 residences, 10 multi-family structures, 14 commercial buildings, and 1 public property would be at risk from a catastrophic dam failure.

The dam currently provides floodwater damage reduction for flood events up to a magnitude of the 500-year flood for 51 single family residences, 4 multi-family buildings accounting for up to 14 units, 2 commercial properties, 1 public property, and 4 roadways.

The continuation of flood damage reduction is needed to protect the downstream properties and infrastructure. The Sponsors want to continue to provide flood protection and recreation in a manner that reduces risk of loss of human life and shows good stewardship of public funds as well as being environmentally conscious. Federal action is required to assist the Sponsors and to assure that the Federal government's interest is protected in that the evaluated life of the structure ends 2071. The reservoir provides a significant water-based recreation asset to the community.

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, human resources, and ecosystem services 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. NRCS conservation practice physical effects (wire frame) diagrams were used during the process to identify ecosystem flows that potentially would be affected. The practice (wire frame) diagrams used were for a Dam (402), and Critical Area Planting (342).

On December 17, 2020, two Scoping Meetings were held virtually via Microsoft Teams. One in the morning and the other in the evening to facilitate participation from government entities and the various publics in the area. A total of 46 people attended these meetings with some people attending both the afternoon and evening meetings. The Scoping Results table below lists the specific concerns and their relevance to the proposed action to the decision-making process.

Various alternative measures to address the deficiencies of the dam were mentioned during the scoping meetings. The specific measures discussed fall into the following four categories:

1. No Action – the action that would be taken in the absence of federal funds for dam rehabilitation, known as the Future Without Federal Investment (FWOFI). The Sponsors would be responsible for the total cost of rehabilitation to WV dam safety and performance standards or removal of the dam.
2. Decommissioning – removal of a dam while providing flood protection
    a. Relocation or acquisition of structures
    b. Floodproofing (including elevating buildings)
3. Rehabilitation – Structural rehabilitation
    a. Roller-compacted concrete in the existing auxiliary spillway location
    b. Roller-compacted concrete over the top of the dam to harden it
    c. Armoring the spillway with articulated concrete block to allow for higher flows
4. Non-structural – least-cost combination of structural and non-structural features
    a. Relocation or acquisition of at-risk structures
    b. Floodproofing (including elevating buildings)

The NRCS conservation measure physical effects network diagrams for “Dam” and “Critical Area Seeding” were used during scoping. These diagrams identify ecosystem flows that potentially would be affected by project action. They also identified potential cumulative effects which provided an initial starting point for cumulative effects analysis.

The table below summarizes the concerns identified by the public as relevant to decision-making related to the project. Those resource issues and ecosystem services marked with an “X” are relevant to the proposed action and are considered in further detail in the document.

Scoping Results for Rehabilitation of Blakes Creek-Armour Creek Watershed Site 7
Kanawha County, West Virginia

ITEM/ CONCERN	Relevant to the proposed action?		RATIONALE
	YES	**NO**	
SOILS			
Land use		X	No major impacts to land use are expected.
Soil Resources		X	Soil disturbance associated with construction and earth movement from project action is anticipated to occur but no major impacts to soil resources are expected.
Prime and Unique Farmland and Farmland of Statewide Importance	X		NRCS policy requires analysis of impacts to this resource. The acres of prime and unique farmland and farmland of statewide importance associated to project activities will be determined and analyzed.
WATER			
Sole Source Aquifers		X	Not applicable to the watershed.
Water Resources	X		Waters of U.S. - USACE Jurisdiction
Water Quality	X		Clean Water Act, Federal Law – Lake impaired for phosphorus in 2016 on 303(d) impaired waterbodies list. Blakes Creek was on 2014 impaired list but not on 2016 list.
Regional Water Mgt. Plans (including Coastal Zone Mgt. Areas)	X		Some development upstream of the dam is planned in the future which could increase impervious surfaces and runoff.
Floodplain Management	X		Executive Order 11988 directs federal agencies to evaluate impacts to floodplain management, which this project involves.
Streams, Lakes and Wetlands	X		NRCS Policy and Executive Order 11990 directs federal agencies to evaluate impacts to wetlands, which this project has in the adjacent streams, impoundments, and wetlands.

Wild and Scenic Rivers	X		Public Law. 90-542 - No local designations of Wild and Scenic Rivers or Nationwide Rivers Inventory-listed segment are in Limit of Disturbance (LOD)
ITEM/ CONCERN	Relevant to the proposed action?		**RATIONALE**
	YES	**NO**	
AIR			
Air Quality	X		Public Law 42 Sec. 7401-7671q, Clean Air Act, Federal Law - project site is not in a non-attainment zone. Project activities may impact air quality near the sites temporarily during the construction phase.
PLANTS			
Forest Resources		X	No significant tree clearing is expected in order to facilitate construction.
Natural Areas		X	No state or federal designated areas for this dam..
Endangered and Threatened Species	X		Public Law 93-205 the Endangered Species Act of 1973 requires consideration of plant species affected by project activities.
Invasive Species	X		Executive Order 12112 - no species were observed during a 2021site visit.
Riparian Areas	X		Project may impact upstream or downstream riparian areas.
ANIMALS			
Fish and Wildlife	X		Lake is stocked for fishing and used extensively.
Essential Fish Habitat		X	Magnuson-Stevens Fishery Conservation and Management Act (50 CFR – Subpart J) is not applicable to this watershed.
Coral Reefs		X	Executive Order 13089, Not applicable to the watershed.

Endangered and Threatened Species	X		Public Law 93-205 - – bats are on IPaC List.
Invasive Species	X		Executive Order 12112 Evaluate for potential presence of and impacts to, invasive species.
Migratory Birds/Bald Eagles/Golden Eagles	X		Executive Order 13186, Migratory Treaty Act, Federal Law but no known nesting areas near the dam.
ITEM/ CONCERN	Relevant to the proposed action?		**RATIONALE**
	YES	**NO**	
HUMANS			
Public Health and Safety	X		Flood control is critical for downstream areas.
Scenic Beauty	X		The area has aesthetic value to area residents.
Scientific Resources		X	No known research is going on in the watershed.
Social / Cultural Issues	X		Potential impacts to social and cultural resources.
Historic Properties	X		National Historic Preservation Act 54USC§306108 & its implementing regulation 36CFR§800: Take into account the effects of the undertaking on historic properties and consult with stakeholders.
Environmental Justice and Civil Rights	X		Executive Order 12898 requires an evaluation of EJ and Civil Rights.
Local and Regional Economy	X		The existing structure is important to the protection of the downstream area. Construction will create jobs and improve the local economy.
Recreation	X		This facility is valuable to area residents. Recreation is an authorized purpose of the facility, as well as flood control.
Park Lands		X	National or state park lands will not be affected.

ECOSYSTEM SERVICES	Relevant to the proposed action?		**RATIONALE**
	YES	**NO**	
Provisioning (tangible goods provided for direct human use and consumption)			
Food		X	Not a significant food production area.
Fiber		X	Not a cropland watershed.
Water		X	Not a water supply.
Timber		X	No timber industry present.
Biomass		X	No significant forage production.
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)			
Flood Control	X		This was a purpose for the structure being studied. No data or evidence specifically tying flooding to disease spread from the structure.
Water Filtration		X	Not a groundwater aquifer area.
Climate Stabilization		X	Not a significant greenhouse gas production area.
Crop Pollination		X	Not a cropland watershed.
Supporting (underlying processes maintaining conditions for life on Earth)			
Nutrient Cycling	X		Some soil disturbance likely.
Soil Formation	X		Some soil disturbance likely.
Primary Production		X	Not a significant green plant production area.
Cultural (make the world a place in which people want to live)			
Recreational Use	X		Area of potential effect (APE) is used for recreation.
Spiritual		X	Consultation revealed no areas of concern.
Aesthetic Viewsheds	X		The area is enjoyed by area visitors.
Tribal Values		X	Consultation revealed no areas of concern.

AFFECTED ENVIRONMENT

This section of the plan describes the elements of the physical, biological, ecological, economic, social/human environments within the project area that might be affected by the project alternatives. This area is referred to as the Area of Initial Analysis (AIA). This area is as outlined on Figure 2 in Appendix C. It provides a context for effects within the Limit of Disturbance (LOD) which is defined later in the planning process. The Blakes Creek – Armour Creek drainage area is approximately 2.36 square miles. Emphasis is placed on the current status of each element and any trends that may be evident both upstream and downstream of the alternatives.

The resource concerns identified as significant to decision-making for this project fall into the following categories: physical, biological, ecological, economic, and social/human. The specific concerns are found in the following guidance documents: USDA NRCS National Watershed Program Manual, 390-NWPH, Part 606, Subpart B, Section 606.18, and NRCS CPA-52. Those identified during the agency and public scoping meetings are also placed under the categories listed above.

Physical Environment

Project Location

The dam is located on Blakes Creek, a tributary of the Kanawha River in the City of Nitro, Kanawha County, West Virginia. Most of the watershed is in the western end of Kanawha County, but a small acreage extends into the southeastern edge of Putnam County.

Topography

Kanawha County, located in southwestern West Virginia, in the Appalachian Plateau. The topography of the land surrounding the dam site consists of hills of varying steepness. Immediately surrounding the Dam, the topography slopes toward Ridenour Lake (the reservoir), with the steepest slopes southeast of the Dam.

Geology

Geology relates to the nature of materials that may occur at depth compared to mapped soils. Investigation and desktop review of the geologic units in the AIA provide information related to expectations of the parent material.
Geologic units in the immediate vicinity of the Dam were identified using the West Virginia Geological and Economic Survey's Geologic Map of West Virginia (1968). The bedrock geologic units identified near the Dam are the Conemaugh Group and the Monongahela Group from the Paleozoic Era and the Pennsylvanian Age. These geologic units are comprised of sedimentary rocks, primarily shale.

The original geologic investigation from the time of dam construction also reported that the underlying rock strata was the Conemaugh Series of Pennsylvanian Age, comprised primarily of shales, siltstones, and claystones with lenses of sandstone. Surficial materials were described as colluvial and alluvial deposits and residual soils (USDA 1965).

The Geology Reports (USDA-SCS, 1965/1966) note that an apparent Precambrian-aged fault zone, with a vertical displacement of 14 feet, may exist beneath the downstream slope of the Dam. Information available on the WVGES website does not indicate the current activity status of this fault. The Tectonic Map inset on the Cardwell et al. (1968) geologic map by H.P. Woodward indicates the presence of strike interruptions north and south of the Dam. The Basement Map inset on the Cardwell et al. (1968) geologic map by H.P. Woodward indicates the Dam is situated within a probable zone of large-scale transcurrent faulting. This zone is described by Woodward as "…possibly a broad belt up to 25 miles in width in which dextral displacement has occurred along many parallel or echelon faults. The cumulative strike-slip displacement may amount to 40 miles or more." The Basement Map estimates this probable large-scale faulting occurred within the Precambrian basement rocks at depths of 10,000 to 15,000 below sea level. Woodward suggests this zone was most recently active in the late Devonian Period.

The seismicity at the Dam is typical of the Central and Eastern United States (CEUS). The CEUS is a stable, intraplate region that is not nearly as active as the Western United States (WUS) that borders a plate boundary; however, much less attenuation occurs with CEUS earthquakes compared to those in the WUS because of the thick, denser crust in the CEUS. Therefore, earthquakes of similar magnitude will impact a much larger region in the CEUS (USGS, 2018). A literature review of regional seismicity was performed to identify seismogenic sources in the area and locations of significant past earthquakes and epicenter density. These events include:

- Body wave magnitude (Mb)2.8 – 8/11/1970 – Lincoln County, West Virginia
- Mb2.5 – 10/2/1998 – Kanawha County, West Virginia
- Mb3.0 – 6/28/1991 – Kanawha County, West Virginia

Two of these earthquakes occurred in the vicinity of an apparent Precambrian fault identified above: 1) the 1991 epicenter was located about 15 miles to the southeast of the Dam and 2) the 1970 epicenter (along the fault) was located about 15 to 20 miles southwest of the Dam. The current activity status of this fault is unknown.

The Dam is located in an area of relatively low seismicity for the CEUS and is near few seismic source zones. In areas where active faults cannot be identified, such as the CEUS, seismic source zones are developed to capture the seismicity of the region. The Dam is on the northern edge of the Giles County Seismic Zone but is otherwise far from any major seismic sources and zones.

Some characteristics of the soils and rock in the embankment, foundation, and surrounding hillsides will constrain the number and types of rehabilitation alternatives available. Some of these characteristics include:

- Essentially homogeneous embankment section consisting of fine-grained soils which are not favorable for stability during seismic and rapid drawdown events and are slightly dispersive.
- The hillsides surrounding abutting the Dam exhibit evidence of being prone to landslides.
- The foundations soils include a deep notch of depositional materials (alluvium and colluvium) located near the original stream channel, with occasional soft zones.
- Artesian groundwater conditions were observed in the soils beneath the downstream toe.

- Much of the bedrock at the Dam rapidly slakes or softens to soil consistency upon exposure.
- Slickensides discontinuities were observed occasionally in rock samples.
- Sixteen 24-inch diameter relief drains, spaced 30 ft center-to-center, were drilled beneath the trench drain to top of rock to intercept seepage in the alluvium and colluvium. The deepest of these relief wells is approximately 50 feet below the bottom of the trench drain.
- The fine aggregate materials in the trench drain are not filter compatible with the fine-grained embankment fill and foundation soils.

Soils

Prime farmland soils are present in the AIA where Senecaville silt loam and Sensabaugh silt loam exist, covering 36.48 acres.

Farmland soils of statewide importance are present in the AIA where Gilpin-Upshur silt loams (20 to 30 percent slopes) and Vandalia silt loam (3 to 8 percent slopes and 8 to 15 percent slopes) are present covering 34.31 acres.

Farmland soils of local importance are present in the AIA where Gilpin silt loam (30 to 40 percent slopes), Gilpin-Upshur complex (20 to 30 percent slopes, severely eroded), Gilpin-Upshur silt loams (steep), and Vandalia silty clay loam (15 to 25 percent slopes, severely eroded) are present covering 117.39 acres. Farmland soils of local importance are identified by local (county) agencies and do not have national or statewide importance. The soils are not necessarily used for cropland or farming, but can be forest land, pastureland, cropland, or other non-urban land.

There is no highly erodible cropland in the project area.

Biological

Plants

The following plant species, among others, were observed at the dam site during the March 2022 wetland delineation: water forget-me-not (*Myosotis scorpioides*), bulrush (*Typha latifolia*), multiflora rose (*Rosa multiflora*), red oak (*Quercus rubra*), Japanese stiltgrass (*Microstegium vimineum*), wild garlic (*Allium vineale*), Japanese honeysuckle (*Lonicera japonica*), black willow (*Salix nigra*), woolgrass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), and broom sedge (*Andropogon virginicus*).

Special Status Plant Species

A U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report was generated for the project and is included in the Administrative Record. The report did not list any federally threatened or endangered plant species in the AIA.

The West Virginia Division of Natural Resources (WV DNR) Natural Heritage Program tracks rare plant species in West Virginia, assigning each species a state rank. An initial environmental data request was submitted to the WV DNR Natural Heritage Program to obtain information on state listed plant species in the AIA. A response letter from WV DNR issued on 11 January 2021

indicated that the Natural Heritage Program has no known records of rare, threatened, or endangered plant species or sensitive habitats in the AIA.

Noxious Weed and Invasive Plant Species

Invasive plant species in West Virginia are categorized by WV DNR as either Rank 1 (highly invasive), Rank 2 (moderately invasive), or Rank 3 (occasionally invasive) (WV DNR 2009). A complete list of West Virginia invasive plant species is included in the Administrative Record. Several invasive plant species were observed during the March 2022 wetland delineation, although an official survey was not conducted as a part of this project. West Virginia state listed invasive plant species observed during the delineation include: multiflora rosa, Japanese honeysuckle, winter creeper (*Euonymus fortunei*), and Japanese stiltgrass.

Riparian Areas

Riparian habitat exists in the transitional areas between Blakes Creek, Ridenour Lake, and the adjoining land. Vegetation cover in the riparian corridor of the AIA and upstream and downstream of the Dam is primarily categorized as riverine wetlands and deciduous forest.

Animals

Fish and Wildlife

Fish inhabit Blakes Creek upstream and downstream of the dam, as well as Ridenour Lake. Fish can migrate from Blakes Creek segments below the Dam to the Kanawha River. However, the dam serves as a barrier to aquatic organism passage from the Kanawha River and Blakes Creek to the portions of the stream upstream of the dam.

Ridenour Lake is classified as a Public Fishing Lake by WV DNR and is stocked with trout twice per year, once in January and once in March, to maintain the impoundment and park as critical recreational resources for the community. This stocking is to establish a put-and-take recreational fishery and is not part of a restoration effort. The most common fish species found in the lake are channel catfish (*Ictalurus punctatus*), crappie (*Pomoxis*), largemouth bass (*Micropterus salmoides*), and rainbow trout (*Oncorhynchus mykiss*) (WV DNR 2020b). Fisheries survey data is not available for Blakes Creek or Armour Creek, but these creeks are anticipated to contain similar warm water fish species as those found in Ridenour Lake.

Wildlife species that are likely present in the study area include a variety of transient migratory birds, mammals, amphibians, and reptiles. Potential habitat for these species is provided in the wooded, grassed, and riparian areas surrounding the project site. There is no sensitive wildlife habitat identified in the AIA based on preliminary consultations with WV DNR Natural Heritage Program (see the Administrative Record).

WV DNR's Wildlife Diversity Program maintains a list of common wildlife species in West Virginia, which includes: eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), groundhog (*Marmota monax)*, Virginia opossum (*Didelphis virginiana*), hairy-tailed mole (*Parasclops breweri*), eastern cottontail (*Sylvilagus floridanus)*, masked shrew (*Sorex cinereus*), American beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), common raccoon

(*Procyon lotor*), white tailed deer (*Odocoileus virginianus*), among others (WV DNR 2001). It is likely that these species utilize the AIA as foraging habitat.

Common amphibian and reptile species in West Virginia include several frog, toad, salamander, snake, lizard, and turtle species, such as: the wood frog (*Rana sylvatica*), eastern American toad (*Bufo americanus*), red-spotted newt (*Notophthalmus* v. *viridescens*), eastern gartersnake (*Thamnophis sirtalis sirtalis*), common five-linked skink (*Plestiodon fasciatus*), and the eastern snapping turtle (Chelydra serpentina serpentina) (Marshall University Herpetology Lab 2020).

Endangered and Threatened Species and Species of Concern

Federally Protected Species

The USFWS IPaC report returned three federally endangered mammal species as potentially present in the AIA: Gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) (USFWS 2020b). One federally threatened mammal species was also listed as potentially present in the AIA; Northern long-eared bat (NLEB) (*Myotis septentrionalis*). One candidate insect species, the monarch butterfly (*Danaus plexippus*), was also listed as potentially present in the AIA.

Consultation with USFWS regarding federally protected animal species was completed on July 15, 2022. See Consultation, Coordination, and Public Participation section.

Gray Bat (Myotis grisescens)

Gray bats roost in caves scattered along rivers during the summer and hibernate in deep, vertical caves during the winter. Female gray bats typically give birth to a single young in late May or early June (USFWS 2019a).

Indiana Bat (Myotis sodalist)

During the summer, the Indiana bat inhabits small to medium river and stream corridors with well-developed riparian woods and upland forests. They prefer to roost under peeling bark of dead and dying trees. Breeding begins in late summer and early fall when swarming occurs near hibernacula. For the remaining winter months, the bats hibernate in caves and mines in dense clusters (USFWS 2019b).

Virginia Big-Eared Bat (Corynorhinus townsendii virginianus)

Virginia big-eared bats hibernate in cool, well-ventilated caves throughout the winter. The species prefer caves located in karst regions dominated by oak-hickory or beech-maple-hemlock forest. In the early spring, female Virginia big-eared bats congregate in warm parts of caves and give birth to a single young (USFWS 2011).

Northern Long Eared Bat (Myotis septentrionalis)

During the summer, NLEB roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). NLEB are flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. Breeding begins in late summer or early fall when males begin to swarm near hibernacula, the caves or mines where NLEB will hibernate during the winter (USFWS 2019c).

Monarch Butterfly (Danaus plexippus)

During the breeding season, which is year-round in many regions, monarchs lay their eggs on their milkweed host plant, and larvae emerge after 2 to 5 days. Larvae develop through five intervals between molts over a period of 9 to 18 days and then pupate into chrysalises before emerging 6 to 14 days later as adult butterflies. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months. Significant threats to the survival of the monarch butterfly includes the loss of milkweed plants which are often eradicated as nuisance weeds, the loss of their winter habitat to development and deforestation, loss of habitat along their migration routes, and climate change which has resulted in more severe storms and temperatures which adversely affect monarch populations.

State Species of Concern

West Virginia Natural Heritage Program maintains a list of rare, threatened, and endangered animal species found in West Virginia. Specific locations of the species are not made publicly available in order to protect the species. An initial environmental data request was submitted to the WV DNR Natural Heritage Program to obtain information on state listed animal species found within the AIA. A response letter from WV DNR issued on 11 January 2021 indicated that the Natural Heritage Program has no known records of rare, threatened, or endangered animal species or sensitive habitats in the AIA. The letter specifies that no surveys have been conducted in the AIA. A copy of the letter is included in the Administrative Record.

Invasive Fish and Wildlife Species

There are no known occurrences of invasive animal species in the project site. A copy of the West Virginia invasive animal species list was obtained from the West Virginia Invasive Species Strategic Plan and Voluntary Guidelines (2014). The project area may provide suitable habitat for several of the listed invasive bird and insect species. Best management practices, as outlined in the aforementioned Plan, will be implemented if any invasive species are encountered.

Migratory Birds/Bald and Golden Eagles

Bald eagles have occasionally been observed in Kanawha County by citizens. However, there are no official recorded observations of nests in the county. It is anticipated that the occasional eagle observation can likely be attributed to eagles utilizing the lake and surrounding habitats while searching or foraging for food. Bald Eagles were not listed on the USFW IPaC report.

The USFWS IPaC report for the AIA identified migratory birds that could potentially utilize the reservoir and surrounding area. These species may include black-capped chickadee (*Poecile atricapillus*), cerulean warbler (*Dendroica cerulea*), eastern whip-poor-will (*Antrostomus vociferus*), Kentucky warbler (*Oporornis formosus*), prairie warbler (*Dendroica discolor),* red-headed woodpecker (*Melanerpes erythrocephalus*), rusty blackbird (*Euphagus carolinus*), and the wood thrush (*Hylocichla mustelina*) (USFWS 2020b). All of these bird species are found on the USFWS Birds of Conservation Concern list (USFWS 2020b).

Ecological Environment

Climate

The climate is moderate with no extremes in either the summer or winter temperatures. Kanawha County is subject to a humid continental climate, consisting of four seasons with warm summers and cold winters. Rainfall is about average for the state and is distributed throughout the year. The average growing season is approximately 160 days. In general, Kanawha County experiences less snowfall than other areas of the state. Severe weather, such as hurricanes and snowstorms, are uncommon.

Climate change impacts to West Virginia include warmer temperatures and more frequent heavy rain events. Average precipitation is expected to increase in the winter and spring and rising temperatures will melt snow earlier in the spring. As a result, climate change is likely to cause more intense flooding during winter and spring, and more severe droughts during summer and fall (EPA 2016a).

Water Resources (including Water Quality, Quantity, and Use/Efficiency

Water Quality

The Clean Water Act requires states to assess the quality of their waterbodies and to identify specific waterbodies where water quality is impaired or threatened by pollutants, based on the waterbodies' assessed designated uses. Each state is required to report findings to EPA every 2 years. Blakes Creek was listed as an impaired waterbody during reporting year 2016 (EPA 2020b, EPA 2020c) and was listed as fully supporting agriculture and wildlife designated uses and water supply, water transport, cooling, and power designated uses (West Virginia Department of Environmental Protection [WV DEP] 2016). Blakes Creek was impaired for iron, fecal coliform, and benthic macroinvertebrates. Total maximum daily loads (TMDLs) were developed for these impairments in 2012 (EPA 2020b) and Blakes Creek was not listed as an impaired water during the 2016 reporting year (WV DEP 2016). However, Ridenour Lake was listed as an impaired waterbody during the 2016 reporting year. The impairment is for phosphorous and a TMDL is scheduled for 2025 (WV DEP 2016). The final integrated water quality report for 2018/2020/2022 has not been published.

Water Quantity

The original work plan indicated that the dam had a 27.5-acre normal pool and a 45.5-acre flood control pool with storage capacity at the auxiliary spillway crest of 541.6 acre-ft (USDA 1969). There is not any agricultural or domestic use of the reservoir pool, therefore water use efficiency is not an issue of this project.

Regional Water Resource Plans (including Coastal Zone Management Areas)

The project area is not located within a coastal zone management area. West Virginia maintains a Water Resources Management Plan, which was released in 2013, to monitor water usage in the state. This project is not anticipated to impact the water use guidelines outlined in the Plan.

Floodplains

Based on review of the FEMA flood insurance rate map for the study area (Panel 54039C0212E) effective 6 February 2008, detailed hydraulic study was performed for areas downstream of the

dam with Zones AE and X delineated as part of the study (FEMA 2020). Lake Ridenour in included in the flood insurance rate map as Zone A (approximate study with no base flood elevations identified). The dam was constructed to protect the City of Nitro after the area experienced several damaging floods between 1934 and 1961. Future planned development upstream of the Dam could potentially result in an increase in impervious surfaces and runoff water.

Waters of the U. S., including Wetlands

Ridenour Lake and Blakes Creek were identified as Waters of the U.S. (WOTUS) during a March 2022 wetland delineation using USACE wetland delineation guidelines. There are also two unnamed perennial streams that feed into Ridenour Lake that were identified as WOTUS.

Wetlands

Wetlands present in the LOD include lake wetlands, freshwater forested/shrub, and freshwater emergent wetlands. Descriptions and acreages of the wetland types are included in the table below. These wetlands were delineated by EA in March 2022 using USACE wetland delineation guidelines and classified using the Cowardin system. The USDA NRCS has adopted *Classification of Wetlands and Deepwater Habitats of the United States* by Cowardin et al. as the agency's official wetland classification system (i.e., the Cowardin System).

Wetland Communities in the Limit of Disturbance

Wetlands Type	Cowardin Description	General Description	LOD (acres)
Lake wetlands	Lacustrine deepwater and associated wetlands	Lake or reservoir basin	22.22
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow. Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.56
Freshwater forested/shrub	Palustrine forested and/or Palustrine shrub	Woody wetlands, forested swamp, shrub bog	1.00
Total wetlands			23.78

Wild and Scenic Rivers

Wild, scenic, or recreational rivers are not present in or near the AIA (National Wild and Scenic Rivers System 2020).

Air Quality

National Ambient Air Quality Standards pollutants include carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. Kanawha County does not violate EPA's standards for any of the six criteria pollutants (EPA 2020d). As all concentrations in the area are below the standards, the dam is located in an attainment area.

Greenhouse gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EPA 2016). Except for routine maintenance at the dam, including grass mowing, there are no emissions sources at the dam site.

Ecosystem Health

The ecosystem structure surrounding the dam consists of deciduous and mixed forest, small patches of wetlands, a maintained grass covered auxiliary spillway, a maintained grass covered earthen dam area, and impounded water upstream of the dam. The dam and auxiliary spillway are surrounded by a municipally maintained park. The presence of the maintained park areas, the dam reservoirs, and the dam structure itself contributes to adverse ecosystem health conditions. The maintained parkland is of lesser habitat value to many native species. Additionally, landscaping materials used at the park, such as fertilizers and/or pesticides, result in further adverse impacts to the overall ecosystem health and quality.

During the site visit to the dam, the entire extent of the existing structure and adjacent land area was walked and visually assessed. The area adjacent to the dam and reservoir are part of a municipal park with maintained grass areas and trails. Beyond the maintained park features, the adjacent areas are deciduous forest with native trees and shrubs. The vegetation and habitat appeared generally healthy. The maintained grass covering the auxiliary spillway and earthen dam was green with a few brown patches. The deciduous trees and wetland shrubs and grasses appeared to be following typical seasonal patterns. Channel erosion was observed upstream of the reservoir, and significant bank erosion was observed extending approximately 100-yards downstream of the principal spillway outlet. Stream water both upstream and downstream of the dam, as well as the reservoir, appeared slightly turbid. The observed erosion and turbidity indicate some ecosystem instability within the upstream watershed.

Ecosystem Services

The following ecosystem service investigation approach is based on Departmental Regulation 9500-013 guidance. It utilizes additional guidance in 40 CFR 1502.15, National Watershed Program Manual (NWPM) (501.38 A. (1), and in Departmental Manual 9500-013 (pgs. 17, 31, 38) which states the intensity of planning is dependent on the potential significance of the project action. It has application to the development of Supplemental Watershed Plans where conservation measures have previously been installed, e.g. Dam Rehabilitation Projects.

To understand ecosystem flows related to project action, the NRCS Conservation Practice Physical Effects (CPPE) network diagrams were employed. The specific diagrams for practices anticipated to be implemented were reviewed. Linkages were defined between the network diagram direct effects and the 16 ecosystem services to be considered in project planning. The direct effect was used as the surrogate measure for impacts to a related ecosystem service. This conceptual model connection was presented during scoping to identify the ecosystem services that would be significant to decision-making. The analysis indicated that three categories of ecosystem services would likely be impacted. These categories include, Regulating, Supporting, and Cultural services. These categories are discussed in more detail below as well as the specific services in each “Service Category” that are anticipated to be impacted by project action. The associated metrics used to evaluate service impacts are also discussed in the following paragraphs.

Regulating Services Category

Regulating ecosystem services are services which help maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe. These benefits are obtained through moderation or control of ecosystem processes, including regulation of local climate, air, or soil quality; carbon sequestration; flood, erosion, or disease control; and pollination. There is inherent uncertainty when trying to predict impacts on regulating ecosystem services, given that most ideas of climate change and potential environmental catastrophes are based on models and simulations.

Flood Control - Service

The dam was constructed for the purpose of flood control to protect the City of Nitro and its residents from flooding events. The creation of the Dam has limited the frequency and extent of flooding events, and as a result lowered the chance of disease spreading through contaminated flood waters. The continuing functionality of the Dam will continue to provide public health and safety benefits to residents impacted by flood reduction associated with the dam.

Surrogate Metric for Flood Control

The key metrics, which will be used as the surrogate measures of the flood control service (and by default disease control) are the number of structures located within the FEMA 100-year flood zone downstream of the Dam and the overall change in size, if any, to the flood zone. The residents and businesses within the flood zone will be directly impacted by changes in flood control because the inundation and destruction of structures are more likely to impact human lives than the inundation of flood zone acres. The impact to critical structures like bridges and homes is likely to result in increasing the risk of loss of life. Reducing flood damages and the potential loss of life is a critical ecosystem service for this project.

Supporting Services Category

Supporting services refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production. There is inherent uncertainty when trying to determine impacts of the project on supporting ecosystem services since there are many other factors unrelated to the project that can affect processes such as nutrient cycling and soil formation.

Nutrient Cycling - Service

Nutrient cycling in ecosystems is the exchange of organic and inorganic material back into the production of energy and matter. The nutrient cycle involves animals, plants, bacteria, fungi, as well as mineral components of the soil.

Surrogate Metric for Nutrient Cycling

The key surrogate metric, which will be used to represent nutrient cycling, is vegetation because the addition, disturbance, or removal of vegetation can impact the nutrient cycling process. The change in the extent of vegetation will be analyzed once the limits of disturbance for the alternatives have been developed.

Soil Formation - Service

Factors that affect soil formation include parent material, climate, topography, biological factors, and time (USDA NRCS 2020).

Surrogate Metric for Soil Formation

The key surrogate metric, which will be used to represent impacts to soil formation, will be the extent and magnitude of the change of perviousness of the land within the limits of disturbance.

Cultural Services Category

Cultural services make the world a place in which people want to live. These services are the non-material benefits that ecosystems provide to human societies and culture, including opportunities for recreation, tourism, aesthetic or artistic appreciation, and spirituality. Uncertainty within cultural ecosystem services lies within society's restructuring of what is deemed culturally important as well as future management actions outside the realm of this project.

Recreational Use - Service

The dam is located in Ridenour Lake Park, a popular 65-acre public park in the City of Nitro. The 24-acre reservoir, Ridenour Lake, is the main attraction of the park, and is used for recreational fishing and boating. The land surrounding the reservoir includes 1.61 miles of trails, used for hiking, and additional grassed areas used for picnicking.

Surrogate Metric for Recreational Use

The key surrogate metric that will be used to represent recreational use will be the change in the amount of recreational land post construction, specifically the change in reservoir size and change in the length of trails, compared to existing conditions.

Aesthetic Viewsheds - Service

The dam and its natural surroundings provide aesthetic viewsheds for those who visit the public park. Project action has the potential to impact the content and extent of a person's view of the aesthetics of the dam site.

Surrogate Metric for Viewsheds

The key surrogate metric, which will be used to represent the viewshed, will be the change in acreage of green landscape post construction compared to existing conditions. This change in acreage will be based on views from prominent points on the landscape like roads, communal areas, or residential structures.

Economic Conditions

It should be noted that the City of Nitro and the area potentially affected by a breach of Lake Ridenour Dam span two counties, Kanawha County and Putnam County. The dam itself and the upstream portions below the dam lie with Kanawha County, while much of the downstream impact area to the Kanawha River lies within Putnam County.

Employment data is presented at the regional level because Nitro is part of the greater Charleston Metropolitan Statistical Area and individuals living in Nitro commute to work and purchase goods

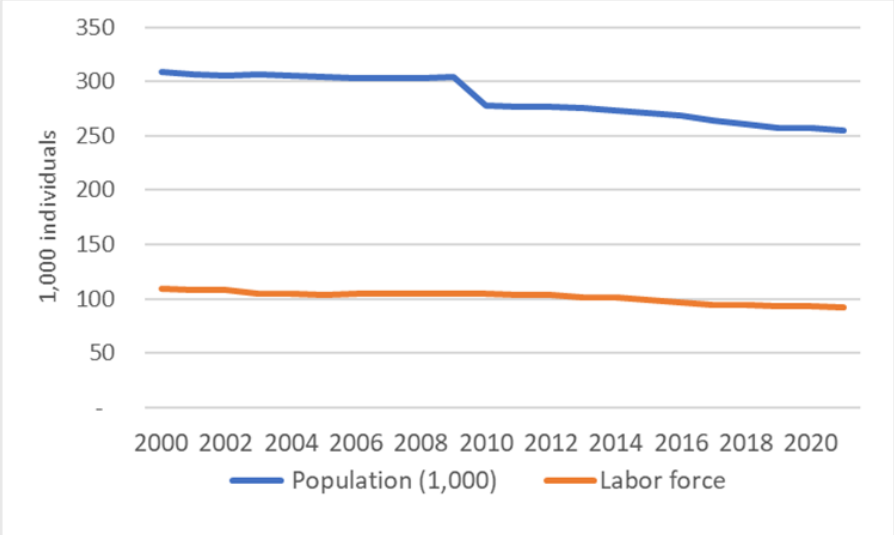
and services at various points around the area. As a result, the economy of Nitro should reflect the economy of the Charleston Metropolitan Statistical Area (MSA). Employment estimates are shown in the table below, accounting for total non-farm employment in the area.

Non-Farm Employment in the Charleston Area

Industry	Employment	Percent of total
Mining, logging, construction	6,300	6.14%
Manufacturing	3,000	2.92%
Trade, transportation, utilities	16,600	16.18%
Information services	1,400	1.36%
Financial services	6,700	6.53%
Professional and business services	12,300	11.99%
Education and health	21,200	20.66%
Leisure and hospitality	8,100	7.89%
Other services	3,800	3.70%
Government	23,200	22.61%
Total non-farm employment	102,600	100.00%

It is apparent that Government, Education and Health, and Trade, Transportation, and Utilities sectors account for about 50 percent of area employment. These rankings are somewhat expected since Charleston is the capital city. Mining and Manufacturing account for less than 10 percent of employment. The unemployment rate associated with the Charleston region was about 3 percent. Similar to regional population, the regional workforce has declined over the last 22 years, as summarized in the figure below.

Regional Civilian Labor Force and Population 2000-2021



Source: Bureau of Labor Statistics, accessed through https://fred.stlouisfed.org

Income and Poverty Status

The table below summarizes the median age, per capita income, median household income, and poverty status for Census Block groups within the area potentially affected by a dam breach. Census Blocks were considered in order to identify potential Environmental Justice populations based on income. It should be noted that Block Group 2 within Kanawha County, representing the older downtown area of Nitro, shows a markedly lower level of per capita income than the surrounding areas. Overall levels of income in Nitro appear to reflect those of the surrounding counties and the State. However, within the city, there appears to be greater variability and higher levels of poverty than in the surrounding areas.

Project Area Income and Poverty Data

	Median age	Per capita income	Median household income	Persons below poverty line (%)
State of West Virginia	42.5	$27,346	$48,037	15.8%
Kanawha County	43.4	$29,981	$47,122	15.7%
City of Nitro	42.1	$28,114	$43,564	19.3%
Census Tract 106 Kanawha County	42.9	$30,627	$42,500	15.6%
Block Group 2	34.8	$15,222	NA	NA
Block Group 3	63.8	$34,650	$32,348	NA
Block Group 4	44.6	$28,205	$66,875	NA
Putnam County	41.8	$31,587	$60,097	9.9%
Census Tract 205 Putman County				17.8%
Block Group 3	42.4	$21,500	43,462	NA
Block Group 5	53.3	$25,120	29,688	NA

Education

The table below summarizes the educational attainment in Nitro as compared to the surrounding counties and the State. The proportion of Nitro residents with a high school degree is the same as for the State overall, but slightly lower than the surrounding counties. The proportion of Nitro residents with a college degree is significantly lower than the surrounding counties and the State.

Educational Attainment

	City of Nitro	Kanawha County	Putnam County	State of West Virginia
High school graduate or higher, percent of persons age 25 years+, 2016-2020	87.6%	89.3%	92.3%	87.6%
Bachelor's degree or higher, percent of persons age 25 years+, 2016-2020	16.0%	26.4%	26.3%	21.30%

Housing

The table below shows most of the Nitro's housing is owner-occupied but valued somewhat less than the housing in the surrounding counties and in the State. The lower housing value is reflected in lower ownership costs and rents.

Housing Status

	City of Nitro	Kanawha County	Putnam County	State of West Virginia
Owner-occupied housing unit rate, 2016-2020	69.3%	70.3%	82.4%	73.7%
Median value of owner-occupied housing units, 2016-2020	$104,000	$115,300	$175,700	$123,200
Median selected monthly owner costs – with a mortgage, 2016-2020	$1,045	$1,053	$1,320	$1,058
Median selected monthly owner costs – without a mortgage, 2016-2020	$371	$370	$381	$331
Median gross rent	$700	$749	$857	$732

Summary

The demographics of the Nitro area compared to Kanawha County, Putnam County, and the State of West Virginia overall reflects evidence of slightly lower per capita income and median household incomes, slightly higher poverty rates, and slightly less expensive housing. The older area of Nitro, within Kanawha County, appears somewhat less affluent than their downstream neighbors in Putman County.

Social/Human Environment

Data characterizing population, income, race, and ethnicity data are reported by the overlying Census Tracts and Blocks in both counties. This breakdown ensures that possible Environmental Justice populations are not overlooked when aggregating data across the city or impact area. Remaining social and economic data is presented for the City of Nitro as a whole and compared to corresponding county and state data. The exclusive source of social and income data is the most recent Census data available.

Population and Race

The table below summarizes population and racial and ethnic composition of the local area compared to the surrounding counties and West Virginia. It is apparent that the area is

predominately white in racial composition. There is a Native American population of approximately 7.1 percent of the total in Block Group 2, Tract 106, Kanawha County, corresponding to the older downtown area of Nitro, and a 5.6 percent Hispanic population Block Group 5, Tract 205 Putman County.

Project Area Race and Ethnicity, 2020 population estimates where available, 2010 racial and ethnic estimates

	Population	White	Black	Hispanic	Native American	Two or more races
State of West Virginia	1,782,959	93.5%	3.6%	1.7%	0.3%	0.9%
Kanawha County	177,952	87.7%	7.1%		0.2%	
City of Nitro	6,624	92.6%	2.3%	0.3%	0.4%	5.8%
Census Tract 106 Kanawha County	4,667	94%	0.9%	0.0%		5.1%
Block Group 2	494	92.9%			7.1%	
Block Group 3	361	100.0%				
Block Group 4	778	100.0%				
Putnam County	57,260	96.3%	1.2%	0.3%	.8%	1.4%
Census Tract 205 Putman County	6.567	95.5%	1.4%	1.2%		
Block Group 3	3,393	97.2%	1.7%	0.6%	0.5%	
Block Group 5	252	94.4%		5.6%		

Age

The table below summarizes the age and gender characteristics of the region. It appears Nitro has a somewhat younger population, as shown by the percentage of individuals under the age of 18, and a higher proportion of females.

Age and Gender Characteristics

	City of Nitro	Kanawha County	Putnam County	State of West Virginia
Persons under 5 years, percent	3.1%	5.2%	5.1%	5.2%
Persons under 18 years, percent	25.9%	20.0%	21.9%	20.1%
Persons 65 years and over, percent	19.1%	21.2%	18.9%	20.5%
Female persons, percent	54.6%	51.8%	50.70%	50.5%

Public Health and Safety

Ridenour Dam provides flood protection and water quality benefits to the area. For a 100-year storm event, the dam eliminates 30 structures from flooding, with the majority of these (26) being single family residences. Impacts of flooding are reduced, but not eliminated for 27 additional structures, compared to no-dam scenario. Flooding on over one-half mile of collector streets and roadways is also eliminated. Reduction to the risk of loss of life is a clear public health and safety benefit of the existing facility. In addition, reduced flooding risks reduce the corresponding risk of contamination of regional surface water supplies with flood run-off.

Visual/Aesthetics and Scenic Beauty

Scenic beauty, as defined by the USDA National Environmental Compliance Handbook Part 610.35, takes into consideration landforms, water, vegetation, and structures, some of which are present near the dam (USDA NRCS 2016b).

Ridenour Lake Park was developed after the construction of the dam, and the Ridenour Lake has become a popular destination in the center of the City of Nitro. The scenic beauty provided by the lake, vegetation, and gazebo in the park are highly valued by visitors of the park and the local community.

Cultural Resources / Historic Properties

54USC§306108 requires, "*The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State... prior to the approval of the expenditure of any Federal funds... shall take into account the effect of the undertaking on any historic property"*. This mandate requires the establishment of an area of potential effect (APE). The APE has been determined to encompass the construction site, staging areas, access roads (new or extant), borrow sites, water impoundment, viewshed, and a reasonable distance, up to 1 mile (1.6 km), depending on topographic restrictions, where there may be a direct, temporary, indirect, or cumulative effect.

Review and comment were requested from West Virginia State Historic Preservation Officer (SHPO). Communication received 20 July 2022 stated that SHPO was satisfied with the undertaking and that no further consultation concerning archaeological or architectural resources would be necessary. SHPO requested notification if the parameters of the project should change.

No land is held in trust by the United States on behalf of Native American governments, nor are any sovereign lands established within the exterior boundaries of West Virginia. Nevertheless, multiple Tribes have ancestral land claims. Therefore, pursuant to 36CFR§800(2)(c) and title 190 Part 315: *Tribal Ancestral Lands Consultation Under the National Historic Preservation Act*, consultation was requested from seventeen (17) sovereign Native American governments.

As shown in the table below, the Catawba Indian Nation and Shawnee Tribe requested further consultation only if artifacts or human skeletal remains were discovered. Fifteen (15) sovereign Native American governments did not respond to NRCS' request for consultation.

Consulting Partner	Method	Date Sent	Response	Request
Catawba Indian Nation	USPS	6/10/2022	Y	Contact if artifacts/human remains discovered
Cayuga Nation	USPS	6/10/2022	N	
Chickahominy Indian Tribe	USPS	6/10/2022	N	
Delaware Nation	USPS	6/10/2022	N	
Eastern Chickahominy	USPS	6/10/2022	N	
Eastern Shawnee Tribe of Oklahoma	USPS	6/10/2022	N	
Eastern Band of Cherokee Indians	USPS	6/10/2022	N	
Monacan Nation	USPS	6/10/2022	N	
Pamunkey Indian Tribe	USPS	6/10/2022	N	
Rappahannock Tribe	USPS	6/10/2022	N	
Saint Regis Mohawk Tribe	USPS	6/10/2022	N	
Seneca-Cayuga Nation	USPS	6/10/2022	N	
Shawnee Tribe	EMAIL	6/16/2022	Y	Contact if artifacts/human remains discovered
Tonawanda Band of Seneca	USPS	6/10/2022	N	
Tuscarora Nation of New York	USPS	6/10/2022	N	
United Keetoowah Band of Cherokee Indians	USPS	6/10/2022	N	
Upper Mattaponi Indian Tribe	USPS	6/10/2022	N	

A Phase 1 Archaeological Survey was conducted on October 14, 2023. The survey confirmed the highly disturbed nature of the planned limits of disturbance (LOD). Further, the Area of Potential Effect (APE) possesses "slopes ranging from 25-45 degrees" which restricted the direct, indirect effects as well as potential viewshed effects of the undertaking. The survey did not identify any archaeological sites within the project's topographically limited APE and recommended, "…that the work proposed by Aterra be allowed to proceed as planned without further consideration of archaeological resources." NRCS West Virginia concurs with the recommendation.

To consider the effects of the undertaking within the context of possible alternatives, the Phase 1 included a Historic Architecture Survey. The survey found, "No previously recorded resources were identified within the direct or indirect APE. One historic district, the Silk Stocking Row

Historic District (KA-8359), encompassing 77 new resources…and is recommended eligible for listing on the National Register of Historic Places (NRHP) under Criteria A and C."

"ERM recommends that the Project as planned would have no effect on the district. However, the APE was stipulated by the NRCS to take into account the contingency of dam failure; if that unfortunate scenario were to occur, the Silk Stocking Row Historic District would likely suffer damage that would constitute an adverse effect." NRCS West Virginia concurs with the analysis.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each Federal agency to make environmental justice a part of its mission. Agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations, low-income populations, and Indian Tribes. The primary means to attain compliance with environmental justice considerations are: (1) Assessing the presence of environmental justice communities in a project area that may experience disproportionately high and adverse human health or environmental effects, and (2) the inclusion of low-income minority, Tribal, or other specified populations in the planning process. The USDA Departmental Regulation 5600-002 provides detailed determination procedures for NEPA and non-NEPA activities and suggests social and economic effects to consider when assessing whether there are disproportionately high and adverse human health or environmental effects to environmental justice communities in a project area.

An environmental justice and civil rights assessment was conducted for areas downstream of the dam, within the zone of a dam breach. The initial steps included collecting the economic, population, and demographic data presented above to screen for concentrations of minorities, minority ethnic groups, and low-income households. Based on the data, the area below the dam is predominately white with slightly lower incomes than the surrounding counties and State. The proportion of households in poverty in Nitro is slightly higher than the surrounding counties and the State. Individuals living in Kanawha County Census Tract 106, Block Group 2, representing the older downtown portion of Nitro, appear to have significantly lower incomes than the surrounding area. Coincidently, this Block Group also has the highest concentration of minorities in the City, approximately 7 percent Native American, although still predominately white (93 percent). This Block Group floods during a dam breach, but not during major storm events.

Recreation and Parklands

The dam is located in Ridenour Lake Park, a public park maintained by the City of Nitro that includes Ridenour Lake, picnic facilities, trails, and fishing areas (Nitro Convention and Visitors Bureau 2018). The park is a total of 65 acres, including approximately 24 acres of public fishing (Ridenour Lake) area and 1.23 miles of trails. The park is a popular destination for various recreational activities for local residents. Outside of the park, there are an additional 0.38 miles of trails which connect to the trails within Ridenour Lake Park. The park and surrounding area does not have a large outdoor venue to hold cultural events. Appendix D contains a narrative of the recreation benefits, including estimates of annual visitation and the economic value of the recreation.

Summary

Blakes Creek-Armour Creek Dam No. 7 is located in a popular recreational area, used for fishing, hiking, and other activities by residents of Nitro and the surrounding area. Within the AIA, there are freshwater wetlands and watercourses, which are regulated areas. The AIA also contains prime farmland soils, soils of statewide importance, and soils of local importance. Based on current publicly available information, there are potential occurrences of four federally threatened or endangered animal species within and around the Dam. Based on preliminary consultations with the WV DNR, there are no known sensitive habitat or state listed plant or animal species in the AIA. Consultation with SHPO and Tribes with ancestral land claims produced no areas of concern.

Dam Rehabilitation Project Considerations

Status of Operation and Maintenance

Operation and maintenance of the dam are the responsibility of the City of Nitro, and they have operated and maintained the dam in accordance with the operation and maintenance agreement. The annual dam inspection is performed jointly by the West Virginia Conservation Agency, Capital Conservation District, and the Kanawha County Floodplain Management Agency. The last inspection was conducted on October 25, 2021.

Sedimentation

The major land use in the watershed above the dam is Woodland (88%) with minor contribution from Pasture (5%) and Urban (4%). However, future sediment accumulation rate is not expected to exceed the historical rate since any projected future build out land use is not expected to increase sediment load to the reservoir. The annual submerged sediment accumulation rate based on the sediment survey was estimated to be 0.59 ac-ft per year. The aerated sediment accumulation was estimated to be 0.021 ac-ft per year. Under existing conditions, the dam has submerged sediment storage availability (90.9 ac-ft) for the next 155 years. However, the proposed rehabilitation measure (Locally Preferred – Alternative 2) will reduce the submerged sediment storage capacity due to flattening of the upstream slope by 2.6 ac-ft or 4.2 years. Therefore, the available sediment storage capacity will be 88.3 ac-ft. The maximum allowable submerged sediment storage capacity is 100 years and, therefore, the capacity in excess of 100 years will be reallocated to recreation purpose.

Breach Analysis and Hazard Classification

To estimate the downstream inundation zone resulting from a dam breach and to confirm the hazard classification of the dam, a breach analysis was performed for the static (sunny-day) breach, the hydrologic probable maximum flood (PMF), and the seismic breach scenarios and breach inundation maps for these conditions were prepared.

The WinDAM C computer program was used to generate the breach hydrographs, which were manually entered into the HEC-RAS hydraulic model. Table D- 15 in Appendix D describes the key inputs for WinDAM C, including soil parameters, which were based on the geotechnical exploration performed as part of this project.

The static (sunny-day) dam breach scenario, with pool elevation at the auxiliary spillway crest and with non-storm conditions downstream, was considered the limiting case for determination of hazard classification. Based on the results of the dam breach analysis, there is no justification to lower the hazard classification of Blakes Creek–Armour Creek Site 7. The breach inundation maps are located in Appendix C.

Climate Change Resilience Facets of Alternatives

To address climate change each construction alternative will include steps to build ecological resiliency. A level of resiliency will be accomplished by recommending the use of grass species that are more drought and flood tolerant during revegetation of the construction site.

Evaluation of Potential Failure Modes

Dams are built for the conditions that existed or could reasonably be anticipated at the time of design. Sometimes these conditions change, resulting in dam failure. Several potential modes of failure were evaluated for Blakes Creek-Armour Creek Site 7.

Slope Stability

The upstream slope of the embankment meets the required NRCS and State (WV DEP) factors of safety for the Normal Pool Steady Seepage and ASW Crest Flood Events but does not meet the required NRCS and State factors of safety for Rapid Drawdown or the State factor of safety for Seismic conditions.

The downstream slope of the embankment meets the required NRCS factors of safety for Normal Pool Steady Seepage and Flood Surcharge FBH Event conditions. The downstream slope does not meet the required State factors of safety for ASW Crest Flood and Seismic conditions.

Hydrologic Capacity and Spillway Integrity

Hydrologic failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and fails. Under current NRCS criteria for high hazard potential dams (TR 210-60), the ASW must have sufficient integrity and capacity to completely pass the full PMF event. The results of the analysis indicate the dam crest minimum elevation of 645.81 ft is slightly overtopped during the 6-hr FBH event for both existing and future buildout conditions and, therefore, the dam does not meet the criteria. However, the overtopping is limited to approximately 50 feet of the left embankment as it transitions into the ASW. The results also indicate that the effective stress on the soil (0.563 psf) exceeds the adjusted allowable value (0.098 psf) and, therefore, measures to stabilize the ASW exit channel will need to be considered as part of the rehabilitation design. The results also indicate that the ASW does not meet TR-210-60 integrity criteria since headcut erosion would result in breach of the control section. The headcut erosion in the ASW is the main reason why the overall potential for hydrologic failure of the dam is 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. The existing corrugated metal pipe (CMP) trench drain collection and outlet pipes are beyond their design life and could potentially create an unfiltered outlet for the trench drain material into the pipe and outlet.

The as-built drawings show that the filter materials were placed along the right and left sides of the downstream section of the spillway conduit, but not above or below the conduit such that the conduit does not have a filter diaphragm as required by TR210-60 and 210-NEH-628, Chapter 45, "Filter Diaphragms."

Evaluation of the existing toe drain material indicates filter incompatibility between the drainfill and the surrounding soils. Incompatibility has the potential to create internal erosion.

Seismic

The structural integrity of an earthen embankment is typically dependent upon the presence of a stable foundation. Foundation movement through consolidation, compression, or lateral movement can cause the creation of voids or cracks within an embankment, separation of the principal spillway conduit joints, or, in extreme cases, complete collapse of the embankment. The dam is located within an area of low seismic hazard.

The results of the geotechnical investigation, testing, and analyses indicate the dam embankment and foundation soils are not susceptible to liquefaction damage due to ground motions resulting from design-level earthquake loading. The analyses indicate that the yield accelerations of the upstream and downstream slopes are less than the minimum design acceleration, but evaluation of the post-event permanent deformations suggests limited deformations that are not anticipated to result in normal pool overtopping or internal damage – which meets NRCS criteria. The analyses indicate that both the upstream and downstream slopes do not meet the WV DEP State Dam Safety seismic criteria, as stated in the "Slope Stability" section above.

Based on the Final Principal Spillway Riser Seismic Evaluation Report, Revision 1, dated January 4, 2022, the existing principal spillway riser meets US Army Corps of Engineers (USACE) criteria for seismic stability. The use of USACE criteria was requested and approved by NRCS-WV.

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. An inspection of the principal spillway pipe was conducted by NRCS using a robotic camera in 2020. Visible portions of the principal spillway riser and pipe appeared to be in generally good condition, although the video appeared to show some degradation of the riser wall interiors. Several pipe joints exhibited spalling and the downstream-most joint appears to have separated relative to the as-built condition. The low-stage slide gate on the upstream face of the spillway riser is anticipated to be buried in sediment and its functionality is unknown. The rehabilitation includes replacement of the principal spillway riser. Therefore, there is low potential

for failure due to material deterioration of the principal spillway system. The corrugated metal pipe in the toe drain is beyond its service life based on expected metal loss over time. The corrosion of the pipe could potentially allow adjacent soil and filter material to backward erode into the remaining pipe and discharge through an unfiltered exit. The existing toe drain pipes should be removed or abandoned (grouted-in-place) and replaced with a new filtered toe drain with plastic piping as part of the dam rehabilitation.

Identified Deficiencies

Below is a summary of deficiencies associated with the dam.

Filter Diaphragm – There is no filter diaphragm around the existing principal spillway conduit. A compliant filter diaphragm should be installed around the conduit.

Drainfill Filter Compatibility - Based on construction gradation testing reports for the drainfill used within the toe drain, the gradation of the existing toe drain material does not meet the filter requirements of NEH Part 633, Chapter 26, "Gradation Design of Sand and Gravel Filters" (August 2017) for the embankment and foundation materials. To meet NRCS criteria, replacement of the existing drainfill with compatible material will be required. However, replacement may not be feasible within portions of the system which pass beneath the Blake Road embankment. Additionally, removal and replacement of the existing drainfill material from the 16 relief drains drilled beneath the toe drain would be a significant construction challenge. The deepest of these relief wells is approximately 50 feet below the bottom of the trench drain. Construction gradation testing reports for the drainfill used in the relief wells were not available to Aterra-Schnabel (or do not exist). Therefore, the compatibility of the relief well drainfill cannot be assessed. Drainfills with gradations falling near the fine boundary of the specification limits would meet the Chapter 26 compatibility requirements with respect to the foundation materials. If a finer drainfill was used in the relief wells than used in the toe drain, filter compatibility could potentially be satisfactory. Investigation of the as-built relief well drainfill gradations (without construction records) is beyond the current scope of this Plan. Additional evaluation is necessary to evaluate whether replacement of the drainfill within these relief drains to improve filter compatibility is feasible and necessary given the substantial remediation efforts that would be required.

Existing Foundation Drains - The condition of the existing toe drains is unknown. The original pipes are corrugated metal pipes which have exceeded their life expectancy. They should be removed or abandoned (grouted-in-place) and replaced with a new toe drain and filter system.

Hydrology and Hydraulic – Based on the SITES analysis results, the dam does not meet the TR 210-60 design criteria for auxiliary spillway capacity and the dam is overtopped during the 6-hr PMP event. However, the overtopping is limited to approximately 50 feet of the left embankment as it transitions into the ASW. As a result, structural rehabilitation options will only need to consider raising the dam crest in this area. Due to the overbuilt dam crest, leveling the dam crest to EL 648 would be sufficient. Please refer to Appendix D, Evaluation of Dam Performance section, for model inputs and detailed results of the analysis. Table 3 provides a summary of critical elevations.

Auxiliary Spillway Stability and Integrity – Based on the SITES analysis results, the ASW does not meet stability criteria during passage of the Spillway Design Hydrograph (SDH), and the Freeboard Hydrograph (FBH) results in breaching of the existing vegetated ASW by headcutting. To meet NRCS criteria, armoring of the spillway will be required to safely pass the FBH.
Slope Stability – The upstream embankment slope fails to meet NRCS and State criteria for Rapid Drawdown and State criteria for Seismic conditions. The downstream embankment slope fails to meet State criteria for ASW Crest Flood and Seismic conditions.

Consequences of Dam Failure

The properties and infrastructure potentially affected by the static (sunny-day) breach of the dam include: 273 residences, 10 apartment buildings, 14 commercial structures, 1 public property, a Historic District, and 4 roadways downstream within the breach inundation zone. In addition, there are third-party adverse impacts associated with a loss in surrounding property values and corresponding reduction in the local tax base.

Due to the nature of the at-risk properties downstream, it is difficult to predict population at risk (PAR) (i.e., individuals subject to injury or even death due to a catastrophic breach of the dam). Therefore, the NRCS publication Guidance for Completion of "Evaluation of Potential Rehabilitation Projects" was utilized to estimate PAR. Based on this guidance the total number of PAR attributable to catastrophic dam breach is estimated to be 1,028.

Water levels greater than one foot in depth would be experienced on 21st Avenue, 2nd and 3rd Avenues, and State Road 25 (1st Avenue), increasing the PAR by 10, based on assumptions used in the NRCS Guidance document, which include assuming one occupant at risk per vehicle. Average annual daily traffic (AADT) on 21st Avenue is in the 1,000 to 5,000 vehicles range and AADT for State Road 25 through the breach area is in the 5,000 to 50,000 vehicle range. Traffic counts are not recorded for 2nd and 3rd Avenues. Regardless, total PAR attributable to structure damage and roadway risk is estimated to be 1,038.

The environmental damage 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. Based on the flow velocities during the breach, significant scouring of the stream channel would occur downstream. 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 the fill material used to build the dam. Some of the embankment material remaining after a breach would also eventually erode into the stream, contributing to the downstream sediment deposition.

ALTERNATIVES

Rationale for Alternative Formulation

During the inventory process, several deficiencies were identified for the dam. When the deficiencies of the dam were compared to the Sponsors' Purpose and Need Statement, it was apparent that various alternatives were needed for the dam including the NRCS policy required alternatives.

Formulation Process

The process begins with identifying alternatives that address the Purpose and Need statement goals. A suite of alternatives was developed to meet the "Statement."

The following alternatives were included based on NRCS policy:

1. No Federal Action or "Future Without Federal Investment (FWOFI)
2. Decommissioning (removal)
3. Nonstructural Alternatives (elevation, relocation, zoning, etc.)
4. Structural Rehabilitation to current criteria

All initial alternatives undergo a screening evaluation involving the "Four Tests" of Completeness, Effectiveness, Efficiency, and Acceptability that are presented in the following text as well as the criteria provided in Departmental Manual 9500-013 which states "Alternatives that may at first appear reasonable but clearly become unreasonable because of cost, logistics, existing technology, social, or environmental reasons, may also be eliminated from further analysis."

The alternatives which were not eliminated during initial screening were carried through to the detailed evaluation phase. This phase required alternatives to be evaluated against additional criteria which are shown below:

- PR&G – Federal Objective
- PR&G – General Requirements
- PR&G – Guiding Principles

After this part of the evaluation was complete, an alternative was identified as the National Economic Efficiency (NEE) alternative. The alternatives that met the above criteria were then compared to the Future Without Federal Investment (FWOFI) alternative in three areas:

1. Effects on environmental resources and ecosystem services
2. Economic contribution
3. Social contribution

The tradeoffs related to the alternatives were defined during the comparison process. At the end of the process, a Recommended Alternative was identified. The Sponsors then selected their "Locally Preferred" alternative from the final suite of alternatives.

This process follows procedures set forth in the NRCS National Watershed Program Manual and other guidance referenced below:

- The Principles and Requirements for Federal Investments in Water Resources, dated March 2013
- USDA Departmental Regulation 9500-013
- USDA Departmental Manual 9500-013
- Interagency Guidelines
- NRCS Economics Handbook, Part II for Water Resources

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, they were exorbitantly expensive, or they were logistically impractical to implement.

Decommission Dam

Consideration of decommissioning is mandatory based on law (PL 83-566, Section 14, (a)(1)(E) and NRCS policy. This option describes an alternative which requires removing the flood detention capacity of the dam by cutting a notch in the existing embankment and re-connecting and restoring the stream channel and 100-year floodplain upstream and downstream of the dam in a non-erosive manner. If the dam were removed, 272 residences, 10 apartment buildings, 14 commercial structures, and 1 public property in the breach zone would no longer be at risk from flooding caused by a breach of the dam. However, federal policy requires that this alternative address the purpose and need for flood protection. With this alternative 79 single family residences, 7 multi-family structures, and 5 commercial structures, 91 structures in total, would be subjected to increases in flooding from all flood events that are attenuated by the dam. For the purpose of this analysis, increases for 50-year, 100-year, and 500-year storms are shown. The table below reflects the extent of flood events without the dam.

Flooding Depths at Buildings Without the Dam

Structures in the 100-year floodplain	Without the Dam Flood Event		
	500-year	100-year	50-year
	Depths Above First Floor Elevation (feet) *		
79 Single family residential	0.0 – 5.4	0.0 – 3.0	0.0 – 2.0
7Multi-family structures (duplex and 3-4 units)	0.0 – 8.0	0.0 – 5.6	0.0 – 4.6
5 Commercial structures	0.3 – 9.1	0.0 – 5.9	0.0 – 4.6

* Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation

Since the regulatory floodplain (100-year) was established assuming the dam is in place, structures in the downstream flood zone would need to be relocated or floodproofed. Downstream flooding conditions would be similar to those that existed prior to construction of the Dam. Therefore, all properties within the 100-year floodplain would need to be protected. A cost of $20 - $25 million was estimated that would include the relocation or buy-out of the 75 affected properties, demolition, and restoration of the building sites. Since relocating so many buildings was not only

very expensive but also impractical, another effort was made to estimate the cost of floodproofing the affected buildings. This measure was estimated to potentially cost as high as $20 million, or nearly as much as the dam rehabilitation itself. Along with addressing the flooding of the buildings, this alternative would also require modifying 3 roadways and stream crossings so that flooding from a 100-year event would not impact vehicles as they traveled along these roads. And, at a minimum, partial removal of the dam's embankment would need to be completed so as to safely pass the 100-year, 24-hour frequency flood event, thus eliminating the structure's ability to store water. It should be noted that this estimated cost only reflects cost to floodproof and/or relocate affected properties and does not include costs to decommission the dam and upgrade stream crossings/roadways.

Decommissioning the dam would also eliminate Lake Ridenour, the basis for a well-established Nitro city park. Mitigating the loss of a local public recreation facility with estimated visitation exceeding 50,000 per year would be very expensive considering the loss of the land area, a major water feature, and the City's investment in boat and meeting facilities adjacent to the lake. As discussed in Appendix D, based on visitation estimates and estimated values per visitor day, Lake Ridenour provides economic benefit of over $500,000 per year, as measured by economic willingness-to-pay.

Due to the high cost of this alternative, and the possibility of having to mitigate the loss of one of the City's major recreation facilities, this alternative was not studied in detail and was eliminated from further study. Furthermore, the City of Nitro specifically requested that the structure remains in place due to its recreational value. Decommissioning would not meet the project purpose and need for the proposed action.

Non-Structural – Relocate, Elevate, or Floodproof At-Risk Structures

This alternative involves elevating, floodproofing, or relocating at-risk structures (structures within the dam breach inundation area), and modification or relocation of roadways and stream crossings within the breach inundation area. This would reduce the hazard classification of the dam and eliminate the loss of life potential and, therefore, lower the requirements for dam rehabilitation to meet State and Federal dam safety and performance standards.

There are 298 at-risk buildings to elevate, floodproof and/or relocate downstream of the dam, and 4 roadways/stream crossings would need to be elevated/modified. In addition, additional flood protection may be needed at the Fike Chemical Plant EPA Superfund site. The estimated cost of this alternative was estimated at $30 to $40 million dollars. The estimated cost only reflects cost to floodproof and/or relocate affected properties. It does not include costs to purchase deed restrictions and modify stream crossings/roadways. Because of the high costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Description of Alternative Plans Considered

The alternatives presented in the following sections will not change the hazard class of the structure. It will remain High Hazard based on the potential loss of life and property damage if the dam were to breach. All of the alternatives presented, with the exception of the FWOFI, will meet NRCS current safety and performance standards if implemented. Therefore, there is very

little hazard for storms defined as the 100-year, 24-hour event because they will not flow through the ASW. The dam will not overtop under any of the proposed alternatives. The same criteria ensures that the proposed alternatives will not fail with respect to the typical modes of failure. Risks of property damage and loss of life increases for storms of a greater magnitude. The frequency of storm events as they relate to climate change are unknown.

Alternative 1 No-Action, Future Without Federal Investment (FWOFI)

One of the alternatives that must be included in the plan is the FWOFI alternative. For the purposes of the rehabilitation program, the FWOFI alternative describes the action that the Sponsors will take if no federal funds are provided for implementation. The Sponsors would be responsible for the total cost of rehabilitation to WV dam safety and performance standards or removal of the dam. The potential for an uncontrolled breach and resulting damage is present and will continue until the existing dam safety issues are addressed and resolved.

The dam is classified as a high hazard dam that does not presently meet both the WV and NRCS dam safety and performance standards. The hazard class is based on the potential loss of life and property damage if the dam were to breach. The results of the 1analysis predict the auxiliary spillway would breach during the design storm.

The FWOFI alternative, barring any contribution of federal funds to rehabilitate the Blakes Armour Site 7 dam the City of Nitro would pursue development of an alternative that meets both State and Federal Standards without this funding source. The FWOFI alternative would be identical to the Locally Preferred Alternative (Alternative 2) and involves a 140-ft wide roller compacted concrete (RCC) auxiliary spillway (ASW) located in the existing auxiliary spillway. The RCC chute would be realigned slightly to minimize excavation and stay away from the potentially unstable hillside. Refer to the Alternatives with Federal Assistance section below for a detailed description of the rehabilitation measures. There will be no change in the current levels of flood protection downstream as a result of project activity.

The engineer's opinion of probable construction cost for Alternative 1 is $17,222,000. Additional costs of $4,089,000 (engineering, real property rights, permits, and project administration) would result in a total cost estimate of $21,311,000.

Alternatives with Federal Assistance

All alternatives include:

- Re-grading and leveling the dam crest to design elevation 648.0 ft.
- Re-grouting the existing 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit joints.
- Constructing a filter diaphragm around the principal spillway conduit.
- Removing the existing principal spillway impact basin, extending the 30-inch diameter principal spillway conduit downstream by approximately 90 feet and constructing a new principal spillway impact basin.

- Removing the existing riser or a portion of the existing riser, constructing a new principal spillway riser and extending the 30-inch diameter principal spillway conduit upstream by approximately 60 feet.
- Partially removing / partially grouting in place the existing corrugated metal pipe trench drains and installing new plastic pipe toe drains. Replacing the existing toe drain drainfill material. Also, the top 3-ft of drainfill in the relief wells will be removed and replaced.
- Enhancing the stability of the downstream embankment slope by flattening the slope with earth fill (approximately 4.5H:1V). This flattening is required to meet West Virginia Department of Environmental Protection requirements.
- Enhancing ground stability at the downstream embankment toe using soil-cement mixed shear panels or similar type stability measures.
- Flattening the upstream slope (approximately 5.5H:1V) with rock riprap to enhance slope stability. This flattening is required to meet West Virginia Department of Environmental Protection requirements.
- Removing the culvert under Tea Table Road within the right abutment of the embankment along with re-grading for surface drainage.
- Replacing/relocating the stormwater drop inlet and discharge pipe in the existing ASW.
- Removing the existing sewer line in the ASW and replacing with a new septic system for the recreation area facility.
- Drawdown of the reservoir for about 5 months to facilitate construction of the work on the principal spillway riser and upstream embankment slope.

The proposed structural alternatives with federal assistance address all the deficiencies identified during planning.

NHPA During an Unexpected Discovery During Construction
Work will cease immediately upon discovery. This situation should be addressed in the PPA with SHPO, THPO, and Consulted Tribes. If a PPA is not in place and a discovery is made during construction the NRCS will seek to avoid or minimize impacts to the discovered resource through consultation or resolve the adverse effects in accordance with 36 CFR Section 800.6.

NHPA Mitigation if Necessary (Mitigation may include but is not limited to the following)
- Avoidance
- Minimize effects
- Mitigation measures to be determined

<u>Alternative 2 (Locally Preferred) Proposed Action (Figures C-22 through C-24, Appendix C)</u>
This alternative involves constructing a 140-ft wide RCC auxiliary spillway (ASW). A stilling basin and rock riprap at the outlet of the ASW will dissipate energy from the flow through the ASW before flowing into Blakes Creek. The ASW will be re-aligned to move it further away from the existing hillside and will prevent high flows from undermining and breaching the spillway crest due to headcut erosion. The ASW will have robust concrete sidewalls to reduce the potential of a landslide blocking it. This Locally Preferred Alternative will allow the Sponsors to comply with applicable State and NRCS dam safety and performance standards, reduce the potential for

loss of life, and continue protection of existing property and infrastructure downstream of the dam. The Sponsors feel that this alternative has four main advantages:

1. It will be more aesthetically pleasing.
2. There will be no bridge to maintain.
3. There will be no unsightly grass growing in the articulated concrete blocks (ACB) increasing O&M costs.
4. There is potentially an opportunity to use the structural auxiliary spillway for amphitheater seating.

The engineer's opinion of probable construction cost for Alternative 2 is $17,222,000. Additional costs of $4,089,000 (engineering, real property rights, permits, and project administration) would result in a total cost estimate of $21,311,000.

Alternative 3

This alternative involves constructing a 120-ft wide articulated concrete block auxiliary spillway (ACB-ASW) with a secant pile cutoff wall to valley floor. The ACB-ASW will be located in the existing ASW location.

The engineer's opinion of probable construction cost for Alternative 3 is $15,169,000. Additional costs of $3,825,000 (engineering, real property rights, permits, and project administration) would result in a total cost estimate of $18,994,000.

Alternative 4

This alternative involves constructing a 140-ft wide RCC auxiliary spillway located over the existing embankment left of the principal spillway. A vehicle bridge (HL-93 loading) with a pedestrian lane will be installed over the ASW to provide access to the recreational area. The existing ASW will be filled-in with the excess excavated soil from the construction of the new ASW.

The engineer's opinion of probable construction cost for Alternative 4 is $14,309,000. Additional costs of $3,806,000 (engineering, real property rights, permits, and project administration) would result in a total cost estimate of $18,115,000.

For purposes of the rehabilitation program, the NEE alternative is defined as the federally assisted alternative with the greatest public benefits, with appropriate consideration of costs. Public benefits (i.e., positive ecosystem services) encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures. Benefits are the same across the alternatives, so the least cost alternative yields the highest public benefit and is considered the NEE alternative.

In terms of monetary benefits, average annual benefits are estimated to be $672,000, which includes $121,200 flood damage reduction benefits and $550,800 recreation benefit. It should be noted that recreation is an authorized purpose of the facility and therefore recreation benefit is considered on an equal basis as flood damage avoidance.

For the NEE Alternative, the average annual cost before O,M,&R is included, is estimated to be $494,800, resulting in a net benefit of $177,200. The PMP storm event will be passed through the dam without overtopping, thus reducing the threat of a catastrophic dam failure (breach), and recreational value continue after construction. From an environmental perspective, adverse impacts during construction would be minimized.

Summary and Comparison of Alternative Plans

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

Summary and Comparison of Alternative Plans

Item or Concern	Alternative 1 Future Without Federal Investment No Federal Action – Sponsors Rehab. (same as Locally Preferred) [1/]	Alternative 2 – (Locally Preferred) 140-Ft Wide Roller Compacted Concrete ASW that is realigned near existing ASW	Alternative 3 – 120-Ft Wide Articulated Concrete Block ASW in existing ASW location - Secant Pile Cut-Off Wall	Alternative 4 - 140-Ft Wide Roller Compacted Concrete ASW over the existing dam embankment
Structural	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.
Total Project Investment	$21,311,000	$21,311,000	$18,994,000	$18,115,000
Total Beneficial Annualized	$672,000	$672,000	$672,000	$672,000
Total Adverse Annualized, prior to O,M,&R	$582,000	$582,000	$518,800	$494,800
Net Beneficial [2/]	$90,000	$90,000	$153,200	$177,200
Estimated OM&R3/	$9,160	$9,160	10,560	$9,160
Annual Remaining Flood Damage	$103,400	$103,400	$103,400	$103,400

Item or Concern	Alternative 1 Future Without Federal Investment No Federal Action – Sponsors Rehab. (same as Locally Preferred) [1/]	Alternative 2 – (Locally Preferred) 140-Ft Wide Roller Compacted Concrete ASW that is realigned near existing ASW	Alternative 3 – 120-Ft Wide Articulated Concrete Block ASW in existing ASW location - Secant Pile Cut-Off Wall	Alternative 4 - 140-Ft Wide Roller Compacted Concrete ASW over the existing dam embankment
Soils	Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Prime & Unique Farmland:*** **No Effect** ***Farmland of statewide importance:*** **No Effect** ***Farmland of local importance:*** **No Effect**	Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Prime & Unique Farmland:*** **No Effect** ***Farmland of statewide importance:*** **No Effect** ***Farmland of local importance:*** **No Effect**	Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Prime & Unique Farmland:*** **No Effect** ***Farmland of statewide importance:*** **No Effect** ***Farmland of local importance:*** **No Effect**	Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Prime & Unique Farmland:*** **No Effect** ***Farmland of statewide importance:*** **No Effect** ***Farmland of local importance:*** **No Effect**
Plants	***Special Status Plant Species:*** No Effect ***Noxious Weed and Invasive Plant Species:*** Short-term, adverse, negligible, direct ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Special Status Plant Species:*** No Effect ***Noxious Weed and Invasive Plant Species:*** Short-term, adverse, negligible, direct ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Special Status Plant Species:*** No Effect ***Noxious Weed and Invasive Plant Species:*** Short-term, adverse, negligible, direct ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Special Status Plant Species:*** No Effect ***Noxious Weed and Invasive Plant Species:*** Short-term, adverse, negligible, direct ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Item or Concern	Alternative 1 Future Without Federal Investment No Federal Action – Sponsors Rehab. (same as Locally Preferred) [1/]	Alternative 2 – (Locally Preferred) 140-Ft Wide Roller Compacted Concrete ASW that is realigned near existing ASW	Alternative 3 – 120-Ft Wide Articulated Concrete Block ASW in existing ASW location - Secant Pile Cut-Off Wall	Alternative 4 - 140-Ft Wide Roller Compacted Concrete ASW over the existing dam embankment
Animals	***Fish:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Endangered Animal Species/Habitat:*** Short-term, minor adverse, direct; long-term, negligible, adverse, direct ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Endangered Animal Species/Habitat:*** Short-term, minor adverse, direct; long-term, negligible, adverse, direct ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Endangered Animal Species/Habitat:*** Short-term, minor adverse, direct; long-term, negligible, adverse, direct ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Endangered Animal Species/Habitat:*** Short-term, minor adverse, direct; long-term, negligible, adverse, direct ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects
Climate	No effect	No effect	No effect	No effect
Water Resources	***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse	***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse	***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse	***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse

Item or Concern	Alternative 1 Future Without Federal Investment No Federal Action – Sponsors Rehab. (same as Locally Preferred) [1/]	Alternative 2 – (Locally Preferred) 140-Ft Wide Roller Compacted Concrete ASW that is realigned near existing ASW	Alternative 3 – 120-Ft Wide Articulated Concrete Block ASW in existing ASW location - Secant Pile Cut-Off Wall	Alternative 4 - 140-Ft Wide Roller Compacted Concrete ASW over the existing dam embankment
Water Resources	***Floodplain Management:*** Short-term, direct, negligible, adverse; no long-term effects ***Waters of the U.S.:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Floodplain Management:*** Short-term, direct, negligible, adverse; no long-term effects ***Waters of the U.S.:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Floodplain Management:*** Short-term, direct, negligible, adverse; no long-term effects ***Waters of the U.S.:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Floodplain Management:*** Short-term, direct, negligible, adverse; no long-term effects ***Waters of the U.S.:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse
Air Quality	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects
Ecosystem Services	***Regulating:*** No effect ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** No effect ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** No effect ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** No effect ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Item or Concern	Alternative 1 Future Without Federal Investment No Federal Action – Sponsors Rehab. (same as Locally Preferred) [1/]	Alternative 2 – (Locally Preferred) 140-Ft Wide Roller Compacted Concrete ASW that is realigned near existing ASW	Alternative 3 – 120-Ft Wide Articulated Concrete Block ASW in existing ASW location - Secant Pile Cut-Off Wall	Alternative 4 - 140-Ft Wide Roller Compacted Concrete ASW over the existing dam embankment
Social/Human Environment	***Public Health and Safety:*** Beneficial impact of improving dam safety to high hazard level ***Scenic Beauty:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice:*** Reduces dam breach risk and maintains flood control and recreation benefits for all residents ***Local & Regional Economy:*** Maintains current flood reduction and recreation benefit; slight positive impact from rehabilitation construction but less than with Federal cost share ***Recreation and Parklands:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse	***Public Health and Safety:*** Beneficial impact of improving dam safety to high hazard level ***Scenic Beauty:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice:*** Reduces dam breach risk and maintains flood control and recreation benefits for all residents ***Local & Regional Economy:*** Maintains current flood reduction and recreation benefit; positive impact from rehabilitation construction due to Federal cost share ***Recreation and Parklands:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse	***Public Health and Safety:*** Beneficial impact of improving dam safety to high hazard level ***Scenic Beauty:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice:*** Reduces dam breach risk and maintains flood control and recreation benefits for all residents ***Local & Regional Economy:*** Maintains current flood reduction and recreation benefit; positive impact from rehabilitation construction due to Federal cost share ***Recreation and Parklands:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse	***Public Health and Safety:*** Beneficial impact of improving dam safety to high hazard level ***Scenic Beauty:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice:*** Reduces dam breach risk and maintains flood control and recreation benefits for all residents ***Local & Regional Economy:*** Maintains current flood reduction and recreation benefit; positive impact from rehabilitation construction due to Federal cost share ***Recreation and Parklands:*** Short-term, direct, moderate, adverse; long-term, direct, minor, adverse

[1/] The FWOFI alternative represents the Sponsors' choice in the event federal assistance is not available. Costs will be 100% borne by the Sponsors.

[2/] Information in this table addressing economic efficiency represents the total values associated with each respective alternative. Information found in other portions of the document, primarily Table 5 and Table 6, display benefit information relative to the No Action FWOFI Alternative.

[3/] "Estimated OM&R" stands for Operation, Maintenance and Replacement Costs.

Alternatives and Associated Ecosystem Services

Alternatives				
	Alternative 1 No Action (FWOFI)	Alternative 2	Alternative 3	Alternative 4
Alternatives				
Locally Preferred		X		
Brief Description of Major Project Features	RCC chute in the existing ASW, dam crest leveled at EL 648, and enhancing slope and ground stability of the dam.	RCC chute in the existing ASW, dam crest leveled at EL 648, and enhancing slope and ground stability of the dam.	ACB armored chute in the existing ASW with secant pile cutoff wall, dam crest leveled at EL 648, enhancing slope and ground stability of the dam.	RCC armored chute through the main embankment, dam crest leveled at EL 648, enhancing slope and ground stability of the dam.
Total Project Investment	$21,311,000	$21,311,000	$18,994,000	$18,115,000
Monetized Net Benefits	$90,000	$90,000	$153,200	$177,200
Provisioning Services	NA	NA	NA	NA
Regulating Services				
Flood and Disease Control	Maintains current level of flood protection, but 298 structures will remain in the Static Breach Zone	Maintains current level of flood protection, but 298 structures will remain in the Static Breach Zone	Maintains current level of flood protection, but 298 structures will remain in the Static Breach Zone	Maintains current level of flood protection, but 298 structures will remain in the Static Breach Zone
Cultural Services				
Recreational Use	The reservoir size is reduced by 0.65 acres.	The reservoir size is reduced by 0.65 acres.	The reservoir size is reduced by 0.65 acres.	The reservoir size is reduced by 0.46 acres.
Aesthetic Viewsheds	Green landscape changes per viewshed: Viewshed 2 1.33 Viewshed 3 0.5 Viewshed 4 2.00	Green landscape changes per viewshed: Viewshed 2 1.33 Viewshed 3 0.5 Viewshed 4 2.00	Green landscape changes per viewshed: Viewshed 2 1.29 Viewshed 3 0 Viewshed 4 1.84	Green landscape changes per viewshed: Viewshed 2 1.62 Viewshed 3 0.45 Viewshed 4 1.68
Supporting Services				
Nutrient Cycling	Green vegetation is reduced by 4.21 Ac.	Green vegetation is reduced by 4.21 Ac.	Green vegetation is reduced by 3.42 Ac.	Green vegetation is reduced by 3.52 Ac.
Soil Formation	The impervious surface in LOD increases by 1.44 Ac.	The impervious surface in LOD increases by 1.44 Ac.	The impervious surface in LOD increases by 0.65 Ac.	The impervious surface in LOD increases by 0.91Ac.

Consideration of PR&G Guiding Principles

PR&G Guiding Principles	Alternative 1 No Action (FWOFI)	Alternative 2	Alternative 3	Alternative 4
Healthy and Resilient Ecosystem	--	-	-	-
Sustainable Economic Development	+	++	+	++
Floodplains	+	+	+	+
Public Safety	+	+	+	+
Environmental Justice	+	+	+	+
Watershed Approach	+	+	+	+

[1] Table symbology: 0 – No effect on the Guiding Principle/Federal Objective, - Moves away from achieving Guiding Principle/Federal Objective, -- Moves appreciably away from achieving Guiding Principle/Federal Objective, + Achieves the Guiding Principle/Federal Objective , ++ Exceeds achieving Guiding Principle/Federal Objective

Consideration of PR&G Federal Objective

Components	Alternative 1 No Action (FWOFI)	Alternative 2	Alternative 3	Alternative 4
Maximize Sustainable Economic Development	+	++	+	++
Avoid Unwise Use of Floodplains	+	+	+	+
Protect & Restore Functions of Natural Systems	+	+	++	+

ENVIRONMENTAL CONSEQUENCES

Alternative plans of action can result in a multitude of potential effects on resources upstream and downstream of the dam. This section describes anticipated effects on physical, biological, ecological, economic, social/human resources and ecosystem services concerns identified by the Sponsors, the public, and agency personnel in the Scoping meeting and the public meetings. The six Guiding Principles of the Principles and Requirements were used in the alternative evaluations.

The limit of disturbance (LOD), which will be the same for all alternatives, is shown in Figure C-2, Appendix C. The LOD is the area where it is anticipated that ground disturbing activities will occur and where vegetation clearing will be conducted, as necessary. The LOD encompasses a total of 50.5 acres and includes a 3.0-acre staging area in the western parking area and a 3.0-acre staging area in the eastern parking area.

Four alternative plans were considered and evaluated in detail.

1. Future Without Federal Investment (FWOFI) (Sponsors' Rehabilitation)
2. Rehabilitate dam with a realigned 140-ft wide RCC ASW
3. Rehabilitate dam with a 120-ft wide ACB ASW with secant pile cut-off wall
4. Rehabilitate dam with 140-ft wide RCC ASW over the existing dam embankment

The Sponsors have indicated that without federal assistance, they would rehabilitate the dam to the West Virginia and NRCS performance standards.

Healthy and Resilient Ecosystems - The composition and structure of the ecosystem is not expected to be significantly impacted by any of the proposed alternatives.

Sustainable Economic Development

Economic – Installation of any of the proposed alternatives will not alter long-term economic conditions (i.e., personal income and distribution, education, job growth opportunities, etc.) within the area of potential effect (APE) downstream of the dam. Any Federal funds used for financing the project will represent a short-term net gain to the regional economy compared to an exclusively locally-funded project.

Social - Installation of any of the proposed alternatives will not alter current social conditions (i.e., poverty, unemployment, etc.) within the APE downstream of the dam. However, it would diminish the possibility of a dam failure, thus providing more protection to the population located within the APE downstream.

Environmental - The alternatives proposed in this project will not have an impact on a potable water supply. The water quality of the tributary waterbody will not change in terms of contaminants. These effects indicate no significant change in the sustainability of the ecosystem or associated economy.

Floodplains - There will be no change in the current levels of flood protection downstream as a result of implementation of any of the alternatives analyzed in detail. There are anticipated to be

minor impacts to the floodplain, both upstream and downstream within the LOD, during construction work; however long-term impacts are expected to be negligible.

Public Safety – The implementation of any of the proposed alternatives will result in long-term beneficial impacts to population downstream because it will allow water to pass more efficiently and safely through the auxiliary spillway in the event a storm event of such magnitude causes it to function. The auxiliary spillway is designed to address erosion, head-cutting and breaching concerns. There are no critical facilities (e.g. hospitals, fire/police stations, nursing homes, etc.) located downstream within the Area of Potential Effect (APE). There are no inhabitable structures upstream of the dam below the crest of the ASW; however, there are several inhabitable structure within the PMP elevation (EL 646.9) and below the top of dam elevation.

Environmental Justice - The affected area is characterized by predominately white households with slightly lower than average household incomes and slightly higher rates of poverty compared to Kanawha and Putnam Counties, and the State of West Virginia. There are no Tribal Communities or other Environmental Justice groups in the APE of the dam rehabilitation project. All of the alternatives involve increasing dam safety and benefit all households in an equal manner.

Watershed Approach - In conducting the effects analysis for each of the analyzed alternatives, both upstream and downstream project impacts were evaluated. A conscious effort was made to investigate both direct and indirect effects.

Physical Environment

Soils

Existing Conditions
Prime farmland soils are present in the LOD abutting Ridenour Lake to the south, covering 0.84 acres within the LOD.

Farmland soils of statewide importance are present in the LOD west of Ridenour Lake, covering 2.87 acres within the LOD.

Farmland soils of local importance are present in the LOD east of Ridenour Lake, covering 5.29 acres within the LOD. Farmland soils of local importance are identified by local (county) agencies and do not have national or statewide importance. The soils are not necessarily used for cropland or farming, but can be forest land, pastureland, cropland, or other non-urban land (USDA NRCS 2016a).

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred alternative.

Alternative 2
Short-term, direct, minor, and adverse impacts and long-term, direct, negligible, and adverse impacts to soils are expected. No indirect effects were identified during analysis. Cumulative

impacts to soils, including some prime and unique farmland soils, which have been ongoing since the original dam construction will continue to occur with this alternative.
The alternative will result in short-term, minor, direct, adverse impacts to soils in the LOD. Short-term adverse effects to soils may include temporary disruption and compaction from heavy construction equipment and vehicles, staging/stockpiling of materials, and general construction work. Long-term, negligible, direct, adverse effects include the excavation of soils along a portion of the existing ASW to construct the new RCC ASW

Less than 20 percent of the LOD is comprised of prime farmland soils, soils of statewide importance, or soils of local importance. These soils are not located where major construction activities will occur and thus it is not anticipated that these soils will be impacted during project work. In the event that these soils will require excavating, they will be stockpiled during project work and then regraded onsite post construction. Long-term impacts to these soils are anticipated to be negligible given that they were previously disturbed.

Alternative 3
It is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternative 2. Alternative 3 involves installing an ASW constructed of ACB instead of RCC, which will result in slightly fewer long-term impacts (i.e., compaction) to underlying soils.

Alternative 4
It is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternative 2.

Biological

Short-term direct, moderate, adverse impacts and long-term, direct, moderate, adverse impacts to terrestrial vegetation are anticipated to result from Alternative 2. No indirect effects were identified during analysis and no cumulative effects exist because there are no known construction projects in the immediate vicinity that would be ongoing concurrently with this project.

The vegetation in the LOD, particularly on the ASW, dam crest, and side slopes, will experience short-term, moderate, adverse impacts from construction work. The movement of construction vehicles throughout the LOD may disturb underlying vegetation; the construction team will utilize mapped access routes to limit the amount of vegetation disturbed. The grassed vegetation in the existing ASW will be replaced with a RCC ASW, which will prevent vegetation from regrowing in this location long-term. Additional long-term impacts to vegetation will occur along the upstream embankment where riprap will replace the existing grassed vegetation.

It is estimated that a maximum of approximately 8 acres of trees may need to be cleared. Long-term impacts to vegetation from tree clearing are considered direct, adverse, and moderate.

Plants

Existing Conditions
The following plant species, among others, were observed at the dam site during the March 2022 wetland delineation: water forget-me-not (*Myosotis scorpioides*), bulrush (*Typha latifolia*),

multiflora rose (*Rosa multiflora*), red oak (*Quercus rubra*), Japanese stiltgrass (*Microstegium vimineum*), wild garlic (*Allium vineale*), Japanese honeysuckle (*Lonicera japonica*), black willow (*Salix nigra*), woolgrass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), and broom sedge (*Andropogon virginicus*).

Riparian Areas

Vegetation cover in the riparian corridor of the LOD is primarily categorized as pasture/hay and deciduous forest by the NLCD. The following plant species, among others, were observed at the dam site during the March 2022 wetland delineation: water forget-me-not (*Myosotis scorpioides*), bulrush (*Typha latifolia*), multiflora rose (*Rosa multiflora*), red oak (*Quercus rubra*), Japanese stiltgrass (*Microstegium vimineum*), wild garlic (*Allium vineale*), Japanese honeysuckle (*Lonicera japonica*), black willow (*Salix nigra*), woolgrass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), and broom sedge (*Andropogon virginicus*). There are a total of approximately 1.56 acres of riparian areas in the LOD, based on the buffer "method" commonly used by the USFWS National Wetlands Inventory, which uses an approximately 20 ft buffer on either side of each stream course.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)

Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2

Riparian areas, which buffer Blakes Creek, exist downstream of the dam. Short-and long-term, cumulative, direct, minor, adverse impacts to riparian zones are anticipated to occur as a result of construction work near the dam embankment. The extension of the downstream toe of the dam, replacement of the principal conduit, and the installation of the concrete impact basin is expected to permanently impact 111 linear ft of stream which will in turn impact approximately 0.17 acres of abutting riparian areas. These impacts to riparian areas are considered long-term, cumulative, adverse, and minor. The adverse cumulative impacts to plants and riparian corridor, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. No new cumulative impacts are anticipated from project action.

There are no anticipated impacts to special status plant species as there are no known occurrences in the LOD. Best management practices as outlined in the West Virginia Invasive Species Strategic Plan and Voluntary Guidelines (2014) will be employed to prevent the spread of invasive plant species during the construction period.

Alternative 3

Impacts to special status plant species, noxious weed and invasive plants, and riparian areas from this Alternative are anticipated to be the same as Alternative 2.

Alternative 4

Impacts to special status plant species, invasive plant, and riparian areas from this Alternative are anticipated to be the same as Alternative 2.

Animals

Existing Conditions

Fish and Wildlife

Fish inhabit Blakes Creek upstream and downstream of the dam, as well as Ridenour Lake upstream of the dam. Fish can migrate from Blakes Creek segments below the dam to the Kanawha River. Ridenour Lake is classified as a Public Fishing Lake by WV DNR and is stocked with trout.

Wildlife species that are likely present in the LOD include a variety of transient migratory birds, mammals, amphibians, and reptiles. Potential habitat for these species is provided in the wooded, grassed, and riparian areas surrounding the project site. There is no sensitive wildlife habitat identified in the LOD based on preliminary consultations with WV DNR Natural Heritage Program. Citizen observations of plant and animal species, indicates that animal species observed near the dam site include great blue heron (*Ardea herodias*), Ross's goose (*Answer rossii*), northern mockingbird (*Mimus polyglottos*), mallard (*Anas platyrhynchos*), and American toad (*Anaxyrus americanus*) (iNaturalist 2022).

Endangered and Threatened Species and Species of Concern

Federally Protected Species

The USFWS IPaC (USFWS 2022) report returned two federally endangered mammal species as potentially present in the LOD: the gray bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*). One federally threatened mammal species was also listed as potentially present in the LOD: the northern long-eared bat (NLEB) (*Myotis septentrionalis*).

Additionally, six federally endangered clam species were listed as having the potential to be affected by activities in the LOD: fanshell (*Cyprogenia stegaria*), pink mucket (*Lampsilis abrupta*), sheepnose mussel (*Lampsilis abrupta*), snuffbox mussel (*Epioblasma triquetra*), spectaclecase (*Cumberlandia monodonta*), and tubercled blossom (*Epioblasma torulosa torulosa*). The Kanawha River is known to support these species.

The IPaC report also listed one candidate insect species, the monarch butterfly (*Danaus plexippus*), with the potential to be affected by project activities.

Migratory Birds/Bald and Golden Eagles

The USFWS IPaC report for the LOD identified migratory birds that could potentially utilize the reservoir or the surrounding area. These species include black-capped chickadee (*Poecile atricapillus*), cerulean warbler (*Dendroica cerulea*), eastern whip-poor-will (*Antrostomus vociferus*), Kentucky warbler (*Oporornis formosus*), prairie warbler (*Dendroica discolor),* red-headed woodpecker (*Melanerpes erythrocephalus*), rusty blackbird (*Euphagus carolinus*), and the wood thrush (*Hylocichla mustelina*) (USFWS 2022). All of these bird species are found on the USFWS Birds of Conservation Concern list (USFWS 2022).

Bald eagles have occasionally been observed in Kanawha County by citizens. However, there are no official recorded observations of nests in the county.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Short-term, direct, minor and moderate, adverse impacts to animals and long-term, direct, negligible, adverse impacts to animals are expected from Alternative 2. No indirect effects were identified during analysis.

Fish and Wildlife
Direct, short-term, adverse, moderate impacts to fish species are anticipated because construction work on the principal spillway riser and upstream embankment slope will require drawdown of the reservoir for 5 months. The City will work with WV DNR to determine the best course of action to capture, remove, or relocate the fish prior to the complete drawdown of the reservoir. WV DNR will continue annual stocking of the lake once the project is complete. Long-term, direct, adverse, negligible impacts to fish habitat and species are anticipated from this Alternative due to the loss of approximately 111 linear ft of stream downstream of the dam and the loss of 0.65 acres of reservoir. Cumulative impacts to fish species from the elimination of the natural stream corridor and creation of the dam impoundment, which resulted from the construction of the original dam, are expected to continue with this alternative.

It is anticipated that this alternative will result in short-term, direct, minor, adverse impacts and long-term, direct, negligible, adverse impacts to wildlife associated with disruption of habitat during construction. Tree clearing in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants as habitat. In addition, the noises associated with construction are likely to displace wildlife temporarily.

Endangered and Threatened Species and Species of Concern

Federally Protected Species

There are anticipated to be short-term, minor, adverse impacts and long-term, negligible, adverse impacts to the northern long-eared bat, gray bat, and the Indiana bat associated with disruption and removal of habitat during construction. Tree cutting may result in the negligible loss of roosting habitat for the bat species. To minimize potential impacts to the species, tree cutting (greater than 3 inches diameter in breast height) will occur outside of the NLEB pup season (1 April to 31 October), as requested by the USFWS. Potential impacts to the bat species are considered negligible as there are no known or documented NLEB summer or winter hibernacula within close proximity of the project site. The predominant threat to NLEB is the spread of a white-nose syndrome; project work is not expected to cause the spread of this disease. The predominant threat to the Indiana bat and gray bat is human disturbance to caves where species hibernate in large numbers; there are no caves near the dam site.

There are anticipated to be short-term, negligible, adverse impacts to monarch butterflies resulting from project work. Milkweed plants have been known to occur in the park; however, the exact locations are not confirmable. Milkweed was not observed within or adjacent to the LOD during site visits. The dam and surrounding park are regularly mowed and maintained, especially in areas around the dam, and this will continue post construction.

There are no anticipated effects to state listed animal species as there are no known occurrences of in the LOD. However, no official surveys have been conducted.

Invasive Fish and Wildlife Species

There are no known occurrences of invasive animal species in the project site. If any invasive species are encountered during construction, best management practices as outlined in the West Virginia Invasive Species Strategic Plan and Voluntary Guidelines (2014) will be employed to prevent the spread.

Migratory Birds/Bald And Golden Eagles

There are no known occurrences of bald or golden eagle nesting areas in the LOD. Migratory birds and eagles may be temporarily impacted by the obstruction of foraging habitat during construction work. As such, impacts to bald and golden eagles and migratory birds are considered short-term, direct, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in any long-term effects to migratory birds or bald or golden eagles.

Alternative 3

It is anticipated to have impacts to animals of similar intensity, duration, and magnitude as Alternative 2 because both involve similar construction duration and activities.

Alternative 4

It is anticipated to have impacts to animals of similar intensity, duration, and magnitude as Alternative 2 because both involve similar construction duration and activities.

Ecological Environment

Climate

There are no anticipated environmental impacts to climate from any of the rehabilitation Alternatives.

Water Resources (including Water Quality, Quantity, and Use/Efficiency)

Water Quality

Existing Conditions

Blakes Creek was not listed as an impaired waterbody during the 2016 reporting year (West Virginia Department of Environmental Protection [WV DEP] 2016). Ridenour Lake was listed as an impaired waterbody during the 2016 reporting year. The impairment is for phosphorous and a TMDL is scheduled for 2025 (WV DEP 2016).

During a March 2021 site visit, stream water downstream of the dam appeared cloudy and turbid.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)

Impacts from the FWOFI Alternative will be the same as impacts from Alternative 1, the Locally Preferred Alternative.

Alternative 2
Short-term and long-term, direct, minor, adverse impacts are anticipated to occur to water resources as a result of this alternative. No indirect effects were identified during analysis. Cumulative impacts to water resources, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. The dam will continue to obstruct the natural flow of the riverine system but will also continue to aid in trapping sediment. No new cumulative impacts to water resources are anticipated from project action.

This alternative is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the reservoir and stream from construction related activities. Long-term impacts to water quality are deemed direct, negligible, and beneficial.

Short-term and long-term, direct, adverse, minor effects to WOTUS are anticipated to occur as a result of Alternative 2. Short-term impacts are anticipated to occur from the temporary drawdown of the reservoir (anticipated to last 5 months) to facilitate construction on the principal spillway riser and upstream embankment slope. Blakes Creek downstream of the dam is expected to experience temporary impacts during the construction of the new principal spillway conduit, impact basin, and toe drains. Stream crossings will be necessary but will be temporary in nature. Impacts to the stream are anticipated to be short-term and minor.

Alternative 3
This alternative is anticipated to have impacts to water of similar intensity, duration, and magnitude as Alternative 2.

Alternative 4
This alternative is anticipated to have impacts to water of similar intensity, duration, and magnitude as Alternative 2.

<u>Water Quantity</u>
Existing Conditions
The original work plan indicated that the dam had a 27.5-acre normal pool and a flood control storage capacity at the ASW crest of 407 acre-ft (USDA 1969).

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
This alternative is anticipated to decrease the normal pool size by 0.65 acres because of the extension of the upstream embankment into the reservoir, reducing the volume of water quantity storage by 6.77 acre-feet. Short and long-term effects to water quantity are deemed direct, adverse, and negligible.

Alternative 3
This alternative is anticipated to have impacts to water of similar intensity, duration, and magnitude as Alternative 2.

Alternative 4
This alternative is anticipated to have impacts to water of similar intensity, duration, and magnitude as Alternative 2. However, Alternative 4 is expected to only reduce the reservoir size by 0.46 acre or 4.23 acre-feet, resulting in slightly fewer impacts to WOTUS and water quantity.

Floodplains

Existing Conditions
The dam is located in Zones A and AE, special flood hazard areas (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event. The dam was constructed to protect the City of Nitro after the area experienced several damaging floods between 1934 and 1961.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
There will be no change to the current levels of flood protection downstream as a result of project activity and therefore no long-term effects to floodplain management. There are anticipated to be short-term, direct, negligible, adverse, impacts to the floodplain area during construction. Inundation maps are included in Appendix C, Figures C-6 through C-17.

Alternative 3
Impacts will be the same as Alternative 2.

Alternative 4
Impacts will be the same as Alternative 2.

Waters of the U. S., including, Streams, Lakes and Wetlands
Ridenour Lake and Blakes Creek were identified as Waters of the U.S. (WOTUS) during a March 2022 wetland delineation using USACE wetland delineation guidelines. There are also two unnamed perennial streams that feed into Ridenour Lake that were identified as WOTUS.

Existing Conditions
Wetland types present in the LOD include lake wetlands, freshwater emergent, and freshwater forested/shrub wetlands.

Wetland Communities in the Limit of Disturbance

Wetlands Type	Cowardin Description	General Description	LOD (acres)
Lake wetlands	Lacustrine deepwater and associated wetlands	Lake or reservoir basin	22.22

Wetlands Type	Cowardin Description	General Description	LOD (acres)
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow. Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.56
Freshwater forested/shrub	Palustrine forested and/or Palustrine shrub	Woody wetlands, forested swamp, shrub bog	1.00
Total wetlands			23.78

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Permanent impacts to the stream, downstream of the dam, are anticipated from the extension of the downstream toe of the dam, the accompanying principal spillway conduit extension, and impact basin. The impacts to Blakes Creek are estimated to result in a loss of approximately 111 linear ft of stream. The extension of the upstream slope and the placement of fill (riprap) in the upstream slope of the dam, will result in permanent impacts to the reservoir and an overall shrinking of the reservoir size by 0.65 acres. These long-term effects to WOTUS are deemed direct, adverse, and minor.

This alternative is anticipated to result in short and long-term, direct, adverse, minor impacts to wetlands. Wetlands upstream of the dam, including lake wetlands, freshwater forested/shrub wetlands, and freshwater emergent wetlands, are expected to be temporarily impacted while the reservoir is drained for about 5 months during construction work. Approximately 1.48 acres of lake wetlands along the northern edge of the reservoir are anticipated to be permanently impacted by the placement of riprap on the upstream embankment. Wetlands downstream of the dam are anticipated to experience both short and long-term impacts from construction work. The installation of the RCC ASW itself is expected to permanently impact 0.01 acres of freshwater emergent wetlands. This Alternative is anticipated to permanently impact a total of 1.49 acres of wetlands overall.

Cumulative impacts to WOTUS and wetlands that have occurred since the original construction of the dam will continue with this Alternative. These cumulative impacts include the removal of the natural stream channel and creation of the impoundment, and the subsequent alteration of wetlands. There are anticipated to be some additional cumulative impacts to both the stream and associated wetlands from the rehabilitation actions.

Alternative 3
This alternative is anticipated to have impacts to water of similar intensity, duration, and magnitude as Alternative 2. It is expected to permanently impact a total of 1.54 acres of wetlands. This includes 1.48 acres of lake wetlands and 0.06 acres of freshwater emergent wetlands where the ACB ASW will be constructed.

Alternative 4
This alternative is expected to reduce the reservoir size by 0.46 acre, resulting in slightly fewer impacts to WOTUS and water quantity. It will also result in fewer permanent wetlands impacts (1.28 acres of lake wetlands).

Reservoir Impacts

	Permanent Reservoir Impacts (acres)
Alternative 2	-0.65
Alternative 3	-0.65
Alternative 4	-0.46

Stream Impacts

	Permanent Stream Impacts (linear ft)
Alternative 2	-111.0
Alternative 3	-111.0
Alternative 4	-111.0

Wetland Impacts

	Permanent Wetland Impacts (acres)
Alternative 2	-1.49
Alternative 3	-1.54
Alternative 4	-1.28

Air Quality

Existing Conditions
There are minimal emissions sources at the dam site, including routine maintenance (e.g., grass mowing) and emissions associated with automotive access of the site for recreational use.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Short-term, direct, negligible, adverse impacts to air quality are anticipated from Alternative 2. A temporary increase in greenhouse gas (GHG) emissions due to construction activities have the potential to adversely impact air quality on site. It is expected that there will be an increase in emissions and dust associated with the batch plant operations and fossil fuels trucks accessing the site. Project work associated with this Alternative is not anticipated to affect the attainment status of the area. As no permanent sources of emissions will be created, Alternative 2 is not anticipated to have long-term effects on ambient air quality or local GHG emissions.

Alternative 3
Air quality impacts from Alternative 3 are expected to be similar to those of Alternative 2 because both Alternatives will generate approximately the same sources and amounts of emissions and particulates for a similar duration. However, Alternative 3 will not require a concrete batch plant as this alternative does not involve large RCC structures. Therefore, Alternative 3 will have generally less emissions than Alternative 2.

Alternative 4
Air quality impacts from Alternative 4 are expected to be similar to those of Alternative 2 because both Alternatives will generate approximately the same sources and amounts of emissions and particulates for a similar duration. This Alternative is also anticipated to require an onsite concrete batch plant during construction.

Ecosystem Health

The ecosystem structure surrounding the dam consists of deciduous and mixed forest, small patches of wetlands, a maintained grass covered ASW, a maintained grass covered earthen dam area, and impounded water upstream of the dam. The dam and ASW are surrounded by a municipally maintained park.

During the site visit to the dam, the entire extent of the existing structure and adjacent land area was walked and visually assessed. The area adjacent to the dam and reservoir are part of a municipal park with maintained grass areas and trails. Beyond the maintained park features, the adjacent areas are deciduous forest with native trees and shrubs. The vegetation and habitat appeared generally healthy. The maintained grass covering the ASW and earthen dam was green with few brown patches. The deciduous trees and wetland shrubs and grasses appeared to be following typical seasonal patterns. Channel erosion was observed upstream of the reservoir, and significant bank erosion was observed extending approximately 100-yards downstream of the principal spillway outlet. Stream water both upstream and downstream of the dam, as well as the reservoir, appeared slightly turbid. Based on these observed conditions it was determined that the ecosystem functions at the dam were being performed adequately. However, the observed erosion and turbidity indicate some signs of ecosystem instability within the watershed.

Ecosystem Services

Regulating Services Category

Regulating ecosystem services help maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe. These benefits are obtained through moderation or control of ecosystem processes, including regulation of local climate, air, or soil quality; carbon sequestration; flood, erosion, or disease control; and pollination. There is inherent uncertainty when trying to predict impacts on regulating ecosystem services, given that our ideas of climate change and potential environmental catastrophes are based on models and simulations.

The attribute of the Regulating Services Category being used to measure project impacts is flood and disease control. The indicator (surrogate metric) associated with this attribute is, the number of structures that would be impacted by a potential breach in the static dam failure scenario.

Flood and Disease Control

The dam was constructed for the purpose of flood control to protect the City of Nitro and its residents from flooding events. The creation of the dam has limited the frequency and extent of flooding events, and as a result, lowered the chance of disease spreading through contaminated flood waters. The continuing functionality of the dam will continue to provide public health and safety benefits to residents impacted by flood reduction associated with the dam.

Surrogate Metric for Flood and Disease Control

The key metric used as the surrogate measure of the flood control service (and by default disease control) is the number of structures that would be impacted by a potential breach in the static dam failure scenario. The impact to critical structures like homes, roads and bridges is likely to result in increasing the risk of loss of life. Reducing flood damages and the potential loss of life is a critical ecosystem service for this project.

Flood and Disease Control Metrics

Structures in Static Breach Scenario Inundation Area Existing Condition	**Structures in Static Breach Scenario Inundation Area Post Construction**
298	298

Environmental Consequences

Alternative 1 Future Without Federal Investment Alternative (FWOFI)

Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2

Alternative 2 is not anticipated to impact flood control, and therefore Regulating Ecosystem Services, of the dam. The existing levels of flood protection provided by the dam will be maintained with this Alternative.

A total of 298 structures have the potential to be impacted by a potential breach of the dam in the static dam failure scenario. This Alternative is not expected to alter the number of structures in the breach inundation area because it will maintain the existing level of flood protection provided by the dam.

Climate change is a key source of uncertainty associated with flood control because it has the potential to increase the frequency and intensity of storm events in the near future and, in turn, increase the risk of a dam breach. Thus, the uncertainty of the future effects from climate changes may result in a greater risk of flood damages because the dam may not have the capability to mitigate for the intensity of future weather patterns.

Alternative 3
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 2 because both alternatives will maintain the existing level of protection.

Alternative 4
Impacts to flood and disease control from Alternative 4 are anticipated to be similar to those of Alternative 2 because both alternatives will maintain the existing level of protection.

Supporting Services Category

Supporting services refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production. There is inherent uncertainty when trying to determine impacts of the project on supporting ecosystem services since there are many other factors unrelated to the project that can affect processes such as nutrient cycling and soil formation.

The two attributes of the Supporting Services Category being used to measure project impacts are Nutrient Cycling and Soil Formation. The indicators (surrogate metrics) associated with these attributes are, green vegetation and the perviousness of the LOD.

Nutrient Cycling

Nutrient cycling in ecosystems is the exchange of organic and inorganic material back into the production of energy and matter. The nutrient cycle involves animals, plants, bacteria, fungi, as well as mineral components of the soil.

Surrogate Metric for Nutrient Cycling
The key surrogate metric used to represent nutrient cycling is vegetation because the addition, disturbance, or removal of vegetation can permanently impact the nutrient cycling process. The change in the extent of established vegetation in the LODs pre and post construction was analyzed.

Nutrient Cycling Metrics

	Established Vegetation (acres) Existing Condition	**Established Vegetation (acres) Post Construction**	**Change in Established Vegetation (acres)**
Alternative 2	49.27	45.06	-4.21
Alternative 3	49.27	45.85	-3.42
Alternative 4	49.27	45.75	-3.52

Soil Formation

Factors that affect soil formation include parent material, climate, topography, biological factors, and time (USDA NRCS 2020).

Surrogate Metric for Soil Formation
The key surrogate metric used to represent impacts to soil formation is the perviousness of the land within the limits of disturbance. The change in the extent of pervious land in the LODs pre and post construction was analyzed.

Soil Formation Metrics

	Impervious Surface (acres) Existing Condition	Impervious Surface (acres) Post Construction	Change in impervious surface (acres)
Alternative 2	3.21	4.65	+1.44
Alternative 3	3.21	3.86	+0.65
Alternative 4	3.21	4.12	+0.91

Environmental Consequences

Alternative 1 Future Without Federal Investment Alternative (FWOFI)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Short-term, long-term, and cumulative negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 2 and therefore to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 2. Some vegetation, including the grassed areas in the ASW and dam side slopes, will be disturbed and compacted, which will temporarily impact the nutrient cycle of the vegetation and soils.

It is anticipated that the nutrient cycle of the vegetation underlying the new RCC ASW, a total of 1.44 acres, will experience long-term impacts. Additionally, the upstream riprap slope is anticipated to permanently impact the nutrient cycle of 2.77 acres of underlying vegetation. Although the riprap will be permeable, it will be installed in such a way that will not allow vegetation regrowth. Thus, the total acreage of impacted established vegetation is expected to be 4.21 acres. These impacts are anticipated to be long-term, cumulative, direct, adverse, and negligible.

Trees will be removed for project work as necessary to help facilitate construction, primarily north and west of the auxiliary spillway (maximum 8 acres). The construction team will try to use land which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because new trees will be planted, impacts to the nutrient cycle from tree clearing are anticipated to be negligible.

Short-term impacts to soil formation in the LOD are anticipated to occur from the movement of construction vehicles and the staging of materials/equipment on the soils. Long-term effects to soil formation are expected from the installation of the RCC-ASW, which will convert approximately 1.44 acres of land to an impervious surface. It is not anticipated that the upstream

slope riprap will have permanent impacts on soil formation because the riprap covered area will remain permeable. Both short- and long-term adverse impacts to soil formation are anticipated to be negligible. Parent material, topography, and existing biological factors, which all affect soil formation, at the site are not expected to change as a result of Alternative 2.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 3
Impacts to nutrient cycling and soil formation from Alternative 3 are anticipated to be similar to those of Alternative 2 because both involve similar construction activities. There are anticipated to be slightly fewer long-term impacts because this Alternative involves an ACB-ASW. Vegetation will be able to grow in the gaps between the ACBs and thus it was estimated that only 50 percent of the established vegetation underlying the ACB ASW will be impacted. This results in the creation of 0.65 acres of impervious surface and a total loss of 3.42 acres of established vegetation, including the riprap embankment.

Alternative 4
Impacts to nutrient cycling and soil formation from Alternative 4 are anticipated to be similar to those of Alternative 2 because both involve similar construction activities. There are anticipated to be slightly fewer impacts to nutrient cycling because the RCC-ASW for this Alternative would impact 0.91 acres of established vegetation and the downstream riprap slope would impact 2.61 acres of established vegetation, totaling 3.52 acres. The RCC-ASW would create 0.91 acres of impervious surface, also resulting in slightly fewer long-term and cumulative impacts to soil formation.

Cultural Services Category

Cultural services make the world a place in which people want to live. These services are the non-material benefits ecosystems provide to human societies and culture, including opportunities for recreation, tourism, aesthetic or artistic appreciation, and spirituality. Uncertainty within cultural ecosystem services lies within society's restructuring of what is deemed culturally important as well as future management actions outside the realm of this project.

The two attributes of the Cultural Services Category being used to measure project impacts are recreational use and aesthetic viewsheds. The indicators (surrogate metrics) associated with these attributes are reservoir size and acreage of green landscape.

Recreational Use

The dam is located in Ridenour Lake Park, a popular 65-acre public park in the City of Nitro. The 24-acre reservoir, Ridenour Lake, is the main attraction of the park, and is used for recreational fishing and boating. The land surrounding the reservoir includes 1.61 miles of trails, used for hiking, and additional grassed areas used for picnicking, dog walking, and nature observing.

Surrogate Metric for Recreational Use
The key surrogate metric used to represent recreational use was the change in the size of the reservoir, which is one of the main recreational features of the park.

Recreational Use Metric

	Change in reservoir size (acres)
Alternative 2	-0.65
Alternative 3	-0.65
Alternative 4	-0.46

Aesthetic Viewsheds

The dam and its natural surroundings provide aesthetic viewsheds for those who visit the public park. Project action has the potential to impact the content and extent of a person's view of the aesthetics of the dam site.

Surrogate Metrics for Viewsheds
The key surrogate metric used to represent aesthetic viewsheds is the change in acreage of green landscape post construction compared to existing conditions. This change in acreage was based on viewsheds from three viewpoints, one at the Ridenour Lake Park gazebo, one north of the dam, and one east of the dam. See Appendix C for figures depicting viewsheds.

Aesthetic Viewsheds Metrics

	Permanent change in green landscape (acres)	
Alternative 2	**Viewshed 1**	-1.33
	Viewshed 2	-0.5
	Viewshed 3	-2.00
Alternative 3	**Viewshed 1**	-1.29
	Viewshed 2	0
	Viewshed 3	-1.84
Alternative 4	**Viewshed 1**	-1.62
	Viewshed 2	-0.45
	Viewshed 3	-1.68

Environmental Consequences

Alternative 1 Future Without Federal Investment (FWOFI) Alternative
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds and long-term, direct, adverse, negligible impacts to recreational use and aesthetic viewsheds are expected from Alternative 2 and therefore to the Cultural Ecosystem Services in the LOD.

Short-term impacts to recreational use will occur during the approximately 2 years of construction work when portions of Ridenour Lake Park within the LOD will be closed to the public. During this time, both parking areas will be closed because they will be occupied by construction staging areas. The reservoir will be unavailable for fishing or kayaking because it will be drained for the duration of construction sequencing. Long-term impacts to recreational use are anticipated to occur from the loss of 0.65 acres of reservoir due to the extension of the upstream slope. This long-term adverse impact to recreational use is anticipated to be negligible because this loss only accounts for a small percentage of the total reservoir size, and the reservoir will continue to be available for recreational use.

During project construction work, which is expected to last approximately 2 years, the aesthetic viewsheds of the LOD will be temporarily impacted due to the appearance of an active construction zone. Short-term adverse impacts to aesthetic viewsheds are considered moderate. Long-term impacts to aesthetic viewsheds were assessed based on the change in green landscape in each of the viewsheds. Project work is anticipated to result in long-term impacts to approximately 1.33 acres of green landscape in Viewshed 1, approximately 0.50 acres in Viewshed 2, and approximately 2.00 acres in Viewshed 3. Long-term adverse impacts to aesthetic viewsheds are anticipated to be negligible.

Alternative 3

Impacts to recreational use and aesthetic viewsheds from Alternative 3 are anticipated to be similar to those of Alternative 2 because both involve similar construction activities. There are anticipated to be fewer impacts to aesthetic viewsheds from Alternative 3 because vegetation will be able to grow between the gaps in the ACB ASW. The vegetation is anticipated to cover the concrete blocks and thus the ACB ASW is not anticipated to impact aesthetic viewsheds. Project work is anticipated to impact approximately 1.29 acres of green landscape in Viewshed 1 and approximately 1.84 acres of green landscape in Viewshed 4. Alternative 3 is not expected to impact the green landscape in Viewshed 2.

Alternative 4

Impacts to recreational use and aesthetic viewsheds from Alternative 4 are anticipated to be similar to those of Alternative 2 because both involve similar construction activities. There are anticipated to slightly fewer impacts to recreational use because Alternative 4 is expected to reduce the reservoir size by 0.46 acres. Project work is anticipated to impact approximately 1.62 acres of green landscape in Viewshed 1, approximately 0.45 acres in Viewshed 2, and approximately 1.68 acres in Viewshed 3.

Economic

The economic benefits provided by the dam and reservoir are reflected in the flood damage avoided to structures and roadways, and the recreation benefit provided by the reservoir.

Local and Regional Economy

The area below the dam potentially affected by flooding is fully developed, predominantly consisting of single-family housing and small percentages of multi-family housing and commercial businesses. Roadways through the affected area consist of an arterial, 21st St, with an AADT between 1,000 and 5,000, and collector roads, 2nd and 3rd Avenues.

Existing Conditions
Of 57 downstream structures potentially impacted by a 100-year flooding event, the dam eliminates flooding to 30, with many of the remaining 27 accruing incremental benefit from reduced flooding. Ninety three (93) structures are impacted by a 500-year event, with flooding eliminated for approximately 58 structures and reduced flooding for 35 structures. The average annual benefit from these avoided flood damages is estimated to be $75,100. Supporting calculations are shown in Appendix D. Dam rehabilitation will continue these benefits into the future.

Roadway flooding is reduced significantly with the dam, translating to an annual benefit of about $46,100, based on avoided road maintenance costs. The recreation benefit associated with Lake Ridenour is estimated to be $50,800 annually based on annual visitation of nearly 50,000. The assumptions behind these values are shown in Appendix D. Dam rehabilitation will continue these benefits into the future.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Flood control and recreation benefits will continue as before. There may be a temporary positive effect on the local economy during construction depending on the source of funding for rehabilitation. If locally funded, these expenditures will not significantly increase the local economy because the funds will preclude other worthy municipal expenditures.

Alternative 2
Flood control and recreation benefits will continue as before. There will be a temporary positive effect on the local economy during construction due to the additional money the federal portion of the project expenditures brings to the regional economy.

Alternative 3
Same as Alternative 2.

Alternative 4
Same as Alternative 2.

Social/Human Environment

Public Health and Safety

Existing Conditions
The dam currently fails to meet dam safety and performance criteria for a high hazard dam. It is estimated that the population at risk (PAR) of fatal impacts downstream of the dam is approximately 1,038.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Under this alternative, the dam would be structurally rehabilitated to West Virginia and NRCS standards. Continued flood protection for 100 years would be provided after the rehabilitation project is complete. The downstream flooding level would remain the same. The threat to loss of life from failure of the dam would be greatly reduced. Access to the site will be restricted during construction.

Alternative 2
Same as Alternative 1 (FWOFI)

Alternative 3
Same as Alternative 1 (FWOFI)

Alternative 4
Same as Alternative 1 (FWOFI)

Scenic Beauty

Existing Conditions
Scenic beauty, as defined by the USDA National Environmental Compliance Handbook Part 610.35, takes into consideration landforms, water, vegetation, and structures, some of which are present near the dam site (USDA NRCS 2016b).

Ridenour Lake Park was developed after the construction of the dam formed the reservoir; Ridenour Lake Park has become a popular destination in the center of the City of Nitro. The scenic beauty provided by the lake, vegetation, and gazebo in the park are highly valued by visitors of the park and the local community.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
This alternative is anticipated to have both short-term, direct, moderate, adverse and long-term, direct, minor, adverse effects on scenic beauty. Short-term effects will result from the appearance of an active construction site in the LOD during the approximately 2 years of project work. During this time visitors of Ridenour Lake Park will not be able to enjoy some of the typical scenic beauty aspects of the park, including the lake and green vegetation. Short- and long-term, adverse impacts to scenic beauty are anticipated to occur from clearing of up to 8 acres of trees in the LOD. There are anticipated to be minor, long-term impacts to landform, water, and vegetation features of scenic beauty from the necessary alterations to the dam site for rehabilitation. This includes the loss of greenspace in the ASW, and upstream embankment slope due to concrete and riprap. Efforts will be made by the design and construction team to maintain the current aesthetics of the dam site to the maximum extent practicable. Long-term impacts to scenic beauty are anticipated to be minor.

Alternative 3
This alternative is anticipated to have impacts to recreation and scenic beauty of similar intensity, duration, and magnitude as Alternative 2. There are anticipated to be slightly fewer impacts to recreation and scenic beauty than Alternative 2 because the ACB-ASW will impact a smaller area of greenspace, and vegetation will be able to grow between the ACBs.

Alternative 4
This alternative is anticipated to have impacts to recreation and scenic beauty of similar intensity, duration, and magnitude as Alternative 2. There are anticipated to be slightly fewer impacts to recreation and scenic beauty because the RCC-ASW and the upstream riprap embankment associated with Alternative 4 will impact a smaller area of greenspace.

Environmental Justice and Civil Rights

Existing Conditions
Residents of the floodplain and dam breach zone are predominantly white with household incomes and education levels comparable to those of the surrounding City, counties and State. Proportions of racial or ethnic minorities are very low and, with one exception, do not appear to be concentrated in any specific area affected by the dam. The area associated with Nitro's older downtown (Census Tract 106, Block Group 2) has significantly lower household incomes compared to the surrounding area and is also predominantly white (93 percent).

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
Dam rehabilitation will ensure all residents in the floodplain and dam breach zone, regardless of race, ethnicity, income, or other potentially disenfranchised groups, will continue to benefit from the flood protection and recreation provided by the dam.

Alternative 3
Same as Alternative 2.

Alternative 4
Same as Alternative 2.

Recreation and Parklands

Existing Conditions
The dam is located in Ridenour Lake Park, a public park maintained by the City of Nitro that includes Ridenour Lake, picnic facilities, trails, a boat ramp, and fishing areas (Nitro Convention and Visitors Bureau 2018). The park is a total of 65 acres, including approximately 24 acres of public fishing (Ridenour Lake) area, 1.23 miles of trails, as well as several acres of green space and a gazebo. The park is a popular destination for various recreational activities for local residents, including hiking, biking, fishing, kayaking, picnicking, dog walking, and nature observing. Outside of the park, there are an additional 0.38 miles of trails which connect to the trails within Ridenour Lake Park.

Alternative 1 Future Without Federal Investment (Sponsors' Rehabilitation)
Impacts from the FWOFI Alternative will be the same as impacts from Alternative 2, the Locally Preferred Alternative.

Alternative 2
There are anticipated to be short-term, direct, moderate, adverse and long-term, direct, minor, adverse impacts to recreation from Alternative 2. Short-term impacts to recreation will occur during the approximately 2 years of construction when portions of Ridenour Lake Park will be unavailable for recreational use. The park's two parking areas will be closed and used as construction staging areas, which will also block access to the gazebo area. Ridenour Lake will be closed for recreational fishing and kayaking while the reservoir is drawn down for about 5 months to facilitate construction on the principal spillway. Approximately 100 feet of trails west of Ridenour Lake will be inaccessible for hiking and biking during construction work. The trails south of the lake are outside of the LOD and will remain accessible throughout the duration of the project, however access may be restricted due to parking constraints.

Long-term, minor, adverse impacts to recreation will result from the elimination of greenspace where the RCC-ASW will be constructed and upstream where riprap will be placed. However, this alternative has the potential to meet a community need for a large outdoor venue for cultural events, in that the RCC steps could be used as an amphitheatre seating area. This would have a large positive recreational impact. Long-term impacts to recreation will also occur from the small reduction of the reservoir size from the extension of the upstream slope. The reservoir will still be of adequate size for recreation post construction and will be open for fishing, kayaking, etc. after project work is complete. Post construction, the parking areas, boat ramp, and other recreational features displaced or disturbed during construction will be replaced as the new rehabilitated dam components allow.

Alternative 3
This alternative is anticipated to have impacts to recreation and scenic beauty of similar intensity, duration, and magnitude as Alternative 2. There are anticipated to be slightly fewer impacts to recreation and scenic beauty than Alternative 2 because the ACB-ASW will impact a smaller area of greenspace, and vegetation will be able to grow between the ACBs.

Alternative 4
This alternative is anticipated to have impacts to recreation and scenic beauty of similar intensity, duration, and magnitude as Alternative 2. There are anticipated to be slightly fewer impacts to recreation and scenic beauty because the RCC-ASW and the upstream riprap embankment associated with Alternative 4 will impact a smaller area of greenspace.

RISK AND UNCERTAINTY

Hydrology and Hydraulics

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, and other factors such as temporal and spatial distributions of the various storm events.

Although potential climatic changes are not expected to alter the calculation of the PMP events within the design life of the project, they could increase the occurrence of low frequency, high intensity storm events and associated flood damages. Furthermore, the PMP values have not been updated using the latest state-of-the-science tools and methods to incorporate data from storms that occurred since the studies were published. The uncertainty associated with rainfall data could be reduced if site-specific or state-wide PMP data were available.

Mathematical, numerical, and computer models have inherent limitations while attempting to simulate complex physical processes, particularly when numerical solutions involve simplifying assumptions (e.g., ignoring depth variations in velocity for 2D hydraulic solutions) and when lumped parameters are used to represent a physical characteristic (e.g., Manning n-values for flow resistance, CNs for watershed retention/losses, etc.).

The SCS Dimensionless Unit Hydrograph method (USDA-NRCS, 2007) was used to transform runoff volumes to flow hydrographs. Unit Hydrograph theory inherently assumes that "discharge at any time is proportional to the volume of runoff and that the time factors affecting hydrograph shape are constant". This linearity assumption is not strictly true when a Unit Hydrograph is applied to storms of varying intensities and temporal and spatial patterns. No adjustments were made to the Unit Hydrograph Model to account for non-linearity, although the SCS Dimensionless Unit Hydrograph is generally known to produce conservatively high peak flows.

Additional uncertainty associated with hydrologic analyses is due to the use of input parameters that are the best approximation of hydrologic conditions in the watershed. The uncertainty and risk could be limited by calibration of the watershed response to rainfall events of the same magnitude; however, the lack of stream gage data limits the potential for calibration.

Very large storm events or deforestation by fire could cause an increased rate of erosion, sedimentation, and deposition.

Engineering

Risk and uncertainty during construction can be reduced by conducting design-phase geotechnical explorations to provide additional characterization of subsurface conditions based on the specific layout and features of the Locally Preferred Alternative. The exploration performed for this Plan was not tailored to specific rehabilitation alternatives as these were not developed when the exploration was performed. Subsurface conditions between boring and test pit locations may vary, and the adequacy of the design should be confirmed if unanticipated conditions are encountered during construction.

Projected sediment deposition is based on historical sedimentation, which was estimated to be lower than at the of the original design (refer to Sedimentation section for detailed results). However, the remaining sediment storage capacity significantly exceeds the minimum requirements. Therefore, the risk is minimal.

Professional opinions of future performance of concrete structures are based on visual observations and engineering analyses. While these structures, including the principal spillway riser and conduit, are expected to perform as intended during design-level hydraulic and seismic loadings within the design life of the structures, risk and uncertainty can be reduced by regular inspection and maintenance, as well as monitoring during and after major flood and seismic events, in accordance with NRCS and WVDEP Dam Safety requirements.

Environmental

There are inherent uncertainties of the predicted potential environmental impacts from this project. This is due to of a variety of factors including the reliance on online publicly available data sources, limited site-specific field surveys, the estimation of disturbance areas, and the inherent inaccuracies of conceptual level drawings.

Risk deals with data probabilities, and a risk analysis is not warranted with this data as the analysis is tied to the level of intensity of planning and perceived intensity of the anticipated impacts from the project.

Climate change is another source of uncertainty. The effects on the resources discussed below, may increase, or decrease in magnitude or intensity due to climate change. This may have an impact on anticipated effects on resources in the vicinity of the project, over the life of the project, but are anticipated to have minimal impact over the course of planning, design, and construction of the project. Due to the inherent dynamic and uncertain nature of climate change, the impacts of it are often based on the predictive models and acceptable degrees of uncertainty in assumptions making future impacts subjective and hard to assess. For example, the climate change literature reviewed for this project implied that precipitation events will be more severe and frequent in the Eastern United States although the degree to which this could occur varies widely.

Soils

Soil information presented in this report was summarized from USDA NRCS WSS data. There is uncertainty in the predicted soil impacts because of inherent inaccuracy of soils data used and the estimated LOD areas. The NRCS WSS uses order two soil survey data which is not a site-specific survey. It is also likely that there have been physical changes to the land since the last soil survey was conducted which would alter the soil characteristics. Additionally, the LODs were estimated based on experience with the type of activities to take place with each alternative and the exact LODs may change once construction sequencing begins.

Water Resources

There is uncertainty related to water quantity, water quality, wetlands, and floodplain management. Water quantity impacts are based on hydrology calculations which require many assumptions

during the calculation process, thus increasing the amount of uncertainty of the final water quantity. Water quality impact assessments were based on impacts to water quality from similar construction projects. These assumptions increase the uncertainty in predictions presented in the Plan-EA.

Wetland data used to evaluate wetlands impacts was delineated by EA using USACE wetland delineation guidelines and classified using the Cowardin system. The delineation process involves human judgement which is subject to error introducing uncertainty. There can also be oversights during the process which adds to the uncertainty of the delineation.

Flood zone data was obtained online from FEMA; however, the flood map panels for the area have not been updated since 2008 and thus the actual flood zones may differ from what is presented.

Vegetation

Initial determination of vegetation communities and land cover types present in the LODs were identified and mapped using the online National Land Cover Database (NLCD) (2019), which provides a general overview of vegetation types in the area. Additionally, information from WV DNR was used to obtain a general knowledge of common trees, bushes, and plant species in floodplain forests of West Virginia. Specific plant species in the onsite wetlands was gleaned from the March 2022 wetland delineation, which involves uncertainty related to human judgement. There is inherent uncertainty in the predicted vegetation impacts because site-specific vegetation surveys were not conducted for the project.

Riparian areas were estimated based on a 20-foot buffer along the streams. The buffer was not field measured or surveyed, which introduces uncertainty.

Animals

The WV DNR Interactive Fishing Map was consulted for fish species and stocking information in the project area (WV DNR 2020b). WV DNR's Wildlife Diversity Program was consulted to obtain general knowledge of wildlife species expected to occur at the dam site (WV DNR 2001). Additionally, the Kanawha County iNaturalist webpage was reviewed to identify species observed in near the dam site (iNaturalist 2022). Because onsite current surveys were not used to derive fish and wildlife information there is inherent uncertainty. Risk is not easily determined because the information does not have any normal probability distribution associated with it.

Human Environment

There is uncertainty related to cultural resource impacts because impact predictions were based on online research on the National Register of Historic Places database. The website indicated that no historical districts, properties, or archaeological resources were present in the LOD. Additionally, the exact extent of the LOD may differ once construction sequencing begins. Phase 1 archaeological and architectural survey ground-truthed the online research. Research sources included, but were not limited to, historical maps, atlases, tax records, photographs, ethnographies, the state preservation plan, SHPO records, NRCS archives or other Agency kept site files, National Register of Historic Places, folk life documentation, oral histories, previous

studies, local informants, and local historical/archaeological societies. The survey report recommendation of "No Effect to Historic Properties" received concurrence from SHPO for both above and below ground cultural resources.

Determining and quantifying impacts to scenic beauty comes with inherent uncertainty because scenic beauty is typically subjective. Some people may consider scenic beauty impacts from the project greater or less than what was stated in the report.

The Sponsors will prohibit future construction of habitable dwellings upstream of the dam and below the elevation of their flowage easement. The Sponsors recognize that the dam is designed to detain floodwaters. The Sponsors and landowners accept the potential risk of, and liability associated with, flood damages that would occur in events between their flowage easement elevation and the elevation of the top of dam.

Economic

Because local tax appraisal district records were utilized to obtain the structural values of residences, commercial, and public properties that would be affected by project activities, there is the possibility of under- and/or over-estimated values as compared to fair market values, which could impose uncertainty into the economic analysis. Content values were estimated as a percentage of assessed property values, which also could result in values not reflective of actual values. Estimated floodwater depths for various storms (including the 500-year storm) for each structure were based on the results of the hydrology and hydraulics (H&H) simulation modeling. This could result in greater and/or less risk of flood events. Depth-to-damage functions embodied in the HAZUS-MP Model were utilized to estimate structural and content damage. Updated functions based on more recent flood events could also provide varying results – increased and/or decreased damages. The risk and uncertainty in the analysis for flood damage reduction could be reduced for the economic analysis, but that would require more intensive primary and secondary data collection. With regards to the value of recreation stemming from Lake Ridenour, it should be noted that the City of Nitro tracks facility utilization but not overall visitation to the lake and surrounding park. As a result, there is a degree of uncertainty in the visitation estimates that is addressed in Appendix D.

The level of analysis for the economic estimates are appropriate to meet the purpose and need of the project. The identification of the NEE alternative is not distorted by the use of these economic estimation procedures. Thus, it was determined that increased investment in analysis was not necessary and any reduction in risk and uncertainty would not result in a different identification of the NEE alternative.

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 Locally Preferred Alternative and can perform the required maintenance on the upgraded structures after construction.

CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

The sponsoring organization is the City of Nitro. The City of Nitro is considered the owner and operator of Blakes Creek-Armour Creek Site 7.

Local and federal support for the rehabilitation of the dam has been strong. Input and involvement of the public have been solicited throughout the planning of the project. At the initiation of the planning process, some meetings were held with representatives of the Sponsors to ascertain their interest and concerns regarding the dam. A Public Participation Plan was developed and approved for the project and has been followed during the planning process.

The City of Nitro and NRCS 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.

Due to COVID-19 risks and restrictions for public gatherings, two virtual Public Scoping Meetings were held using Microsoft Teams software on December 17, 2020. During the meetings, the participants identified issues of economic, environmental, cultural, and social concerns in the watershed. Input was provided at the meeting or through letters and emails to NRCS. There were 30 people in attendance at the morning session and 13 people at the evening session. Agencies and organizations attending or providing input include the City of Nitro, Kanawha County, WV DEP Dam Safety Agency, US Army Corps of Engineers, WV Conservation Agency, U.S. Senator Joe Manchin's office, EA Engineering, Science and Technology, Schnabel Engineering, Aterra Solutions, Headwaters Corporation, NRCS, and some landowners and anonymous callers. The meeting recording and PowerPoint Presentation were saved to the City's website for reference and viewing by the general public at large.

The Sponsors and NRCS held an onsite public meeting on May 17, 2022 to discuss the proposed rehabilitation alternatives for the Blakes Creek–Armour Creek Watershed Site 7. The meeting was held in the Nitro City Council Chambers located at 497 1st Avenue, in Nitro. The meeting was also available virtually using Microsoft Teams**.** Representatives from the Local Sponsors and NRCS, along with their consultants, provided information on the planning activities to date, described the various rehabilitation alternatives being considered for this multipurpose flood control and recreation structure, presented the recommended alternative, answered questions and concerns about the planned activities, and sought public input. Meeting participants provided input on their issues and concerns to the planning team. Agencies and organizations participating or providing input include the City of Nitro, Aterra Solutions, Schnabel Engineering, EA Engineering, Science and Technology, Inc., Headwaters Corporation, and NRCS. The meeting recording and PowerPoint Presentation were saved to the City's website for reference and viewing by the general public at large.

Agency coordination and tribal consultations were conducted by written correspondence from NRCS on dates specified in the table below and in the table in *Cultural Resources / Historic Properties* section. The consultation requested participation through review and comment on the evaluated environmental, cultural, and historic impacts of the project.

On August 12, 2024 a public/inter-agency meeting was held in the city of Nitro to review the Draft Plan-EA. Questions were fielded by Aterra Solutions personnel. The attendees were informed that copies of the document were available to download along with its accompanying Appendices. It was also stated that a copy of the document was available for review at the public library. Attendees were informed that comments on the document would be received until September 12th which meets the required thirty day public/inter-agency review period. The contact information for those receiving comments was discussed at the close of the meeting. No comments were received on the draft Plan-EA during the thirty day review period.

Consultation, Coordination and Public Participation Activities

Date	Type	Purpose	Participants
November 10, 2020	Planning	Determine key local, State, and Federal Agencies to involve in planning	Sponsors, NRCS, and Planning Team
December 17, 2020	Public Meeting	Scoping	Local, State, and Federal agencies including SHPO,USFWS, and USACE with jurisdiction, local governing entities, and Sponsors
December 17, 2020	Public Meeting	Scoping	Local, State, and Federal agencies including, SHPO, USFWS, and USACE with jurisdiction, local governing entities, Sponsors, General Public
Monthly Teleconferences	Informational	Project updates	Sponsors, NRCS, & Planning Team
April 20, 2022	Teams Meeting	Identify Locally Preferred Alternative	NRCS, Sponsors, and Planning Team
April 11, 2022	Public Meeting Announcement Materials	Inform everyone about upcoming public meeting	Contacts from the Public Participation Plan, agencies, organizations, tribes, and general public.
May 17, 2022	Onsite and Virtual Public Meeting	Present findings, review various alternatives analyzed, and discuss the Recommended Alternative	Public, local nongovernment entities, federal, state, and local government agencies including, SHPO, USFWS, USACE, and other entities, tribal organizations, legislative reps.
July 15, 2022	USFWS Consultation	T&E Species	Initial request for information, concerns
July 19, 2022	USFWS Response Letter	T&E Species	USFWS to NRCS
July 15,2022	WVSHPO	Subsurface Cultural Resources	NRCS request for feedback
July 20, 2022	WVSHPO Response Letter	Cultural Resources (106)	WVSHPO to NRCS
July 7, 2023	Letter to USACE	Discuss Permitting	NRCS To USACE
July 14, 2023	USACE Response	Permitting Coordination	USACE to NRCS

Date	Type	Purpose	Participants
July 18, 2023 June 22, 2023	Agency Coordination	Review effects of Locally Preferred Alternative	Government Agencies including the USFWS and USACE.
June 10-15, 2022	Tribal Consultation	Review effects of Locally Preferred Alternative	• Catawba Indian Nation • Cayuga Nation • Chickahominy Indian Tribe • Delaware Nation • Eastern Chickahominy • Eastern Shawnee Tribe of Oklahoma • Eastern Band of Cherokee Indians • Monacan Nation • Pamunkey Indian Tribe • Rappahannock Tribe • Saint Regis Mohawk Tribe • Seneca-Cayuga Nation • Shawnee Tribe • Tonawanda Band of Seneca • Tuscarora Nation of New York • United Keetowah Band of Cherokee Indians • Upper Mattaponi Indian Tribe
July 3, 2024	Tribal Notice	Public/Interagency Review of Draft Plan	All affected Tribes
July 8, 2024	NRCS Website Publication of Draft Plan	Inform Public	Public
July 16, 2024	Letters of Notice	Inform Stakeholders of Meeting to Review Draft Plan	Public Participation Plan Stakeholder List
July 26, 2024	Social Media Notice of Public/Interagency Meeting to Review Draft Plan	Inform Public	Public
August 12, 2024 to September 12, 2024	Interagency and Public Meeting	Review of Draft Plan	Public, Federal, State and Local Agencies including SHPO, USFWS, USACE, Tribal Organizations (same as noted above), Sponsors, and Stakeholders
August 12, 2024	Public Meeting	Present the draft Plan-EA	NRCS, local sponsor, public, and Aterra Solutions
Per Public Participation Plan Schedule	Distribution and Posting of Final Plan to NRCS and Sponsors' Websites	Inform public of Final Plan	Sponsors mail out and post Final Plan to ensure public awareness. Specific outreach to SHPO, USFWS, and USACE as well as Tribal Organizations and Publics/Stakeholders

LOCALLY PREFERRED (PROPOSED) ALTERNATIVE

Rationale for Plan Selection

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

- Reduces the threat to loss of life to approximately 1,038 people who live, work, and who are otherwise at risk in the breach zone.
- Reduces the threat of catastrophic dam breach for 272 residences, 10 apartment buildings, 14 commercial structures, 1 public property, and 4 roadways downstream within the breach inundation zone.
- Reduces the threat of catastrophic dam breach for over 15,000 vehicles and their occupants who utilize 21st Street and 1st Avenue on an average daily basis.
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Reduces the threat of catastrophic dam breach for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 100 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current West Virginia and NRCS safety and performance standards. Maintains liability associated with allowing upstream buildings between the flowage easement and the top of dam elevations
- Retains the majority of the existing aquatic and terrestrial habitat in and around the dam.
- Leverages federal resources to install the planned works of improvement.
- Potentially meets a community need for a large outdoor venue for cultural events.
- Requires a minimal amount of land rights acquisition. The Sponsors recognize the continued threat of upstream flooding associated with the dam.
- Maintains liability associated with allowing upstream buildings between the flowage easement and the top of dam elevations.
- Will meet current State and NRCS safety and performance standards for a high hazard potential dam.

The Locally Preferred Alternative meets the Sponsors' objectives of bringing this dam into compliance with current dam design and safety criteria, providing some flood protection for downstream properties, and addressing resource concerns identified by the public. The selected plan is Alternative 2, the Locally Preferred Alternative. The plan reasonably meets the following four criteria: completeness, effectiveness, efficiency, and acceptability. NRCS and the Sponsors agree on the selected plan.

Measures to be Installed

The selected plan of action for the dam is to:

- Re-grade and level the dam crest to design elevation 648.0 ft.
- Re-grout the existing 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit joints.
- Construct a filter diaphragm around the principal spillway conduit.
- Remove the existing principal spillway impact basin, extend the 30-inch diameter principal spillway conduit downstream by approximately 90 feet and construct a new principal spillway impact basin.
- Remove the existing riser, construct a new principal spillway riser with the same configuration and extend the 30-inch diameter principal spillway conduit upstream by approximately 60 feet.
- Partially remove and partially grout in place the existing corrugated metal pipe trench drains and install new plastic pipe toe drains. Replace existing toe drain drainfill material. Also, the top 3 ft of drainfill in the relief wells will be removed and replaced.
- Enhance the stability of the downstream embankment slope by flattening the slope with earth fill (4.5H:1V).
- Enhance ground stability at the downstream embankment toe using soil-cement mixed shear panels.
- Flatten the upstream embankment slope (5.5H:1V) with rock riprap to enhance slope stability.
- Remove the culvert under Tea Table Road within the right abutment of the embankment along with re-grading for surface drainage.
- Replace the stormwater drop inlet and discharge pipe in the existing ASW.
- Remove the existing sewer line in the ASW and replace it with a new septic system for the recreation area facility.
- Constructing a 140-ft wide roller compacted concrete auxiliary spillway (RCC-ASW) and realigning it near the existing ASW spillway location.

After the implementation of these planned works of improvement, the dam will meet current WV and NRCS safety performance standards.

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

The Remaining Hazard Related to the Alternative

The Locally Preferred Alternative will maintain the current level of flood protection. However, the table below reflects the type and number of properties that would still be at risk of flood damage.

Remaining Flood Hazard of the Preferred Alternative (Flood Depths)

Type of Property	Number (500-year)	Depth of Floodwaters Above First Floor Elevation in ft (FFE) [1/]	
		500-year	100-year
Single family residential	28	0.0 – 3.6	0.0 – 2.0
Multi-family structures (duplex and 3-4 units)	3	0.0 – 6.2	0.0 – 4.8
Commercial structures	3	0.0 – 5.4	0.0 – 3.5
Total	**34**	**-**	**-**

[1/] Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation.

Remaining Flood Hazard of the Preferred Alternative (Velocities)

Type of Property	Number (500-year)	Maximum Velocities of Floodwaters (fps)[1/]	
		500-year	100-year
Single family residential	28	0.2 – 2.3	0.1 – 2.3
Multi-family structures (duplex and 3-4 units)	3	0.6 – 1.9	0.5 – 1.8
Commercial structures	3	1.6 – 2.6	1.4 -2.4
Total	**34**	**-**	**-**

Costs

As indicated in Table 1, the total installation cost of the selected plan is $21,311,000. Of this amount, PL-83-566 funds will bear $14,858,100 and nonfederal funds will bear $6,452,900. 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 2022 price base was used and amortized at 2.50 percent discount for a100-year period of analysis (including a design and installation period of four years and an expected useful life of 100 years).

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

Operation, Maintenance, and Replacement

Measures installed as part of this plan, and previously installed measures, will be operated and maintained by the City of Nitro with technical assistance from federal, state, and local agencies in

accordance with their delegated authority. A new Operation and Maintenance (O&M) agreement will be developed for Blakes Creek-Armour Creek Watershed Site 7 and will be executed between the City of Nitro and the NRCS prior to construction of the project. The term of the new O&M agreement will be 100 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 state and federal representatives to inspect all structural measures and their appurtenances at any time.

Easements and Landrights

The City of Nitro currently owns the majority of the land below the auxiliary spillway (ASW) crest elevation of 635.8 (NAVD 88). Below this elevation, the City of Nitro owns 37.4 acres of land and 0.8 acre are privately owned. At the proposed dam crest elevation (648.0) there would be 8.5 acres outside of the currently City-owned land. There are no buildings currently below the auxiliary spillway crest; however, there are several buildings below the PMF elevation (EL 646.9) or TOD elevation (EL 648). The City of Nitro was encouraged to acquire landrights up to the PMF elevation; however, a decision was made to secure only the minimum land rights at this time. The public was informed during the public meeting that water could potentially reach the elevation equal or greater than the TOD elevation. There are no buildings downstream of the dam that would receive induced flooding due to the presence of the dam during the passage of the 100-yr, 24-hr storm.

The minimum upstream NRCS landrights elevation for this dam is the elevation during the passage of the 100-yr, 24-hr storm (EL 630.1). The City of Nitro will procure the additional 0.1 acre of flood storage easements up to this elevation upstream of the dam. The landrights will include a prohibition on future construction of inhabitable dwellings below the elevation of the acquired landrights.

Mitigation

The United States Army Corps of Engineers (USACE) is responsible for protection of Waters of the United States. Therefore, compensation for any impacts to wetlands from project action must be approved by the USACE. In West Virginia there is an “in-lieu-fee” (ILF) option for mitigating impacts to streams and wetlands. It is assumed this option will be used for mitigating project impacts. When the project is completed the West Virginia Stream and Wetland Valuation Metric will be used to calculate the project’s ILF. For planning purposes, wetland mitigation was estimated at $350,000 and was included in the construction cost estimate.

During construction if a potential cultural resource is discovered work will stop, the NRCS and the landowner notified. The first option for mitigation is always avoidance which can take a variety of forms including, (moving the practice to another area, changing the work limits, changing to an acceptable alternative practice or measure, or modifying the practice design. Other options including minimizing effects will be approved by the SHPO and frequently discussed in at State level prototype programmatic agreement (PPA). Adverse effects must be resolved via a MOA between, NRCS, SHPO, and THPO.

Permits and Compliance

Prior to construction, the Sponsors will be responsible for obtaining all required permits. During construction, the successful contractor is required to develop a Stormwater Pollution Prevention Plan (SWPPP) and acquire any applicable air quality and erosion and sediment control permits.

The construction general permit would require the operator to implement a site-specific SWPPP. The SWPPP would outline the steps that an operator must take to comply with the permit, including water quality and quantity requirements to reduce pollutants in the stormwater runoff from the construction site. The SWPPP also specifies all potential pollutant sources that could enter stormwater leaving the construction site and covers methods used to reduce pollutants in stormwater runoff during and after construction.

The National Flood Insurance Program regulations state: "*A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements will be based upon current data."* Implementation of the Locally Preferred Alternative will have no impact on the 500-year and smaller floods; therefore, there will be no impact on the flooding conditions shown in the flood insurance studies or on the FIRMs; however, the local communities may choose to provide to FEMA the results of the hydraulic analyses developed for this project for consideration in revising the FIRMs.

In addition to the permits listed above, it is anticipated that the following natural resource related permit applications may also be necessary depending on disturbance areas outlined during the design process:

- Individual Permit Authorization from the United States Army Corps of Engineers (USACE) under federal Clean Water Action Section 404.
    - Individual Permit (as opposed to NWP authorization) is anticipated due to permanent impacts >1 acre.
- Section 401 Water Quality Certification from the West Virginia Department of Environmental Protection, Division of Water and Waste Management
    - https://dep.wv.gov/wwe/programs/pages/401certification.aspx
    - Required for projects that need an Individual Permit from USACE
- Certificate of Approval from the West Virginia Department of Environmental Protection, Division of Water and Waste Management under the Dam Control and Safety Act.
    - https://dep.wv.gov/WWE/ee/ds/services/Pages/dscertificate.aspx
    - Required for rehabilitation of a state-regulated dam
- Stream Activity Application review from West Virginia Department of Natural Resources
    - https://dep.wv.gov/WWE/Programs/nonptsource/streamdisturbance/Documents/WVStreamDisturbancePermitGuide.pdf
    - Required for activities occurring within or adjacent to streams.

- Construction Stormwater General Permit from the West Virginia Department of Environmental Protection, Division of Water and Waste Management
    - https://dep.wv.gov/WWE/Programs/stormwater/csw/Pages/home.aspx
    - Required for construction projects that entail 1 acre or more of land disturbance.
- State Waters Permit is not required unless the project will impact a non-federally regulated wetland.
- County Floodplain Permit
    - https://kanawha.us/wp-content/uploads/2017/03/Quick_Guide_Overview_of_Floodplain_Regulations.pdf
    - Required for work within floodplains.

Other state or local permits may be necessary, and this determination will be made during pre-permit application meetings with local, state and federal regulatory agencies once designs have been sufficiently developed to facilitate conversations.

Installation Sequence

The installation of the project will be completed within four years following appropriation of construction funds. Actual construction will occur over about 24 months. However, with time allowed for set-up and winter shutdown, the actual construction activities will occur over about 15 months. All required easements and permits will be secured before the solicitation of construction bids for the project.

The contractor will determine the installation sequence after a construction contract has been awarded. The actual sequence of construction may vary somewhat from the bulleted items below, but these are the basic steps expected for this rehabilitation project.

- The contractor's schedule, Safety Plan, Quality Control Plan, Erosion and Sediment Control Plan, Water Control Plan and other necessary contract plans will be developed and approved.
- A detailed survey and layout of the limits of disturbance, access routes, and major works of improvement will occur.
- The erosion and sediment control measures will be installed.
- The staging area will be cleared and grubbed. Gravel will be placed over geotextile fabric to limit ground disturbances within the staging area. Access routes will be established from the staging area to the work areas.
- Construction trailers will be set up and materials will begin to arrive onsite.
- The reservoir will be drawn down.
- The existing principal spillway (PSW) riser and impact basin will be removed. The PSW conduit will be extended and a new riser and impact basin constructed.
- The dam crest will be graded/leveled at EL 648.0 and riprap shell will be placed on the upstream slope. The riprap shell will also accomplish flattening of the upstream slope.
- Foundation strengthening will be performed, toe drains and filter diaphragm will be installed, and the downstream slope will be flattened.
- The pond drain gate will be closed and the reservoir will begin to be filled.

- Excavation of the auxiliary spillway will begin followed by construction of the reinforced concrete sidewalls.
- The concrete batch plant will be set up. The construction of the RCC stilling basin with riprap outlet protection will occur followed by the RCC chute.
- The concrete batch plant will be removed.
- All disturbed areas, including the staging area, will be seeded and mulched.

Installation and Financing

The project is planned for installation in about 4 years. During construction, the City of Nitro light, noise, and other pollution ordinances will be followed.

NRCS will assist the Sponsors with the rehabilitation project. NRCS will be responsible for the following:

- Execute a project agreement with the City of Nitro before either party initiates work involving funds of the other party. Such agreements set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
- Execute a Memorandum of Understanding with the Sponsors to provide a framework within which cost-share funds are accredited.
- Execute an updated Operation and Maintenance Agreement with the City of Nitro that extends the O&M responsibilities for another 100 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.
- Verify that all required land rights are secured before construction is initiated.
- Provide consultative engineering support, technical assistance, and approval during the design and construction of the project.
- Provide contract administration technical assistance during construction of the project.
- Provide construction management technical assistance.
- Certify completion of all installed measures.

The Sponsors will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for the installation, operation, and maintenance of the rehabilitated structure.
- Prepare an updated Emergency Action Plan for the dam prior to the initiation of construction.
- Execute a Memorandum of Understanding with the NRCS to provide a framework for crediting in-kind services.
- Execute an updated Operation and Maintenance Agreement with NRCS for the dam. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide local administrative and contract services necessary for the installation of the project.

- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of the total eligible project costs.
- Participate in and comply with applicable Federal floodplain management and flood insurance programs.
- Prohibit future construction of habitable dwellings upstream of the dam and below the flowage easement at 100-year, 24-hour WSEL (elevation 635.8 NAVD 88).
- Enforce all associated easements and rights-of-way for the safe operation of the dam.

Table 1 – Estimated Installation Cost

Blakes Creek–Armour Creek Site 7

City of Nitro, West Virginia

(Dollars) Installation Cost Items	Estimated Costs		
	PL-83-566 Funds[1/]	Other Funds	Total
Structural measures to rehabilitate Blakes Creek–Armour Creek Site 7	$14,858,100	$6,452,900	$21,311,000
Total Project:			

Price base: 2022 Prepared: March, 2022

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

Table 2 – Estimated Cost Distribution – Structural Measures

Blakes Creek–Armour Creek Site 7

City of Nitro, West Virginia

(2022 Dollars)

							Other Funds							Total Project Cost, PL-83-566 Costs plus SLO cost[3/]
Construction Costs	Engineering Technical Assistance Costs	Geo-technical Costs	Project Admin. Costs	AE Constr. Phase Costs	Landrights Costs	Total PL-83-566 Costs	Construction Costs	Engineering Costs	Real Property Landrights	Permits	Project Admin. Costs	AE Constr. Phase Costs	Total SLO Expenditures	
$11,194,300	$1,400,000	$200,000	$1,404,000	$650,000	$9,800	$14,858,100	$6,027.700	$7,000	$5,200	$56,000	$7,000	$350,000	$6,452,900	$21,311,000

Price base: 2022 Prepared: March, 2022

1/Federal Engineering, Geo-Technical, and Project Administration costs are not included when calculating federal cost share for the rehabilitation project. Sponsors' permitting costs are not eligible for cost share either. The actual federal cost/share cannot exceed 100% of the construction cost.

2/ 35% of total eligible project cost, excluding permits cost.

3/ 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 purpose 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.

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Table 3 – Structural Data for Rehabilitated Dam

Blakes Creek–Armour Creek Site 7

City of Nitro, West Virginia

Item	Unit	Structure Data
Class of structure		High Hazard
Uncontrolled drainage area	mi^2	2.36
Controlled drainage area	mi^2	0
Total drainage area	mi^2	2.36
Runoff curve number (AMC II)		72
Time of concentration (T_c)	hours	0.97
Top of dam elevation	feet	648.0
Elevation crest auxiliary spillway	feet	635.8
Elevation crest high stage inlet	feet	622.5
Elevation crest low stage inlet	feet	N/A
Auxiliary spillway type		Structural
Auxiliary spillway crest width	feet	140
Auxiliary spillway exit slope	percent	1.9% and 20%
Maximum height of dam	feet	50
Volume of fill	yd^3	251,327
Total capacity		545.9
Sediment submerged	acre-feet	59. 0
Sediment aerated	acre-feet	13.4
Beneficial use (recreation)	acre-feet	80.8
Floodwater retarding	acre-feet	392.7
Between high and low stage	acre-feet	N/A
Surface area		
Sediment pool	acres	18.8
Beneficial use pool (recreation)	acres	23.3
Floodwater retarding pool	acres	37.9
Principal spillway design		
Runoff volume (1-day)	inches	3.41
Runoff volume (10-day)	inches	6.81
Capacity	ft^3/s	127
Dimensions of conduit	inches	30
Type of conduit		AWWA C-301 steel cylinder concrete lined pressure pipe

Item	Unit	Structure Data
Frequency of operation-auxiliary spillway	percent chance	<0.2
Auxiliary spillway hydrograph		
Rainfall volume	inches	10.07
Runoff volume	inches	6.81
Storm duration	hours	6
Max. reservoir water surface elev.	feet	638.79
Freeboard hydrograph		
Rainfall volume	inches	27.82
Runoff volume	inches	24.01
Storm duration	hours	6
Max. reservoir water surface elev.	feet	646.81
Capacity equivalents		
Sediment volume	inches	0.58
Floodwater retarding volume	inches	3.12
Beneficial volume (recreation)	inches	0.64

Prepared: April 2023

Table 4 – Average Annual National Economic Efficiency (NEE) Costs

Blakes Creek–Armour Creek Site 7

City of Nitro, West Virginia

(Dollars[1/])

Average Annual Equivalent Cost	**Average Annual Equivalent O&M Costs** [2/]	**Total Average Annual Equivalent Cost**
$582,000	$9,160	$591,160

Prepared: March, 2022

[1/] The average annual equivalents are based on a 2.50 % discount rate and a 100-year period of analysis (2 years for project design and 2 years for installation precedes 100 years of expected useful life).

[2/] Estimated O,M,&R expenditures are for dam facilities and related facilities exclusively and do not include recreation facilities, the latter of which are covered by the City of Nitro.

Table 5 – Estimated Average Annual Flood Damage Reduction and Recreation Benefits

Blakes Creek–Armour Creek Site 7
City of Nitro, West Virginia
(Dollars)

Flood Damage Category	Estimated Average Annual Equivalent Flood Damages		Annual Damage Reduction Benefit	Annual Equivalent Recreation Benefit		Net Annual Recreation Benefit	Total Annual Benefit [1]
	Future Without Federal Investment (FWOFI)	Future With Federal Investment (FWFI)		FWOFI	FWFI		
Structures, contents, inventory	$39,700	$39,700	$0.0				$0.0
Roads and bridges	$62,600	$62,600	$0.0				$0.0
Recreation				$550,800	$550,800	$0.0	$0.0
Totals	**$102,300**	**102,300**	**$0.0**	**$550,800**	**$550,800**	**$0.0**	$0.0

Price base: 2022 Prepared: March, 2022

[1/] For this project, the Future Without Federal Investment (FWOFI) is identical to the Future With Federal Investment (FWFI). As a result, benefits for each are also equal and there is no difference between FWFI and FWOFI.

Table 6 – Comparison of National Economic Development (NED) Benefits and Costs

Blakes Creek–Armour Creek Site 7

City of Nitro, West Virginia

(Dollars)

Average Annual Equivalents[1/]				Benefit/ Cost Ratio
Flood Reduction and Recreation Benefit 2/	**Total Average Annual Benefits**	**Average Annual Costs**	**Net Average Annual Benefits**	
$0.0	$0.0	$591,160	$(-591,160)	1.0 to 1.0

Price base: 2022 Prepared: March, 2022

[1/] The average annual equivalents are based on a 2.5% discount rate and a 100-year period of analysis (2 years for project design and 2 years for installation precedes 100 years of expected useful life).

[2/] Since the FWOFI Alternative is identical to the FWFI Alternative, there is no net benefit when these two alternatives are compared and, since the benefit-cost ratio is relative to the FWOFI, the resulting benefit-cost ratio is assumed to be 1.0.

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REPORT PREPARERS

The Blakes Creek-Armour Creek Site 7 Dam Watershed Supplemental Plan and Environmental Assessment was prepared by Aterra Solutions - Schnabel Engineering Joint Venture with support from EA Engineering, Science, and Technology (EA), and other consultants. The Draft Plan was reviewed by NRCS West Virginia State Office Staff and the Sponsors. The NRCS State staff specialists concurring with the plan included those having responsibility for engineering, resource conservation, soils, biology, economics, geology, and contract administration. The in-house review was followed by a review by the NRCS National Water Management Center, NRCS National Office programmatic review, and an interagency and public review.

The table below provides a list of preparers directly responsible for providing significant input to the preparation of the Supplemental Plan-EA.

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

List of Preparers

Name	Project Role	Professional Title	Education	Experience in Years	Other
NRCS					
Harold Russell	Contracting Officer's Representative	Geotechnical Civil Engineer	B.S., M.S., and PhD in Civil Engineering (Geotechnical)	8	P.E. in WV
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Aterra Solutions					
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Wade Biddix	Planning and Public Participation Coordinator	Senior Planner	M.S. Public Administration B.S. Agriculture	40	
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Headwaters Corporation					
George Oamek		Economist	Ph.D., M.S., and B.S. Agricultural Economics	38	

ERM					
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Megan Wiginton	Architectural Historian	Senior Consultant, Architectural Historian	MA Georgia State University, BA Georgia State University	9	

DISTRIBUTION LIST

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

	Response Received on Draft Plan/EA
Federal Agencies	
Environmental Protection Agency Region 3, Philadelphia, PA	
U.S. Army Corps of Engineers Huntington District, Huntington, WV	
U.S. Department of the Interior Fish and Wildlife Service West Virginia Field Office, Davis, WV	
Federal Emergency Management Agency Region III, Philadelphia, PA	
U.S. Department of Agriculture U.S. Forest Service, Milwaukee, WI	
West Virginia State Agencies	
WV Conservation Agency, Charleston, WV	
WV Department of Environmental Protection, Charleston, WV	
WV DEP, Dam Safety Section, Fairmont, WV	
WV Division of Natural Resources, South Charleston, WV	
WV Department of Agriculture, Charleston, WV	
WV Department of Arts, Culture and History (SHPO), Charleston, WV	
Other	
City of Nitro, Nitro, WV	

	Response Received on Draft Plan/EA
Kanawha County Commission, Charleston, WV	
Western Conservation District, Leon, WV	
Capital Conservation District, Cross Lanes, WV	
Great Kanawha RC&D Council, West Hamlin, WV	
Catawba Indian Nation	
Shawnee Tribe	

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APPENDIX A

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

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USDA United States Department of Agriculture

Natural Resources Conservation Service

News Release

Release No.: ____

Contact:
Harold Russell, (304) 284-7567
Harold.Russell@usda.gov

Public Scoping Meetings for Blakes Creek – Armour Creek Watershed Site 7 Rehabilitation Project Set for December 17, 2020

(Morgantown, WV - Insert Date of Release) – USDA-Natural Resources Conservation Service (NRCS), the City of Nitro, the Kanawha County Commissioners, the Capital Conservation District, and the Western Conservation District are co-sponsoring two Public Scoping Meetings to discuss the proposed rehabilitation of Blakes – Armour Dam No. 7 located on Blakes Creek in the City of Nitro, West Virginia. The meetings will be held virtually using Microsoft Teams. The first meeting at 10 a.m. is mostly for agencies, organizations, watershed associations, etc. but is also open to the public. The evening meeting at 7 p.m. is for the general public.

Representatives from the Local Sponsors and NRCS, along with their consultants, will provide information on the dam rehabilitation program, planning activities to date for the Blakes – Armour Dam, describe the various rehabilitation alternatives being considered for this multipurpose floodwater retarding and recreation structure, answer questions and concerns about the planned activities, and seek public input.

The dam provides flood protection to residents of Kanawha County and the City of Nitro located downstream as well as recreational opportunities. Local sponsors, NRCS staff, and their consultants are developing a plan for rehabilitating this dam so it meets current dam safety regulations and design standards. Alternatives being considered include: no action, decommissioning (dam removal), structural rehabilitation, and nonstructural measures.

Federal funding has been received to assist the local sponsors in developing the plan but has not yet been secured for the design or construction of this project.

NRCS provides reasonable accommodations to enable all persons with disabilities to participate in agency programs and activities. If you require special accommodations, please contact Harold Russell by December 10th. For further information on the meetings, contact Harold Russell, Civil Engineer, NRCS, at (304) 284-7567 or Harold.Russell@usda.gov.

###

USDA is an equal opportunity provider, employer and lender.

Blakes Creek – Armour Creek Dam No. 7
Scoping Meeting on Dam Rehabilitation

Date: December 17, 2020
Place: Virtual Meeting Using Microsoft Teams
Information at www.cityofnitro.org
(Meeting Information TBA 1 Week Prior)
Time: 10 a.m. for agencies and organizations
7 p.m. for general public
Sponsors: City of Nitro
Kanawha County Commissioners
Capital Conservation District
Western Conservation District

The Blakes Creek - Armour Creek Watershed Sponsors are working in cooperation with the USDA Natural Resources Conservation Service (NRCS) to develop a plan for rehabilitating Site 7 which is located in the City of Nitro, WV.

A virtual public meeting will be held to discuss the dam rehabilitation program, planning activities to date, the various alternatives to be evaluated, and the planning schedule. NRCS, County, City, and District officials, and their consultants will present detailed information and discuss your questions and concerns. Please plan to participate.

For more information contact Dave Casebolt, Mayor, City of Nitro, at (304) 755-0705 or dcasebolt@cityof nitro.org.



FULL NAME	USER ACTION	TIMESTAMP	
Petr Masopust	Joined	12/17/2020, 10:00:08	
+1 304-203-5918	Joined before	12/17/2020, 10:00:08	
+1 304-444-7907	Joined before	12/17/2020, 10:00:08	
Stutler, Julie - NRCS,	Joined before	12/17/2020, 10:00:08	
Cross lanes, WV	Joined before	12/17/2020, 10:00:08	
Deichert, Andy - NRCS,	Joined before	12/17/2020, 10:00:08	
Morgantown, WV	Joined before	12/17/2020, 10:00:08	
Dove, David W	Joined before	12/17/2020, 10:00:08	
Pritt, Lauren A CIV	Joined before	12/17/2020, 10:00:08	
USARMY CELRH (USA)	Joined before	12/17/2020, 10:00:08	
Devlin, Brooke - FPAC-	Joined before	12/17/2020, 10:00:08	
NRCS, Morgantown, WV	Joined before	12/17/2020, 10:00:08	
Mitchell, Patricia - NRCS,	Joined before	12/17/2020, 10:00:08	
Cross Lanes, WV	Joined before	12/17/2020, 10:00:08	
Tim Sweeney	Joined before	12/17/2020, 10:00:08	
Russell, Harold - FPAC-	Joined before	12/17/2020, 10:00:08	
NRCS, Morgantown, WV	Joined before	12/17/2020, 10:00:08	
DeCarli, Salvatore	Joined before	12/17/2020, 10:00:08	
Lyons, Judith	Joined before	12/17/2020, 10:00:08	
Ridley, Timothy - NRCS,	Joined before	12/17/2020, 10:00:08	
Morgantown, WV	Joined before	12/17/2020, 10:00:08	
Wade Biddix	Joined	12/17/2020, 10:00:15	
Dave Casebolt (Guest)	Left	12/17/2020, 10:01:36	
Tracy Toler (Guest)	Joined	12/17/2020, 10:05:40	
Dalton McComas (Guest)	Joined	12/17/2020, 10:00:15	
Kim Reed (Guest)	Joined	12/17/2020, 10:00:21	
Joe Stevens (Guest)	Joined	12/17/2020, 10:01:20	
John Luoni	Joined	12/17/2020, 10:01:57	
Rob Monahan	Joined	12/17/2020, 10:02:05	
Rob Monahan	Joined	12/17/2020, 10:02:11	
Rob Monahan	Joined	12/17/2020, 10:03:40	
+1 304-539-5211	Joined	12/17/2020, 10:05:21	
George Oamek			
Lutz, Robert			
McClure, Jeff - NRCS,			
Morgantown, WV			
Morrissey, Jessica			
Janigian, Greta			
+1 336-209-6869			
+1 304-549-8823			

City of Nitro

Sal DeCarli	EAEAST
Andy Deichert	NRCS
Patricia Mitchell	NRCS
Jeff Jenkins	Landowner
George Oamek	Headwaters Corporation
Kim Reed	City of Nitro
Harold Russell	NRCS
Erin O'Leary	NRCS
Wade Biddix	Aterra -Schnabel JV
Finley Lloyd	Aterra -Schnabel JV
Petr Masopust	Aterra -Schnabel JV
Tim Sweeney	Aterra -Schnabel JV

8/12/24 Blakes Creek - Armour Creek Watershed Site 7
Public meeting Reviewing Draft Plan-EA

Bill Savins	City Council	304-539-5211
Kathryn Gates	citizen of Nitro	681-781-7310
Cyndi McGill	City of Nitro	City Council
Rich Hively	City Recorder	304-755-7876
Harold Russell	NRCS	304-203-5918
Sigrid Icots	WVCA	304-993-6224
Tina Smith	NRCS	304-322-5401
Dave Casebolt	City of Nitro	304-49-3322
Andy Deichert	NRCS	304-284-7563
Kim Reed	City of Nitro	304-881-9592
Neil Huffman	I-64 E 132	304-638-2234
Robert Merritt	I-64 E 132	304-533-4895
Ron King	Citizen of Nitro	304-755-5490
Tim Sweeney	Aterra Solutions - Schnabel Engineering Joint Venture	

Appendix A - Blakes Creek–Armour Creek No. 7 Agency and Tribal Correspondence

Initiation of consultation letters were sent to the following agencies and tribal organizations:

- USFWS: 7/15/22
- WVSHPO: 7/15/22
- USACE: 7/15/22
- Catawba Indian Nation: 6/15/22 – Accepted invitation for consultation.
- Cayuga Nation: 6/15/22
- Chickahominy Indian Tribe: 6/15/22
- Delaware Nation: 6/15/22
- Eastern Chickahominy: 6/15/22
- Eastern Shawnee Tribe of Oklahoma: 6/15/22 – Accepted invitation for consultation.
- Eastern Band of Cherokee Indians: 6/15/22
- Monacan Nation: 6/15/22
- Pamunkey Indian Tribe: 6/15/22
- Rappahannock Tribe: 6/15/22
- Saint Regis Mohawk Tribe: 6/15/22
- Seneca-Cayuga Nation: 6/15/22
- Tonawanda Band of Seneca: 6/15/22
- Tuscarora Nation of New York: 6/15/22
- United Keetowah Band of Cherokee Indians: 6/15/22
- Upper Mattaponi Indian Tribe: 6/15/22

Example letters for Agencies and Tribes are provided below.

USDA
United States Department of Agriculture
Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505
Phone: (304) 284-7540
Fax: (855) 857-6448

June 10, 2022

Dr. Wenonah G. Haire
Tribal Historic Preservation Officer
Catawba Indian Nation
1536 Tom Steven Road
Rock Hill, SC 29730

RE: Initiation of Consultation on the Proposed Improvements to the Blakes Creek-Armour Creek Watershed, Dam Site No. 7 Supplemental Watershed Plan / Environmental Assessment, Nitro, Kanawha County, West Virginia

Dear Dr. Wenonah G. Haire,

The United States Department of Agriculture, Natural Resources Conservation Service, West Virginia State Office (NRCS), hereby solicits concerns and/or comments regarding the proposed rehabilitation of Dam Site No. 7 in the Blakes Creek-Armour Creek Watershed (Proposed Action), located in Kanawha County, Town of Nitro, West Virginia (Figure 1). The local Sponsors of the project are the City of Nitro, the County Court of Kanawha County, the Capitol Conservation District, and the Western Conservation District.

This action is being funded by the NRCS through the Watershed Rehabilitation Program, which is authorized by Public Law 83-566 Section 14, the Watershed Protection and Flood Prevention Act. Per the National Environmental Policy Act (NEPA) of 1969, a Supplemental Watershed Plan / Environmental Assessment is being planned to evaluate environmental, cultural, economic, and public interest concerns associated with this proposed project. NRCS has determined that the proposed project is an undertaking, as defined in 36 CFR 800,16(y), that has the potential to affect historic properties and we are initiating consultation under Section 106 of the National Historic Preservation Act (NHPA) with your tribe, the Catawba Indian Nation.

The Supplemental Watershed Plan / Environmental Assessment will evaluate the four alternatives being considered: No Action Alternative – Future Without Federal Assistance; Alternative 1 – Construct a 140-ft Wide Roller Compacted Concrete Chute Auxiliary Spillway. The ASW will be realigned to keep it further away from the existing hillside and will prevent high flows from undermining and breaching the spillway crest due to headcut erosion; Alternative 2 – Construct a 120-ft Wide Articulated Concrete Block Auxiliary Spillway with Secant Pile Cutoff Wall. The ASW will remain in the existing location; and Alternative 3 – Construct a 140-ft Wide Roller Compacted Concrete Chute Auxiliary Spillway over the existing embankment left of the principal spillway. The existing ASW will be filled in with an earthen berm. Alternative 1 is the Preferred Alternative by the Sponsors.

The project is proposed because Dam Site No. 7 is out of compliance with NRCS and West Virginia performance and safety criteria. This project proposes rehabilitation improvements to the dam to bring it into compliance and meet current NRCS and State safety and performance

standards. Figures 2 and 3 depict the approximate location and the Limit of Disturbance (LOD) for Alternative 1, the Preferred Alternative. The attached engineering plan sheets depict activities associated with the Preferred Alternative. The LOD for this project is also considered the Area of Potential Effect (APE) for all SHPO Consultations.

PROPOSED ACTION

The Proposed Action includes the rehabilitation of Dam Site No. 7. The dam is located on Blakes Creek, in the City of Nitro, Kanawha County, West Virginia. The dam itself and the surrounding land is owned and maintained by the City of Nitro and is located in a public park, Ridenour Lake Park (Figure 2). The dam was originally designed and constructed by NRCS in 1970 with a dam safety high hazard classification and the single purpose of flood control. The dam provides limited attenuation of floods and limited protection of downstream structures. In addition, critical structures or facilities are located within the 500-year floodplain downstream from the dam.

The Locally Preferred Alternative involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (RCC-ASW). A stilling basin and rock riprap at the outlet of the RCC-ASW will stabilize flows down to Blakes Creek. The RCC-ASW will be re-aligned to keep it further away from the existing hillside and will prevent high flows from undermining and breaching the auxiliary spillway crest due to headcut erosion. The auxiliary spillway will have robust concrete sidewalls to reduce the potential of a landslide blocking the auxiliary spillway. A new principal spillway riser will be constructed after removing the existing riser and extending the 30-inch diameter reinforced concrete principal spillway conduit. The upstream dam slope will be flattened and covered with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the auxiliary spillway. Rehabilitation activities involve ground disturbance by construction equipment such as excavators, bulldozers, graders, and dump trucks. Disturbances around the dams will occur in the area of the toe of the dam, the auxiliary spillway, principal spillway, impact basin, and staging areas. Most of the work is expected to occur in areas that were previously disturbed during the original construction of the dam. The site can be accessed from Blake Road and 21st Street to the east of the dam. There are two proposed staging and stockpiling areas, one in the park's eastern parking lot and the other in the western parking lot (see Figures 2 and 3). It is estimated that a maximum of 8 acres of trees in the LOD will need to be cleared, located primarily north and west of the auxiliary spillway and Ridenour Lake. Tree clearing within the LOD will be necessary but will only include the clearing of trees necessary to facilitate construction, site access, and staging, and any trees within 15 feet of the dam abutment. Disturbed areas would be regraded and vegetated with an appropriate native seed mix and trees will be replanted to help reestablish the site after construction, where allowable based on the dam's Operation and Maintenance Plan. Best management practices such as erosion control devices, the placement of mats, or similar care through sensitive resources, low impact construction techniques, restoration, and the prevention of the establishment of invasive species will be administered pre- and post-construction.

NRCS is seeking your input on any resources of cultural and/or religious significance in or around the area of potential effect for the proposed dam rehabilitation project. Additionally, NRCS is seeking your input regarding the cultural resources survey, which can be conducted during the planning phase or when more-detailed designs have been completed for the dam.

Please advise regarding your recommendations for the Phase I cultural resources investigations for the dam or any additional resources of concern which should be considered during the planning process.

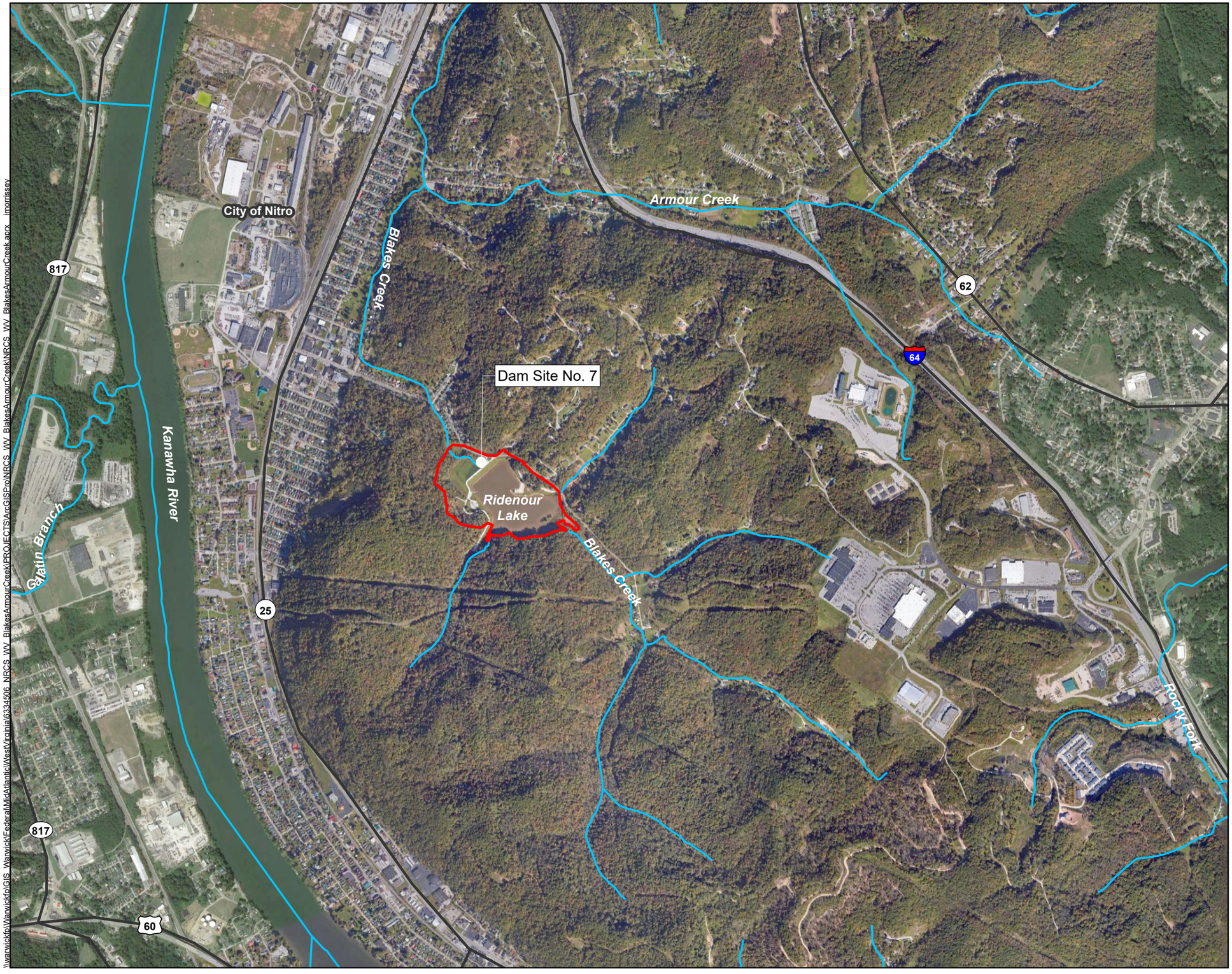
Please forward your recommendations, concerns, and comments to Jon Bourdon, NRCS State Conservationist in West Virginia, so that they can be included in the Draft Supplemental Watershed Plan and Environmental Assessment. Once the Draft Plan-EA is finished, it will be circulated for further consultation and an interagency and public comment period.

If you have any questions or need additional information, contact Tyler Stumpf at tyler.stumpf@usda.gov or 859-224.7312.

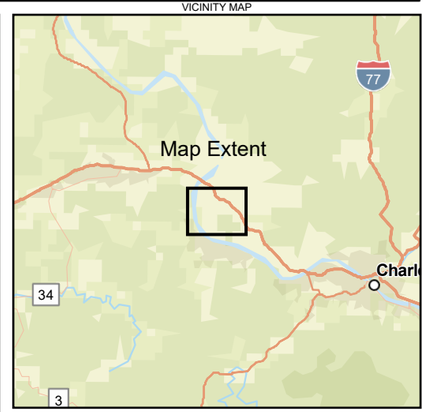
Sincerely,

Jon Bourdon
State Conservationist
USDA – NRCS
West Virginia State Office
1500 Earl L. Core Road
Suite 200
Morgantown, WV 26505
(304) 284-7540
jon.bourdon@usda.gov

Attachments: Figures on the Blakes Creek-Armour Creek Dam Site No. 7 Rehabilitation Project



VICINITY MAP



Legend

- National Hydrology Dataset Streams
- Major Road
- Limit of Disturbance/Area of Potential Effect

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; Google Earth 2015; USGS 2019a, FEMA 2020; USDOT 1997
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

0 0.25 0.5 Miles

March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 1
Site Overview Aerial

\\warwickfs\Warwickfs\GIS_Warwick\Federal\MidAtlantic\WestVirginia\6334506_NRCS_WV_BlakesArmourCreek\PROJECTS\ArcGISProNRCS_WV_BlakesArmourCreek\NRCS_WV_BlakesArmourCreek.aprx imorrissey



VICINITY MAP



Legend

- National Hydrology Dataset Streams
- Limit of Disturbance/Area of Potential Effect
- Staging Area
- Temporary Stream Crossing

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; Google Earth 2015; USGS 2019a
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

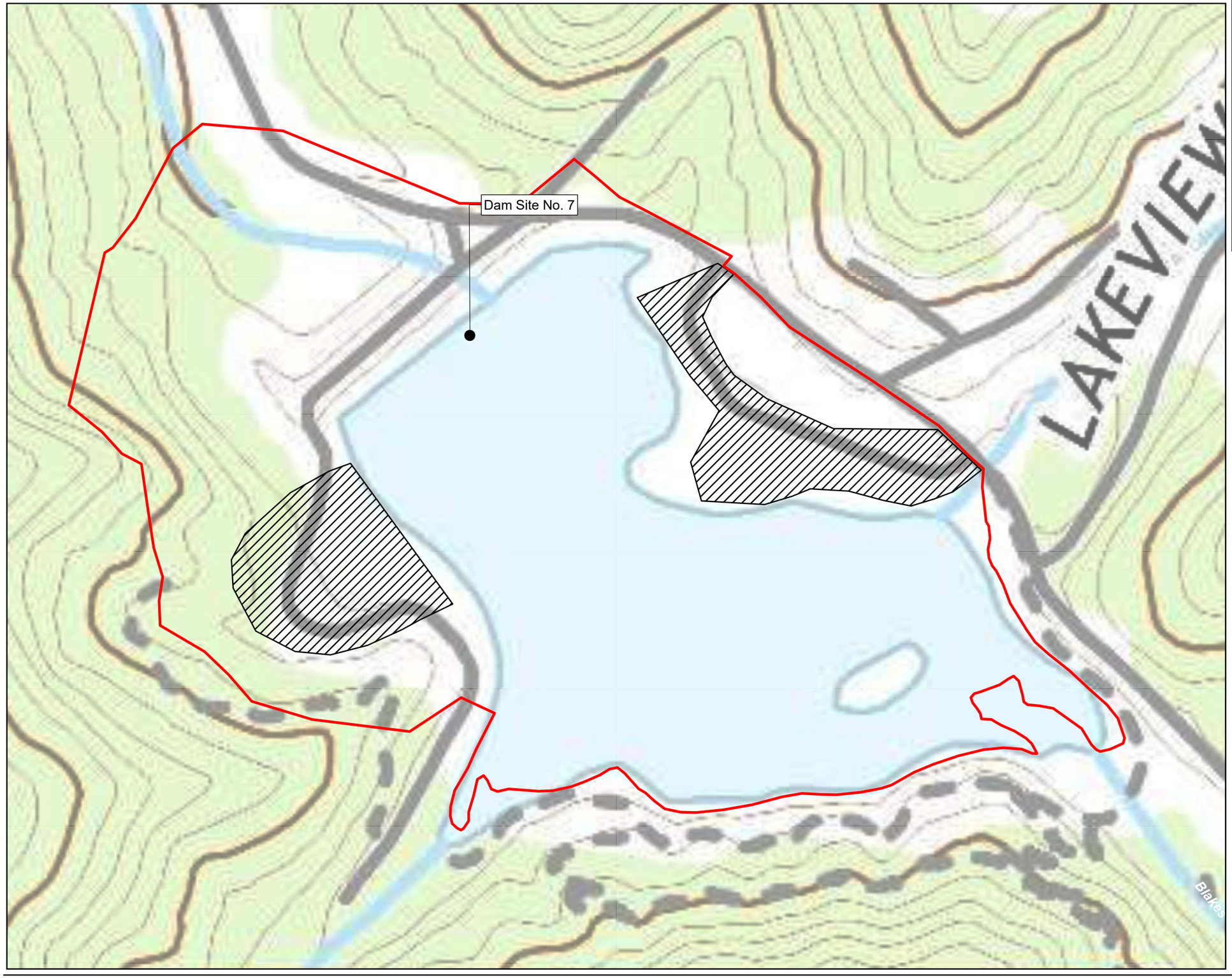
0 200 400 Feet

March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 2
Limit of Disturbance Aerial

\\warwickfp\Warwickfp\GIS_Warwick\FederalMidAtlanticWestVirginia\63345\06_NRCS_WV_BlakesArmourCreek\PROJECTS\ArcGIS\Pro\NRCS_WV_BlakesArmourCreek\NRCS_WV_BlakesArmourCreek.aprx imorrissey



VICINITY MAP



Legend

Limit of Disturbance/Area of Potential Effect

Staging Area

Contours

6000 Index

Intermediate

Rivers, Lakes, and Canals

Perennial River

Perennial Lake/Pond

Road Classification

Local Road

Trail

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; USGS 2019a; USGS 2019b
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

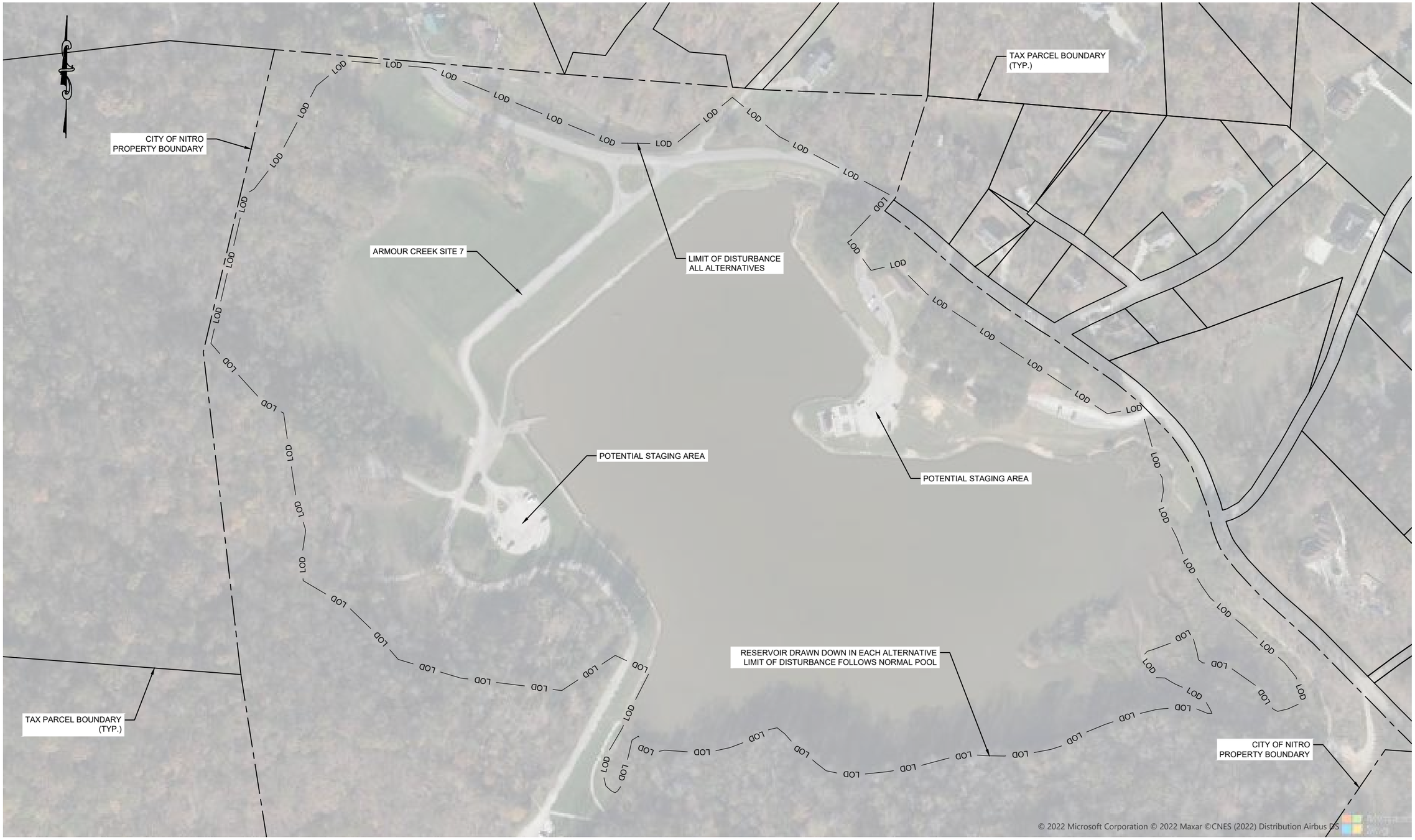
0 200 400 Feet

N

March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 3
Limit of Disturbance Topography



TOTAL LIMIT OF DISTURBANCE

1
G-1

SCALE: 1"=200'

0 200' 400'

NOTES:

1. PARCEL DATA OBTAINED FROM WV COUNTY ASSESSOR TAX PARCEL BOUNDARY DATA FOR 2021.
2. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

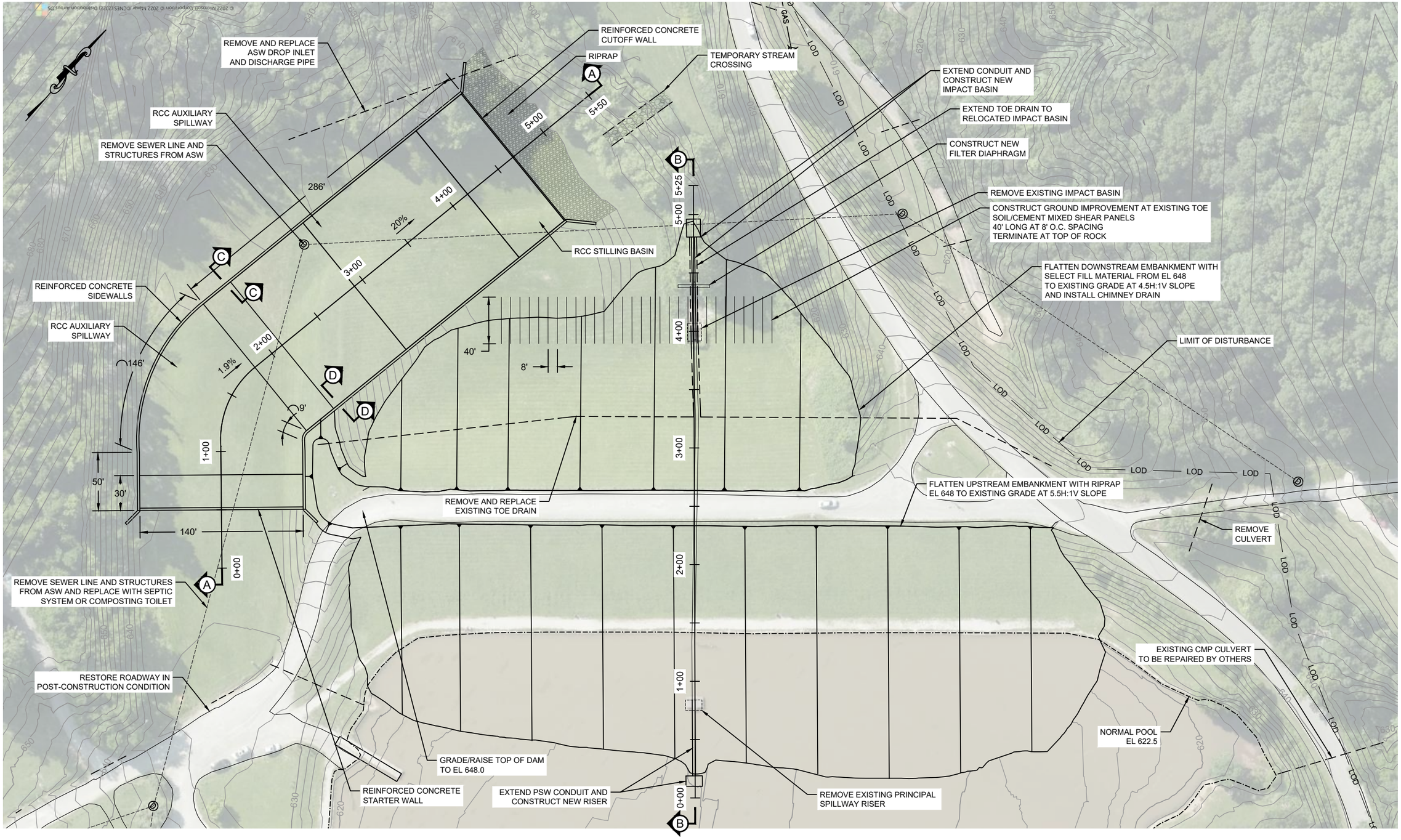
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Approved	PM

Rev.	Description	Date
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BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
TOTAL LIMIT OF DISTURBANCE
FOR ALL ALTERNATIVES

United States Department of Agriculture
USDA Natural Resources Conservation Service
Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

G-1



ALTERNATIVE 1 AERIAL IMAGE

1
C-1

SCALE: 1"=80'

0 80' 160'

NOTES:

1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.
3. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

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Approved	PM

Rev.	Description	Date
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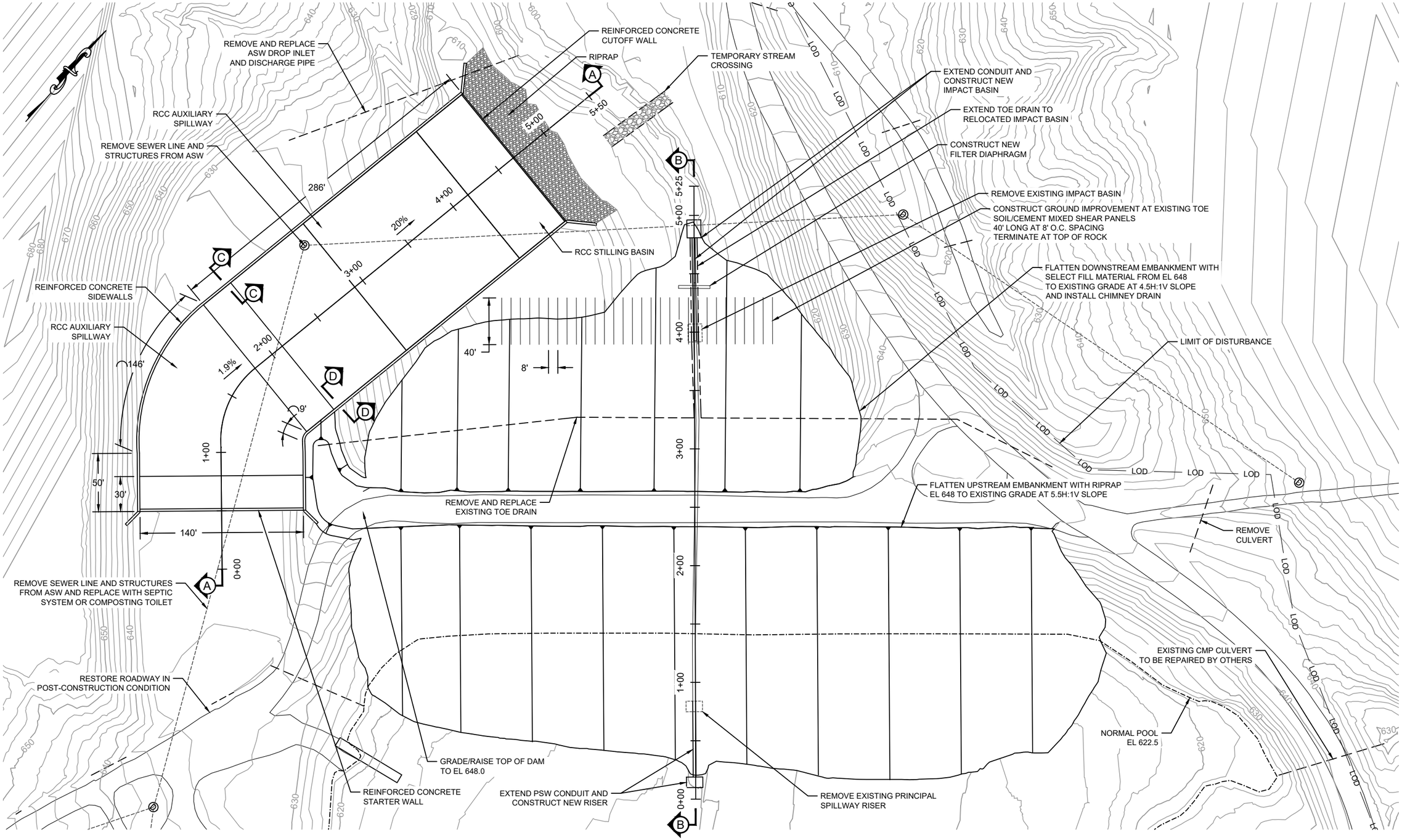
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - AERIAL IMAGE

United States Department of Agriculture
Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-1



ALTERNATIVE 1 PLAN

1 / C-2

SCALE: 1"=80'

0 80' 160'

NOTES:

1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.

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Approved	PM

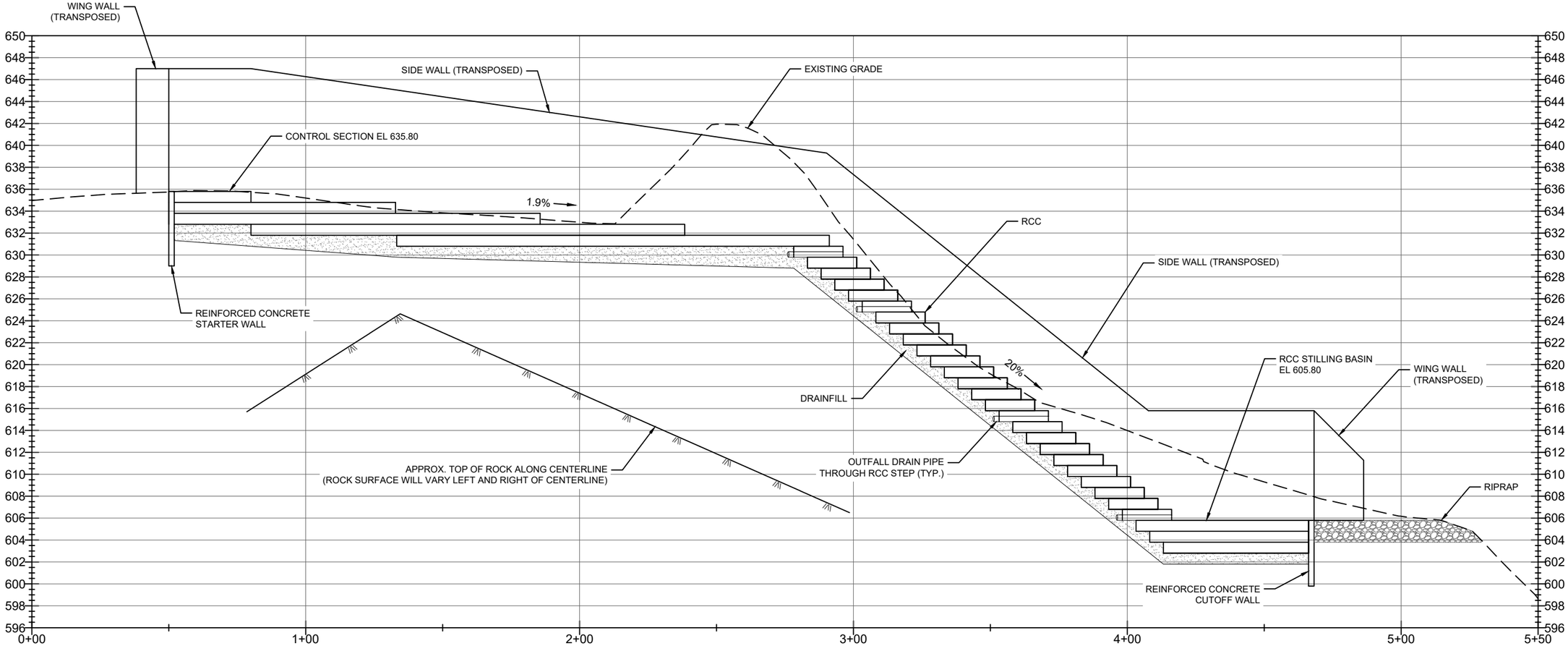
Rev.	Description	Date
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BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - PLAN

United States Department of Agriculture
Natural Resources Conservation Service
USDA
Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-2



ALTERNATIVE 1 PROFILE A-A

1
C-3

SCALE: 1"=40'
VERTICAL SCALE: 1"=10'

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Approved	PM		
Rev.	Description	Date	
0			

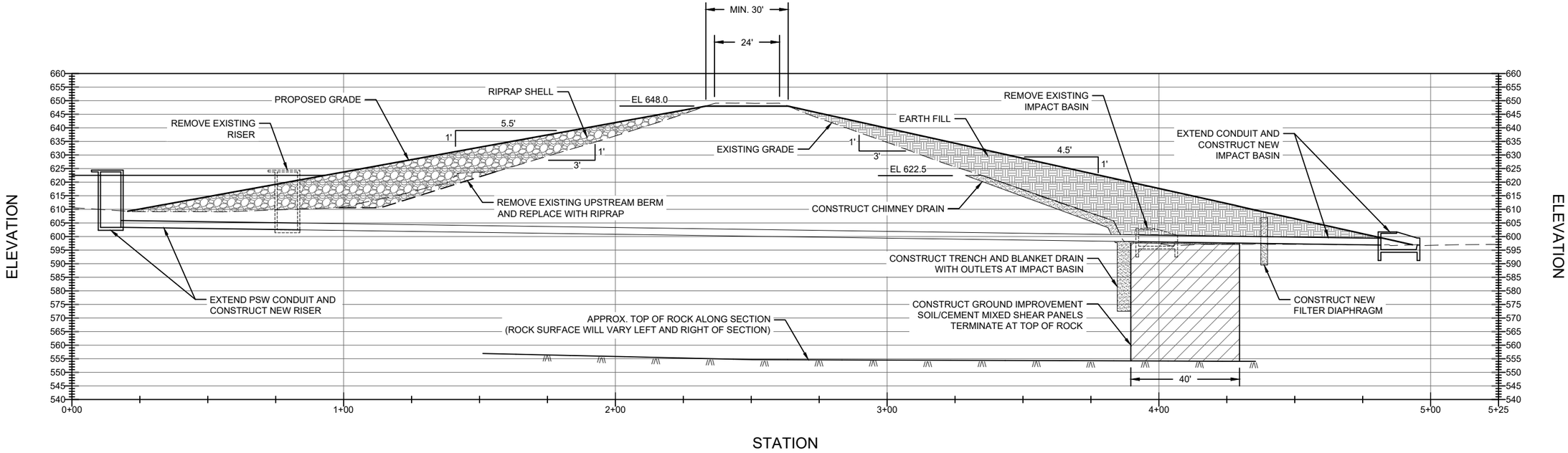
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - ASW PROFILE

United States Department of Agriculture
Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

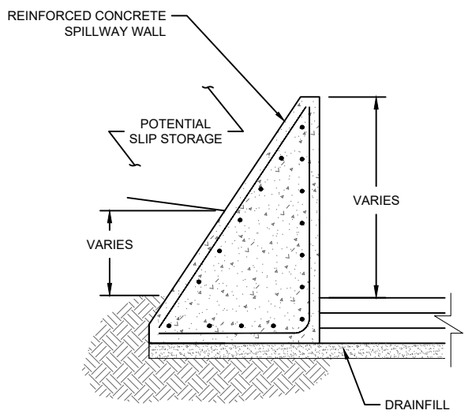
C-3



PROFILE B-B

SCALE: 1" = 40'

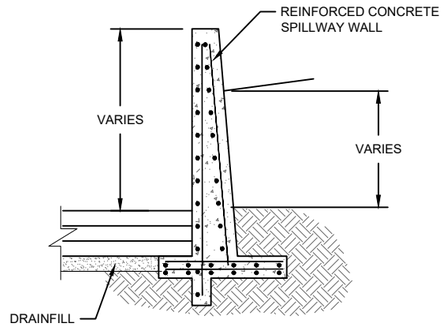
1 / C-4



SECTION C-C

SCALE: NTS

2 / C-4



SECTION D-D

SCALE: NTS

3 / C-4

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Checked	CG	
Approved	PM	
0		Date
Rev.		Description

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - PSW PROFILE AND SECTIONS

United States Department of Agriculture
USDA Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions

300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-4

Catawba Indian Nation
Tribal Historic Preservation Office
1536 Tom Steven Road
Rock Hill, South Carolina 29730

Office 803-328-2427

October 14, 2022

Attention: Jon Bourdon
USDA – NRCS
1500 Earl L. Core Road, Suite 200
Morgantown, WV 26505

Re. THPO #	TCNS #	Project Description
		Proposed Improvements to the Blakes Creek- Armour Creek Watershed, Dam Site No. 7
2022-68-125		Supplemental Watershed Plan/Environmental Assessment, Nitro, Kanawha Co., WV

Dear Mr. Bourdon,

The Catawba have no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas. **However, the Catawba are to be notified if Native American artifacts and / or human remains are located during the ground disturbance phase of this project.**

If you have questions please contact Caitlin Rogers at 803-328-2427 ext. 226, or e-mail Caitlin.Rogers@catawba.com.

Sincerely,

Caitlin Rogers for

Wenonah G. Haire
Tribal Historic Preservation Officer

From: Section106 <section106@shawnee-tribe.com>
Sent: Monday, June 20, 2022 12:29 PM
To: Stumpf, Tyler - FPAC-NRCS, Lexington, KY <Tyler.Stumpf@usda.gov>
Subject: RE: WV-NRCS Blakes Armor Watershed Consultation Initiation

This letter is in response to the above referenced project.

The Shawnee Tribe's Tribal Historic Preservation Department concurs that no known historic properties will be negatively impacted by this project. However, there is still potential for the discovery of unknown resources. We would like to accept your invitation for consultation.

We have no issues or concerns at this time, but in the event that archaeological materials are encountered during construction, use, or maintenance of this location, please re-notify us at that time as we would like to resume immediate consultation under such a circumstance.

If you have any questions, you may contact me via email at Section106@shawnee-tribe.com

Thank you for giving us the opportunity to comment on this project.

Sincerely,

Erin Paden
TRIBAL HISTORIC PRESERVATION SPECIALIST
Office: (918) 542-2441, x140
Email: epaden@shawnee-tribe.com
29 S Hwy 69A
Miami, OK 74354
shawnee-tribe.com

From: Stumpf, Tyler - FPAC-NRCS, Lexington, KY <Tyler.Stumpf@usda.gov>
Sent: Thursday, June 16, 2022 10:56 AM
To: Tonya Tipton <tonya@shawnee-tribe.com>
Subject: WV-NRCS Blakes Armor Watershed Consultation Initiation

CAUTION: External email. Do not click links or open attachments unless you are confident the content is safe.

Good afternoon Tonya,

I am reaching out to initiate consultation on the Blakes Armor-Blakes Creek Dam Rehabilitation project in Kanawha County, Town of Nitro, WV. Please see the attached official initiation letter and early planning details. The project is in the early planning phases and we seek to initiate consultation before we begin drafting our environmental assessment. We look forward to working with you on this project. If you have any questions, concerns, or need additional information, please let me know.

Thank you,

Tyler Stumpf
Archaeologist / Cultural Resource Specialist
USDA Natural Resources Conservation Service
Kentucky State Office
771 Corporate Drive
Suite 300
Lexington, KY 40503
Office: 859.224.7312
Cell: 270.339.2401
Tyler.Stumpf@usda.gov

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United States Department of Agriculture
Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505
Phone: (304) 284-7540
Fax: (855) 857-6448

May 25, 2021

Susan Pierce
Deputy State Historic Preservation Officer
West Virginia Department of Arts, Culture and History
Capitol Complex
1900 Kanawha Boulevard East
Charleston, WV 25305-0300

RE: Initiation of Consultation on the Proposed Improvements to the Blakes Creek-Armour Creek Watershed, Dam Site No. 7 Supplemental Watershed Plan / Environmental Assessment, Nitro, Kanawha County, West Virginia

Dear Susan Pierce,

The United States Department of Agriculture, Natural Resources Conservation Service, West Virginia State Office (NRCS), hereby solicits concerns and/or comments regarding the proposed rehabilitation of Dam Site No. 7 in the Blakes Creek-Armour Creek Watershed (Proposed Action), located in Kanawha County, Town of Nitro, West Virginia (Figure 1). The local Sponsors of the project are the City of Nitro, the County Court of Kanawha County, the Capitol Conservation District, and the Western Conservation District.

This action is being funded by the NRCS through the Watershed Rehabilitation Program, which is authorized by Public Law 83-566 Section 14, the Watershed Protection and Flood Prevention Act. Per the National Environmental Policy Act (NEPA) of 1969, a Supplemental Watershed Plan / Environmental Assessment is being prepared to evaluate environmental, cultural, economic, and public interest concerns associated with this proposed project.

The Supplemental Watershed Plan / Environmental Assessment will evaluate the four alternatives being considered: No Action Alternative – Future Without Federal Assistance; Alternative 1 – Construct a 140-ft Wide Roller Compacted Concrete Chute Auxiliary Spillway. The ASW will be realigned to keep it further away from the existing hillside and will prevent high flows from undermining and breaching the spillway crest due to headcut erosion; Alternative 2 – Construct a 120-ft Wide Articulated Concrete Block Auxiliary Spillway with Secant Pile Cutoff Wall. The ASW will remain in the existing location; and Alternative 3 – Construct a 140-ft Wide Roller Compacted Concrete Chute Auxiliary Spillway over the existing embankment left of the principal spillway. The existing ASW will be filled in with an earthen berm. Alternative 1 is the Preferred Alternative by the Sponsors.

The project is proposed because Dam Site No. 7 is out of compliance with NRCS and West Virginia performance and safety criteria. This project proposes rehabilitation improvements to the dam to bring it into compliance and meet current NRCS and State safety and performance

standards. Figures 2 and 3 depict the approximate location and the Limit of Disturbance (LOD) for Alternative 1, the Preferred Alternative. The attached engineering plan sheets depict activities associated with the Preferred Alternative. The LOD for this project is also considered the Area of Potential Effect (APE) for all SHPO Consultations.

PROPOSED ACTION

The Proposed Action includes the rehabilitation of Dam Site No. 7. The dam is located on Blakes Creek, in the City of Nitro, Kanawha County, West Virginia. The dam itself and the surrounding land is owned and maintained by the City of Nitro and is located in a public park, Ridenour Lake Park (Figure 2). The dam was originally designed and constructed by NRCS in 1970 with a dam safety high hazard classification and the single purpose of flood control. The dam provides limited attenuation of floods and limited protection of downstream structures. In addition, critical structures or facilities are located within the 500-year floodplain downstream from the dam.

The Locally Preferred Alternative involves re-grading and leveling the dam crest to EL 648 ft and constructing a 140-ft wide roller compacted concrete chute auxiliary spillway (RCC-ASW). A stilling basin and rock riprap at the outlet of the RCC-ASW will stabilize flows down to Blakes Creek. The RCC-ASW will be re-aligned to keep it further away from the existing hillside and will prevent high flows from undermining and breaching the auxiliary spillway crest due to headcut erosion. The auxiliary spillway will have robust concrete sidewalls to reduce the potential of a landslide blocking the auxiliary spillway. A new principal spillway riser will be constructed after removing the existing riser and extending the 30-inch diameter reinforced concrete principal spillway conduit. The upstream dam slope will be flattened and covered with rock riprap to enhance slope stability. The downstream slope will be flattened with earth fill to enhance slope stability and soil-cement mixed shear panels will be installed at the downstream embankment toe to enhance ground stability. Additional improvements include a new filter diaphragm, a new impact basin, a new toe drain, and removal of the sanitary sewer line from the auxiliary spillway. Rehabilitation activities involve ground disturbance by construction equipment such as excavators, bulldozers, graders, and dump trucks. Disturbances around the dams will occur in the area of the toe of the dam, the auxiliary spillway, principal spillway, impact basin, and staging areas. Most of the work is expected to occur in areas that were previously disturbed during the original construction of the dam. The site can be accessed from Blake Road and 21st Street to the east of the dam. There are two proposed staging and stockpiling areas, one in the park's eastern parking lot and the other in the western parking lot (see Figures 2 and 3). It is estimated that a maximum of 8 acres of trees in the LOD will need to be cleared, located primarily north and west of the auxiliary spillway and Ridenour Lake. Tree clearing within the LOD will be necessary but will only include the clearing of trees necessary to facilitate construction, site access, and staging, and any trees within 15 feet of the dam abutment. Disturbed areas would be regraded and vegetated with an appropriate native seed mix and trees will be replanted to help reestablish the site after construction, where allowable based on the dam's Operation and Maintenance Plan. Best management practices such as erosion control devices, the placement of mats, or similar care through sensitive resources, low impact construction techniques, restoration, and the prevention of the establishment of invasive species will be administered pre- and post-construction.

NRCS is seeking your input on the best approach regarding the Phase I cultural resources investigations of the area of potential effect for the proposed dam rehabilitation project. The cultural resources survey can be conducted during the planning phase or when more-detailed

designs have been completed for the dam. Please advise regarding your recommendations for the Phase I cultural resources investigations for the dam.

The dam is a floodwater retarding structure that is typical of many earthfill dams in West Virginia and the United States. However, since it was constructed in 1970 and exceeds 50 years old, NRCS is seeking your input and/or decision regarding the historical significance of the dam.

Information and data collected from this solicitation will be included in the Supplemental Watershed Plan and Environmental Assessment which will be finalized in 2022.

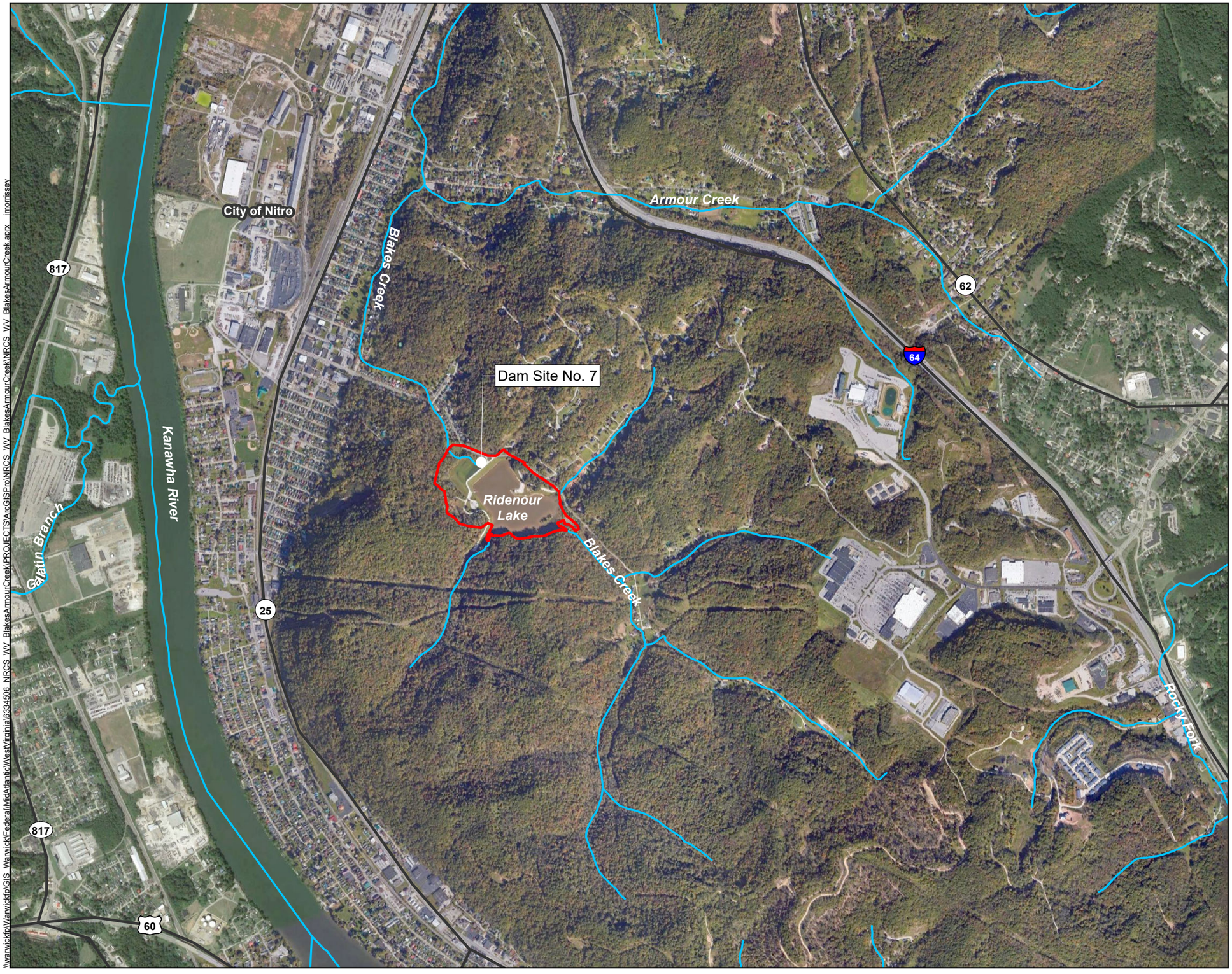
Please forward your recommendations, concerns, and comments to Jon Bourdon, NRCS State Conservationist in West Virginia, so that they can be included in the Draft Supplemental Watershed Plan and Environmental Assessment. Once the Draft Plan-EA is finished, it will be circulated for an interagency and public comment period.

If you have any questions or need additional information, contact Tyler Stumpf at tyler.stumpf@usda.gov or 859-224.7312.

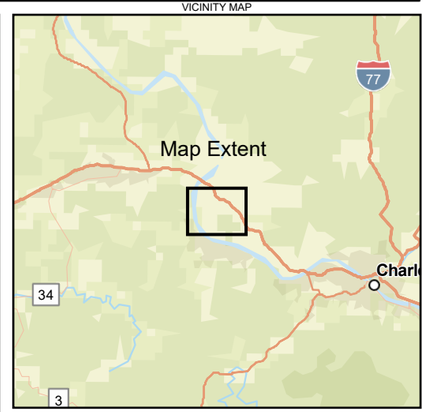
Sincerely,

Jon Bourdon
State Conservationist
USDA – NRCS
West Virginia State Office
1500 Earl L. Core Road
Suite 200
Morgantown, WV 26505
(304) 284-7540
jon.bourdon@usda.gov

Attachments: Figures on the Blakes Creek-Armour Creek Dam Site No. 7 Rehabilitation Project



VICINITY MAP



Legend

- National Hydrology Dataset Streams
- Major Road
- Limit of Disturbance/Area of Potential Effect

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; Google Earth 2015; USGS 2019a, FEMA 2020; USDOT 1997
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

0 0.25 0.5 Miles

March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 1
Site Overview Aerial

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VICINITY MAP



Legend

- National Hydrology Dataset Streams
- Limit of Disturbance/Area of Potential Effect
- Staging Area
- Temporary Stream Crossing

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; Google Earth 2015; USGS 2019a
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

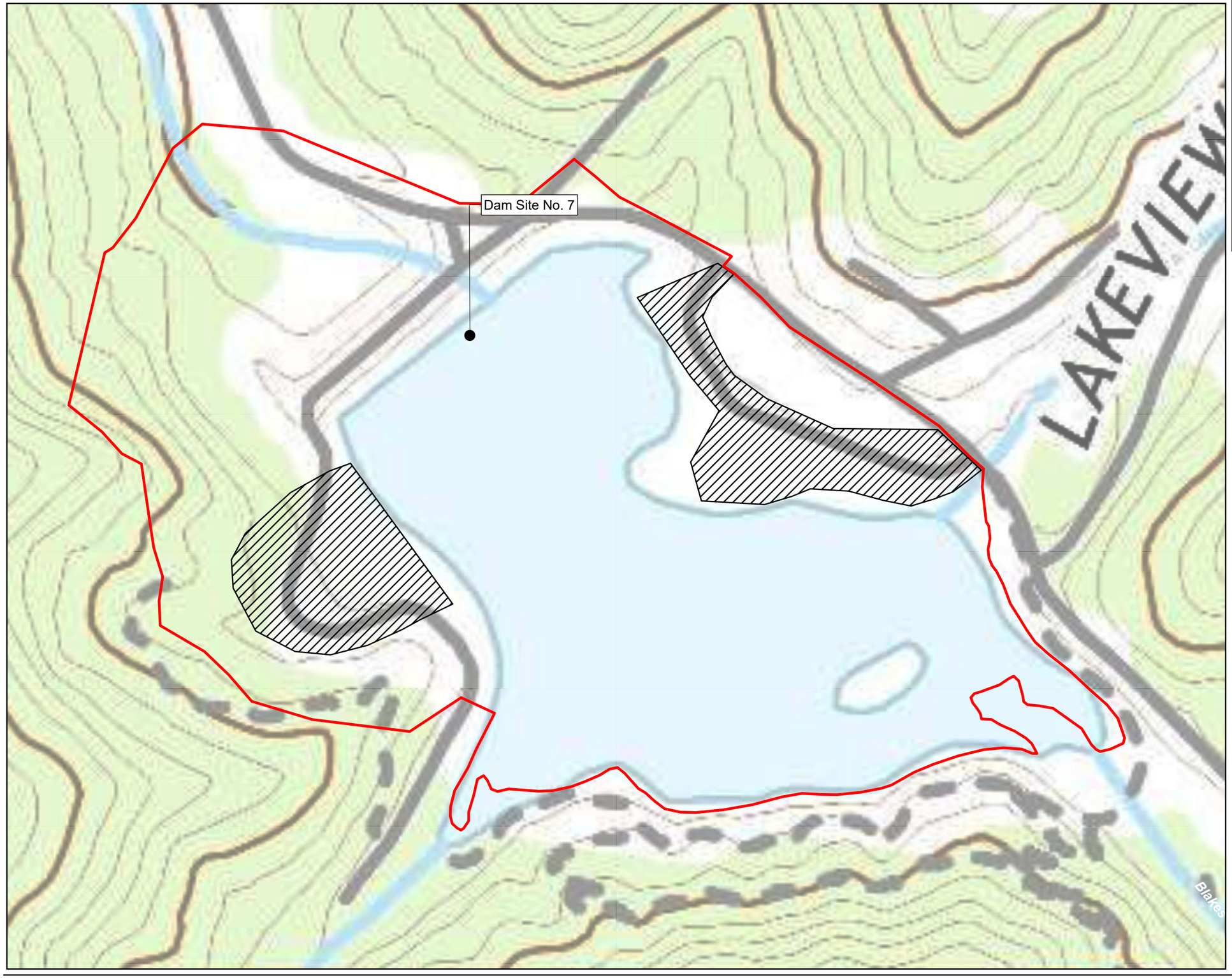
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March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 2
Limit of Disturbance Aerial

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VICINITY MAP



Legend

Limit of Disturbance/Area of Potential Effect

Staging Area

Contours

6000 Index

Intermediate

Rivers, Lakes, and Canals

Perennial River

Perennial Lake/Pond

Road Classification

Local Road

Trail

Map Date: 3/23/2022
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; USGS 2019a; USGS 2019b
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

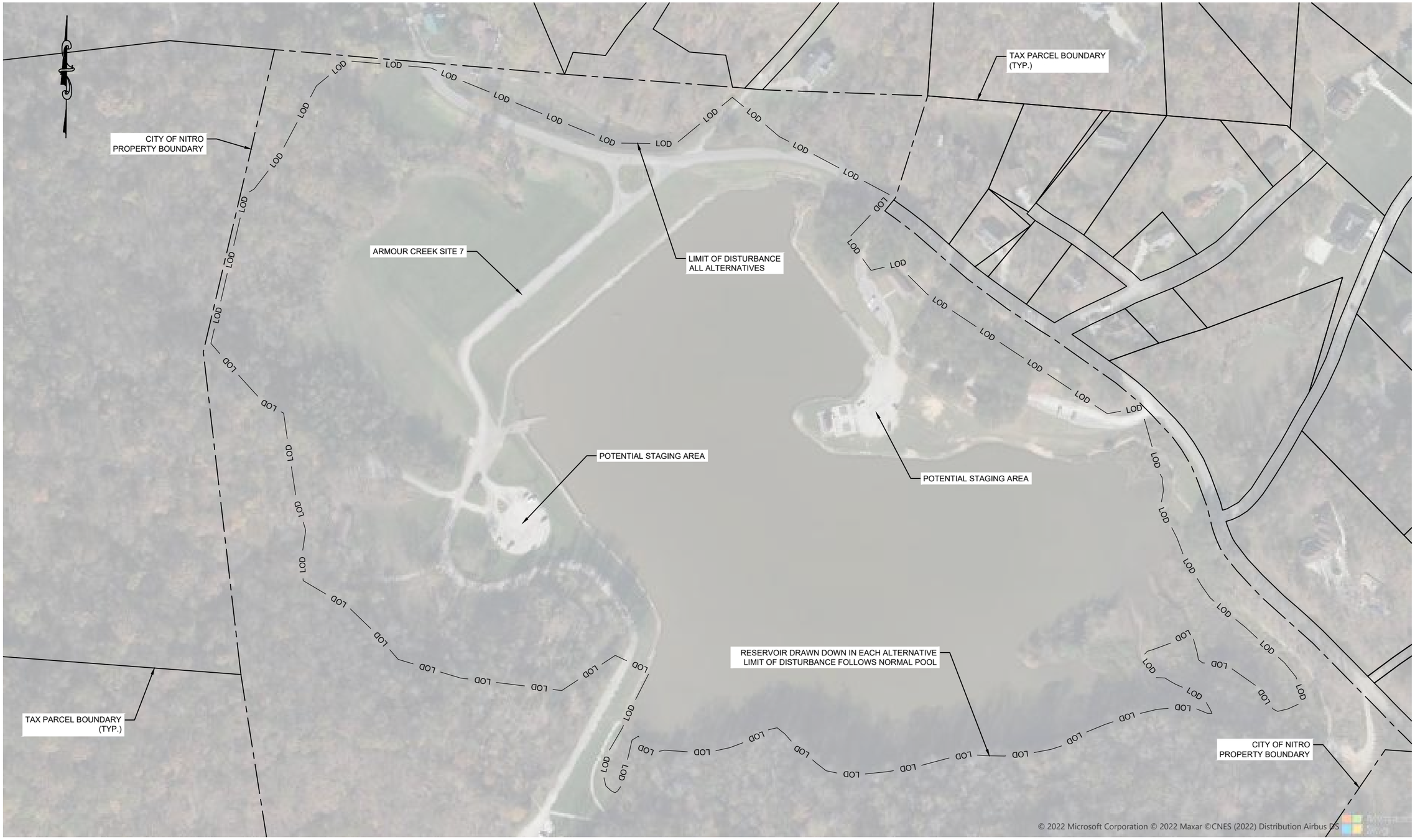
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N

March 2022

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 3
Limit of Disturbance Topography



TOTAL LIMIT OF DISTURBANCE

1
G-1

SCALE: 1"=200'

0 200' 400'

NOTES:

1. PARCEL DATA OBTAINED FROM WV COUNTY ASSESSOR TAX PARCEL BOUNDARY DATA FOR 2021.
2. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

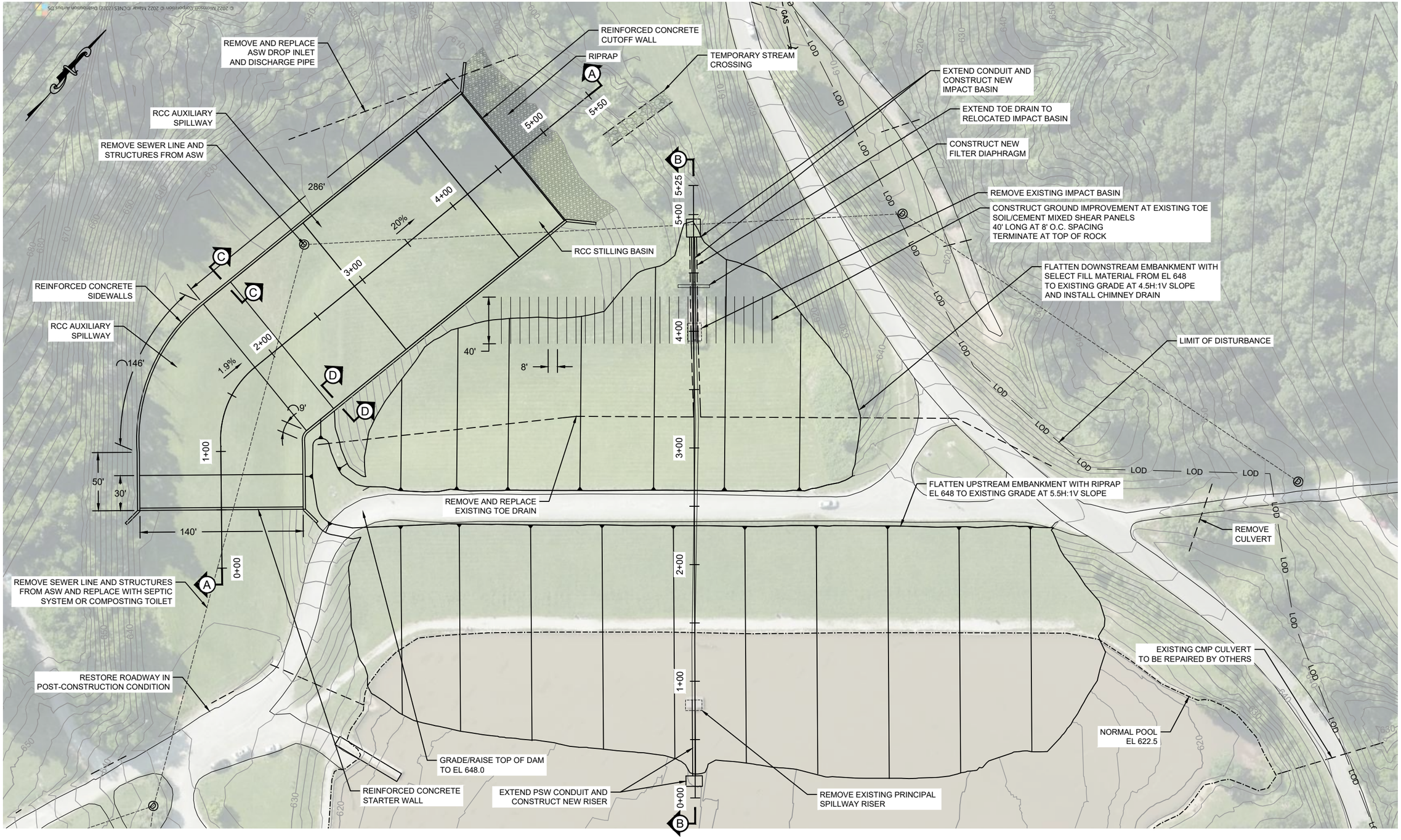
Designed	PM
Drawn	TS
Checked	CG
Approved	PM

Rev.	Description	Date
0		

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
TOTAL LIMIT OF DISTURBANCE
FOR ALL ALTERNATIVES

United States Department of Agriculture
USDA Natural Resources Conservation Service
Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

G-1



ALTERNATIVE 1 AERIAL IMAGE

1
C-1

SCALE: 1"=80'

0 80' 160'

NOTES:

1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.
3. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

Designed	PM
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Checked	CG
Approved	PM

Rev.	Description	Date
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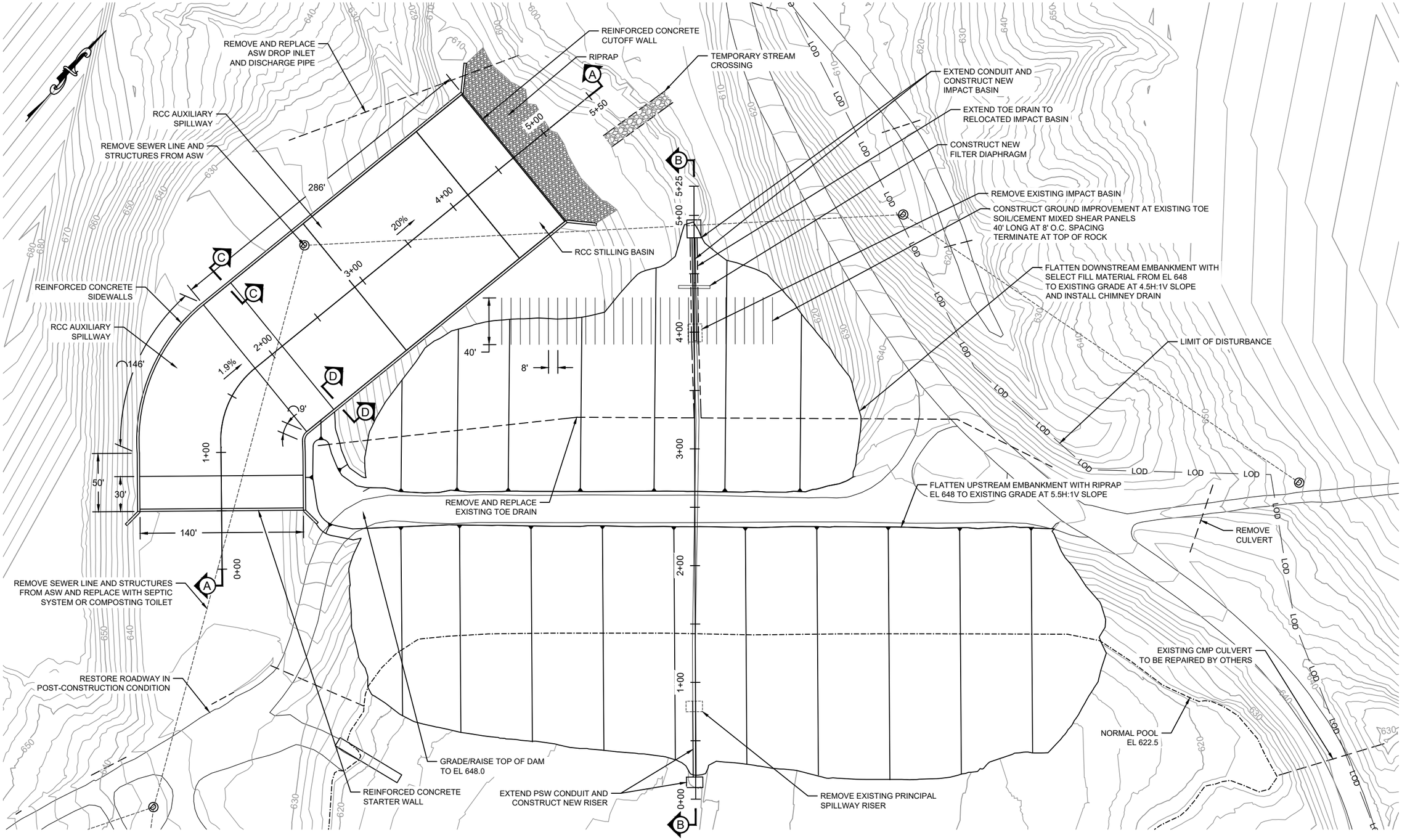
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - AERIAL IMAGE

United States Department of Agriculture
Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-1



ALTERNATIVE 1 PLAN

1 / C-2

SCALE: 1"=80'

0 80' 160'

NOTES:

1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.

Designed	PM
Drawn	TS
Checked	CG
Approved	PM

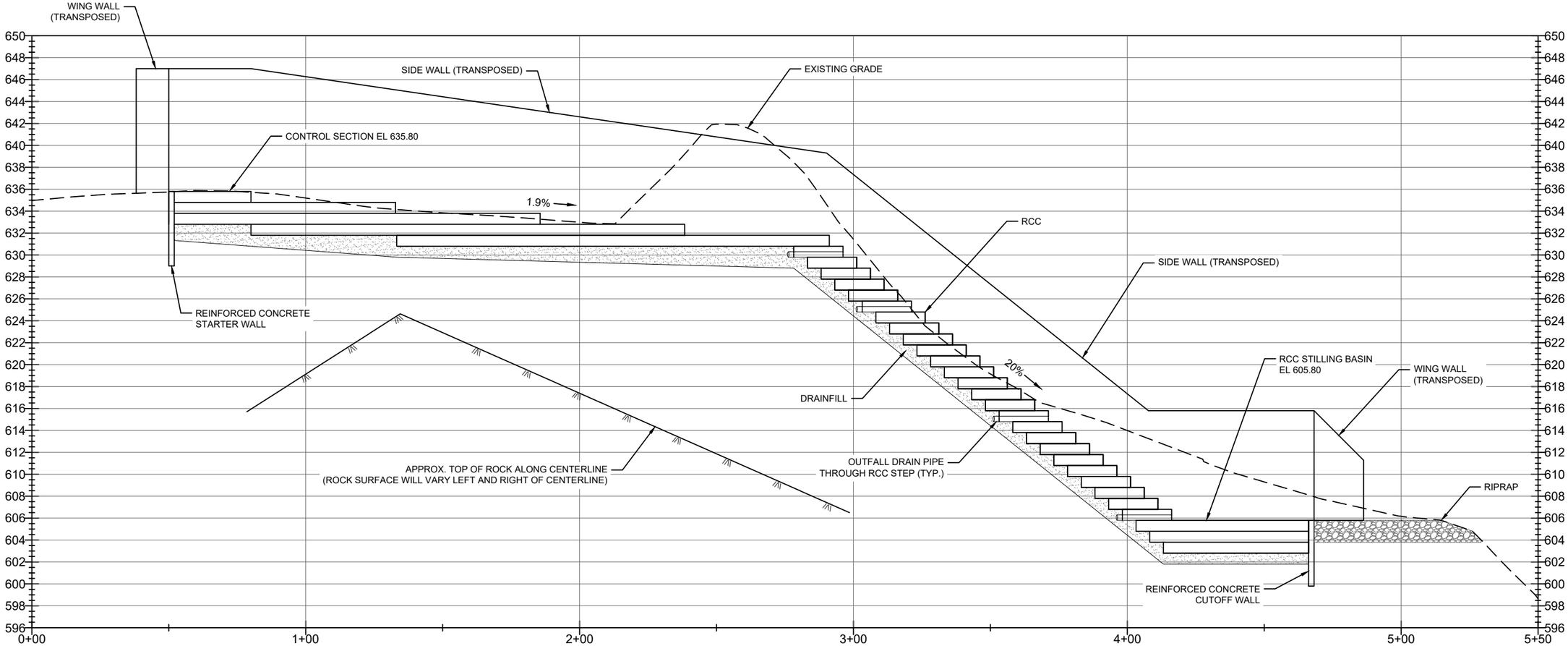
Rev.	Description	Date
0		

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - PLAN

United States Department of Agriculture
Natural Resources Conservation Service
USDA
Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-2



ALTERNATIVE 1 PROFILE A-A

1
C-3

SCALE: 1"=40'
VERTICAL SCALE: 1"=10'

Designed	PM		
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Checked	CG		
Approved	PM		
Rev.	Description	Date	
0			

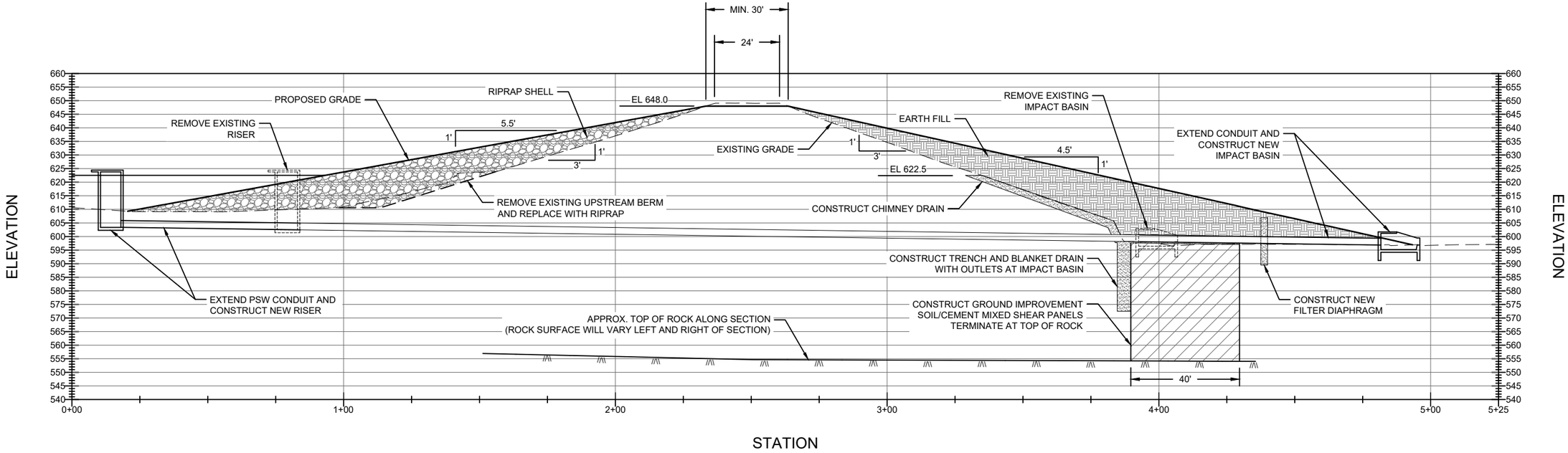
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - ASW PROFILE

United States Department of Agriculture
Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

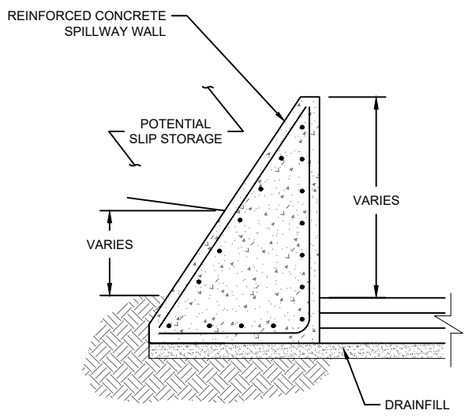
C-3



PROFILE B-B

SCALE: 1" = 40'

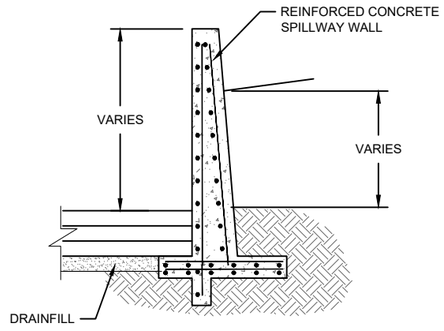
1 / C-4



SECTION C-C

SCALE: NTS

2 / C-4



SECTION D-D

SCALE: NTS

3 / C-4

Designed	PM	
Drawn	TS	
Checked	CG	
Approved	PM	
0		Date
Rev.		Description

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - PSW PROFILE AND SECTIONS

United States Department of Agriculture
USDA Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions

300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-4

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
6263 Appalachian Highway
Davis, West Virginia 26260

December 13, 2023

Harold Russell
Natural Resource Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505

Re: Natural Resource Conservation Service, Blakes Creek-Armour Creek Site 7 dam rehabilitation project, Putnam County, West Virginia (FWS File Number 2023-0089485)

Dear Harold Russel:

This letter responds to your November 8, 2023, request for concurrence for federally listed species and their designated critical habitats within the proposed project area. The project is located in Kanawha County, near the town of Nitro, West Virginia. It has been assigned FWS File Number 2023-0089485 and all future correspondence should clearly reference this number.

It is the U.S. Fish and Wildlife Service (Service) West Virginia Field Office's (WVFO) understanding that the Natural Resource Conservation Service is proposing the rehabilitation of an existing dam. In your project submission, you indicated that eight acres of tree clearing will occur. You have also committed to implement seasonal tree clearing restrictions (November 15th – March 31st).

These comments are provided pursuant to the Endangered Species Act (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq). The Service's WVFO has determined that two federally listed species may occur within the proposed project area and may be affected by the construction of the project. These include the federally endangered Indiana bat (*Myotis sodalis*), and federally endangered gray bat (*Myotis grisescens*).

Federally Listed Bats

The Indiana bat may use the project area for foraging and roosting between April 1 and November 15. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites. In West Virginia, the Service considers all forested habitat containing trees greater than or equal to five inches in diameter at breast height to be potentially suitable as summer roosting and foraging habitat for the Indiana bat.

Indiana bats feed on emerged aquatic and terrestrial flying insects. Moths, caddisflies, flies, mosquitoes, and midges are major prey items. Aquatic insects that have concentrated emergences or that form large mating aggregations above or near water appear to be preferred prey items. As a result, streams, wetlands, and associated riparian forests are often preferred foraging habitats

for pregnant and lactating Indiana bats. Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures. Increased erosion and sedimentation of streams reduces diversity and biomass of benthic invertebrates, (i.e., insects). Impacts to aquatic features such as streams or wetlands, could result in a decrease in insects available to the species for foraging.

Indiana bats use caves or mine portals for winter hibernation in West Virginia between November 15 and March 31. These species also use the hibernacula and the areas around them for fall-swarming and spring-staging activity (August 15 to November 14 and April 1 to May 14 in West Virginia, respectively). Some males have been known to stay close to the hibernacula during the summer and may use the hibernacula as a summer roosting site.

The gray bat uses caves and mines year-round, though has also been found in the crevices of bridges and in culverts. The gray bat forages over rivers, streams, and reservoirs, consuming primarily night flying aquatic insects. Most foraging occurs within five meters of water surface. Increased erosion and sedimentation of streams reduces diversity and biomass of benthic invertebrates, impacting food resources and foraging habitat for the gray bat.

When the WVFO evaluates potential impacts to listed bats, we consider the biological requirements for the species, the location of the project, and the extent of impacts. This proposed project is not located within any bat known-use areas[1], and will not affect any suitable caves or mines. The project may temporarily impact foraging habitat; however, erosion and sedimentation best management practices will be used to minimize impacts to foraging habitat. Additionally, you have committed to seasonal restrictions (November 15 – March 31) for all tree clearing, ensuring impacts to suitable habitat will only occur during the winter when bats are hibernating. Therefore, WVFO concurs with the Natural Resource Conservation Service that the project may affect but is not likely to adversely affect listed bat species.

Conclusion

If the project plans change or amendments are proposed that we have not considered in your proposed action, or if additional information on listed and proposed species becomes available, or if new species become listed or critical habitat is designated, this concurrence may be reconsidered.

If you have any questions regarding this letter, please contact my team at curtis_roth@fws.gov or at the letterhead address.

Sincerely,

Jennifer L. Norris
Field Supervisor

[1] 10 mile radius around a known Priority 1 or 2 Indiana bat hibernaculum, 5 mile radius around a known Priority 3 or 4 Indiana bat hibernaculum, a 2.5 mile radius around any known maternity roost, or a 5 radius from summer detection sites where no roosts were identified.

West Virginia Department of
ARTS, CULTURE
AND HISTORY

The Culture Center
1900 Kanawha Blvd., E.
Charleston, WV 25305-0300

Randall Reid-Smith, Curator
Phone 304.558.0220 • www.wvculture.org
Fax 304.558.2779 • TDD 304.558.3562
EEO/AA Employer

July 20, 2022

Mr. Jon Bourdon
State Conservationist
USDA – NRCS
West Virginia State Office
1500 Earl L. Core Road
Suite 200
Morgantown, WV26505
Via email: jon.bourdon@usda.gov

RE: Proposed Improvements to the Blakes Creek-Armour Creek Watershed, Dam Site No. 7
Supplemental Watershed Plan / Environmental Assessment
FR#: 22-739-KA

Dear Mr. Bourdon:

We have reviewed the information that was submitted in support of the above-mentioned project. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

According to the submitted information, the U.S. Department of Agriculture, Natural Resources Conservation Service proposes to rehabilitate Dam Site No. 7 in the Blakes Creek-Armour Creek Watershed in the Town of Nitro, Kanawha County, West Virginia. A Supplemental Watershed Plan/Environmental Assessment, which is currently being prepared, will evaluate four alternatives that are being considered in addition to the No Action Alternative. Alternative 1, which is currently preferred, proposes to construct a 140-foot-wide roller-compacted concrete chute auxiliary spillway (RCC-ASW). The RCC-ASW will be realigned to keep it further away from the existing hillside. The project also will involve regrading and leveling the dam crest to an elevation of 648 feet, flattening with earth the downstream slope and installing soil-cement mixed panels at the downstream embankment toe to enhance stability. Two staging and stockpiling areas are proposed, and an estimated eight acres of trees will be cleared. The area of potential effect (APE) is defined as the area where ground disturbance will occur.

Archaeological Resources:
A search of our records indicates that no previously documented archaeological sites are located within the proposed project area. Submitted information indicates that most of the proposed work will be confined to the previously disturbed terrain. Other terrain within the APE is steeply sloped. This makes it unlikely that significant archaeological resources would be encountered. As a result, it is our opinion that the proposed project will have no effect on archaeological historic properties. No further consultation is necessary regarding archaeological resources.

Architectural Resources:
We have reviewed the submitted information and determined that no architectural properties eligible for or included in the National Register of Historic Places are located within the proposed project's direct or indirect Area of Potential Effects (APE). There are no structures within the direct APE of the project. According to submitted information, mapping, and aerial photography there appear to be no historic structures within the visual APE of the project. No further consultation is necessary regarding architectural resources; however, we ask that you contact our office if your project should change.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please contact Lora A. Lamarre-DeMott, Senior Archaeologist, or Stephen L. Gifford, Structural Historian, at (304) 558-0240.*

Sincerely,

Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/LLD/SLG

CC: Tyler Stumpf, USDA – NRCS;

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HUNTINGTON DISTRICT
502 8TH STREET
HUNTINGTON, WV 25701-2018

July 14, 2023

Regulatory Division
South/Transportation Branch
LRH-2023-565-KAN

Mr. Harold Russell
NRCS Civil Engineer
1550 Earl Core Road, Suite 200
Morgantown, West Virginia 26505

Dear Mr. Russell:

I refer to preliminary information received in this office on July 7, 2023, regarding the proposed Improvements to the Blakes Creek-Armour Creek Watershed Dam Site 7 located in Kanawha County, West Virginia. This project has been assigned file number LRH-2023-565-KAN. Please refer to this number in any future correspondence regarding this matter.

The United States Army Corps of Engineers' (Corps) authority to regulate waters of the United States is based on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act (Section 404) requires a Department of the Army (DA) permit be obtained prior to discharging dredged and/or fill material into waters of the United States, including wetlands. Section 10 of the Rivers and Harbors Act of 1899 (Section 10) requires a DA permit be obtained for any work in, on, over or under a navigable water.

Based on your description of the proposed work, and other information available, it appears the project may include the discharge of dredged and/or fill material into waters of the United States. Therefore, under Section 404 and Section 10, a DA authorization may be required. It is the responsibility of the applicant, or the applicant's consultant, to determine the presence and limits of potential waters of the United States, including wetlands, within the project area.

To further evaluate the project additional information is required. Typically, the attached DA permit application form (DA form 6082), completed in accordance with the included instructions, provides the information required to evaluate the proposed project.

Printed on Recycled Paper

If you have any questions regarding DA permit requirements, please contact the South Regulatory Branch at (304) 399-5710.

Sincerely,

Sarah M. Workman

Sarah M. Workman
Regulatory Project Manager
South/Transportation Branch

Enclosure(s)

U.S. Army Corps of Engineers (USACE)

NATIONWIDE PERMIT PRE-CONSTRUCTION NOTIFICATION (PCN)

33 CFR 330. The proponent agency is CECW-CO-R.

Form Approved -
OMB No. 0710-0003
Expires: 02-28-2022

DATA REQUIRED BY THE PRIVACY ACT OF 1974

Authority	Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332.
Principal Purpose	Information provided on this form will be used in evaluating the nationwide permit pre-construction notification.
Routine Uses	This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of the agency coordination process.
Disclosure	Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued.

The public reporting burden for this collection of information, 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR RESPONSE TO THE ABOVE EMAIL.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (*see sample drawings and/or instructions*) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (*agent is not required*)
First - Middle - Last -	First - Middle - Last -
Company -	Company -
Company Title -	E-mail Address -
E-mail Address -	
6. APPLICANT'S ADDRESS:	**9. AGENT'S ADDRESS:**
Address-	Address-
City - State - Zip - Country -	City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. with AREA CODE	**10. AGENT'S PHONE NOs. with AREA CODE**
a. Residence b. Business c. Fax d. Mobile	a. Residence b. Business c. Fax d. Mobile

STATEMENT OF AUTHORIZATION

11. I hereby authorize, _____ to act in my behalf as my agent in the processing of this this nationwide permit pre-construction notification and to furnish, upon request, supplemental information in support of this nationwide permit pre-construction notification.

_____ _____
SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME or TITLE (*see instructions*)

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

13. NAME OF WATERBODY, IF KNOWN (*if applicable*)

14. PROPOSED ACTIVITY STREET ADDRESS (*if applicable*)

15. LOCATION OF PROPOSED ACTIVITY (*see instructions*)
Latitude °N Longitude °W

City: State: Zip:

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (*see instructions*)

State Tax Parcel ID Municipality

Section Township Range

17. DIRECTIONS TO THE SITE.

18. IDENTIFY THE SPECIFIC NATIONWIDE PERMIT(S) YOU PROPOSE TO USE:

19. DESCRIPTION OF PROPOSED NATIONWIDE PERMIT ACTIVITY (*see instructions*)

20. DESCRIPTION OF PROPOSED MITIGATION MEASURES (*see instructions*)

21. PURPOSE OF NATIONWIDE PERMIT ACTIVITY (*Describe the reason or purpose of the project, see instructions*)

22. Quantity of Wetlands, Streams, or Other Types of Waters Directly Affected by Proposed Nationwide Permit Activity (*see instructions*)

Acres Linear Feet Cubic Yards Dredged or Discharged

Each PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site.

23. List any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project on any related activity (*see instructions*)

24. If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and requires pre-construction notification, explain how the compensatory mitigation requirement in paragraph (c) of general condition 23 will be satisfied, or explain why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required for the proposed activity.

25. Is Any Portion of the Nationwide Permit Activity Already Complete? ☐ Yes ☐ No If Yes, describe the completed work:

26. List the name(s) of any species listed as endangered or threatened under the Endangered Species Act that might be affected by the proposed NWP activity or utilize the designated critical habitat that might be affected by the proposed NWP activity. (*see instructions*)

27. List any historic properties that have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic property or properties. (*see instructions*)

28. For a proposed NWP activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, identify the Wild and Scenic River or the "study river":

29. If the proposed NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, have you submitted a written request for section 408 permission from the Corps district having jurisdiction over that project? ☐ Yes ☐ No

If "yes", please provide the date your request was submitted to the Corps District:

30. If the terms of the NWP(s) you want to use require additional information to be included in the PCN, please include that information in this space or provide it on an additional sheet of paper marked Block 30. (*see instructions*)

31. Pre-construction notification is hereby made for one or more nationwide permit(s) to authorize the work described in this notification. I certify that this information in this pre-construction notification is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The Pre-Construction Notification must be signed by the person who desires to undertake the proposed activity (applicant) and, if the statement in block 11 has been filled out and signed, the authorized agent.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Instructions for Preparing a

Department of the Army

Nationwide Permit (NWP) Pre-Construction Notification (PCN)

Blocks 1 through 4. To be completed by the Corps of Engineers.

Block 5. Applicant' Name. Enter the name and the e-mail address of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the preconstruction notification, please attach a sheet of paper with the necessary information marked Block 5.

Block 6. Address of Applicant. Please provide the full address of the party or parties responsible for the PCN. If more space is needed, attach an extra sheet of paper marked Block 6.

Block 7. Applicant Telephone Number(s). Please provide the telephone number where you can usually be reached during normal business hours.

Blocks 8 through 11. To be completed, if you choose to have an agent.

Block 8. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, consultant, or any other person or organization. Note: An agent is not required.

Blocks 9 and 10. Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone number where he / she can be reached during normal business hours.

Block 11. Statement of Authorization. To be completed by the applicant, if an agent is to be employed.

Block 12. Proposed Nationwide Permit Activity Name or Title. Please provide a name identifying the proposed NWP activity, e.g., Windward Marina, Rolling Hills Subdivision, or Smith Commercial Center.

Block 13. Name of Waterbody. Please provide the name (if it has a name) of any stream, lake, marsh, or other waterway to be directly impacted by the NWP activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 14. Proposed Activity Street Address. If the proposed NWP activity is located at a site having a street address (not a box number), please enter it in Block 14.

Block 15. Location of Proposed Activity. Enter the latitude and longitude of where the proposed NWP activity is located. Indicate whether the project location provided is the center of the project or whether the project location is provided as the latitude and longitude for each of the "corners" of the project area requiring evaluation. If there are multiple sites, please list the latitude and longitude of each site (center or corners) on a separate sheet of paper and mark as Block 15.

Block 16. Other Location Descriptions. If available, provide the Tax Parcel Identification number of the site, Section, Township, and Range of the site (if known), and / or local Municipality where the site is located.

Block 17. Directions to the Site. Provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site. You may also provide a description of the location of the proposed NWP activity, such as lot numbers, tract numbers, or you may choose to locate the proposed NWP activity site from a known point (such as the right descending bank of Smith Creek, one mile downstream from the Highway 14 bridge). If a large river or stream, include the river mile of the proposed NWP activity site if known. If there are multiple locations, please indicate directions to each location on a separate sheet of paper and mark as Block 17.

Block 18. Identify the Specific Nationwide Permit(s) You Propose to Use. List the number(s) of the Nationwide Permit(s) you want to use to authorize the proposed activity (e.g., NWP 29).

Block 19. Description of the Proposed Nationwide Permit Activity. Describe the proposed NWP activity,including the direct and indirect adverse environmental effects the activity would cause. The description of the proposed activity should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal. Identify the materials to be used in construction, as well as the methods by which the work is to be done.

Provide sketches when necessary to show that the proposed NWP activity complies with the terms of the applicable NWP(s). Sketches usually clarify the activity and result in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed NWP activity (e.g.,a conceptual plan), but do not need to be detailed engineering plans.

The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked Block 19.

Block 20. Description of Proposed Mitigation Measures. Describe any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed NWP activity. The description of any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or additional mitigation measures.

Block 21. Purpose of Nationwide Permit Activity. Describe the purpose and need for the proposed NWP activity. What will it be used for and why? Also include a brief description of any related activities associated with the proposed project. Provide the approximate dates you plan to begin and complete all work.

Block 22. Quantity of Wetlands, Streams, or Other Types of Waters Directly Affected by the Proposed Nationwide Permit Activity. For discharges of dredged or fill material into waters of the United States, provide the amount of wetlands, streams, or other types of waters filled, flooded, excavated, or drained by the proposed NWP activity. For structures or work in navigable waters of the United States subject to Section 10 of the Rivers and Harbors Act of 1899, provide the amount of navigable waters filled, dredged, occupied by one or more structures (e.g., aids to navigation, mooring buoys) by the proposed NWP activity.

For multiple NWPs, or for separate and distant crossings of waters of the United States authorized by NWPs 12 or 14, attach an extra sheet of paper marked Block 21 to provide the quantities of wetlands, streams, or other types of waters filled, flooded, excavated, or drained (or dredged or occupied by structures, if in waters subject to Section 10 of the Rivers and Harbors Act of 1899) for each NWP. For NWPs 12 and 14, include the amount of wetlands, streams, or other types of waters filled, flooded, excavated, or drained for each separate and distance crossing of waters or wetlands. If more space is needed, attach an extra sheet of paper marked Block 21.

Block 23. Identify Any Other Nationwide Permit(s), Regional General Permit(s), or Individual Permit(s) Used to Authorize Any Part of Proposed Activity or Any Related Activity. List any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. For linear projects, list other separate and distant crossings of waters and wetlands authorized by NWPs 12 or 14 that do not require PCNs. If more space is needed, attach an extra sheet of paper marked Block 22.

Block 24. Compensatory Mitigation Statement for Losses of Greater Than 1/10-Acre of Wetlands When Pre-Construction Notification is Required. Paragraph (c) of NWP general condition 23 requires compensatory mitigation at a minimum one-for-one replacement ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation is more environmentally appropriate or the adverse environmental effects of the proposed NWP activity are no more than minimal without compensatory mitigation, and provides an activity-specific waiver of this requirement. Describe the proposed compensatory mitigation for wetland losses greater than 1/10 acre, or provide an explanation of why the district engineer should not require wetland compensatory mitigation for the proposed NWP activity. If more space is needed, attach an extra sheet of paper marked Block 23.

Block 25. Is Any Portion of the Nationwide Permit Activity Already Complete? Describe any work that has already been completed for the NWP activity.

Block 26. List the Name(s) of Any Species Listed As Endangered or Threatened under the Endangered Species Act that Might be Affected by the Nationwide Permit Activity. If you are not a federal agency, and if any listed species or designated critical habitat might be affected or is in the vicinity of the proposed NWP activity, or if the proposed NWP activity is located in designated critical habitat, list the name(s) of those endangered or threatened species that might be affected by the proposed NWP activity or utilize the designated critical habitat that might be affected by the proposed NWP activity. If you are a Federal agency, and the proposed NWP activity requires a PCN, you must provide documentation demonstrating compliance with Section 7 of the Endangered Species Act.

Block 27. List Any Historic Properties that Have the Potential to be Affected by the Nationwide Permit Activity. If you are not a federal agency, and if any historic properties have the potential to be affected by the proposed NWP activity, list the name(s) of those historic properties that have the potential to be affected by the proposed NWP activity. If you are a Federal agency, and the proposed NWP activity requires a PCN, you must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

Block 28. List the Wild and Scenic River or Congressionally Designated Study River if the Nationwide Permit Activity Would Occur in such a River. If the proposed NWP activity will occur in a river in the National Wild and Scenic River System or in a river officially designated by Congress as a "study river" under the Wild and Scenic Rivers Act, provide the name of the river. For a list of Wild and Scenic Rivers and study rivers, please visit http://www.rivers.gov/

Block 29. Nationwide Permit Activities that also Require Permission from the Corps Under 33 U.S.C. 408. If the proposed NWP activity also requires permission from the Corps under 33 U.S.C. 408 because it will temporarily or permanently alter, occupy, or use a Corps federal authorized civil works project, indicate whether you have submitted a written request for section 408 permission from the Corps district having jurisdiction over that project.

Block 30. Other Information Required For Nationwide Permit Pre-Construction Notifications. The terms of some of the Nationwide Permits include additional information requirements for preconstruction notifications:

* NWP 3, Maintenance –information regarding the original design capacities and configurations of the outfalls, intakes, small impoundments, and canals.
* NWP 31, Maintenance of Existing Flood Control Facilities –a description of the maintenance baseline and the dredged material disposal site.
* NWP 33, Temporary Construction, Access, and Dewatering –a restoration plan showing how all temporary fills and structures will be removed and the area restored to pre-project conditions.
* NWP 44, Mining Activities –if reclamation is required by other statutes, then a copy of the final reclamation plan must be submitted with the pre-construction notification.
* NWP 45, Repair of Uplands Damaged by Discrete Events –documentation, such as a recent topographic survey or photographs, to justify the extent of the proposed restoration.
* NWP 48, Commercial Shellfish Aquaculture Activities –(1) a map showing the boundaries of the project area, with latitude and longitude coordinates for each corner of the project area; (2) the name(s) of the species that will be cultivated during the period this NWP is in effect; (3) whether canopy predator nets will be used; (4) whether suspended cultivation techniques will be used; and (5) general water depths in the project area (a detailed survey is not required).
* NWP 49, Coal Remining Activities –a document describing how the overall mining plan will result in a net increase in aquatic resource functions to the district engineer and receive written authorization prior to commencing the activity.
* NWP 50, Underground Coal Mining Activities –if reclamation is required by other statutes, then a copy of the reclamation plan must be submitted with the pre-construction notification.

If more space is needed, attach an extra sheet of paper marked Block 29.

Blocks 31 and 32. For bank stabilization activities, we are collecting information on the use of living shorelines in coastal waters and lakes to inform future NWP rulemaking efforts. If the PCN is for a proposed NWP 13 activity, and it is located in coastal waters or a lake, please check the appropriate box in block 31 to indicate whether you considered the use of a living shoreline to protect your property from erosion. If the PCN is for a proposed NWP 13 activity, and it is located in coastal waters or a lake, please check the appropriate box in block 32 to indicate whether there are contractors in your area that construct living shorelines.

Block 33. Signature of Applicant or Agent. The PCN must be signed by the person proposing to undertake the NWP activity, and if applicable, the authorized party (agent) that prepared the PCN. The signature of the person proposing to undertake the NWP activity shall be an affirmation that the party submitting the PCN possesses the requisite property rights to undertake the NWP activity (including compliance with special conditions, mitigation, etc.).

DELINEATION OF WETLANDS, OTHER SPECIAL AQUATIC SITES, AND OTHER WATERS

Each PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current wetland delineation manual and regional supplement published by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. The 45 day PCN review period will not start until the delineation is submitted or has been completed by the Corps.

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a Vicinity Map, a Plan View or a Typical Cross-Section Map. Identify each illustration with a figure or attachment number. For linear projects (e.g. roads, subsurface utility lines, etc.) gradient drawings should also be included. Please submit one original, or good quality copy, of all drawings on 8½x11 inch plain white paper (electronic media may be substituted). Use the fewest number of sheets necessary for your drawings or illustrations. Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross-section). While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.

ADDITIONAL INFORMATION AND REQUIREMENTS

For proposed NWP activities that involve discharges into waters of the United States, water quality certification from the State, Tribe, or EPA must be obtained or waived (see NWP general condition 25). Some States, Tribes, or EPA have issued water quality certification for one or more NWPs. Please check the appropriate Corps district web site to see if water quality certification has already been issued for the NWP(s) you wish to use. For proposed NWP activities in coastal states, state Coastal Zone Management Act consistency concurrence must be obtained, or a presumption of concurrence must occur (see NWP general condition 26). Some States have issued Coastal Zone Management Act consistency concurrences for one or more NWPs. Please check the appropriate Corps district web site to see if Coastal Zone Management Act consistency concurrence has already been issued for the NWP(s) you wish to use.

Russell, Harold - FPAC-NRCS, WV

From: Belcher, Michele (CTR) - FPAC-NRCS, WV
Sent: Monday, April 24, 2023 1:23 PM
To: Russell, Harold - FPAC-NRCS, WV
Subject: FW: [EXTERNAL] Blakes Creek Armour Creek Consultation Letter
Attachments: Initial Assessment of Potential Impacts to Species Table_20220418.pdf

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From: West Virginia FO, FW5 <FW5_WVFO@fws.gov>
Sent: Thursday, July 21, 2022 4:50 PM
To: Belcher, Michele (CTR) - FPAC-NRCS, MORGANTOWN, WV <Michele.Belcher@usda.gov>
Subject: Re: [EXTERNAL] Blakes Creek Armour Creek Consultation Letter

Currently, the information you provided does not contain the essential information for the WVFO to provide guidance on potential impacts to federally listed species.

To assist in making the Service's technical assistance under the Endangered Species Act review efficient, we suggest that project proponents follow *all* instructions on our website at: https://www.fws.gov/office/west-virginia-ecological-services/project-planning.

Steps within these instructions are summarized below.

1. Use the IPaC system (https://ipac.ecosphere.fws.gov/) to obtain a list of federally listed species for your project area. Should the IPaC suggest that federally listed species under the Endangered Species Act (ESA) are within the project area, then please complete our office's self-certification process (step 2). If the IPaC does not reveal ESA-listed species, then no further coordination with our office is needed.
2. If federally listed species are included in your IPaC output, utilize our office's self-certification process (visit https://www.fws.gov/office/west-virginia-ecological-services/project-planning and scroll to Instructions for Self Certification) to determine potential impacts to listed species. Please note that the *Initial Assessment of Potential Impacts to Species Table* in this self-certification process has been recently updated, therefore we have attached this table for your immediate use.
3. For each of the federally listed species in the IPaC Official Species List, answer each question from the *Initial Assessment of Potential Impacts to Species Table* in order, moving from left to right. Based on your answers to each question, you will come to a determination for each species: “no effect” or “potential impact”. Provide the answers and rationale into the *Species Conclusion Table* (attached).
4. If in the self-certification process the action agency determines there is no potential impact to listed species, then no further coordination with our office is needed.
5. If your assessment through our self-certification process suggests the project actions may have an impact on ESA listed species, our office can provide additional technical assistance. However, to do so we will at minimum need the following: 1) shapefile or spatial coordinates with a map of the project location; 2) a thorough (detailed) description of the proposed actions for the project; 3) the Species Conclusion Table; and 4) the complete and official Species List from IPaC with the IPaC (project) number (e.g., YEAR-XXXX) identified in your email subject line. Additionally, to ensure proper processing, include "TA NEEDED" at the front of the email's subject line.

6. The WVFO Submission Form (https://www.fws.gov/media/optional-wvfo-submission-form) is intended to aid project proponents in composing complete project descriptions, and you may find this to be a helpful resource. This is indicated as an optional form but is valuable in providing the necessary project description information.

Please submit to our general email box (fw5_wvfo@fws.gov) so that we can properly track projects. Submissions to biologists will not be accepted.

Should you need additional assistance from the Service's WVFO, please submit your request to our general inbox (fw5_wvfo@fws.gov).

From: Belcher, Michele (CTR) - FPAC-NRCS, MORGANTOWN, WV <Michele.Belcher@usda.gov>
Sent: Tuesday, July 19, 2022 2:19 PM
To: West Virginia FO, FW5 <FW5_WVFO@fws.gov>
Subject: [EXTERNAL] Blakes Creek Armour Creek Consultation Letter

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

This electronic message contains information generated by the USDA solely for the intended recipients. Any unauthorized interception of this message or the use or disclosure of the information it contains may violate the law and subject the violator to civil or criminal penalties. If you believe you have received this message in error, please notify the sender and delete the email immediately.

Table. *Initial Assessment* of Potential Impacts to Species

Important information for use of Table

The below table will guide a project proponent through a series of questions to assess potential impacts (this includes adverse and beneficial) that their projects may have on federally listed species. The goal of this table is to efficiently assess potential actions that may have no effect to federally listed species in West Virginia.

Should the questions for your project result in a "no effect" determination for all species identified in your IPaC review, no further coordination with the West Virginia Field Office (WVFO) is needed.

Please note that potential impacts (affects) may be beneficial or adverse. Should the answers to the questions result in a potential impact (affect), either beneficial or adverse to any species identified in your IPaC review, **you should submit project to FW5_WVFO@fws.gov (see instructions on project review page for WVFO).**

Draft updated: 4/18/2022

Table. *Initial Assessment* of Potential Impacts to Species

Species	Question 1	Question 2	Question 3	Question 4
Indiana bat	Will the project involve any tree removal or trimming? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 2.	Are there any caves or anthropogenic features,[1] suitable for hibernating or roosting bats within the proposed project area? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 3.	Is your project within known summer maternity or spring staging/fall swarming areas for the Indiana bat? [2] **Yes** = Proceed to Question 4. **No =** No Effect*.	Will the project involve any stream/wetland impacts? **Yes** = Potential impact, submit project to WVFO. **No =** No Effect*.
Northern long-eared bat	Is your project within 150-feet of a documented NLEB roost tree or ¼ mile of a documented NLEB hibernacula according to IPaC? [2] **Yes** = Potential impact, submit project to WVFO. **No** = Final 4(d) Rule applies[3]. Submit streamlined 4(d) Rule form to WVFO.			

[1]Caves and anthropogenic features include caves and all associated features (e.g., sinkholes, rock fissures), mine portals, tunnels, and bridges. Consult Range-wide Indiana Bat Survey Guidelines, Appendix H: Potential Hibernaculum Survey Guidance for more specific information on potential Indiana Bat hibernacula. For guidance related to bridge suitability, refer to FHWA Programmatic Biological Assessment, Appendix B: Bridge / Abandoned Structure Assessment Guidance.

[2] This information is located on your official species list from IPaC.

[3] On March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat (NLEB) as endangered under the Endangered Species Act. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). Depending on the type of effects a project has on NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). If your project may result in incidental take of NLEB after the new listing goes into effect this will first need to be addressed in an updated consultation that includes an Incidental Take Statement. If your project may require re-initiation of consultation, please contact the WVFO for additional guidance.

Draft updated: 4/18/2022

Table. *Initial Assessment* of Potential Impacts to Species

Virginia big-eared bat	Will your project occur within a known use area for this species[2]? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			
Gray bat	Are there any caves, mine portals, bridges, fissures, structures, or culverts within the proposed project area? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 2.	Will the project involve any stream/wetland impacts? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.		
Cheat Mountain salamander	Does the project occur within forested habitat above 2,000 feet in elevation in Grant, Pendleton, Pocahontas, Randolph, or Tucker counties? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			

Table. *Initial Assessment* of Potential Impacts to Species

Flat-spired three toothed land snail	Will your project impact sandstone outcrops, cliff line features, emergent boulders, or talus slopes in the Cheat River Gorge? **Yes** = Potential impact, submit project to WVFO. **No =** No Effect*.			
Madison Cave isopod	Will earth moving activities occur as part of the project in Jefferson or Berkeley counties? **Yes** = Proceed to Question 2. **No** = No Effect*.	Will the activity occur entirely within a previous construction footprint? **Yes=** No Effect*. **No** = Proceed to Question 3.	Will the project affect any wells, springs, sinkholes, or caves; result in the creation of new sinkholes; result in changes to hydrology, groundwater recharge, or water levels; cause sedimentation from earth disturbance; or place debris or other materials within 100-feet of a sinkhole? **Yes** = Potential impact, submit project to WVFO. **No =** No Effect*.	
Rusty-patched bumble bee	Is your project within a RPBB High Potential Zone? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			

Draft updated: 4/18/2022

Table. *Initial Assessment* of Potential Impacts to Species

Harperella	Will the project directly affect the streambed (below ordinary high-watermark) or the streambanks and riparian vegetation of Back Creek, Sleepy Creek, Potomac River, or Cacapon River? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 2.	Will the project involve earth moving that could cause erosion, sedimentation, or contamination within close proximity[2] to these streams? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.		
Virginia spiraea	Will the project directly affect the streambed (below ordinary high-watermark) or the streambanks and riparian vegetation of the Lower New, Meadow, Marsh Fork, Gauley, Greenbrier, Buckhannon or Bluestone rivers? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 2.	Will the project involve earth moving that could cause erosion, sedimentation, or contamination within close proximity[2] to these rivers? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.		
Northeastern bulrush	Will the project affect any wetlands in Berkeley or Hardy counties? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			

Table. *Initial Assessment* of Potential Impacts to Species

Shale barren rock cress	Will the project affect any shale barrens in Greenbrier, Hardy, or Pendleton counties? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			
Small whorled pogonia	Does the project occur within deciduous forest in Greenbrier, Randolph, Tucker, or Pocahontas counties? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.			
Federally listed aquatic species (includes mussels, crayfish, and darters) *If your project occurs within close proximity of a stream providing habitat for a federally listed species[2], answer the Question 1.* *If your project occurs within a watershed known to support a federally listed species[2], see the row below (within watershed only).*	Will the project directly affect the streambed (below ordinary high-watermark) of the stream or tributary? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 2.	Will the project bore underneath (directional bore or horizontal directional drill) a mussel/crayfish/darter stream? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 3.	Will the project involve earth moving within close proximity to a mussel/crayfish/darter stream? **Yes** = Potential impact, submit project to WVFO. **No** = Proceed to Question 4.	Will the project affect fish quantities[4] or water quantity/quality[5] in a mussel/crayfish/darter mussel stream? **Yes** = Potential impact, submit project to WVFO. **No** = No Effect*.

Table. *Initial Assessment* of Potential Impacts to Species

Aquatic species (within watershed only)[2]	Will the project involve earth moving that could cause erosion, sedimentation, or contamination into waterways? **Yes** = Proceed to Question 2. **No =** No Effect*.	Will the impacts (sedimentation into waterways) occur within a tributary of a stream that provides habitat for federally listed species? **Yes** = Potential impact, submit project to WVFO. **No =** No Effect*.		

[4] Projects that could affect fish movement include but are not limited to: stocking or harvesting, or any project that could result in an increase to recreational fishing.
[5] This includes water withdrawals and discharge of contaminants (even with a NPDES permit).

USDA

United States Department of Agriculture

July 16, 2024

To Interested Agencies, Organizations and Individuals:
Colonel Phillip J. Valenti U.S. Army Corps of Engineers, Huntington District

The USDA, Natural Resources Conservation Service (NRCS) is the lead federal agency for the Watershed Plan – Environmental Assessment for the rehabilitation of the Blakes Creek-Armour Creek Site 7 Watershed Dam in Nitro, WV. The local sponsors of the project are the Capitol Conservation District, Western Conservation District, West Virginia Conservation Agency, Kanawha County Commission and the City of Nitro. The Blakes Creek-Armour Creek Site 7 Dam is classified as a high hazard dam that does not presently meet the West Virginia Department of Environmental Protection (WVDEP) and NRCS current dam safety and performance standards. The rehabilitation plan was prepared under authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended by the Small Watershed Rehabilitation Amendments of 2000 (Section 313 of Public Law 106-472), and in accordance with section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190).

The Final Plan – Environmental Assessment will be submitted to the National Program Manager with a request for construction authorization to the Chief of the NRCS for approval.

The ASW of the Blakes Creek-Armour Creek Site 7 Dam does not have the capacity to pass the 6-hr PMP event. The ASW would also breach due to erosion. The downstream slope does not meet NRCS and WVDEP Dam Safety stability criteria for seismic conditions nor rapid drawdown conditions. As a result, the Sponsors have chosen to rehabilitate the dam to address the identified safety deficiencies. A number of alternatives were evaluated. The Sponsor Preferred Alternative involves the following modifications to the structure:

- Constructing a 140-ft wide RCC auxiliary spillway (ASW).
- Re-grading and leveling the dam crest to design elevation 648.0 ft.
- Re-grouting the existing 30-inch diameter steel cylinder concrete lined pressure pipe principal spillway conduit joints.
- Constructing a filter diaphragm around the principal spillway conduit.
- Removing the existing principal spillway impact basin, extending the 30-inch diameter principal spillway conduit downstream by approximately 90 feet and constructing a new principal spillway impact basin.
- Removing the existing riser or a portion of the existing riser, constructing a new principal spillway riser and extending the 30-inch diameter principal spillway conduit upstream by approximately 60 feet.
- Partially removing / partially grouting in place the existing corrugated metal pipe trench drains and installing new plastic pipe toe drains. Replacing the existing toe drain drainfill material. Also, the top 3-ft of drainfill in the relief wells will be removed and replaced.
- Enhancing the stability of the downstream embankment slope by flattening the slope with earth fill (approximately 4.5H:1V). This flattening is required to meet West Virginia Department of Environmental Protection requirements.

- Enhancing ground stability at the downstream embankment toe using soil-cement mixed shear panels or similar type stability measures.
- Flattening the upstream slope (approximately 5.5H:1V) with rock riprap to enhance slope stability. This flattening is required to meet West Virginia Department of Environmental Protection requirements.
- Removing the culvert under Tea Table Road within the right abutment of the embankment along with re-grading for surface drainage.
- Replacing/relocating the stormwater drop inlet and discharge pipe in the existing ASW.
- Removing the existing sewer line in the ASW and replacing with a new septic system for the recreation area facility.

Number of Direct Beneficiaries/Population at Risk: 1,038

Other Beneficial Effects:

- Reduces the threat to loss of life to approximately 1,038 people who live and/or work in the breach zone.
- Protects 263 residences, 10 apartments, 14 commercial structures, 1 public property, numerous outbuildings (sheds, etc.), 1 stream crossing (bridge), and 4 roadways downstream within the breach inundation zone.
- Provides protection for an average annual daily traffic (AADT) and their occupants on 21st Avenue in the 1,000 to 5,000 vehicles range and AADT for State Road 25 through the breach area in the 5,000 to 50,000 vehicle range. Traffic counts are not recorded for 2nd and 3rd Avenues.
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- 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 100 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current WVDEP and NRCS safety and performance standards.
- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Leverages federal resources to install the planned works of improvement.
- Will meet current WVDEP and NRCS safety and performance standards for a high hazard potential dam.

The various alternatives analyzed for the rehabilitation of this dam, along with their ecosystem services and environmental effects/impacts, are described in detail in the plan.

There will be no change in the current levels of flood protection downstream as a result of project activity. Project installation cost is estimated to be $21,311,000 of which $14,858,100 will be paid from the Small Watershed Program funds and $6,452,900 from nonfederal funds.

The electronic version of the Blakes Creek-Armour Creek Site 7 – Environmental Assessment is available for download from the NRCS website at https://www.nrcs.usda.gov/conservation-

basics/conservation-by-state/west-virginia/blakes-creek-armour-creek-site-7 after the August 12th public meeting.

Attera-Schnabel Joint Venture (contractor) has scheduled a public meeting to review the Plan-Environmental Assessment on August 12, 2024 5-7PM, at the Convention and Visitor's Bureau (201 21st St, Nitro, WV 25143). Virtual attendance is available via the link or call in information:

Public Meeting:
https://tinyurl.com/BAC7-Public-Meeting

Call in:
Phone number: +1 917-768-5183
Phone conference ID: 640 776 050#

We are requesting that comments on this draft plan be received by 1550 Earl Core Road, Suite 200, Morgantown, WV 26505 or email to Titus.Smith@usda.gov on or before September 12, 2024. If you have any questions, please contact Titus Smith at (304) 284-7562 or Titus.Smith@usda.gov. If your comments are not received by the due date, we will assume you do not wish to comment.

Sincerely,

Harold Russell, PhD, PE
Geotechnical Civil Engineer
USDA Natural Resources Conservation Service

Appendix A - Blakes Creek–Armour Creek No. 7 Agency and Tribal Correspondence

Notice of FONSI availability were sent to the following agencies and tribal organizations on July 17, 2025:

- Capital Conservation District
- City of Nitro
- Great Kanawha RCD Council
- Kanawha County Commissioners
- West Virgina Conservation Agency
- Western Conservation District
- West Virginia Department of Agriculture
- West Virginia Department of Environmental Protection
- West Virginia Division of Natural Resources
- USEPA
- USFWS
- USFS
- WVSHPO
- USACE
- Catawba Indian Nation
- Eastern Shawnee Tribe of Oklahoma

Example letters for Agencies and Tribes are provided below.

USDA
United States Department of Agriculture
Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505
Phone: (304) 284-7540
Fax: (855) 857-6448

July 17, 2025

Dr. Wenonah G. Haire
Tribal Historic Preservation Officer
Catawba Indian Nation
1536 Tom Steven Road
Rock Hill, SC 29730

RE: Notice of Availability of Finding of No Significant Impact (FONSI)
Blakes Creek Armour Creek Watershed
Watershed Rehabilitation Program
Nitro, Kanawha County, West Virginia

Dear Dr. Wenonah G. Haire,

Enclosed are copies of the Finding of No Significant Impact (FONSI) and the Notice of Finding of No Significant Impact for the Supplemental Watershed Plan – Environmental Assessment for the Blakes Creek-Armour Creek Watershed Dam No. 7 in Kanawha County, West Virginia. The local sponsor is the City of Nitro. This plan provides for the rehabilitation of Dam No. 7 with an economic evaluation life of 100 years after project completion. The watershed dam rehabilitation plan will be carried out with assistance from the USDA - Natural Resources Conservation Service.

Comments supporting or disagreeing with the decision not to prepare an Environmental Impact Statement may be submitted to the Natural Resources Conservation Service for consideration. All comments must be received within 30 days of the date of this notice. No action on implementation of this measure will be taken until 30 days after the publication of the Notice of Finding of No Significant Impact in the Charleston Gazette newspaper.

Sincerely,

Jon Bourdon
State Conservationist

Enclosures – Notice of Availability of Finding of No Significant Impact (FONSI)

USDA
United States Department of Agriculture
Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505
Phone: (304) 284-7540
Fax: (855) 857-6448

July 17, 2025

Colonel Jayson Putnam
U.S. Army Corps of Engineers, Huntington District
502 Eighth Street
Huntington, WV 25701

RE: Notice of Availability of Finding of No Significant Impact (FONSI)
Blakes Creek Armour Creek Watershed
Watershed Rehabilitation Program
Nitro, Kanawha County, West Virginia

Dear Colonel Jayson Putnam,

Enclosed are copies of the Finding of No Significant Impact (FONSI) and the Notice of Finding of No Significant Impact for the Supplemental Watershed Plan – Environmental Assessment for the Blakes Creek-Armour Creek Watershed Dam No. 7 in Kanawha County, West Virginia. The local sponsor is the City of Nitro. This plan provides for the rehabilitation of Dam No. 7 with an economic evaluation life of 100 years after project completion. The watershed dam rehabilitation plan will be carried out with assistance from the USDA - Natural Resources Conservation Service.

Comments supporting or disagreeing with the decision not to prepare an Environmental Impact Statement may be submitted to the Natural Resources Conservation Service for consideration. All comments must be received within 30 days of the date of this notice. No action on implementation of this measure will be taken until 30 days after the publication of the Notice of Finding of No Significant Impact in the Charleston Gazette newspaper.

Sincerely,

Jon Bourdon
State Conservationist

Enclosures – Notice of Availability of Finding of No Significant Impact (FONSI)

U.S. DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

Blakes Creek-Armour Creek Watershed, Kanawha County, West Virginia

AGENCY: Natural Resources Conservation Service

ACTION: Notice of Availability of Finding of No Significant Impact (FONSI)

SUMMARY: Pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969; the Council on Environmental Quality Guidelines (40 CFR Part 1500); and the Natural Resources Conservation Service Guidelines (7 CFR Part 650), the Natural Resources Conservation Service, U.S. Department of Agriculture, gives notice that a Finding of No Significant Impact has been prepared for the Blakes Creek-Armour Creek Watershed in Kanawha County, West Virginia.

FOR FURTHER INFORMATION CONTACT: Jon Bourdon, West Virginia State Conservationist, Natural Resources Conservation Service, 1550 Earl L. Core Road, Suite 200, Morgantown, West Virginia, 26505. Telephone: (304) 284-7540 or email: Jon.Bourdon@usda.gov.

SUPPLEMENTAL INFORMATION: A determination has been made by Jon Bourdon, NRCS State Conservationist in West Virginia, to issue a Finding of No Significant Impact for the proposed works of improvement for the rehabilitation of Dam No. 7 in the Blakes Creek-Armour Creek Watershed in Kanawha County, West Virginia. The Blakes Creek-Armour Creek Supplemental Watershed Plan-Environmental Assessment prepared for this project indicates that this Federal action will not cause significant adverse local, regional, or national impacts to the environment. Therefore, based on the above findings, Jon Bourdon has determined that an environmental impact

statement for the Blakes Creek-Armour Creek Watershed is not required. The sponsoring local organization (City of Nitro.) concur in this determination. Detailed information on the FONSI may be obtained from Jon Bourdon, NRCS State Conservationist in West Virginia at the above address, phone or email.

No administrative action on implementation of the proposed rehabilitation of Dam No. 7 will be taken until 30 days after the date of this publication in the Charleston Gazette newspaper.

_____ _____

Jon Bourdon
WV State Conservationist
USDA – NRCS
Morgantown, West Virginia

Date

[Catalog of Federal Domestic Assistance Program No. 10.904, Watershed Protection and Flood Prevention. Executive Order 12372 regarding State and local clearinghouse review of Federal and federally assisted programs and project is applicable].

Petr Masopust

From: Smith, Titus - FPAC-NRCS, WV <Titus.Smith@usda.gov>
Sent: Friday, November 1, 2024 10:35 AM
To: Tim Sweeney; Petr Masopust; Wade Biddix
Cc: Russell, Harold - FPAC-NRCS, Morgantown, WV
Subject: Blakes Creek Armour Creek 7- Final Draft Plan EA
Attachments: 2024_11_01.zip

Good morning Tim,

As per our conversation yesterday, here are the items you requested.

Attached are pdf copies of the template letters sent to the PPP; the letters between the tribes and the rest of the PPP are not identical.
The Final Public Meeting letters to the tribes were sent out on July 3rd, 2024. The certified letters have also been attached.
The Final Public Meeting letters sent to the remainder of the PPP were sent July 16th, 2024. The pdf letters sent have also been attached.

The Final Draft Plan EA was posted to our NRCS-WV website July 8th, 2024.

The news release was posted on social media (@ https://www.facebook.com/share/p/8bHQL5eBdDhDkgPa/), the City of Nitro website (@ https://cityofnitro.org/), to the newspaper (https://www.wvgazettemail.com/metrokanawha/public-input-sought-for-nitro-dam-rehabilitation-plan/article_ffdc5dc0-584b-560b-ae54-a3f524731ca3.html), inside Nitro City Hall, and inside the Nitro Public Library on July 26th, 2024.

NRCS-WV and the City of Nitro did not receive any comments on the public, agencies, tribes, or organizations during the interagency and public comment period (08/12/2024-09/12/2024).

In the Final Draft Plan-EA, there are no additional comments from NRCS-WV.

I will continue to work on finalizing the FONSI and Notice as soon as possible.

Thank you,

Titus Smith, E.I.
Civil Engineer
West Virginia State Office | Engineering Section

USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE
1550 Earl L. Core Road, Suite 200, Morgantown, WV 26505
p: (304)-284-7562| c: (304)-322-5401
e: Titus.Smith@usda.gov | w: www.nrcs.usda.gov/westvirginia

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NITRO
A Living Memorial to World War I

Jon Bourdon
NRCS WV State Conservationist
1550 Earl Core Avenue
Morgantown, WV 26505

Dear Mr. Bourdon,

The City of Nitro is requesting approval to modify the designation of Sponsoring Local Organizations (SLO) for Blakes Creek-Armour Creek Site 7 Supplemental Watershed Agreement for the dam rehabilitation project.

The City of Nitro, Kanawha County Commission, Western Conservation District, and the Capitol Conservation District were all SLOs on the latest version of the Supplemental Watershed Agreement Number 3 (dated August 20, 1971). Since that time, changes within the various organizations have necessitated that only the City of Nitro will enter into Supplemental Watershed Agreement Number 4 for the dam rehabilitation project. The City of Nitro will enter into this watershed agreement, acknowledging that it will be the SLO eligible for future USDA NRCS PL-566 Watershed Rehabilitation program funding for the rehabilitation of the Blakes Creek Armour Creek Site 7 and associated recreation facilities.

All parties acknowledge that the request will not modify the current Operation and Maintenance (O&M) agreement as amended on September 23, 2002. The City of Nitro, Capitol Conservation District, and West Virginia State Conservation Committee are responsible for O&M and are referred to as the Sponsors in the O&M Agreement. The O&M agreement will be amended for the watershed rehabilitation project before obligating implementation funding.

Signed,

Dave Casebolt

DAVE CASEBOLT
MAYOR
304-755-0705

P. O. BOX 308
NITRO, WEST VIRGINIA 25143

RICH HIVELY
RECORDER
304-755-0707

NITRO
A Living Memorial to World War I

Supplemental Watershed Agreement No. 4

For Blakes Creek Armour Creek Site 7 in Kanawha County, West Virginia

By

Exchange of Correspondence

(also contained in Supplemental Watershed Plan)

Since the original watershed work plan agreement was signed on March 7, 1966 and supplemented by agreements in February 27, 1969, June 22, 1971, and August 20, 1971, it has become necessary to modify the agreement to designate the Sponsoring Local Organization (SLO) responsible for entering into a watershed agreement with the Natural Resources Conservation Service for watershed rehabilitation of Blakes Creek Armour Creek Site 7 and associated recreation facilities. This paragraph clarifies that the City of Nitro is designated as the SLO to enter into an agreement with the Natural Resources Conservation Service for the watershed rehabilitation project.

This EOC does not modify the current Operation and Maintenance (O&M) agreement as amended on September 23, 2002. The City of Nitro, Capitol Conservation District, and West Virginia State Conservation Committee are responsible for O&M and are referred to as the Sponsors in the O&M Agreement. The O&M agreement will be amended for the watershed rehabilitation project before obligating implementation funding.

The parties below concur with the proposed changes to signatories for the Blakes Creek Armour Creek Supplemental Watershed Agreement No. 4:

DAVE CASEBOLT
MAYOR
304-755-0705

P. O. BOX 308
NITRO, WEST VIRGINIA 25143

RICH HIVELY
RECORDER
304-755-0707

Dave Casebolt 8/28/25

Mayor, City of Nitro Date

2025-446

At a Regular Session of the County Commission of Kanawha County, West Virginia, held at the Courthouse thereof, on the 11th day of September, 2025, the following Order was made and entered:

SUBJECT: Order Authorizing the President of the Kanawha County Commission to sign the Supplemental Watershed Agreement No. 4 for Blakes Creek Armour Creek Site 7 in Kanawha County West Virginia by Exchange of Correspondence

The following Motion was offered by **Ben Salango**, Commissioner:

The County Commission of Kanawha County, West Virginia hereby the President of the Kanawha County Commission to sign the Supplemental Watershed Agreement No. 4 for Blakes Creek Armour Creek Site 7 in Kanawha County West Virginia by Exchange of Correspondence (copies are attached hereto and made a part hereof).

The adoption of the foregoing Motion having been moved by:

Ben Salango, Commissioner, and duly seconded by:

Lance Wheeler, Commissioner, the vote thereon was as follows:

Ben Salango, President	**AYE**
Lance Wheeler, Commissioner	**AYE**
Natalie E. Tennant, Commissioner	**AYE**

WHEREUPON, Ben Salango, President declared said Motion duly adopted; and it is therefore **ADJUDGED** and **ORDERED** that said Motion be, and the same is hereby adopted.

Ben Salango, President

Lance Wheeler, Commissioner

Natalie E. Tennant, Commissioner

Approved by:

Marc J. Slotnick, County Attorney

Supplemental Watershed Agreement No 4

For Blakes Creek Armour Creek Site 7 in Kanawha County, West Virginia

By

Exchange of Correspondence

(also contained in Supplemental Watershed Plan)

Since the original watershed work plan agreement was signed on March 7, 1966 and supplemented by agreements in February 27, 1969, June 22, 1971, and August 20, 1971, it has become necessary to modify the agreement to designate the Sponsoring Local Organization (SLO) responsible for entering into a watershed agreement with the Natural Resources Conservation Service for watershed rehabilitation of Blakes Creek Armour Creek Site 7 and associated recreation facilities. This paragraph is clarified to designate the City of Nitro as the SLO to enter into agreement with the Natural Resources Conservation Service for the watershed rehabilitation project.

This EOC does not modify the current Operation and Maintenance (O&M) agreement as amended on September 23, 2002. The City of Nitro, Capitol Conservation District, and West Virginia State Conservation Committee are responsible for O&M and are referred to as the Sponsors in the O&M Agreement. The O&M agreement will be amended for the watershed rehabilitation project prior to obligating implementation funding.

The below parties concur with the proposed changes to signatories for the Blakes Creek Armour Creek Supplemental Watershed Agreement No 4:

9-11-25

President, Kanawha County Commission Date

Supplemental Watershed Agreement No 4

For Blakes Creek Armour Creek Site 7 in Kanawha County, West Virginia

By

Exchange of Correspondence

(also contained in Supplemental Watershed Plan)

Since the original watershed work plan agreement was signed on March 7, 1966 and supplemented by agreements in February 27, 1969, June 22, 1971, and August 20, 1971, it has become necessary to modify the agreement to designate the Sponsoring Local Organization (SLO) responsible for entering into a watershed agreement with the Natural Resources Conservation Service for watershed rehabilitation of Blakes Creek Armour Creek Site 7 and associated recreation facilities. This paragraph is clarified to designate the City of Nitro as the SLO to enter into agreement with the Natural Resources Conservation Service for the watershed rehabilitation project.

This EOC does not modify the current Operation and Maintenance (O&M) agreement as amended on September 23, 2002. The City of Nitro, Capitol Conservation District, and West Virginia State Conservation Committee are responsible for O&M and are referred to as the Sponsors in the O&M Agreement. The O&M agreement will be amended for the watershed rehabilitation project prior to obligating implementation funding.

The below parties concur with the proposed changes to signatories for the Blakes Creek Armour Creek Supplemental Watershed Agreement No 4:

Charles T. Lippard 10/16/2025

Chairman, Western Conservation District Date

Supplemental Watershed Agreement No 4

For Blakes Creek Armour Creek Site 7 in Kanawha County, West Virginia

By

Exchange of Correspondence

(also contained in Supplemental Watershed Plan)

Since the original watershed work plan agreement was signed on March 7, 1966 and supplemented by agreements in February 27, 1969, June 22, 1971, and August 20, 1971, it has become necessary to modify the agreement to designate the Sponsoring Local Organization (SLO) responsible for entering into a watershed agreement with the Natural Resources Conservation Service for watershed rehabilitation of Blakes Creek Armour Creek Site 7 and associated recreation facilities. This paragraph is clarified to designate the City of Nitro as the SLO to enter into agreement with the Natural Resources Conservation Service for the watershed rehabilitation project.

This EOC does not modify the current Operation and Maintenance (O&M) agreement as amended on September 23, 2002. The City of Nitro, Capitol Conservation District, and West Virginia State Conservation Committee are responsible for O&M and are referred to as the Sponsors in the O&M Agreement. The O&M agreement will be amended for the watershed rehabilitation project prior to obligating implementation funding.

The below parties concur with the proposed changes to signatories for the Blakes Creek Armour Creek Supplemental Watershed Agreement No 4:

Jerry D Pierson 10-15-25

Chairman, Capitol Conservation District Date

Natural Resources Conservation Service

UNITED STATES DEPARTMENT OF AGRICULTURE

Approved by:

_____

Jon Bourdon

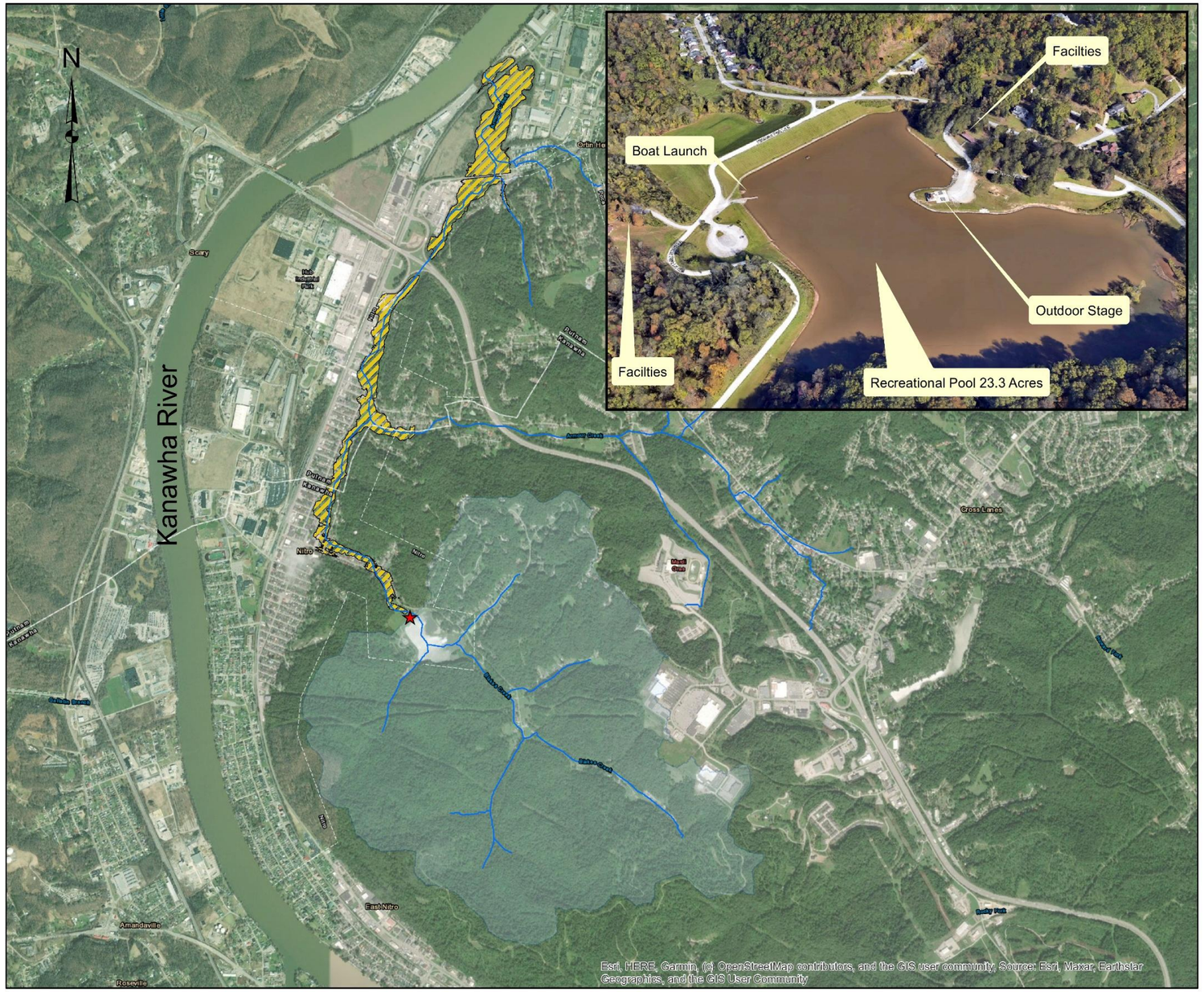
State Conservationist

Date: _____

APPENDIX B

PROJECT MAP

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Project Map

1 inch = 2,250 feet

0 0.25 0.5 1 Miles

Legend

- Blakes Creek Site 7
- Streams
- Ridenour Lake Watershed
- Area Benefitted



ATERRA SOLUTIONS | Schnabel ENGINEERING

Figure B-1 - Project Map

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APPENDIX C

SUPPORT MAPS

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VICINITY MAP

Legend

- Streams
- Major Road
- Area of Initial Analysis
- FEMA 100 yr Flood Zone
- Dam Catchment

Map Date: 3/8/2021
Sources: Esri, DeLorme, HERE, USGS, et.al 2020; Google Earth 2015, USGS 2019a, FEMA 2020; USDOT 1997
Projection: NAD 1983 2011 StatePlane West Virginia South FIPS 4702 FtUS

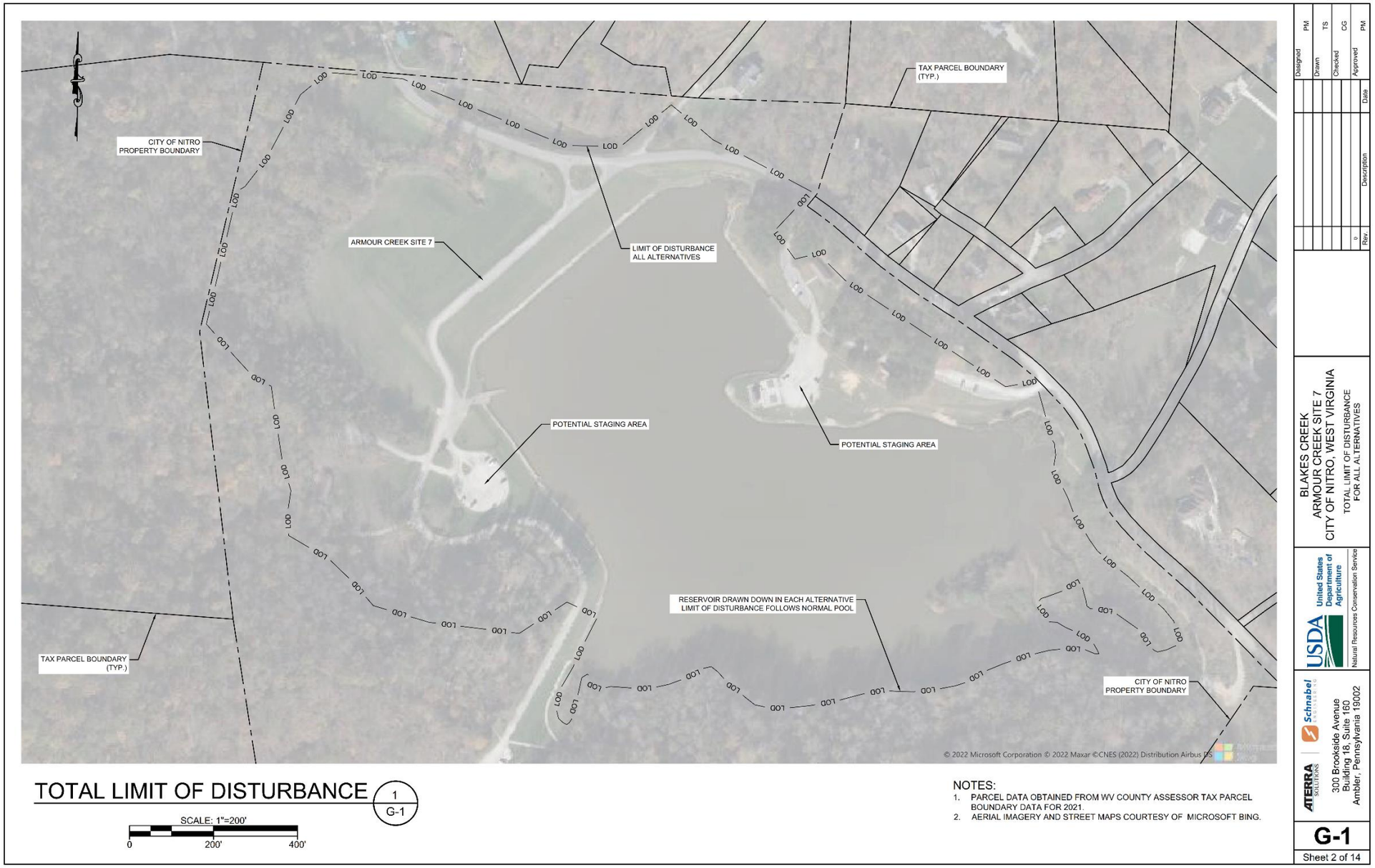
0 0.25 0.5 Miles

March 2021

Dam Site No. 7
Blakes/Armour Creek Watershed
Nitro, West Virginia

Figure 1
Site Overview Aerial

Figure C- 1 – Area of Initial Analysis



TOTAL LIMIT OF DISTURBANCE 1 G-1

SCALE: 1"=200'

0 200' 400'

NOTES:
1. PARCEL DATA OBTAINED FROM WV COUNTY ASSESSOR TAX PARCEL BOUNDARY DATA FOR 2021.
2. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

Designed	PM
Drawn	TS
Checked	CG
Approved	PM

Rev.	Description	Date
0		

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
TOTAL LIMIT OF DISTURBANCE
FOR ALL ALTERNATIVES

United States Department of Agriculture
USDA
Natural Resources Conservation Service

Schnabel Engineering
ATERRA Solutions
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

G-1

Sheet 2 of 14

Figure C- 2 – Limits of Disturbance

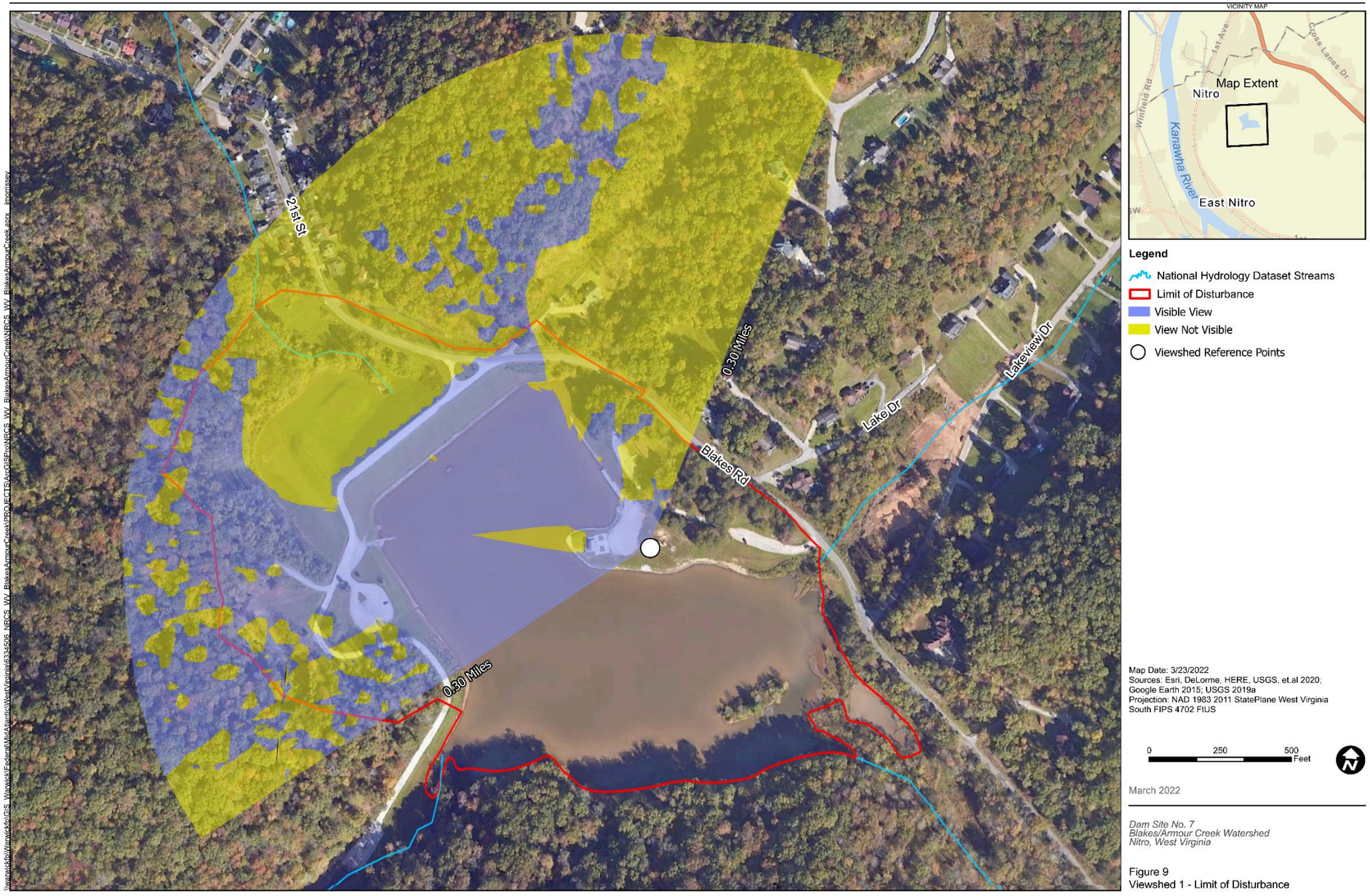


Figure C- 3 – Line of Sight Viewshed 1

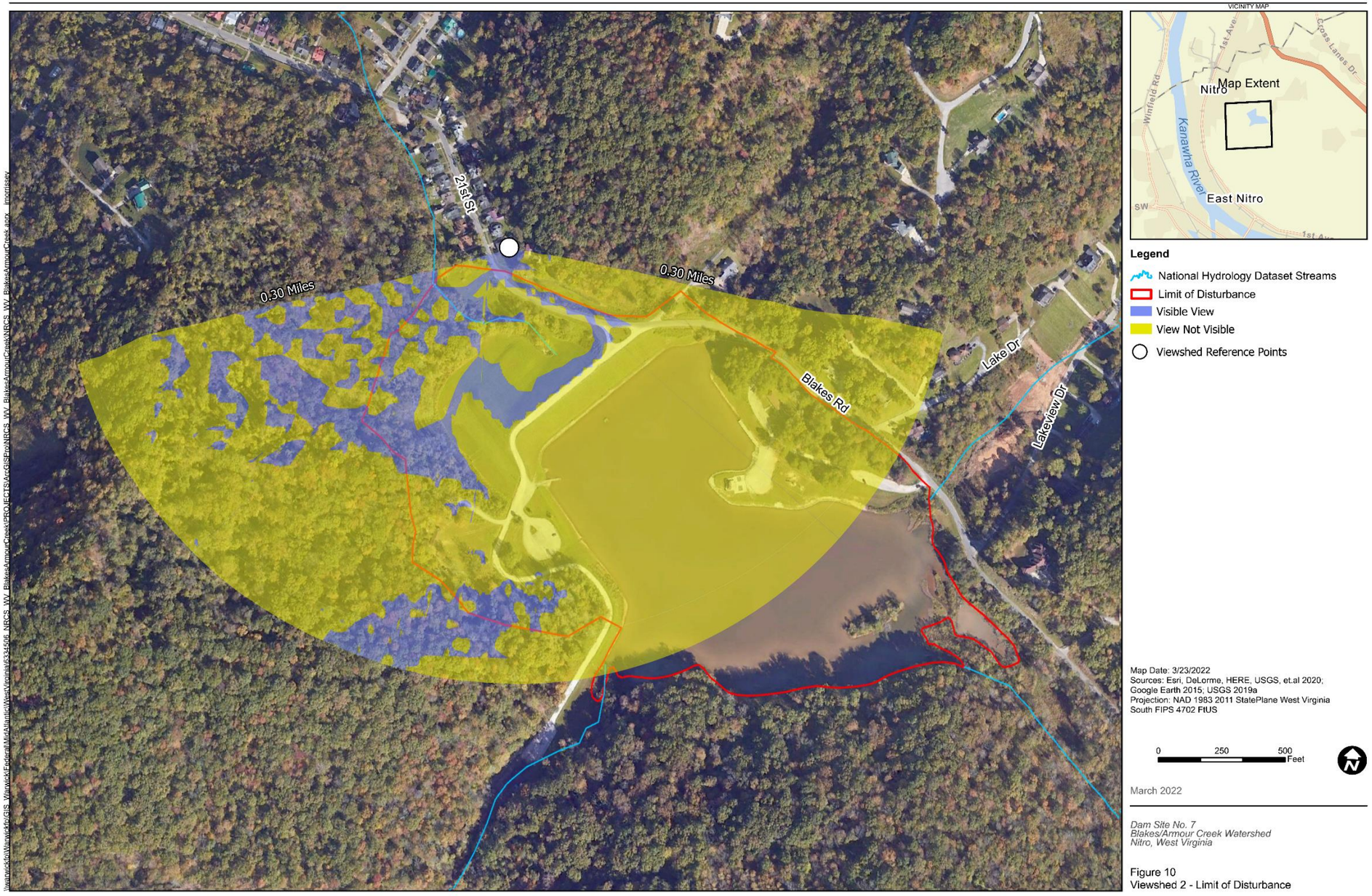


Figure C- 4 – Line of Sight Viewshed 2

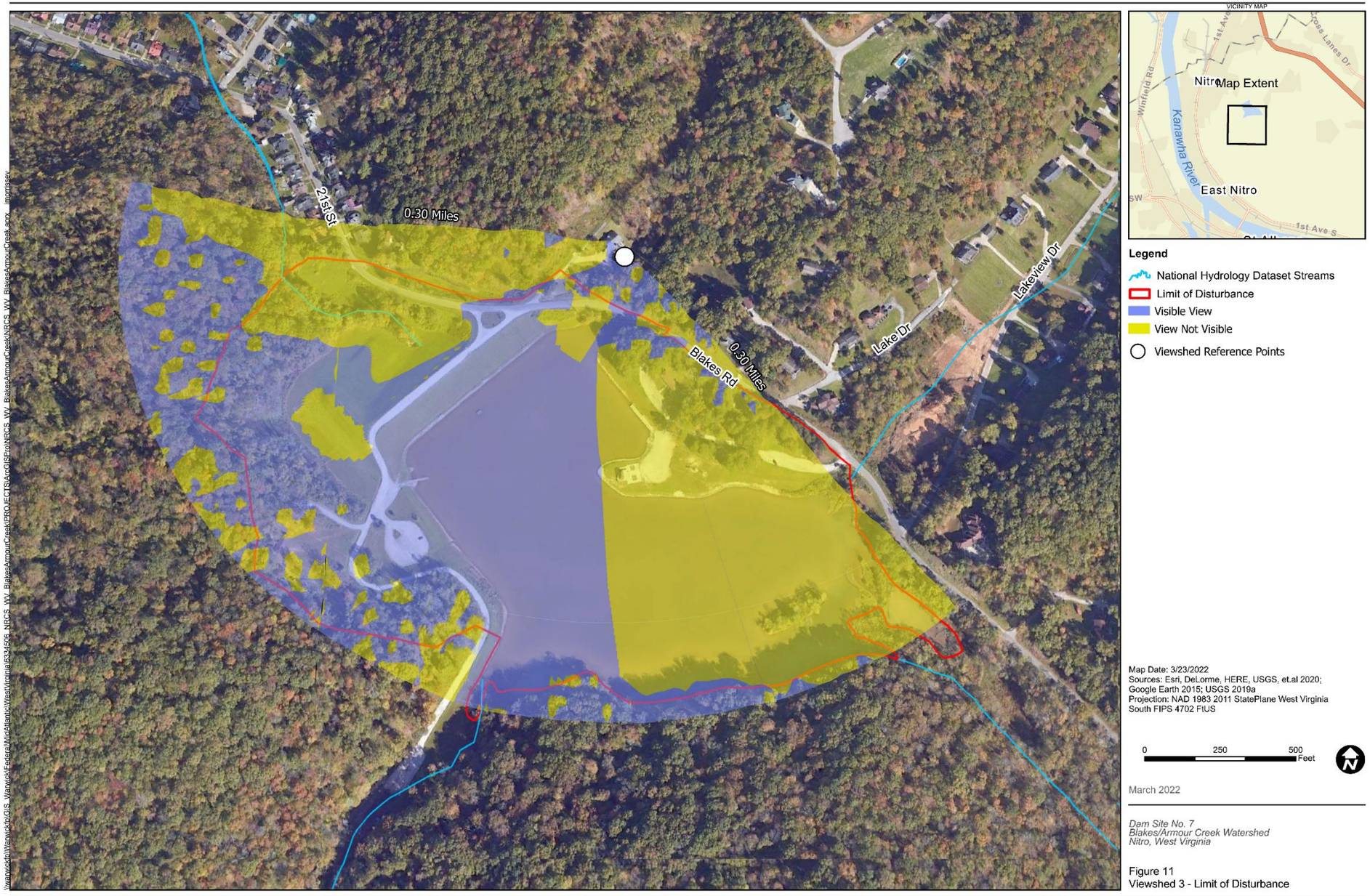
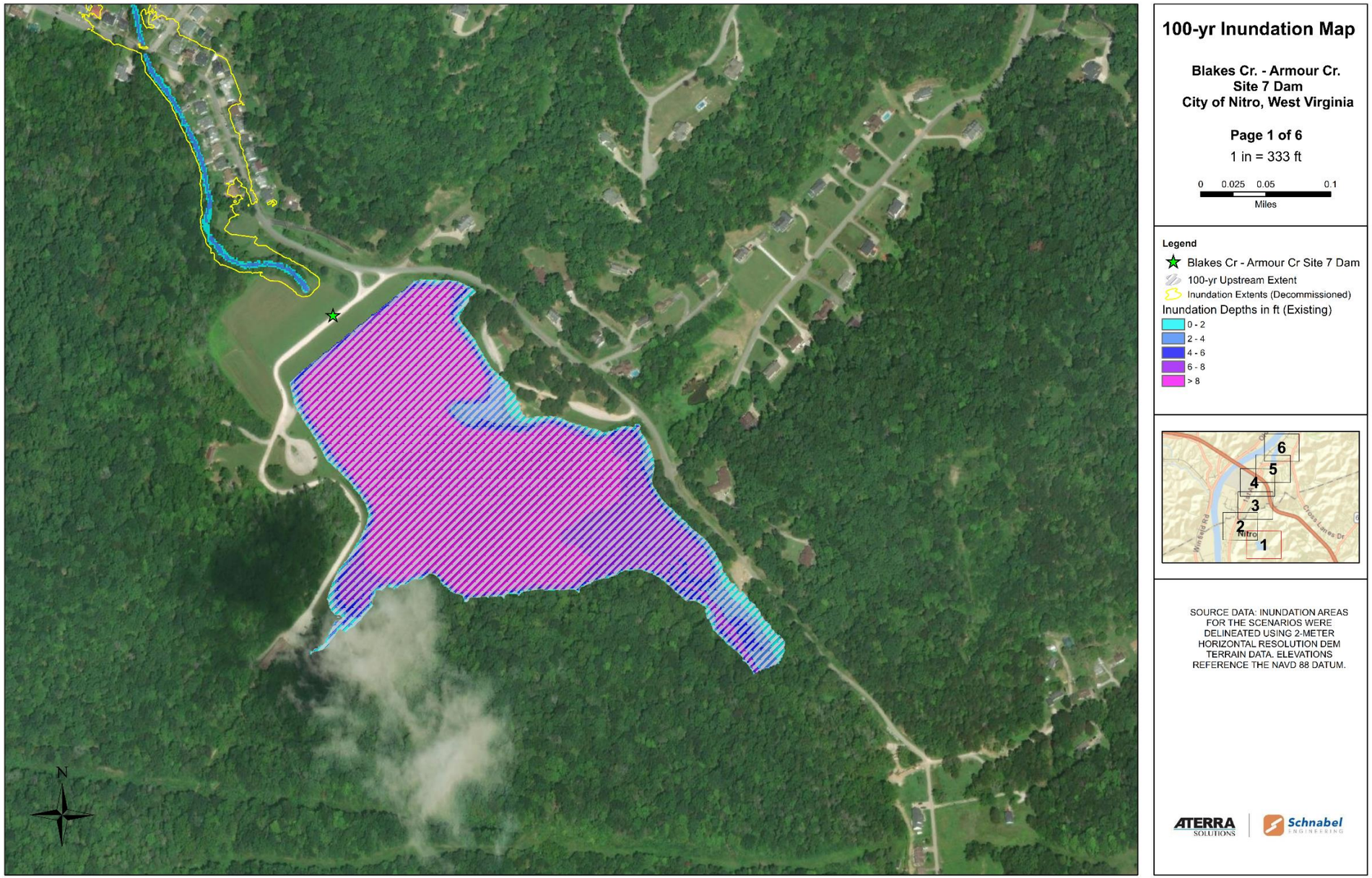


Figure C- 5 – Line of Sight Viewshed 3



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 1 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

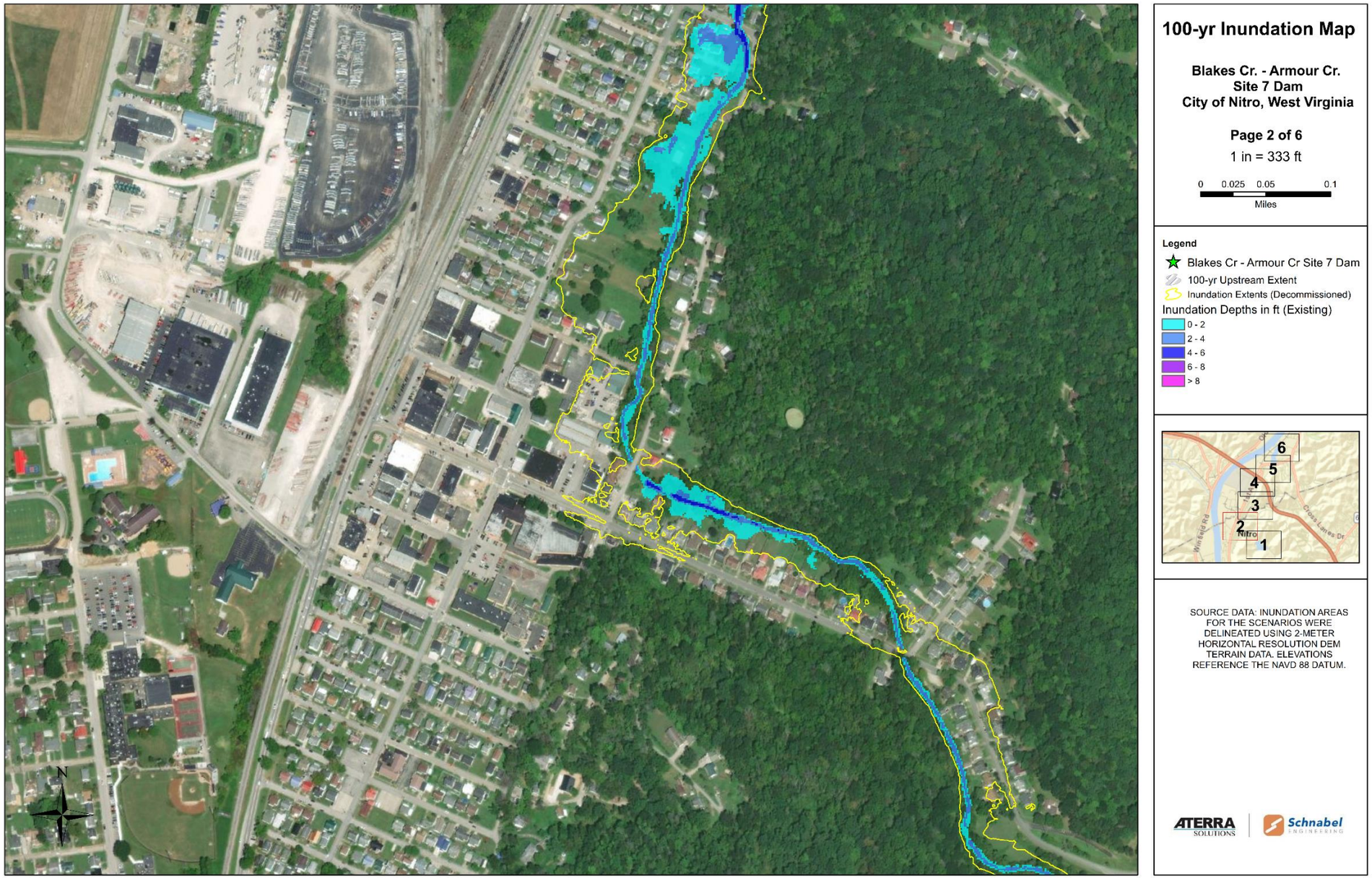
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 6 – 100-Year Floodplain Map (Page 1 of 6)



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 2 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

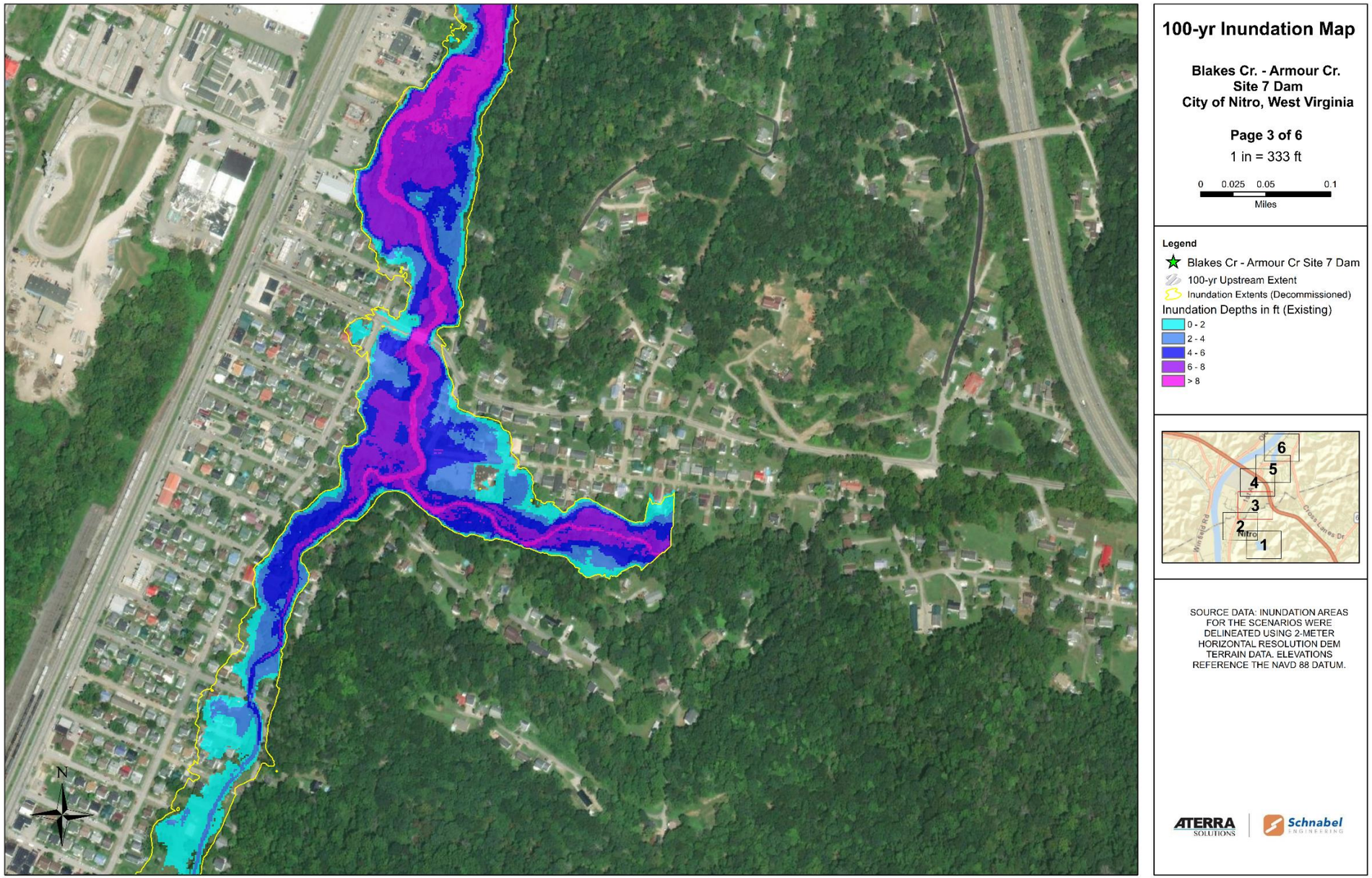
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 7 - 100-Year Floodplain Map (Page 2 of 6)



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 3 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

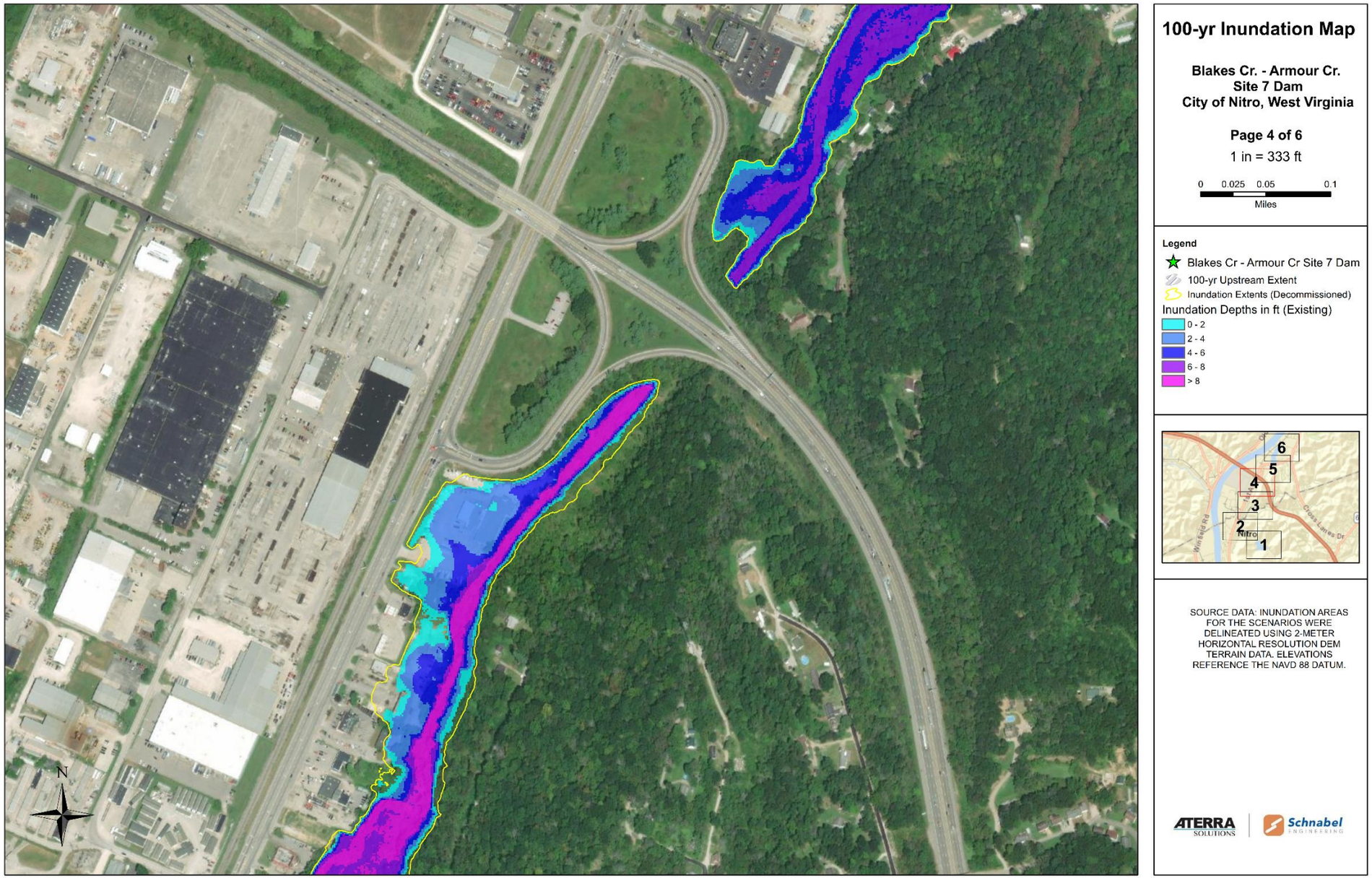
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 8 - 100-Year Floodplain Map (Page 3 of 6)



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 4 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

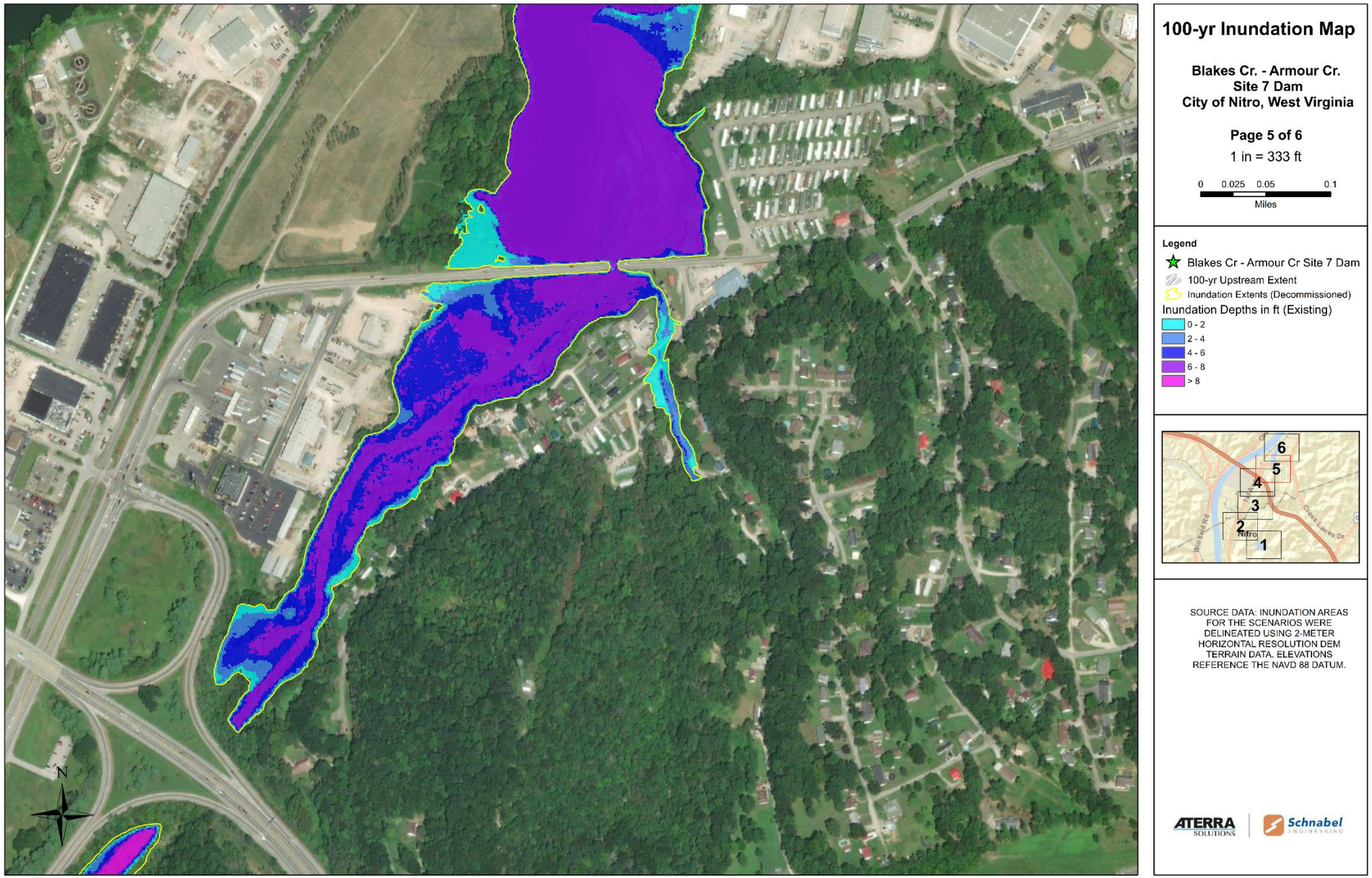
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 9 - 100-Year Floodplain Map (Page 4 of 6)



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 5 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

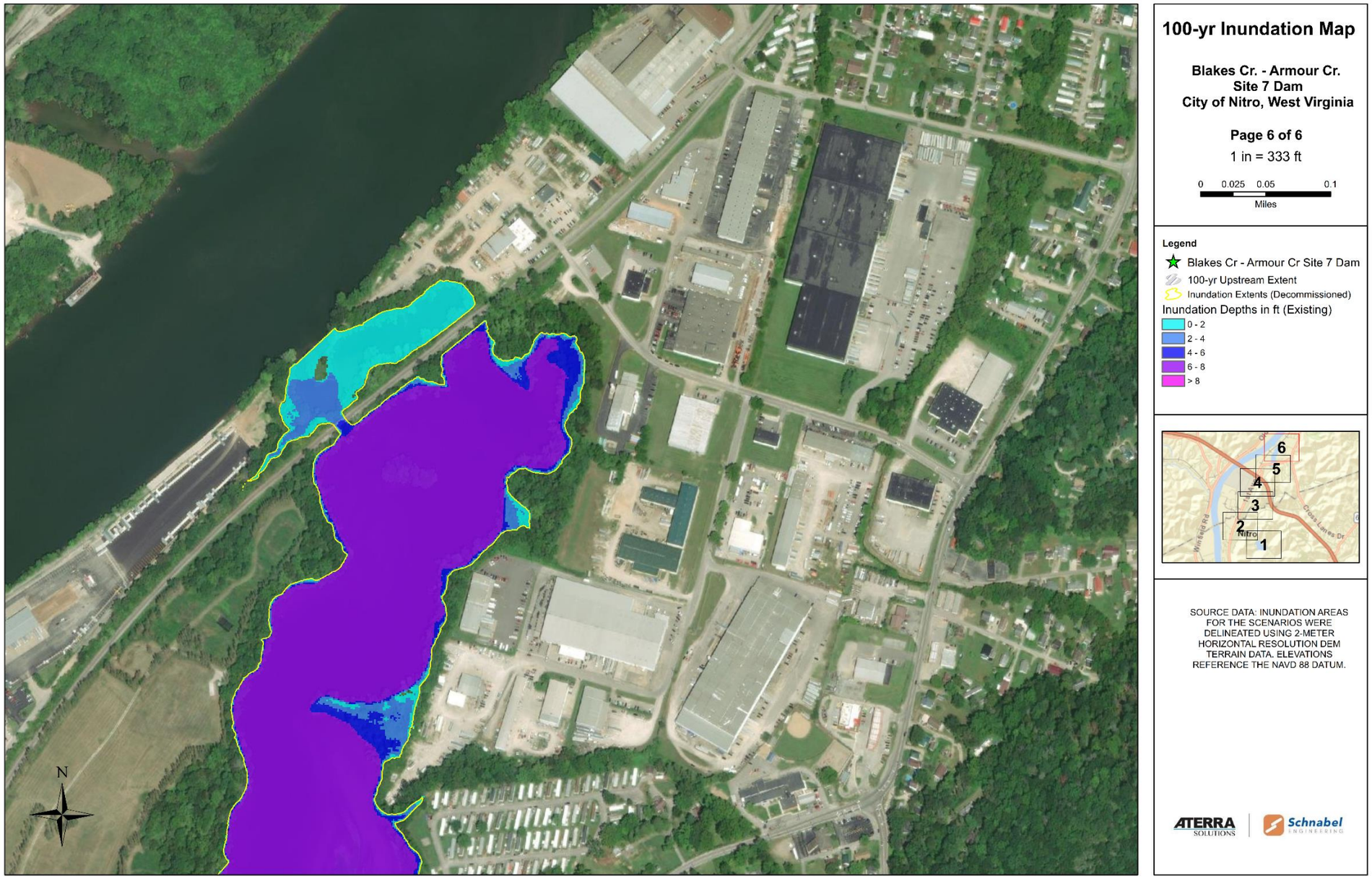
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 10 - 100-Year Floodplain Map (Page 5 of 6)



100-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 6 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 100-yr Upstream Extent
- Inundation Extents (Decommissioned)

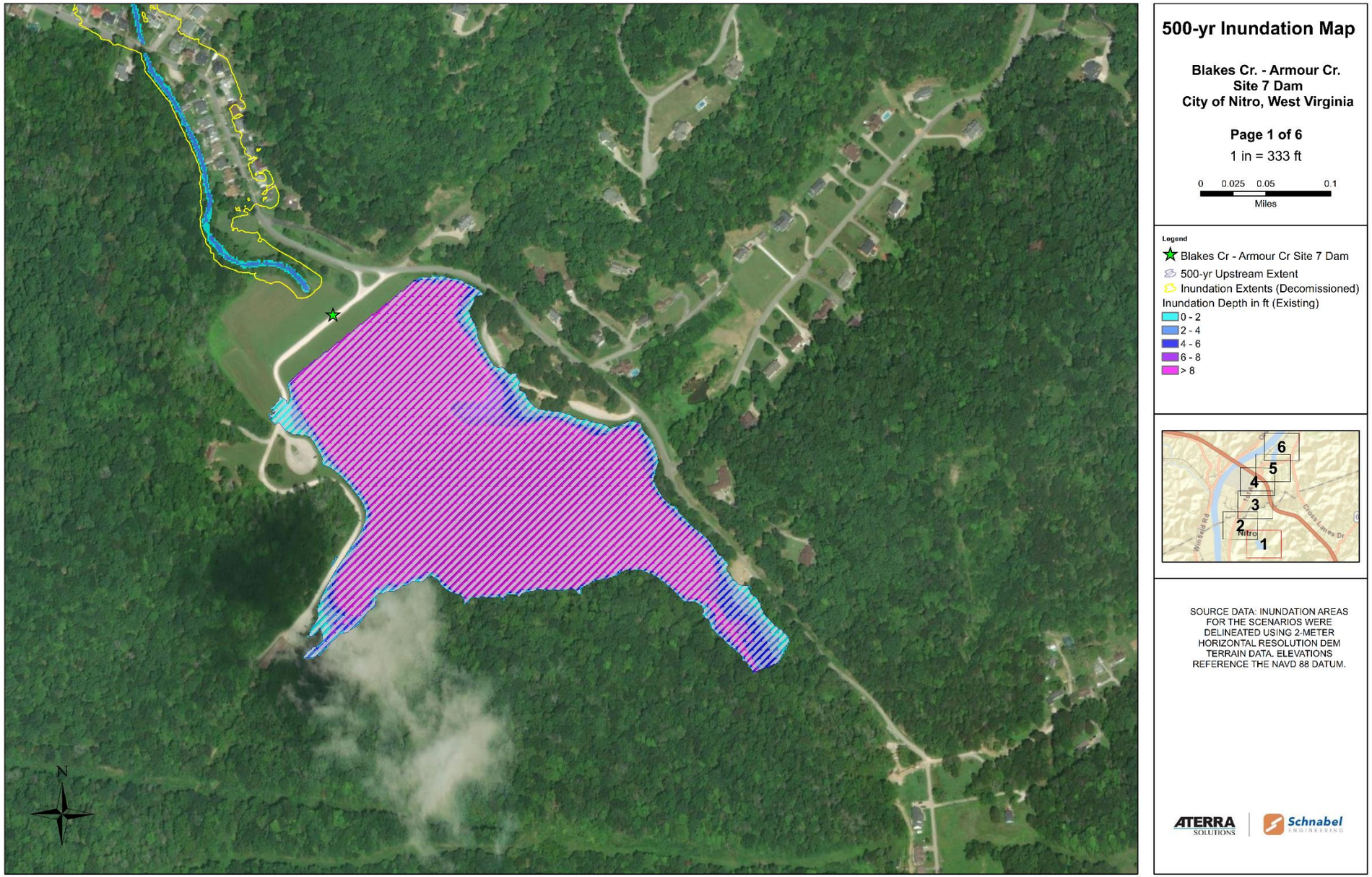
Inundation Depths in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 11 - 100-Year Floodplain Map (Page 6 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 1 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

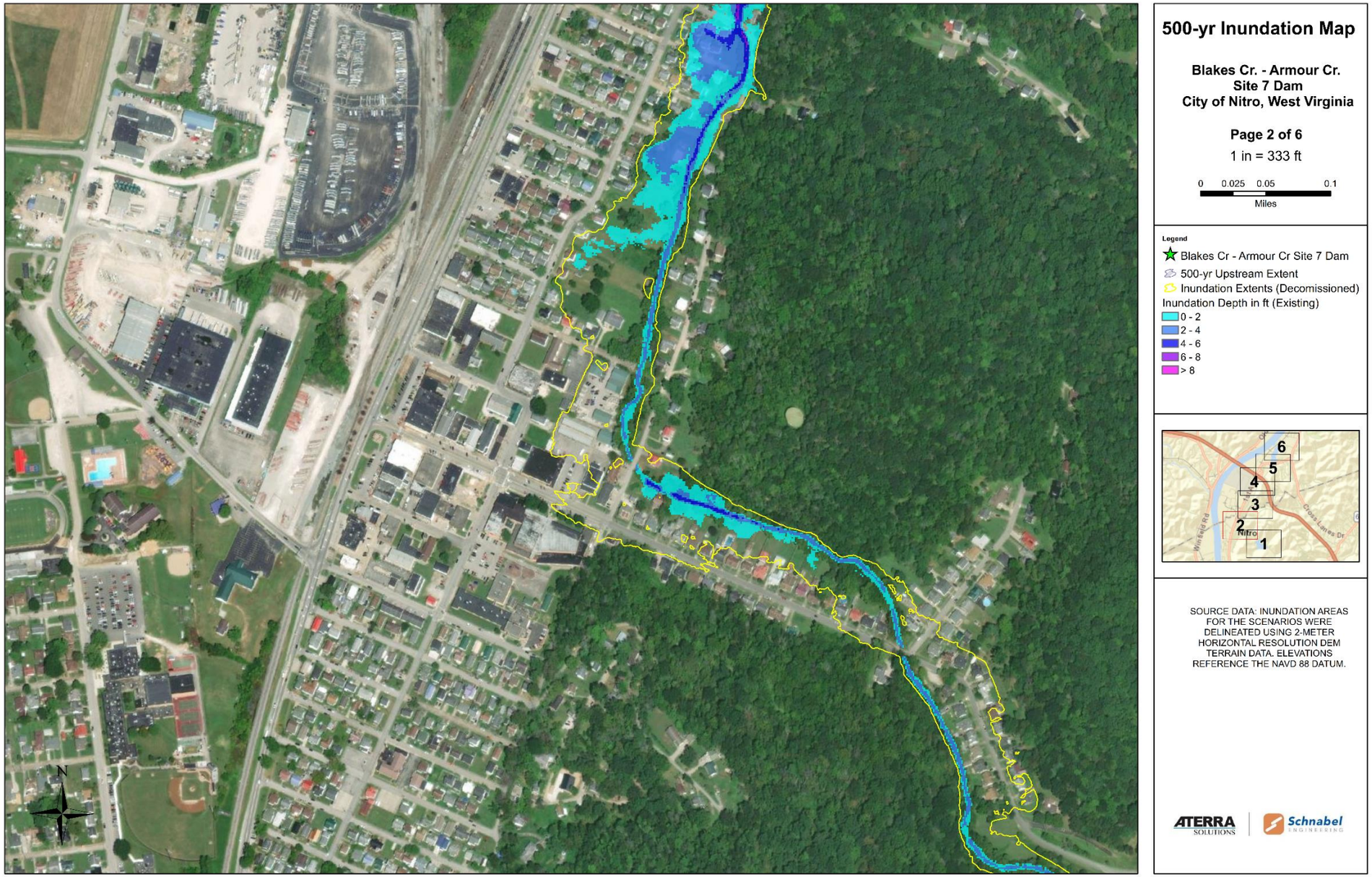
Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 12 - 500-Year Floodplain Map (Page 1 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 2 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

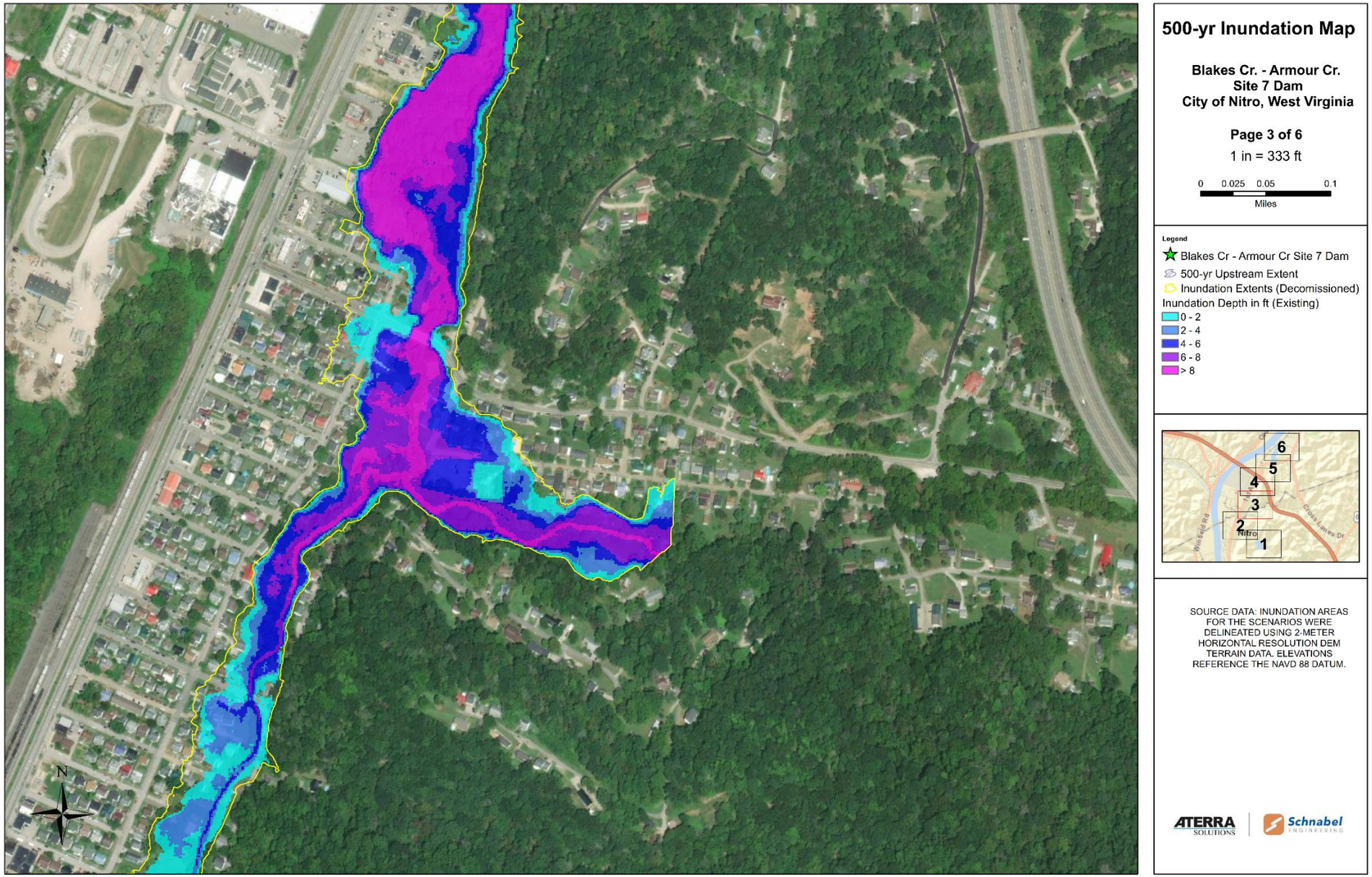
Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 13 - 500-Year Floodplain Map (Page 2 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 3 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

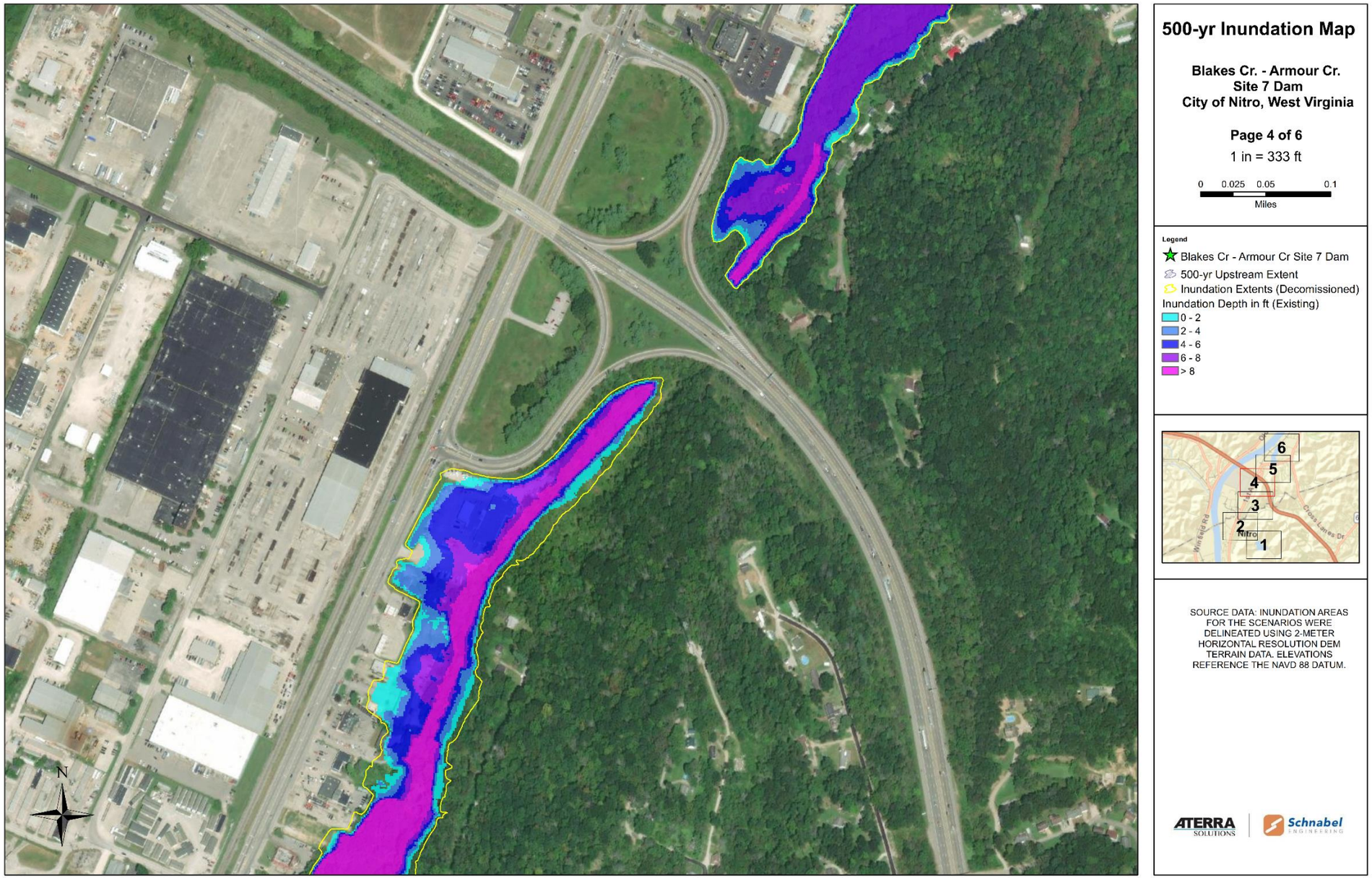
Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 14 - 500-Year Floodplain Map (Page 3 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 4 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

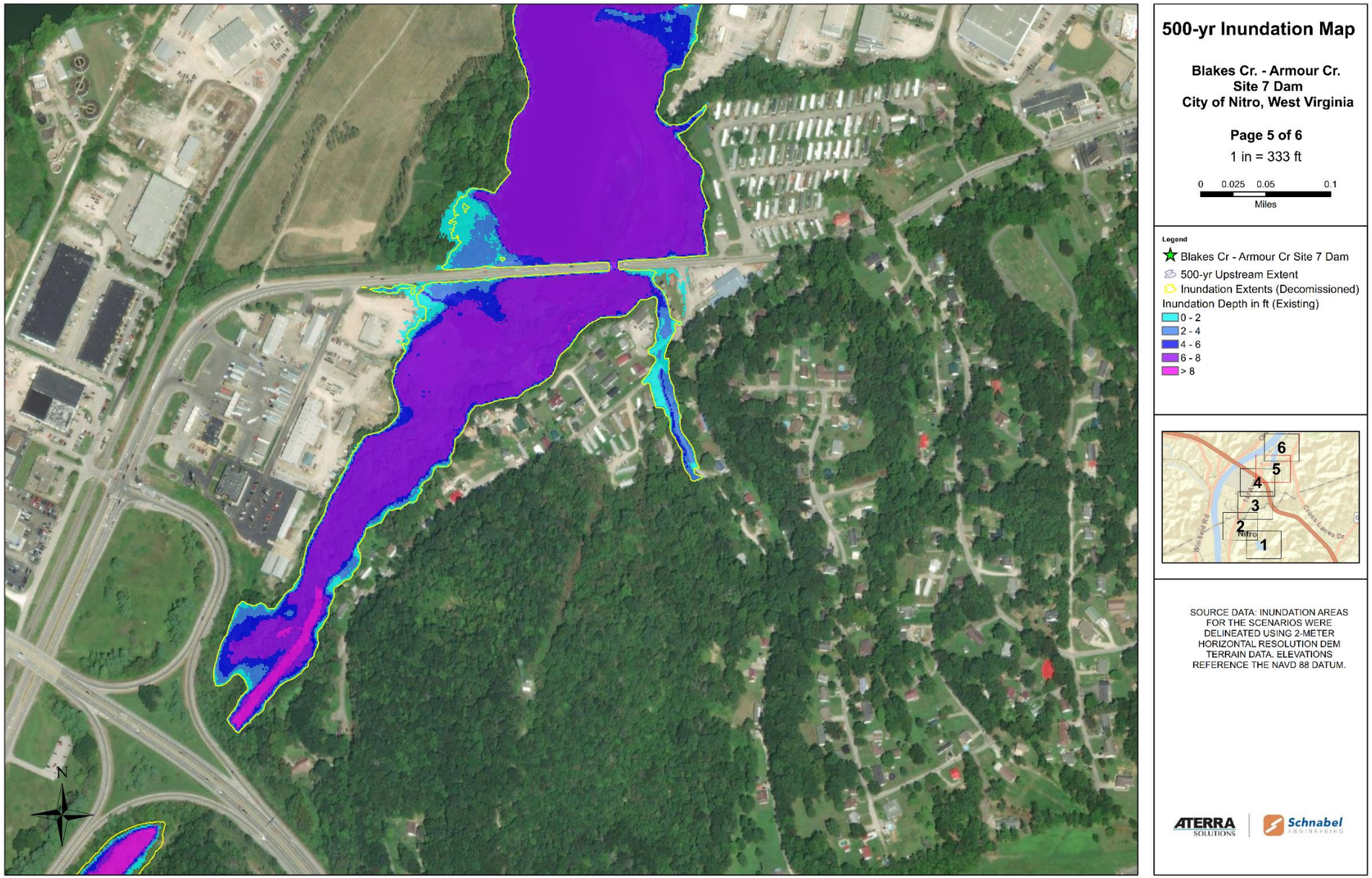
Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 15 - 500-Year Floodplain Map (Page 4 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 5 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

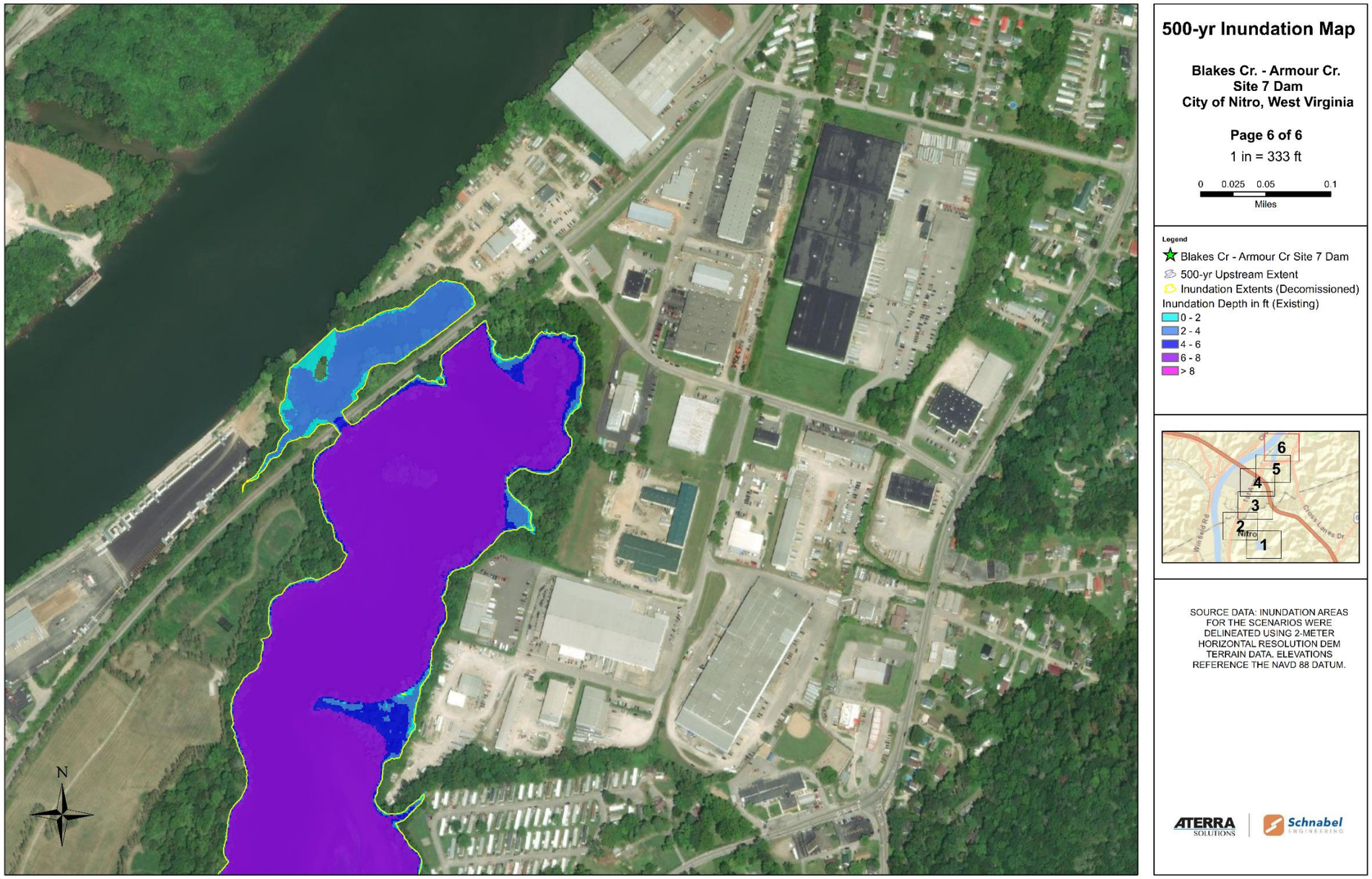
Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 16 - 500-Year Floodplain Map (Page 5 of 6)



500-yr Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 6 of 6

1 in = 333 ft

0 0.025 0.05 0.1
Miles

Legend

- Blakes Cr - Armour Cr Site 7 Dam
- 500-yr Upstream Extent
- Inundation Extents (Decomissioned)

Inundation Depth in ft (Existing)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- > 8

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 17 - 500-Year Floodplain Map (Page 6 of 6)

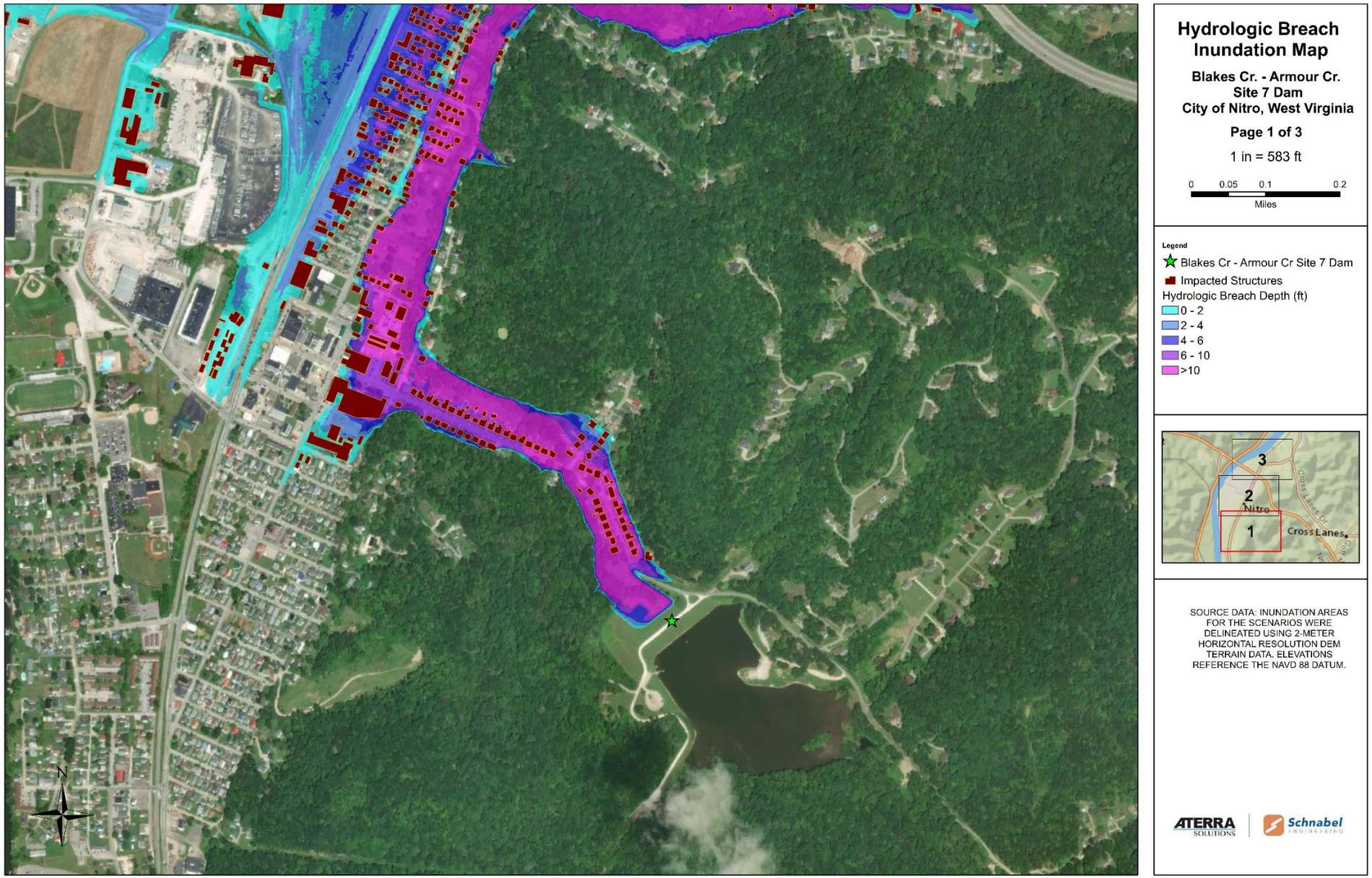
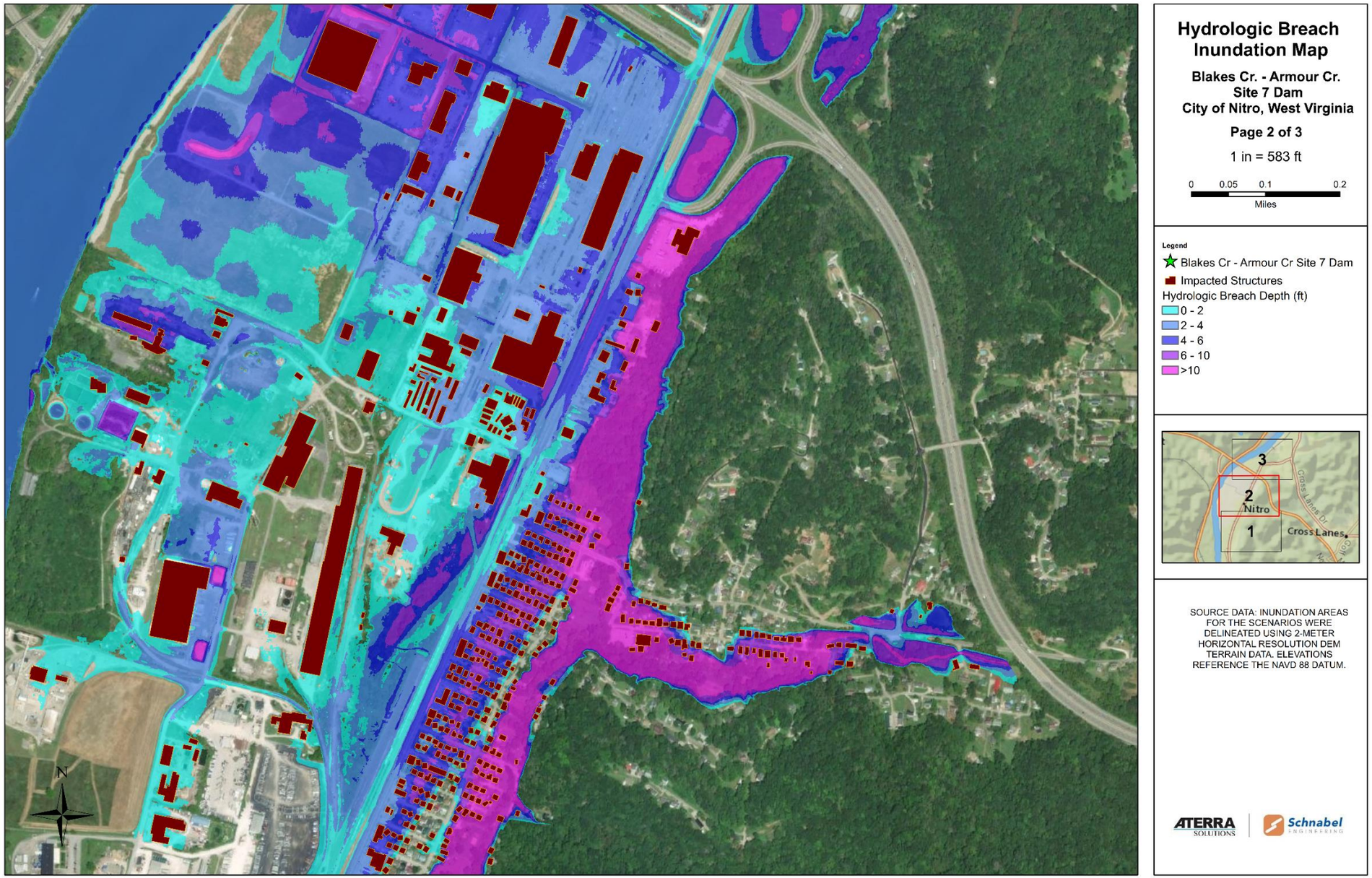


Figure C- 18 –PMF Breach Inundation Map (Page 1 of 3)



Hydrologic Breach Inundation Map

Blakes Cr. - Armour Cr.
Site 7 Dam
City of Nitro, West Virginia

Page 2 of 3

1 in = 583 ft

0 0.05 0.1 0.2
Miles

Legend
Blakes Cr - Armour Cr Site 7 Dam
Impacted Structures
Hydrologic Breach Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 10
>10

SOURCE DATA: INUNDATION AREAS FOR THE SCENARIOS WERE DELINEATED USING 2-METER HORIZONTAL RESOLUTION DEM TERRAIN DATA. ELEVATIONS REFERENCE THE NAVD 88 DATUM.

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Figure C- 19 - PMF Breach Inundation Map (Page 2 of 3)

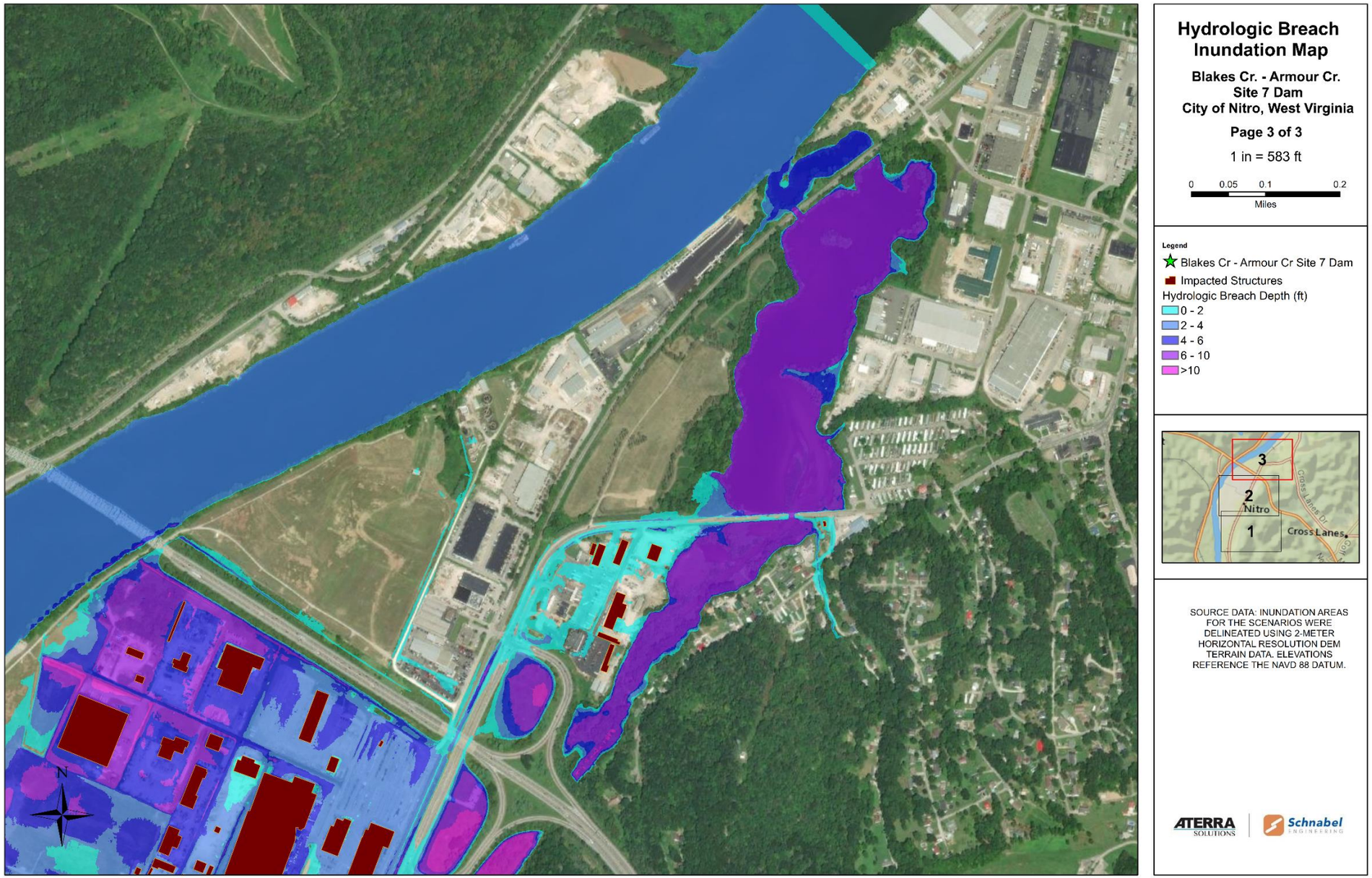
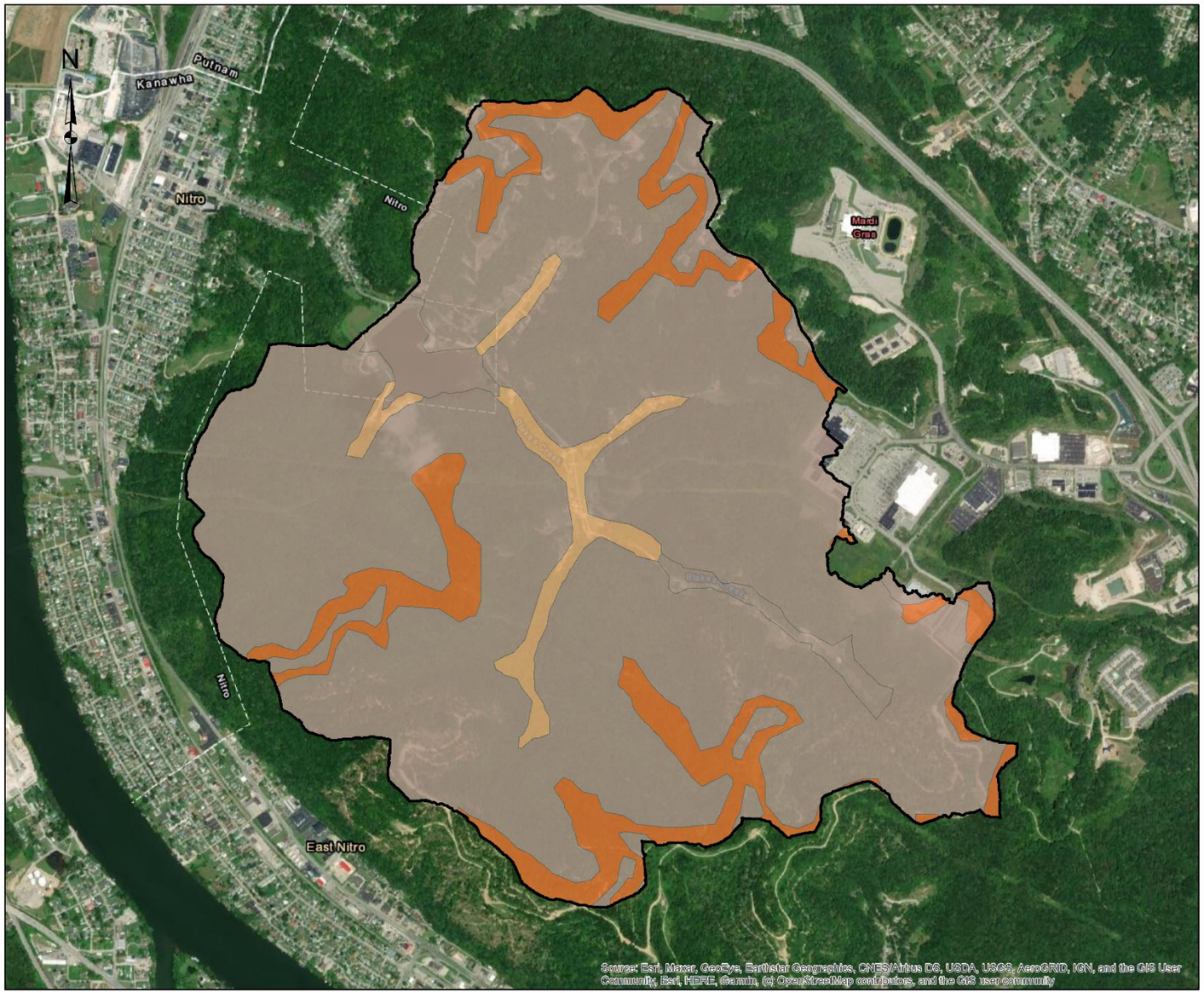


Figure C- 20 - PMF Breach Inundation Map (Page 3 of 3)



Hydrologic Soil Group

Blakes Creek Site 7
Kanawha County, WV

1 inch = 1,250 feet

0 0.125 0.25 0.5 Miles

Legend

Ridenour Lake Watershed

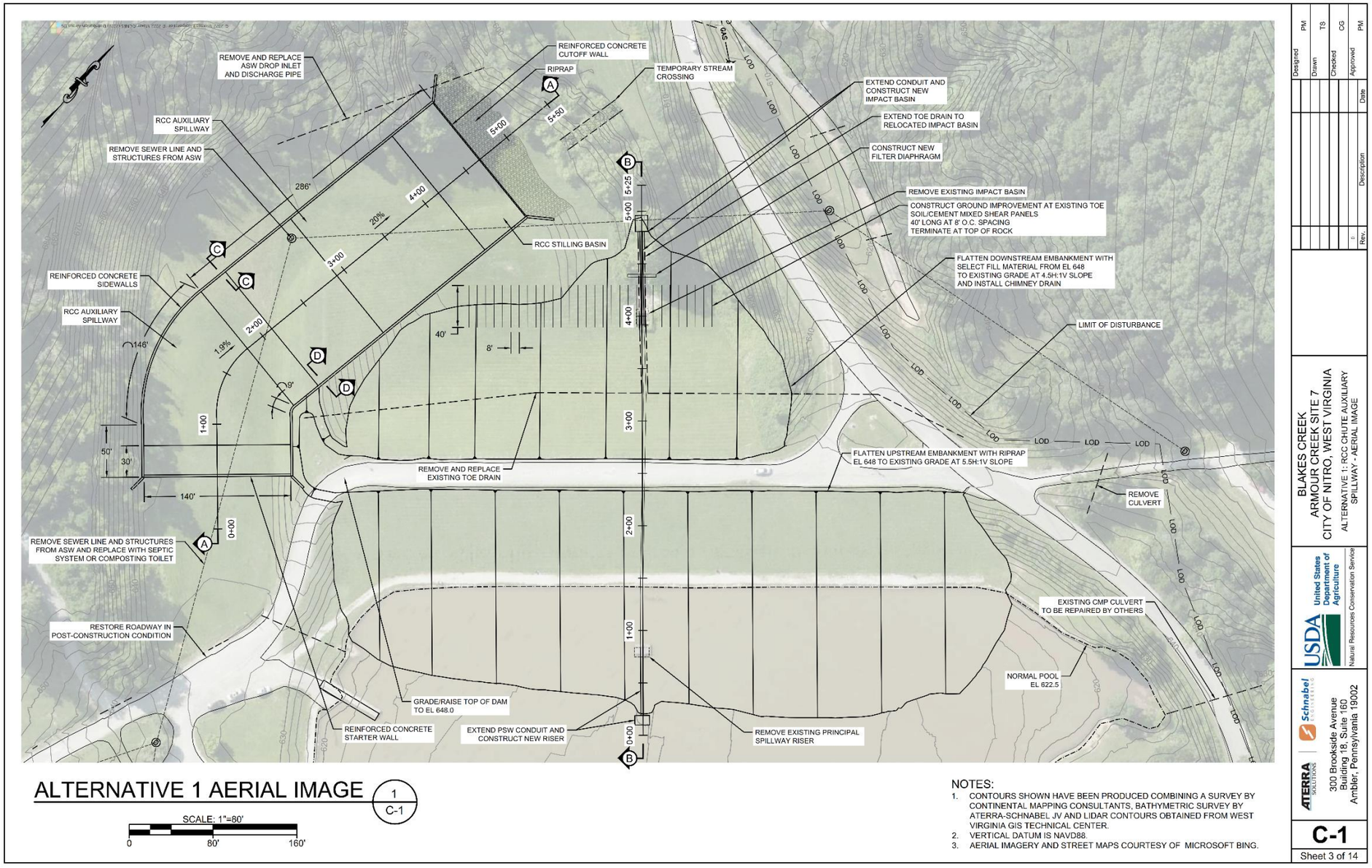
Hydrologic Soil Group

A
B
C



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Figure C- 21 – Hydrologic Soil Group



ALTERNATIVE 1 AERIAL IMAGE (1 / C-1)

SCALE: 1"=80'

0 80' 160'

NOTES:
1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.
3. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

Designed PM | Drawn TS | Checked CG | Approved PM

Rev.	Description	Date

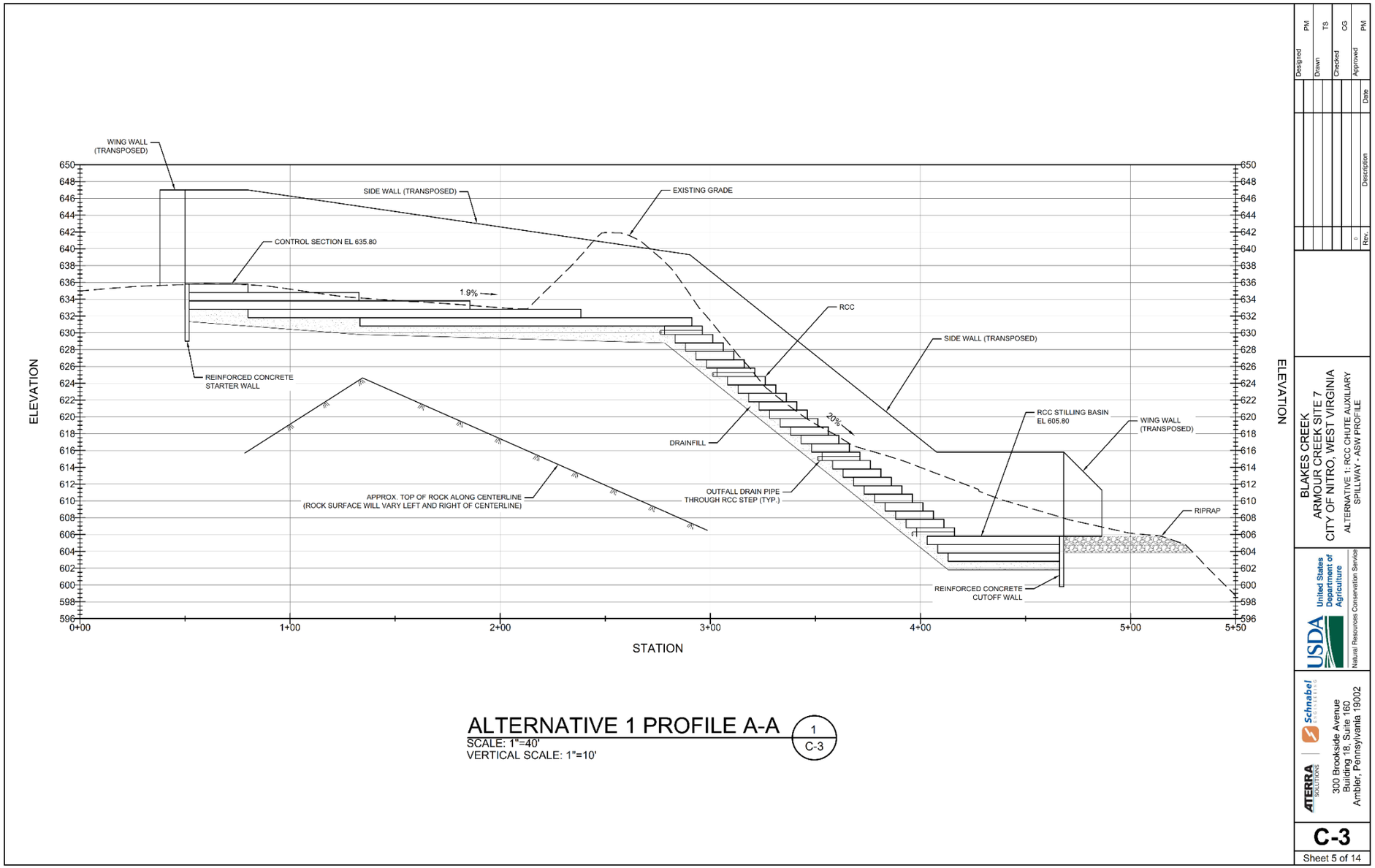
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - AERIAL IMAGE

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Ambler, Pennsylvania 19002

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Sheet 3 of 14

Figure C- 22 – Alternative 2 Plan View



ALTERNATIVE 1 PROFILE A-A (1 / C-3)
SCALE: 1"=40'
VERTICAL SCALE: 1"=10'

Designed PM
Drawn TS
Checked CG
Approved PM
Rev. | Description | Date

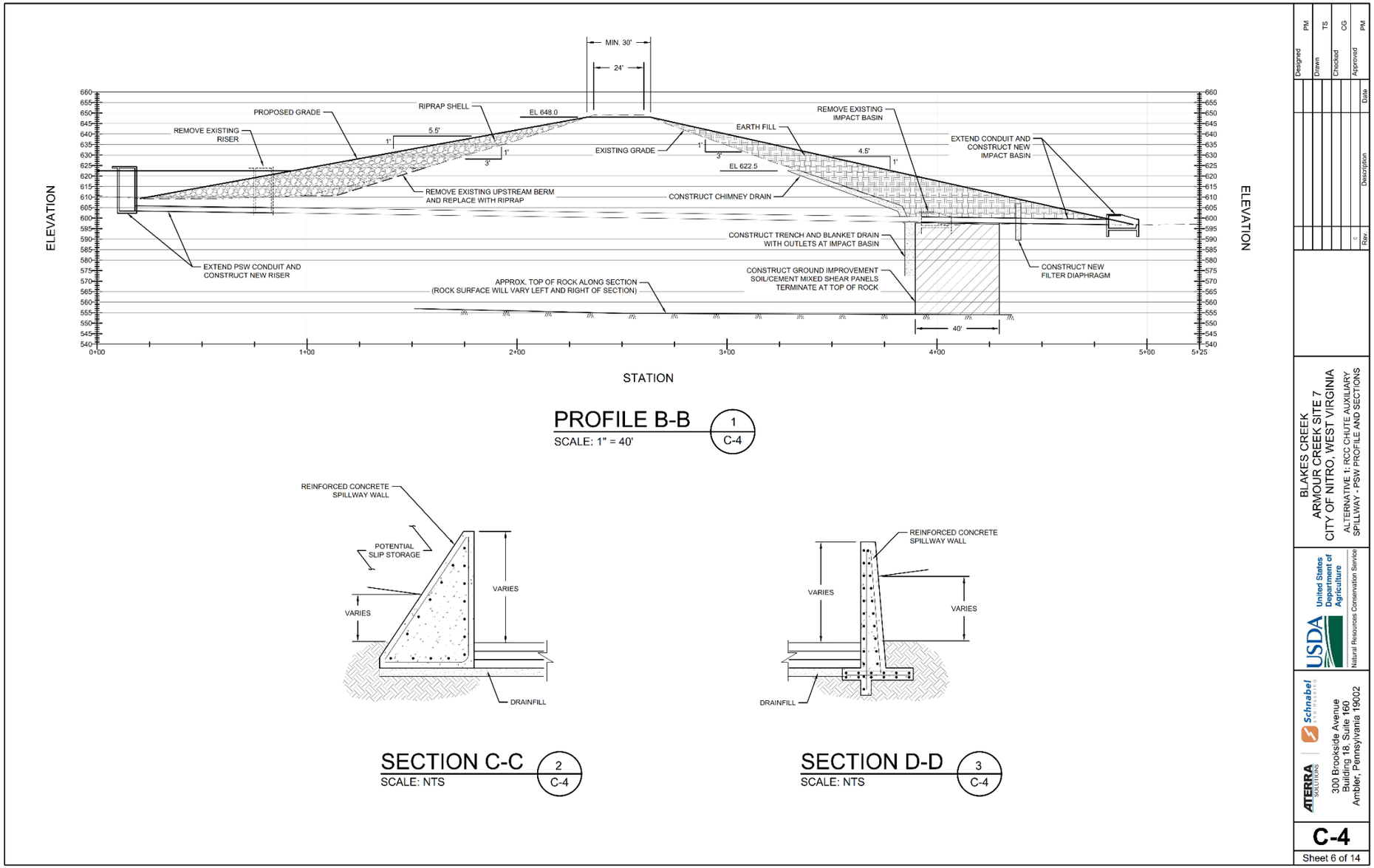
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - ASW PROFILE

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Figure C- 23 - Alternative 2 Auxiliary Spillway Profile



PROFILE B-B (1 / C-4)
SCALE: 1" = 40'

SECTION C-C (2 / C-4)
SCALE: NTS

SECTION D-D (3 / C-4)
SCALE: NTS

Designed	PM
Drawn	TS
Checked	CG
Approved	PM

Rev.	Description	Date
0		

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA

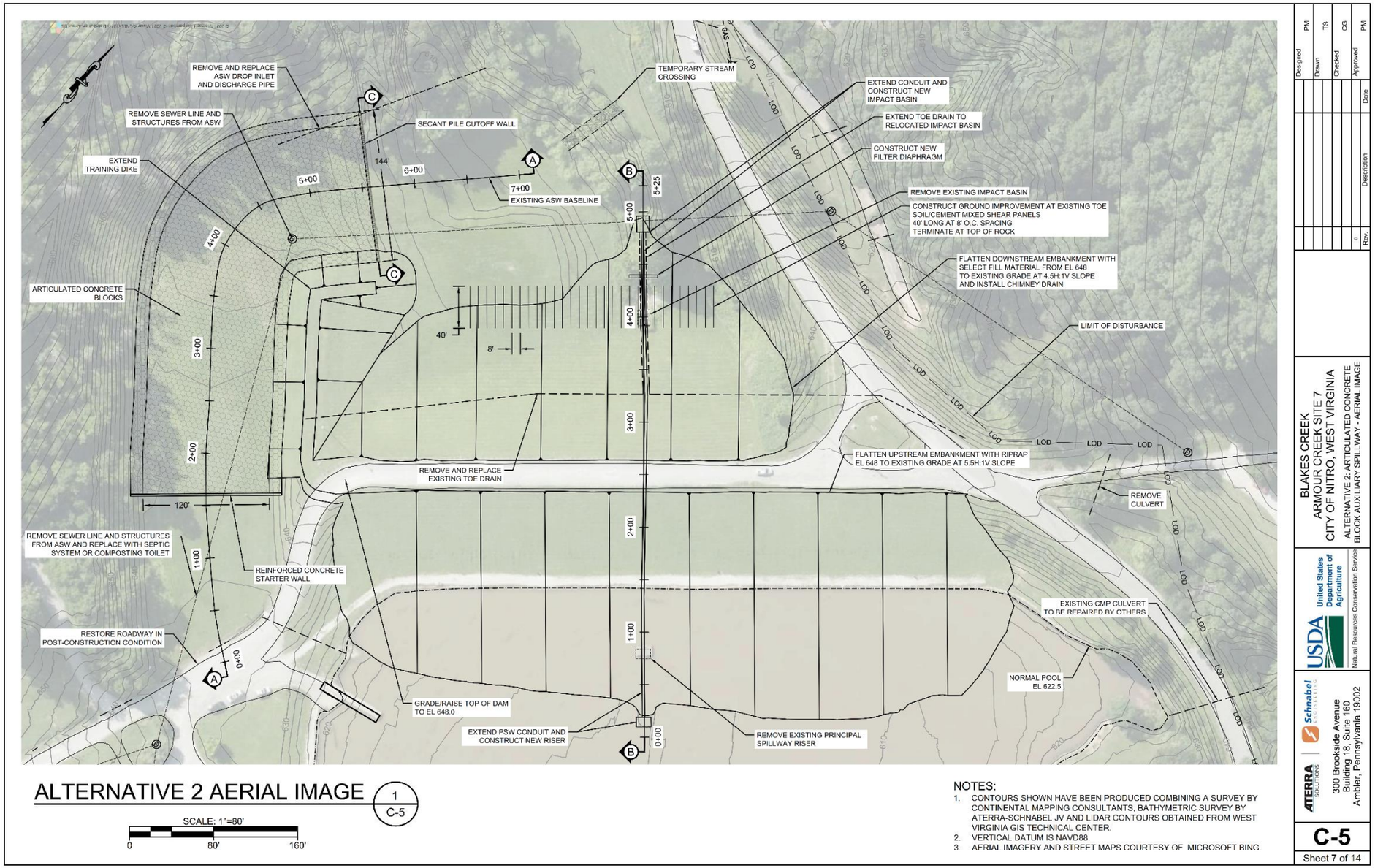
ALTERNATIVE 1: RCC CHUTE AUXILIARY SPILLWAY - PSW PROFILE AND SECTIONS

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Sheet 6 of 14

Figure C- 24 - Alternative 2 Dam Section and Training Wall Detail



ALTERNATIVE 2 AERIAL IMAGE (1 / C-5)

SCALE: 1"=80'

0 80' 160'

NOTES:
1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.
3. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

Designed PM
Drawn TS
Checked CG
Approved PM
Rev. | Description | Date

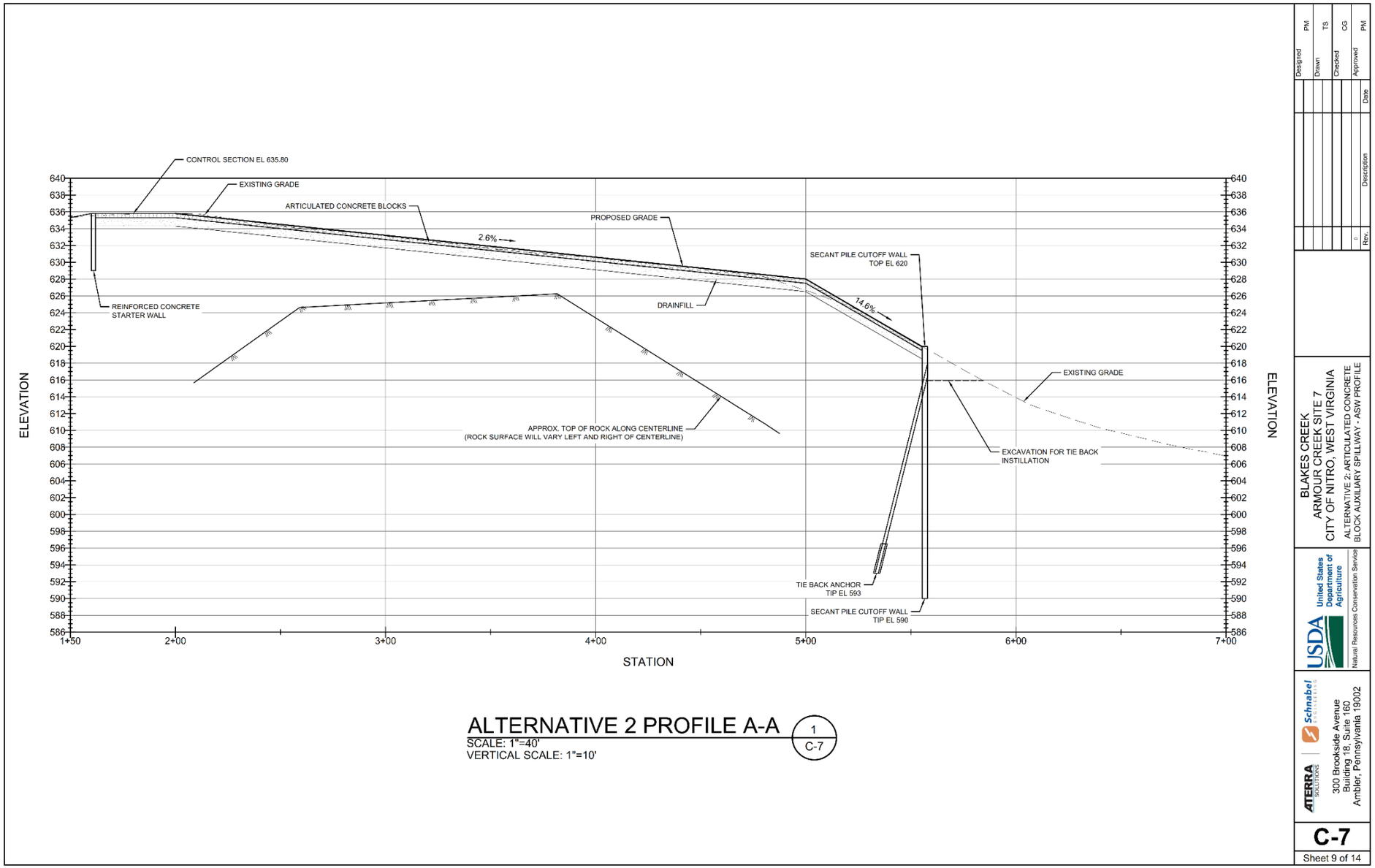
BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 2: ARTICULATED CONCRETE BLOCK AUXILIARY SPILLWAY - AERIAL IMAGE

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C-5
Sheet 7 of 14

Figure C- 25 – Alternative 3 Plan View



ALTERNATIVE 2 PROFILE A-A (1 / C-7)
SCALE: 1"=40'
VERTICAL SCALE: 1"=10'

Designed PM
Drawn TS
Checked CG
Approved PM
Rev. | Description | Date

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 2: ARTICULATED CONCRETE BLOCK AUXILIARY SPILLWAY - ASW PROFILE

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Sheet 9 of 14

Figure C- 26 - Alternative 3 Auxiliary Spillway Profile

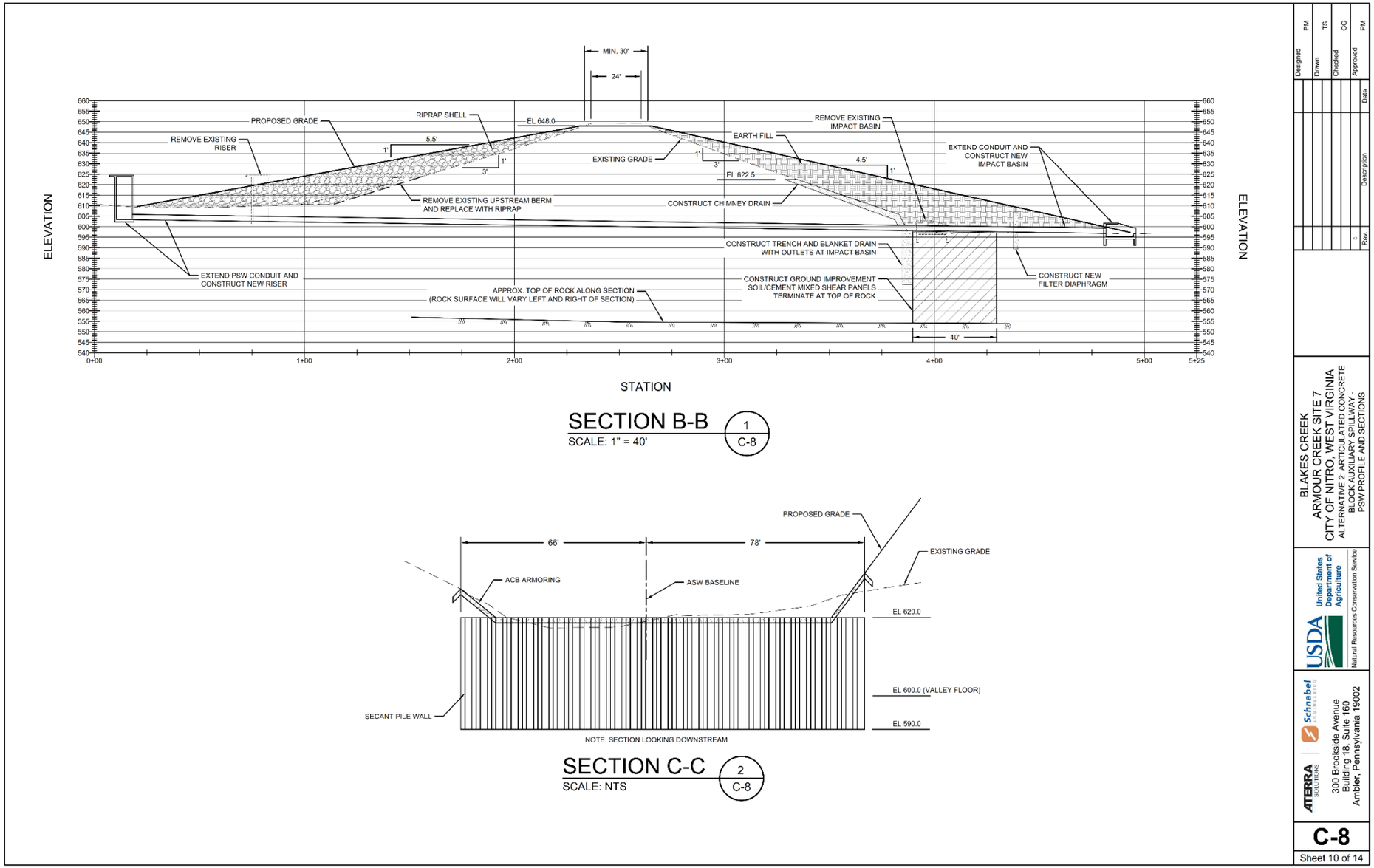
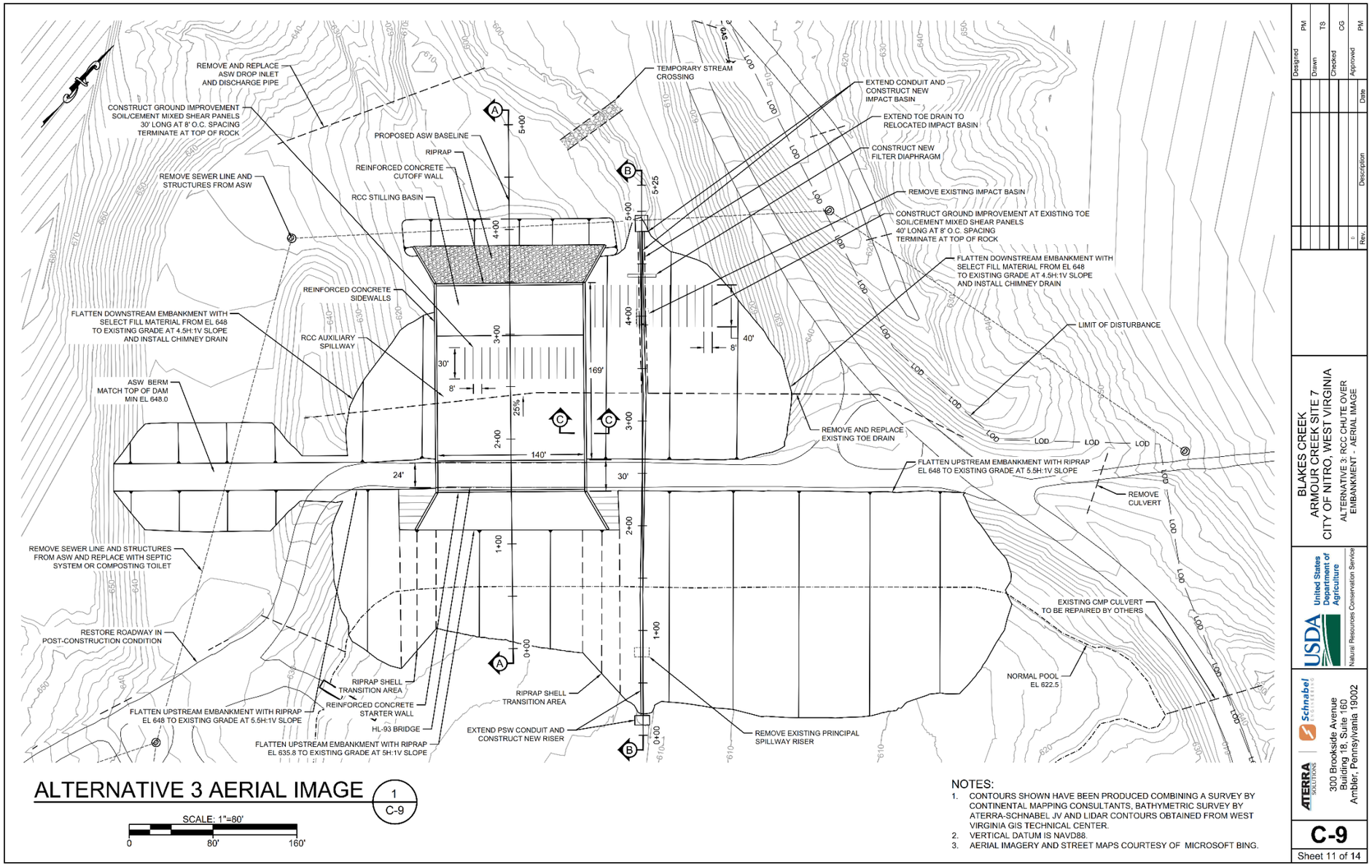


Figure C- 27 - Alternative 3 Dam Section and Secant Pile Cutoff Detail



ALTERNATIVE 3 AERIAL IMAGE (1 / C-9)

SCALE: 1"=80'

0 80' 160'

NOTES:
1. CONTOURS SHOWN HAVE BEEN PRODUCED COMBINING A SURVEY BY CONTINENTAL MAPPING CONSULTANTS, BATHYMETRIC SURVEY BY ATERRA-SCHNABEL JV AND LIDAR CONTOURS OBTAINED FROM WEST VIRGINIA GIS TECHNICAL CENTER.
2. VERTICAL DATUM IS NAVD88.
3. AERIAL IMAGERY AND STREET MAPS COURTESY OF MICROSOFT BING.

Designed	PM	
Drawn	TS	
Checked	CG	
Approved	PM	
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Rev.		Description

BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 3: RCC CHUTE OVER EMBANKMENT - AERIAL IMAGE

United States Department of Agriculture
Natural Resources Conservation Service

ATERRA SOLUTIONS | Schnabel Engineering
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-9

Sheet 11 of 14

Figure C- 28 – Alternative 4 Plan View

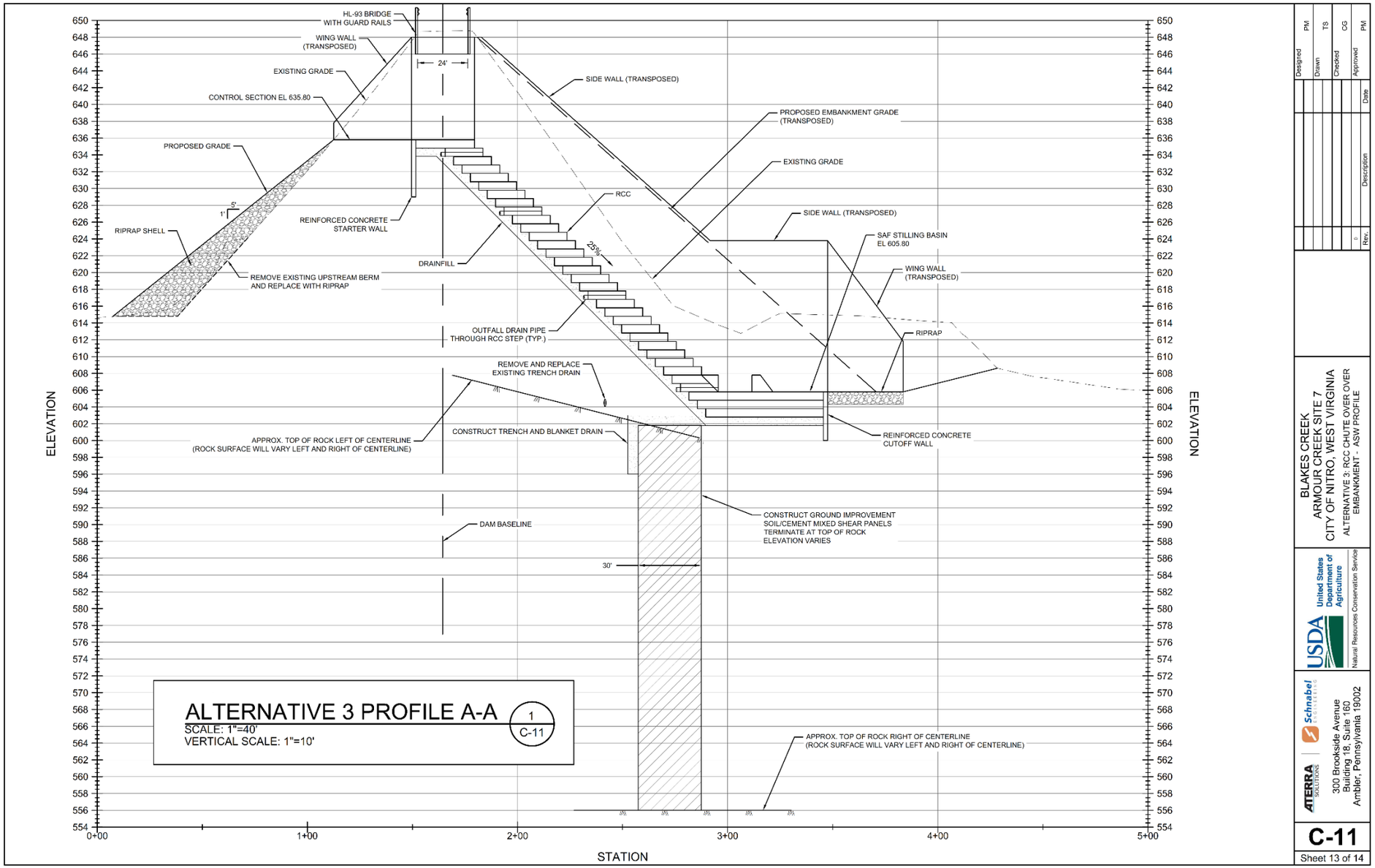
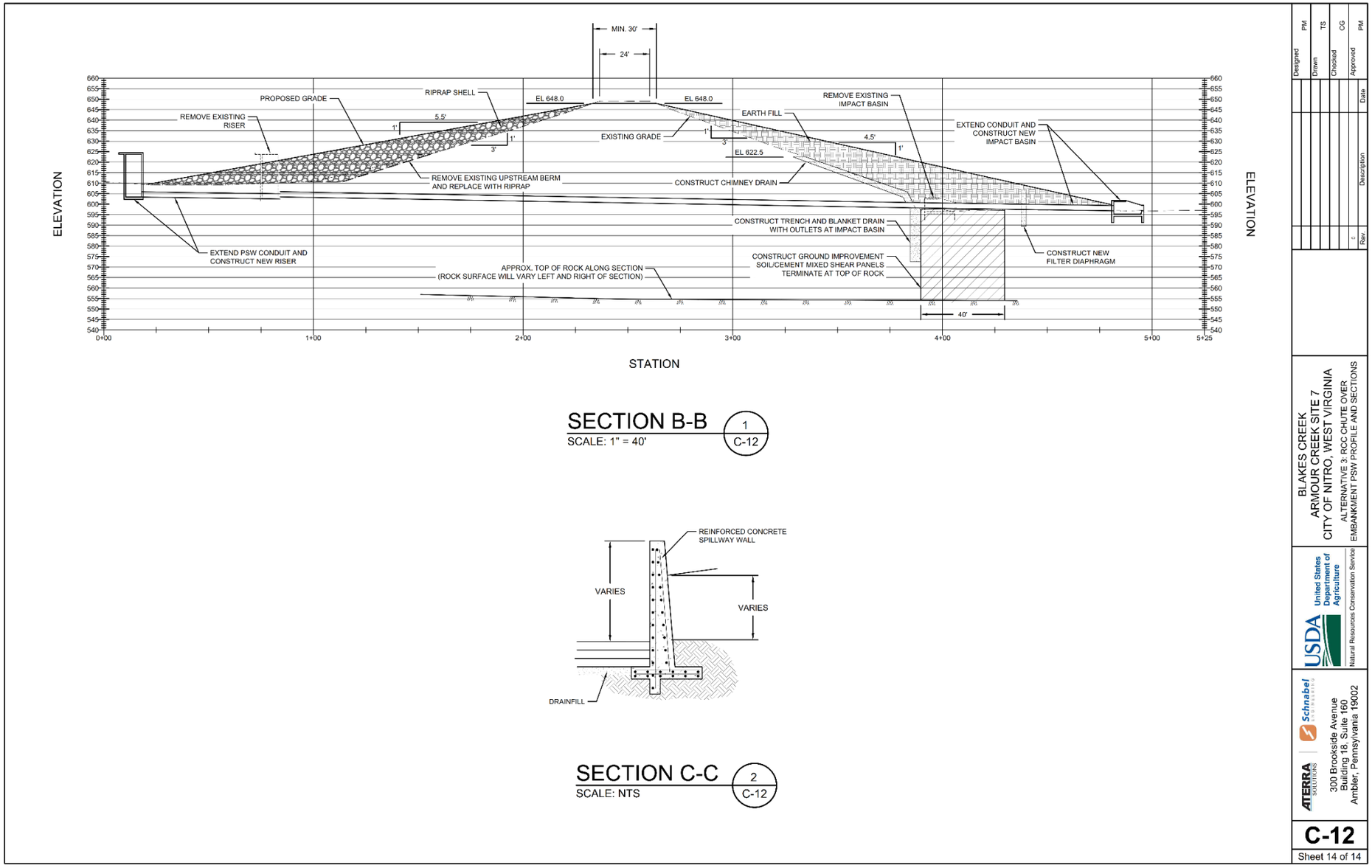


Figure C- 29 - Alternative 4 Auxiliary Spillway Profile



SECTION B-B

SCALE: 1" = 40'

1 / C-12

SECTION C-C

SCALE: NTS

2 / C-12

Designed	PM
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Approved	PM

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BLAKES CREEK
ARMOUR CREEK SITE 7
CITY OF NITRO, WEST VIRGINIA
ALTERNATIVE 3: RCC CHUTE OVER EMBANKMENT PSW PROFILE AND SECTIONS

United States Department of Agriculture
Natural Resources Conservation Service

Schnabel Engineering
ATERRA SOLUTIONS
300 Brookside Avenue
Building 18, Suite 160
Ambler, Pennsylvania 19002

C-12

Sheet 14 of 14

Figure C- 30 - Alternative 4 Dam Section and Secant Pile Cutoff Detail



Figure C- 31 – Wetland Map

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APPENDIX D

INVESTIGATIONS AND ANALYSES REPORT

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Project Formulation

Project formulation for all dams identified in this plan followed five primary documents:

- NRCS NWPM & NWPH
- DM9500-013
- DR9500-013
- Principles and Requirements for Federal Investments in Water Resources, March 2013
- Interagency Guidelines

This appendix also summarizes the planning engineering investigations and analysis completed for the dam rehabilitation planning engineering of Blakes Creek–Armour Creek Site 7, including a summary and reference for the existing conditions, breach studies, deficiencies, alternatives studied, and the selected rehabilitation alternative for this dam.

The basis for the planning engineering investigations and analysis is current NRCS criteria and standards, including the following:

- National Engineering Handbook, Part 630, Hydrology
- National Engineering Handbook, Part 628, Dams
- Technical Release 210-60, Earth Dams and Reservoirs, March 2019 (USDA-NRCS, 2019)
- NRCS Conservation Practice Standard Dam (Practice Code 402)

Summary of Data Sources

Waters of the U.S.

The reservoir, the wetlands, and the streams were identified as WOTUS during the March 2022 wetland delineation. Water quality data obtained from EPA and WV DEP was used to determine the impairment status of the waterbodies in the LOD, as well as upstream and downstream of the dam site (EPA 2021c; WV DEP 2016). The National Wild and Scenic Rivers System website was consulted and indicated that there are no wild, scenic, or recreational rivers in or near the LODs. There are also not National Rivers Inventory segments within the LODs.

Wetlands

A wetland delineation within the LOD was conducted by EA in March 2022. The wetlands were identified using USACE wetland delineation guidelines and classified using the Cowardin system.

Floodplains

Flood zone data was obtained from the FEMA flood insurance rate map (Panel 54039C0212E) effective 6 February 2008.

Plants

Vegetation communities and land cover types present in the LODs were identified and mapped using the online National Land Cover Database (NLCD) (2019). Additionally, information from WV DNR was used to obtain a general knowledge of common trees, bushes, and plant species in floodplain forests of West Virginia, since official field surveys to identify vegetation types were not conducted for this project (WV DNR 2020a). The iNaturalist website was used to ascertain plant species that have been observed in proximity to the dam site (iNaturalist 2022).

Special Status Plant Species
A USFWS IPaC report was generated for the projects to determine the presence or absence of federally listed endangered or threatened species at the dam site.

Consultation with the WV DNR Natural Heritage Program indicated that no state listed rare, threatened, or endangered plant species or habitat are known to occur in the project area.

Noxious Weeds and Invasive Plants
The WV DNR state listed invasive plant species list (WV DNR 2009) was reviewed. WV DNR does not maintain a map of invasive species location, but no species were observed during a 2021site visit.

Animals

Fish and Wildlife
The WV DNR Interactive Fishing Map was consulted for fish species and stocking information in the project area (WV DNR 2020b). A fisheries survey data request to WV DNR in January 2022 was not returned.

WV DNR's Wildlife Diversity Program was consulted to obtain general knowledge of wildlife species expected to occur at the dam site (WV DNR 2001). Additionally, the Kanawha County iNaturalist webpage was reviewed to identify species observed in near the dam site (iNaturalist 2022).

Threatened and Endangered Species
A USFWS IPaC report was generated for the project to determine the presence of federally listed threatened or endangered animal species. Attendees of the Public Scoping Meeting indicated that there are no known bald eagle nesting areas near the dam.

Consultation with the WV DNR Natural Heritage Program indicated that no state listed rare, threatened, or endangered animal species or habitats are known to occur in the project area.

Cultural Resources and Historic Properties
The National Register of Historic Places was used to determine the proximity of historic properties to the dam site. The WV SHPO online mapping tool was also consulted, and this resource indicated that there are no archaeological surveys, building surveys, or historic properties/districts in the LOD (WV SHPO 2022). Phase 1 archeological survey and Phase 1 historic architecture survey for the entire Area of Potential Effect (APE) were performed as part of the project. The reports documenting those surveys are provided in Appendix E.

Land Use Land Cover – WV Land Use Land Cover (NAIP 2016)
The Natural Resource Analysis Center (NRAC) at WVU developed a statewide classification for WV using geographic object-based image analysis (GEOBIA), random forest (RF) machine learning, and National Agriculture Imagery Program (NAIP) orthophotography. Three products are available: Land Cover (25 Category) for West Virginia, WV Spectral Classes, and Forest

Fragmentation for West Virginia. The land use land cover data has a 5m resolution. The data can be accessed at: http://wvgis.wvu.edu/data/dataset.php?ID=489.

Land Cover - Future Buildout Conditions
Since Putnam and Kanawha Counties do not have zoning restrictions, future buildout landcover was estimated based on evaluation of land cover, topography and discussions with the City of Nitro and the NRCS Capitol District Conservationist. Based on this, every ridgetop and relatively flat areas of the watershed were converted to buildout landcover.

Prime and Unique Soils
Soil information presented in this report was summarized from USDA NRCS WSS data (USDA NRCS 2020a).

SSURGO Soils (Hydrology)
This product was used to derive the Hydrologic Groups in the Blakes Creek-Armour Creek Watershed. SSURGO datasets consist of map data, tabular data, and information about how the maps and tables were created. The extent of a SSURGO dataset is a soil survey area, which may consist of a single county, multiple counties, or parts of multiple counties. SSURGO map data can be viewed in the Web Soil Survey or downloaded in ESRI® Shapefile format. The coordinate systems are geographic. Attribute data can be downloaded in text format that can be imported into a Microsoft® Access® database.

Hydrologic Soil Groups
This layer was derived from the USDA NRCS – SSURGO data for West Virginia. The NRCS Soil Data Viewer version 6.2 was used, with ArcGIS 10.8.1. The attributes selected for this layer are under "Soil Qualities and Features" – Hydrologic Soil Groups. Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration, when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

Sub-Watershed Boundaries
Sub-watershed boundaries for evaluation of hydrologic responses were delineated using the ArcGIS 10.8.1 Spatial Analyst tool and the U.S. Corps of Engineers Geospatial Hydrologic Modeling Extension (HEC-GeoHMS). A 2-meter digital elevation model (DEM) was used as the bas input.

Digital Elevation Models
2009 Bluestone Lake and Downstream QL3 LiDAR
The Bluestone Lake and Downstream 2009 Bare-Earth DEM (digital elevation model) has a 2-meter spatial resolution and was derived from a bare-earth LiDAR data set. The dataset can be accessed through the West Virginia GIS Technical Center (http://wvgis.wvu.edu/data/dataset.php?ID=417).

2018 FEMA South Central WV Lidar and 2018 FEMA Mason and Putnam Counties QL2 LiDAR

The FEMA South Central WV Lidar and 2018 FEMA Mason and Putnam Counties QL2 DEMs have a 1-meter spatial resolution and were derived from a bare-earth LiDAR data set. The datasets can be accessed through The National Map (https://apps.nationalmap.gov/downloader/).

Geotechnical Review

Regional and Site Geology: According to the 1965/1966 SCS Geology Reports, the Blakes Creek–Armour Creek Site 7 is located in the Appalachian Physiographic Province. The claystone, shale, and sandstones of the Casselman Formation are present at the dam site. At the site, the Casselman Formation is characterized primarily of sandy shales to sandstones that are nearly horizontal in dip. Members of the Casselman Formation include the Grafton Member, Saltsburg Member, and Morgantown Member with highly irregular sandstones and associated shales. These members primarily consist of red shale beds and claystone beds, while the sandstones are thin and come and go as sand lenses. The Grafton Member exists beneath the shale, and is characterized as grayish brown to blue, massive, and moderately hard. The Saltsburg sandstone is the deepest member explored, existing as light gray, massive, calcareous, and hard with intermittent shale lenses. Upstream of the dam exists the Morgantown sandstone, and while well developed, is fairly concealed (Cardwell et al., 1968).

The Geology Reports (USDA-SCS, 1965/1966) indicate the members of the Casselman Formation in the vicinity of the dam have no economically minable coal. No underground mines were found within the vicinity of Dam No.7 on the interactive maps available on the WV Geological & Economic Survey (WVGES) website.

The Geology Reports (USDA-SCS, 1965/1966) note that an apparent Precambrian-aged fault zone, with a vertical displacement of 14 feet, may exist beneath the downstream slope of the dam within the Saltsburg member. Information available on the WVGES website does not indicate the activity status of this fault.

Regional and Site Seismicity: The seismicity at the dam site is typical of the Central and Eastern United States (CEUS). The CEUS is a stable, intraplate region that is not nearly as active as the Western United States (WUS) that borders a plate boundary; however, much less attenuation occurs with CEUS earthquakes compared to those in the WUS because of the thick, denser crust in the CEUS. Therefore, earthquakes of similar magnitude will impact a much larger region in the CEUS (USGS, 2018).

A literature review of regional seismicity was performed to identify seismogenic sources in the area and locations of significant past earthquakes and epicenter density. These events include:

- Body wave magnitude (Mb)2.8 – 8/11/1970 – Lincoln County, West Virginia
- Mb2.5 – 10/2/1998 – Kanawha County, West Virginia
- Mb3.0 – 6/28/1991 – Kanawha County, West Virginia

Two of these earthquakes occurred in the vicinity of the apparent Precambrian fault identified above: 1) the 1991 epicenter was located about 15 miles to the southeast of the site and 2) the 1970 epicenter (along the fault) was located about 15 to 20 miles southwest of the site. The current activity status of this fault is unknown.

The dam is located in an area of relatively low seismicity for the CEUS and is near few seismic source zones. In areas where active faults cannot be identified, such as the CEUS, seismic source zones are developed to capture the seismicity of the region. The dam is on the upper edge of the Giles County Seismic Zone but is otherwise far from any major seismic sources and zones.

No magnitude 4 (M4.0) or greater earthquakes were mapped within a 100-km radius of the dam site based on data from the USGS Earthquake Catalog Search Tool (https://earthquake.usgs.gov/earthquakes/search/), the Earthquake Epicenters of West Virginia (1824 through 2016) map from the WV Geological and Economic Survey (WVGES), and the Ohio Department of Natural Resources' Division of Geosurvey Epicenter Mapping tool (https://gis.ohiodnr.gov/MapViewer/?config=earthquakes).

According to USGS maps (USGS, accessed August 2021), no surficial faults have been identified as active or capable during the Quaternary Period within the 100-km radius around the site.

Previous Explorations

Original Design Phase Exploration

Numerous test pits and test borings were performed across the site to support the original design of the dam. Results and findings are summarized in the USDA-SCS Geology Report dated September 8, 1965, and the USDA-SCS Soil Mechanics Memorandum dated October 6, 1966. See references list at the end of this report for all references used in this report. The table below summarizes the general investigation locations.

Table D- 1 - Summary of 1966 Subsurface Investigations

Location	No. of Test Holes (TH)	No. of Drilled Holes (DH)	Test Holes and Drilled Holes ID
Proposed Dam Centerline	7	6	TH-1 through TH-7, DH-51 through DH-54, RH/DH-55, RH/DH-56
Proposed Principal Spillway	5	4	TH-301 through TH-305, DH-351* through DH-354
Proposed Borrow Area	7	0	TH-101 through TH-107
Proposed Auxiliary Spillway	4	3	TH-201 through TH-204, DH-251 through DH-253
Other**	6	2	TH-601, TH-602, TH-603, TH-604, TH-605, TH-606, RH/DH-651, RH/DH-652
Upstream Toe	2	2	TH-304, TH-305, DH-351, DH-354
Downstream Toe	1	1	TH-301 and DH-353

TH – Test Holes were excavated with a Massey-Ferguson backhoe (model unreported).
DH – Drill Holes were drilled with skid-mounted rotary drills and NX-M core barrel.
RH/DH – (Roller Bit Holes) were drilled with a roller bit down to rock without sampling.
* DH-351 is identified as a Principal Spillway boring but was located at the upstream toe of the embankment footprint near the original stream channel, approximately 200 ft right of the Principal Spillway alignment.
** TH-601 through TH-606 are called out as "Relief Wells". A representative dam location is not indicated for RH/DH-651 and RH/DH-652. All 8 of these investigation locations are located just upstream of the embankment footprint.

The 1966 design exploration program performed at the site is described in the Geology Section of the Design Report, and soils data are provided in the Soil Mechanics Section of the Design Report. There is no mention of monitoring instrumentation at the dam in the documents that were reviewed.

Original Design and Construction Phase Laboratory Testing
The laboratory testing performed during the original design phase of the dam, with available documentation, included:

- 5 Particle Size Distribution with Hydrometer
- 5 Atterberg Limits
- 3 Specific Gravity
- 3 Dry Unit Weight – undisturbed samples
- 2 Standard Proctor Compaction Tests
- 2 Consolidated Undrained Triaxial Shear Test – remolded samples

Details of the testing can be found in the 1966 Soil Mechanics Memorandum included in the documents provided to the Aterra - Schnabel Joint Venture by the NRCS.

2021 Geologic and Geotechnical Investigation
Borings and Test Pits
The 2021 geologic and geotechnical investigation was performed to explore and characterize the subsurface materials comprising the dam embankment, foundation, and auxiliary spillway. The investigation included seven borings from the dam crest, upstream bench, and downstream toe, and five borings in the auxiliary spillway. Open standpipe piezometers were installed in two borings located at the dam crest and downstream toe; slug testing was attempted in the crest piezometer and slug testing was completed in the downstream toe piezometer.

Drilling, Sampling, and In Situ Testing Methods
The boreholes were advanced using 4¼-inch inside diameter (I.D.) hollow stem augers (HSA). Bedrock was cored using HQ and NQ triple tube wireline coring methods.

The Standard Penetration Tests (SPTs) were performed continuously within the embankment and at 5-foot intervals elsewhere. SPTs were performed using a 24-inch long, split-spoon sampler lowered through the HSA to collect soil samples and measure the relative penetration resistance of the soils. The number of blows (blow count) of a 140-lb hammer falling 30-inches required to drive the split-spoon sampler four consecutive 6-inch increments was recorded. The SPT N-value, recorded as blows-per-foot (bpf), is defined as the sum of the second and third 6-inch blow count intervals. The SPT samples were obtained using a 140-lb automatic trip hammer (ATH) using ASTM D1586.

Undisturbed thin-wall Shelby tube (SH) samples were collected at select depths in the embankment and foundation material underlying the embankment.

Aterra-Schnabel personnel described the collected soils in the field using visual-manual procedures as described in ASTM D2488. Final soil descriptions provided on the logs are based on the visual-manual procedures (ASTM D2488) and confirmed by laboratory testing of select samples using the Unified Soil Classification System (USCS) per ASTM D2487.

Pocket penetrometer and Torvane field tests were performed on select portions of SPT and SH sampled materials.

Aterra-Schnabel personnel measured water levels in the test borings using an electronic water level meter. Water levels were typically measured several times in each boring, including during drilling (prior to adding any water), after completion of drilling, at the beginning and end of each day, and immediately prior to grouting. Water levels in permanent piezometers were measured multiple times after the completion of piezometer installation.

Two borings included the installation of an open standpipe piezometer in a separate, offset auger probe borehole, with the slotted screen set at selected depths to target strata of interest based on the conditions encountered. The remaining borings were grouted from the bottom of the boring to the ground surface with cement-bentonite grout using a tremie pipe.

Laboratory Testing for 2021 Investigations

The laboratory testing performed for the 2021 geologic and geotechnical investigation included:

- 32 Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216)
- 19 Particle-Size Distribution (Gradation) of Soils using Sieve Analysis – without hydrometer (ASTM D6913)
- 5 Particle-Size Distribution (Gradation) of Soils using Sieve Analysis – with hydrometer (ASTM D6913)
- 16 Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D4318)
- 5 Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)
- 3 Consolidated Undrained Triaxial Compression Tests for Cohesive Soils (ASTM D4767) – undisturbed samples
- 3 Dispersive Characteristics of Clayey Soils by the Crumb Test (ASTM D6572)
- 3 Identification and Classification of Dispersive Clay Soils by the Pinhole Test (ASTM D4647, Method A)
- 2 Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter – undisturbed samples (ASTM D5084)
- 6 Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures (ASTM D7012, Method C (unconfined))

The testing results aided in the classification of materials encountered during investigation and provided data for use with empirical correlations to support selection of material properties and engineering parameters.

Subsurface Conditions

Original Design Phase Investigation

General subsurface conditions documented by the 1966 exploration and included in the Design Report are summarized in the table below:

Table D- 2 - Summary of Foundation Soils from 1966 Design Exploration

Dam Element	Subsurface Conditions Beneath Dam Element
Embankment	Alluvial soils with depths ranging from less than 10 ft to approximately 46 ft, primarily consisting of silts and sands (ML and SM) and lean clays (CL) with occasional layers of organic material. The deepest portions of the alluvium occur within a deep "canyon" beginning somewhere between Station 3+50 and 5+00 and continuing to Station 7+50 (As-Built stationing, Dam Centerline). Consistencies are loose within the upper 10 ft. The alluvial soils are underlain by a bedrock layer, described as shale interbedded with sandstone and siltstone. The As-Built Drawings indicate that the embankment includes a cut-off trench, which extends 4-ft below the stripped ground surface. Field permeability values ranged from roughly 0.3 to 5 ft/day (roughly $1x10^{-4}$ to $1x10^{-3}$ cm/s) with some "zero-permeability" zones. .
Abutments	Approximately 10 ft of colluvial and residual soils, primarily consisting of silts (ML), lean clays (CL), and clayey gravel (GC). Field permeability values within the soils of the abutments ranged from roughly 0.7 to 18 ft/day (roughly $2x10^{-4}$ to $6x10^{-3}$ cm/s) with some "zero-permeability" zones. The soils are underlain by a bedrock layer, described as sandy shale.
Principal Spillway Conduit	40 to 50 feet of alluvial soils, similar to those noted for the embankment foundation (noted above).
Auxiliary Spillway	Bedrock described as weathered claystone and highly fractured/weathered shale.

Note: No shear strength or consolidation tests were performed in foundation soils.

2021 Geologic and Geotechnical Investigation

Several different natural geologic and embankment construction material strata were encountered during the 2021 investigation. The following informal, project-specific strata names have distinct characteristics that are identified based on visual descriptions, field testing, drilling observations, laboratory test results, and engineering properties. The soil classifications are visual-manual classifications, except at specific intervals where laboratory testing has been performed, using USCS classifications.

- Topsoil/Surficial Soils
- Stratum A: Fill Material
    - Sub-Stratum A1: Fine-Grained Fill (CL)
    - Sub-Stratum A2: Coarse-Grained Fill (GC)
- Stratum AA: Alluvial material
    - Sub-Stratum AA1: Fine-Grained Alluvium (CL, CL-ML)
    - Sub-Stratum AA2: Coarse-Grained Alluvium (SP-SC, SW-SC, SC, GC)
- Stratum B: Residual
    - Sub-Stratum B1: Fine-Grained Residuum (CL)
    - Sub-Stratum B2: Coarse-Grained Residuum (GP, SC)
- Stratum C: Disintegrated Rock
- Stratum D: Bedrock
    - Sub-Stratum D1: RQD less than 75 percent
    - Sub-Stratum D2: RQD greater 75 percent

Water Level Observations

Water levels were measured in the borings and piezometers during and after the subsurface investigation program to obtain information about groundwater and piezometric conditions within the dam embankment, foundation, and auxiliary spillway. When possible, initial water level readings in boreholes were generally obtained during or after drilling and prior to the installation of a piezometer or grouting. Piezometers were installed in two borings – one at the dam crest and one at the downstream toe. The water levels recorded on the boring logs were measured before and after development of the piezometers. The piezometers indicate that phreatic levels within the embankment and foundation, as represented by the screened interval for each piezometer, range from approximately EL 608 below the embankment crest centerline to EL 600 at the downstream toe approximately 55 feet right of the principal spillway conduit. The upstream pool level at the time of these readings was approximately EL 622.5.

Geotechnical Evaluations

Dispersive Soils

There is no significant evidence of materials that are potentially susceptible to dispersion being present within the embankment, the embankment foundation, or the auxiliary spillway in amounts that could compromise the integrity of either structure.

Filter Compatibility

Evaluations of NRCS filter and drain compatibility were performed on the trench drain materials using the fine and coarse filter drain limits recorded in the as-built drawings, along with laboratory test results performed during construction on the drainfill used in the trench drain (provided to Aterra-Schnabel on March 18, 2022). The evaluation was performed using procedures outlined in the NEH, Part 633, Chapter 26 Gradation Design of Sand and Gravel Filters (August 2017). The filter compatibility calculations analyze the compatibility of each strata that potentially contacts the filter drain material.

Attempting to intercept the drain with a borehole could create a potential risk for damaging the trench drain and collector pipe, fouling the drain, or not encountering the drain materials due to the limited width of the drain. Therefore, the gradations specifications shown on the as-built drawings and laboratory test results for the drainfill materials were used for the analysis.

Based on the analyses, portions of the existing drainfill material gradation band shown on the As-Built Drawings are too coarse to meet the filter requirements of Chapter 26 of NEH Part 633 for the embankment and foundation materials. However, much of the existing material's fine boundary specification falls within the Chapter 26 requirements, especially at the D15 size. The foundation materials are filter compatible with the embankment fill, but do not meet minimum particle size requirements to serve as a drain. ASTM C-33 Fine Aggregate is filter compatible with the embankment samples and with the majority of the foundation based on the requirements of Chapter 26 of NEH Part 633, although additional filtration measures may be required where in contact with the finest foundation material (represented in this investigation by the 7 to 9 ft sample in B-601a). These measures could potentially include the use of a geosynthetic to prevent seepage or provide additional separation across the incompatible materials, in accordance with the limitations detailed in TR 210-60. These limitations would likely require the geosynthetic to be used intermittently. Additionally, the construction gradation specifications for the existing drainfill were compared to ASTM C-33 Fine Aggregate. These two materials do not meet the

gradation requirements of Chapter 26 of NEH Part 633 when either is considered the filter, however the material considered the filter is finer than the fine limits of the Chapter 26 requirements. Therefore, internal erosion between the two materials is not considered likely if they were to be contact with each other. Additional evaluation is considered warranted during rehabilitation design. On March 18, 2022, Aterra-Schnabel was provided with eight laboratory sieve analysis results performed during construction. The gradation curves for all eight samples were relatively consistent and all fall outside of the coarse limit established by the analyses noted above for existing drainfill material in contact with the fine-grained embankment fill and foundation soils.

Removal and replacement of the existing drainfill material from the 16 relief drains drilled beneath the trench drain would be a significant construction challenge. The deepest of these is approximately 50 feet below the bottom of the trench drain. Additional evaluation is necessary to evaluate whether replacement of the drainfill within these relief drains to improve filter compatibility is feasible and necessary given the substantial remediation efforts that would be required.

Foundation Toe Drain System
The as-built drawings show the collector and outlet drain pipes consist of corrugated metal pipe, which is susceptible to corrosion and does not meet current dam safety standards.

Filter Diaphragm for Principal Spillway Conduit
TR 210-60 states "for embankments of all hazard potential classifications with penetrations not protected by comprehensive filter and drainage features, include a filter drainage diaphragm around any structure that extends through the embankment to the downstream slope." At the Blakes Creek–Armour Creek Site 7, this applies to the principal spillway conduit. The as-built drawings indicate nine reinforced concrete anti-seep collars were installed along the principal spillway conduit, but do not show that a dedicated filter diaphragm was installed around the conduit. According to the as-built drawings, the portion of the trench drain which parallels the principal spillway conduit includes a widened section left and right of the conduit, but no vertical extension beneath the pipe cradle or above the top of the pipe. It is unclear from the as-built drawings whether the main trench drain alignment includes increased vertical dimensions around the conduit. Replacement of the existing trench drain with a toe drain and chimney filter is recommended, incorporating a conduit seepage diaphragm, to address this issue as well as the trench drain filter compatibility concerns. Although a chimney filter does not appear to be critical at this site, its inclusion is considered prudent given the opportunity while a construction excavation is open for installation of the toe drain.

Historical Concerns Regarding Seepage, Settlement, and Stability
Visual inspections conducted in 2015, 2016 and 2020 noted a low area with standing water within the flat built-up area (or "bench") just downstream of the dam, left of the downstream channel. This built-up area is not shown on the as-built drawings and appears to be a fill pad – possibly created from waste material generated during dam construction or the 1970's repair of a slip above the auxiliary spillway. This apparent fill pad does not tie in to the dam embankment or auxiliary spillway training dike. No evidence of subsurface seepage, such as drainage rills or iron oxidizing bacteria, was noted. The standing water appears to be ponding rainwater within depressions in the

fill surface. Based on historical Google Earth imagery, this feature has seen intermittent standing water since at least 2003. No evidence of through-seepage (through the embankment) or under-seepage (through the embankment foundation) was observed around the downstream toe areas.

No numerical stability analyses were performed during the original design. More recently, there are no seepage, settlement, or stability concerns identified in the previous dam inspection and assessment reports provided by NRCS to Aterra-Schnabel for review.

Seepage Analysis

The finite-element analysis program SEEP/W (GeoStudio, 2019) was used to develop a steady-state seepage model for the approximate maximum section of the dam embankment, located approximately 55 feet right of the principal spillway (PSW) centerline. The model was developed to evaluate piezometric and seepage conditions through the embankment and foundation and estimate pore water pressures for use in the slope stability analysis.

Preliminary seepage input parameters were selected for each stratum based on lab and field test results, applicable published soil type correlations, and soil classifications from the exploration and testing program. No testing was included in the scope to determined anisotropy ratios (vertical to horizontal permeability); however values were assigned to the model based on our experience. Depositional strata and compacted fill layers were assumed to have horizontal permeabilities of twice their vertical permeabilities. Permeability parameters selected for the seepage analysis are summarized in the table below:

Table D- 3 – Summary of Hydraulic Parameters for Seepage Analysis

Material	Hydraulic Conductivity K_x, cm/s	Anisotropy Ratio K_y/K_x
A: Fill – Zone 1	1.1×10^{-7}	0.5
A: Fill – Zone 2	1.1×10^{-7}	0.5
AA1: Fine Grained Alluvium	1.7×10^{-7}	1
AA2: Coarse Grained Alluvium	4.5×10^{-3}	0.5
B1: Fine Grained Residuum	5×10^{-5}	1
D: Bedrock	5×10^{-5}	1
Drainfill	1.0×10^{-3}	1

Steady state phreatic surfaces were computed for two scenarios, one assuming a functional trench drain and one assuming a non-functional trench drain. The two scenarios yielded nearly identical phreatic surfaces, with a localized depression around the functional trench drain. Both phreatic surfaces were compared to the stabilized water levels in piezometers B-02a and B-601a to provide a model calibration. The steady state phreatic surface computed by the seepage model for the non-functional drain scenario is slightly higher than the water surface elevations observed in the piezometers but is considered a conservative reasonable estimate. This model was established for subsequent phreatic surface computations.

To evaluate potential changes in seepage and piezometric conditions during flood events, a transient seepage analysis was performed based on the freeboard hydrograph (FBH) developed for this project (Existing Structure Hydrology Report, 2021). The transient headwater (pool) condition increases from normal pool at EL 622.45 up to a maximum level at EL 646.85 before receding back to normal levels. The reservoir pool was conservatively assumed to remain at the maximum level for 30 days. Minimal change was observed in the piezometric surface based on the transient analysis. The tailwater elevation was assumed to remain at the assumed normal tailwater EL 598.

The results of the steady state seepage analysis show that the phreatic surface does not daylight above the downstream toe (for both the functional and non-functional trench drain assumptions). The transient FBH model indicates that during the FBH storm, the saturated wetting front migrates less than five feet into the embankment, and the majority of the embankment fill remains unsaturated.

Static Slope Stability

Static and pseudo-static slope stability analyses were performed in accordance with Section 5 of TR 210-60. The analyses considered the following load cases:

- Steady Seepage: Normal pool EL 622.45, steady-state seepage conditions, downstream slope
- Rapid Drawdown: Drawdown from normal pool level to invert of the low-level outlet, upstream slope
- Flood Surcharge: Freeboard hydrograph (FBH) pool EL 646.85 with transient seepage and tailwater at EL 598, downstream slope (Aterra-Schnabel JV (2021). Existing Structure Hydrology Report)

Stability during construction was not analyzed because details of the construction excavation are beyond the current scope.

Two-dimensional, limit-equilibrium slope stability analyses were performed using SLOPE/W, a module within the GeoStudio 2019 suite of software. The model utilizes the approximate maximum section of the dam, located approximately 55 feet right of the PSW centerline. Surface elevations were derived from the survey performed by Continental Mapping Services. Embankment and foundation stratigraphy were modeled based on the data collected during the 2021 field investigation and laboratory testing program, as well as review of historical records. The available data was used to select soil strength parameters based on a variety of applicable published empirical correlations for SPT N-values, material type, and anticipated shear behavior. Soil strength parameters selected for the slope stability analyses are summarized in the table below:

Table D- 4 – Summary of Material and Strength Properties for Stability Analyses

Material	Moist Unit Weight, γ (pcf)	Drained Strength Properties	Undrained Strength Properties
A: Fill – Zone 1	120	$\phi' = 30^o$, c' = 0 psf	$\phi = 22.8^o$, c = 1 psf
A: Fill – Zone 2	120	$\phi' = 30^o$, c' = 0 psf	$\phi = 22.8^o$, c = 1 psf

AA1: Fine Grained Alluvium	120	ϕ' = 34º, c' = 0 psf	ϕ = 19.9º, c = 72 psf
AA2: Coarse Grained Alluvium	120	ϕ' = 32º, c' = 0 psf	ϕ = 26º, c = 1 psf
B1: Fine Grained Residuum	120	ϕ' = 30º, c' = 0 psf	ϕ = 0º, c = 600 psf
D: Bedrock	Impenetrable		
Drainfill	120	ϕ' = 34º, c' = 0 psf	ϕ = 33.9º, c = 1 psf

The slope stability models and analyses assessed both near surface failures and deeper global failures per requirements provided in TR 210-60, Figure 5-3. To assess both of these failure types, the following input criteria were used:

- Minimum depth of failure equal to 5 ft (general global stability failure)
- Minimum depth of failure equal to 1 ft (near surface failure)

Rapid drawdown was analyzed using the staged method developed by Duncan et al (1990). The pre-drawdown piezometric surface was defined as the normal pool steady-state seepage piezometric surface, and the post-drawdown piezometric surface was conservatively defined as if water in the reservoir was instantaneously removed but the embankment soils remained saturated to the surface. Soil shear strength parameters were modelled with a total stress (R) envelope.
The static stability analysis results, including minimum required factors of safety (FS) per TR 210-60 Figure 5-3, are presented in the table below.

Table D- 3 – Static Slope Stability Analysis Results (NRCS Criteria)

Load Condition	**Calculated Factor of Safety**		**NRCS *TR 210-60* Minimum Required Factor of Safety**
	Near Surface	**Crest and Foundation Failure**	
Normal Pool Steady Seepage, Downstream Slope	1.6	1.7	*1.5* *1.3 (Near Surface)*
Normal Pool Rapid Drawdown, Upstream	0.8	0.9	*1.2* *1.1 (Near Surface)*
Flood Surcharge, FBH Event, Downstream	1.6	1.7	*1.4* *1.2 (Near Surface)*

The slope stability results demonstrate that the dam does not satisfy the minimum criteria for slope stability for rapid drawdown. The critical factor of safety shown above for the rapid drawdown scenario is for a failure which encompasses the toe berm and does not extend above this berm (roughly coincident with the normal pool elevation). The analysis indicates failures that intersect the crest have a factor of safety greater than 1.5. To increase the factor of safety against a toe berm failure, stabilization measures, such as installation of a surcharge at the toe, may be warranted.

As requested by NRCS-WV, static slope stability analyses were also completed in accordance with West Virginia Department of Environmental Protection, Dam Safety regulations (47CSR34 "Dam Safety Rule", Part 7.4.b.1.D). The analyses considered the following load cases:

- Rapid Drawdown: Drawdown from steady state seepage originating at the crest of auxiliary spillway control section to invert of the low-level outlet, upstream slope
- Flood Surcharge: Steady state seepage originating at the elevation of the crest of auxiliary spillway control section, downstream and upstream slopes

The stability analysis results, including minimum required factors of safety (FS) per 47CSR34, Part 7.4.b.1.D, are presented in the table below.

Table D- 4 – Static Slope Stability Analysis Results (WVDEP Criteria)

Load Condition	Calculated Factor of Safety	WVDEP Minimum Required Factor of Safety
Rapid Drawdown from ASW Crest, Upstream	0.9	*1.2*
Flood Surcharge, ASW Crest, Downstream	0.6	*1.5*
Flood Surcharge, ASW Crest, Upstream	2.0	*1.5*

The slope stability results demonstrate that the dam does not satisfy the WVDEP minimum criteria for the rapid drawdown and ASW crest flood surcharge (downstream slope) conditions. To increase the factor of safety, stabilization measures may be warranted.

Embankment Seismic Performance

Peak Ground Acceleration and Earthquake Magnitude

The seismic hazard analysis for this project consists of estimating the annual rate of exceedance of ground motion parameters of interest for design that may originate from the various historic and probabilistic earthquake sources around the site. Peak ground accelerations (PGA) were obtained using the Dynamic: Conterminous US 2014 (v4.2.0) data from the online Unified Hazard Tool provided by the USGS as part of their Earthquake Hazards Program. The data indicate the horizontal PGA for boundary B/C "firm rock" (defined as having a shear wave velocity of 760 meters [2,500 ft] per second) for the dam site is 0.183g for the 10,000-year recurrence interval earthquake event.

NRCS requires selection of a maximum design earthquake (MDE) and its corresponding PGA based on the anticipated consequence of seismic failure under normal pool conditions. The Blakes Creek–Armour Creek Site 7 has been determined to have a High Consequence (as defined in TR 210-60) if the dam experiences a seismic failure with the reservoir at normal pool, based on breach inundation assessments performed by Aterra Schnabel. Based on this categorization, the PGA associated with the 10,000-year return period was used for the analysis of the embankment.

The USGS Uniform Hazard Tool provides deaggregation of the data that was the basis of the 2014 seismic mapping. The deaggregation plot is a graphical representation of the relative contribution

of various historic and probabilistic seismic sources based on magnitude and distance. The deaggregation data for the dam site indicates the mean value for the magnitude of the MDE is Mw 5.6.

Site Class and Factored Peak Ground Acceleration
The dam was constructed over foundation strata of alluvial deposits which could result in amplification of seismic waves. PGA amplification factors were selected based on the site classification for the dam using the procedure outlined in Chapters 11 and 20 of American Society of Civil Engineers Standard 7-16, Minimum Design Loads for Buildings and Other Structures (ASCE 7-16). Although ASCE 7-16 is not typically applied to earthen embankments, the application of the site coefficients presented in this standard to account for soil amplification is appropriate since a site-specific seismic hazard analysis or site response analysis has not been performed. Site classification is based on the relative stiffness of the upper 100 ft of the site soil profile, the presence of soils vulnerable to potential failure or collapse under seismic loading, and the presence of thick layers of soft clays or organic soils. Table 20.3-1 of ASCE 7-16 provides guidance on selecting an appropriate Site Class based on *in situ* testing of the subsurface materials. A Site Class D was selected for this site based on the SPT N-values collected in the foundation strata during the 2020 investigation. The average N-value in the foundation soils encountered below the embankment was N_{60} = 18 bpf.

A Site Amplification Factor was applied as defined in Table 11.8-1 of ASCE 7-16. This coefficient represents the estimated site amplification within the foundation soils based on the specific Site Class D for the dam. The coefficient is multiplied by the Site Class Boundary B/C PGA to get the factored Class D Soil PGA. An amplification factor of 1.43 was applied resulting in a factored PGA of 0.26g.

Liquefaction Potential
As required by TR 210-60 based on the factored PGA of 0.26g, the potential for the dam and foundation to experience cyclic liquefaction was evaluated using the methodology presented by Idriss and Boulanger in *Soil Liquefaction during Earthquakes* (2008). This methodology estimates a factor of safety against liquefaction for a given soil interval. A factor of safety of 1.0 or greater indicates that the soil is not anticipated to experience liquefaction during the analyzed earthquake ground motions.

The borings performed during the 2021 investigation were used for the evaluation. SPT N-values recorded during the field investigation were corrected to $N_{1,60}$ for the liquefaction analysis to account for hammer energy, overburden, borehole diameter, rod length, and sampler type. Where laboratory data was not available, fines contents (defined as materials passing the #200 sieve) were assumed based on soil descriptions from the boring logs. Soil unit weights were assigned and groundwater depth was based on materials and conditions observed during the field investigation and piezometer readings.

The liquefaction potential was evaluated for the saturated embankment and foundation soils for ground motions corresponding to the factored PGA of 0.26g for a Mw 5.6 earthquake event. The calculated factors of safety against liquefaction for the majority of the analyzed SPT samples were greater than 1.1 under the design ground motions. Zones of alluvium SPT samples with factors of

safety of 1.1 or less were encountered sporadically in two of the downstream toe borings and in the upstream bench boring. These zones appear to be isolated and have estimated thicknesses of 6 feet or less. No SPT samples with factors of safety of 1.1 or less were observed in the crest borings. Based on the analyses the foundation soils are not expected to experience widespread cyclic liquefaction or cyclic softening when subjected to the design ground motions

Seismic Yield Acceleration and Performance
A pseudo-static slope stability analysis was performed to estimate the seismic yield acceleration for the embankment upstream and downstream slopes. The yield acceleration is defined as the site ground accelerations at which the FS for slope stability is equal to 1.0, and above which deformation of the dam may begin to occur. Saturated soils in the bottom of the embankment fill and underlying foundation that are anticipated to experience undrained loading during seismic ground motions were modeled using estimated total stress shear strengths conservatively selected to reduce strength from drained strengths. Soils anticipated to be free draining were modeled with effective strength strengths.

These results indicate that the yield acceleration of the upstream slope (0.24g) and downstream slope (0.17g) are less than the Site Class D PGA for the site (PGA=0.26g). Because the yield accelerations are less than the design ground motions, the analyzed embankment section is expected to experience permanent slope deformations due to the design seismic event. The simplified procedures developed by Bray and Travasarou (2007), Saygili and Rathje (2008), and the National Cooperative Highway Research Program (2008) were used to estimate permanent lateral deformation. The median lateral displacements predicted by the models were less than 1 foot. Seismically induced settlement was also assessed with the correlation developed by Swaisgood (2013), and the calculated median value was less than 1 foot. The existing embankment geometry has approximately 24 feet of freeboard at normal pool. Therefore, there is a negligible risk of overtopping when the embankment is exposed to the 10,000-year return seismic event.

As requested by NRCS-WV, pseudo-static slope stability analyses were also completed in accordance with West Virginia Department of Environmental Protection, Dam Safety regulations (47CSR34 “Dam Safety Rule”, Part 7.4.b.1.D) using the site PGA. The analyses considered the following load case:

- Pseudo-Static Seismic Loading: Steady state seepage conditions originating at the Normal Pool EL 622.45, upstream and downstream slopes

The stability analysis results, including minimum required factors of safety (FS) per 47CSR34, Part 7.4.b.1.D, are presented in the table below.

Table D- 5 – Seismic Slope Stability Analysis Results (WVDEP Criteria)

Load Condition	Calculated Factor of Safety	WVDEP Minimum Required Factor of Safety
Seismic – Upstream	1.0	1.2
Seismic – Downstream	0.8	1.2

The pseudo-static slope stability results demonstrate that the dam does not satisfy the WVDEP minimum criteria for seismic loading. To increase the factor of safety, stabilization measures may be warranted.

Seismic Stability and Structural Condition of the Principal Spillway Riser

The principal spillway riser was evaluated for seismic stability in accordance with the NRCS *Technical Release 68 – Seismic Analysis of Risers* (TR-68) and NRCS *Technical Release 30 – Structural Design of Standard Covered Risers* (TR-30). The "in-air" and "in-water" cases were considered in accordance with the requirements of TR-68. The base shear was calculated using ASCE 7-16 seismic criteria. The stability criteria were evaluated per USACE EM 1110-2-2100 at the direction of WV NRCS.

Seismic stability analysis results are shown in the table below and indicate that the existing riser meets USACE criteria for sliding factor of safety and the location of the resultant. USACE criteria has a requirement for the location of the resultant force to evaluate rotational behavior and does not indicate a required factor of safety for overturning. The calculated overturning factor of safety is also shown for reference.

Table D- 6 - Seismic Evaluation of Existing Principal Spillway Riser – Factors of Safety

Loading Condition	Riser in Air	Riser in Water	Required Factor of Safety[1]
% of Base in Compression (Calculated Overturning Factor of Safety)	100% (5.0)	70% (1.9)	Resultant within Base
Calculated Factor of Safety – Sliding	4.5	1.6	1.3
[1]Stability criteria based on USACE EM 1110-2-2100. NRCS-WV approved the use of USACE criteria for this project via email correspondence dated December 1, 2021.			

Reinforcing steel in the footing was analyzed using ACI 350, but with a limit on the flexural tensile stress in the rebar based on NRCS policy. The analysis includes calculations for motion parallel to the endwalls as the riser is expected to be most vulnerable to movement in that direction. Structural analysis of the reinforced concrete indicates that the existing riser meets ACI 350 criteria for seismic loading, except for the shrinkage and temperature criteria. The primary function of temperature and shrinkage reinforcing steel is to limit cracking during the early life of a structure. For the existing riser, concrete shrinkage has already occurred, and the structure has likely experienced numerous thermal cycles during its 52-year lifespan with no reported performance issues.

Calculated bearing pressures of the existing riser are expected to be within the allowable bearing capacities calculated in accordance with NAVFAC DM 7.02.

Existing Conditions and Deficiencies

The dam was inspected on December 14, 2020, by Finley Lloyd, PE of Schnabel Engineering. The weather was cool and cloudy and the reservoir was approximately 7 inches above normal pool. The dam was observed to be in generally in good condition. This qualitative condition rating is based on the generally well-maintained condition of the structure and that the deficiencies observed during the inspection did not appear to pose an imminent threat to the dam or the surrounding area at the time of the inspection. Notable observations and recommendations include:

- Continue to monitor for loss of grass cover or growth of woody vegetation. Perform annual seeding and fertilize as needed.
- Review the impact residential and utility installations around and on the dam may have on the flood performance of the dam and modify as needed. The impacts of these installations on flood performance are anticipated to be relatively minor. If flood performance is negatively affected, relatively simple solutions are anticipated to either replace, repair, or relocate the installations. A non-exhaustive list of these installations noted during the inspection include:
    - Numerous residential landscaping installations along the right end of the dam embankment such as ornamental trees, a wood fence, and a plastic culvert pipe beneath Tea Table Road (with invert elevations below top of dam).
    - Concrete monuments, buried power lines, power poles, and flag poles were noted at the dam crest where the Blake Road embankment intersects with the dam embankment and at the upstream end of the ASW training dike.
    - Buried power lines are located within the downstream edge of the crest road.
    - Ornamental trees line the shoulder of Blake Road where the road embankment overlaps the downstream slope of the dam.
    - Occasional surface voids were noted around wooden bollards and gate posts along the gravel road on the dam crest.
- Continue monitoring the general condition of the slopes and specifically the upstream-left portion of the embankment for any evidence of movement.
- Continue monitoring the flat built-up area (or "bench") just downstream of the dam, left of the downstream channel, for any changes in behavior or appearance. Alternatively, the surface of this feature could be re-graded to prevent rainwater from ponding (along with follow-up monitoring to confirm water no longer collects in this area over the course of several years).
- Remove vehicle access to the Auxiliary Spillway, remove the archery targets, and remove the small soil mound at the control section. Continue to monitor the ditches around the Auxiliary Spillway entrance and left edge for erosion. Repair the damaged and buried portions of the stormwater drop inlet and discharge pipe at the Auxiliary Spillway exit channel.
- Closely inspect Joint J-20 of the principal spillway conduit to determine whether the joint has opened excessively and might be open to the surrounding soils (where the pipe cradle meets the impact basin at a 3-inch-wide preformed joint filler). Continue to monitor joint spalls for progressive deterioration and make repairs as needed.

Conclusions

Although the embankment consists of delineated zones, the 2021 investigation suggests a relatively homogenous embankment consisting of low-permeability, low plasticity clays, some of which have slightly dispersive characteristics. Because normal pool is low relative to the total height of the embankment and the embankment consists of low permeability, relatively homogeneous soils, the presence of slightly dispersive soils at the dam site is not considered a potential threat to the integrity of the embankment or foundation.

Based on the analyses of the apparent critical embankment / foundation cross section, TR-210-60 criteria is satisfied for seepage exit gradient, steady-state slope stability, and liquefaction. Although the computed seismic yield accelerations were less than the design PGA, permanent deformations due to the design seismic event were estimated to be relatively minor. The slope stability results also demonstrate that the dam does not satisfy the minimum criteria for static slope stability for rapid drawdown. The slope stability analyses also indicate that the WVDEP Dam Safety criteria are not satisfied for the rapid drawdown, downstream slope with flood surcharge, and seismic conditions. To increase the factor of safety, stabilization measures are required.

The filter compatibility analysis indicates portions of the existing trench drain material gradation band shown on the As-Built Drawings are too coarse to meet the filter requirements of Chapter 26 of NEH Part 633 for the embankment and foundation materials. The gradation curves for the drainfill samples collected during construction fall outside of the coarse limit established by the compatibility analyses for existing drainfill material in contact with the fine-grained embankment fill and foundation soils. Replacement of the trench drain with filter-compatible drainfill is recommended. Additional evaluation is necessary to evaluate whether replacement of the drainfill within the relief drains to improve filter compatibility is feasible and necessary given the substantial remediation efforts that would be required. Where replacement of the trench drain is unfeasible due to the existing roadway embankment, additional remedial measures may be required.

The As-Built Drawings indicate nine reinforced concrete anti-seep collars were installed along the principal spillway conduit, but do not show that a dedicated filter diaphragm was installed around the conduit. According to the As-Built Drawings (Section A-A, Sheet 5), the portion of the trench drain which parallels the principal spillway conduit includes a widened section left and right of the conduit, but no vertical extension beneath the pipe cradle or above the top of the pipe. It is unclear from the As-Built Drawings whether the main trench drain alignment includes increased vertical dimensions around the conduit. TR 210-60 states, "… for embankments of all hazard potential classifications with penetrations not protected by comprehensive filter and drainage features, include a filter drainage diaphragm around any structure that extends through the embankment to the downstream slope." Replacement of the existing trench drain with a toe drain and chimney filter is recommended, incorporating a conduit seepage diaphragm, to address this issue as well as the trench drain filter compatibility concerns. Although a chimney filter does not appear to be critical at this site, its inclusion is considered prudent given the opportunity while a construction excavation is open for installation of the toe drain. The replacement toe drain system should include abandonment or removal of the existing corrugated metal drainage pipes. The replacement toe drain system should extend to both abutments and consist of a graded filter system with PVC or HDPE collector and outlet pipes. Per the analysis in Appendix D, fine aggregate with

gradations specified in ASTM C33 would be an appropriate filter for the site material, with the potential for additional filtration measures for locally finer foundation soils. Note also that the As-Built Drawings appear to indicate that the left end of the existing trench drain is approximately 30 horizontal feet from the edge of the Auxiliary Spillway with elevations above and below the Auxiliary Spillway floor. The proximity of this material to the Auxiliary Spillway should be addressed during spillway integrity analyses.

In light of the evidence of historic landslides in the vicinity of the dam site, a thorough review of potential impacts that possible past mass movements may have on the dam, appurtenances, or the reservoir is recommended during the design phase. This should include on-site observation of existing topographic features at suspected movement zones.

Life Span and Reservoir Storage

As of 2022, the Blakes Creek–Armour Creek Site 7 is 52 years old. Our analysis provides information on historical submerged and aerated sediment accumulation in the reservoir. It should be noted that estimation of sediment accumulation in the reservoir inherently carries a certain level of inaccuracy due to the lack of detailed survey pre- and post-construction and variability in the land use.

Elevation data for the bottom of the reservoir and the bottom of the submerged sediment that were estimated during the sediment survey were imported into ArcGIS and overlaid with existing LiDAR data. The point cloud data in the LASer (LAS) format was obtained from USACE (2009 QL3 LiDAR for Bluestone Lake and Downstream) and processed in ArcGIS to create a bare earth raster at a 2-ft resolution. This data was then used to calculate areas above normal pool.

Spatial interpolation tools in ArcGIS were used to create two raster datasets: one for the bottom of the sediment, which represents terrain at the time the dams were constructed; and one for the bottom of the reservoir, which represents the existing terrain. ArcGIS tools were also used to develop stage-storage relationships for both raster datasets for submerged sediment. The stage-storage relationships are presented in Appendix D. The volumetric difference between the two raster datasets below the normal pool elevation represents the accumulated submerged sediment volume and is 22.5 acre-feet.

Aerated sediment accumulation was evaluated based on the auger sampling locations. Auger samples showed evidence of alluvial sediment that we interpreted to have accumulated since the construction of the dam. Using ArcGIS, a polygon area was created such that it encompassed the points. An interpolation routine was used in the ArcGIS Spatial Analyst software to create a smooth surface of sediment thickness values within the aerated boundary. The thickness of sediment in feet in each grid cell was then converted to a volume by considering the horizontal measurements of the grid cell. Summing the volumes of each cell then provided an estimate of the total volume of aerated sediment within the polygon area. The total estimated aerated sediment volume was 1.0 acre-feet.

After our sediment survey was completed and reporting was underway, we learned from the City of Nitro that in approximately 1986 (35 years ago), a portion of the lake was dredged to remove submerged sediment. Documents we reviewed include a letter from Jerry N. Fox dated

September 26, 1986 (with no attachments); a memo from Richard L. Judy dated September 30, 1986, an inspection and maintenance report (Sheet 2 of 2 only) dated April 21, 1987; and a letter to Mayor Arden Ashley dated March 25, 1988 (page 1 only). In addition, we reviewed historical aerial images from 1986, 1990, 1996, and several more recent aerials.

The documents we reviewed indicate that dredging occurred, but the volume and exact location of sediment that was dredged are not specified. While the City of Nitro does not have specific records of how much sediment was removed, Mayor Casebolt of the City of Nitro confirmed that the location of dredging was near the main inlet and presented an approximate boundary of where the dredging may have occurred. To estimate the volume that may have been dredged in 1986, we have assumed that the current volume of submerged sediment in the area at the inlet of the lake is equivalent to the amount that was removed in 1986. This estimation appears to be conservative since the dredging occurred only 16 years after the construction of the dam, and we are not aware of any additional dredging since (35 years). We estimated that the volume in this area is 6.9 acre-feet. This volume was added to the volume estimated during the sediment survey for a total of 29.4 acre-feet of submerged sediment and an annual accumulation rate of 0.59 acre-feet. Even with the addition of the conservative amount of material assumed to have been removed, the volumes measured and calculated currently are significantly less than the estimates used in the design..

Based on the results of our survey, we propose using future sedimentation rates based on the sedimentation rates obtained from the sediment survey, adjusted due to the 1986 dredging, which is 0.59 acre-feet/year.

Based on the results of the sediment survey, it appears that sediment accumulation is concentrated in the area at the inlet to the lake, which was dredged previously. Therefore, dredging may have to be performed on a regular basis and included in the maintenance costs for the project. A summary of the results is provided in Table D- 7.

Table D- 7 - Summary of Results

Submerged sediment accumulation rate (ac-ft/year)	0.59
Available submerged sediment storage (ac-ft)[1]	90.9
Future Submerged sediment storage availability (years)	155

1. Available submerged sediment storage is calculated based on actual submerged sediment volume estimated during the sediment survey (22.5 ac-ft) and subtracted from the design submerged sediment storage capacity (113.4 ac-ft).

The primary material components are the principal spillway riser, pipe, and trench drains. The corrugated metal pipe trench drains are beyond their service life and should be replaced as part of the rehabilitation. The condition of pipe joint J-20 should be evaluated further to evaluate life expectancy and repaired or replaced, as needed.

Hydrologic Analysis

Hydrologic analysis of the Blakes Creek–Armour Creek Watershed was performed in support of the benefit cost analysis. One HEC-HMS model was developed to model rainfall-runoff processes in the watershed and to estimate inflow hydrographs for the two-dimensional HEC-RAS hydraulic model (USACE, 2016), which was used to extract flood depth data for each recurrence interval.

The Blakes Creek–Armour Creek Watershed was divided into 6 sub-watersheds, represented by the schematic shown in Figure D- 1.

The components of the HEC-HMS model are described in the following sections. A summary of the resulting hydrologic parameters and hydrologic soil groups is provided in Table D- 9.

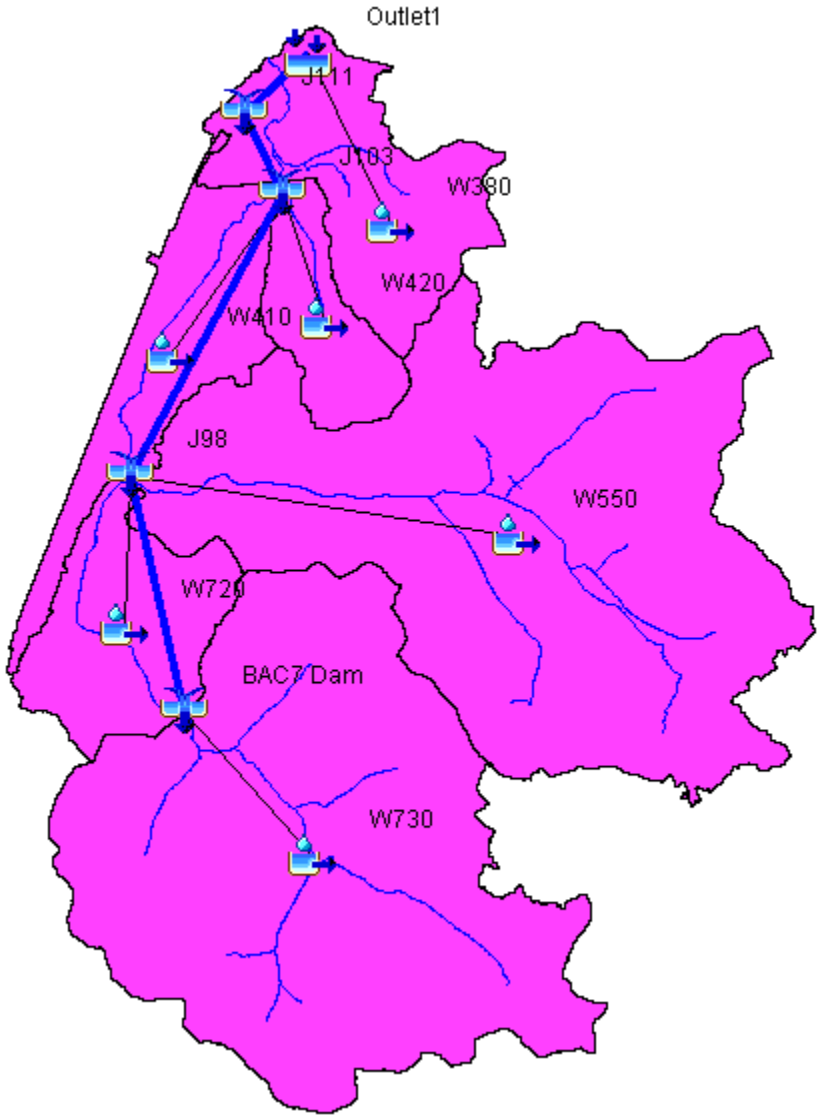


Figure D- 1 – HEC-HMS Model Schematic

Rainfall

Point precipitation data for the 2-year, 5 – year, 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year recurrence intervals and the 24-hour durations were obtained from NOAA Atlas 14 (Table D- 8).

Table D- 8 – NOAA Atlas 14 Rainfall Volume

Duration	Average Recurrence Interval (Years)							
	2	5	10	25	50	100	200	500
	Precipitation							
5-min	0.408	0.489	0.55	0.625	0.683	0.736	0.789	0.857
15-min	0.78	0.933	1.04	1.18	1.28	1.38	1.47	1.57
60-min	1.28	1.6	1.84	2.16	2.41	2.66	2.9	3.22
2-hr	1.47	1.84	2.12	2.5	2.81	3.11	3.42	3.83
3-hr	1.54	1.92	2.22	2.63	2.95	3.28	3.62	4.08
6-hr	1.81	2.24	2.58	3.06	3.45	3.84	4.25	4.82
12-hr	2.12	2.59	2.97	3.52	3.96	4.43	4.91	5.58
24-hr	2.58	3.12	3.56	4.17	4.67	5.19	5.73	6.46

Runoff Losses

The SCS curve number (CN) method was used to estimate runoff losses. CNs were developed using the National Engineering Handbook, Part 630, Chapter 9 based on cover type, hydrologic conditions, and hydrologic soil groups (HSGs) obtained from the following sources:

- WV Land Use Land Cover (NAIP 2016) data
- Soil Survey Geographic (SSURGO) database

The classification table that was used to assign CNs based on the corresponding land cover type and HSG is provided in Table D- 10.

Table D- 9 - Summary of Hydrologic Parameters

Sub-Watershed	Area (sq mi)	CN	I_a coefficient	Lag (min)	Lag (hrs)
W720	0.48	72.95	0.20	24.76	0.41
W550	2.54	77.76	0.20	40.74	0.68
W420	0.26	78.09	0.20	16.74	0.28
W410	0.46	83.59	0.20	29.72	0.50
W380	0.60	83.19	0.20	24.01	0.40
W730	2.36	71.79	0.20	34.90	0.58

Table D- 10 - Curve Number Classification Based on Land Cover and HSG Type

Land Cover	NLCD ID	NLCD/TR-55 Land Cover	Hydrologic Soil Group			
			A	B	C	D
Barren	31	Barren Land / Sand Rock Clay	77	86	91	94
Cultivated Crops	82	Cultivated Crops	67	78	85	89

Land Cover	NLCD ID	NLCD/TR-55 Land Cover	Hydrologic Soil Group			
			A	B	C	D
Dry Oak (~Pine) Forests	41	Deciduous Forests	36	60	73	79
Dry-Mesic Oak Forests	41	Deciduous Forests	36	60	73	79
Hay / Pasture	81	Pasture / Hay	30	58	71	78
Impervious	TR-55	Impervious Areas	98	98	98	98
Low Vegetation	TR-55	Herbaceous - Good	50	62	74	85
Mixed Development	TR-55	Residential -1/4 acre	61	75	83	87
Mixed Mesophytic Forests	41	Deciduous Forests	36	60	73	79
Other Forests	41	Deciduous Forests	36	60	73	79
River Floodplains	TR-55	Wood Grass Comb. Fair	43	65	76	82
Roads	TR-55	Impervious Areas	98	98	98	98
Small Stream Riparian Habitats	TR-55	Herbaceous - Good	50	62	74	85
Water	11	Open Water	100	100	100	100
Wetlands PEM	90	Woody Wetlands	100	100	100	100
Wetlands PFO PSS	90	Woody Wetlands	100	100	100	100

Runoff Transformation

The SCS Dimensionless Unit Hydrograph method was used to transform runoff volumes to flow hydrographs. This method consists of parameters such as rainfall duration (D), time-to-peak (T_p), time-of-recede (T_r), and peak flow (q_p). The dimensionless hydrograph is scaled by Lag Time (L) and the Peak Flow (q_p) to produce the basic shape of unit hydrograph. Lag time can be calculated using various approaches, including the SCS lag equation and the segmental approach. The SCS lag equation is an empirical-based approach that estimates lag time directly. This approach is recommended for homogeneous basins less than 2,000 acres in size.

The SCS lag time equation is given as:

$$L = \frac{l^{0.8}(S+1)^{0.7}}{1900Y^{0.5}}$$

where:

L = lag time [hrs]
l = length of the longest path [ft]
Y = average watershed land slope [%]
S = maximum potential retention [inch]
= (1,000/CN) – 10
where:
CN = curve number

In the segmental approach, the parameter being estimated is essentially the time of concentration or longest travel time within the basin. The time of concentration is calculated individually for sheet flow, shallow concentrated flow, and channel flow. The sum of the individual travel times

represents the time of concentration. USDA-NRCS relates lag time, L, and time of concentration, T_c, as:

$$L = 0.6T_c$$

For this analysis, the more detailed segmental approach was utilized to develop time of concentration (and lag time) for the watershed upstream of Blakes Creek–Armour Creek Site 7 since time of concentration is one of the critical parameters for development of the design hydrograph. The individual segments were analyzed using the best available topography (LiDAR), aerial photography, and by using data obtained in the field.

For all other watersheds downstream of Ridenour Lake Dam, the SCS lag equation was used to estimate lag time. The NRCS lag time equation's input parameters (flow length and average watershed land slope) were calculated for each sub watershed using HEC-GeoHMS. This approach was determined to be satisfactory for developing downstream hydrology and lateral inflow hydrographs for hydraulic modeling and for evaluating flood damages for "with" and "without" dam scenarios.

Routing

The main purpose for development of the HEC-HMS model was to generate inflow hydrographs from individual sub-basins as input for the HEC-RAS model, in which stream/river routing will be performed. Therefore, stream/river routing in HEC-HMS was only set up to allow for the model to execute and does not have an effect on the outflow hydrographs from the individual sub-basins.

Hydraulic Analysis

A two-dimensional HEC-RAS hydraulic model was developed for hydraulic analysis of Blakes Creek and Armour Creek downstream of the dam. The model domain extended from the dam site to the confluence with Kanawha River. Unsteady flow modeling for several recurrence intervals was performed to simulate downstream flow conditions and estimate flood depth at impacted structures, roads, bridges, and culverts. For each model scenario, inflow hydrographs developed in the HEC-HMS model were dynamically linked with the HEC-RAS model. For the "without" dam scenarios, the storage area and the inline structure representing the reservoir and the dam were removed and a new geometry file was created.

LiDAR-based topographic data was used to develop model geometry. Manual adjustments were made to the terrain model in several areas, in particular around bridges, based on field measurements. Bridge and culvert dimensions were based on measurements obtained in the field durign the initial site reconnaissance. The model domain with boundary conditions and locations of stream crossings is shown in the figure below.

Manning's n-values

Manning's n-values were assigned to each land cover type (Table D- 11) based on available guidance documents, including the HEC-RAS User's Manual and a publication by NRCS Kansas

(Manning's n Values for Various Land Covers To Use for Dam Breach Analyses by NRCS in Kansas).

Table D- 11 – Manning's n-values

Land Cover	Manning's n-value
Barren	0.025
Cultivated Crops	0.035
Dry Oak (Pine) Forests	0.16
Dry-Mesic Oak Forests	0.16
Hay / Pasture	0.03
Impervious	0.016
Low Vegetation	0.035
Mixed Development	0.08
Mixed Mesophytic Forests	0.16
Other Forests	0.16
River Floodplains	0.07
Roads	0.016
Small Stream Riparian Habitats	0.07
Stream – upper reach	0.035
Stream – lower reach	0.03
Water	0.04
Wetlands PEM	0.07
Wetlands PFO PSS	0.12

Stage-Discharge Rating Table for Principal Spillway

Discharge through the principal spillway was modeled in HEC-RAS using a stage-discharge relationship developed in SITES based on dimensions of the riser structure and the principal spillway conduit (Table D- 12).

Table D- 12 – Principal Spillway Stage-Discharge Rating Table

Stage [ft]	Discharge [cfs]
622.5	0
622.9	11.33
623.29	32.03
623.68	58.85
624.07	90.61
627.31	96.65
630.55	102.3
633.79	107.65
637.04	112.74

Stage [ft]	Discharge [cfs]
640.28	117.62
643.52	122.3
646.76	126.81
650	131.16

Stage-Storage Relationship

The stage-storage relationship for the reservoir was developed using bathymetry survey data performed as part of this project and combined with the 2-meter LiDAR-based DEM. The analysis was documented in *Sediment Survey Report* (Aterra-Schnabel JV, 2021). The stage-storage relationship used for this analysis is presented in Table D- 13.

Table D- 13 - Stage-Storage and Stage-Discharge Relationships

Elevation [ft]	Principal Spillway Discharge [cfs]	Storage [ac-ft]
608.4		0.0
610.0		0.5
612.0		3.0
614.0		11.3
616.0		27.7
618.0		55.6
620.0		90.6
622.5	0	142.4
624.0	63.8	178.6
626.0	94.0	230.8
628.0	97.8	287.0
630.0	101.1	347.0
632.0	104.6	411.0
634.0	108.0	479.2
635.8	110.7	546.6
636.0	111.0	552.8
638.0	114.1	634.2
642.0	120.0	820.3
646.0	125.6	1036.3
650.0	131.2	1279.6

Downstream Boundary Condition

Given the significant difference in watershed size, it can be reasonably assumed that Kanawha River and Armour Creek are hydrologically independent. Assigning a water surface elevation based corresponding to an annual flood frequency in the Kanawha River as a downstream boundary condition that occurs coincidently with various annual flood frequencies along Armour Creek is arbitrary and would not accurately represent annual exceedance probabilities for the cost-benefit analysis. For hydrologically independent waterways, the joint probability of, for example, a 1/10-year flood (i.e., 0.10 annual exceedance probability) along the Kanawha River occurring coincidentally to a 1/50-year flood (i.e., 0.02 annual exceedance probability) along Armour Creek would be approximately equal to 0.10 x 0.02 x (1/365) = 5.5E-6. Following this example, Table D- 14 below shows that coincidental probabilities for various frequency combinations would all be very low. Therefore, applying an annual flood frequency along the Kanawha River as a downstream boundary condition for Armour Creek would not be appropriate.

Table D- 14 – Joint Probabilities for Hydrologically Independent Waterbodies

		Armour Creek (Frequency of Flooding)							
		0.5	**0.2**	**0.1**	**0.04**	**0.02**	**0.01**	**0.005**	**0.002**
Kanawha River (Frequency of Flooding)	**0.5**	6.85E-04	2.74E-04	1.37E-04	5.48E-05	2.74E-05	1.37E-05	6.85E-06	2.74E-06
	0.2	2.74E-04	1.10E-04	5.48E-05	2.19E-05	1.10E-05	5.48E-06	2.74E-06	1.10E-06
	0.1	1.37E-04	5.48E-05	2.74E-05	1.10E-05	5.48E-06	2.74E-06	1.37E-06	5.48E-07
	0.04	5.48E-05	2.19E-05	1.10E-05	4.38E-06	2.19E-06	1.10E-06	5.48E-07	2.19E-07
	0.02	2.74E-05	1.10E-05	5.48E-06	2.19E-06	1.10E-06	5.48E-07	2.74E-07	1.10E-07
	0.01	1.37E-05	5.48E-06	2.74E-06	1.10E-06	5.48E-07	2.74E-07	1.37E-07	5.48E-08
	0.005	6.85E-06	2.74E-06	1.37E-06	5.48E-07	2.74E-07	1.37E-07	6.85E-08	2.74E-08
	0.002	2.74E-06	1.10E-06	5.48E-07	2.19E-07	1.10E-07	5.48E-08	2.74E-08	1.10E-08

A more appropriate method for considering coincident flows along the Kanawha River is to identify its "flow-duration" properties. The flow-duration curve, which is a relationship between flow and % time exceeded on any given day, can be developed using USGS streamflow data along the Kanawha River. The closest USGS gage to the Kanawha River-Armour Creek confluence is the upstream USGS gage at Charleston, WV. Flows recorded at this gage can be transposed to the confluence with Armour Creek and vice versa. According to the FEMA FIS, the 10-yr recurrence interval flow in the Kanawha River just downstream of the confluence with Armour Creek is 129,000 cfs and approximately 123,000 cfs at the USGS Charleston gage. The USGS Charleston gage, with a drainage area of 10,448 sq mi, has been recording streamflow data since 1939. Based on flow-duration curve developed using streamflow data at the USGS Charleston gage, the probability of exceeding the 10-year annual frequency flow (123,000 cfs) on any given day is only 0.1% or 0.001 (Figure D- 2). This would equate to a coincident probability of 0.001 x 0.04 = 4.0E-5 for, say, the 25-year flood in Armour Creek. Similarly low coincident probabilities would result if a 2-year annual frequency flow in the Kanawha River and other annual flood frequencies in Armor Creek were used.

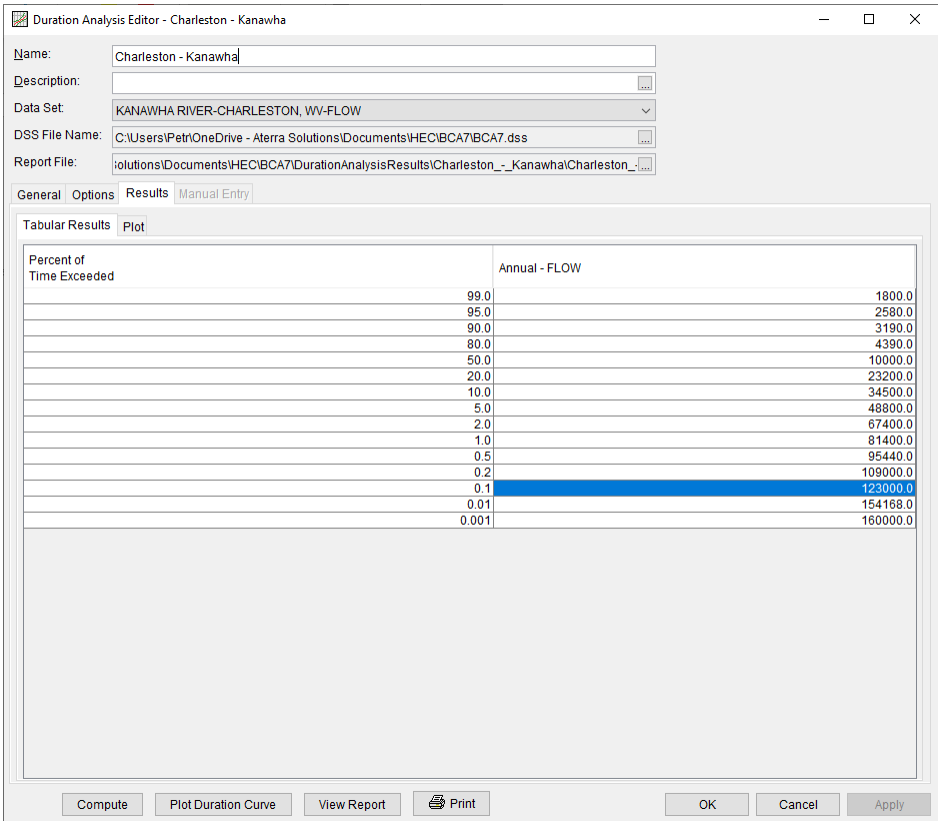


Figure D- 2 –Duration Analysis Results at Charleston USGS Gage

In summary, given the extremely low coincidental probabilities, the use of boundary condition based on the "normal" flow conditions in the Kanawha River is reasonable for evaluation of with and without dam scenarios in support of the benefit cost analysis. Therefore, the downstream boundary condition was established as known water surface elevation of 566.25 ft which corresponds to the approximate normal water surface elevation in the Kanawha River based on the LiDAR data.

Hydraulic Analysis Results

The hydraulic analysis was performed to estimate inundation depths at downstream structures for a range of flood recurrence intervals, from the 2-year to the 500-year floods, in support of the economic analysis. Flood inundation rasters for each recurrence interval were developed in HEC-RAS and were used as input for the FEMA HAZUS MP framework to evaluate the effects of the dam.

Dam Breach Analysis

Review of Hazard Classification

Dam breach analysis was performed to evaluate the current hazard classification and to estimate breach consequences for the Plan-EA. The "Statement of Work for Supplemental Watershed Plan-Environmental Document for Blakes Creek–Armour Creek Site 7" specifies loading conditions to be used for dam breach analysis as following:

i. The hydrologic breach inundation area will be determined by routing a breach hydrograph downstream beginning just downstream of the dam. The constructed breach hydrograph shall use a minimum peak breach discharge computed in accordance with TR-60 assuming the worst-case reservoir water surface elevation at the crest of dam embankment or at the maximum water surface elevation obtained by routing a 6- or 24-hour inflow hydrograph developed using the probable maximum precipitation through the dam. A spreadsheet tool to compute TR-60 minimum peak breach discharges and to construct breach hydrographs is available from the NRCS upon request. Alternately, the process-based model WinDAM may be used.

ii. The static breach inundation area will be determined by routing a breach hydrograph downstream beginning just downstream of the dam. The constructed breach hydrograph shall use a minimum peak breach discharge computed in accordance with TR-60 assuming the reservoir water surface elevation is at the crest of the auxiliary spillway elevation or at the maximum reservoir water surface elevation obtained by routing a 100-yr-generated inflow hydrograph through the dam, whichever is higher.

iii. Seismic breaches will be computed by routing a breach hydrograph downstream beginning just downstream of the dam. The constructed breach hydrograph shall use a minimum peak breach discharge computed in accordance with TR-60 assuming the reservoir is at the crest of the principal spillway (permanent pool) elevation or in the case of significant base flows at the reservoir water surface elevation obtained by routing the base flow through the dam.

All scenarios were evaluated using a process-based model, WinDAM C. Internal erosion breach analysis option was assumed for the static and seismic breach scenarios. Both overtopping and internal breach options were evaluated for the FBH breach scenario.

Since WinDAM C does not have an option for zone embankments, two sets of dam breach parameters were developed for each zone (Table D- 15). The parameters were based on the results of the geotechnical exploration, the corresponding laboratory tests, and the WinDAM C guidance documents (Visser, 2015).

Table D- 15 - WinDAM C Parameters

Parameter	Unit	Zone I	Zone II	Source
Erosion Model	N/A	Hanson/Robinson Stress Erosion Model		
Total Unit Weight	lb/ft^3	125	125	Geotechnical Evaluation Report (Aterra-Schnabel JV, 2021)
Erodibility Index (K_d)	$(ft/hr)/(lb/ft^2)$	0.5	10	
Undrained Shear Strength	lb/ft^2	835	418	
Critical Shear Stress	lb/ft^2	0.0008	0	
Upstream Embankment				
Slope (H/V)	N/A	3.5		As-built drawings (USDA - SCS, 1967)
Retardance Curve Index (or n-value)	N/A	5.6		Assumed Retardance Class C, Table 7-5 (USDA-NRCS, 2007)
Dam Crest				
Width	feet	26		As-built drawings (USDA - SCS, 1967)

Parameter	Unit	Zone I	Zone II	Source
Retardance Curve Index (or n-value)	N/A	0.023		Manning's n-value for gravel surface
Downstream Embankment				
Slope (H/V)	N/A	3		As-built drawings (USDA - SCS, 1967)
Retardance Curve Index (or n-value)	N/A	5.6		Assumed Retardance Class C, Table 7-5 (USDA-NRCS, 2007)
Plasticity Index	N/A	15	10	Geotechnical Evaluation Report (Aterra-Schnabel JV, 2021)
Particle Diameter	in	0.0039	0.0394	
Vegetal Cover Factor (C_f)	N/A	0.75		Assumed Grass Mixture, Table 7-3 (USDA-NRCS, 2007)
Maintenance Code	N/A	1		Page 4-46 of the SITES User Guide
Dam Base EL	ft	595		As-built drawings (USDA - SCS, 1967)

Tailwater Rating Relationship

The tailwater rating relationship was developed from the HEC-RAS model used for frequency-based flood-routings (Aterra-Schnabel JV, 2021). The tailwater rating relationship is presented in Table D- 16.

Table D- 16 - Tailwater Rating Relationship

Tailwater Elevation [ft]	Reservoir Outflow [cfs]
595	0
599.5	109
600.7	350
604.7	1979
607.2	4351
608.9	7017
609.9	9381
611.3	12969
611.7	14076
613.9	24980
624.6	83349

Static Breach Flows

The 100-year flood elevation in the Blakes Creek–Armour Creek Site 7 reservoir is below the auxiliary spillway crest elevation and, therefore, water surface elevation at the crest of the auxiliary spillway elevation was used for evaluation of the static breach scenario.

Internal erosion breach option was evaluated in WinDAM C. The internal conduit dimensions and elevations were iteratively adjusted to maximize the breach outflow. The results indicate that Zone II internal conduit breach with invert elevation 632 ft and 1-ft wide by 1-ft high conduit results in the highest peak flow. The summary of peak flows is provided in Table D- 17.

Hydrologic Breach

The results of the hydrologic analysis of existing structure showed that the 6-hr FBH event governs. In accordance with TR-210-60, the 6-hr FBH generated using SITES, which results in the peak reservoir stage resulting from the PMF, was used as inflow hydrograph for the hydrologic breach scenario.

WinDAM C results indicate that overtopping breach is not a credible failure scenario. Therefore, internal erosion breach option was also evaluated. The internal conduit dimensions and elevations were iteratively adjusted to maximize the breach outflow. The results indicate that Zone II internal conduit breach with invert elevation 642 ft and 1-ft wide by 1-ft high conduit results in the highest peak flow. The summary of peak flows is provided in Table D- 17.

Seismic Breach

The seismic dam breach scenario with water at normal pool elevation was evaluated in WinDAM C. The internal conduit dimensions and elevations were iteratively adjusted within Zone I of the embankment to maximize the breach outflow. The results indicate that internal conduit breach with invert elevation 602 ft and 1-ft wide by 1-ft high conduit results in the highest peak flow. The summary of peak flows is provided in Table D- 17.

Table D- 17 - Peak Breach Flows

Loading Scenario	Peak Flow (cfs)
Static Loading Breach Peak Flow (crest of ASW) – Internal Zone I	4780
Static Loading Breach Peak Flow (crest of ASW) – Internal Zone II	20195
Hydrologic Loading Breach Peak Flow (6-hr FBH) – Overtopping	14250
Hydrologic Loading Breach Peak Flow (6-hr FBH) – Internal Zone I	15967

Loading Scenario	Peak Flow (cfs)
Hydrologic Loading Breach Peak Flow (6-hr FBH) – Internal Zone II	51340
Seismic Loading Breach Peak Flow (normal pool)	1322

HEC-RAS Breach Routing

The HEC-RAS model developed for frequency-based flood-routings (Aterra-Schnabel JV, 2021) was updated to allow for routing of the WinDAM C output breach hydrographs. The model parameters, such as Manning's n values, bridge and culvert dimensions, and downstream boundary conditions remained the same. The model domain was, however, expended to account for greater flows associated with the hydrologic dam breach scenario. The model terrain was also updated due to availability of QL2 LiDAR data for Putnam and Kanawha Counties. The breach output hydrographs were entered as inflow boundary condition just downstream of the existing dam. 2-year frequency flows (approximately bankfull) were used as lateral inflow hydrographs from downstream watersheds.

Population at Risk

NRCS Population at Risk (PAR) worksheets were used to estimate population at risk based on the inundation depths for each of the dam failure scenarios. The results show that the failure of Blakes Creek–Armour Creek Site 7 may cause loss of life and serious damage to homes, industrial or commercial buildings, important public utilities, main highways, or railroads. Therefore, the high hazard potential classification is appropriate for this dam. The PAR worksheets are included in the Administrative Record for this project. Note that the PAR for hydrologic dam breach was based on incremental increase in flood depths when compared to the no breach scenario.

Evaluation of Dam Performance

NRCS SITES software package was used to evaluate performance of the dam in accordance with TR 210-60 design criteria. The Principal Spillway Hydrograph (PSH), the Stability Design Hydrograph (SDH), and the Freeboard Hydrograph (FBH) provide the basis for evaluating dam capacity and stability and integrity of the auxiliary spillway.

Rainfall Data

Runoff volumes for evaluation of the PSH runoff condition were obtained from Figure 21-2 and 21-3 in National Engineering Handbook, Part 630, Chapter 21 (USDA-NRCS, 2019). Current NOAA precipitation-frequency data from NOAA Atlas 14 (NOAA, n.d.) and Probable Maximum Precipitation (PMP) based on HMR 51 (NOAA, 1978) and NRCS standard 6-hr and 24-hr (5-point) distributions were used as precipitation input in the analysis.

A summary of TR 210-60 design criteria and the corresponding rainfall and runoff values are provided in Table D- 18 through Table D- 20.

Table D- 18 - Auxiliary Spillway Hydrologic Criteria (TR-210-60)

SDH Rainfall Data	P_{100} + 0.26 (PMP – P_{100})	Figure 2-2, TR-210-60
FBH Rainfall Data	PMP	Figure 2-2, TR-210-60

Table D- 19 - Rainfall and Runoff Data

	Depth	Source
100-year 6-hour Rainfall	3.84 in	NOAA Atlas 14
100-year 24-hour Rainfall	5.19 in	NOAA Atlas 14
100-year 1-day Runoff	3.41 in	Figure 21-2 & 21-3, NEH, Part 630, Ch 21
100-year 10-day Rainfall	8.18 in	NOAA Atlas 14
100-year 10-day Runoff	6.81 in	Figure 21-2, NEH, Part 630, Ch 21
SDH Point Rainfall, 6-hour Rainfall	10.07 in	HMR 51 & NOAA Atlas 14
FBH Point Rainfall, 6-hour PMP	27.82 in	HMR 51
FBH Point Rainfall, 24-hour PMP	35.27 in	HMR 51

Table D- 20 - Additional Hydrology Parameters

	Value	Source
Quick Return Flow (rainfall)	5.63 csm	Table 21-5, NEH, Part 630, Ch 21
Climactic Index	1.42	SITES, Lookup Value for Kanawha County
Quick Return Flow (runoff)	5.12 csm	Figure 21-4, NEH, Part 630, Ch 21
Baseflow	6 csm	USDA-SCS Blakes Creek Site No.7 Design Report, Hydraulic Design, page 13 of 20

Soil Parameters and Material Properties

Soil parameters and material properties for stability and integrity analysis were developed based on data obtained as part of the geotechnical investigation. The auxiliary spillway was modelled with five soil layers:

- Fill material
- Residuum
- Partially Weathered Rock (PWR)
- Very Weak Shale / Claystone
- Weak Shale / Claystone

A summary of the soil parameters is provided in Table D- 21. Figure D- 3 shows the auxiliary spillway profile with the corresponding material stratification.

Table D- 21 - SITES Material Properties

Material	A - Fill	B - Residuum	C - PWR	D - Very Weak Shale	E - Weak Shale
USCS Classification	CL	CL	CL, ML, SC	-	-
Plasticity Index	16	16	0	0	0
Dry Density (pcf)	100	110	120	140	140
Percent Clay (%)	25	25	5	-	-
Rep. Dia, D_{75} (mm)	0.001	0.001	0.031	36*	36*
Head Cut (Erodibility) Index, K_h	0.04	0.13	0.45	2.83**	36.5**

* D75 values for rock are based on rough estimates of joint spacing and patterns. Suggest SITES sensitivity analysis based on this parameter. Additional refinement of the D75 rock size is not feasible without exposing the rock. Due to the tendency for the claystone and some shales at this site to slake rapidly with exposure, SITES analyses that indicate acceptable integrity conditions should be reevaluated using reduced D75 values (using a value of approximately 0.1 inch in lieu of the values shown in this table, based on the SITES Help Handbook example parameters for Decomposed Shale).

** Due to the tendency for the claystone and some shales at this site to slake rapidly with exposure, SITES analyses that indicate acceptable integrity conditions should be reevaluated using reduced Kh values (using a value of approximately 0.2 in lieu of the values shown in this table, based on the SITES Help Handbook example parameters for Decomposed Shale).

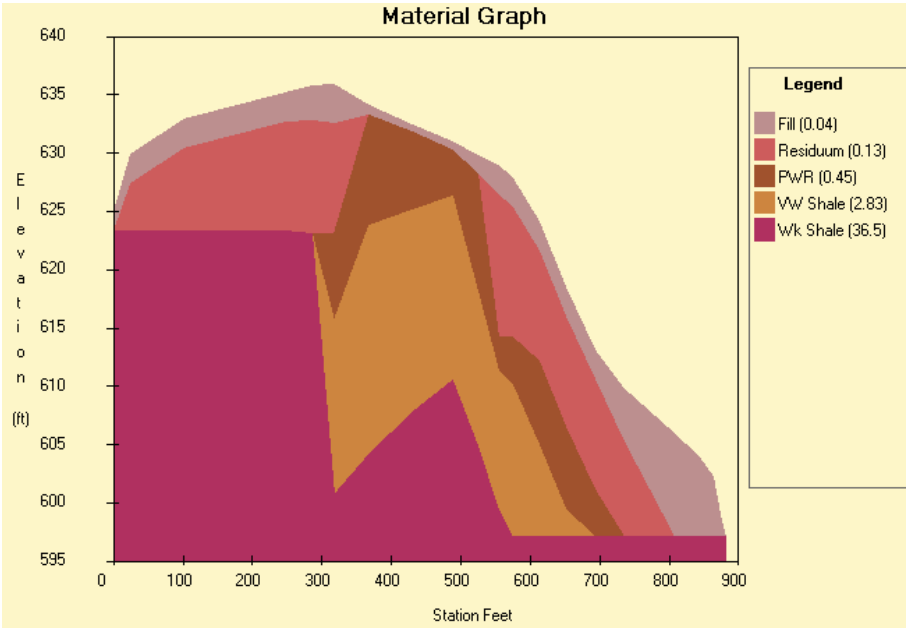


Figure D- 3 – SITES Material Stratification of Auxiliary Spillway

Design Hydrographs

For the Principal Spillway Hydrograph (PSH), a combined 1-day/10-day 100-year rainfall is used to analyze the capacity of the principal spillway. Typically, the objective is to pass the PSH without overtopping the auxiliary spillway; however, the NRCS allows for some overtopping if the spillway is considered "structural" (not applicable to the existing spillways). The pool elevation should be drawn down in 10 days after passage of the PSH. If more than 15% of the PSH volume remains, the minimum elevation of the auxiliary spillway is typically raised to accommodate the remaining storm volume. Further routing of the FBH or SDH is performed with the starting reservoir elevation set to the 10-day drawdown water surface elevation. For the PSH, the starting elevation was 622.95 ft (determined by SITES based on the baseflow elevation). The minimum required ASW crest elevation, based on the PSH analysis, is 632.52 ft. The existing ASW crest is at elevation 635.84 feet; therefore, the crest is approximately 3.32 feet higher than required. A summary of the PSH model runs is provided in Table D- 22 and Table D- 23.

Table D- 22 – Summary of PSH Model Runs (Existing Land Use)

	Peak Outflow (cfs)	**Peak Stage (ft)**	**Storm Duration**	**Meets Criteria** [Y/N]
PSH (Runoff)	105.5	632.52	10-day	Y
PSH (Rainfall)	103.9	631.57	10-day	Y

Table D- 23 - Summary of PSH Model Runs (Future Build-out Land Use)

	Peak Outflow (cfs)	**Peak Stage (ft)**	**Storm Duration**	**Meets Criteria** [Y/N]
PSH (Runoff)	105.5	632.52	10-day	Y
PSH (Rainfall)	104.5	631.94	10-day	Y

The 6-hour Stability Design Hydrograph (SDH) is used to evaluate the stability of the auxiliary spillway. During the design storm event, the auxiliary spillway should not experience excessive stripping of vegetation. The stress limitations may be increased 20 percent when the anticipated average use is once in 50 years or 50 percent when the anticipated average use is once in 100 years.

The auxiliary spillway is evaluated for headcut development and advancement during the Freeboard Hydrograph (FBH) event. The auxiliary spillway should pass the worst case of the 6-hour or the 24-hour FBH event without breaching.

The FBH is also used to evaluate the total spillway flow and establish the minimum settled elevation of the top of the dam. In addition, the minimum elevation difference between the crest of the auxiliary spillway and the top of the dam must be 3 feet or higher. The auxiliary spillway should pass the worst case of the 6-hour or the 24-hour FBH event with the associated maximum water surface elevation at or below the crest of the top of the settled dam.

Existing Conditions Results

Based on the SITES analysis results, the dam does not meet the stability and integrity criteria per TR 210-60 and the auxiliary spillway is compromised during the design storm. The results also indicate that the dam crest minimum elevation of 645.81 ft is overtopped during the 6-hr FBH event for both existing and future buildout conditions. However, the overtopping is limited to approximately 50 feet of the left embankment as it transitions into the auxiliary spillway (see Figure D- 4). A summary of the results is provided in Table D- 24 and

Table D- 25.

Table D- 24 – Existing Conditions SITES Analysis Results (Existing Land Use)

	Peak Outflow (cfs)	Peak Stage (ft)	Storm Duration
SDH	1553	638.65	6-hr
FBH	14267	646.71	6-hr
FBH	6917	642.82	24-hr

Table D- 25 - Existing Conditions SITES Analysis Results (Future Build-out Land Use)

	Peak Outflow (cfs)	Peak Stage (ft)	Storm Duration
SDH	1695	638.79	6-hr
FBH	14596	646.85	6-hr
FBH	6941	642.84	24-hr

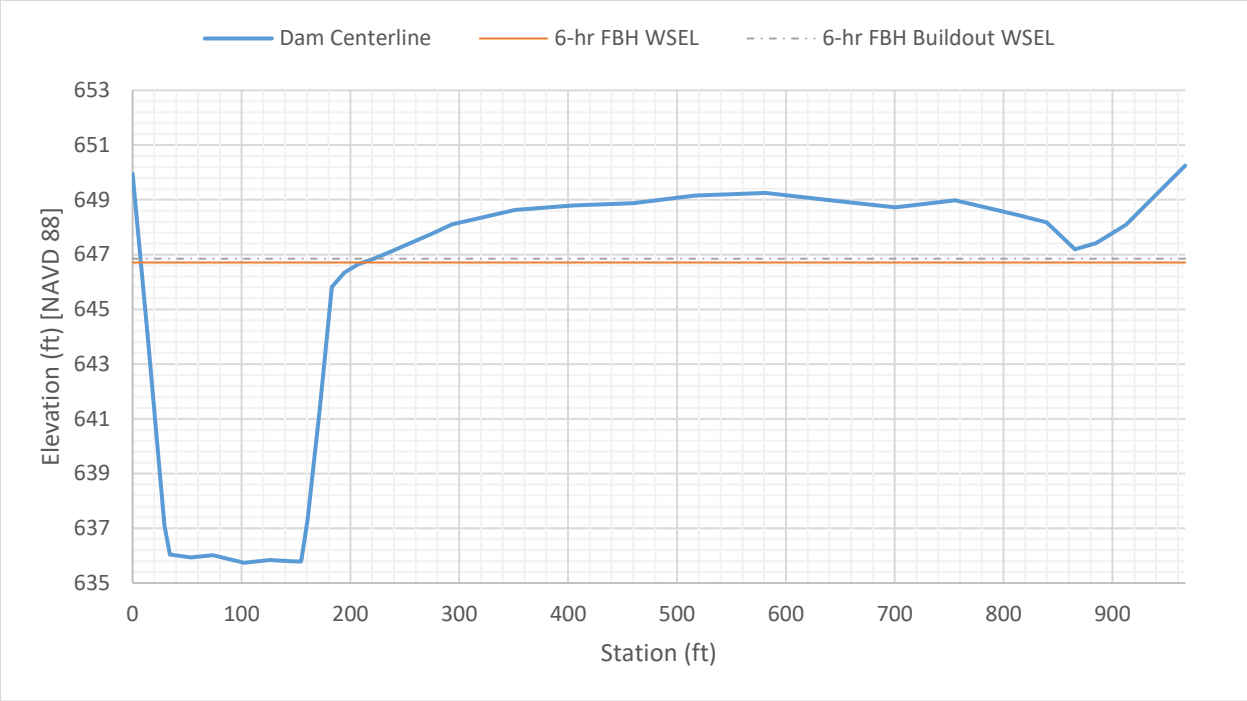


Figure D- 4 - Controlling FBH Peak Stage Elevations and Dam Centerline Profile

Rehabilitation Alternatives

Table D- 26 shows a comparison of peak flows and stages between the existing conditions and the structural rehabilitation alternatives. Only the controlling FBH event is presented. As shown in Table D- 26, the outflow of the Locally Preferred Alternative is hydraulically equivalent to existing configuration, and it does not result in induced flooding upstream or downstream of the dam.

Table D- 26 - Comparison of SITES Analysis Results for Existing Conditions and Rehabilitation Alternatives

Scenario	Peak Outflow (cfs)	Peak Stage (feet)
Existing Conditions	14596	646.85
Alternative 2	14535	646.81
Alternative 3	14638	646.87
Alternative 4	14525	646.81

Social and Economic Conditions

The NRCS National Watershed Program Manual (NWPM) was used as a reference for the economic analysis along with three other documents: the *National Resource Economics Handbook, Part 611 Water Resources Handbook for Economics*, USDA/Natural Resources

Conservation Service, July 1998; *Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G)*, December 1983; and *Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (PR&G), DM 9500-013*. The latter includes requirements set forth in the Council on Environmental Quality (CEQ) *Principles and Requirements for Federal Investments in Water Resources (P&R)* and *Interagency Guidelines (IAG)*. DM 9500-013 provides guidance on completing a PR&G analysis, including steps in the planning and evaluation process, differences between project- and programmatic-level evaluations, direction on incorporating an ecosystem services framework, and techniques for economic analysis.

PR&G requires that public benefits (monetary and non-monetary) be maximized relative to cost. Furthermore, there is not a hierarchal relationship among the economic, social, or environmental goals. In general, the economic, social, and environmental impacts presented in this plan were developed based on PR&G utilizing methods of evaluating rural community flood reduction damages and related impacts. In order to estimate annual benefits of Blakes Creek-Armour Dam, average annual floodwater damages and impacts as the result of no dam in place were compared to average annual floodwater damages and impacts with the dam in place.

In cooperation with local interests that have oversight or implementation authorities and responsibilities, a "Locally Preferred" alternative was identified. This alternative was fully considered and carried forward into the final array of solutions and given full and equal consideration in the decision-making process.

PR&G allows a wide range of alternatives to illustrate the range of potential tradeoffs among environmental, economic, and social goals. Alternatives considered included the Future Without Federal Investment (FWOFI) Alternative, nonstructural alternatives, the Locally Preferred Alternative, and the National Efficiency Evaluation (NEE) Alternative. Alternatives were compared against the FWOFI Alternative which involved projecting existing resources and conditions into the future to establish a benchmark against which alternatives were evaluated. Tradeoffs between alternatives with respect to environmental, economic, and social goals were identified.

The Federal Objective, as set forth in the Water Resources Development Act of 2007, specifies that Federal water resources investments shall reflect national priorities, encourage economic development, and protect the environment by: (1) seeking to maximize sustainable economic development; (2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and (3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

The Guiding Principles constitute the concepts that should be considered when analyzing Federal investments in water resources and the General Requirements are topics that agencies must consider when analyzing Federal investments in water resources. The following Principles constitute the overarching concepts the Federal government seeks to promote through Federal investments in water resources now and into the foreseeable future.

A. Healthy and Resilient Ecosystems. Federal investments in water resources should protect and restore the functions of ecosystems and mitigate any unavoidable damage to these natural systems.

B. Sustainable Economic Development. Federal investments in water resources should encourage sustainable economic development.

C. Floodplains. Federal investments in water resources should avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used.

D. Public Safety. Threats to people, including both loss of life and injury, from natural events should be assessed in the determination of existing and future conditions, and ultimately, in the decision-making process.

E. Environmental Justice. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Agencies should ensure that Federal actions identify any disproportionately high and adverse public safety, human health, or environmental burdens of projects on minority, Tribal, and low-income populations.

F. Watershed Approach. A watershed approach to analysis and decision-making facilitates evaluation of a more complete range of potential solutions and is more likely to identify the best means to achieve multiple goals over the entire watershed.

One overarching concern associated with dam rehabilitation analyses is the intent of the program to minimize threat to human life. Threat to human life is central to the dam rehabilitation program.

Roadway Damages

Estimated flood damage to roadways is based on the length of roadway inundated rather than some combination of depth and length. Damages themselves are based on estimated cost of repair in relation to the cost of rebuilding. For this analysis, it was assumed that the incremental road repair cost is $104 per linear foot of roadway. This cost is intended to be a weighted average between repair costs for collector roads and arterials in an urban, mountainous setting.

Table D-27 summarizes the expected damages for each probability of occurrence for each dam, establishing a stage-damage relationship. Table D-28 uses an integration-by-parts method to calculate the approximate area under the stage-damage relationships for estimated flood damages. The difference in the areas under the dam and no-dam scenarios is the expected benefit provided by the dam, expressed on an annual equivalent basis.

Table D-27 – Summary of Roadway Impacts and Estimated Damage

				Estimated damage, $/linear foot				$ 104
	No dam			With dam				
Recurrence	Total length of roadway flooded (ft)	Estimated damage		Total length of roadway flooded (ft)	Estimated damage		Net roadway impact	Estimate of avoided damage
2	1,059	110,154		983	102,177		(77)	$ 7,977
5	1,980	205,869		1,176	122,223		(805)	$ 83,646
10	2,669	277,529		1,322	137,447		(1,347)	$ 140,082
25	3,605	374,816		1,477	153,590		(2,128)	$ 221,226
50	3,932	408,759		1,692	175,910		(2,240)	$ 232,849
100	4,667	485,206		1,770	183,977		(2,897)	$ 301,229
200	5,496	571,452		1,974	205,230		(3,522)	$ 366,223
500	6,091	633,292		2,723	283,148		(3,368)	$ 350,144

Table D-28 – Summary of Expected Damages to Roadways

Summary of Expected Annual Damages to Roadways				Annual equivalent damage:				**$ 46,088**
		No Dam				**With Dam**		
Recurrence	**Interval**	**Damage at stage**	**Average**	**Interval**		**Damage at stage**	**Average**	**Interval**
0.5000		$ 110,188				$ 102,208		
	0.3000		$ 158,060	$ 47,418			$ 112,234	$ 33,670
0.2000		$ 205,932				$ 122,260		
	0.1000		$ 241,773	$ 24,177			$ 129,875	$ 12,987
0.1000		$ 277,613				$ 137,489		
	0.0600		$ 326,272	$ 19,576			$ 145,563	$ 8,734
0.0400		$ 374,931				$ 153,637		
	0.0200		$ 391,907	$ 7,838			$ 164,800	$ 3,296
0.0200		$ 408,884				$ 175,964		
	0.0100		$ 447,119	$ 4,471			$ 179,999	$ 1,800
0.0100		$ 485,354				$ 184,034		
	0.0050		$ 528,490	$ 2,642			$ 194,663	$ 973
0.0050		$ 571,627				$ 205,292		
	0.0030		$ 602,556	$ 1,808			$ 244,263	$ 733
0.0020		$ 633,485				$ 283,234		
	0.0020		$ 316,742	$ 633			$ 141,617	$ 283
						$ -		
	-		$ -	$ -			$ -	$ -
	0.5000			$ 108,564				$ 62,477

Urban Damages

Local tax appraisal district records were utilized in order to obtain the structural values of residences, commercial and public properties, and numerous outbuildings (sheds, workshops, etc.) that would be affected by project activities. Contents and inventory values were estimated using depth-damage relationships in FEMA's HAZUS MP software and were based on a percentage of assessed structure values, which are based on periodically updated market values. Estimated floodwater depths for various storms (including the 500-year storm) for each structure were based on the results of the hydrology and hydraulics (H&H) simulation modeling. Floodwater data was then used with water depth to damage functions (U.S. Army Corps of Engineers, as contained in the HAZUS MP model) to estimate structural and content damages based on the point of entry where damage would begin, which in the case of the residences would be basement elevation for

those residences with basements or first floor elevations for those structures built on or above grade. The structural data included point on entry elevations for all structures. A similar analysis was conducted for commercial properties and public properties, within the floodplain area.

Table D-29 summarizes the number of structures affected at each flood occurrence and the avoided economic impacts.
Table D-30 summarizes the estimate of total and annual equivalent economic damages.

Table D-29 – Summary of Impacts to Structures

	Without dam		With dam			
Recurrence	Structures impacted	Structural and content damage	Structures impacted	Structural and content damage	Structures avoided	Economic damages avoided
2	6	$ 17,586	1	9,884	5	7,702
5	23	$ 87,809	11	34,499	12	53,310
10	32	$ 308,344	12	103,982	20	204,362
25	44	$ 784,930	16	181,903	28	603,027
50	51	$ 1,091,460	18	395,808	33	695,652
100	57	$ 1,356,115	27	586,696	30	769,419
200	75	$ 1,680,303	30	752,463	45	927,840
500	93	$ 2,108,210	35	955,995	58	1,152,215

Table D-30 - Summary of Total and Annual Equivalent Damages to Structures

Summary of Expected Annual Damages to Structures									$ 75,085
Recurrence	Interval		Damage at stage	Average	Interval		Damage at stage	Average	Interval
0.5000			$ 17,586				$ 9,884		
	0.3000			$ 52,698	$ 15,809			$ 22,192	$ 6,657
0.2000			$ 87,809				$ 34,499		
	0.1000			$ 198,077	$ 19,808			$ 69,241	$ 6,924
0.1000			$ 308,344				$ 103,982		
	0.0600			$ 546,637	$ 32,798			$ 142,943	$ 8,577
0.0400			$ 784,930				$ 181,903		
	0.0200			$ 938,195	$ 18,764			$ 288,856	$ 5,777
0.0200			$ 1,091,460				$ 395,808		
	0.0100			$ 1,223,788	$ 12,238			$ 491,252	$ 4,913
0.0100			$ 1,356,115				$ 586,696		
	0.0050			$ 1,518,209	$ 7,591			$ 669,580	$ 3,348
0.0050			$ 1,680,303				$ 752,463		
	0.0030			$ 1,894,257	$ 5,683			$ 854,229	$ 2,563
0.0020			$ 2,108,210				$ 955,995		
	0.0020			$ 1,054,105	$ 2,108			$ 477,998	$ 956
	0.5000				$ 114,799				$ 39,714

Recreation Benefits

Recreational Value of Ridenour Lake and Park

Visitation

Ridenour Lake was built in 1970 with a maximum depth of 17 feet and an average depth of 8 feet. The area provides opportunities for various recreational activities including picnicking, hiking, running, and fishing. It is a focal point of the community, as it attracts both locals and tourists (e.g., visiting the World War I Memorial in Nitro town).

Conservative estimates were used to quantify the visitation at Ridenour Lake and Park. More than 51,000 people are believed to visit the lake annually . This estimation was guided and informed by documentation provided by the Ridenour Lake and Park personnel and using publicly available sources (e.g., http://www.nitrocvb.com/outdoor-recreation, https://cityofnitro.org/attraction/ridenour-lake/). Examples of some visitation associated with specific activity are provided in Table-33.

Table D-31 - Estimated yearly visitors at the Ridenour Lake and Park by activity

Activity	Estimated visitors/year*
Shelter	8,000
Gazebo	5,000
Hiking	2,000
Running	500
Biking (trail & skilled)	18,800
Fishing	7,300
Kayaking and paddle boarding	1,000
Birdwatching	300
Dog park	2,600
Other**	5,500
Total	51,000 visits/year 139.7 visits/day

*The Ridenour Lake and Park personnel do not collect exact visitation data. Daily visits were estimated based on the information shared by the personnel and online resources (e.g., http://www.nitrocvb.com/outdoor-recreation, https://cityofnitro.org/attraction/ridenour-lake/).

**Other activities include "Model airplane club," "Ridenour Regatta," "Festival of Fright" Halloween, Christmas display, sleigh riding, archery club.

Visitation Values

Visitation values were estimated using the point value method provided in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies March 10, 1983, pp 83-87* (Principles and Guidelines). Evaluation decisions were guided and informed by the Ridenour Lake and Park personnel and publicly available information. Point values were assigned based on measurement standards described for the five criteria of activities: recreational experience; availability of opportunity; carrying capacity; accessibility; and

environmental quality. Based on the variety of recreational activities available at the Ridenour Lake and Park, it was determined that the Ridenour Lake and Park provides "general recreation" opportunities (not "specialized recreation"), as defined Principles and Guidelines *(page84)*.

Following the point value method, 64 points were received for general recreational activities at the Ridenour Lake and Park (see Table D-34). Following the Principles and Guidelines (Table VIII-3-1) and using the Consumer Price Index (CPI) published by the Bureau of Labor Statistics (February 2022 CPI value = 283.716 was compared to July 1982 CPI = 97.5), 64 points translate to $10.8. The estimate suggest that the annual recreational value at Ridenour Lake and Park is at least $550,800.

Table D-32 - Point values and justification for general recreation by criteria

Criteria	Justification	Points
Recreation experience	Several general activities (fishing, hiking, trail biking, birdwatching, picnic facility, kayak, paddle boarding, new trail biking trails for all skills, archery).	10
Availability of opportunity	Several within 1 hour travel time (e.g., Rollins Lake Wildlife Management Area, Elk Fork Lake).	6
Carrying capacity	Ultimate facilities to achieve intent of selected alternative.	12
Accessibility	Good access, high standard road to site; good access within site (e.g., picnic facilities, drinking water, and flush toilets; a trail surrounding the entire lake provides bank fishing access).	18
Environmental quality	Outstanding aesthetic quality; no factors exist that lower quality.	18
Total points		64

The information below was provided by the City of Nitro and Ridenour Lake and Park personnel.

RIDENOUR LAKE USAGE

- Shelter Rentals-130 (April-October 2019)
- Gazebo Weddings-41 (April-October 2019)
- The trails around the lake are utilized daily by many hikers, including a "Community Hike Group" that meets regularly as part of our "Get out and move physical fitness" campaign.
- Several cross country teams utilize the trails around the lake, including teams from Nitro High School, Andrew Jackson Middle School, Hurricane Middle School, Winfield Middle School, George Washington High School, John Adams Middle School
- Several organized 5k runs use the trails at Ridenour Lake as part of the run
- Estimate of 150 bikers per week ride the mountain trails around the lake
- Estimate of 30 bikers per day use the "Dynamite Bike Skills" bike park located at the lake's back section.
- The "Dynamite Bike Park" is also enjoyed by remote control car enthusiasts.
- Every Wednesday, when the weather allows, the lake is used by a model airplane club.
- Many dog owners regularly enjoy the "Bark Park" located at the lake's back end.
- Between 500-1000 people participate in the July weekend "Ridenour Regatta" event.
- Between 500-700 people participate in the October "Festival of Fright" Halloween event.
- Kayakers, paddleboarders, and canoe enthusiasts regularly utilize the lake.
- Every Christmas, the City decorates the gazebo and erects tens of thousands of dollars of Christmas displays that are viewed and enjoyed by the public.
- The West Virginia DNR stocks the lake twice a year with catfish and trout, and the City of Nitro stocks it ten times a year. Because of the stockings, many anglers fish in the lake daily.
- The gazebo and other lake areas are utilized regularly for picture taking, especially during graduations and formal dances.
- Nitro Elementary will utilize a newly constructed nature art trail that connects with Ridenour Lake.
- During times of snow, many families use the dam for sleigh riding.
- The gazebo area is also used by churches for services and gospel sings.

- In conclusion, Ridenour Lake is a focal point of the community. It is not unusual to visit the lake and see hundreds of individuals recreating in one form or another.

Alternative 2, the Locally Preferred Alternative, includes a roller-compacted concrete (RCC) auxiliary spillway which has been presented as a potential future outdoor amphitheater. Though speculative and requiring engineering, safety, and Americans with Disabilities Act considerations, the analysis could neither find an example of this multi-use nor find a fatal flaw with its concept. There is not yet a stated demand for an outdoor amphitheater in Nitro, such as what might be documented in the City's Comprehensive Plan but is considered by City leaders as a unique opportunity. Ridenour Park is locally popular, as documented above, is easily accessible for low- and high-income households alike, and is set in the middle of Bluegrass music country. Local demand for such a venue appears reasonable in response.

It is noted that using RCC for the auxiliary spillway adds approximately $3.2 million to the project's cost compared to the least expensive rehabilitation alternative. On an annual equivalent

basis, this accounts for about $87,400 in additional cost. Combinations of the number of possible events at such a unique amphitheater, the attendees' willingness to pay for the experience, and the attendance show that this cost is not unreasonable compared to potential benefits. For instance, 20 events per year, with 200 attendees placing a $22 value on the experience would yield an annual benefit in excess of the annual equivalent cost. These informal calculations are not intended to replace a more rigorous economic feasibility analysis but demonstrate that reasonable assumptions could support the additional expenditures for RCC.

Population at Risk (PAR)

Due to the potential catastrophic nature of a breach of Blakes Creek-Armour Creek Site 7, population at risk (PAR) was estimated. It should be noted that estimating a number for population at risk is based on professional judgment coupled with empirical data. Population at risk estimates were provided for motorists, residents, and other people located downstream affected by the breach. These include people in cars (motorists) traveling on roads downstream of the dam and those living in homes and working in businesses.

Guidance for Completion of "Evaluation of Potential Rehabilitation Projects," December 10, 2001, updated July 5, 2013, was utilized to estimate PAR for residences and motorists downstream of the dam. According to the guidance, 3 people per residence are estimated to be at risk where floodwaters are greater or equal to 1.0-foot inundation depth above natural ground elevation. However, for buildings with furnished basements, people in those buildings would be considered at risk from floodwaters where water enters the basement (usually a small window). For public and commercial properties, a reasonable number of people at risk should be used at the facility under normal conditions (not peak capacity). For paved roads with predominantly local traffic, two PAR are estimated to be at risk where floodwaters are road overflow depth of greater or equal to 1.0 foot. For state and federal highways with predominant traffic including non-local vehicles, four PAR are estimated to be at risk. Table D-33 below shows the worksheet used to calculate PAR for the static breach condition.

Table D-33 - Population at Risk Worksheet for the Static Breach Condition

COMPUTATION OF POPULATION AT RISK (PAR) DURING DAM FAILURE						
STATE	West Virginia		BY	George Oamek	DATE	8/27/21
DAM	Blakes Creek - Armour Creek Site 7 Dam		CHECKED BY	Petr Masopust	DATE	8/29/21
YEAR BUILT	1970	DESIGN HAZARD CLASS	H	DRAINAGE AREA	2.36	mi^2
WORK PLAN DATE	3/7/1966	CURRENT HAZARD CLASS	H	DAM HEIGHT	47	ft
sht 1 of 3	STATIC FAILURE SCENARIO (ver. 2013-01)				NID ID	
Structures (Elevated) Impacted by Potential Breach	Number of Structures			PAR per Exposure with Inundation Depths >=2.0 Ft.		PAR
	Inundation Depth Above Natural Ground		Total			
	<2.0 Ft	>=2.0 Ft.				
Mobile Homes		1	1	3		3
Seasonal Use RV's				2		
Other						
Structures (With Foundations) Impacted by Potential Breach	Number of Structures			PAR per Exposure with Inundation Depths >=1.0 Ft.		PAR
	Inundation Depth Above Natural Ground		Total			
	<1.0 Ft	>=1.0 Ft.				
Homes	35	228	263	3		684
Seasonal Use Homes and Cabins				1.5		
Duplexes		9	9	5		45
Apartments	2	8	10	12		96
Commercial Buildings	6	8	14	25		200
Schools (In Use)		0				
Schools (Not in Use)		1	1			0
Hospitals						
Other						
Highways and Railroads	Number of Roads, Highways and Railways			PAR per Exposure with Inundation Depths >=1.0 Ft.		PAR
	Road Overflow Depth		Total			
	<1.0 Ft	>=1.0 Ft.				
Main Local Roads and Minor State Highways						
21st Avenue		1	1	2		2
2nd and 3rd Avenues		2	2	2		4
Major State and Minor Federal Highways						
State Road 25/1st Avenue		1	1	4		4
				4		
Major Federal and Interstate Highways						
Highway Name(s) or Number(s)				8		
Highway Name(s) or Number(s)				8		
Railroads						
UPSF Freight Traffic Only				3		
Passenger Traffic				20		
TOTAL NUMBER OF PEOPLE AT RISK (PAR)						**1,038**

[1/] The above referenced school not in use is currently not in service but not abandoned.

Period of Analysis Determination

The Sedimentation section of the Affected Environment states that "…under existing conditions, the dam has submerged sediment storage availability for the next 155 years. However, the proposed rehabilitation measure will reduce the submerged sediment storage capacity by 2.6 ac-ft or 4.2 years. Remaining sediment storage capacity tends to drive the period of analysis, in the sense that it can be cost prohibitive to remove sediment through dredging. Since there is remaining sediment storage for an excess of 100 years, a maximum 100-year expected useful life of the project is expected. This is the maximum useful life recommended in federal P&G planning guidelines. If no other major investments in the facility are needed in the facility during the next 100 years other than O,M.&R. then the 100-year period of life should also result in the lowest cost and maximum benefit for the Preferred Alternative (Alternative 2).

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APPENDIX E

SUPPLEMENTAL INFORMATION

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Phase I Archaeological Survey

Blakes Creek-Armour Creek, Kanawha County, West Virginia

16 November 2023

Project No.: 0709415

USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

The business of sustainability

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16 November 2023

Phase I Archaeological Survey

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ABSTRACT

On October 14, 2023, ERM conducted Phase I archaeological investigations on behalf of Aterra Solutions at the request of the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), the lead federal agency for the Blakes Creek-Armour Creek Project (Project) in Kanawha County, West Virginia. Aterra is conducting the work to help the NRCS satisfy the requirements of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act of 1966. The Project is in the City of Nitro, West Virginia, and encompasses Ridenour Lake/Ridenour Park. The Project entails safety modifications on the existing dam to prevent downstream flooding.

This report presents the results of a Phase I survey to inventory cultural resources that could be affected by the Project. A total of approximately 224 acres was covered in the archaeological survey. The Area of Potential Effects (APE) for archaeological sites is limited to the area of potential direct effects where ground-disturbing activities are possible. While ground-disturbing activities will principally take place in the immediate area of the dam, it is possible that other nearby areas will be used for staging materials or operating machinery; these areas are primarily paved or graveled areas within Ridenour Park.

Although nine previously recorded sites are located within a mile of the APE, the field survey did not identify any archaeological sites. Therefore, ERM recommends that the work proposed by Aterra be allowed to proceed as planned without further consideration of archaeological resources.

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Acronyms and Abbreviations

Name	Description
APE	Area of Potential Effects
ERM	Environmental Resources Management
GPS	Global Positioning System
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
USDA	U.S. Department of Agriculture
WVGES	West Virginia Geological and Economic Survey
WVSHPO	West Virginia State Historic Preservation Office

1. INTRODUCTION

1.1 Overview

On October 14, 2023, Environmental Resources Management (ERM) conducted Phase I archaeological investigations on behalf of Aterra Solutions at the request of the U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS), for the Blakes Creek-Armour Creek Project (Project) in Kanawha County, West Virginia. Aterra is conducting the work to help the NRCS satisfy the requirements of the National Environmental Policy Act (NEPA), effects on historic properties (54 USC 306108) and Section 106 of the National Historic Preservation Act (NHPA) of 1966 and its implementing regulations (36 C.F. R, § 800). The Project is located in the City of Nitro, West Virginia, and encompasses Ridenour Lake/Ridenour Park (Figures 1.1-1 and 1.1-2). The Project entails safety modifications on the existing dam to prevent downstream flooding.

This report presents the results of a Phase I survey to inventory cultural resources that could be affected by the Project. The potential Project footprint covered in this report includes approximately 224 acres. An Area of Potential Effects (APE) is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist” (36 C.F.R. § 800.16[d]). The APE for archaeological sites is limited to the area of potential direct effects where ground-disturbing activities are possible. While ground-disturbing activities will principally take place in the immediate area of the dam, it is possible that other nearby areas will be used for staging materials or operating machinery; these areas are primarily paved or graveled areas within Ridenour Park. The results from ERM’s historic architectural survey will be presented in a separate report.

1.2 Management Recommendations

Although nine previously recorded sites are located within a mile of the APE, the field survey did not identify any new archaeological sites within the Project area. Current survey observations suggest that the areas in the Project area that weren’t on slopes ranging from 25–45+ degrees and in the wetland that surrounded the lake, were developed and disturbed. These conditions help explain the absence of archaeological resources within the Project area. Based on these findings, ERM recommends that no further investigation is warranted and that the Project should be allowed to proceed as planned with no further consideration of archaeological resources.

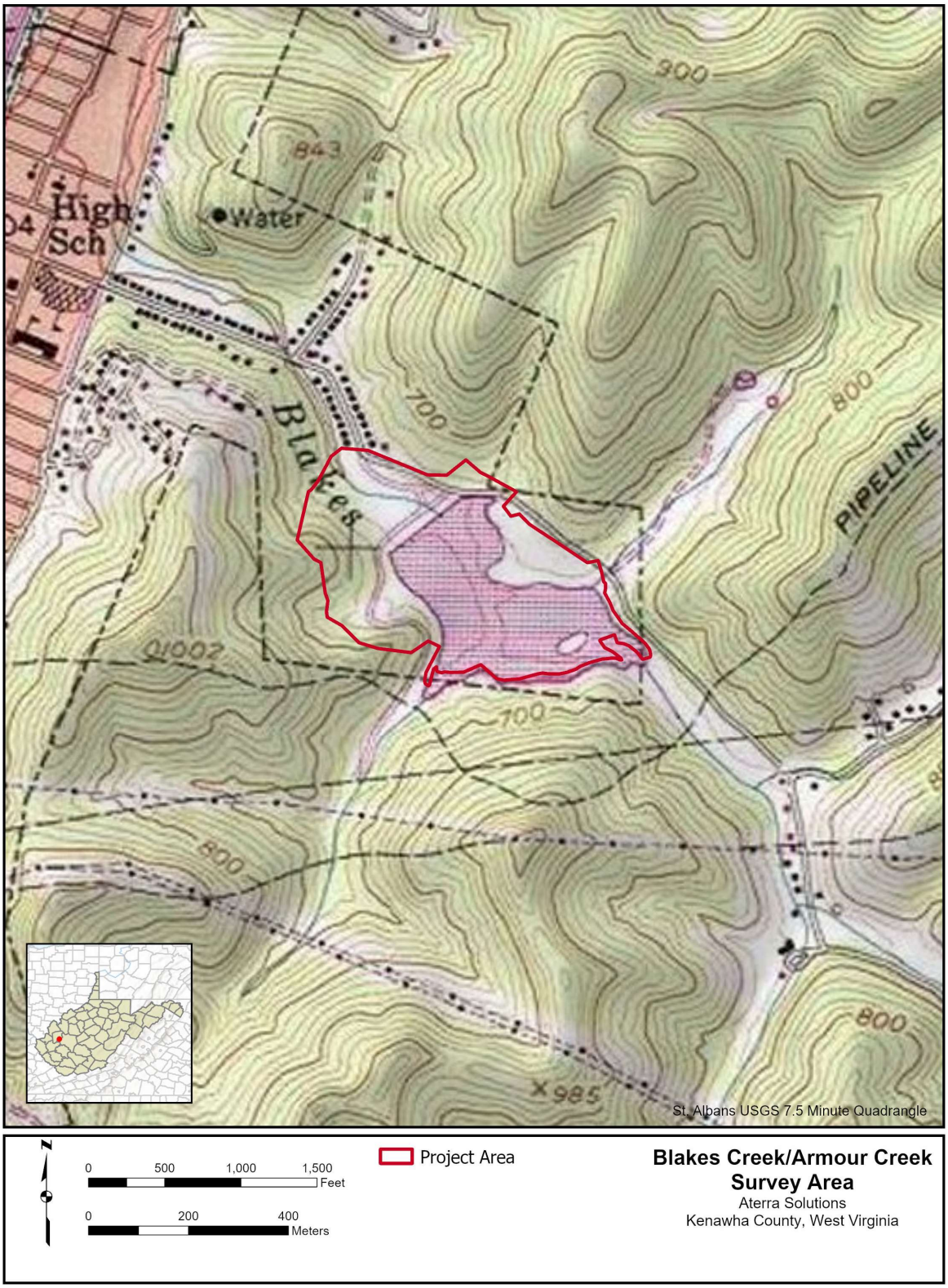


Figure 1.1-1: Project Overview, Topographic View



Figure 1.1-2: Project Overview, Aerial View

2. ENVIRONMENTAL SETTING

2.1 General Setting

The Project is located in an area characterized by developed land and forested hills and mountains within the Appalachian Plateau Physiographic Province (West Virginia Geological and Economic Survey [WVGES] 2023). This province covers the western portion of West Virginia and consists of relatively flat and gently folded Pennsylvanian and Permian strata. The Project is within the Central Appalachians Forested Hills and Mountains ecoregion (Woods et al. 1999). It is an extensively forested, high, dissected, and rugged plateau made up of sandstone, shale, conglomerate, and coal, occupying the highest and most rugged parts of the Central Appalachians. The hills, mountains, and ridges are steep sided and have narrow valleys with elevations averaging between 1,800 to 2,600 feet but also reaching up to about 4,600 feet (Woods et al. 1999). The Project vicinity is within the Kanawha River valley and adjacent hilly uplands. Land use within the Project APE consists of existing park facilities and roadways and forested greenspace.

2.2 Climate Past and Present

Eastern United States climatic trends in Late Pleistocene times were shaped by the glaciers that occurred north and west of the Project area, from points originating in northern Canada. During the Late Pleistocene, a moist, cool climate characterized the area that would become West Virginia, and there was a mosaic of environments, including grasslands, coniferous forests of pine, fir, spruce, and hemlock, and small islands of deciduous woodlands. Alpine tundra existed at the higher elevations of the Appalachians. The changing climatic patterns at the Pleistocene-Holocene transition also contributed to the extinction of numerous species, including many species of megafauna.

West Virginia's varied terrain creates a great deal of local and regional variability in terms of temperature and rainfall. Elevations in the state range from 247 feet above mean sea level near Harper's Ferry in the Eastern Panhandle to 4,863 feet at Spruce Knob, in Pendleton County. The mountains in the state generally hold cloud cover, trap precipitation, and account for locally colder microclimates. Those settings contained alpine tundra until the late glacial period between 15,000 and 10,000 years ago when northern hardwoods became established, followed by a gradual transition to mesic oak-hickory forests over time. The Pleistocene boreal forests at lower elevations underwent similar transitions. The climate became generally harsher, with more severe winter extremes in temperature at the outset of the Holocene (Delcourt and Delcourt 1981; Whitehead 1973).

The replacement of open grasslands by closed forests was taking place throughout the region at the end of the Pleistocene, which had major effects on the composition and distribution of animal populations across the landscape, which included a reduction in numbers and greater territorial dispersal of large mammals such as deer. The ecological changes of the Pleistocene-Holocene transition also contributed to the extinction of numerous species, including many species of megafauna. Pleistocene mammalian species in the region included mastodon, long-nosed peccary, caribou, musk ox, stag moose, ground sloth, dire wolf, and giant beaver (Kurten and Anderson 1980). Meltzer and Mead (1983) suggest that by 10,000 B.P., as many as 35 different genera of mammals may have already vanished from North America. The modern faunal and floral communities of the region were becoming established as early as 12,500 B.P., but the evolution of biomes and their geographic distribution was a complex process, and the environment did not approach modern conditions for several thousand years (Delcourt and Delcourt 1985, 1993; Grimm and Jacobsen 2004). But over time, boreal forests gave way to modern deciduous forests, and Pleistocene megafauna gave way to deer and smaller mammals as a result of the changing environment. These floral and faunal changes had a marked effect on the cultural adaptations made

through time by the regional inhabitants during prehistory. Those adaptations are reflected in the known artifact assemblages for each temporal period (Delcourt and Delcourt 1993).

During the Middle Holocene, from about 8,000–5,000 B.P., climatic change described as the Hypsithermal interval brought drier conditions and more dramatic seasonal temperature extremes to most areas, although local variability in climate effects has been argued (Delcourt 1979; Delcourt and Delcourt 1997). Pollen data from the Gallipolis Lock and Dam on the Ohio River indicate that the arboreal taxa characteristic of Mixed Mesophytic forest communities had become established in the region by 7000–6500 B.C. (Fredlund 1989). Beginning around 3,000–2,500 B.P., another climatic event known as the Sub-Atlantic episode (roughly coinciding with the inception of the Early Woodland cultural period) brought relatively stable and moister conditions that have persisted into modern times. From this point, vegetational communities known from the earliest historic period became established across West Virginia.

Generally, the potential natural vegetation is characterized as Mixed Mesophytic Forest. Prior to modern land use changes, plant communities composed of sugar maple-basswood-buckeye-tulip poplar associations were common on north-facing slopes; oak-chestnut and oak-hickory communities occupied upper slopes and ridgetops; pine was dominant in xeric ridgetop settings where rock outcrops occurred; and beech and white oak grew on soils where shale was the underlying rock. Oak, oak-hickory, and oak-pine communities predominate in contemporary forests (Braun 1950; Elias and Mock 2013; Webb and Bryson 1972).

Today, warm, humid summers and cold, dry winters characterize the midcontinental climate of the Project area. The average summer high temperature in Kanawha County is upper 80°s Fahrenheit (F), and the average winter low temperature is 20° F. Average total annual rainfall is 38 inches per year, and average annual snowfall is approximately 28 inches (National Weather Service 2023).

3. FIELD METHODS

The primary objectives of the investigation were to determine whether the area to be affected by the proposed Project contains any archaeological resources and if those resources are potentially eligible for listing in the National Register of Historic Places (NRHP). All work was conducted in accordance with the West Virginia Historic Preservation Office (WVSHPO) *Guidelines for Phase I, II, and III Archaeological Investigations and Technical Report Preparation* (WVSHPO 2021), and the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* [48 Federal Register 44716-44740] (National Park Service [NPS] 1983).

The survey area was navigated using a Trimble TDC600 sub-meter global positioning system (GPS) unit. Survey data were recorded through standardized digital forms and the field director's daily log. Field notes, maps, photographs, and other technical materials generated from this survey will be stored on ERM's secure server.

Standard archaeological survey methods were used during the field study. Survey coverage was limited to pedestrian reconnaissance with visual inspection of the ground surface throughout most of the Project area due to existing development that has impacted the potential for intact near-surface archaeological deposits; in some cases, development entails pavement that precluded shovel testing. Safety concerns also guided survey coverage adjacent to existing park infrastructure. No intact archaeological deposits are expected in the Project in areas of existing buried utilities, nor in areas where roads and above-ground features have been constructed.

Shovel tests were conducted at 15-meter intervals where ground surface visibility is less than 25 percent, and in places that are not inundated, severely disturbed, or on slope that is greater than 20 percent. The shovel tests were a minimum of 50 centimeters in diameter and excavated until subsoil or the water table was reached. Soil from shovel tests was screened through ¼-inch wire mesh. Any artifacts recovered were to be collected in plastic zip-lock bags labeled with provenience information and returned to the landowner after processing and analysis.

Manicured lawn, a developed park with gravel or paved access roads and buried utilities, wetland and slopes ranging from 25–45+ degrees characterized the Project. Therefore, survey coverage within these previously disturbed areas was limited to pedestrian walkover with visual inspection of the ground surface. Shovel testing was limited to three judgmental shovel tests.

4. RESULTS

On October 14, 2023, ERM conducted Phase I archaeological investigations in the Project area located in Kanawha County, West Virginia. The Project area encompasses the Ridenour Lake/Ridenour Park and dam located in the lake. The park is maintained as green space with pavilions sitting on concrete slabs with buried utilities, playgrounds, a gazebo, a restroom facility, graveled roads/parking areas with graveled trails running around the lake's southern portion. There are several tributary creeks and low-lying wetland areas around the lake's southern portion that flood during periods of high discharge, as well as uplands with slope ranging from 25–45+ degrees. The surrounding hill sides within the park are wooded areas characterized by slopes ranging from 25–45+ degrees. Due to extensive previous ground disturbance in the Project area, slope and wetland, the potential for encountering intact archaeological deposits was low. A discussion of previously reported surveys and resources, followed by summary descriptions of the Project areas, survey coverage, and findings are provided in the sections below.

4.1 Previous Investigations

A review of the WVSHPO Online Mapping System was conducted before the initiation of fieldwork. Four previous surveys and six previously recorded archaeological sites were identified within 1 mile of the Project area (WVSHPO 2023). The locations of the previous surveys and previously recorded resources are illustrated in Figure 4.1-1 and are listed in Tables 4.1-1 and 4.1-2.

Four previous Phase I investigations have been conducted within 1 mile of the Project area (see Table 4.1-1). One previous Phase I survey (03-929-KA) was a Phase I survey for the proposed Ridenour Lake Stream Restoration Project in 2004 that covered an area adjacent to the current APE.

Table 4.1-1: Previous Surveys within 1 Mile of the Project Area

Number	Year	Title	Author(s)
03-929-KA	2004	Report for Phase I Archaeological survey of the Proposed Ridenour Lake Stream Restoration Project Located Near Nitro, Kanawha County, West Virginia	Aaron O. Smith, Cultural Resources Analysts, Inc.
18-392-KA	2018	Phase I Cultural Resource Management Survey for the Proposed Nitro Wireless Communications Tower in Kanawha County, West Virginia	Justin Zink, Lawhon & Associates, Inc.
19-66-KA	2018	Phase I Cultural Resource Management Survey for the Proposed Nitro Wireless Communications Tower in Kanawha County, West Virginia	Justin Zink, Lawhon & Associates, Inc.
03-584-KA	2002	Phase II Eligibility Testing Strategy for Dominion Transmission's TL-272 Kanawha River Pipeline Crossing Project	David Breetzke, Environment and Archaeology, LLC

Source: WVSHPO (2023)

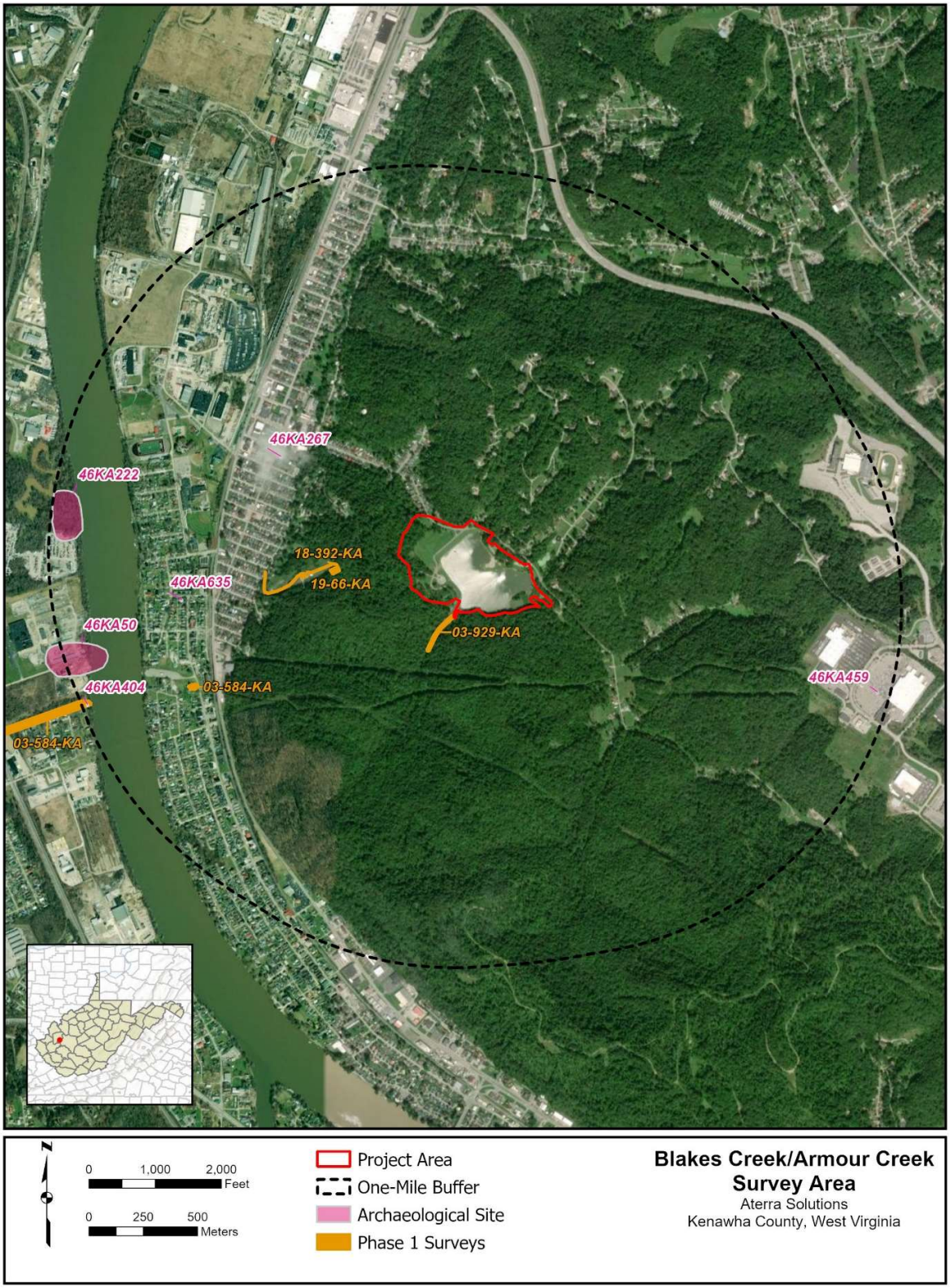


Figure 4.1-1: Previous Surveys and Recorded Resources within 1 Mile of the Blakes Creek-Armour Creek Project

A review of the WVSHPO online database (WVSHPO 2023) identified six previously recorded archaeological sites within 1 mile of the Project area (Table 4.1-2). One of the sites (46KA459/96-861-KA) is a historic period burial and the rest of the sites date to the prehistoric period. 46KA635 and 46KA404 sites are described as lithic scatters, while the rest of the sites are habitations. None of the previously recorded sites are within the Project footprint and all nine sites are unevaluated for NRHP eligibility.

Table 4.1-2: Previously Recorded Archaeological Sites within 1 Mile of the Project Area

Site Number	Site Type	NRHP Eligibility
46KA50	Undetermined	Undetermined
46KA222	Prehistoric Habitation	Undetermined
46KA267	Prehistoric Habitation	Undetermined
46KA404	Prehistoric Lithic Scatter	Undetermined
46KA459 (96-861-KA)	Historic Burial	Undetermined
46KA635	Paleo Lithic Scatter	Undetermined

Source: WVSHPO (2023)

4.2 Project Components and Survey Coverage

The Blakes Creek-Armour Creek work area includes approximately 224 acres of land that encompasses Ridenour Lake/Ridenour Park and the dam that forms the lake. Due to the extensive development of the park, buried utilities, wetland and slope ranging from 25–45+ degrees, only approximately 1 acre of undisturbed land was covered in the archaeological survey. The survey area is depicted in Figure 4.2-1. Because most of the Project area is developed, disturbed, and /or is characterized by wetlands and slope, only three judgmental shovel tests were excavated in areas that appeared to have the potential for intact archaeological remains.

A typical soil profile from the Project consisted of 0–25 cm dark grayish brown (7.5YR 4/2) silty loam/silty clay loam over a rocky impasse that was not consistent with the expected Wheeling or Brookside silt loams expected in this location. Instead, the soil profiles appear to reflect disturbance. Representative soil profiles are presented in Figure 4.2-2.

Conditions encountered throughout the Project area are summarized in Table 4.2-1 and depicted in Figures 4.2-4 through 4.2-9.



Figure 4.2-1: Project Area Survey Coverage

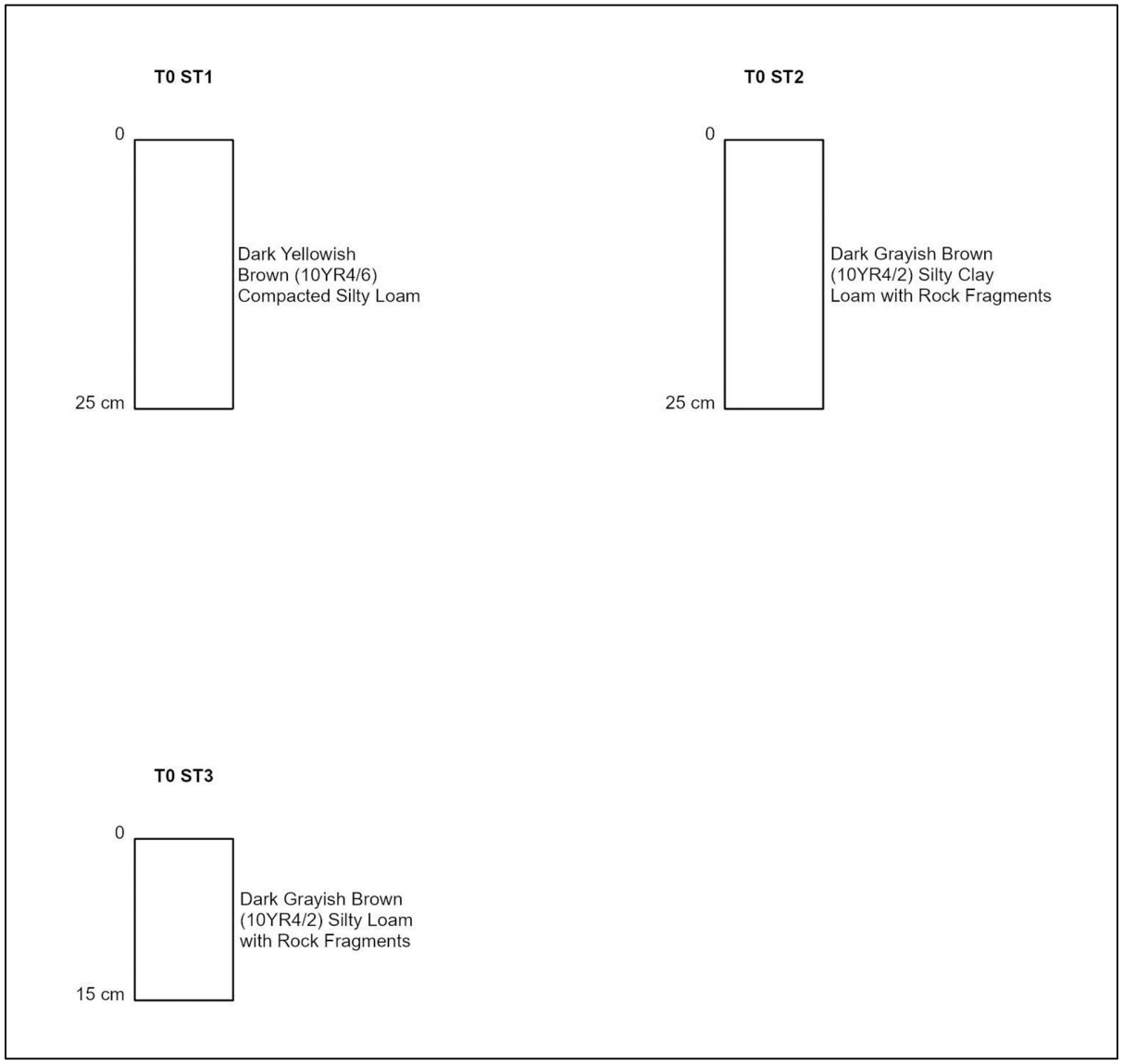


Figure 4.2-3: Shovel Test Profiles

Table 4.2-1: Summary of Archaeological Survey Areas

Survey Area	Current Land Use	Survey Methods	Number of Shovel Tests Excavated	Archaeological Resources Found
Blakes Creek-Armour Creek Work Area	Ridenour Lake/ Ridenour Park	Visually cleared, pedestrian survey, judgmental shovel testing	3	None



Figure 4.2-4: Ridenour Lake and Surrounding Portions of Project Area, Facing Southeast



Figure 4.2-5: Portion of Project Area along Blakes Creek, Facing Southeast



Figure 4.2-6: Ridenour Park Amenities within the Project Area, Facing Southwest

4.3 Findings

No newly recorded archaeological resources were identified within the Project areas. Given the extreme slope of the impoundment area, the limited line of sight to and from the project, and the fact that the retention pool elevation will remain unchanged, ERM recommends that no further investigation is warranted and that the Project should be allowed to proceed as planned with no further consideration of archaeological resources.

5. CONCLUSION AND RECOMMENDATIONS

On October 14, 2023, ERM conducted Phase I archaeological investigation on behalf of Aterra Solutions, at the request of the USDA NRCS, in association with the Blakes Creek-Armour Creek Project in Kanawha County, West Virgina. Aterra is conducting the work to help the NRCS satisfy the requirements of the NEPA, effects on historic properties (54 USC 306108) and Section 106 of the National Historic Preservation Act of 1966. This report presents the results of a Phase I survey to inventory archaeological resources that could be affected by the Project within the 224-acre work area centered on the Ridenour Lake dam.

The field survey did not identify any archaeological sites within the Project's APE. Therefore, ERM recommends that the work proposed by Aterra be allowed to proceed as planned without further consideration of cultural resources.

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Phase I Historic Architecture Survey

Blakes Creek-Armour Creek, Kanawha County, West Virginia

30 November 2023

Project No.: 0709415709415

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November 30, 2023

Phase I Historic Architecture Survey

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ABSTRACT

On October 14, 2023, ERM conducted a Phase I historic architectural investigation on behalf of Aterra Solutions (Aterra) in association with the Blakes Creek-Armour Creek Site 7 Rehabilitation Project (Project) in Kanawha County, West Virginia. The Project will entail repair of the dam that forms Ridenour Lake. The investigation was carried out at the request of the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), the lead federal agency for the Project. Aterra is conducting the work to help the NRCS satisfy the requirements of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act of 1966.

This document presents the results of a Phase I survey to inventory historic architectural resources that could be affected by the Project. The Area of Potential Effects (APE) for historic resources includes the area of direct effects within the Project's Limits of Disturbance (LOD), consisting of 224 acres, which was set by Aterra in consultation with NRCS. The APE also encompasses a larger area of potential indirect effects, which was set by NRCS as the potential area that would be impacted were the dam to fail. The results of the archaeological survey are presented in a separate document.

No previously recorded resources were identified within the direct or indirect APE. One historic district, the Silk Stocking Row Historic District (KA-8359), encompassing 77 new resources, was identified in the indirect APE and is recommended eligible for listing on the National Register of Historic Places (NRHP) under Criteria A and C. Of the 77 individual resources within the district, 55 resources are recommended contributing and 22 are recommended non-contributing with respect to the district's historic context and architectural character. ERM recommends that the Project as planned would have no effect on the district. However, the APE was stipulated by the NRCS to take into account the contingency of dam failure; if that unfortunate scenario were to occur, the Silk Stocking Row Historic District would likely suffer damage that would constitute an adverse effect. No further documentation is recommended.

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Acronyms and Abbreviations

Name	Description
APE	Area of Potential Effect
Aterra	Aterra Solutions
CIC	Charleston Industrial Corporation
ERM	Environmental Resources Management
GIS	Geographic Information Systems
HPI	Historic Property Inventory
LOD	Limits of Disturbance
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
ROW	Right-of-Way
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WVSHPO	West Virginia State Historic Preservation Office
WVU	West Virginia University

1. INTRODUCTION

1.1 Overview

On October 14, 2023, Environmental Resources Management (ERM) conducted a Phase I historic architectural investigation on behalf of Aterra Solutions, at the request of the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), the lead federal agency for the Blakes Creek-Armour Creek Project (Project) in Kanawha County, West Virginia. Aterra is conducting the work to help the NRCS satisfy the requirements of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act of 1966. The Project is located in the City of Nitro, West Virginia Ridenour Lake/Ridenour Park (Figures 1.1-1 and 1.1-2), and will entail repair of the dam that forms Ridenour Lake.

This document presents the results of a Phase I survey to inventory historic architectural resources that could be affected by the Project. The results of ERM's archaeological survey for the Project are presented in a separate report. The Area of Potential Effects (APE) for historic resources includes the area of direct effects within the Project's Limits of Disturbance (LOD), consisting of 224 acres, which was set by Aterra in consultation with NRCS. The APE also encompasses a larger area of potential indirect effects, which was set by NRCS as the potential area that would be impacted were the dam to fail.

1.2 Management Recommendations

Eight previously recorded historic architectural resources were identified within 1 mile of the Project area. None fall within the direct or indirect APE for the Project. One historic district, encompassing 77 new resources, was identified in the indirect APE and is recommended eligible for listing on the National Register of Historic Places (NRHP) under Criteria A and C. Of the 77 resources, 55 resources are considered contributing to the historic district, and 22 resources are non-contributing with respect to the district's historic context and architectural character. No further documentation is recommended. ERM recommends the proposed Project will have no effect on the historic district, given that repairs to the dam will rely on existing roads and ROWs and will not create a significance change in the viewscape. The APE was stipulated by the NRCS to take into account the contingency of dam failure; while that is obviously not part of the planned Project, if it were to occur, the Silk Stocking Row Historic District would likely suffer damage that would constitute an adverse effect.

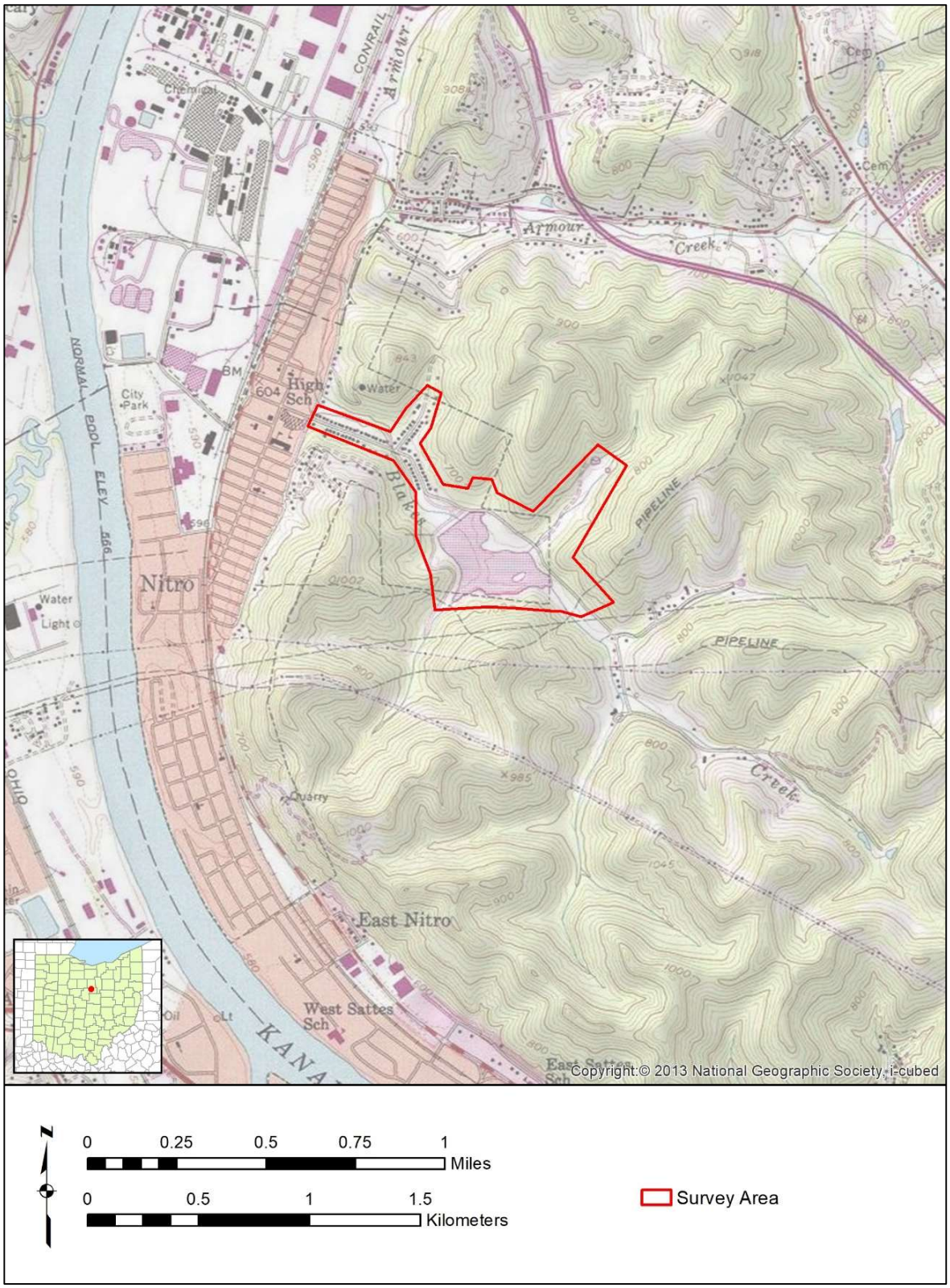


Figure 1.1-1: Project Overview



Figure 1.1-1: Project Overview, Aerial View

2. HISTORIC CONTEXT AND PROJECT SETTING

This section provides a context for understanding the historical development of the Project area within the broader developments of the region and the state. The context also identifies the important periods of development and the major cultural and economic themes represented.

2.1.1 Kanawha County

The Project area is located in the western part of Kanawha County near its border with Putnam County. The site is situated just east of the town of Nitro, which developed in the early twentieth century to house the workers at the gunpowder plant established in 1917 to produce munitions for World War I. The area had originated as an agricultural community until the late nineteenth century when mining and drilling in the region contributed to industrial development (Wintz 2023).

Kanawha County was created in 1798 from Greenbrier and Montgomery counties, and at the time included most of the southwest quarter of what is now West Virginia. Numerous counties were created from its original territory, including Putnam County in 1848. Its current boundaries were finalized in 1867 with the creation of Lincoln County (Newberry Library 2012).

Settlers of European descent began to take up land in what is now Kanawha County after the defeat of the Shawnee at the Battle of Point Pleasant at the mouth of the Kanawha River in 1774. Although the Shawnee ceded the territory south of the Ohio River in the subsequent treaty, conflict with Native American groups continued until after the Treaty of Greenville displaced them from Ohio in 1795 (Harper 2023a). The first settler in what is now Kanawha County is believed to be Walter Kelly, who established a homestead at the mouth of Kelly Creek on the Kanawha River, about 20 miles above Charleston, in 1774. George Clendenin established the town of Charleston in 1787, on land patented to Major Thomas Bullitt for his service in Braddock's War. Clendenin built a blockhouse on the site, and the protection offered attracted other settlers to build cabins nearby (Atkinson 1876). In 1800, the still vast territory embraced by Kanawha County contained only 3,239 inhabitants (Forstall 1996).

Early settlers relied on the Kanawha and Ohio rivers for transportation. Timber was cleared from the river bottoms and rafted down the Kanawha and the Ohio to Cincinnati and other river towns in the Mississippi valley. When the fields were cleared, corn, wheat, oats, tobacco, and fruit were planted, and livestock was raised. The products not used on the farm were transported on flatboats or keelboats to markets downriver (Atkinson 1876).

Besides the farmland along the river, the Kanawha valley also possessed salt deposits that proved to be an important resource throughout the county's history. The earliest salt furnace in the county was established in 1797 at Campbells Creek near what is now Malden. By 1815, there were 52 furnaces in the region. Charcoal from the plentiful timber was first used to fire the furnaces, but coal was soon found to be more efficient and was mined at Coal River, Mill Creek, and Cannelton beginning about 1817. In 1829 the James River & Kanawha Turnpike was authorized to connect the Chesapeake region of Virginia with its far-flung western territory on the Ohio River. Although the planned canal was never completed, the project attracted interest in the resources of western Virginia. By 1850, a much smaller Kanawha County included over 15,000 residents. By that time, the county seat at Charleston had become a thriving town of approximately 1,000 (Forstall 1996; Harper 2023a; Newberry Library 2012).

Kanawha County's population included 3,140 enslaved people representing about 20 percent of the total populace. This was considerably higher than 6.7 percent in the state as a whole and reflects the use of slave labor on the large farms along the Kanawha River, in the county's many salt furnaces, and in homes and industries in Charleston. When the western Virginia counties debated secession, Kanawha County was divided in its loyalties, with many of its leaders supporting the commercial interests championed by Whig candidates, while others supported secession. One of the earliest battles of the Civil

War took place in the vicinity of the Project area, when Confederate forces successfully held off a Union advance at Scary Creek, opposite Nitro, temporarily preventing the Yankees from occupying Charleston. Union forces occupied Charleston for most of the war, but much damage was inflicted on Kanawha County as a result of Confederate raids and foraging parties from both armies (Andre 2023; Harper 2023a; Lowry 2019).

After the Civil War, the capital of the newly created state of West Virginia moved between Wheeling and Charleston before settling in Charleston in 1877. Railroad connections were established in Kanawha County with the completion of the Chesapeake and Ohio Railroad through Charleston in 1873, linking the Chesapeake Bay and the Ohio River at Huntington. In 1884, the Kanawha and Michigan Railroad constructed a line along the north side of the Kanawha River from the Ohio River at Point Pleasant to Charleston. This line was well situated to serve the coal mines that were established after the Civil War on the north side of the river below Charleston. The communities of Glen Elk, Spring Hill, and Sattes developed along this line. The expansion of coal mining around Charleston in the late nineteenth century contributed to the city's growth as a center for banking, commerce, industry, and government. By 1900, the city had 11,000 residents, and Kanawha County had a population of 54,696 (Andre 2023; Harper 2023a).

During the early twentieth century, the Kanawha valley became a center for the modern chemical industry, as companies like DuPont, Union Carbide, and Owens-Illinois established factories for producing ammonia, glass, and ethylene for plastics using the coal, gas, and salt extracted from the region. In 1917, DuPont had selected a site on the Kanawha River on the border between Kanawha and Putnam counties for a nitrocellulose plant to produce smokeless gunpowder needed for the U.S. entry into World War I. Before the plant could be built, the War Department intervened and built the plant, which was to be operated by Hercules Powder Company. The massive plant and the accompanying town to house its workers, called Nitro, was constructed in less than a year by over 100,000 workers. However, the war ended before the project was completed, and the plant was sold to the Charleston Industrial Corporation. A variety of chemical companies used the facilities, and many of its workers resided in the houses built for the powder plant (Harper 2023a, 2023b).

The industrial activity led to over a half century of explosive growth in Kanawha County. During World War II, a synthetic rubber plant was built at what would become Union Carbide's research and development center at Institute, about 10 miles west of Charleston. By 1960, the population had surpassed a quarter of a million inhabitants. Yeager Airport was constructed in 1947, and Kanawha Boulevard was constructed along the riverfront around the same time. In the 1960s, three interstates were constructed that met in Charleston. This modern development preceded a decline in the chemical industry after 1950, as the demand exceeded the capacity of the facilities constructed during the first wave of the petrochemical boom. Early companies in the industry were consolidated into major corporations with global operations, and smaller legacy plants were closed. In the 1960s, the population of Kanawha County fell for the first time in its history. The decline has continued over the next 50 years, and the current population is estimated at 175,515. About 88 percent of the population identifies as white, and 7.5 percent as African American or Black. The largest employers in the county are CAMC Health System, the county school system, the state Department of Health and Human Services, Thomas Health System, and Walmart (Denham 2023; Forstall 1996; Harper 2023a; U.S. Census Bureau 2023a).

2.2 Historical Context of Nitro and the Project Vicinity

The Project area encompasses Ridenour Lake and dam, as well as areas below the dam that might be affected by Project activities. The lake on the east side of the town of Nitro, which is located on the right descending bank of the Kanawha River in western Kanawha County. The town was built by the U.S. War Department in 1918 to support a nitrocellulose plant needed to produce gunpowder for the war effort. The plant and most of the housing for its workers were located on the level ground adjacent to the river. The

Project is located in the hills to the east of the town on Blakes Creek. Blake Road, which pre-dates the town, runs through the creek's valley. Numerous houses were constructed along the lower portion of this road, renamed 21st Street, for officers and key civilian employees as part of Nitro's construction.

In 1917, DuPont had selected a site on the Kanawha River on the border between Kanawha and Putnam counties for a nitrocellulose plant, but political objections to the awarding of such a large contract to one company resulted in the War Department stepping in to oversee the construction of the plant and the town using a New York engineering firm. Once completed, the plant was to be operated by Hercules Powder Company. The massive plant and the accompanying town to house its workers, called Nitro, was constructed in less than a year by over 100,000 workers. However, the war ended before the project was completed, and the plant was sold to the Charleston Industrial Corporation. A variety of chemical companies used the facilities, and many of its workers resided in the houses built for the powder plant (Harper 2023a, 2023b).

2.2.1 Origins of U.S. Explosive Plant "C" and the Town of Nitro

With the U.S. entry into World War I in 1917, the need for explosives for ordinance was critical, and it was evident to the War Department that existing facilities would not be able to meet the demand. In response, Congress passed the Deficiency Appropriations Act in October 1917, authorizing funds to construct three massive munitions plants with a capacity of 500,000 pounds per day each of gunpowder. Sites were selected based on a number of criteria including railroad and water transportation facilities, secure location, favorable climate, and access to raw materials. The Nitro site was the number one location, along with sites near Nashville, Tennessee and Louisville, Kentucky. However, once work was underway at Nitro and Nashville, it was determined that increasing the capacity at those two facilities to 700,000 pounds per day would eliminate the need for the Louisville plant (City of Nitro, West Virginia 2019).

After plans for the plant and its support facilities were approved, ground was broken in December 1917 for the construction of 27 barracks to house workers who began arriving by train to build the facility. Over the course of the next 11 months, more than 110,000 people were employed on the Nitro project, although the average time on the job was only 40 days. The facility, known as Explosive Plant "C," covered 1,772 acres and included housing for nearly 24,000 people. A view from the hills east of town (Figure 2.2-1) shows a portion of the worker cottages and Explosive Plant "C" (Science History Institute [SHI] 1920). The general layout of the plant and town are shown in the plan in Figure 2.2-2 (U.S. War Department ca. 1918). The map shows that the plant operations were located between the New York Central Railroad tracks and the Kanawha River, while housing was generally located to the south of the plant (on the right in Figure 2.2-2) and between the tracks and the base of the hills to the east of the plant.

The plan was developed by the prominent Chicago architectural firm of Graham, Anderson, Probst & White. The company stated that "In providing these housing accommodations the well recognized facts were considered that the best workmen can only be obtained and held where housing is not only comfortable but attractive and designed to fit the special needs of each class" (Graham, Anderson, Probst & White 1919). Employees were grouped into six classes: unskilled white American laborers, African Americans, foreign laborers, skilled mechanics, executives, and military guards. Each class was housed in designated sections in housing types designed for their perceived needs (and by extension, their social status). African American and foreign laborers were housed in one section (labeled "A" on the map in Figure 2.2-2), while skilled mechanics ("O"), unskilled white American laborers ("P"), executives ("R"), and military guards ("S") each had separate sections. Skilled mechanics' residences were also located in the sections designated for unskilled white American laborers, executives, and military guards.

The area that would be potentially impacted by the proposed Project is located in the upper right of the map in Figure 2,2-2, primarily within Parcel 3 and extending east along Blakes Creek from the main part of the town. It is labeled "R" on the map, which was for executive residences, skilled mechanics quarters,

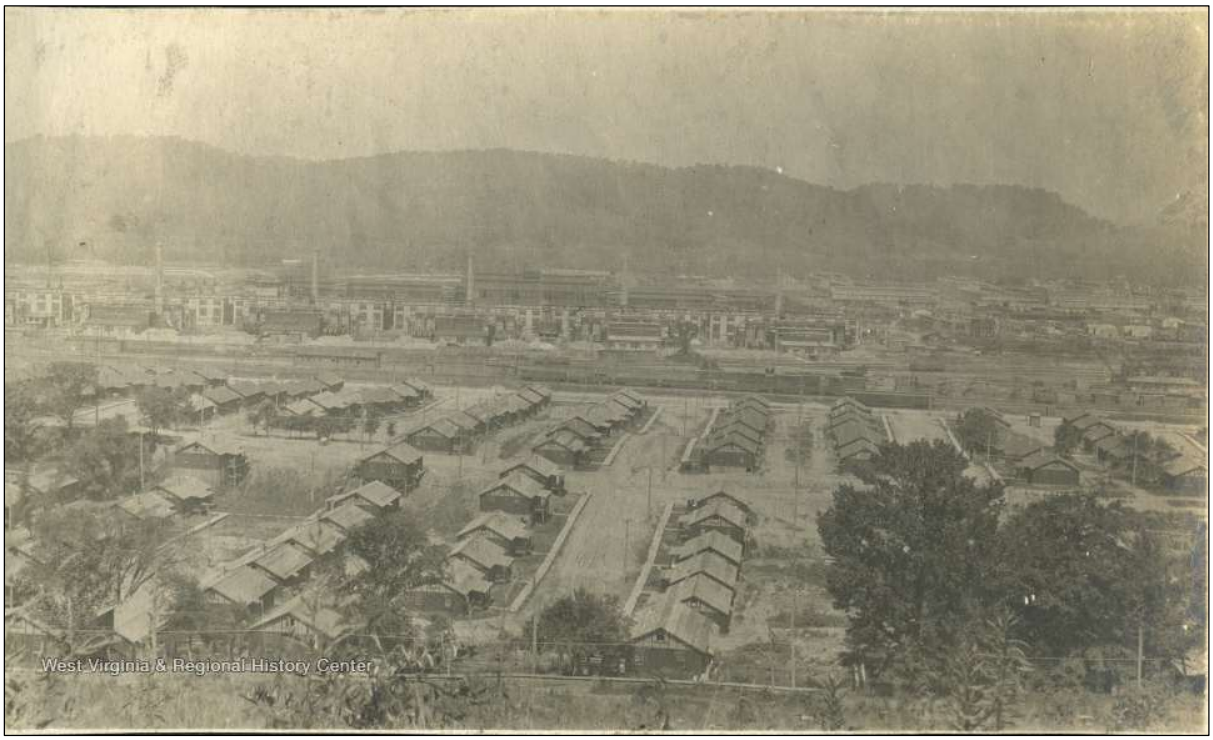


Figure 2.2-1: Panoramic Photograph Showing Portion of Worker Housing and Explosive Plant, View to the West, ca. 1918

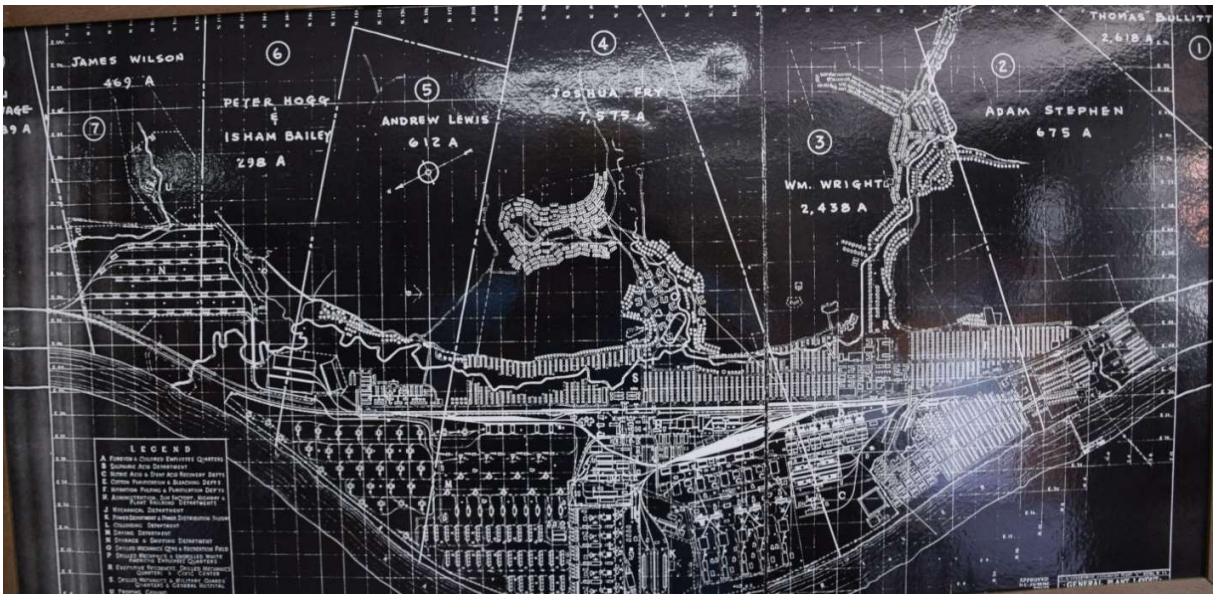


Figure 2.2-2: General Layout of Explosive Plant "C" and Nitro as Planned by the War Department (courtesy of Nitro Wars Museum, Nitro, West Virginia)

and the Civic Center. The Civic Center buildings appear to have been located at the base of the hill. There are dwellings shown on the map extending into the area now occupied by Ridenour Lake on roads

that do not currently exist. Based on a 1931 U.S. Geological Survey (USGS) topographic map (USGS 1931), it appears that these residences were not constructed, and that the houses built on 21stStreet/Blake Road only extended east from 3rd Avenue about 0.4 miles to the second bend in the road (Figure 2.2-3). Houses were also constructed on North 21st Street. It is difficult to determine how many houses were built since they are represented on the 1931 map as a solid block rather than individual structures.

A panoramic photograph taken in 1920 (SHI 1920) shows the houses located on 21st Street and North 21st Street as seen from the hill to the south (Figure 2.2-4). These dwellings represented "Executive" residences that housed superintendents, officials, and skilled mechanics. This area was referred to as Silk Stocking Row (Wintz 1985), because the wives of these employees could afford the expensive hosiery. The houses on the north side of 21st Street and those on North 21st Street correspond to resources ML-AM-03 through ML-AM-22, and ML-AM-31 through ML-AM-55 in the current survey. The structures on the south side of 21st Street also appear to correspond to surveyed resources but are more difficult to identify from the rear.

Most of the dwellings constructed for plant employees were "pre-cut" houses provided by Minter Homes Corporation that represent an early example of pre-fabricated homes. The homes were shipped by rail to the site, where 60 per day were built. Minter provided 1,724 pre-cut houses for the project (WVU 1919). These houses were seen as part of a "transitory city" by Graham, Anderson, Probst, and White, and were designed to be dismantled after the plant was no longer needed, to be re-used by coal companies to house workers or for other company towns. The houses on Silk Stocking Row were not Minter houses, however, but were stick-built (Graham, Anderson, Probst & White ca. 1918; Wintz 1985), and thus represent a semi-permanent or permanent design that might be sold as middle class family housing.

Photographs and sketches of different house types at Nitro indicate that the dwellings on 21st Street and North 21st Street represent at least five types of "executive residences" built at Nitro (Nitro Wars Museum ca. 1919). This includes 5-, 6-, 7-, and 9-room varieties. The 5-room and one of the 6-room house types were single-story, while one of the 6-room types and the 7- and 9-room types were two-story. A sketch and floor plan of Type 169 is shown in Figure 2.2-5. The houses contained porches, a pantry, ventilation systems, and basements with furnaces and laundry. Some of the houses of the same type were mirror images of each other. The mix of types, sizes, and orientations suggest an effort to avoid an overly homogenous feel to the neighborhood.

2.2.2 Explosive Plant "C" during and after World War I

Explosive Plant "C" was put into operation prior to the end of the war on November 1918, and the town was 90 percent complete. Besides housing for almost 24,000 people, the town had modern utilities, a school system, a fire department, a hospital, and recreational facilities. It was clear, however, that the powder plant would not be needed after the war, and about half of the residents left immediately when it was announced that production would cease. The entire operation was turned over to the War Department as surplus. The town continued to operate to serve the remaining employees that were engaged in decommissioning the facility. Some items were sold at auction, but the entire reservation was also offered for sale, including the residential facilities. About one year after the end of the war, the state created the Charleston Industrial Corporation (CIC) for the purpose of purchasing the plant and associated town facilities for redevelopment. The CIC offered $8.5 million for the operation, which was accepted by the federal government (City of Nitro, West Virginia 2019).

The CIC allowed residents to purchase their homes if desired, or they could continue to pay rent. In 1923, a 4-room bungalow sold for between $1,200 and $1,600, a 5-room bungalow from $1,350 to $2,100, and a 6-room bungalow from $1,500 to $2,150, depending on the location (Nitro Wars Museum 1923). A number of industries took advantage of the practically new facilities that were offered by the CIC at

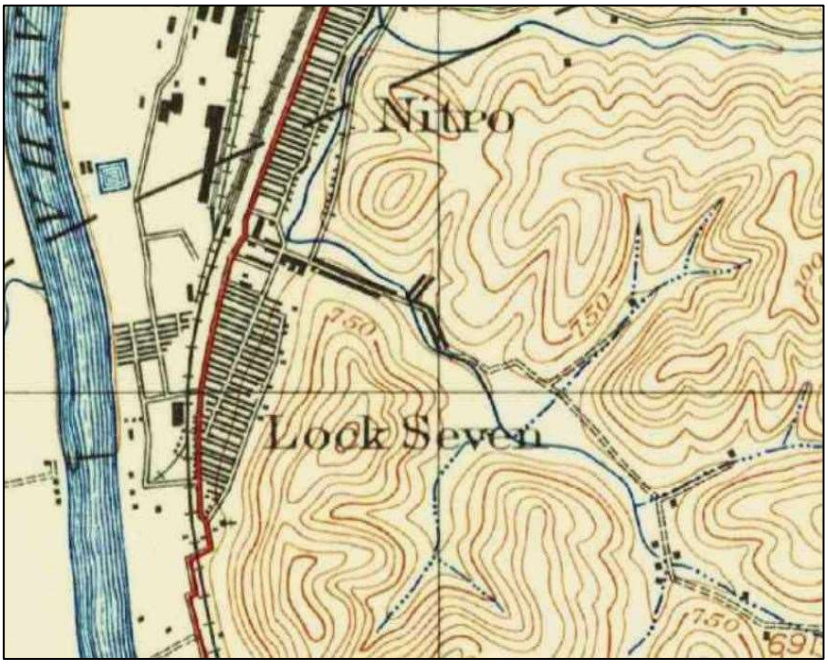


Figure 2.2-3: Topographic Map Showing Nitro After Sale to Charleston Industrial Corporation, 1931

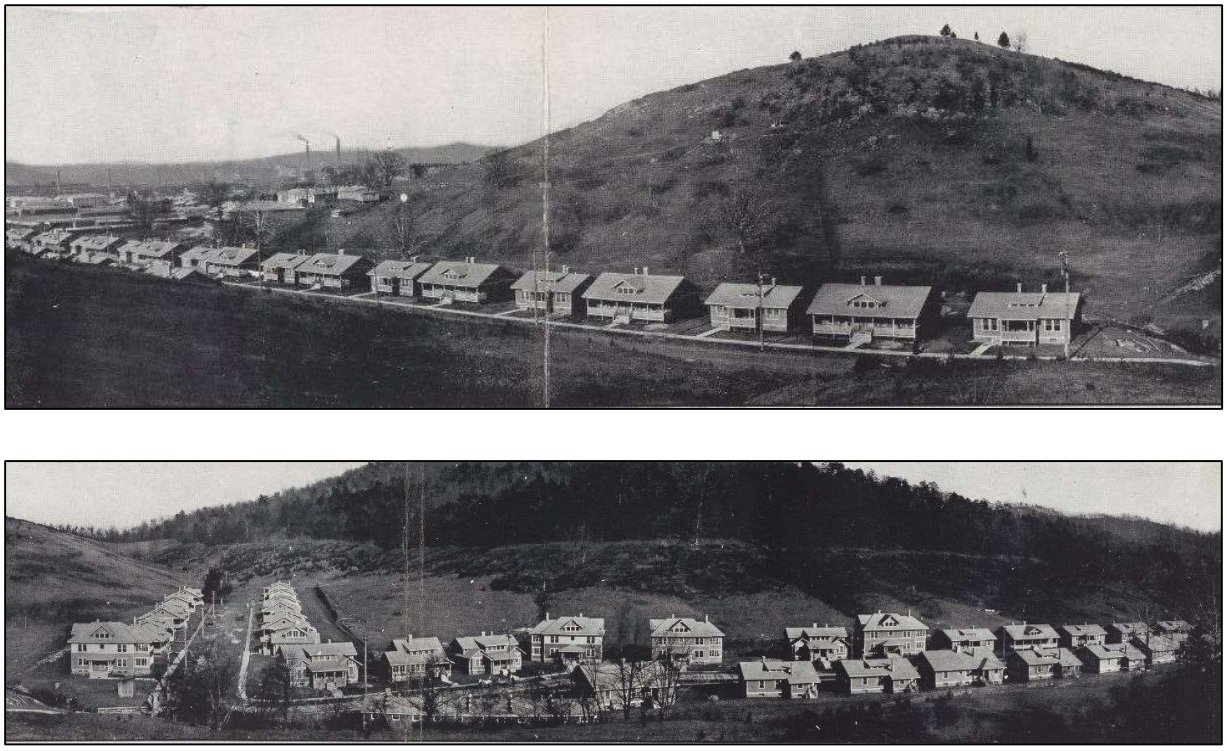


Figure 2.2-4: Panoramic View of West End of 21st Street (top), North 21st Street and East End of 21st Street (bottom), View to the North, ca. 1919

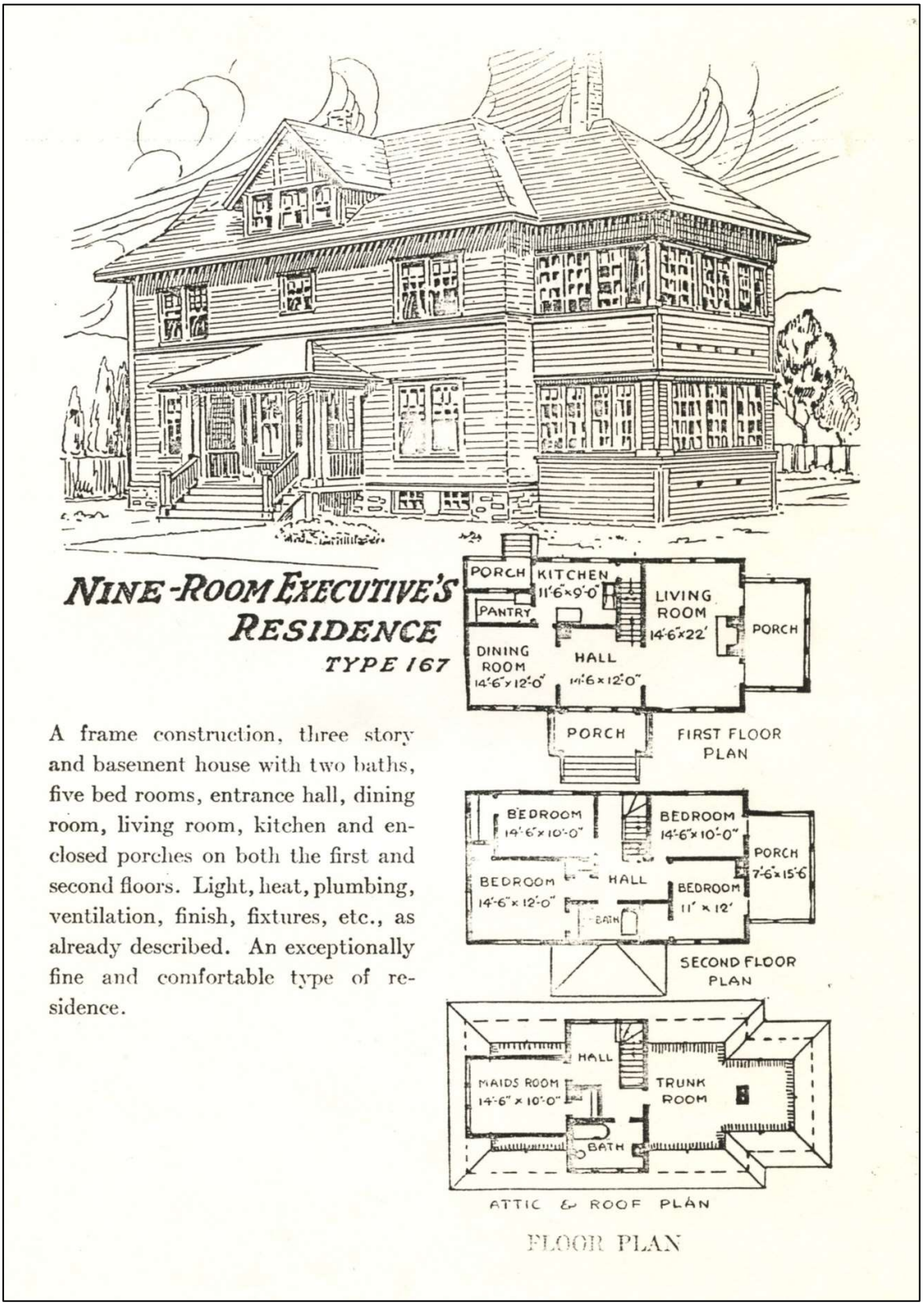


Figure 2.2-5: Description of Nine-Room Executive's Residence, Type 167

reasonable prices. Within a few years, the workforce had been stabilized and new leaders had moved in to administer the town as its own political entity. The town was incorporated in 1932, and in 1940 had a population of just under 2,000 (City of Nitro, West Virginia 2019).

Nitro continued to grow after World War II, in part due to overall growth in Kanawha and Putnam counties tied to a variety of industries that operated there. Between 1949 and 1971, Monsanto manufactured the agricultural herbicide known as Agent Orange at a facility in Nitro. Ridenhour Lake to the east of town was constructed following a flood in the 1960s and appears on a topographic map revised in 1978 (USGS 1978). The population of the town peaked in 1980 at just over 8,000 people. Ten years later it had fallen to 6,851. That number has declined slightly in the years since 1990, and is currently estimated at 6,458 (Harvey 1993; Rushe 2012; U.S. Census 2023b). Many of the bungalows and cottages constructed to house plant workers are still standing, including in the Project vicinity.

2.2.3 Conclusions

The government-contracted houses in Nitro represent a development in the emergence of the military-industrial complex in the twentieth century, as well as city planning movement that began in the late nineteenth century. The need for inexpensive housing that could be erected quickly and efficiently was already a concern in the United States before World War I, as the cost of labor and materials and the advent of utilities as standard amenities had driven up the cost of construction. The situation was exacerbated by the industrial buildup that accompanied the U.S. entry into the war. The facilities for manufacturing munitions, planes, armor, and other materiel were often in remote areas where land was cheap, but housing was scarce. In response, in 1918 President Wilson empowered the Secretary of Labor to administer funds authorized by Congress for “providing housing, local transportation, and other general community utilities for such industrial workers as are engaged in arsenals and navy yards of the United States and industries connected with and essential to the national defense, and their families.” The Bureau of Industrial Housing and Transportation was created in the Labor Department, and the U.S. Housing Corporation became the executive agent of the bureau (U.S. Housing Corporation 1919).

A report on housing projects carried out by the U.S. Housing Corporation describes the planning that went into the projects, the principles that guided the process, and the results at 47 sites across the country, including one at the Naval Ordnance Works in Charleston, West Virginia, about 8.5 miles southeast of Nitro. Although Nitro was not built by the U.S. Housing Corporation, Explosive Plant “C” was similar to the Charleston project in a number of ways. The considerations for the housing at the Naval Ordinance Works included separating the housing from the plant to reduce the amount of noise and smoke the residents would be exposed to, and creating a pleasant environment that would attract and retain high quality managers and laborers. Houses were provided with hot and cold running water, electricity, indoor plumbing, gas heating and cooking, and attractive landscaping. The houses differed from those at Nitro in that they were finished with stuccoed terra cotta rather than wood lap siding. The report for the Charleston project noted that a greater variety of house types and the use of more color, along with minor details such as blinds would have created a less homogenous and more inviting appearance to the development (U.S. Housing Corporation 1919).

The attention to sanitation, health, aesthetics, and community planning in the development of Nitro’s residential neighborhoods reflects the influence of Progressivism during the late nineteenth and early twentieth centuries. While lumber, textile, and mining companies often built housing and community facilities for its workers, the federal agencies overseeing the construction of Nitro and other defense industry operations considered its obligation to its employees’ welfare to be a primary concern. The houses along 21st Street and North 21st Street in Nitro illustrate the historical themes of emergency war time housing, social history, and community planning.

3. METHODS

The sections that follow provide detail on the methods employed for the historic architectural reconnaissance-level survey. These include gathering background information on the Project area and types of resources that would typically be found, field survey methods, and post-survey analysis.

3.1 Background Research

Before field investigations were initiated, a file search was conducted for previously identified historic resources, along with information on properties listed in or nominated for the NRHP. Background research included the direct Project footprint as well as up to a 1-mile search radius. ERM collected information on resources maintained by the West Virginia Department of Arts, Culture and History's State Historic Preservation Office's (WV SHPO) Interactive Map Viewer. The purpose of the search was to identify resources that might be located within the APE, and to anticipate the types of resources likely to the encountered in the region. The results of the file search are presented in Chapter 4. Background research also entailed historical research on the origins and development of the City of Nitro to provide context for evaluating the historical and architectural significance of resources identified in the APE.

3.2 Field Survey Methods

In the context of cultural resource investigations conducted under Section 106 of the National Historic Preservation Act, an APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist" (36 CFR Part 800.16[d]). The APE for historic resources was defined by the NRCS to include the area of direct effects conforming to the Project's 224-acre Limits of Disturbance (LOD), and a larger area of potential indirect effects, which was defined to encompass areas that would be impacted were the dam to fail (see Figure 1.1-1 and 1.1-2).

ERM examined the APE for properties 50 years or older. Digital photography was used to document each resource, notes were taken on architectural style, materials, and construction details, and the resources were plotted on Project maps. Each resource was photographed and marked on the applicable USGS quadrangle map. Digital photographs were taken to record the structures' overall appearance and details. Additional information on the structures' appearance and integrity was recorded to assist in making recommendations of eligibility and further study. Observations were made from the nearest public right-of-way, augmented with a review of historic maps and aerial imagery and tax records. Details on each surveyed resource were entered into a Historic Property Inventory form (HPI form).

3.3 Analysis of Resources

Analysis relied on a combined consideration of NRHP eligibility criteria and the historic context relating to the proposed historic district. ERM considered resources' potential NRHP eligibility under Criterion A, evaluating whether the historic district associated with military industrial production for World War I and later civilian repurposing made a significant contribution to broad patterns of history. Integrity of individual contributing and non-contributing resources played a key role in making a determination of eligibility under Criterion C. Historic map research in addition to observations in the field supported assessments of whether a contributing resource has retained integrity.

3.4 NRHP Eligibility Criteria

According to 36 CFR 60.4 (Andrus and Shrimpton 2002), cultural resources eligible for listing on the NRHP are defined as buildings, structures, objects, sites, and districts that have "integrity" and that meet

one or more of the criteria outlined below. Criterion D is typically relevant to archaeological sites and was not relevant to the resources considered in this study.

- Criterion A (Event). Association with one or more events that have made a significant contribution to the broad patterns of national, state, or local history.
- Criterion B (Person). Association with the lives of persons significant in the past.
- Criterion C (Design/Construction). Embodiment of distinctive characteristics of a type, period, or method of construction; or representation of the work of a master; or possession of high artistic values; or representation of a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D (Information Potential). Properties that yield, or are likely to yield, information important in prehistory or history. Criterion D is most often (but not exclusively) associated with archaeological resources. To be considered eligible under Criterion D, sites must be associated with specific or general patterns in the development of the region. Therefore, sites become significant when they are seen within the larger framework of local or regional development.

“Integrity” is perhaps the paramount qualification of NRHP eligibility, and can be related to any or all of the following (Andrus and Shrimpton 2002):

- Location: the place where the historic property (or properties) was/were constructed or where the historic event(s) occurred;
- Design: the combination of elements that create the form, plan, space, structure, and style of a property (or properties);
- Setting: the physical environment of the historic property (or properties);
- Materials: the physical elements that were combined to create the property (or properties) during the associated period of significance;
- Workmanship: the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory;
- Feeling: the property’s (or properties’) expression of the aesthetic or historic sense of the period of significance; and
- Association: the direct link between the important historic event(s) or person(s) and the historic property (or properties).

Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the NRHP (Andrus and Shrimpton 2002). However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

- Consideration A: A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- Consideration B: A building or structure removed from its original location, but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- Consideration C: A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his or her productive life; or

- Consideration D: A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- Consideration E: A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- Consideration F: A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
- Consideration G: A property achieving significance within the past 50 years if it is of exceptional importance.

4. RESULTS

This chapter presents the findings of the reconnaissance survey. ERM recorded 77 new historic resources during the survey. The 77 newly identified resources constitute a proposed historic district eligible for listing on the NRHP under Criterion A for its connections to the military, and eligible under Criterion C for the high degree of integrity the dwellings retain. Of these identified resources, 55 are contributing to the proposed historic district, while 22 are non-contributing as they are not associated with the historic context defining the district (see Section 2.2).

4.1 Previous Investigations

Prior to beginning field investigations, ERM reviewed the data that is available in the West Virginia Interactive Map database maintained by the WV SHPO for the purpose of identifying the locations of previously recorded aboveground resources in the Project APE, gathering information on those resources, and reviewing their eligibility status for the NRHP. ERM also conducted historical research on central West Virginia and Kanawha County in particular, to better understand the general context of the aboveground resources.

Review of the West Virginia Interactive Map revealed that no cultural resource surveys have been conducted in the Project APE. However, eight previously identified historic resources had been recorded within the 1-mile search boundary (Table 4.1-1). Their locations are depicted in Appendix A, Figure 1; however, none fall within the Project APE for architectural review.

Table 4.1-1: Previously Recorded Historic Resources within 1 Mile of the Project

Resource Number	Property Name/Location	Description	County	NRHP Status
PU-0002-0274	Al Cochron House	House, ca. 1895	Putnam	Unevaluated
PU-0002-0275	House	House, ca. 1917	Putnam	Unevaluated
KA4657A	House	House, ca. 1865-1909	Kanawha	Unevaluated
KA5976	Nitro High School	School, ca. 1960s	Kanawha	Unevaluated
KA5977	Nitro High School Annex	School, ca. 1960s	Kanawha	Unevaluated
KA5978	Nitro Elementary School	School, ca. 1960s	Kanawha	Unevaluated
KA5979	Freedom Christian Academy	School, ca. 1960s	Kanawha	Unevaluated
KA5980	Twin City Christian Academy	School	Kanawha	Unevaluated

4.2 Current Survey Findings

Following the field survey, the resources within the APE were analyzed to determine their potential eligibility as a historic district under the context of military history associated with the Nitro Munitions Factory during World War I (see Section 2.2). Out of the 77 individual resources in the APE, ERM recommends that 55 are contributing to the proposed historic district's World War I military context (Criterion A) and/or retain a level of architectural integrity as examples of Minter pre-fabricated homes (Criterion C). The remaining 22 are non-contributing resources (Table 4.2-1). The locations of all the resources are depicted in Appendix A, Figure 2.

Table 4.2-1: Summary of Historic Resources in the APE

Resource Number	Description	ERM Recommendation
KA-8359	Silk Stocking Row Historic District	Eligible

4.2.1 KA-8359, Silk Stocking Row Historic District

The historic district contains housing constructed for employees of U.S. Explosives Plant "C" in Nitro, one of two powder plants authorized by Congress in 1917 to increase production of munitions in support of the United States war effort in World War I. The dwellings are located along 21st Street and North 21st Street and based on photographs and sketches of the different house types at Nitro, include at least five types of "executive residences" intended for plant superintendents, officials, and skilled mechanics (Nitro Wars Museum ca. 1919).

The majority of the houses are Types 170 and 171, located on the western end of 21st Street and North 21st Street. Type 170 is a 6-room, single-story Massed Plan dwelling, while Type 171 is a 5-room Bungalow style residence. Other house types include Types 167, 169 and 172. Type 167 is a 9-room, 3-story Colonial Revival style, Type 169 is a 7-room, two-story Airplane Bungalow, and Type 172 is a 6-room, two-story Bungalow style. All of the houses contained porches, a pantry, ventilation systems, and basements with furnaces and laundry. The 2- and 3-story house types included enclosed sleeping porches. Graham, Anderson, Probst, and White were the designing engineers, while Thompson-Storrett Company was the construction manager.

There are a total of 58 structures on 21st Street and North 21st Street built from 1917 or 1918 during the construction of Explosive Plant "C". In addition to this, there are 21 resources that are not associated with the Explosive Plant "C" construction and were added from the 1940s to the 1970s. One dwelling was added in the 1940s, one in the 1960s, and five in the 1970s. Additionally, seven were constructed or significantly remodeled in the 1950s. These resources are non-contributing to the historic district, with styles and forms that fall outside of the historic district's period of significance and architectural themes. In summary, there are a total of 77 resources within the historic district, 55 contributing and 22 non-contributing, which are summarized in the table below (Table 4.2-2).

Table 4.2-2: Resources within the Proposed Silk Stocking Row Historic District

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0001	Contributing	27 5002500000000	2162 21st ST.	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow. Outbuildings: Ca. 1990 Shed	located approximately 0.02 mile north	This dwelling is likely Executive Residence Type 171 with the dormer, chimney, and upper half story removed and a carport attached. The dwelling has a corrugated metal side-gabled roof and clapboard siding. The primary entrance is within the partially enclosed shed porch, which is accessible via a run of wood steps. The dwelling rests on a continuous brick foundation. Despite the alterations, the dwelling retains its association with the rapid residential development associated with the Nitro Munitions Factory.	
KA-8359-0002	Contributing	27 5002400000000	2160 21st ST.	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow.	located approximately 0.03 mile north	Dwelling resembles an Executive Residential Type 172. However, the dormer has been altered, the porch has been enclosed, and a garage has been added. The side-gabled roof is clad in asphalt shingles and the dwelling is covered in vinyl siding. There is an on-peak brick chimney off-center from the dormer. The windows are all one-over-one. The dwelling rests on a continuous brick foundation. The dwelling does retain its association with the Nitro Munitions Factory despite these alterations.	
KA-8359-0003	Contributing	27 5002300000000	2158 21st ST.	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuildings: Ca. 1950	located approximately 0.04 mile north	The dwelling features a cross-gabled roof clad in asphalt shingles. The recessed patio provides access to the primary entrance into the enclosed front porch. The dwelling has both a tripartite window and six-over-six double-hung windows. The dwelling has been altered with a gable constructed on the southwest façade; however, the remaining elevations appear to have been unaltered. The dwelling was likely an Executive Residence, Type 171 and retains its historic association to the Nitro Munitions Factory.	
KA-8359-0004	Contributing	27 5002200000000	2156 21st ST.	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuildings: Ca. 1985	located approximately 0.05 mile north	The dwelling is an Executive Residence Type 170 and retains much of its original design, including the gable-front dormer, full-length porch set on a pier foundation, brackets on the side elevations, and a central brick chimney. The dwelling has asphalt shingle roofing and clapboard siding. The first floor features a row of one-over-one windows, while the dormer retains the original three, six-over-six windows. It retains its historic association to the Nitro Munitions Factory.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0005	Contributing	27 5002100000000	2154 21st ST.	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.06 mile north	The dwelling is an Executive Residence Type 171 with the standard shed dormer, central bump out porch, and brackets on the side elevations. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory and retains aspects characteristic of its original design.	
KA-8359-0006	Contributing	27 5002000000000	2152 21st ST.	City of Nitro	Dwelling: Ca. 1918, Colonial Revival	located approximately 0.07 mile north	This dwelling is an Executive Residence Type 167 that is two stories with a gable-front dormer, and central one-story porch. The dwelling retains material and design integrity, including character defining features that underline its historic association to the Nitro Munitions Factory.	
KA-8359-0007	Contributing	27 5001900000000	2150 21st ST.	City of Nitro	Dwelling: Ca. 1918, Airplane Bungalow Outbuildings: Ca. 1965 garage	located approximately 0.08 mile north	The roof is clad in asphalt shingles and the dwelling features clapboard siding. There is a centrally located, on-peak brick chimney. The windows on the dormer are shaded by an awning. This dwelling is an Executive Residence Type 169, defined by the side-gable roof flanked by two gable-front wings and a shed dormer above a central porch. This dwelling possesses these character defining features of the Executive Residence Type 169 and retains its historic association to the Nitro Munitions Factory.	
KA-8359-0008	Contributing	27 5001800000000	2146 21st ST	City of Nitro	Dwelling: Ca. 1918, Colonial Revival	located approximately 0.09 mile north	This dwelling is an Executive Residence Type 167 that is two stories with a gable-front dormer, and central one-story porch. The dwelling retains its historic association to the Nitro Munitions Factory as it is identifiable as the Executive Residence Type 167 and retains aspects of its character defining features from that time period. The dwelling features asphalt shingle roofing pierced by two brick chimneys. Each of the pairs of double-hung windows are flanked by shutters.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0009	Contributing	27 5001700000000	2144 21st ST	City of Nitro	Dwelling: Ca. 1918, Colonial Revival Outbuildings: Ca. 2010 Pavilion Ca. 2010 Car Port	located approximately 0.11 mile north	This dwelling is an Executive Residence Type 167 that is two stories with a gable-front dormer, and a central one-story porch with a hipped roof that is accessible via a run of brick steps. There is an an interior brick chimney. The dwelling retains its historic association to the Nitro Munitions Factory as it is identifiable as the Executive Residence Type 167 and retains aspects of its character defining features from that time period.	
KA-8359-0010	Contributing	27 5001600000000	2143 21st ST	City of Nitro	Dwelling: Ca. 1918, Airplane Bungalow Outbuilding: Ca. 1950 Garage	located approximately 0.12 mile north	This dwelling is an Executive Residence Type 169, defined by the side-gable roof flanked by two gable-front wings and a shed dormer. The central porch has been enclosed. This dwelling possesses many character defining features of the Executive Residence Type 169 and retains its historic association to the Nitro Munitions Factory.	
KA-8359-0011	Contributing	27 5001500000000	2142 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.13 mile north	This dwelling is an Executive Residence Type 172, defined by a large, shed dormer, a wing off one elevation (historically having a wall of windows), and an offset porch to the opposite end. This Executive Residence Type 172 retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0012	Contributing	27 5001400000000	2141 21st ST	City of Nitro	Dwelling: Ca. 1918, Airplane Bungalow Outbuilding: Ca. 1940 Garage	located approximately 0.14 mile north	This dwelling is an Executive Residence Type 169, defined by the side-gable roof flanked by two gable-front wings and a shed dormer. The central porch has been enclosed. This dwelling possesses many character defining features of the Executive Residence Type 169 and retains its historic association to the Nitro Munitions Factory.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0013	Contributing	27 5001300000000	2136 N 21st ST	City of Nitro	Dwelling: Ca.1918, Airplane Bungalow	located approximately 0.15 mile north	This dwelling is an Executive Residence Type 169, defined by the side-gable roof flanked by two gable-front wings and a shed dormer. The central porch has been enclosed. This dwelling possesses many character defining features of the Executive Residence Type 169 and retains its historic association to the Nitro Munitions Factory.	
KA-8359-0014	Contributing	27 5001200000000	2138 21st ST N	City of Nitro	Dwelling: Ca.1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Shed	located approximately 0.15 mile north	The dwelling is an Executive Residence Type 170 and retains some of its original features on the exterior façades, including the gable-front dormer, brackets on the side elevations, and a central brick chimney. A portion of the porch has been enclosed. The porch foundation is continuous brick. The dwelling retains its historic association to the Nitro Munitions Factory and retains aspects of its character defining features as an identifiable example of the Executive Residential Type 170.	
KA-8359-0015	Contributing	27 5001100000000	2140 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1990 Shed	located approximately 0.16 mile north	The dwelling is an Executive Residence Type 171 with central bump out porch, and brackets on the side elevations. The dwelling has had its shed dormer removed and its porch enclosed. The dwelling retains its historic association to the Nitro Munitions Factory as an identifiable example Executive Residence Type 171 constructed during the significant residential development for the factory.	
KA-8359-0016	Contributing	27 5001000000000	2164 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Garage	located approximately 0.17 mile north	The dwelling is an Executive Residence Type 170 and retains original features, including the gable-front dormer, a full-length porch, brackets on the side elevations, and a central brick chimney. The porch foundation is continuous brick. As it is identifiable as an Executive Residence Type 170, the dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0017	Contributing	27 5000900000000	2166 N 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.18 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch (now enclosed), and brackets on the side elevations. The dwelling's main entrance was relocated when the original porch was enclosed. The brick foundation has also been covered by a stone veneer and a carport was added off one elevation. However, this dwelling is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0018	Contributing	27 5000800000000	2168 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1990 Carport	located approximately 0.19 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer, on-peak brick chimney, central bump out porch (now enclosed), and brackets on the side elevations. The dwelling has its original porch enclosed and the main entrance has been relocated. Also, stone veneer has been applied. It is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0019	Contributing	27 5000700000000	2170 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1980 Garage	located approximately 0.20 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, on-peak brick chimney, central bump out porch (now enclosed), and brackets on the side elevations. The dwelling had its original porch enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0020	Contributing	27 4005400000000	2169 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.20 mile north	This dwelling is an Executive Residence Type 170; however, two thirds of the full-length porch has been enclosed, the primary entrance has been relocated, and the pier foundation of the porch has been covered with a stone veneer. The dwelling retains its gable front dormer and brackets in the gable ends. The dwelling remains associated with the historic context of residential development to meet the housing demand associated with construction of the Nitro Munitions Factory.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0021	Contributing	27 4005000000000	2137 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1950 Garage	located approximately 0.17 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch (now enclosed), and brackets on the side elevations. The dwelling has its original porch enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory and retains aspects of its character defining features from that time period.	
KA-8359-0022	Contributing	27 4004900000000	2135 21st ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Garage	located approximately 0.17 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, a full-length porch, and a central brick chimney. The porch foundation is continuous brick. It is identifiable as an Executive Residence Type 170, retaining aspects of its character defining features from that time period. The dwelling also retains its historic association to the Nitro Munitions Factory.	
KA-8359-0023	Contributing	27 4004800000000	2134 N 21st ST	City of Nitro	Dwelling: Ca. 1918, Colonial Revival Outbuildings: Ca. 1950 Garage	located approximately 0.16 mile north	This dwelling is an Executive Residence Type 167 that is two stories with a gable-front dormer, and central one-story porch. The dwelling retains its historic association to the Nitro Munitions Factory as it is identifiable as the Executive Residence Type 167, displaying character defining features from that time period.	
KA-8359-0024	Contributing	27 4004700000000	2133 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1980 Garage	located approximately 0.17 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch (now enclosed), and brackets on the side elevations. The dwelling has its original porch enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory, displaying character defining features from that time period.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0025	Contributing	27 4004600000000	2132 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.18 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer and a central brick chimney. The porch has been partially enclosed. The foundation is continuous brick. As it is identifiable as an Executive Residence Type 170, the dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0026	Contributing	27 4004500000000	2131 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1970 Garage	located approximately 0.19 mile north	The dwelling is an Executive Residence Type 171 with a covered shed dormer, and a central bump out porch (now enclosed). The dwelling has its original porch enclosed and the main entrance has been relocated. Alterations to shed dormer and porch have diminished the resource's architectural integrity. However, it remains associated to the Nitro Munitions Factory as its was constructed as part of the necessary housing for the employees of the factory.	
KA-8359-0027	Contributing	27 4004400000000	2130 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.19 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer and a central brick chimney. As it is identifiable as an Executive Residence Type 170 and retains many of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0028	Non-contributing	27 4004300000000	2129 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. Ca. 1970 Garage	located approximately 0.20 mile north	The dwelling is an Executive Residence Type 170 and has lost much of its character defining features to updates and changes made throughout the dwelling's history. These include the modification of its gable front dormer, stone veneer on the porch foundation and pedestals for the replacement tapered porch columns, adding Craftsman stylistic elements lacking in the original design. The dwelling also has lost its side brackets on the gable ends. Due to this dwelling's significant alterations past the recognizable type it is recommended non-contributing.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0029	Contributing	27 4004200000000	2128 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1980 Garage	located approximately 0.20 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer and a central brick chimney. The dwelling contains many of its character defining features defined above. As it is identifiable as an Executive Residence Type 170 and retains many of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0030	Contributing	27 4004100000000	2127 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.22 mile north	The dwelling is an Executive Residence Type 171 with a covered shed dormer, and a central bump out porch (now enclosed). It is identifiable as an Executive Residence Type 171 and retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0031	Contributing	27 4004000000000	2125 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Garage	located approximately 0.23 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer and a central brick chimney. The porch is partially enclosed; however, the original entryway is still in place. As it is identifiable as an Executive Residence Type 170 and retains many of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0032	Non-contributing	27 4003900000000	2123 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1990 Garage	located approximately 0.24 mile north	The cross-gabled dwelling is clad in Masonite hardboard and vinyl siding and asphalt shingle roofing. It features an off-center primary entrance under a shed roof. The dwelling rests on a continuous brick foundation. The dwelling appears to have originated as Executive Residence Type 171, but major modifications to the dwelling include the projecting gable wing on the façade, enclosure of the original central porch, and extensive use of replacement materials. While the dwelling is associated with the residential development that supported the Nitro Munitions Factory, it has lost sufficient architectural integrity to convey the historic feeling of the district during its period of significance.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0033	Contributing	27 4003800000000	2121 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1985 Garage	located approximately 0.25 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, and a continuous brick foundation. The windows and primary entrance appear to be in their original locations as well. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0034	Contributing	27 4003700000000	2119 21st ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1980 Garage	located approximately 0.26 mile north	The dwelling has an asphalt shingle side-gabled roof, vinyl siding, and a brick foundation. The windows have been replaced with vinyl one-over-one double-hung units. The dwelling is likely an Executive Residence Type 171 with a central bump out porch. The shed dormer has been shifted and added to with a clipped hip dormer along with an increased roof height to accommodate a second story. Although the dwelling has undergone alternations from the original Executive Residential Type 171, it remains associated with the historic context of development brought on by the Nitro Munitions Factory retains the feeling of the district's period of significance.	
KA-8359-0035	Contributing	27 4003600000000	2117 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Garage	located approximately 0.27 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable front dormer, brackets in the gable ends, and a central brick chimney. The porch is partially enclosed; however, the original entryway is still in place. The dwelling also appears to have retained its original exterior cladding. As it is identifiable as an Executive Residence Type 170 and retains many of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0036	Non-contributing	27 4003500000000	2115 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow modified to become Compact Ranch Outbuilding: Ca. 1950 Garage	located approximately 0.28 mile north	This dwelling likely originated as an Executive Residence Type 171 that was substantially remodeled in the 1950s to achieve the current compact Ranch design. Because of the extent of the changes, the dwelling no longer retains the important characteristics associated with the Executive Residences in the district. The loss of integrity prevents the dwelling from conveying the feeling of the district during its period of significance.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0037	Contributing	27 4003400000000	2113 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.29 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, central brick chimney, and brick foundation. The windows and primary doorway appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0038	Contributing	27 4003200000000	2109 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1965 Garage	located approximately 0.30 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, and central brick chimney. However, the porch is mostly enclosed, and the original entryway has been relocated. Notwithstanding those changes, the dwelling is identifiable as an Executive Residence Type 170 and retains many of its character defining features associated with the Nitro Munitions Factory.	
KA-8359-0039	Contributing	27 4003100000000	2107 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.32 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch (now enclosed), and brackets on the side elevations. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0040	Contributing	27 4003000000000	2105 1/2 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.34 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, and a central brick chimney. The porch is partially enclosed and has been lowered to ground level and the original entrance has been relocated to the portion that is enclosed. As it is identifiable as an Executive Residence Type 170 and retains its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0041	Contributing	27 4002900000000	2103 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1950 Garage	located approximately 0.36 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central brick chimney, and central bump out porch. The original porch is enclosed and a new porch constructed on one side. The main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0042	Contributing	27 4021600000000	2112 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.31 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central brick chimney, and central bump out porch. The original porch has been enclosed and a new porch constructed on one side. The main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0043	Contributing	27 4021700000000	2114 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.31 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, central brick chimney, brackets in the gable ends, and brick foundation. The windows and primary entrance appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0044	Contributing	27 4021800000000	2116 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1990 Garage	located approximately 0.30 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch, and brackets on the side elevations. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0045	Contributing	27 4021900000000	2118 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.28 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full length porch, a central brick chimney, and a brick foundation. The windows and primary entrance appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0046	Contributing	27 4022000000000	2120 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.27 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer, central bump out porch, and brackets on the side elevations. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0047	Contributing	27 4022100000000	2122 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.26 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, a central brick chimney, and a brick foundation. The windows and primary entrance appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0048	Contributing	27 4022200000000	2124 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.25 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer removed and the central bump out porch now enclosed. It features a side-gabled roof clad in asphalt shingles and all elevations are clad in vinyl siding. These changes have not severely impacted the dwelling's character defining features. The dwelling was constructed to support the Nitro Munitions Factory, and changes to the dwelling have had little impact on the resource's ability to convey the historic feeling of the district during its period of significance.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0049	Contributing	27 4022300000000	2126 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.24 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, brackets in the gable ends, and a central brick chimney. The porch is partially enclosed; however, the original entryway is still in place. The dwelling has a two-car garage constructed, detracting somewhat from its character defining features. As it is identifiable as an Executive Residence Type 170 and retains many of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0050	Contributing	27 4023100000000	2145 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.10 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, a central brick chimney, and a brick foundation. The windows and primary entrance appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0051	Contributing	27 4023200000000	2147 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1965 Garage	located approximately 0.08 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer, brackets on the gable ends, a central brick chimney, and a central bump out porch. The original porch has been enclosed and a new porch constructed on one side. The main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0052	Contributing	27 4023300000000	2149 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1980 Garage	located approximately 0.07 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer, central bump out porch, and brackets on the side elevations. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0053	Contributing	27 4023400000000	2151 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan Outbuilding: Ca. 1950 Garage	located approximately 0.06 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, brackets in the gable ends, and a central brick chimney. The porch is mostly enclosed, and the original entryway has been relocated. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0054	Contributing	27 4023500000000	2153 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 1990 Garage	located approximately 0.05 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, central bump out porch. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0055	Contributing	27 4023600000000	2155 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow Outbuilding: Ca. 2000 Shed	located approximately 0.04 mile north	The dwelling is an Executive Residence Type 171 with shed dormer, a side-gable roof, and a central bump out porch. It is one of the few dwellings of the Executive Residence Type 171 in which the porch has not been enclosed, and the primary entrance is in its original location. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0056	Contributing	27 4023700000000	2157 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.03 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, full-length porch, a central brick chimney, and a brick foundation. The windows and primary doorway appear to be in their original locations. As it is identifiable as an Executive Residence Type 170 and retains some of its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0057	Contributing	27 4023800000000	2159 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow	located approximately 0.01 mile north	The dwelling is an Executive Residence Type 171 with the shed dormer, brackets in the gable ends, and a central bump out porch. The original porch has been enclosed and the main entrance has been relocated; however, it is identifiable as an Executive Residence Type 171. The dwelling retains its historic association to the Nitro Munitions Factory as it retains aspects of its character defining features from that time period.	
KA-8359-0058	Non-contributing	27 4003300000000	2111 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow modified to become Minimal Traditional Outbuilding: Ca. 1970 Garage	located approximately 0.31 mile north	The dwelling originated as an Executive Residence Type 171, but appears to have been substantially remodeled in the 1950s to achieve the current Minimal Traditional design. It now features a cross-gabled roof clad in asphalt shingles and an interior brick chimney. The protected porch provides access to the primary entrance, which is accessible via a run of brick steps. Because of its diminished material and design integrity, the dwelling has lost many of defining characteristics of an Executive Residence associated with the Nitro Munitions Factory and no longer conveys the feeling of the district during its period of significance.	
46KA790	Non-Contributing	27 5003000000000	21st Street	City of Nitro	Dudding Cemetery, Ca. 1860.	located approximately 0.02 mile north	The Dudding Cemetery contains 83 known interments that date as early as 1860, with the most recent dating to 2007. Although the cemetery was not established as part of the rapid residential development that occurred to accommodate the employees of the Nitro Munitions Factory, the majority of the burials took place between the 1920s through 1940s, totaling 40 interments. Because the cemetery predates the Nitro Munitions Factory and the majority of the burials took place outside the district's period of significance, it is recommended non-contributing to the proposed district.	
KA-8359-0059	Non-contributing	25 21000400010000	182 Ridenour Park S	City of Nitro	Earthen Dam, Ca. 1971	Within Project Area	The Earthen Dam was put in place well after the rapid residential development to support the Nitro Munitions Factory. It is not associated with the historical events surrounding the plant and its employee housing. Therefore, it is considered non-contributing to the district.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0060	Non-contributing	27 5002600000000	2 Blake Rd	City of Nitro	Dwelling: Ca. 1970, Split Level	located approximately 0.01 mile north	This Split Level dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0061	Non-contributing	27 5000600000000	2172 21st ST N	City of Nitro	Dwelling: Ca. 1970, Split-Level	located approximately 0.02 mile north	This Split Level dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0062	Non-contributing	27 5000500000000	2178 N 21ST ST	City of Nitro	Dwelling: Ca.1970, Split-Level	located approximately 0.02 mile north	This Split Level dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0063	Non-contributing	27 5000400000000	2182 N 21ST ST	City of Nitro	Dwelling, Ca. 1950, Split-Level	located approximately 0.02 mile north	This Split Level dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0064	Non-contributing	27 5000300000000	2187 N 21ST ST	City of Nitro	Dwelling, Ca. 1970, Linear with Clusters Ranch	located approximately 0.02 mile north	This Ranch style dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0065	Non-contributing	27 5000200000000	2189 N 21ST ST	City of Nitro	Dwelling, Ca. 1940, not visible	located approximately 0.02 mile north	This dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0066	Non-contributing	27 4005700000000	2175 21ST ST N	City of Nitro	Dwelling, Ca. 1950, Linear with Clusters Ranch	located approximately 0.02 mile north	This Ranch style dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0067	Non-contributing	27 4005600000000	2173 21ST ST N	City of Nitro	Dwelling, Ca. 1950, Compact Ranch	located approximately 0.02 mile north	This Ranch style dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0068	Non-contributing	27 4005500000000	2171 21ST ST N	City of Nitro	Dwelling, Ca. 1960, Compact Ranch	located approximately 0.02 mile north	This Ranch style dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0069	Non-contributing	27 4005300000000	2167 21ST ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow modified to become Vernacular	located approximately 0.02 mile north	The dwelling originated as an Executive Residence Type 170, but appears to have been substantially remodeled in the 1980s to achieve the current design. It now features a second story with full-width front porch. The entry remains in the same central location and the chimney has been extended to the second story. Because of the severity of the alterations it has diminished its integrity since the dwelling has lost many of its defining characteristics of an Executive Residence associated with the Nitro Munitions Factory.	
KA-8359-0070	Non-contributing	27 4005200000000	2165 21ST ST N	City of Nitro	Dwelling: Ca. 1918, Vernacular Bungalow modified to become Minimal Traditional	located approximately 0.02 mile north	The dwelling originated as an Executive Residence Type 171, but appears to have been substantially remodeled in the 1950s to achieve the current Minimal Traditional design. It now features a cross-gabled roof clad in asphalt shingles. The protected porch provides access to the primary entrance, which is accessible via a run of brick steps. Because of its diminished material and design integrity, the dwelling has lost many of defining characteristics of an Executive Residence associated with the Nitro Munitions Factory and no longer conveys the feeling of the district during its period of significance.	
KA-8359-0071	Non-contributing	27 4005100000000	2139 21ST ST N	City of Nitro	Dwelling, Ca. 1950, Colonial Revival	located approximately 0.02 mile north	This dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0072	Non-contributing	27 4002800000000	2101 21ST ST	City of Nitro	Dwelling, Ca. 2012, Vernacular	located approximately 0.02 mile north	The dwelling originated as an Executive Residence Type 170, however it was demolished in March of 2012, leaving only the foundation. The current structure was then built in its place. Due to the demolition of the historic Residence Type 170, it has lost its integrity of association with the Nitro Munitions Factory.	
KA-8359-0073	Contributing	27 4021200000000	2102 21ST ST	City of Nitro	Dwelling: Ca. 1918, Vernacular Massed Plan	located approximately 0.02 mile north	The dwelling is an Executive Residence Type 170 and retains portions of its original design, including the gable-front dormer, and a central brick chimney. The porch is partially enclosed and has been lowered to ground level. As it is identifiable as an Executive Residence Type 170 and retains its character defining features, the dwelling retains its historic association to the Nitro Munitions Factory.	
KA-8359-0074	Non-contributing	27 4021400010000	2108 21ST ST	City of Nitro	Dwelling, Ca. 1950, Apartment	located approximately 0.02 mile north	This apartment building was constructed decades after the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	
KA-8359-0075	Non-contributing	27 4022400000000	2178 21ST ST	City of Nitro	Dwelling, Ca. 1950, Minimal Traditional	located approximately 0.02 mile north	This Minimal Traditional dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	

Survey #	Contributing or Non-contributing	Parcel ID/ Control Number	Resource Address	Municipality	Resource Description Date of Construction	Approximate Location to Project Area	Resource Description	Photo (s)
KA-8359-0076	Non-contributing	27 4022900000000	2180 21ST ST	City of Nitro	Dwelling, Ca. 1950, Split Level	located approximately 0.02 mile north	This Split Level dwelling post-dates the construction of employee housing for the Nitro Munitions Factory. It has no association with the history of the district.	

NRHP Assessment: The proposed Silk Stocking Row Historic District contains 77 individual resources along 21st and 21st Street North in Nitro, West Virginia. ERM is recommending the historic district eligible for listing on the NHRP under Criterion A as the military's need for employment at the Nitro Munitions Factory was an integral part of Nitro's residential development. ERM is also recommending the historic district eligible under Criterion C, as collectively the dwellings along 21st Street remain excellent examples of government-contracted homes constructed to accommodate the influx of factory employees at a World War I materiels plant. Although individually, many of the dwellings do not retain sufficient architectural integrity to be considered eligible, they present the range of Executive Residential Types that when viewed collectively retain a high level of architectural distinction unique to planned housing. Of the 77 dwellings and sites within the historic district, 55 are considered contributing to the district's eligibility under Criterion A, as they were all built for the military's factory employees, and Criterion C, as examples of the Executive Residential Type retaining a high degree of architectural integrity. The remaining 22 resources are considered non-contributing because their construction dates after the period of military influence within Nitro. The cemetery is also considered non-contributing because it predates the district. The period of significance for the Silk Stocking Row Historic District dates from 1917 to 1920, marking when the Nitro Munitions Factory broke ground to when it was decommissioned and sold to CIC after the war.

Assessment of Effects: The specifics of the Project are still currently in development, but repair of the dam at Ridenour Lake will be involved. Although an increase in traffic might occur during the active stages of the Project, this is temporary and will not permanently impact the Silk Stocking Row Historic District's integrity under Criterion A and C. Although the dam is a part of the historic district, it is considered non-contributing and any modifications it undergoes during the Project will not affect the contributing dwellings and district's overall eligibility. For these reasons, ERM recommends that the Project will have no effect on the Silk Stocking Row Historic District. The APE was stipulated by the NRCS to contemplate an area potentially at risk should the dam fail. That contingency is obviously not part of the planned Project, but if in the unfortunate event it were to occur, the Silk Stocking Row Historic District would likely suffer damage that would constitute an adverse effect.

5. SUMMARY AND RECOMMENDATIONS

The current study represents the reconnaissance-level survey of historic and architectural resources in the APE for the Aterra Blakes Creek-Armour Creek Project. During the reconnaissance-level survey, it was found that a total of 77 newly identified resources are within the APE. Eight previously recorded historic resources were identified within on1e mile of the Project area; however, none are within the APE.

ERM recommends that the 77 new resources constitute a potential historic district eligible for listing on the NRHP under Criteria A and C. Of the 77 resources, 22 resources are non-contributing to the historic context and architectural distinction of the historic district. The remaining 55 resources within the proposed historic district are contributing to the historic district's recommended eligibility under Criteria A and C. ERM recommends the proposed Project will have no effect on the historic district if the Project utilizes existing roads and rights-of-way with no alterations. The APE was stipulated by the NRCS to take into account the contingency of dam failure; while that is obviously not part of the planned Project, if it were to occur, the Silk Stocking Row Historic District would likely suffer damage that would constitute an adverse effect.

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APPENDIX A PROJECT AERIAL MAP SHOWING RESOURCES

APPENDIX B HISTORIC PROPERTY INVENTORY FORMS

APPENDIX C RESUMES OF KEY PERSONNEL

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