

FINAL

SUPPLEMENTAL WATERSHED WORK PLAN No. 7  
AND ENVIRONMENTAL EVALUATION

FOR

HIBERNIA DAM (PA-436F)

OF THE BRANDYWINE CREEK WATERSHED

(CHESTER, DELAWARE, LANCASTER COUNTIES, PENNSYLVANIA AND  
NEW CASTLE COUNTY, DELAWARE)



PREPARED BY  
USDA NATURAL RESOURCES CONSERVATION SERVICE

IN COOPERATION WITH  
CHESTER COUNTY BOARD OF COMMISSIONERS

&

CHESTER COUNTY WATER RESOURCES AUTHORITY

NOVEMBER 2013

# TABLE OF CONTENTS

<b>ABSTRACT:</b> .....	<b>V</b>
<b>SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 7</b> .....	<b>VI</b>
<b>SUMMARY</b> .....	<b>S-1</b>
Sponsors of Hibernia Dam Project.....	S-1
Additional Sponsors of Brandywine Creek Watershed Project.....	S-1
Authorities .....	S-1
Proposed Action.....	S-1
Project Purpose and Need.....	S-2
Preferred Alternative .....	S-2
Project Benefits .....	S-3
Alternative Plans Considered.....	S-3
Resource Information.....	S-3
Project Beneficiary Profile.....	S-6
Project Costs.....	S-9
Environmental Considerations and Effects.....	S-10
Mitigation.....	S-12
Major Conclusions .....	S-12
Areas of Controversy .....	S-12
Issues to be Resolved.....	S-12
Evidence of Unusual Congressional or Local Interest.....	S-12
Compliance Certification .....	S-12
<b>1.0 PURPOSE AND NEED FOR ACTION</b> .....	<b>1</b>
1.1 Changes Requiring Preparation of a Supplement.....	1
1.2 Introduction .....	1
1.3 Project Purpose .....	1
1.4 Project Need .....	1
1.5 Problems and Opportunities .....	2
<b>2.0 SCOPE OF THE PLAN</b> .....	<b>3</b>
2.1 Scoping Process .....	3
2.2 Identified Resource Concerns.....	3
<b>3.0 AFFECTED ENVIRONMENT</b> .....	<b>6</b>
3.1 Project Setting.....	6
3.2 Soils .....	6
3.3 Soil Erosion and Sedimentation.....	7
3.4 Water Resources .....	8
3.5 Air Quality.....	9
3.6 Biological Resources .....	10
3.7 Human, Economic, and Social Considerations.....	10
3.8 Special Environmental Concerns.....	12
3.9 Other Concerns.....	14
3.10 Background and Status of Dam .....	15
3.11 Current Condition of Dam .....	17
3.12 Principal Spillway Assessment .....	18
3.13 Status of Operation and Maintenance .....	19
3.14 Breach Analysis and Hazard Classification .....	20
3.15 Potential Dam Failure Modes.....	20
3.16 Consequences of Dam Failure .....	22
<b>4.0 ALTERNATIVES</b> .....	<b>23</b>
4.1 Formulation Process .....	23
4.2 Sponsor's Rationale for Conditions of Future Without Project .....	26

4.3	Alternatives Considered but Eliminated from Detailed Study .....	26
4.4	Description of Alternative Plans .....	28
4.5	Summary and Comparison of Alternative Plans .....	30
4.6	National Economic Development (NED) Alternative.....	32
<b>5.0</b>	<b>ENVIRONMENTAL CONSEQUENCES.....</b>	<b>33</b>
5.1	NRCS-CPA-52 .....	33
5.2	Categorical Exclusion .....	33
<b>6.0</b>	<b>CONSULTATION, COORDINATION AND PUBLIC PARTICIPATION.....</b>	<b>43</b>
6.1	Public Participation .....	43
6.2	Agency Consultation .....	44
<b>7.0</b>	<b>PREFERRED ALTERNATIVE: REHABILITATE TO HIGH HAZARD CLASS DAM .....</b>	<b>45</b>
7.1	Rationale for Preferred Alternative .....	45
7.2	Measures to Be Installed .....	45
7.3	Mitigation.....	47
7.4	Compliance with Federal, State, and Local Laws.....	48
7.5	Costs and Cost Sharing .....	48
7.6	Installation and Financing .....	49
7.7	Emergency Action Plan.....	50
7.8	Contracting.....	50
7.9	Real Property .....	51
7.10	Solid and Hazardous Wastes.....	51
7.11	Cultural Resources .....	51
7.12	Financing.....	51
7.13	Operation, Maintenance, and Replacement .....	51
<b>8.0</b>	<b>REFERENCES .....</b>	<b>59</b>
<b>9.0</b>	<b>LIST OF PREPARERS.....</b>	<b>62</b>
<b>10.0</b>	<b>INDEX .....</b>	<b>63</b>
<b>APPENDIX A COMMENTS AND RESPONSES.....</b>		<b>A-1</b>
<b>APPENDIX B MAPS.....</b>		<b>B-1</b>
<b>APPENDIX C SUPPORT MAPS .....</b>		<b>C-1</b>
<b>APPENDIX D INVESTIGATIONS AND ANALYSES REPORT.....</b>		<b>D-1</b>
D.1	Introduction .....	D-2
D.2	Existing Data .....	D-2
D.3	Effects Analysis.....	D-2
D.4	Economic and Social Effects .....	D-2
D.5	Engineering .....	D-4
<b>APPENDIX E PROJECT DATA .....</b>		<b>E-1</b>

## LIST OF TABLES AND FIGURES

Table S-1 Resource Information .....	S-4
Figure S-1 Land Ownership in Watershed.....	S-5
Figure S-2 Project Location Map .....	S-5
Table S-2 Project Beneficiary Profile .....	S-6
Table S-3 Primary Alternative Plans Considered .....	S-7
Table S-4 Estimated Project Costs <sup>1</sup> .....	S-9
Table S-5 Estimated Project Benefits <sup>1</sup> .....	S-10
Table S-6 Estimated Project Benefits and Costs.....	S-10
Table S-7 Summary of Relevant Resource Concerns and Effects of Rehabilitation.....	S-11
Table 2-1 Summary of Scoping .....	3
Table 3-1 Summary of Soil Units within Project Study Area.....	7
Table 3-2 Social and Economic Profile <sup>1</sup> .....	11
Table 3-3 Existing Conditions .....	16
Table 4-1 Range of Alternatives and Determination for Detailed Study.....	25
Table 4-2 Rehabilitation of Hibernia Dam to Current High Hazard Class Dam Criteria .....	30
Table 4-3 Summary of Alternative Plans Considered for Detailed Study.....	31
Table 4-4 National Economic Development Account Comparison of Alternative Plans.....	32
Figure 5-1 NRCS-CPA-52.....	34
Table 7-1 Preferred Alternative Design Features <sup>1</sup> .....	47
Table 7-2 Annual Operation and Maintenance Costs <sup>1</sup> .....	52
Table 1 Total Estimated Project Installation Cost <sup>1</sup> .....	53
Table 2 Estimated Cost Distribution.....	54
Table 3 Structure Data <sup>1</sup> .....	55
Table 4 Estimated Average Annual NED Costs <sup>1</sup> .....	56
Table 5 Average Annual Flood Damage Reduction Benefits <sup>1</sup> .....	57
Table 5A Estimated Average Annual Non-Flood Benefits <sup>1</sup> .....	57
Table 6 Comparison of NED .....	58
Table 9-1 List of Preparers .....	62
Figure B-1 Project Location Map .....	B-2
Figure B-2 Brandywine Creek Watershed Map .....	B-3
Figure B-3 Project Watershed Map.....	B-4
Figure B-4 – Project Site Map.....	B-5
Figure C-1 – Approximate Breach Inundation Map .....	C-2
Figure C-2 – FEMA Map – 100-year and 500-year Floodplain.....	C-3
Figure C-3 – FEMA Map – 100-year and 500-year Floodplain.....	C-4
Figure C-4 – FEMA Map – 100-year and 500-year Floodplain.....	C-5

Figure C-5 - Existing Conditions .....	C-6
Figure C-6 – Future Without Project Alternative .....	C-7
Figure C-7 – Decommissioning Alternative .....	C-8
Table D-1 - Benefit Index Assignment .....	D-4
Table D-2 - Price and Cost Indexes .....	D-4

SUPPLEMENTAL WATERSHED WORK PLAN NO. 7  
AND ENVIRONMENTAL EVALUATION  
FOR HIBERNIA DAM (PA-436F) OF THE BRANDYWINE CREEK WATERSHED  
(CHESTER, DELAWARE, AND LANCASTER COUNTIES, PENNSYLVANIA AND NEW CASTLE  
COUNTY, DELAWARE)

**PREPARED BY:**

United State Department of Agriculture,  
Natural Resources Conservation Service

**PROJECT LOCATION:**

Chester County, Pennsylvania

**IN COOPERATION WITH:**

Chester County Board of Commissioners  
Chester County Water Resources Authority

**FOR MORE INFORMATION:**

Denise Coleman  
State Conservationist  
USDA - Natural Resources Conservation Service  
One Credit Union Place, Suite 340  
Harrisburg, PA 17110-2993

Telephone: 717-237-2100

E-mail: [denise.coleman@pa.usda.gov](mailto:denise.coleman@pa.usda.gov)

**ABSTRACT:**

Supplemental Watershed Work Plan No. 7 and Environmental Evaluation (EE) describes a plan to meet all applicable USDA-Natural Resources Conservation Service (NRCS) and Commonwealth of Pennsylvania dam safety and performance standards and to extend the useful life of the Hibernia Dam (PA-436F) beyond its original evaluated life expectancy. The dam was originally constructed in 1994 with a 50-year service life. The dam was designed and constructed as an NRCS High Hazard Class dam. The new life expectancy is 50 years. The project is located in West Caln Township, Chester County, Pennsylvania. Hibernia Dam (PA-436F) is located on Birch Run, approximately 3.3 miles northwest of Coatesville and one mile west of State Route 82.

The purpose of the project is to maintain or improve the current level of flood damage reduction for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features; maintain the existing water supply availability; maintain or improve the recreational and habitat values of Chambers Lake and adjacent riparian lands; and comply with applicable design, performance and safety criteria for High Hazard Class dams.

The need for this project is to continue providing flood damage reduction downstream from the dam and address applicable NRCS and Commonwealth of Pennsylvania standards and design criteria for public health and safety to reduce the risk of loss of human life and property damage; continue providing up to 4 million gallons per day of source water for public water supplies; continue providing water for fire protection; and continue supporting and improving the recreational uses and aquatic and terrestrial wildlife habitat directly dependent upon Chambers Lake and its surrounding riparian lands.

The Sponsors primary objectives for this project are to meet or exceed state and federal dam safety criteria; maintain or enhance the current level of flood protection; maintain or enhance the current level of availability of water supplies; maintain or enhance the current recreational values and aquatic and terrestrial wildlife habitat; maintain or enhance the current provision of water for fire protection.

Alternative plans include no action and rehabilitation of the existing dam. Other alternatives were considered but were not evaluated in detail due to a variety of shortcomings described in the plan. The recommended plan is to rehabilitate the existing dam. This is also the National Economic Development Plan which is the plan that reasonably maximizes net national economic development benefits consistent with protecting the Nation's environment.

Dam rehabilitation will include: (1) maintaining the axis of the dam at its present locations, (2) raising and widening the auxiliary spillway, (3) installing a concrete cutoff wall at the crest of the auxiliary spillway, (4) upgrading the foundation, embankment, and drainage system, and (5) replanting 0.6 acres of trees.

Economic benefits will exceed costs. Sponsors will incur at least 35% of the total rehabilitation project cost. The planned action will bring the Hibernia Dam (PA-436F) into compliance with current, applicable NRCS and Commonwealth of Pennsylvania dam safety and performance standards for High Hazard Class dams.

This plan is intended to document the requirements of the National Historic Preservation Act of 1966, the Endangered Species Act of 1973, and other applicable environmental laws for this federal action. The plan also documents the applicability of NRCS Categorical Exclusions for purposes of the National Environmental Policy Act of 1969.

---

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers. If you believe you experienced discrimination when obtaining services from USDA, participating in a USDA program, or participating in a program that receives financial assistance from USDA, you may file a complaint with USDA. Information about how to file a discrimination complaint is available from the Office of the Assistant Secretary for Civil Rights. USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, complete, sign, and mail a program discrimination complaint form, available at any USDA office location or online at [www.ascr.usda.gov](http://www.ascr.usda.gov), or write to: USDA, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW., Washington, DC 20250-9410 or call toll free at (866) 632-9992 (voice) to obtain additional information, the appropriate office or to request documents. Individuals who are deaf, hard of hearing, or have speech disabilities may contact USDA through the Federal Relay service at (800) 877-8339 or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

Persons with disabilities who require alternative means for communication of program information (e.g., Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 7

between the

CHESTER COUNTY BOARD OF COMMISSIONERS  
and  
CHESTER COUNTY WATER RESOURCES AUTHORITY

(Referred to herein as Sponsors)

and the

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

Formerly the Soil Conservation Service (SCS)

(Referred to herein as NRCS)

Whereas, the Watershed Plan Agreement for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the second day of October 1962; and

Whereas, a Supplemental Watershed Plan Agreement No.1 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the twentieth day of October 1966; and

Whereas, a Supplemental Watershed Plan Agreement No.2 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the fifteenth day of February 1974; and

Whereas, a Supplemental Watershed Plan Agreement No.3 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the fourteen day of October 1977; and

Whereas, a Supplemental Watershed Plan Agreement No.4 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the third day of June 1987; and

Whereas, a Supplemental Watershed Plan Agreement No.5 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the twenty-second day of May 1991; and

Whereas, a Supplemental Watershed Plan Agreement No.6 for the Brandywine Creek Watershed, Commonwealth of Pennsylvania and the State of Delaware, executed by the Sponsors named therein and NRCS, became effective on the twentieth day of January 1995; and

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

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for works of improvement for the Hibernia Dam (PA-436F) in the Brandywine Creek Watershed, Commonwealth of Pennsylvania, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012); and

Whereas, there has been developed through the cooperative efforts of the Sponsors and NRCS a Watershed Work Plan No.7- Environmental Evaluation for works of improvement for the rehabilitation of Hibernia Dam (PA-436F), Commonwealth of Pennsylvania, hereinafter referred to as the Plan-EE or plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsors hereby agree upon the following additional terms, conditions, and stipulations of said Watershed Plan Agreement, as supplemented.

**The following terms, conditions, and stipulations are specifically related to the rehabilitation works of improvement for Hibernia Dam and do not change the terms, conditions, and stipulations of said Watershed Work Plan Agreement, as supplemented, not modified herein.**

**Hibernia Dam (PA-436F)** - 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-EE and including the following:

1. **Term.** The term of this agreement is for the installation period and evaluated life of the project (50 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 sponsors will acquire such real property as will be needed in connection with the works of improvement. The amounts and percentages of the real property acquisition costs to be borne by the Sponsors and NRCS are as shown in the Cost-share table in item 5 hereof. The sponsors acknowledge the potential risk of flood damages for the real property between the flowage rights elevation and the top of dam elevation.

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

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

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

Works of Improvement	NRCS	Sponsors	Total
<b>Cost-Sharable Items</b> <sup>1</sup>			
Rehabilitation of dam (Construction Costs)	\$ 1,460,000	\$ 311,000	\$ 1,771,000
Relocation <sup>2</sup>	\$ -	\$ -	\$ -
Sponsors' Planning Costs	\$ -	\$ 425,000	\$ 425,000
Sponsors' Engineering Costs	NA	\$ 25,000	\$ 25,000
Sponsors' Project Administration	NA	\$ 25,000	\$ 25,000
Land Rights Acquisition Cost <sup>3</sup>	NA	\$ -	\$ -
<b>Subtotal: Cost-Share Costs</b>	<b>\$ 1,460,000</b>	<b>\$ 786,000</b>	<b>\$ 2,246,000</b>
<b>Cost-Share Percentages</b>	<b>65.0%</b>	<b>35.0%</b>	<b>100.0%</b>
<b>Non Cost-Sharable Items</b>			
NRCS Engineering & Project Administration	\$ 596,000	NA	\$ 596,000
Natural Resource Rights	NA	\$ -	\$ -
Federal, State and Local Permits	NA	\$ 1,000	\$ 1,000
<b>Subtotal: Non Cost-Share Costs</b>	<b>\$ 596,000</b>	<b>\$ 1,000</b>	<b>\$ 597,000</b>

<sup>1</sup> Total eligible rehabilitation project costs for the purpose of cost sharing includes construction; land rights, easements, or rights-of-way; and all non- NRCS technical and engineering assistance for planning, design and project administration. The Sponsors share shall be paid with non-federal funds. In-kind contributions may be counted as specified in a separate Memorandum of Understanding between the Sponsors and NRCS.

<sup>2</sup> 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.

<sup>3</sup> No land rights acquisition is needed under present conditions. In the event land rights must be acquired at a later date, the sponsors will acquire with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the sponsors' share of the works of improvement costs. In no case will the amount of an in-kind contribution exceed the sponsor's 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.

6. **Land treatment agreements.** The Sponsors will encourage landowners and operators to continue to operate and maintain needed land treatment conservation measures for the protection and improvement of the watershed upstream of the dam.
7. **Floodplain Management.** Before construction of any project for flood prevention, the sponsors shall comply with all applicable Federal floodplain management and flood insurance programs.
8. **Water and mineral rights.** The sponsors will acquire or provide assurance that landowners or resource users have acquired such water, mineral, or other natural resources rights pursuant to State law as may be needed in the installation and operation of the works of improvement. Any costs incurred shall be borne by the sponsors and these costs are not eligible as part of the sponsor's cost-share.

9. **Permits.** The sponsors will obtain and bear the cost for all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement. These costs are not eligible as part of the sponsors' cost-share.
10. **NRCS assistance.** This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.
11. **Additional agreements.** A separate agreement will be entered into between NRCS and the sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
12. **Amendments.** This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the sponsors have failed to comply with the conditions of this agreement or when the program funding or authority expires. In this case, NRCS shall promptly notify the sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the sponsors or recoveries by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the sponsors having specific responsibilities for the measure involved.
13. **Prohibitions.** No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
14. **Operation and Maintenance (O&M).** The sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with an O&M Agreement. An O&M agreement will be entered into before Federal funds are obligated and will continue for the project life (50 years). Although the sponsors' responsibility to the Federal Government for O&M ends when the O&M agreement expires upon completion of the evaluated life of measures covered by the agreement, the sponsors acknowledge that continued liabilities and responsibilities associated with works of improvement may exist beyond the evaluated life.
15. **Emergency Action Plan.** Prior to construction, the sponsors shall 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 shall be reviewed and updated by the sponsors as required by Pennsylvania Department of Environment Protection. The EAP shall 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.
16. **Nondiscrimination Provisions.** The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA Assistant Secretary for Civil Rights, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, S.W., Stop 9410, Washington, DC 20250-9410, or call toll-free at (866) 632-9992 (English) or (800) 877-8339 (TDD) or (866) 377-8642 (English Federal-relay) or (800) 845-6136 (Spanish Federal-relay).

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

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

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

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

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

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

**Certification:**

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

- (1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition.
- (2) Establishing an ongoing drug-free awareness program to inform employees about—
  - (a) The danger of drug abuse in the workplace;
  - (b) The grantee's policy of maintaining a drug-free workplace;
  - (c) Any available drug counseling, rehabilitation, and employee assistance programs; and
  - (d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace
- (3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1).

- (4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will—
  - (a) Abide by the terms of the statement; and
  - (b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.
- (5) Notifying the NRCS in writing, within 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 shall 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 shall 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 Federal, State, or local health, law enforcement, or other appropriate agency.
- (7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6).

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

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

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

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

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The sponsors shall 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 shall certify and disclose accordingly.

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

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

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

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

- A. The project sponsoring organizations signatory to this agreement certify as follows:
- (1) Any facility to be utilized in the performance of this proposed agreement is (\_\_\_\_), is not (X) listed on the Environmental Protection Agency List of Violating Facilities.
  - (2) To promptly notify the NRCS-State administrative officer prior to the signing of this agreement by NRCS, of the receipt of any communication from the Director, Office of Federal Activities, U.S. Environmental Protection Agency, indicating that any facility which is proposed for use under this agreement is under consideration to be listed on the Environmental Protection Agency List of Violating Facilities.
  - (3) To include substantially this certification, including this subparagraph, in every nonexempt sub-agreement.
- B. The project sponsoring organizations signatory to this agreement agrees as follows:
- (1) To comply with all the requirements of section 114 of the Clean Air Act as amended (42 U.S.C. Section 7414) and section 308 of the Federal Water Pollution Control Act (33 U.S.C. Section 1318), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, issued there under before the signing of this agreement by NRCS.
  - (2) That no portion of the work required by this agreement will be performed in facilities listed on the EPA List of Violating Facilities on the date when this agreement was signed by NRCS unless and until the EPA eliminates the name of such facility or facilities from such listing.
  - (3) To use their best efforts to comply with clean air standards and clean water standards at the facilities in which the agreement is being performed.
  - (4) To insert the substance of the provisions of this clause in any nonexempt subagreement.

C. The terms used in this clause have the following meanings:

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

**21. Assurances and Compliance.** As a condition of the grant or cooperative agreement, the sponsors assures and certifies that it is in compliance with and will comply in the course of the agreement with all applicable laws, regulations, Executive orders and other generally applicable requirements, including those set out below which are hereby incorporated in this agreement by reference, and such other statutory provisions as 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 sponsors shall give the NRCS or the Comptroller General, through any authorized representative, access to and the rights 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.** The signing of this Public Law 83-566 Supplemental Watershed Agreement by an authorized representative of the Sponsors indicates that the Sponsors have reviewed this Agreement and the Hibernia Dam (PA-436F) Supplemental Watershed Work Plan No. 7- Environmental Evaluation and concur with the intent and contents of each.

**CHESTER COUNTY BOARD OF COMMISSIONERS**

The signing of this plan was authorized by a resolution by the Chester County Board of Commissioners governing body and adopted at an official meeting held on

\_\_\_\_\_, 2014 at \_\_\_\_\_, Pennsylvania.

By:

\_\_\_\_\_  
Ryan Costello  
Commissioner

Date: \_\_\_\_\_

By:

\_\_\_\_\_  
Kathi Cozzone  
Commissioner

Date: \_\_\_\_\_

By:

\_\_\_\_\_  
Terence Farrell  
Commissioner

Date: \_\_\_\_\_

**CHESTER COUNTY WATER RESOURCES AUTHORITY**

The signing of this plan was authorized by a resolution by the Chester County Water Resources Authority governing body and adopted at a meeting held on

\_\_\_\_\_, 2014 at \_\_\_\_\_, Pennsylvania.

By:

\_\_\_\_\_  
Chairperson

Date: \_\_\_\_\_

**USDA-NATURAL RESOURCES CONSERVATION SERVICE**

Approved by:

\_\_\_\_\_  
Denise Coleman, State Conservationist  
Natural Resources Conservation Service  
U.S. Department of Agriculture  
One Credit Union Place, Suite 340  
Harrisburg, PA 17110-2993

Date: \_\_\_\_\_

SUMMARY OF SUPPLEMENTAL WATERSHED WORK PLAN NO. 7  
AND ENVIRONMENTAL EVALUATION  
FOR THE  
HIBERNIA DAM (PA-436F) OF THE  
BRANDYWINE CREEK WATERSHED

(CHESTER, DELAWARE, LANCASTER COUNTIES, PENNSYLVANIA  
AND NEW CASTLE COUNTY, DELAWARE)

CONGRESSIONAL DISTRICTS – PA: 6<sup>TH</sup>, 7<sup>TH</sup>, 16<sup>TH</sup> AND DE: 0<sup>TH</sup>

(OFFICE OF MANAGEMENT AND BUDGET FACT SHEET)

**SPONSORS OF HIBERNIA DAM PROJECT**

Chester County Board of Commissioners  
Chester County Water Resources Authority

**ADDITIONAL SPONSORS OF BRANDYWINE CREEK WATERSHED PROJECT**

Chester County Conservation District  
New Castle Conservation District  
Pennsylvania Department of Environmental Protection  
Pennsylvania Fish and Boat Commission  
Pennsylvania Department of General Services

**AUTHORITIES**

Brandywine Creek Watershed Work Plan was completed and approved July 23, 1962, executed by the Sponsors and the USDA Soil Conservation Service (now USDA Natural Resources Conservation Service [NRCS]) and became effective in October 2, 1962 under the authority of Public Law (PL) 83-566, Watershed Protection and Flood Prevention Act (16 U.S.C.1001-1008).

Rehabilitation of PL 83-566 assisted dams has been authorized under the authority of Section 14 of Public Law 83-566, the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Parts 1001-1008, 1010, and 1012. The responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to NRCS.

**PROPOSED ACTION**

The proposed action is the rehabilitation of the Hibernia Dam (PA-436F) to current design, performance, and safety criteria with a service life of 50 years.

## PROJECT PURPOSE AND NEED

The purpose of the project includes the following:

- Maintain or improve the current level of flood damage reduction provided by the Hibernia Dam (PA-436F) for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features.
- Maintain the existing water supply availability provided by the Hibernia Dam and Chambers Lake Reservoir.
- Maintain or improve the recreational and habitat values of Chambers Lake and adjacent riparian lands.
- Comply with applicable design, performance and safety criteria for High Hazard Class dams.

The need for this project includes the following:

- Continue providing and improving flood damage reduction downstream from the dam and address applicable NRCS and Commonwealth of Pennsylvania standards and design criteria for public health and safety to reduce the risk of loss of human life and property damage.
- Continue providing up to 4 million gallons per day of source water for public water supplies from Hibernia Dam and Chambers Lake Reservoir.
- Continue providing water for fire protection.

## PREFERRED ALTERNATIVE

The Preferred Alternative is the National Economic Development (NED) Alternative, which is to rehabilitate the Hibernia Dam. This will:

- Rehabilitate the Dam to current NRCS High Hazard Class dam design criteria.
- Extend the service life for an additional 50 years.
- Comply with Commonwealth of Pennsylvania Department of Environmental Protection (PADEP) dam safety regulations.

The Preferred Alternative results in the following:

- Maintaining the axis of the dam at the present location.
- Widening the auxiliary spillway and constructing a flow splitter dike to divide the spillway in bays of less than 200 feet.
- Raising the auxiliary spillway control section.
- Installing a concrete cutoff wall at the crest of the auxiliary spillway.
- Installing a filtered toe between the impact basin and the existing rock toe.
- Planting 0.6 acres of trees.

## PROJECT BENEFITS

The Preferred Alternative includes these benefits:

- Flood control
- Municipal water supply
- Minimized risk of loss of human life
- Minimized risk of extensive damages
- Sediment storage
- Improved downstream water quality
- Recreation
- Maintained land values
- Maintained fish and wildlife habitat

## ALTERNATIVE PLANS CONSIDERED

Several alternatives and variations of alternatives were considered. The National Economic Development (NED) Alternative is the alternative that reasonably maximizes net economic benefits consistent with protecting the Nation's environment.

Alternatives included structural and non-structural measures. All alternatives are based on an additional 50 years operational life so they could be consistently compared. Table S-3 summarizes the primary alternatives considered for the Project.

## RESOURCE INFORMATION

Hibernia Dam (PA-436F) is located on Birch Run in West Caln Township, Chester County, Pennsylvania, approximately 3.3 miles northwest of Coatesville and one mile west of State Route 82. Birch Run flows into the West Branch of the Brandywine Creek approximately 1,700 feet downstream from the dam. Figure S-2 shows the location of the Hibernia Dam (PA-436F).

The dam is owned and operated by Chester County Water Resources Authority (CCWRA). Hibernia Dam (PA-436F) is a multipurpose, zoned-earth embankment structure. The dam is currently classified by the Pennsylvania Department of Environmental Protection – Division of Dam Safety as Size Class B, Hazard Category 1 and an NRCS High Hazard Class dam.

The following resource information was obtained from the Chester County Soil Survey (USDA 1963).

### ***Climate***

- ***Temperature***  
High temperatures average between 38°F in January and 86°F in July. Low temperatures average between 21°F in January and 63°F in July, with the record high being 107°F, and record low being -19°F.
- ***Precipitation***  
The average annual precipitation is 45.8 inches. Precipitation is well distributed throughout the year. Monthly precipitation average between 3.3 inches in February, October and November to 4.5 inches in June. The heaviest 1-day rainfall during the period of record was 5.6 inches. Precipitation amounts of greater than 0.2 inches occur on about 80 days each year.
- ***Snowfall***  
The average seasonal snowfall is 27 inches. The most snow reported in a month was 70 inches and occurred in February.
- ***Topography and Drainage***  
The topography of Chester County ranges from gently rolling uplands, with occasional low hills and ridges. Elevations range from 10 feet above mean sea level at the Delaware River to 1,056 feet above mean sea level in the northern part of the County. The Hibernia Dam is situated on Birch Run, which is a tributary of Brandywine Creek, which is subsequently a tributary of the Delaware River.

Table S-1 provides relevant resource information and the existing land use conditions upstream from the Hibernia Dam.

**Table S-1  
 Resource Information**

<b>Resource</b>	<b>Hibernia Dam (PA-436F) Contributing Watershed</b>
Location of Structure <sup>1</sup>	
Longitude	75° 50' 54.74" W
Latitude	40° 01' 44.12" N
Hydrologic Unit Code <sup>2</sup>	02040205
HUC Watershed Name <sup>2</sup>	Brandywine - Christina
Congressional District <sup>3</sup>	Pennsylvania U.S. Congressional District 7
Drainage Area above dam (square miles) <sup>4</sup>	4.68
Land Use above dam (acres) <sup>5</sup>	Total – 2,995
Residential	603
Commercial	85
Cropland	526
Farmstead	33
Pasture and Rangeland	295
Forest	1153
Water	105
Wetlands	63
Transportation	78
Other	54

November 2013

<sup>1</sup> Google Earth 6.1.0.5001

<sup>2</sup> CCWRA – Hydrologic Unit Codes in Chester County

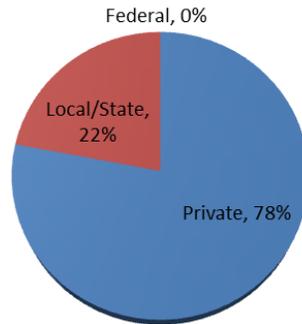
<sup>3</sup> <http://meehan.house.gov/district-map/>

<sup>4</sup> AMEC - SITES Model Parameters - Existing Land Use Conditions

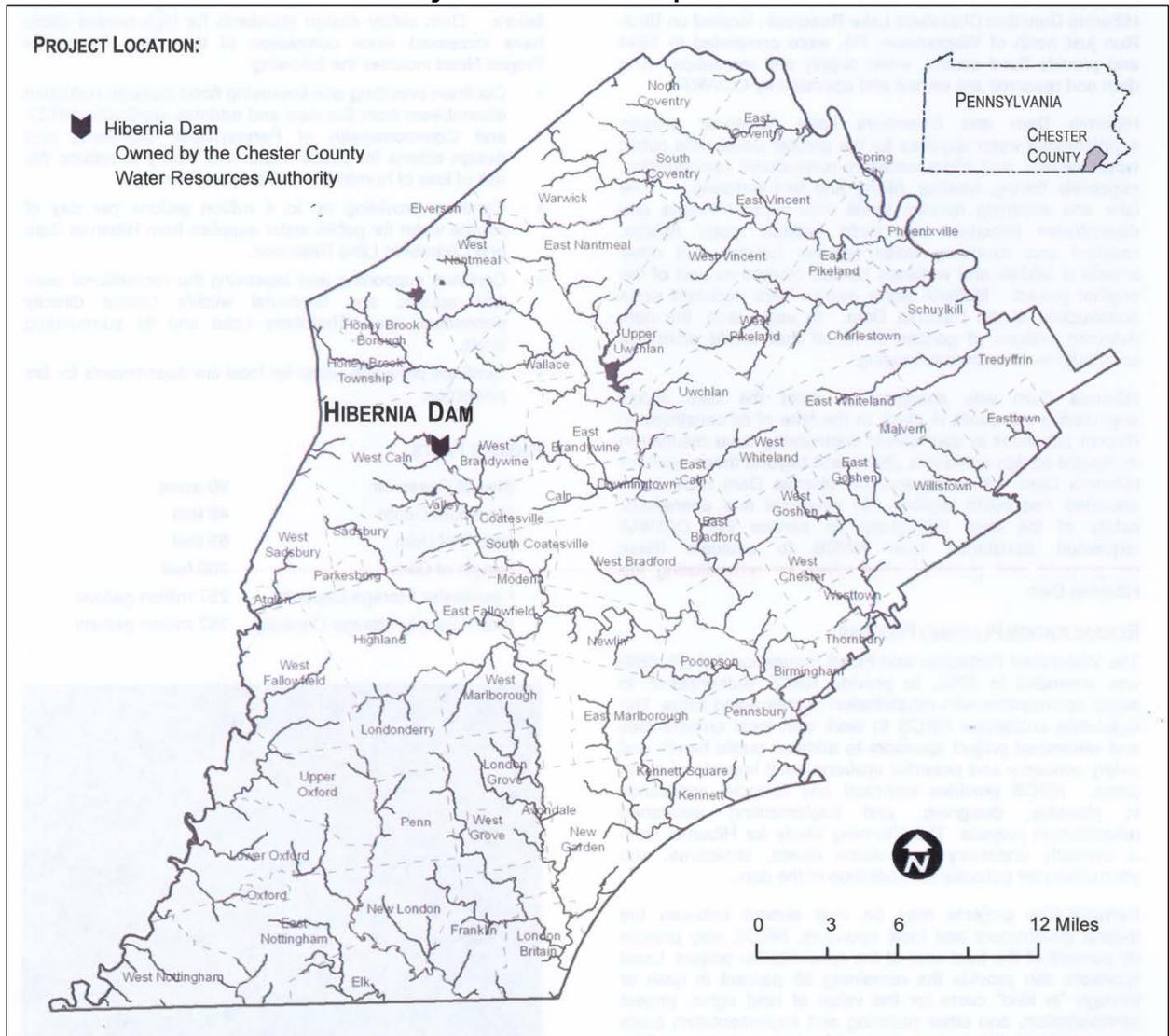
<sup>5</sup> AMEC - Runoff Curve Number Calculations - USGS Landsat Cover Grid

Figure S-1 provides relevant information regarding the percentages of private, state/local and federal land ownership upstream from the Hibernia Dam.

### Figure S-1 Land Ownership in Watershed



### Figure S-1 Project Location Map



## PROJECT BENEFICIARY PROFILE

Table S-2 provides relevant information regarding the Project beneficiary profile.

**Table S-2**  
**Project Beneficiary Profile**

<b>Beneficiary</b>	<b>West Caln Township<sup>1</sup></b>	<b>Coatesville<sup>1</sup></b>	<b>Chester County<sup>1</sup></b>	<b>Pennsylvania<sup>1</sup></b>	<b>U.S.<sup>1</sup></b>
Population	9,014	13,100	498,886	12,702,379	308,745,538
Median Age	41.9 years	29.9 years	39.3 years	40.1 years	37.2 years
Per Capita Income	\$30,149	\$17,247	\$42,042	\$27,824	\$27,915
Median Household Income	\$71,544	\$36,526	\$86,264	\$51,651	\$52,762
Total Number of Households	3,346	4,409	182,732	4,952,566	114,761,359
Median Value of Housing Units	\$237,000	\$141,400	\$333,400	\$163,200	\$186,200
Percent of Families Living Below Poverty Level	7.9%	22.9%	3.7%	8.8%	10.5%

<sup>1</sup> Source: United States Census Bureau, Census 2010

The proposed action directly benefits 3,346 households in West Caln Township and 4,409 households in Coatesville, downstream from the dam. Additionally the proposed action indirectly benefits approximately 498,886 people which include the population of Chester County.

**Table S-3  
 Primary Alternative Plans Considered**

Alternative	Summary of Alternative	Screening Method			Carried Forward for Detailed Study?
		Estimated Cost	Project Purpose Met	Project Need Met	
<b>No Action/Future Without Federal Project</b>	<ul style="list-style-type: none"> <li>Minimum constructed breach in the embankment to remove the storage function of the dam and restore the stream to a free-flowing state through the impoundment area and the footprint area of the dam.</li> </ul>	\$2,834,000			Yes
<b>Dam Rehabilitation (NED Alternative)</b>	<ul style="list-style-type: none"> <li>Federally assisted rehabilitation of dam to NRCS and Commonwealth of Pennsylvania High Hazard Class dam design criteria by raising and widening the auxiliary spillway, installing a filtered toe, and regrading the downstream face of the dam.</li> </ul>	\$2,418,000	✓	✓	Yes
<b>Dam Decommissioning</b>	<ul style="list-style-type: none"> <li>Federally assisted removal of the entire embankment and restore the stream and 100-year floodplain to a free-flowing state through the impoundment area and the footprint area of the dam.</li> </ul>	\$8,113,000			No
<b>Dam Decommissioning with Nonstructural and other measures</b>	<ul style="list-style-type: none"> <li>Federally assisted removal of the entire embankment and restore the stream and 100-year floodplain to a free-flowing state through the impoundment area and the footprint area of the dam.</li> <li>Acquire and demolish existing residential and public structures in the downstream 100-year floodplain.</li> <li>Replace lost water supply and water-based recreation features.</li> </ul>	>\$40,000,000	✓	✓	No

Alternative	Summary of Alternative	Screening Method			Carried Forward for Detailed Study?
		Estimated Cost	Project Purpose Met	Project Need Met	
<b>Other Nonstructural Measures (Floodproofing)</b>	<ul style="list-style-type: none"> <li>▪ Maintain dam at current configuration.</li> <li>▪ Replace lost water supply and water-based recreation features</li> <li>▪ Construct a levee or floodwall to protect 327 residences, 30 businesses, 3 schools, 1 child care center, 1 nursing home and the Coatesville Wastewater Treatment Plant.</li> <li>▪ Elevate 273 residences and 15 businesses above the breach inundation elevation.</li> <li>▪ Prevent development in breach inundation area.</li> </ul>	>\$89,000,000	✓	✓	No
<b>Acquisition or Relocation of At-Risk Structures</b>	<ul style="list-style-type: none"> <li>▪ Maintain dam at current configuration.</li> <li>▪ Acquire &amp; demolish or relocate 600 residences, 30 businesses, 3 schools, 1 child care center, 1 nursing home and the Coatesville Wastewater Treatment facility.</li> <li>▪ Prevent development in breach inundation area.</li> <li>▪ Replace lost water supply and water-based recreation features</li> </ul>	>\$97,000,000	✓	✓	No

## PROJECT COSTS

Table S-4 summarizes the allocation of Project costs for the Preferred Alternative. Funding will be requested annually until the Project is funded.

**Table S-4**  
**Estimated Project Costs<sup>1</sup>**

Rehabilitate to NRCS High Hazard Class Dam	Source				Total Costs
	PL 83-566 Funds <sup>2</sup>		Other Funds		
	\$	%	\$	%	
Construction	\$ 1,460,000	82%	\$ 311,000	18%	\$ 1,771,000
Engineering	\$ 506,000	95%	\$ 25,000	5%	\$ 531,000
Relocation	\$ -	0%	\$ -	0%	\$ -
Real Property Rights	\$ -	0%	\$ -	0%	\$ -
Natural Resource Rights	\$ -	0%	\$ -	0%	\$ -
Project Administration	\$ 90,000	78%	\$ 25,000	22%	\$ 115,000
Permits	\$ -	0%	\$ 1,000	100%	\$ 1,000
<b>Total Costs</b>	<b>\$ 2,056,000</b>	<b>85%</b>	<b>\$ 362,000</b>	<b>15%</b>	<b>\$ 2,418,000</b>
Annual O & M Costs	\$ -	0%	\$ 95,000	100%	\$ 95,000

November-2013

<sup>1</sup> Price base 2013

<sup>2</sup> Maximum PL83-566 cost-share is 65% of eligible cost-sharable items, not to exceed 100% of total construction costs. Not all cost-sharable items are included in the table, such as non-NRCS technical and engineering assistance for initial project planning.

Source: NRCS Rehab Cost Comp Est Worksheet

**Table S-5  
 Estimated Project Benefits<sup>1</sup>**

<b>Rehabilitate to NRCS High Hazard Class Dam</b>	<b>Estimated Average Annual Monetary Benefits</b>
<b>Flood Damage Reduction</b>	
Residential, Commercial and Transportation	\$ 188,700
<b>Other Benefits</b>	
Municipal Water Supply	\$ 495,300
Recreation	\$ 2,167,400
Avoided Cost <sup>2</sup>	\$ 126,300
<b>Total Monetary Benefits</b>	<b>\$ 2,977,700</b>

November-2013

<sup>1</sup> Price base 2013

<sup>2</sup> Per Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 1.7.2 (b) (3) - the avoided cost of the most likely alternative to the planned action.

**Table S-6  
 Estimated Project Benefits and Costs**

<b>Item</b>	<b>Value</b>
Average Annual Benefits <sup>2</sup>	\$ 2,977,700
Average Annual Costs <sup>2</sup>	\$ 202,800
Net Economic Benefits	\$ 2,774,900
Period of Analysis	50 years
Project Life	50 years

November-2013

<sup>1</sup> Price base 2013

<sup>2</sup> Amortized over 50 years at 3.75%, includes Operation and Maintenance.

## ENVIRONMENTAL CONSIDERATIONS AND EFFECTS

Table S-7 describes the resource concerns identified during Project scoping and summarizes the potential impacts related to the Preferred Alternative.

**Table S-7  
 Summary of Relevant Resource Concerns and Effects of Rehabilitation**

Relevant Resource Concern	Summary of Effects of Preferred Alternative
Air Quality/Clean Air Act	<ul style="list-style-type: none"> <li>• There will be some temporary affects during construction (dust and exhaust). Measures will be implemented to minimize effects</li> </ul>
Aquatic Resources	<ul style="list-style-type: none"> <li>• Chambers Lake and the surrounding areas provide aquatic resources will be preserved.</li> </ul>
Cultural Resources	<ul style="list-style-type: none"> <li>• No effect.</li> </ul>
Endangered and Threatened Species	<ul style="list-style-type: none"> <li>• No effect.</li> </ul>
Environmental Justice	<ul style="list-style-type: none"> <li>• Continued flood protection for the City of Coatesville, which has a 22.9 percent of households living below the poverty level.</li> <li>• No disproportionate adverse effects are anticipated to any ethnic, racial, or socioeconomically disadvantaged families or groups downstream of the dam.</li> </ul>
Erosion and Sedimentation	<ul style="list-style-type: none"> <li>• Sediment retention capacity maintained. Temporary increase during construction. Measures will be implemented to minimize effects.</li> </ul>
Fish and Wildlife	<ul style="list-style-type: none"> <li>• High value habitat for numerous aquatic and terrestrial species maintained.</li> </ul>
Floodplain Management	<ul style="list-style-type: none"> <li>• Floodplain protection maintained.</li> </ul>
Floodwater Damage	<ul style="list-style-type: none"> <li>• Threat of loss of life or unsafe conditions from the Dams failing minimized.</li> </ul>
Forest Resources	<ul style="list-style-type: none"> <li>• 0.6 acres of trees will be planted to replace trees removed as part of dam rehabilitation.</li> </ul>
Invasive Species	<ul style="list-style-type: none"> <li>• Construction could potentially introduce invasive plant species. Measures will be taken to minimize effects.</li> </ul>
Land Use	<ul style="list-style-type: none"> <li>• Land use in the benefit area will be maintained.</li> <li>• 0.6 acres of trees will be planted to replace trees removed as part of dam rehabilitation. The site will be chosen to avoid adverse environmental effects.</li> </ul>
Migratory Birds/Bald and Golden Eagle Protection Act	<ul style="list-style-type: none"> <li>• Temporary effects possible during construction. Present and potential habitat sites will be maintained.</li> </ul>
Parklands	<ul style="list-style-type: none"> <li>• The Hibernia County Park at Chambers Lake and the surrounding area will be maintained.</li> </ul>
Prime and Unique Farmlands	<ul style="list-style-type: none"> <li>• Maintain existing level of flood protection for Prime Farmland or Farmland of Statewide Importance.</li> </ul>
Public Health and Safety	<ul style="list-style-type: none"> <li>• Continue to provide flood protection to agricultural land, rural transportation facilities, and rural residential structures in a manner that minimizes the risk of loss of human life.</li> </ul>
Regional Water Resources Plans	<ul style="list-style-type: none"> <li>• Maintain public water supply and support Regional Water Resources Plans.</li> </ul>
Riparian Areas	<ul style="list-style-type: none"> <li>• Maintain existing lake &amp; stream riparian areas.</li> </ul>

Relevant Resource Concern	Summary of Effects of Preferred Alternative
Scenic Beauty	<ul style="list-style-type: none"> <li>Maintain scenic quality of the general landscape.</li> </ul>
Social Issues	<ul style="list-style-type: none"> <li>Promote public health and safety; continue flood protection; maintain water supply; water-based recreation; and support local labor and management requirements.</li> </ul>
Water-Based Recreation	<ul style="list-style-type: none"> <li>Maintain water-based recreation.</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>No effect.</li> </ul>
Water Resources	<ul style="list-style-type: none"> <li>No effect.</li> </ul>
Waters of the United States/Clean Water Act	<ul style="list-style-type: none"> <li>No effect.</li> </ul>
Wetlands	<ul style="list-style-type: none"> <li>No effect.</li> </ul>

### MITIGATION

Trees will be planted to replace 0.6 acres of trees removed to widen auxiliary spillway. All needed measures will be taken to mitigate (avoid, minimize, and compensate) any adverse impacts during construction and may include timing of the work, sediment controls such as seeding, mulching and silt fences and wetting construction areas to reduce dust.

### MAJOR CONCLUSIONS

The Preferred Alternative is to rehabilitate Hibernia Dam (PA-436F) to current Commonwealth of Pennsylvania and NRCS High Hazard Class dam design criteria and to extend the service life for an additional 50 years. This is also the National Economic Development Alternative.

### AREAS OF CONTROVERSY

No areas of controversy were identified.

### ISSUES TO BE RESOLVED

None identified.

### EVIDENCE OF UNUSUAL CONGRESSIONAL OR LOCAL INTEREST

No evidence of unusual congressional or local interests was identified.

### COMPLIANCE CERTIFICATION

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

## 1.0 PURPOSE AND NEED FOR ACTION

### 1.1 CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

Hibernia Dam (PA-436F), designed and constructed as a High Hazard Class dam, does not meet current NRCS and PADEP dam design and safety criteria.

### 1.2 INTRODUCTION

This Supplemental Watershed Work Plan No.7 and Environmental Evaluation formulate, evaluate, and resolve alternatives for the rehabilitation of Hibernia Dam (PA-436F).

The Brandywine Creek Watershed Work Plan was completed and approved July 23, 1962. It has subsequently been supplemented six times.

In addition, a Supplemental Watershed Work Plan No. 7 was developed in August 1996. The purpose of the plan was to remove two flood water retarding structures from the Watershed Work Plan. This plan was completed, but is on hold. It was not approved or signed by the Sponsors and NRCS. To maintain sequence, this supplement is designated as Supplement No. 7.

NRCS completed an evaluation and estimated risk based profile of the dam in August 2010. The evaluation indicated that Hibernia Dam (PA-436F) Risk Index was 17,580. NRCS reviewed the breach inundation zone downstream from the dam and determined that developments immediately downstream were subject to flooding during a breach of the dam. This document was prepared by the individuals identified in Table 9-1 List of Preparers (Project Team), under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, and in accordance with the National Environmental Policy Act of 1969, the National Historic Preservation Act of 1966 and the Endangered Species Act of 1973.

### 1.3 PROJECT PURPOSE

The purpose of the project includes the following:

- Maintain or improve the current level of flood damage reduction provided by the Hibernia Dam (PA-436F) for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features.
- Maintain the existing water supply availability provided by the Hibernia Dam and Chambers Lake Reservoir.
- Maintain or improve the recreational and habitat values of Chambers Lake and adjacent riparian lands.
- Comply with applicable design, performance and safety criteria for High Hazard dams.

### 1.4 PROJECT NEED

The need for the proposed federal action arises from the fact that Hibernia Dam, designed and constructed as a High Hazard Dam, does not meet current dam design and safety criteria. The dam was originally constructed in 1994 with a 50-year service life. Both NRCS and the Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering, have classified Hibernia Dam as a High Hazard Class dam. The hazard classification is based on the potential for loss of life due to the prevalence of bridges, roads, and buildings existing in the downstream dam breach inundation zone. The need for this project includes the following:

- Continue providing flood damage reduction downstream from the dam and address applicable NRCS and Commonwealth of Pennsylvania standards and design criteria for public health and safety to reduce the risk of loss of human life.

- Continue providing up to 4 million gallons per day of source water for public water supplies from Hibernia Dam and Chambers Lake Reservoir.
- Continue providing water for fire protection.
- Continue supporting and improving the recreational uses and aquatic and terrestrial wildlife habitat directly dependent upon Chambers Lake and its surrounding riparian lands. These uses include in lake and downstream fisheries; bog turtle habitat; raptor habitat; wading; resident and migratory avian species habitat; and wetlands created as part of project mitigation. Recreation uses include fishing, birding, non-motorized boating, hiking, and geocaching.

## 1.5 PROBLEMS AND OPPORTUNITIES

**Problem** – Hibernia Dam, designed and constructed as a High Hazard Class dam, does not meet current dam design and safety criteria. The dam was originally constructed in 1994 with a 50-year service life. Both NRCS and the PADEP, Bureau of Waterways Engineering, have classified Hibernia Dam, as a High Hazard Class dam. The high hazard classification is based on the potential for loss of life due to bridges, roads, residential structures and businesses existing in the downstream dam breach inundation area.

**Opportunities** - In addition to addressing the Project Needs noted in Section 1.4, the following opportunities will be recognized:

- Reduce Sponsor liability associated with operation of noncompliant dam.
- Sustain the existing level of agricultural flood protection for downstream agricultural land, houses, businesses, and infrastructure.
- Protect real estate values.

## 2.0 SCOPE OF THE PLAN

### 2.1 SCOPING PROCESS

A scoping process identified issues of economic, environmental, cultural, and social concerns related to the project. Concerns of Sponsors and local citizens were expressed at planning and at public meetings of the Chester County Water Resources Authority. Factors that affect soil, water, air, plant and animal resources were identified by engineers, biologists, economists, resource conservationists, water quality specialists and others. The scoping process of the Environmental Evaluation for the Dam involved site investigations, public meetings, and consultations with jurisdictional agencies.

The scoping process identified the (1) objectives, needs, and primary concerns for the Sponsor, (2) the relevant issues, and (3) the environmental concerns associated with the Project.

### 2.2 IDENTIFIED RESOURCE CONCERNS

Table 2-1 identifies the primary Resource Concerns based on the National Watershed Program Manual, Part 501.24 and the additional Resource Concerns included in the Project Scope-of-Work. Relevancy to the proposed action was determined when sufficient rationale was provided. Irrelevant concerns are eliminated from further consideration. Relevant resource concerns were reviewed in detail for the alternatives comparison.

**Table 2-1  
 Summary of Scoping**

Resource Concern	Relevant to Proposed Action?	Rationale
National Economic Development (NED)	Yes	<ul style="list-style-type: none"> <li>The proposed action reduces the offsite or public problem and maximizes net national economic development benefits.</li> </ul>
Air Quality/Clean Air Act	Yes	<ul style="list-style-type: none"> <li>The proposed action or alternatives are located in a nonattainment area.</li> <li>There will be some temporary affects during construction (dust and exhaust).</li> </ul>
Aquatic Resources	Yes	<ul style="list-style-type: none"> <li>Chambers Lake and the surrounding areas provide high quality aquatic resources.</li> </ul>
Coastal Zone Management Area	No	<ul style="list-style-type: none"> <li>The Hibernia Dam is not located in an area subject to Coastal Zone Management regulations.</li> </ul>
Coral Reefs	No	<ul style="list-style-type: none"> <li>No coral reefs or associated water bodies (e.g. embayment areas) are present in or near the planning area.</li> </ul>
Cultural Resources	Yes	<ul style="list-style-type: none"> <li>No cultural resources are known to exist within the Project area.</li> <li>Cultural resources may be affected by some alternatives.</li> </ul>
Ecological Critical Areas	No	<ul style="list-style-type: none"> <li>There are no critical habitat areas in or near the project area.</li> </ul>

Resource Concern	Relevant to Proposed Action?	Rationale
Endangered and Threatened Species	Yes	<ul style="list-style-type: none"> <li>Some alternatives have potential to affect federal- or state-listed threatened or endangered species.</li> </ul>
Environmental Justice	Yes	<ul style="list-style-type: none"> <li>The Hibernia Dam provides flood protection for the City of Coatesville, which has a 22.9 percent of households living below the poverty level.</li> </ul>
Erosion and Sedimentation	Yes	<ul style="list-style-type: none"> <li>The Brandywine Creek watershed has USEPA-approved TMDLs for sediment, bacteria and nutrients.</li> <li>Significant sediment accumulations have been observed in the reservoir.</li> </ul>
Essential Fish Habitat	No	<ul style="list-style-type: none"> <li>There are no essential fish habitats in or near the project area.</li> </ul>
Fish and Wildlife	Yes	<ul style="list-style-type: none"> <li>Chambers Lake is a high value habitat for numerous aquatic and terrestrial species.</li> </ul>
Floodplain Management	Yes	<ul style="list-style-type: none"> <li>The breach inundation area includes portions of the Brandywine Creek 100-year floodplain.</li> <li>Hibernia Dam is a multi-purpose dam. One of those purposes is to reduce flooding losses in downstream communities.</li> </ul>
Floodwater Damage	Yes	<ul style="list-style-type: none"> <li>Project Purpose is to provide flood protection for residents, motorists, and other persons using downstream facilities, and minimize threat of loss of life or unsafe conditions from the Dams failing.</li> </ul>
Forest Resources	Yes	<ul style="list-style-type: none"> <li>Widening the auxiliary spillways will result in the clearing of approximately 0.6 acres of woodlands. Tree replacement may be required by local municipality.</li> </ul>
Invasive Species	Yes	<ul style="list-style-type: none"> <li>There are several species of invasive vegetation around Chambers Lake and Hibernia Dam that are common in southeastern Pennsylvania.</li> <li>Construction could potentially introduce invasive species.</li> </ul>
Land Use	Yes	<ul style="list-style-type: none"> <li>Land use has been planned in the benefit area under the premise that the dam would be retained.</li> <li>Loss of the dam would significantly impact land use in the benefit area.</li> </ul>
Migratory Birds/Bald and Golden Eagle Protection Act	Yes	<ul style="list-style-type: none"> <li>Habitat for native birds, including nesting sites, exists in Hibernia Park.</li> <li>Bald eagles have been observed numerous times at Chambers Lake, although it is believed that its nesting site is not at the lake.</li> <li>The site is along the east coast migratory path.</li> <li>Migratory birds and their nesting activities would be temporarily disturbed during construction.</li> </ul>
Natural Areas	No	<ul style="list-style-type: none"> <li>No designated Natural Areas will be affected by the project.</li> </ul>
Parklands	Yes	<ul style="list-style-type: none"> <li>Chambers Lake and the surrounding area is designated as a Park.</li> </ul>
Prime and Unique Farmlands	Yes	<ul style="list-style-type: none"> <li>Soils surrounding Chambers Lake are classified as either Prime Farmland or Farmland of Statewide Importance.</li> </ul>

Resource Concern	Relevant to Proposed Action?	Rationale
Public Health and Safety	Yes	<ul style="list-style-type: none"> <li>Project Purpose is to continue to provide flood protection to agricultural land, rural transportation facilities, and rural residential and commercial structures in a manner that minimizes the risk of loss of human life.</li> </ul>
Regional Water Resources Plans	Yes	<ul style="list-style-type: none"> <li>The proposed project may affect Regional Water Resources Plans.</li> <li>Water supply is included as a Project Purpose.</li> </ul>
Riparian Areas	Yes	<ul style="list-style-type: none"> <li>Riparian areas may be impacted by the project alternatives.</li> </ul>
Scenic Beauty	Yes	<ul style="list-style-type: none"> <li>Scenic quality of the general landscape may be affected by some alternatives.</li> </ul>
Scientific Resources	No	<ul style="list-style-type: none"> <li>No scientific resources known in or near project area.</li> </ul>
Sole Source Aquifer	No	<ul style="list-style-type: none"> <li>Chester County is not identified as a county that is at risk of contaminating sole source aquifers.</li> <li>The project is not included in a stream flow source zone within two miles of the Delaware River</li> </ul>
Social Issues	Yes	<ul style="list-style-type: none"> <li>Numerous social issues, including, public health and safety, flood damages, water supply, and local labor and management requirements.</li> </ul>
Water-Based Recreation	Yes	<ul style="list-style-type: none"> <li>Water-based recreation is included as a Project Purpose.</li> </ul>
Water Quality	Yes	<ul style="list-style-type: none"> <li>Surface water quality may be affected by some alternatives.</li> <li>There are no identified ground water issues.</li> </ul>
Water Resources	Yes	<ul style="list-style-type: none"> <li>Chambers Lake and the surrounding areas provide water resources.</li> </ul>
Waters of the United States/Clean Water Act	Yes	<ul style="list-style-type: none"> <li>Alternatives may have impacts to surface waters and wetlands.</li> <li>The Brandywine Creek watershed has USEPA-approved TMDLs for sediment, bacteria and nutrients.</li> </ul>
Wetlands	Yes	<ul style="list-style-type: none"> <li>Wetlands are present in the vicinity of the Project area and could be disturbed by Project Alternatives.</li> </ul>
Wild and Scenic Rivers	No	<ul style="list-style-type: none"> <li>Birch Run is neither a Federally-listed nor a State-Listed Wild and Scenic River.</li> </ul>

## 3.0 AFFECTED ENVIRONMENT

Unless otherwise noted in the following sections, future conditions are projected to remain unchanged.

Additional information regarding the Affected Environment of the Brandywine Watershed can be found in the Brandywine Work Plan. Conditions that have changed specific to Hibernia Dam are provided below.

### 3.1 PROJECT SETTING

Hibernia Dam is located in West Caln Township, Chester County, Pennsylvania. Its geographic coordinates are 40° 01' 44.12" North Latitude and 75° 50' 54.74" West Longitude (see Project Location Map in Appendix B). The Dam is situated at approximately 594 feet above mean sea level. The rolling topography of the area is characteristic of the Piedmont Uplands Section of the Piedmont Physiographic Province. Hibernia Dam is located approximately 3.3 miles northwest of Coatesville, PA.

Hibernia Dam was designed and constructed under the supervision of the USDA Natural Resources Conservation Service (NRCS, formerly USDA Soil Conservation Service, SCS) from 1983 to 1994. It is situated on Birch Run and has created Chambers Lake, approximately 90 acres in area. The Hibernia Dam Watershed encompasses 4.68 square miles. Chambers Lake discharges in to Birch Run which subsequently flows into the West Branch Brandywine Creek approximately 1,700 feet downstream from the dam. The purpose and objective for the construction of Hibernia Dam was to provide flood control for the West Branch Brandywine Creek and main stem of the Brandywine Creek, provide an additional source of water supply for the City of Coatesville and surrounding communities, and provide additional water-based recreation opportunities for Hibernia Park and the region. Neither Birch Run nor Chambers Lake is listed as impaired water bodies.

### 3.2 SOILS

A current soil survey report obtained from the USDA NRCS Web Soil Survey indicates that there are 14 soil map units within the defined study area. For the purposes of this resource (e.g. soils) the defined study area encompasses the perimeter around Chambers Lake and along Birch Run to its confluence with the West Branch Brandywine Creek. A majority of the soil types identified within the project area and depicted on the Web Soil Survey are presently under water. For the portion of the study area not presently under water; the predominant soils group is the Neshaminy Silt Loam. The second most predominant soils group is the Gladstone Gravelly Loam. Table 3-1 below summarizes the soil units present within the defined study area.

**Table 3-1  
 Summary of Soil Units within Project Study Area**

Soil Map Unit Name	Soil Map Unit Symbol	K Factor Erosion Potential**	Prime Farmland***	Hydric Soil
Gladstone gravelly loam, 3 to 8 percent slope	GdB	.28	PFL	No
Gladstone gravelly silt loam, 8 to 15 percent slope*	GdC	.28	FSI	No
Gladstone gravelly silt loam, 15 to 25 percent slope	GdD	.28	No	No
Gladstone gravelly silt loam, 8 to 25 percent slope, very bouldery	GfD	.28	No	No
Hatboro silt loam*	Ha	.37	No	Yes
Mount Lucas silt loam, 3 to 8 percent slope*	MIB	.32	PFL	No
Neshaminy silt loam, very deep over mafic gneiss, 0 to 3 percent slope	NvA	.32	PFL	No
Neshaminy silt loam, very deep over mafic gneiss, 3 to 8 percent slope	NvB	.32	PFL	No
Neshaminy silt loam, very deep over mafic gneiss, 8 to 15 percent slope	NvC	.32	FSI	No
Neshaminy silt loam, very deep over mafic gneiss, 0 to 8 percent slope, very stony	NxB	.24	No	No
Neshaminy silt loam, very deep over mafic gneiss, 8 to 25 percent slope, very stony*	NxD	.24	No	No
Neshaminy silt loam, very deep over mafic gneiss, 25 to 60 percent slope, very stony*	NxF	.24	No	No
Towhee silt loam, 0 to 3 percent slope*	ToA	.43	No	Yes
Watchung silt loam, 0 to 3 percent slope*	WaA	.47	No	Yes

Notes: \* Indicates that this soil unit is mapped within the project study area, but a majority of it has been flooded by Chambers Lake.  
 \*\* K Factor Erosion Potential indicates the soil unit's susceptibility to sheet and rill erosion, K Factor < .39 = Not Susceptible to Erosion; K Factor > .39 = Susceptible to Erosion.  
 \*\*\* PFL Indicates Prime Farm Land; FSI Indicates Farmland of Statewide Importance

### 3.3 SOIL EROSION AND SEDIMENTATION

A sediment survey was completed in November 2011 and the amount of sediment accumulated in the Chambers Lake impoundment was calculated to be 27.1 acre-feet based on sediment depths from field measurements. This is a rate of 1.594 acre-feet per year, which is higher than the design rate of 1.02 acre-feet per year.

This indicates a greater amount of erosion occurring in the upstream watershed than predicted in the 1990 final design report. There are no current, on-site sheet or rill erosion issues, and no

current ephemeral gully erosion issues identified. There is also no indication of on-site streambank or lake shore erosion issues.

An AMEC sediment survey of Hibernia Dam estimated an annual sedimentation rate of 1.594 acre-feet/year in the dam impoundment. Given the agricultural nature of the watershed, the source of sediment is assumed to be sheet and rill erosion, although there may be some streambank erosion within the watershed that also contributes some of the sediment. The presence of Hibernia Dam reduces the downstream loading of sediment. It also reduces the amount of sediment and the cost of removal from downstream bridges and culverts.

Formulation of the project alternatives considered the 100-year sediment storage capacity for the Hibernia Dam sediment pool. The sedimentation rate was evaluated to determine if the remaining sediment storage capacity is sufficient storage capacity for an extended service life. The Project Team determined that providing an additional 100-year sediment storage capacity would require significant modifications to the existing structure, negative impacts to the Affected Environment or loss of municipal water supply storage capacity. Consequently, the planned alternatives included consideration of the 50-year sediment storage capacity consistent with National Watershed Planning Manual Section 505.35 C.

### 3.4 WATER RESOURCES

**Excessive Subsurface Water.** A subsurface investigation has been conducted in response to a spike in the phreatic levels in the dam, which concluded that there is a lack of complete foundation cutoff for the dam. The existing finger drains appear to be functioning as designed, but it is thought that the finger drains do not have sufficient capacity for the additional water moving through the incomplete foundation cutoff. Left unmanaged, the excessive subsurface water could create a dam safety problem that would impact the downstream community.

**Excessive Seepage.** A report investigating the cause of observed piezometer spike was prepared by Gannet Fleming in June 2011. This report identified potential seepage at the dam.

Site observations on the downstream toe of the dam have identified two locations where there is very minor seepage. This identified seepage is not filtered. While very minor, if left uncorrected, this seepage could result in the piping of material from the embankment and a dam safety problem that would impact the downstream community.

**Excessive Runoff, Flooding or Ponding.** Hibernia Dam was constructed in 1994 as a multi-purpose dam; one of those purposes is to reduce flooding losses in the downstream communities. Currently, the dam controls runoff from a 4.7 square mile area up to the 100-year storm, and mitigates flood flows greater than that return period. At the present time, upstream excessive runoff is not a problem as the upstream Birch Run watershed remains predominantly forested and agricultural land.

The peak inflow to the dam from the Birch Run Watershed during the 100 year storm is 3,480 cfs. According to the April 1991 NRCS Design Report, the peak flow from the Hibernia Dam Principal Spillway during the 100-year storm is 228 cfs. This means the presence of Hibernia Dam reduces the peak flow rate by 3,252 cfs, a 93% reduction. The 1999 Dam Failure Analysis reported the Probable Maximum Flood inflow of 11,687 cfs, and a peak breach discharge of 48,300 cfs. PADEP and NRCS have classified Hibernia Dam as a High Hazard Class dam, which is based on the potential for loss of life due to the prevalence of bridges, roads, and buildings existing in the downstream dam breach inundation zone.

**Surface Water Quality.** The watershed surrounding Hibernia Dam is mostly forested and/or agricultural. As a result fertilizers applied to agricultural land and sediment in overland runoff could contain excessive levels of nutrients. The US Geological Survey (USGS) sampled three sites on Birch Run up gradient of Chambers Lake and a fourth site on an unnamed tributary to Chambers Lake in 2004. The results indicate very good to excellent water quality and do not show excessive levels of nutrients entering Chambers Lake. However, Chambers Lake occasionally experiences increased algae growth.

The Brandywine Creek watershed has USEPA-approved TMDLs for sediment, bacteria and nutrients. Birch Run is not listed as impaired and has not been assigned a waste load allocation for sediment or bacteria. Birch Run is listed with waste load allocations for Total Nitrogen and Total Phosphorus.

The impoundment (Chambers Lake) created by Hibernia Dam is classified as a Warm Water Fishery (WWF) and is not listed as impaired by PADEP. There are no identified or documented problems related to temperatures. The dam owner monitors temperature on Birch Run and the West Branch Brandywine Creek downstream of the impoundment.

There are no identified problems associated with pathogens in the surface waters of the watershed. A USGS study confirms loading of bacteria in the watershed. Chambers Lake serves as a sink for bacteria reducing downstream loading of bacteria.

**Groundwater.** The geology of Chester County form fractured-rock aquifers, where weathered bedrock (saprolite) and soil overlie the competent bedrock. Water-bearing properties differ by geologic unit. Thickness of the saprolite varies but commonly is 10 to 40 ft. Soils in much of the county are moderately deep and well-drained, although the soils are thin and (or) poorly drained in some areas. Drilled wells generally are completed as open holes in the bedrock, with casing extending through the saprolite to the top of competent bedrock. Hand-dug wells dating from the period before drilled wells were common (by the early 20th century) generally are completed in the saprolite. Unconsolidated deposits in the county generally are not used as aquifers.

The fractured-rock aquifers are recharged locally by precipitation infiltrating through soils and saprolite to the bedrock. Groundwater flows through fracture openings in the bedrock and also in the saturated part of the saprolite. Under natural conditions, groundwater discharges to streams and springs. The water table generally is a subdued replica of the land surface, as shown by 27 maps of groundwater levels in the county; such that groundwater flow paths commonly follow topography. Base flow (supplied by groundwater discharge to streams) comprises about 60 percent of total annual stream flow on average, as estimated from water budgets for several streams in Chester County, and may be as high as about 80 percent of stream flow.

Depth to water typically varies by topography; depths to water are greater under hilltops than on slopes or in valleys. Groundwater levels fluctuate seasonally because of changes in net recharge rates; depth to water is greatest in the fall and least in the spring. Although precipitation is distributed nearly evenly throughout the year, net recharge generally is greater in the cooler months (October–April), when evapotranspiration is reduced, than in the warmer months (May–September). Long-term average groundwater levels and base flow are highest in spring and lowest in fall in Chester County.

**Groundwater Quality.** This section is based on the review of the Chester County Groundwater Atlas, USGS Report 03-442, dated 2004.

There are no identified pesticide problems in the ground water. Wells have been sampled by USGS in the past in the Birch Run watershed, and none of the samples detected pesticides.

The watershed surrounding Hibernia Dam is mostly forested and/or agricultural. As a result fertilizers used on the agricultural land could be a source of contaminates to groundwater. Wells have been sampled by the U.S. Geological Survey in the past in the Birch Run watershed for nitrate (4 detections of 4 wells sampled), nitrite (0 detections of 3 wells sampled), and phosphorus (1 value above the 75% percentile of 3 wells sampled). None of the nitrate detections exceeded the USEPA PMCL.

There are no identified problems associated with pathogens in the groundwater of the watershed.

### 3.5 AIR QUALITY

Chester County is in the Philadelphia-Wilmington Nonattainment area for 24-hour Particulate Matter less than 2.5 micrometers diameter (PM<sub>2.5</sub>) and is in a moderate excessive eight (8) hour ozone zone according to the USEPA. There are no known chemical plants or sources within the

watershed that would cause any chemical drift issues. There are no known permitted air emission sources or sources of objectionable odors from Hibernia Dam.

### 3.6 BIOLOGICAL RESOURCES

**Vegetation.** Vegetation present in and around Hibernia Dam and Chambers Lake is typical of the Chester County and Southeastern, Pennsylvania. Habitats include: deciduous hardwood forest, meadows, and mowed/maintained fields. The deciduous hardwood forests in the region are aptly classified as Mixed Oak Forest, dominated by white, red and black oaks, often mixed with tulip poplar, and red maple, with lesser amounts of red maple, hickory, black cherry and beech. Stands of eastern hemlock (and occasionally sugar maple) are less frequent in the county, limited primarily to the cool north-facing slopes along streams. Understory plants typically include mountain laurel, blueberry, and huckleberry and a sparse herb layer containing plants such as partridgeberry and frostweed. There are also 12+ acres of constructed wetlands and wetland vegetation in and around the perimeter of Chambers Lake.

**Noxious and Invasive Plants.** There are several species of invasive vegetation around Chambers Lake and Hibernia Dam that are common in southeastern Pennsylvania. These include phragmites, Russian olive and multi-flora rose among others. At this time, these are not causing a problem for the management of the dam or lake.

**Fish and Wildlife.** Pennsylvania Fish and Boat Commission (PFBC) have conducted extensive stocking and fishery management in Chambers Lake that has produced a diverse, well established fishery in Chambers Lake.

The lake is stocked with warm water species, including pan fish, channel catfish, chain pickerel, and smallmouth and largemouth bass. Chambers Lake is one of only three Pennsylvania lakes that is a Pan fish Enhancement Area, which regulates number, quality and size of pan fish through minimum length limits. It is also one of a select few in the Big Bass Program. Therefore, the lake is closed to bass fishing from late April to early June.

When the lake isn't drawn down, the dike creates a fish attracting shoal. Downstream of the dam, the West Branch Brandywine Creek is an approved trout stream that is stocked by the PFBC.

Chambers Lake is a high value habitat for numerous aquatic and terrestrial species. According to the biologist report from the Pennsylvania Fish and Boat Commission (2002), this is in part due to be satisfactory cover and shelter provide within the lake by mitigation activities completed as part of the dam.

Wildlife in the vicinity of Hibernia Dam can be described as typical for southeastern Pennsylvania. It is not uncommon to see whitetail deer, fox, beaver, grey squirrel, and other common terrestrial species in the immediate vicinity of Hibernia Dam.

Bald eagles and osprey are regular visitors, while migratory waterfowl, wading birds and belted kingfishers, among others are common. The wetlands have attracted egrets, sandpipers, herons, turtles, frogs and an assortment of aquatic insects. The northern end of Chambers Lake and surrounding park area is designated part of a migratory bird sanctuary. It is closed to boating and foot traffic from April 1 to mid-June.

### 3.7 HUMAN, ECONOMIC, AND SOCIAL CONSIDERATIONS

**Social Conditions.** The Project site is located in a rural area of Chester County, Pennsylvania. Coatesville, Pennsylvania is the nearest population center, which is approximately 5 miles downstream from the Project site. The population of the area around the Project shows steady growth due to rural residential development in Chester County. The land use in the Project drainage area is primarily rural residential and agriculture. Table 3-2 provides relevant information regarding the social and economic conditions in the study area.

**Table 3-2  
 Social and Economic Profile<sup>1</sup>**

Beneficiary	West Caln Township <sup>1</sup>	Coatesville <sup>1</sup>	Chester County <sup>1</sup>	Pennsylvania <sup>1</sup>	U.S. <sup>1</sup>
Population	9,014	13,100	498,886	12,702,379	308,745,538
Median Age	41.9 years	29.9 years	39.3 years	40.1 years	37.2 years
Per Capita Income	\$30,149	\$17,247	\$42,042	\$27,824	\$27,915
Median Household Income	\$71,544	\$36,526	\$86,264	\$51,651	\$52,762
Total Number of Households	3,346	4,409	182,732	4,952,566	114,761,359
Median Value of Housing Units	\$237,000	\$141,400	\$333,400	\$163,200	\$186,200
Percent of Families Living Below Poverty Level	7.9%	22.9%	3.7%	8.8%	10.5%

<sup>1</sup> Source: United States Census Bureau, Census 2010

**Land Use and Land Cover.** West Caln Township has a Zoning Ordinance which regulates the use, intensity of use, size and location of buildings and other structures as well as establishing regulations for land use by trades, industry, recreation and public activities. The provisions of the ordinance address prohibition of nuisances and performance standards as well as control of home professional offices and home occupations. This Ordinance is also constantly reviewed and up-dated with the intention of preserving the rural atmosphere and beauty of the township.

Hibernia Dam is located within an area zoned as Site Responsive Residential (SRR) District. According to the West Caln Township Zoning Ordinance and the policies of the West Caln Township Comprehensive Plan, the purpose of the SRR District zoning is to:

- Support the conservation of sensitive environmental features: primary natural resources such as floodplains, areas of very steep slope, and wetlands and secondary natural resources such as woodlands and riparian buffers.
- Retain and protect open space areas within residential development in the Township to protect the Township’s rural, open character.
- Protect and minimize the potential adverse effects of land development on historic resources.
- Provide opportunities for housing types at a density and in a cluster configuration that preserves and protects the rural character of West Caln Township.
- Provide greater design flexibility and efficiency in the provision of services and infrastructure, including the opportunity to reduce the amount of impervious surfaces related to new development.
- Provide for a diversity of lot sizes, building densities, and housing choices to accommodate a variety of age and income groups and residential opportunities.
- Protect areas with productive agricultural soils for continued or future agricultural use, by conserving areas of land large enough to allow for efficient farm operations.

Hibernia Dam and the associated impoundment; Chambers Lake, is partially located within Hibernia County Park. Hibernia County Park encompasses approximately 900 acres and includes trails, woodlands, meadows, open fields, play areas, camping and picnic areas. Small boating and fishing occur on the 90-acre Chambers Lake. Chambers Lake is stocked with warm

water species, including pan fish, channel catfish, chain pickerel, and smallmouth and largemouth bass. Chambers Lake is one of only three Pennsylvania lakes that is a Panfish Enhancement Area, and one of a select number in the Big Bass Program. Fishing also occurs in the West Branch Brandywine Creek, which receives to outflow from Chambers Lake. Predominantly, West Branch Brandywine Creek is a cold water fishery that is very popular with local anglers.

The land use in the watershed is predominantly agricultural and forested. Residential areas account for approximately 20% of the total watershed area. The contributing watershed consists of an estimated 29% agricultural and 41% forested land use. The remaining 10% of the land use in the upstream watershed includes commercial and institutional uses.

Land use at Hibernia County Park is consistent with the West Caln Township SRR District zoning.

**Public Health and Safety.** Hibernia Dam is a High Hazard Class dam. The dam owner estimates that there are 1,500 residents, 3 schools with an enrollment population of 800 students, and approximately 45 businesses within the dam breach inundation zone. The dam reduces flooding downstream for high frequency events up to and including the 100-year storm. The dam also provides flood protection from extreme events (greater than the 100-year storm) and allows for more time for the evacuation of the population downstream.

Chambers Lake reservoir is a supplemental source of raw water supplies supporting the public water system for the greater Coatesville region. The treatment plant provides up to 5 million gallons per day of finished water to the region.

Chambers Lake has two dry hydrants – one on the north shoreline and the other on the south shoreline. These serve as water intakes for the Martins Corner Fire Company and the Wagontown Fire Company.

**Labor.** The labor needed to maintain the dam and reservoir is estimated as the equivalent of 2 full time staff, which includes support from multiple firms to provide grounds maintenance, valve maintenance, reservoir operations and other miscellaneous operation and maintenance services.

**Management Level.** The dam owner has sufficient education and experience to manage and maintain the dam and reservoir; however, a consulting firm has been engaged for professional engineering services. The effort to provide management is estimated at 1.0 full time staff.

### 3.8 SPECIAL ENVIRONMENTAL CONCERNS

**Clean Air Act.** Chester County is designated as being in non-attainment for the 24-hour PM 2.5 Standards and 8-hour Ozone standards.

Hibernia Dam is currently meeting the full compliance of the Clean Air Act.

**Clean Water Act/Waters of the US.** The Brandywine Creek watershed has USEPA-approved TMDLs for sediment, bacteria and nutrients. The Birch Run subbasin is not listed as impaired and has not been assigned a waste load allocation for sediment, however there are allocations for Total Nitrogen and Total Phosphorus.

**Coastal Zone Management.** The Hibernia Dam is not located in an area subject to Coastal Zone Management regulations.

**Coral Reefs.** The Hibernia Dam is not located in an area subject to coral reef protection regulations.

**Cultural Resources / Historic Properties.** SJS Archaeological Services prepared a historic resources report titled, "West Brandywine Creek Drainage Phase I and Phase II Cultural Resources Investigations on Three Proposed Dam Locations" in 1985. The report did not identify any cultural or historical resources affected by Hibernia Dam. In April 2013 the State Historic Preservation Office confirmed there were no cultural resources at the project site.

The following historic properties are known to be outside the Area of Potential Effects (APE) considered in this study but within the dam breach inundation zone.

- Pennsylvania Railroad High Bridge
- Mortonville Bridge
- Lenape Bridge
- Lukens, Main Office Building
- Spruce Grove School House
- Brinton's Mill

There are currently no federally recognized tribes in Pennsylvania.

**Endangered and Threatened Species.** A Pennsylvania Natural Diversity Inventory (PNDI) review for Hibernia Dam was conducted. Results indicate that no known impacts to threatened or endangered species and/or special concern species and resources are within the project area. The presence of a bog turtle and bog turtle habitat had been documented in the immediate vicinity of the dam and reservoir. On 1/23/2013 the U.S. Fish & Wildlife Service determined the project site is not bog turtle habitat.

In addition, according to the PNDI database, an aquatic plant species of concern occurs in two locations in West Branch Brandywine Creek including part through Hibernia County Park. This plant species is located downstream of the confluence of Birch Run with West Branch Brandywine Creek and extending to Route 340 downstream. Large boulders and cobbles and a swift current characterize the creek in this stretch. Associated species include waterweed (*Elodea* sp.), aquatic mosses and algae. These stretches receive direct sunlight for part of the day as well as having swift currents and a bottom of boulders and gravel. The species appears to drop out where the stream is entirely shaded. The plants grow directly on the rocks and do not tolerate much sedimentation. The major concern is the sediment load in the creek. Any upstream source or sources of sediment need to be identified and stabilized. Protection of the floodplain and riparian zone of the creek can do much to protect water quality and this species that depends on clear water.

**Environmental Justice.** The Hibernia Dam (PA-436F) provides flood protection to the City of Coatesville, which has a large percentage of households living below the poverty level. The Hibernia Dam provides flood protection, water supply, and recreation opportunities for large population of households living below the poverty level.

**Essential Fish Habitat.** There are no Essential Fish Habitats in the Hibernia Dam Watershed.

**Floodplain Management.** Based on the review of US EPA NEPA Assist and FEMA's Flood Insurance Rate maps of the project study area, the project study area contains areas that are situated within Special Flood Hazard Areas (SFHAs) subject to inundation by the 1 percent chance annual flood. The 1 percent chance annual flood (e.g. 100-year flood), also known as the base flood, is the flood that has a 1 percent chance of being equaled or exceeded in any given year. The SFHA is the area subject to flooding by the 1 percent chance of flood. The base flood elevation is the water surface elevation of the 1 percent annual chance flood. Chambers Lake and the immediate periphery of Hibernia Dam are classified as being within Flood Zone AE which has a base flood elevation of 587.5 feet above mean sea level. The Flood Zone AE ends at Hibernia Dam. The area downstream of Hibernia Dam, along Birch Run and West Branch Brandywine Creek, is classified as Flood Zone A. The 14 communities downstream of Hibernia Dam are participants in the National Flood Insurance Program.

Hibernia Dam is a multi-purpose dam. One of those purposes is to reduce flooding losses in downstream communities. The floodplain was estimated through a detailed Hydrologic and Hydraulic Study and presented in the Chester County Flood Insurance Study, effective September 29, 2006.

**Forest Resources.** 1153 acres (38%) of the 2995 acres in the contributing watershed for Hibernia Dam is woodland.

**Invasive Species.** There are several species of invasive vegetation around Chambers Lake and Hibernia Dam that are common in southeastern Pennsylvania. These include phragmites, Russian olive and multi-flora rose among others. At this time, these are not causing a problem for the management of the dam or lake.

**Migratory Birds / Bald Eagle and Golden Eagle Protection Act.** All native wild birds found in the United States, with the exception of the house sparrow, starling, feral pigeons and resident game birds (e.g. pheasant, grouse, wild turkey) are protected under the Migratory Birds/Bald and Golden Eagle protection Acts. Habitat for native birds, including nesting sites, exists in Hibernia Park. Bald eagles have been observed numerous times at Chambers Lake, although it is believed that their nesting site is not at the lake. Other raptors including multiple species of hawks, American Kestrel, and ospreys have been observed at Hibernia Park. The site is along the east coast migratory path, and care will be taken not to "Take" any migratory species.

**Prime and Unique Farmlands.** According to the NRCS Web Soil Survey soils surrounding Chambers Lake are classified as either Prime Farmland or Farmland of Statewide Importance. Soils specifically at Hibernia Dam and immediately downstream along Birch Run are not identified as Prime Farmland or Farmland of Statewide Importance.

**Riparian Areas.** The riparian area along the northern bank is heavily forested County Park land. The riparian area along the southern bank is managed as more of a meadow condition. The northwest shoreline is a 2+ acre constructed wetland. The western and southern shoreline is managed closer to a meadow condition. A portion of the western shoreline abuts cropland, and there is a meadow buffer established between the cropland and the lake. The riparian area that extends along Birch Creek downstream of Hibernia Dam is heavily forested.

**Sole Source Aquifers.** Chester County is not identified as a county that is at risk of contaminating sole source aquifers.

**Wetlands.** Based on the review of National Wetland Inventory (NWI) maps using the US EPA NEPAAssist tool, two natural wetlands are present within the project area. Both are located downstream of Hibernia Dam and are associated with Birch Run. One wetland area is identified as a freshwater pond and is located immediately south of Lions Head Road along Birch Creek. The second is identified as a freshwater emergent wetland situated at the convergence of Birch Run and West Branch Brandywine Creek. Several freshwater forested wetlands are also present upstream of Chambers Lake along Birch Run. No NWI wetlands are identified along the immediate periphery of Chambers Lake.

Although not included in the NWI inventory, the construction of the dam included construction of 12+ acres of wetlands, including wetlands along the shoreline of Chambers Lake within the lake (including 6 acres of submerged wetland bench) and a 2+ acre wetland at the northwest edge of the lake. There are natural wetlands immediately downstream of the toe of dam. In addition to those wetlands, there are several terrestrial mitigation efforts completed on land immediately adjacent to the lake and dam to fulfill federal dam construction permits requirements.

**Wild and Scenic Rivers.** Birch Run is neither a Federally-listed nor a State-Listed Wild and Scenic River.

### 3.9 OTHER CONCERNS

**Recreation.** Hibernia County Park, where Hibernia Dam and Chambers Lake are located, provides over 900 acres of recreational opportunities including fishing, boating, hiking, camping, and bicycling.

The following resource concerns were determined to be not relevant to the proposed action:

- Ecological Critical Areas
- Natural Areas
- Scientific Resources

### 3.10 BACKGROUND AND STATUS OF DAM

Hibernia Dam (PA-436F) is a rolled earthfill dam. Floodwater retention, municipal water supply and recreation are the primary objectives of the Dam. Other potential incidental benefits include grade stabilization, sediment retention, groundwater recharge, and fishery and wildlife habitat enhancement.

The earth auxiliary spillway is on the right abutment. The principal spillway consists of a 36-inch diameter, steel reinforced concrete pipe barrel and a rectangular reinforced concrete riser and metal trash rack. A reinforced concrete impact basin provides energy dissipation at the outlet of the conduit.

Seepage through the dam is collected by a chimney drain. The chimney drain outlets through one of three internal finger drains to the rock toe of the dam. The rock toe does not contain drain pipes, rather seepage is allowed to flow out of the toe and into the original stream bed before entering the re-aligned Birch Run.

Foundation seepage cutoff features at Hibernia Dam include a soil-bentonite slurry cutoff wall flanked on either side by an excavated cutoff trench. A triple-line grout curtain was constructed in the underlying bedrock at the centerline of the dam and extends beneath the auxiliary spillway. As-Built drawings indicate a window or gap of untreated foundation soil exists beneath the dam. The untreated foundation soil, approximate Stations 2+80 to 5+40, exists below the limits of the slurry cutoff and above the limits of the grout curtain.

Table 3-3 describes the existing conditions of Hibernia Dam (PA-436F).

**Table 3-3  
 Existing Conditions**

<b>Resource</b>	<b>Hibernia Dam (PA-436F)</b>
<b>Statistics</b>	
Year Completed	1994
Actual Construction Cost	\$5,145,385
Purposes	Flood Control, Municipal Water Supply and Recreation
NRCS Hazard Class	High
Drainage Area Controlled	4.68 Square Miles
AMC II Runoff Curve Number	72
<b>Key design elevations</b>	
Crest of dam	596.50 feet
Crest of auxiliary spillway	587.53 feet
Crest of the principal spillway	580.00 feet
<b>Structure components</b>	
Dam height	64.5 feet
Dam length	700 feet
Embankment volume	246,000 cubic yards
<b>Auxiliary spillway</b>	
Type	Vegetated earth
Bottom width	200 feet
Capacity	Unknown
<b>Principal spillway type</b>	
Type	Reinforced Concrete Pipe
Diameter	36-inch
Capacity	228 cfs
<b>Structure capacities</b>	
Sediment storage	23.9 acre-feet
Water storage	1174.9 acre-feet
Detention storage	813.4 acre-feet

November 2013

### 3.11 CURRENT CONDITION OF DAM

The Project Team conducted a site visit to document the current conditions of Hibernia Dam on December 2, 2011. At the time of the site visit, the weather conditions were clear skies and temperatures in the 30s. Prior to the site visit, rainfall accumulation from November 21 to November 23, 2011 was approximately 2.4 inches; however, the last rainfall event preceding the site walk generated 0.9 inches on November 29, 2011.

Hibernia Dam includes the following appurtenant structures:

- Regulatory Release – A 6-inch diameter ductal iron pipe (DIP) conduit, which runs through the dam embankment from an intake at elevation 554 feet offset approximately 5 feet to the south of the riser structure and discharges at the southern wing wall of the impact basin, provides a regulatory release of 1 cfs as set forth in the SCS Environmental Impact Statement and state permits. The 6-inch diameter DIP runs through an automatic flow control valve and 6-inch shutoff valve located in a vault on the downstream side of the embankment near the impact basin. The vault was locked and secured; and the regulatory release outfall was observed as flowing full at the time of the site walk.
- Siphon Bypass - A 12-inch diameter siphon bypass pipe runs along the auxiliary spillway channel and outlets downstream of the dam into Birch Run. The siphon bypass was installed to augment flow in the downstream channel for the water supply withdrawal located downstream. A 10-foot wide stone embankment over the siphon pipe on the lake-side of the auxiliary spillway crest provides maintenance vehicle access over the pipe. The siphon appeared inactive at the time of the site walk.

Notable observations during the site walk of Hibernia Dam include:

- Abutments – Stone slope stabilization along the north and south abutments was placed during the construction of the dam. Movement of the stone stabilization as well as minor erosion was observed along the abutments toward the crest. Areas of unstabilized soil, caused by either poor vegetative cover or missing stone were observed along the abutment. Erosion control netting was installed toward the top of the abutments to stabilize sod cover after the areas were seeded in the spring of 2011.
- Standing water along berm gutter - Standing water along the berm gutter on the downstream face of dam was observed. Standing water was observed in minor depressions along the berm gutter, which would not allow for positive drainage toward the north and south abutments.
- Isolated areas of poor vegetative cover – Vegetative cover on the upstream and downstream faces of the dam was generally in good condition. An isolated area on the downstream face of the dam near the crest had erosion control netting installed. Poor vegetative cover was also observed adjacent to the stone slope stabilization along the abutments. Erosion control netting was also installed along these areas. Vegetative cover along the entrance of the auxiliary spillway was in good condition. Vegetative cover diminished toward the crest and outlet of the auxiliary spillway as this surface was exposed weathered rock.
- Evidence of settlement/subsidence – There was no evidence of uneven subsidence/settlement observed along the top of dam or along either abutment.
- Animal Burrows – One small animal burrow was identified on the downstream face of the dam near the south abutment. No other animal burrows or depressions were observed during the site walk.
- Upstream riprap stabilization at normal pool – Riprap has been placed along the upstream face of the dam at the normal pool water level. The shoreline at the dam appeared stable with no observable evidence of scour or erosion.
- Seepage/piping – There was no clear visible evidence of seepage or piping through the dam embankment during the site visit.
- The condition of principal and auxiliary spillways - The principal spillway was in good condition and clear of debris. Some stripping of vegetative cover is evident upslope of the

outlet structure. Erosion control netting has been placed and seedlings have sprouted. The auxiliary spillway crest appeared stable with no observable erosion. The auxiliary spillway crest appeared level and had poor sod coverage due to the exposed weathered rock surface.

A sediment survey and flood pool storage evaluation was conducted for the reservoir to determine the current condition. The analysis indicated a total 7% storage reduction below the normal pool elevation and a total 3% storage reduction below auxiliary spillway crest. The reduction in flood storage capacity above normal pool elevation, which corresponds to the principal spillway crest elevation, is negligible. Based on the storage computations, the significant reduction in storage occurs below the normal pool and becomes negligible in the flood storage area.

The difference in storage between the initial and current conditions indicates that the total volume of accumulated sediments in the reservoir below normal water pool surface at elevation 580.00 feet is approximately 27.1 acre-feet.

The results of the Principal Spillway Hydrograph analysis indicate that the principal spillway has an adequate capacity to empty the detention storage in 6.76 days, which meets the TR-60 10-day limit. Per TR-60, the initial starting elevation for the Spillway Design Hydrograph and Freeboard Hydrograph analyses was set at the base flow water surface elevation of 580.70 ft. Peak pool elevation for the Principal Spillway Hydrograph analysis was 588.23 feet, resulting in flow over the auxiliary spillway at its current configuration and crest elevation of 587.53 feet.

The results of the Stability Analysis indicate that the maximum peak flow in the auxiliary spillway during the Spillway Design Hydrograph event is 2,432 cfs with maximum velocities of 9.4 feet/sec. The total stress ( $2.86 \text{ lb/ft}^2$ ) will likely cause sod stripping in the exit channel.

The results of the integrity analysis indicate that the integrity of the spillway is not compromised during the Freeboard Hydrograph event. Neither the 6-hour nor the 24-hour Freeboard Hydrograph events result in breaching of the auxiliary spillway, although the analyses indicated that significant erosion and head cutting did occur in the spillway exit channel downstream of the crest. This result was, however, anticipated based on the results of the soil borings survey within the centerline of the auxiliary spillway, which showed that auxiliary spillway is comprised mostly of bed rock. Confirmation that the auxiliary spillway will not breach along the left side of the auxiliary spillway is recommended during the design phase.

The results of the discharge capacity analysis show that the 24-hour Freeboard Hydrograph event based on the USACE distribution governs and results in the highest maximum water surface elevation of the impoundment (597.05 feet). This is below the surveyed top of dam elevation (597.12 feet), but above the designed top of dam elevation (596.50 feet). It should be also pointed out that the USACE distribution results in a significantly higher peak flow occurring at later stages of the storm compared to both the 5-point curve distribution and the NRCS dimensionless design storm distribution. The total runoff volume appears to be comparable between each of the 24-hour storm distribution analyses. However, the USACE distribution analysis, which has a higher peak flow occurring later during the storm, results in lower attenuation of flows and a higher maximum water surface elevation.

### 3.12 PRINCIPAL SPILLWAY ASSESSMENT

The Project Team conducted a video (TV) inspection of the principal spillway as part of the documentation of the current conditions of Hibernia Dam on December 2, 2011.

Based on the visual inspection, the inlet and outlet of the principal spillway pipe are functioning. There were about 2 inches of flow in the outlet pipe at the time of inspection due to a leak in the drawdown sluice gate. The leaked water flowed freely from the riser structure to the impact basin with no observable backup or loss through the pipe.

Notable observations during the TV inspection include:

- Surficial cracks - There were surficial cracks in the outlet pipe toward the riser structure at the crawler measured distance of 253.9 feet from the impact basin.
- Concrete scour – Minor scouring of concrete pipe observed at Joint 24.
- Joint displacement - A joint displacement of an estimated ¼” in the vertical direction at Joint 17 was observed. This displacement causes a small step-down in the pipe at this joint, which was evident by the movement of the camera as the crawler traversed the joint. The measured joint gaps at this location were within the tolerance and there was no observable flow loss, pipe deformation, or instability at this location.

Using the on-board laser measurement device on the TV crawler, the Project Team measured the joint gaps of each of the 14 joints where visible. Overall, the joint measurements ranged from 0 mm (0”) to 2 mm (~1/12”), which is less than the maximum allowable tolerance gap of ¾”.

### 3.13 STATUS OF OPERATION AND MAINTENANCE

The NRCS State Conservationist must verify that operation and maintenance is current prior to construction of the planned rehabilitation measures. The Sponsor is responsible for keeping the structure free of brush and trees, burrowing animals and recreational vehicle traffic.

CCWRA employs a routine monitoring protocol. Observations of the dam embankment, abutments and areas down gradient of the toe of the dam are conducted twice each month or as needed basis on evaluation of subsurface conditions.

Observations are made at the following locations including the spring on the left abutment up gradient of the bench, the downstream toe of the dam (both to the right and left of the existing filtered toe), locations of previously identified seeps, the outlet of the two central finger drains (which is in the center of the existing filtered toe), the riprap groin to the left of the impact basin, and the grassy area downstream of the toe of the dam.

The observations include the presence or absence of moist condition or flowing water, indication of sediment in any flowing water, indication of soil erosion on the surface of the dam, changes in soil condition or local grades, the qualitative difference between the observed condition and the historical condition of the locations observed, and taking photographs of the points observed.

Staff also makes a note of the lake elevation using the staff plate on the riser. The lake is also equipped with a continuous USGS gage that can be accessed via the internet to track pool elevations.

There are nineteen piezometers installed at Hibernia Dam, and CCWRA collects piezometer data on at least a monthly basis. The data are collected more frequently under certain circumstances, however, the frequency is subject to change based on evaluation of subsurface conditions as additional data are collected and reviewed.

These observations and piezometer data are sent to the Authority's engineer, Gannett Fleming, Inc., for review on a monthly basis, or immediately if any unusual condition is observed.

Thirteen piezometers have continuous vibrating wire piezometers and data loggers set to record the water level at predetermined intervals. Data are downloaded at least monthly from the 13 piezometers with continuous data loggers and a sensor that measures barometric pressure. Following the download of vibrating wire data, CCWRA staff input and review the data using an Excel spreadsheet to compare the measured water surface elevations to established action thresholds and previous measurements. Data are transmitted to Gannett Fleming, Inc. for review on a monthly basis, or immediately if any unusual condition is observed.

The other 6 piezometers are not equipped with vibrating wire piezometers and are measured manually. The six piezometers are measured monthly. Water surface levels are measured once each month in all 19 piezometers using a hand held water level meter (typically a Solinst Model

102 meter). Due to current subsurface conditions, all observations and measurements, as well as the lake elevation, precipitation and local groundwater level data are entered into a piezometer spreadsheet database which is transmitted to Gannett Fleming, Inc. each month for review.

CCWRA increases monitoring until it is determined that there is no dam safety concern should any of the following occur:

- When any piezometer exceeds the Action Level 1 threshold established in Gannett Fleming, Inc.'s most current piezometer evaluation report. These action thresholds are used to evaluate the measured phreatic surface in the piezometers.
- When the pool elevation increases over 1 foot above normal pool due to a storm event.
- Following a significant precipitation event(s) or cumulative increasing ground saturation conditions.

There were no post construction changes to the structure that influence the safety of the dam. No road cuts, quarries or mining activities were observed in the vicinity of the dam or reservoir.

At the time of the site walk through activities, the dam and associated structures were found to be functional and operation and maintenance is current.

### 3.14 BREACH ANALYSIS AND HAZARD CLASSIFICATION

A breach analysis of the existing dam was not conducted as part of this study. The dam is currently classified by the PADEP – Division of Dam Safety as Size Class B, Hazard Category 1. The dam is classified as a High Hazard Class dam by the NRCS.

### 3.15 POTENTIAL DAM FAILURE MODES

The Project Team examined five potential modes of dam failure during the planning study. These include failure due to sedimentation, insufficient hydrologic capacity, seepage, seismic activity, and material deterioration, which are described below.

**Sedimentation – No Risk.** Sedimentation can fill the designed sediment pool and encroach on the available municipal water supply capacity of a reservoir, but will not encroach on the detention capacity. The analyses of sediment accumulation and the adjustments of the beneficial use volumes result in approximately 50 years of functional life remain for the sediment pool. Consequently sedimentation presents a no risk failure mode for the dam.

**Insufficient Hydrologic Capacity – Moderate Risk.** An auxiliary spillway breach or overtopping of the existing dam during a storm event can cause hydrologic failure. The integrity and stability of the auxiliary spillway is dependent upon depth, velocity, and duration of flow, the vegetative cover, and the embankment's resistance to erosion.

There is a potential of erosion occurring along the left training dike and resulting in a failure of the embankment.

The dam was designed as High Hazard Class dam; however, the auxiliary spillway may only have moderate resistance to erosion. The principal spillways and auxiliary spillways may be considered inadequate according to current High Hazard Class dam design criteria. This deficiency, resulting from the upgraded design criteria, poses a moderate risk for hydrologic failure of the dam during extreme runoff events.

**Seepage and Slope Stability – Moderate Risk.** The Project Team performed a review of three reports provided by Chester County Water Resources Authority, written by Gannett Fleming, Inc. to evaluate the slope stability and seepage of Hibernia Dam:

- Bench Drainage, dated January 3, 2007;
- Stability Evaluation, dated June 2011; and
- Maximum Surcharge Pool Seepage and Slope Stability Engineering Analysis, dated September 2011.

The January 2007 Bench Drainage report analyzed the drainage of the embankment bench on the downstream side of the dam. The bench was designed with a ditch to drain laterally away from the dam face toward the abutments. Subsequently, the gravel in the ditch became fouled with soil and vegetation due to maintenance equipment, etc. Portions of the ditch tend to pond water, allowing the water to seep into the dam embankment. The Gannett Fleming report recommended reestablishing the gravel ditch, filling the low areas for positive drainage toward the abutments, monitoring of piezometers, and careful control of routine maintenance activities.

The June 2011 Stability Evaluation report discussed the subsurface investigation and stability evaluation of Hibernia Dam performed by Gannett Fleming. This report concluded that the downstream slope of Hibernia Dam has an acceptable factor of safety with respect to slope stability in accordance with USACE design criteria for maximum storage pool and steady-state seepage conditions. The factor of safety for the downstream embankment slope ranges from 1.5 to 1.6 when considering maximum storage pool (Elevation 580) for steady state conditions. The required factor of safety, per USACE design criteria, is 1.5. Gannett Fleming also performed a cursory evaluation of the maximum surcharge pool conditions per USACE criteria. This cursory evaluation indicated that the factor of safety could be as low as 1.2 at the maximum surcharge pool. Those criteria are similar to the criteria published in NRCS TR-60, Chapter 5, Table 5-2 (both criteria are attached); however, TR-60 does not include a separate distinction for the “maximum surcharge pool” case that is included in the USACE method. The USACE criteria states that for pervious foundations with no positive cutoff, steady state seepage may develop under maximum surcharge pool.

The June 2011 report indicates a “window” in the seepage cut-off, which can cause excess seepage and a high phreatic surface within the dam embankment during high water levels in the reservoir. Those conditions result in a lower factor of safety than allowed under the USACE criteria. Furthermore, Gannett Fleming’s June 2011 report concluded that the existing finger drains appear to be functional and adequate for embankment through seepage. However, the drains do not appear to have sufficient capacity to handle embankment and foundation seepage given the “window” in the foundation cutoff. The Gannett Fleming report also indicates there are areas of uncontrolled, unfiltered seepage exiting the face of the dam. Such uncontrolled unfiltered seepage can lead to piping failure of the dam.

Gannett Fleming’s September 2011 report shows that “Station 3+50, which does not incorporate a finger drain or a rock toe, does not meet the minimum factor of safety of 1.4 recommended by USACE for maximum surcharge pool conditions.” Furthermore, Gannett Fleming states that the dam owners can attain a factor of safety for the dam that meets USACE criteria by adding a rock toe; however, Gannett Fleming did not study that measure in depth and it must be further analyzed.

The Project Team reviewed the available documents used as a basis for the Slope Stability and Seepage Analyses evaluation by Gannett Fleming. Gannett Fleming analyzed the dam for slope stability using soil seepage and strength parameters developed by laboratory and field tests and correlations with published information. The slope stability and seepage analyses indicate that the dam may be marginally stable when loaded to the maximum design flood case and that uncontrolled seepage can compromise dam safety. These deficiencies pose a moderate risk for seepage and slope stability failure of the dam during extreme operating conditions.

**Seismic Activity – Very Low Risk.** The integrity and stability of an earthen embankment during seismic activity are dependent on the magnitude of the activity and the presence of unstable embankment or foundation material. Foundation movement through consolidation, compression, or lateral movement can create weak zones within the embankment where voids can form. This can cause conduit joint failure or collapse of the embankment.

Basic seismic indicators were checked and no seismic concerns were discovered. This will be confirmed during project design. The dam is located in an area designated as Seismic Zone 1. Seismic Zones indicate the effects of an earthquake at a particular place based on geological observations from the affected areas. Zone 1 represents areas with little to no historical seismic activity. Because Seismic Zone 1 is considered an area of low risk for seismic activity, seismic activity poses a very low risk for dam failure.

**Material Deterioration – Low Risk.** The Project Team conducted video inspections of the principal spillway conduits. Based on the visual inspection, the inlet and outlet of the principal spillway pipe are functioning. There were about 2 inches of flow in the outlet pipe at the time of inspection due to a leak in the drawdown sluice gate. The leaked water flowed freely from the riser structure to the impact basin with no observable backup or loss through the pipe. Notable observations during the TV inspection of Dam include:

- Surficial cracks - There were surficial cracks in the outlet pipe toward the riser structure at the crawler measured distance of 253.9 feet from the impact basin.
- Concrete scour – Minor scouring of concrete pipe observed at J24.
- Joint displacement - A joint displacement of an estimated ¼-inch in the vertical direction at J17 was observed. This displacement causes a small step-down in the pipe at this joint, which was evident by the movement of the camera as the crawler traversed the joint. The measured joint gaps at this location were within the tolerance and there was no observable flow loss, pipe deformation, or instability at this location.

Based on the noted inspection and no reported observation of cracking or deterioration of the conduits, material deterioration poses a low risk of dam failure.

### 3.16 CONSEQUENCES OF DAM FAILURE

Inundation due to dam failure potentially has the following consequences.

**Loss of Life.** The breach inundation study indicates that a dam failure may result in inundation of agricultural land, public utilities, homes, schools, commercial and public buildings, roads and bridges including 600 houses, 3 schools, 45 businesses, roads and a railroad with a total Population-At-Risk of 5,000.

**Release of Harmful Materials.** Large volumes of sediment and eroded embankment material released to the stream would harm water quality, degrade aquatic habitat and reduce downstream channel capacity.

**Agricultural Damage.** Sedimentation may cause reduced productivity of agricultural land downstream from the structure.

**Infrastructure Destruction.** Residential dwellings, public buildings, fences, roads, bridges, public utilities, and farm equipment may be damaged or destroyed.

The hazard classification was based on results of a breach routing completed by NRCS separate from this study. Due to potential impacted habitable structures downstream, the Hibernia Dam is classified as a High Hazard Class dam. Detailed discussions on the analyses, a presentation of results, and the inundation maps can be found in the stand-alone Breach Inundation Study report.

## 4.0 ALTERNATIVES

### 4.1 FORMULATION PROCESS

The following alternatives were considered in the development of this plan:

- **No Action/Future Without Federal Project (FWOP)**  
The FWOP alternative describes the most likely future condition that could be expected if NRCS takes no action. It describes what is most likely to happen in the absence of any developed Federal alternative or changes in law or public policy.  
  
The FWOP is used to compare other alternatives to determine the magnitude of benefits and adverse effects. Clearly describing the FWOP condition provides the reference necessary to evaluate changes caused by the alternatives. The FWOP alternative may contain flaws, violate a law, or fail to meet the Project Purpose and Need; but it must still be developed as a comparison.
- **Rehabilitation to High Hazard Class Dam**  
Rehabilitation alternative includes federally assisted upgrading the existing dam to current applicable standards. Sediment storage life will be for an additional 50 years.
- **Decommissioning of Dam**  
The Decommissioning alternative includes federally assisted removal of the entire dam and stabilizing the site.
- **Decommissioning of Dam with Nonstructural and Other Measures**  
In addition to the federally assisted removal of the entire dam and stabilizing the site, this alternative includes acquisition and demolition of existing residential and public structures in the downstream 100-year floodplain along with replacing lost water supply and water-based recreation features.
- **Relocation or Floodproofing of At-Risk Dwellings in the Breach Inundation Area**  
This alternative includes acquisition and demolition, relocation and/or flood protection of structures in the breach inundation area so that the hazard class can be lowered and less stringent dam safety standards can be evaluated.
- **Other nonstructural measures**  
This alternative includes floodproofing, floodplain regulations, and other nonstructural measures so the hazard class can be lowered and less stringent dam safety standards can be evaluated.
- **All other reasonable alternatives**  
Other alternatives that meet the purpose and need.
- **National Economic Development (NED) Alternative**  
The National Economic Development (NED) alternative is not an independent option. It is the alternative, or combination of alternatives, that reduces the offsite or public problem and maximizes net national economic development benefits.

Alternative plans, including the NED plan, were formulated with consideration to completeness, effectiveness, efficiency, and acceptability (as required by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 10, 1983.) These criteria are described below.

- **Completeness.** Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to the realization of the contributions to the objective.
- **Effectiveness.** Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.

- **Efficiency.** Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- **Acceptability.** Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and public and to compatibility with existing laws, regulations, and public policies.

Table 4-1 summarizes the alternatives considered and the results of the screening process.

**Table 4-1**  
**Range of Alternatives and Determination for Detailed Study**

Alternative	Screening Criteria <sup>1</sup>				Carried Forward for Detailed Study
	Completeness	Effectiveness	Efficiency	Acceptability	
<b>No Action/Future Without Federal Project (FWOP)</b>	<ul style="list-style-type: none"> <li>Does not meet Project Purpose and Need.</li> </ul>	<ul style="list-style-type: none"> <li>Does not meet Project Purpose of providing flood protection to agricultural land, rural transportation facilities, and rural residential structures.</li> <li>Does not provide water supply or water based recreation purposes.</li> <li>Addresses current risk of loss of human life resulting from dam failure through compliance with State regulations.</li> </ul>	<ul style="list-style-type: none"> <li>Benefit/Costs of the FWOP were evaluated only for comparison of Federal alternatives.</li> <li>Sponsor financial resources may limit timely implementation of FWOP alternative.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with state and local laws, regulations, and policies.</li> </ul>	Yes
<b>Rehabilitation to a High Hazard Dam/NED Alternative</b>	<ul style="list-style-type: none"> <li>Technically reliable</li> <li>Meets Project Purpose and Need</li> <li>Accounts for planned effects including NED, EQ, and OSE.</li> </ul>	<ul style="list-style-type: none"> <li>Meets Project Purpose by providing flood protection, water supply and water based recreation.</li> <li>Minimizes risk of loss of human life resulting from dam failure.</li> </ul>	<ul style="list-style-type: none"> <li>Most cost-effective Federal alternative.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with state and local laws, regulations, and policies.</li> </ul>	Yes
<b>Federal Decommissioning of the Hibernia Dam</b>	<ul style="list-style-type: none"> <li>Does not meet Project Purpose and Need because removing the Dam eliminates benefits of flood control, water supply and recreation.</li> <li>Does not account for all EQ effects due to reduced water quality from loss of existing sedimentation trapping and storage capacity.</li> <li>NED Account was not evaluated.</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide flood protection to agricultural land, rural transportation facilities, and rural residential structures.</li> <li>Does not provide water supply or water based recreation purposes.</li> <li>Results in increased flooding and sedimentation.</li> <li>Addresses current risk of loss of human life resulting from dam failure.</li> <li>Reconnects the stream.</li> <li>Reduces future operation and maintenance costs.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed planning was not conducted because alternative does not meet the purpose and need for flood protection, water supply and water-based recreation.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with state and local laws, regulations, and policies.</li> </ul>	No
<b>Federal Decommissioning of Hibernia Dam with Nonstructural and other measures</b>	<ul style="list-style-type: none"> <li>Meets Project Purpose and Need.</li> <li>Does not account for all EQ effects due to reduced water quality from loss of existing sedimentation trapping and storage capacity.</li> <li>NED Account was not evaluated.</li> </ul>	<ul style="list-style-type: none"> <li>Meets Project Purpose.</li> <li>Results in increased flooding and sedimentation.</li> <li>Addresses current risk of loss of human life resulting from dam failure.</li> <li>Reconnects the stream.</li> <li>Reduces future operation and maintenance costs.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed planning was not conducted due to the exorbitant cost of the alternative.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with state and local laws, regulations, and policies.</li> </ul>	No
<b>Acquisition or Relocation of At-Risk Structures</b>	<ul style="list-style-type: none"> <li>Technically reliable and provides for all accounts.</li> <li>NED, EQ, and OSE Accounts were not evaluated.</li> </ul>	<ul style="list-style-type: none"> <li>Meets Project Purpose.</li> <li>Minimizes risk of loss of human life resulting from dam failure.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed planning was not conducted due to the exorbitant cost of the alternative.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with local laws, regulations, and policies.</li> <li>Requires special restrictions on future development in breach inundation area.</li> </ul>	No
<b>Other Nonstructural Measures (floodproofing)</b>	<ul style="list-style-type: none"> <li>Technically reliable and provides for all accounts.</li> <li>NED, EQ, and OSE Accounts were not evaluated.</li> </ul>	<ul style="list-style-type: none"> <li>Meets Project Purpose.</li> </ul>	<ul style="list-style-type: none"> <li>Detailed planning was not conducted due to the exorbitant cost of the alternative.</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with local laws, regulations, and policies.</li> <li>Requires special restrictions on future development in breach inundation area</li> </ul>	No

<sup>1</sup> Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Section V. — Alternative Plans - 1.6.1 (c)

## 4.2 SPONSOR'S RATIONALE FOR CONDITIONS OF FUTURE WITHOUT PROJECT

Hibernia Dam, designed and constructed as a High Hazard Class dam, does not meet current dam design and safety criteria for High Hazard Class dams.

Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering (PADEP) will likely issue an administrative order requiring that the Sponsor upgrade the Dam to current state standards; remove and/or relocate the hazards; or remove the hazard by removing the storage function of the reservoir. If the Sponsor does not comply with the administrative order, PADEP would likely breach the structure to remove the storage functions and bill the Sponsor for the work.

An evaluation of the Sponsor's options for meeting a PADEP administrative order, in the absence of NRCS technical and financial assistance, indicated that the likely Sponsor response would be to remove the storage function of the reservoir by constructing a breach, as directed by PADEP.

## 4.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

***Decommissioning of Hibernia Dam.*** The Decommissioning Alternative was evaluated to include the removal of the entire Hibernia Dam, removal of the principal spillway structure, release of the impoundment (Chambers Lake), and stabilization/restoration of stream and 100-year floodplain functions.

Using the historical pre-Hibernia Dam aerial images, the Project Team estimated 8,720 linear feet of the stream channel and floodplain restoration could be required. However, additional hydraulic analysis would have to be performed during the design stage to determine the most adequate stream channel and geometry and to delineate the new 100-year floodplain downstream of the site. The stream channel would be approximately 25 feet wide, to reflect the natural channel width just upstream of the existing impoundment. The associated floodplain would be approximately 650 feet wide, and would merge upstream with the existing Zone AE 100-year floodplain. Other tributaries also merge within Chambers Lake; therefore, restoration of smaller tributary channels was included in the conceptual design in order to protect the integrity of the restored main channel. Based on the Guidelines for Natural Stream Channel Design for Pennsylvania Waterways, stream restoration would incur construction costs up to \$130 per linear foot of stream restoration. This assumes no constraints to constructing the new channel, and readily available materials are nearby. The areas of the impoundment outside of the floodplain would also require additional stabilization against erosion from runoff.

The Decommissioning Alternative would eliminate flood storage and flood protection provided by the dam, which would expose downstream properties to an increased risk of flooding, property damage, and loss of life. As a result, the Decommissioning Alternative alone would not meet the objective to maintain the downstream flood damage reductions provided by the existing project. The Decommissioning Alternative was eliminated from the detailed study because it does not meet the Project Purpose and Need of maintaining flood damage reduction, water supply and water based recreation.

After decommissioning, there is no impounded water or sediment storage provided by the dam. The principal spillway system would be removed and disposed of in a suitable manner. If the dam was decommissioned, it would cause the following impacts:

- ***Periodic Flooding, Sedimentation, and Other Damage***  
The existing dam provides sediment storage capacity, flood protection and flood-damage reduction to landowners, residents, motorists, and others using the Project benefit area. Without the Dam, periodic flood events would result in flood damages, sedimentation damage and other associated damages at or in excess of pre-Project levels.

- ***Increased Flood Zone***

The existing downstream structures are currently protected from damage resulting from the 100-year storm events because the presence of the dam regulates the release of the water. Decommissioning induces flooding downstream. NRCS requires that induced damages be mitigated. Consequently, damages to the roads, bridges, utilities, and other structures must be mitigated.

The cost for dam decommissioning is approximately \$8,113,000. The average annual flood benefits lost with implementation of the Decommissioning alternative are \$188,700 as described in Table 5. Additionally, the average annual non-flood benefits lost with implementation of the Decommissioning Alternative, including municipal water supply and recreation, are \$2,662,700 as described in Table 5A. The additional cost for providing these benefits in the absence of the Hibernia Dam (PA-436F) was not determined since the alternative is being eliminated from detailed study due to failure to meet the Project Purpose and Need.

***Decommissioning with Nonstructural and Other Measures.*** To meet Project Purpose and Need, the Decommissioning Alternative would have to be supplemented by other measures such as acquisition or relocation of structures located within the 100-year floodplain and other measures to replace the loss of water supply capacity and public water-based recreation. Based on the evaluations of flood proofing and relocation/acquisition of residential structures, an additional cost estimate of \$31,796,000 for relocation of 197 structures located within the existing 100-year floodplain is included in the decommissioning cost estimate.

The cost associated with Decommissioning along with the necessary costs of nonstructural flood damage reduction measures is estimated to be over \$40,000,000 or nearly seventeen (17) times the cost of rehabilitating the dam to meet NRCS High Hazard Class dam standards. Additional costs would be incurred to replace the lost municipal water supply and recreation benefits provided by the dam. Decommissioning with Nonstructural and Other Measures was eliminated from detailed study due to exorbitant costs and social disruptions caused by this alternative.

***Acquisition or Relocation of At-Risk Structures.*** This alternative removes the downstream hazard and allows the Hibernia Dam to be reclassified as a Low Hazard Class dam. Land use restrictions would need to be implemented to prevent future upgrades to High Hazard Class dam due to downstream development within the breach inundation area. The threat to human life from sudden dam failure would be reduced by relocating the residential and commercial structures and raising and/or relocating the roadways within the potential breach inundation.

The cost for acquisition or relocation of at risk structures within the dam breach inundation zone of Hibernia Dam was evaluated. Per the 2010 Emergency Action Plan (EAP) provided by CCWRA, there are 600 residences, 45 businesses, 3 schools, 1 nursing home, and 1 child care center within the dam breach inundation zone of Hibernia Dam.

Based on available data from the United States Census Bureau, the median value of owner-occupied housing units for years 2007-2011 in the City of Coatesville, PA is approximately \$141,400. The City of Coatesville is located within the Hibernia Dam breach inundation zone and, therefore, the median value was used to provide a conservative cost estimate for this planning level evaluation.

The estimated cost to purchase the 600 residences at risk in the downstream breach inundation zone is \$84,840,000. Additional cost would be incurred for demolition of existing houses and restoration of the site (i.e., filling in a basement, grading, and landscaping, and disconnection and capping of utility lines). The costs for demolition vary greatly; however, an estimate of \$20,000 per house based on average demolition prices in Bucks County (NRCS Pennsylvania State Office email communication). The total cost for the Acquisition or Relocation of At-Risk Structures Alternative is approximately \$96,840,000.

This cost is tens of millions of dollars more than other alternatives under consideration even without including costs for purchasing and relocating 45 businesses, 3 schools, 1 nursing home, and 1 child care center also located in the breach inundation zone or the additional costs incurred to replace the lost water supply and recreation benefits provided by the dam. The cost of acquisition of residential structures alone is not economically feasible and, therefore, costs for additional measures were not provided due to the complexity associated with estimation of these costs. The excessive cost of this alternative and social disruption caused by this approach is considered unreasonable. Therefore, the Acquisition or Relocation of At-Risk Structures Alternative was eliminated from detailed study.

**Other Non-Structural Measures (Floodproofing of At-Risk Structures).** The Project Team considered installation of a levee and floodwall system downstream from the dam. 327 residences and the Coatesville Wastewater Treatment Plant could potentially be protected by a total of 36,450 linear feet of levee or floodwall. Per the December 2009 FEMA Guidelines, the approximate cost for a construction of a 6-ft high levee is \$197 per linear foot. For this estimate, the 30 businesses, 3 schools, and 1 nursing home, and 1 child care center were also assumed to be protected by construction of a levee system. Additionally, implementation of this floodproofing alternative would include the cost of closure structures, land acquisition, permitting/wetland mitigation, or long-term operation and maintenance costs.

The total cost for the Other Non-Structural Measures (Floodproofing of At-Risk Structures) Alternative is greater than \$89,000,000. The excessive cost of this alternative and social disruption caused by this approach is considered unreasonable. Therefore, the Floodproofing of At-Risk Structures Alternative was eliminated from detailed study.

**Variations of Rehabilitation Alternative.** The following rehabilitation alternatives were considered and eliminated from detailed evaluation in consultation with CCWRA and based on effectiveness, efficiency, constructability and compatibility with the purpose and need for the Project.

- Remove sediment from the reservoir to provide an additional 50 years of sediment storage capacity.
- Raise the dam crest, auxiliary spillway crest and principal spillway crest to provide additional sediment storage capacity.
- Regrade the berm gutter to drain toward the abutments and install drain trench filled with drainfill wrapped in geotextile to address the standing water on the berm gutter.
- Install a filtered toe between the impact basin and the existing rock toe to address the minimum factor of safety for embankment stability.
- Install a French Drain to address the standing water on the berm gutter.
- Grout the "window" of untreated foundation soils beneath the dam.
- Install a fuse plug auxiliary spillway to provided additional detention capacity and reduce the frequency of auxiliary spillway discharge.
- Increase the height of the embankment by installing additional fill, PVC sheet piling or a parapet wall to provide additional freeboard and prevent dam overtopping during the Probable Maximum Precipitation event.
- Install a labyrinth weir to increase the effective width of the auxiliary spillway.

#### 4.4 DESCRIPTION OF ALTERNATIVE PLANS

**Future without Project.** The Future without Project condition is the baseline from which all other alternatives are measured. It reflects the most likely future conditions expected to exist over the life of the Project without the potential federal funding identified in this plan.

The Sponsors have indicated that a minimum level breach of the dam, such as the removal of a portion of the earthen embankment, as directed by PADEP, would be the Future Without Project

approach conducted by CCWRA. See Figure C-1 – Approximate Breach Inundation Map in Appendix C.

PADEP has implemented a simplified approval process for dam removals; however, the proposed breach plan “must essentially restore the stream to its natural, free-flowing state through the impoundment area and the footprint area of the dam.” In addition, PADEP requires the breached dam to pass the 100-year flood without increasing flood elevations more than one foot behind the remaining structure. For the purposes of this planning study, pre-construction drawings of existing conditions were used to determine the pre-construction bank-to-bank stream width of approximately 25 feet. The existing embankment would be partially removed. However, due to the height of the dam and the need for a stable slope the final breach width at top of dam would be approximately 500 feet. Additional hydraulic modeling would be required to determine the increase in flood elevations behind the remaining structure. The total installation cost of the Future Without Project condition is estimated to be \$2,835,000. The average annual value of the lost benefits resulting from implementing the Future Without Project condition would be \$2,851,400 annually.

If Hibernia Dam was breached by the sponsors, it would cause the following impacts:

- *Periodic Flooding, Sedimentation, and Other Damage*  
The existing dam provides sediment storage capacity, flood protection and flood-damage reduction to landowners, residents, motorists, and others using the Project benefit area. Without the Dam, periodic flood events would result in increased flood damages, sedimentation damage and other associated damages at or in excess of pre-Project levels.
- *Increased Flood Zone*  
The existing downstream structures are currently protected from damage resulting from the 100-year storm events because the presence of the dam regulates the release of the water. The Future Without Project condition induces flooding downstream.

**Rehabilitation to High Hazard Class Dam.** The Hibernia Dam would be rehabilitated to meet current NRCS and PADEP High Hazard Class dam design and safety criteria. The service life would be extended an additional 50 years. See the Project Site Map in Appendix B.

Rehabilitation would require raising the control section of the auxiliary spillway to elevation 588.23 feet MSL and widening the auxiliary spillway to 260 feet. To meet the NRCS design criteria for earthen spillways, the auxiliary spillway should provide for uniform, consistent flow. To accomplish this criterion, a flow splitter dike would have to be constructed to divide the spillway into bays of less than 200 feet and the extent of this splitter dike would be confirmed during design. In addition, a concrete cutoff wall would be constructed along the upstream edge of the control section and along the left side of the exit channel to prevent head cut erosion from undermining the earthen embankment and breaching the spillway crest. The cutoff wall will be extended as needed based on the foundation of the widened control section.

The Rehabilitation Alternative would also include a filtered toe being installed between the impact basin and the existing rock toe, regrading of the berm on the downstream face of the dam to eliminate the ponding of water, and assigning surplus dam storage capacity to sediment storage capacity in order to provide adequate sediment storage capacity for the service life of the dam.

No drawdown of the lake will be required to construct the planned rehabilitation measures. Trees will be planted to replace 0.6 acres of trees removed to widen the auxiliary spillway. All needed measures will be taken to mitigate any adverse impacts during construction and may include timing of the work, sediment controls such as seeding, mulching and silt fences and wetting construction areas to reduce dust.

The total estimated cost of this alternative is \$2,418,000 resulting in an average annual cost of \$202,800. The average annual benefit of this alternative is \$2,977,700.

Rehabilitation is a feasible alternative due to its low cost compared to the other alternatives and limited disturbance to surrounding land and communities.

Rehabilitation to High Hazard Class Dam is the National Economic Development (NED) Alternative and is also the Preferred Alternative for the following reasons:

- It fulfills the Project Purpose and Need, which were defined by the Sponsors and public.
- It has positive impacts on human resources and minimal impacts on natural resources.
- It has the highest benefit to cost ratio of the federally-assisted alternatives considered.
- It maximizes net economic benefits consistent with protecting the nation's environment.

Detailed information for the Rehabilitation to a High Hazard Class Dam Alternative is provided in Table 4-2

**Table 4-2**  
**Rehabilitation of Hibernia Dam to Current High Hazard Class Dam Criteria**

Project Feature	Original As-Built Conditions	Rehabilitation to Current High Hazard Dam
Principal Spillway Crest Elevation	580.00 feet	580.00 feet
Principal Spillway Conduit	36-inch diameter RCP	36-inch diameter RCP
Auxiliary Spillway Crest Elevation	587.53 feet	588.23 feet
Auxiliary Spillway Bottom Width	200 feet	260 feet
Top of Dam Elevation	596.50 feet	596.50 feet

November 2013

#### 4.5 SUMMARY AND COMPARISON OF ALTERNATIVE PLANS

Table 2-1 identifies the relevant resource concerns for the Project. Table 4-3 summarizes the project measures. Table 4-4 compares project alternative costs. The NRCS-CPA-52 in Figure 5-1 compares the alternatives with respect to the relevant resource concerns and NRCS planning requirements.

**Table 4-3**  
**Summary of Alternative Plans Considered for Detailed Study**

Alternative	
No Action/Future Without Project (Sponsor Breach)	
<ul style="list-style-type: none"> <li>• Controlled breach of dam by Sponsor</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain the axis of the Dam at the present location.</li> </ul>
<ul style="list-style-type: none"> <li>• Excavate through the main embankments</li> </ul>	<ul style="list-style-type: none"> <li>• Raise the auxiliary spillway control section.</li> </ul>
<ul style="list-style-type: none"> <li>• Construct gutter berms to reduce slope length on excavated embankment notch.</li> </ul>	<ul style="list-style-type: none"> <li>• Install a filtered toe between the impact basin and the existing rock toe.</li> </ul>
<ul style="list-style-type: none"> <li>• Provide riprap slope protection and stream bed erosion control.</li> </ul>	
<ul style="list-style-type: none"> <li>• Use existing auxiliary spillway for onsite disposal area for excess excavated material.</li> </ul>	<ul style="list-style-type: none"> <li>• Reallocate water supply storage to provide additional sediment storage capacity.</li> <li>• Plant trees.</li> </ul>

November 2013

#### 4.6 NATIONAL ECONOMIC DEVELOPMENT (NED) ALTERNATIVE

The NED Alternative is the federally-assisted alternative with the greatest net benefits for an existing dam that (a) does not meet the current safety and performance standards, and (b) would put human life at risk if it catastrophically failed.

**Table 4-4**  
**National Economic Development Account Comparison of Alternative Plans**

Item	Alternative <sup>1</sup>	
	No Action/Future Without Project (Sponsor Breach)	Rehabilitate to NRCS High Hazard Class Dam
Total Investment	\$ 2,835,000	\$ 2,418,000
P.L. 83-566 Funds	\$ -	\$ 2,056,000
Other Funds	\$ 2,835,000	\$ 362,000
Difference in cost from Future Without Project	\$ -	\$ (417,000)
Average Annual Benefits <sup>2</sup>	\$ -	\$ 2,977,700
Average Annual Costs <sup>2</sup>	\$ 126,300	\$ 202,800
Net Beneficial	\$ (126,300)	\$ 2,774,900

November-2013

<sup>1</sup> Price base 2013.

<sup>2</sup> Amortized over 50 years at a discount rate of 3.75 percent. Based on total economic benefits and costs of alternatives as compared to existing conditions.

## 5.0 ENVIRONMENTAL CONSEQUENCES

### 5.1 NRCS-CPA-52

The NRCS-CPA-52 displayed in Figure 5-1 documents the benchmark conditions and environmental consequences of the project alternatives considered for detailed study.

### 5.2 CATEGORICAL EXCLUSION

Consistent with Environmental Evaluation Worksheet (NRCS-CPA-52), Pennsylvania Supplemental Instructions, the planned activities are categorically excluded actions. The CEQ regulations at 40 CFR § 1508.4 defines “categorical exclusion” to mean “a category of actions that does not individually or cumulatively have a significant effect on the human environment...” NRCS’ regulation that supplements and further implements NEPA requires that the Responsible Federal Official (RFO) must determine whether the proposed action fits within a categorical exclusion listed in the agency’s implementing NEPA regulations (see 7 CFR § 650.6(a)), and the proposed action does not involve any extraordinary circumstances (see 7 CFR § 650.6(b)).

If the entire planned action is listed as one or more of the NRCS categorically excluded activities and there are no extraordinary circumstances identified in the NRCS-CPA-52, Section O, then the activity is categorically excluded. The following categorically excluded activities Number 14, 15, and 16 apply to the actions described in this Plan:

15. Repairing or improving (deepening/widening/armoring) existing auxiliary/emergency spillways associated with dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the dam or abutment areas, and no major change in reservoir or downstream operation will result;
16. Repairing embankment slope failures on structures, originally built to NRCS standards, where the work is confined to the embankment or abutment areas;

For the categorical exclusions to apply, the proposed action must:

- Be designed to mitigate soil erosion, sedimentation, and downstream flooding;
- Require disturbed areas to be vegetated with adapted species that are neither invasive nor noxious;
- Be based on current Federal principals of natural stream dynamics and processes, such as those presented in the Federal Interagency Stream Corridor Restoration Working Group document, “Stream Corridor Restoration, Principles, Processes, and Practices” ([http://www.nrcs.usda.gov/technical/stream\\_restoration/](http://www.nrcs.usda.gov/technical/stream_restoration/));
- Incorporate the applicable NRCS conservation practice standards as found in the Field Office Technical Guide (<http://www.nrcs.usda.gov/technical/efotg/>);
- Not require substantial dredging, excavation, or placement of fill; and
- Not involve a significant risk of exposure to toxic or hazardous substances.

**Figure 5-1**  
**NRCS-CPA-52**  
 National Environmental Compliance Handbook

U.S. Department of Agriculture Natural Resources Conservation Service ENVIRONMENTAL EVALUATION WORKSHEET		NRCS-CPA-52 6/2010		<b>A. Client Name:</b> Chester County Water Resources Authority	
		<b>B. Conservation Plan ID # (as applicable):</b>			
		<b>Program Authority (optional):</b>		Section 14 of PL 83-566, the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Parts 1001-1008, 1010, 1012).	
<b>D. Client's Objective(s) (purpose):</b> The purpose of the project includes maintaining or improving the current level of flood damage reduction for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features; maintaining the existing water supply availability; maintaining or improving the recreational and habitat values of Chambers Lake and adjacent riparian lands; and complying with applicable design, performance and safety criteria for High Hazard dams.  The primary objectives for Hibernia Dam (PA-436F) are to meet applicable NRCS and Commonwealth of Pennsylvania standards for public health and safety, including meeting the NRCS High Hazard Dam criteria; provide public water supply; and provide public recreation.		<b>C. Identification # (farm, tract, field #, etc as required):</b>  Hibernia Dam (PA-436F)			
<b>E. Need for Action:</b> The need includes to continue providing flood damage reduction downstream from the dam and address applicable NRCS and Commonwealth of Pennsylvania standards and design criteria for public health and safety to reduce the risk of loss of human life; continue providing up to 4 million gallons per day of source water for public water supplies; continue providing water for fire protection; and continue supporting and improving the recreational uses and aquatic and terrestrial wildlife habitat directly dependent upon Chambers Lake and its surrounding riparian lands.		<b>G. Alternatives</b>			
		<b>No Action</b> ✓ if RMS		<b>Alternative 1</b> ✓ if RMS	
		No Federal Action/Future Without Project (FWOP) - A Sponsor controlled breach of the dam, such as the removal of a portion of the earthen embankment, as directed by the Pennsylvania Department of Environmental Protection (PADEP).		Rehabilitate the Dam to current NRCS High Hazard Dam design criteria, and extend the design life an additional 50 years.	
<b>Resource Concerns</b>					
In Section "F" below, analyze, record, and address concerns identified through the Resources Inventory process. (See FOTG Section III - Resource Quality Criteria for guidance).					
<b>F. Resource Concerns and Existing / Benchmark Conditions</b> (Analyze and record the existing/benchmark conditions for each identified concern)		<b>H. Effects of Alternatives</b>			
		<b>No Action</b>		<b>Alternative 1</b>	
		Amount, Status, Description (short and long term)		Amount, Status, Description (short and long term)	
		✓ if does NOT meet QC		✓ if does NOT meet QC	
		Amount, Status, Description (short and long term)		Amount, Status, Description (short and long term)	
		✓ if does NOT meet QC		✓ if does NOT meet QC	
<b>SOIL</b>					
<b>Erosion (Sheet and Rill)</b>  No significant sheet and rill erosion is evident upstream or downstream from the Dam. Significant sediment accumulations have been observed in the reservoir.		No change upstream. Short-term increase in suspended sediment and turbidity downstream during construction, but proper controls will minimize erosion. With the dam removed, sediment loading will increase downstream at a rate of 1.594 acre-feet/year.		No change upstream. Short-term increase in suspended sediment and turbidity downstream during construction, but proper controls will minimize erosion. Sediment pool will continue to trap 1.594 acre-feet/year of sediment.	
		NOT meet		NOT meet	
		QC		QC	
		<input type="checkbox"/>		<input type="checkbox"/>	
<b>Erosion (Ephemeral Gully)</b> N/A		N/A		N/A	
		NOT meet		NOT meet	
		<input type="checkbox"/>		<input type="checkbox"/>	

National Environmental Compliance Handbook

<b>Erosion (Streambank)</b> N/A	N/A	NOT meet	N/A	NOT meet		NOT meet
		QC		QC		QC
<b>Condition (Organic Matter)</b> N/A	N/A	NOT meet	N/A	NOT meet		NOT meet
		QC		QC		QC
<b>Condition (Compaction)</b> N/A	N/A	NOT meet	N/A	NOT meet		NOT meet
		QC		QC		QC
<b>F. Resource Concerns and Existing / Benchmark Conditions</b> (Analyze and record the existing/benchmark conditions for each identified concern)	<b>H. Effects of Alternatives</b>					
	<b>No Action</b>		<b>Alternative 1</b>		<b>Alternative 2</b>	
	Amount, Status, Description (short and long term)		Amount, Status, Description (short and long term)	✓ if does NOT meet QC	Amount, Status, Description (short and long term)	✓ if does NOT meet QC
<b>WATER</b>						
<b>Quantity (Excessive Subsurface Water)</b> The finger drains do not have sufficient capacity for the additional water moving through the incomplete foundation cutoff. Left unmanaged, the excessive subsurface water could create a dam safety problem that would impact the downstream community.	Removes potential hazard.	NOT meet	Fixed.	NOT meet		NOT meet
		QC		QC		QC
<b>Quantity (Excessive Seepage)</b> The volume of seepage is minor with respect to impacting the normal pool elevation and posing a risk to the downstream community.	Removes potential hazard.	NOT meet	Fixed.	NOT meet		NOT meet
		QC		QC		QC
<b>Quantity (Excessive Runoff, Flooding, or Ponding)</b> The 1% annual occurrence (100-year) flow rate from Birch Run upstream from Hibernia dam was detained with construction of the Dam. Annual average flood damage prevention from Hibernia Dam (PA-436F) is \$188,700.	Residential, commercial and transportation resources will be a greater risk of flood damage. Average annual flood damage reduction benefits of \$188,700 will be lost.	NOT meet	Maintain flood damage reduction downstream from the Hibernia Dam (PA-436F) with an average annual value estimated at \$188,700.	NOT meet		NOT meet
		QC		QC		QC
<b>Quality (Groundwater: Harmful Levels of Pesticides)</b> There are no identified pesticide problems in the ground water.	No Effect.	NOT meet	No Effect.	NOT meet		NOT meet
		QC		QC		QC
<b>Quality (Surface Water: Harmful Levels of Pesticides)</b> No identified problems.	No Effect.	NOT meet	No Effect.	NOT meet		NOT meet
		QC		QC		QC
<b>Quality (Groundwater: Excessive Nutrients and Organics)</b> No identified problems.	No Effect.	NOT meet	No Effect.	NOT meet		NOT meet
		QC		QC		QC

National Environmental Compliance Handbook

<p><b>Quality (Surface Water: Excessive Nutrients and Organics)</b></p> <p>Birch Run is not listed as impaired.</p>	<p>Increased downstream impacts to water quality by reducing the detention time for runoff upstream from Hibernia Dam (PA-436F). Increased transport of nutrients adsorbed to suspended sediments.</p>	<input type="checkbox"/> NOT meet  QC	<p>Maintain current level of surface water quality downstream from Hibernia Dam (PA-436F).</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC
<p><b>Quality (Surface Water: Excessive Susp. Sedmt &amp; Turbidity)</b></p> <p>Birch Run is not listed as impaired.</p>	<p>The 1.594 acre-feet/year will be delivered downstream.</p>	<input type="checkbox"/> NOT meet  QC	<p>Temporary increases during reconstruction. After reconstruction is completed, sediment pool will continue to trap 1.594 acre-feet/year.</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC
<p><b>Quality (Surface Water: Harmful Temperatures)</b></p> <p>USGS operated a water quality gage (01480399) that monitored the water temperature in the impoundment. The USGS gage did not record any temperatures that were outside of the WWF acceptable levels.</p>	<p>The impoundment (Chambers Lake) created by Hibernia Dam is classified as a Warm Water Fishery (WWF) and is not listed as impaired by PADEP. Water temperature is monitored at the USGS gage below the dam, gage 01480400 Birch Run near Wagontown. The No Action Alternative will not result in water temperatures outside of the WWF acceptable levels.</p>	<input type="checkbox"/> NOT meet  QC	<p>No Effect.</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC
<p><b>Quality (Surface Water: Harmful Levels of Pathogens)</b></p> <p>No identified problems.</p>	<p>Increased potential of delivering bacteria downstream with removal of dam.</p>	<input type="checkbox"/> NOT meet  QC	<p>No Effect.</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC
<p><b>Quality (Groundwater: Harmful Levels of Pathogens)</b></p> <p>No identified problems.</p>	<p>No Effect.</p>	<input type="checkbox"/> NOT meet  QC	<p>No Effect.</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC
<p><b>F. Resource Concerns and Existing / Benchmark Conditions</b> (Analyze and record the existing/benchmark conditions for each identified concern)</p>	<p><b>H. (continued)</b></p>				
	<p><i>No Action</i></p> <p>Amount, Status, Description (short and long term)</p>	<p>✓ if does NOT meet QC</p>	<p><i>Alternative 1</i></p> <p>Amount, Status, Description (short and long term)</p>	<p>✓ if does NOT meet QC</p>	<p><i>Alternative 2</i></p> <p>Amount, Status, Description (short and long term)</p>
<p><b>AIR</b></p>					
<p>Pennsylvania air quality nonattainment counties can be found at:                  PM 2.5: <a href="http://www.epa.gov/reg3air/airquality/pm25nonattareas.htm">http://www.epa.gov/reg3air/airquality/pm25nonattareas.htm</a>                  Ozone: <a href="http://www.epa.gov/reg3air/airquality/ozone8hrmaintareas_2.htm">http://www.epa.gov/reg3air/airquality/ozone8hrmaintareas_2.htm</a></p>					
<p><b>Quality [Particulate Matter &lt; 2.5µm diameter ('PM2.5')]</b></p> <p>Chester County is in the Philadelphia-Wilmington Nonattainment area for PM2.5</p>	<p>Minimal, short term, highly localized emissions of PM 2.5 may result from the use of diesel equipment and earth disturbances may cause localized increased in dust and coarse, airborne particulate matter that will be controlled using dust and erosion control BMPs.</p>	<input type="checkbox"/> NOT meet  QC	<p>Minimal, short term, highly localized emissions of PM 2.5 may result from the use of diesel equipment and earth disturbances may cause localized increased in dust and coarse, airborne particulate matter that will be controlled using dust and erosion control BMPs.</p>	<input type="checkbox"/> NOT meet  QC	<input type="checkbox"/> NOT meet  QC

National Environmental Compliance Handbook

<b>Quality (Excessive Ozone)</b>  Chester County is in a moderate excessive ozone zone according to the EPA	No Effect.	<input type="checkbox"/> NOT meet QC	No Effect.	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC
<b>Quality (Chemical Drift)</b>  There are no known chemical plants or sources within the watershed that would cause any chemical drift issues.	No Effect.	<input type="checkbox"/> meet QC	No Effect.	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC
<b>Quality (Objectionable Odors)</b>  There are no known sources of objectionable odors from Hibernia Dam.	No Effect.	<input type="checkbox"/> NOT meet QC	No Effect.	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC
<b>F. Resource Concerns and Existing / Benchmark Conditions</b> (Analyze and record the existing/benchmark conditions for each identified concern)	<b>H. (continued)</b>					
	<b>No Action</b> <input type="checkbox"/>		<b>Alternative 1</b> <input type="checkbox"/>		<b>Alternative 2</b> <input type="checkbox"/>	
	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC
<b>PLANTS</b>						
<b>Condition (Noxious and Invasive Plants)</b>  There are several species of invasive vegetation around Chambers Lake and Hibernia Dam that are common in southeastern Pennsylvania. These include phragmites, Russian olive and multi-flora rose among others.	Minor occurrences following construction.	<input type="checkbox"/> NOT meet QC	Will be minimized with replanting of adapted species and management of noxious plants.	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC
<b>F. Resource Concerns and Existing / Benchmark Conditions</b> (Analyze and record the existing/benchmark conditions for each identified concern)	<b>H. (continued)</b>					
	<b>No Action</b> <input type="checkbox"/>		<b>Alternative 1</b> <input type="checkbox"/>		<b>Alternative 2</b> <input type="checkbox"/>	
	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC	Amount, Status, Description (short and long term)	<input type="checkbox"/> if does NOT meet QC
<b>ANIMALS</b>						
<b>Fish and wildlife (Inadequate Cover/Shelter)</b>  Chambers Lake (Dam Impoundment) is a high value habitat for aquatic, wetland and terrestrial species. The lake is stocked with warm-water species.	Loss of high value habitat, Warm Water Fishery and warm water aquatic species. Degraded habitat for wetland and terrestrial species that depend on the lake.	<input type="checkbox"/> NOT meet QC	Maintain high value habitats, Warm Water Fishery and warm water aquatic species.	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC
<b>Domestic animals (Inadequate Quantities and Qual. of Feed &amp; Forage)</b>  N/A	N/A	<input type="checkbox"/> NOT meet QC	N/A	<input type="checkbox"/> NOT meet QC		<input type="checkbox"/> NOT meet QC

National Environmental Compliance Handbook

<b>Domestic animals (Inadequate Stock Water)</b> N/A	N/A	NOT met <input type="checkbox"/>	N/A	NOT met <input type="checkbox"/>	NOT met <input type="checkbox"/>
<b>HUMAN - Economic and Social Considerations</b>					
<b>Land Use</b> The land use in the watershed is predominantly agricultural and forested. Residential areas account for approximately 20% of the total watershed area. The contributing watershed consists of an estimated 28% agricultural and 41% forested land use. The remaining 10% of the land use in the upstream watershed includes commercial and institutional uses.	The breach area will change from introduced grass species to native riparian woodland, slightly increasing the woodland habitat.	<input type="checkbox"/>	Local municipality may require tree replacement planting to offset for 0.6 acres of woods removed as part of the auxiliary spillway being widen.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Public Health and Safety</b> Hibernia Dam is a High Hazard Dam. Does not meet current dam safety standards. The City of Coatesville has the greatest population density downstream of Hibernia Dam with a total population of 13,100. The dam reduces flooding downstream and in extreme events allows for more time for the evacuation of the population downstream.	Increased flooding of residential commercial and transportation facilities downstream from Hibernia Dam (PA-436F). Average annual flood damage reduction benefits of \$188,700 will be lost.		Maintain flood damage reduction downstream from the Hibernia Dam (PA-436F) with an average annual value estimated at \$188,700. Reduced risk to 1500 residents, 3 schools, and 45 businesses.		
<b>Labor</b> 2 full time staff needed to maintain the dam.	No staff needed.		Maintain 2 full time staff.		
<b>Management Level</b> Experienced and educated staff with assistance from hired consulting firm.	No future dam management needed.		Maintain experienced and educated staff with assistance from hired consulting firm.		
<b>Recreation</b> Hibernia County Park, where Hibernia Dam and Chambers Lake are located provides over 900 acres of recreational opportunities including fishing, boating, hiking, camping, and bicycling.	Water based recreation opportunities would be lost. Average annual recreation benefits of \$2,167,400 will be lost.		No Effect. Recreation benefits will remain.		
<b>Special Environmental Concerns: Environmental Laws, Executive Orders, policies, etc.</b>					
In Section "I" complete and attach applicable Environmental Procedures Guide Sheets for documentation. Items with a "●" may require a federal permit or consultation/coordination between the lead agency and another government agency. In these cases, effects may need to be determined in consultation with another agency. Planning and practice implementation may proceed for practices not involved in consultation.					
<b>I. Special Environmental Concerns</b> (Document compliance with Environmental Laws, Executive Orders, policies, etc.)	<b>J. Impacts to Special Environmental Concerns</b>				
	<b>No Action</b>		<b>Alternative 1</b>		<b>Alternative 2</b>
	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)	✓ if needs further action	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)	✓ if needs further action	Status and progress of compliance. (Complete and attach Guide Sheets as applicable)
● <u>Clean Air Act</u> Chester County is in the Philadelphia-Wilmington Nonattainment area.	Dust controls will be implemented during construction to minimize airborne Particulate Matter. Construction equipment will conform to requirements, if any, of the Pennsylvania State Implementation Plan for Clean Air Act compliance.		Dust controls will be implemented during construction to minimize airborne Particulate Matter. Construction equipment will conform to requirements, if any, of the Pennsylvania State Implementation Plan for Clean Air Act compliance.		

National Environmental Compliance Handbook

<p><b>•Clean Water Act / Waters of the U.S.</b>                  Watershed has U.S. EPA approved TMDLs for sediment, bacteria and nutrients. Birch Run is not listed as impaired.</p>	<p>No material will be filled or dredged within the bed and bank of a jurisdictional stream.</p>	<input type="checkbox"/>	<p>CCWRA will obtain necessary permits from PA DEP. NPDES permit will be needed; No section 404 permit needed.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>•Coastal Zone Management Areas</b>                  Not Applicable</p>	<p>N/A</p>	<input type="checkbox"/>	<p>N/A</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Coral Reefs</b>                  Not Applicable</p>	<p>N/A</p>	<input type="checkbox"/>	<p>N/A</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>•Cultural Resources / Historic Properties</b>                  No Cultural Resources are known to exist within the Project Area and confirmed by SHPO in April 2013.</p>	<p>No Effect.</p>	<input type="checkbox"/>	<p>No Effect.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>•Endangered and Threatened Species</b>                  No known impacts to threatened or endangered species and/or state special concern species and resources are within the project area. Potential bog turtle habitat identified by USFWS on 1/23/13 however, due to distance to a known site, size, and depth of muck, it was determined to be not bog turtle habitat.</p>	<p>No Effect.</p>	<input type="checkbox"/>	<p>No Effect.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Environmental Justice</b>                  The Hibernia Dam (PA-436F) provides flood protection to the City of Coatesville, which has a large percentage of households living below the poverty level.</p>	<p>The Hibernia Dam (PA-436F) provides flood protection to the City of Coatesville, which has 22.9 percent of households living below the poverty level.</p>	<input type="checkbox"/>	<p>No disproportionate adverse affects are anticipated to any ethnic, racial, or socioeconomically disadvantaged families or groups downstream of the dam.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>•Essential Fish Habitat</b>                  There are no Essential Fish Habitats in the Hibernia Dam Watershed</p>	<p>N/A</p>	<input type="checkbox"/>	<p>N/A</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Floodplain Management</b>                  Hibernia Dam is primarily a flood control dam that reduces the flooding effects downstream. The Floodplain was estimated through a detailed Hydrologic and Hydraulic Study and presented in the Chester County Flood Insurance Study, effective September 29, 2006.</p>	<p>Residential, commercial and transportation resources will be at greater risk of flood damage. Average annual flood damage reduction benefits of \$188,700 will be lost.</p>	<input type="checkbox"/>	<p>Maintain flood damage reduction benefits downstream from the Hibernia Dam (PA-436F) with an average annual value estimated at \$188,700.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Invasive Species</b>                  There are several species of invasive vegetation around Chambers Lake and Hibernia Dam that are common in southeastern Pennsylvania. These include phragmites, russian olive and multi-flora rose among others. At this time, these are not causing a problem for the management of the dam or lake.</p>	<p>Construction could potentially introduce invasive plant species. Will be minimized by planting adapted species.</p>	<input type="checkbox"/>	<p>Construction could potentially introduce invasive plant species. Will be minimized by planting adapted species.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>•Migratory Birds/Bald and Golden Eagle Protection Act</b>                  Habitat for native birds, including nesting sites exists in Hibernia Park.</p>	<p>Migratory birds and nesting activities could be temporarily disturbed during construction.</p>	<input type="checkbox"/>	<p>Migratory birds and nesting activities could be temporarily disturbed during construction.</p>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Prime and Unique Farmlands</b>                  According to the NRCS Farmland classification report 56.8% of the total watershed area is classified as prime farmland.</p>	<p>No Effect.</p>	<input type="checkbox"/>	<p>No Effect.</p>	<input type="checkbox"/>	<input type="checkbox"/>

National Environmental Compliance Handbook

<b>Riparian Area</b> The riparian area along the northern bank is heavily forested County Park land. The southern bank is managed with more of a meadow condition.		Decrease in shoreline riparian area with removal of storage function of dam.	<input type="checkbox"/>	No Effect.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Sole Source Aquifers</b> Chester County is not identified as a county that is at risk of contaminating sole source aquifers.		No Effect.	<input type="checkbox"/>	No Effect.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Wetlands</b> Construction of the dam included construction of 12+ acres of wetlands, including wetlands along the shoreline of Chambers Lake within the lake (6 acres of submerged wetland bench) and a 2+ acre wetland at the northwest edge of the lake. There are natural wetlands immediately downstream of the toe of dam. In addition to those wetlands, there are several terrestrial mitigation efforts completed on land immediately adjacent to the lake and dam.		There may be a change in site hydrology and change in the character of the 12 acres of wetlands created by the lake.	<input type="checkbox"/>	No Effect.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Wild and Scenic Rivers</b> Birch Run is neither a Federally-Listed nor State-Listed Wild and Scenic River.		No Effect.	<input type="checkbox"/>	No Effect.	<input type="checkbox"/>	<input type="checkbox"/>
<b>K. Other Agencies and Broad Public Concerns</b>		<i>No Action</i>		<i>Alternative 1</i>		<i>Alternative 2</i>
Easements, Permissions, Public Review, or Permits Required and Agencies Consulted.		NPDES Construction Permit, Stormwater Pollution Prevention Plan and PADEP review. <input type="checkbox"/>		NPDES Construction Permit, Stormwater Pollution Prevention Plan and PADEP review. <input type="checkbox"/>		<input type="checkbox"/>
<b>K. (continued) Other Agencies and Broad Public Concerns</b>		<i>No Action</i>		<i>Alternative 1</i>		<i>Alternative 2</i>
Cumulative Effects Narrative (Describe the cumulative impacts considered, including past, present and known future actions regardless of who performed the actions)		Residential, commercial and transportation resources will be a greater risk of flood damage. Average annual flood damage reduction benefits of \$188,700 will be lost. Increased downstream delivery of sediment, bacteria, loss of high value habitat, reduced shoreline riparian areas, and other effects listed previously in CPA-52.		No adverse cumulative environmental, socioeconomic, or infrastructural impacts are anticipated for the dam rehabilitation alternative.		
<b>L. Mitigation</b>		E&S and dust control measures will be utilized to minimize temporary effects.		E&S and dust control measures will be utilized to minimize temporary effects. 0.6 acres of forest resources removed will be replaced as per West Cain Township requirements.		
<b>M. Preferred Alternative</b>	√ preferred alternative			<b>PREFERRED ALTERNATIVE</b>		
	Supporting reason			Rehabilitation Alternative will meet Purpose and Need for Project and Maintain flood damage reduction downstream from the Hibernia Dam (PA-436F) with an average annual value estimated at \$188,700. This is the National Economic Development (NED) Alternative with net benefits of \$2,774,900 and a B:C ratio of 14.7 to 1. On 4/17/2013 the CCWRA Board approved this alternative.		

National Environmental Compliance Handbook

<b>N. Context</b> (Record context of alternatives analysis)	Local	Regional	National
The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.			
<b>O. Determination of Significance or Extraordinary Circumstances</b>			
<p><b>Intensity:</b> Refers to the severity of impact. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.</p> <p>If you answer <b>ANY</b> of the below questions "yes" then contact the State Environmental Liaison as there may be extraordinary circumstances and significance issues to consider and a site specific NEPA analysis may be required.</p>			
Yes	No		
X		● Is the preferred alternative expected to cause significant effects on public health or safety?	
X		● Is the preferred alternative expected to significantly effect unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?	
X		● Are the effects of the preferred alternative on the quality of the human environment likely to be highly controversial?	
X		● Does the preferred alternative have highly uncertain effects or involve unique or unknown risks on the human	
X		● Does the preferred alternative establish a precedent for future actions with significant impacts or represent a decision in principle about a future consideration?	
X		● Is the preferred alternative known or reasonably expected to have potentially significant environment impacts to the quality of the human environment either individually or cumulatively over time?	
X		● Will the preferred alternative likely have a significant adverse effect on ANY of the special environmental concerns? Use the Evaluation Procedure Guide Sheets to assist in this determination. This includes, but is not limited to, concerns such as cultural or historical resources, endangered and threatened species, environmental justice, wetlands, floodplains, coastal zones, coral reefs, essential fish habitat, wild and scenic rivers, clean air, riparian areas, natural areas, and invasive species.	
X		● Will the preferred alternative threaten a violation of Federal, State, or local law or requirements for the protection of the environment?	
<b>P. The information recorded above is based on the best available information:</b>			
In the case where a non-NRCS person (i.e. a TSP) assists with planning they are to sign the first signature block and then NRCS is to sign the second block as the responsible federal agency for the planning action.			
<input type="text"/> _____ Signature (TSP if applicable)		<input type="text"/> _____ Title	<input type="text"/> _____ Date
<input type="text"/> _____ Signature (NRCS)		<input type="text"/> _____ Title	<input type="text"/> _____ Date
<b>The following sections are to be completed by the Responsible Federal Official (RFO)</b>			
<b>Q. NEPA Compliance Finding (check one)</b>			
The preferred alternative:		Action required	
X	1) is <b>not a federal action</b> where the agency has control or responsibility.	Document in "R.1" below. No additional analysis is required	
X	2) is a federal action that is <b>categorically excluded</b> from further environmental analysis <b>and</b> there are no <b>extraordinary circumstances</b> .	Document in "R.2" below. No additional analysis is required	
X	3) is a federal action that has been <b>sufficiently analyzed</b> in an existing Agency state, regional, or national NEPA document <b>and</b> there are no predicted <b>significant adverse environmental effects or extraordinary circumstances</b> .	Document in "R.1" below. No additional analysis is required.	
X	4) is a federal action that has been sufficiently analyzed in another Federal agency's NEPA document (EA or EIS) that addresses the proposed NRCS action and its effects <b>and has been formally adopted by NRCS</b> . NRCS is required to prepare and publish the agency's own Finding of No Significant Impact for an EA or Record of Decision for an EIS when adopting another agency's EA or EIS document. <b>Note: This box is not applicable to FSA.</b>	Contact the State Environmental Liaison for list of NEPA documents formally adopted and available for tiering. Document in "R.1" below. No additional analysis is required	
X	5) is a federal action that has <b>NOT</b> been sufficiently analyzed or may involve predicted significant adverse environmental effects or extraordinary circumstances and may require an EA or EIS.	Contact the State Environmental Liaison. Further NEPA analysis required.	

National Environmental Compliance Handbook

R. Rationale Supporting the Finding		
R.1 Findings Documentation		
R.2 Applicable Categorical Exclusion(s) (more than one may apply)	14. Repairing or maintaining principal spillways and appurtenances associated with existing serviceable dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the existing footprint of the dam, and no major change in reservoir or downstream operations will result;	
	15. Repairing or improving (deepening/widening/armoring) existing auxiliary/emergency spillways associated with dams, originally constructed to NRCS standards, in order to meet current safety standards. Work will be confined to the dam or abutment areas, and no major change in reservoir or downstream operation will result;	
	16. Repairing embankment slope failures on structures, originally built to NRCS standards, where the work is confined to the embankment or abutment areas;	
<p><i>I have considered the effects of the alternatives on the Resource Concerns, Economic and Social Considerations, Special Environmental Concerns, and Extraordinary Circumstances as defined by Agency regulation and policy.</i></p>		
<p>S. Signature of Responsible Federal Official:</p>		
Signature	Title	Date
<b>Additional notes</b>		

## 6.0 CONSULTATION, COORDINATION AND PUBLIC PARTICIPATION

### 6.1 PUBLIC PARTICIPATION

NRCS completed an evaluation and estimated risk based profile of the Hibernia Dam in August 2010. The evaluation indicated the Risk Index was 17,580. NRCS reviewed the breach inundation zone downstream from the dam and determined that developments immediately downstream were subject to flooding during a breach of the dam. The evaluations indicated that the dam did not meet NRCS and Commonwealth of Pennsylvania Dam Safety requirements with respect to the current hazard classification and recommended modifications to meet current design criteria.

The Sponsor submitted a formal request for assistance to NRCS on September 15, 2010. The request for assistance listed concerns about compliance with current dam safety standards, including the function of the auxiliary spillway, principal spillway, foundation and embankment.

NRCS, CCWRA and the Project Team (listed in Table 9-1) conducted a project kickoff meeting at Chester County Water Resources Authority, 601 Westtown Road, Suite 260, West Chester, PA on November 14, 2011. Shortly after this meeting a Public Participation Plan was prepared to serve as a guide for carrying out the activities related to consultation, coordination and public participation. The planning effort was conducted with close coordination with the Pennsylvania Department of Environmental Protection's Bureau of Waterways Engineering Division of Dam Safety.

Public scoping open forums were conducted by CCWRA at monthly meetings. CCWRA received input, discussed problems and opportunities, and issued updates on progress. All CCWRA monthly meetings are open forums conducted in compliance with Commonwealth of Pennsylvania Sunshine Act which requires public agencies to hold certain meetings and hearings open to the public.

**April 17, 2013 – Project Team/NRCS.** The Project Team and NRCS held a meeting at the NRCS Field Office in West Chester, Pennsylvania. This provided instruction and guidance on the Project scope and the extent of activities required for developing the Supplemental Watershed Plan.

**April 17, 2013 – Public Forum.** The Project Team and NRCS attended the CCWRA monthly meeting and conducted an open forum to discuss the Project. The monthly meetings are advertised with public notice published in Chester County, Pennsylvania. The following topics were discussed:

- Problems and opportunities identified
- Sponsor objectives
- Alternatives considered
- Alternatives evaluated and comparison of effects

The Sponsor allowed public input at all monthly meetings prior to and during the planning process. The Draft Supplemental Watershed Work Plan No. 7 and Environmental Evaluation for Hibernia Dam (PA-436F) of the Brandywine Creek Watershed was available upon request.

## 6.2 AGENCY CONSULTATION

The following agencies and elected officials received the Project Fact Sheet and later the Abstract of the Supplemental Watershed Plan No. 7 and Environmental Evaluation for Hibernia Dam of the Brandywine Creek Watershed.

- Chester County Conservation District
- PADEP, Bureau of Waterways Engineering,
- PA Fish and Boat Commission, Bureau of Director
- Pennsylvania Department of General Services
- New Castle Conservation District
- West Caln Township
- Chester County Planning Commission
- Chester County Department of Emergency
- Delaware River Basin Commission
- Pennsylvania Governor's Policy Office
- Pennsylvania American Water Co.
- Honorable Robert P. Casey
- Honorable Patrick Toomey
- Honorable James Gerlach
- Honorable Joseph R. Pitts
- Honorable Patrick Meehan
- Honorable Tim Hennessey
- Honorable Stephen R. Barrar
- Honorable John A. Lawrence
- Honorable Chris Ross
- Honorable Curt Schroder
- Honorable Dan Truitt
- Honorable John C. Rafferty, Jr.
- Honorable Andrew Dinniman
- Honorable Dominic F. Pileggi

Prior to construction of the dam, consultation with the State Historic Program Office (SHPO) and Chester County Historical Society determined that no archeological, historic, or cultural resources would be disturbed by the proposed dam construction. Since the dam was built in the footprint previously cleared for such resources, none of the proposed project alternatives pose a risk of impact to archeological or historic resources. A recent follow-up review of The National Register of Historic Places website [<http://nrhp.focus.nps.gov>] reconfirmed that while several historical sites are nationally listed for Chester County, none occur in the area of potential effect for the Project. On March 29, 2013 the Pennsylvania Historical and Museum Commission confirmed there are no known archeological or historical sites in the area of potential effect.

The U.S. Fish & Wildlife Service was consulted and they responded on February 28, 2013 that no federally listed species under their jurisdiction is known or likely to occur in the project area.

As per the Pennsylvania State Programmatic General Permit (PASPGP-4) issued by the USACE, PA DEP has been given the authority to review projects such as the Hibernia Dam (PA-436F) for the Section 404 Clean Water Act requirements. CCWRA will be responsible for obtaining the necessary permits from PA DEP.

The Pennsylvania Natural Diversity Inventory (PNDI) online database was queried to determine if protected species or species proposed for protection ranged within the watershed). As documented in the NRCS-CPA-52 form, this review of the natural heritage data indicates that none of the project alternatives pose a risk of adverse impact to individuals, populations or habitats of federal- or state-listed species of endangered or threatened flora or fauna.

## 7.0 PREFERRED ALTERNATIVE: REHABILITATE TO HIGH HAZARD CLASS DAM

### 7.1 RATIONALE FOR PREFERRED ALTERNATIVE

The following alternatives were developed and presented to the Chester County Water Resources Authority on April 17, 2013:

- No Action/Future Without Federal Project (FWOP)
- Rehabilitation to a High Hazard Class dam
- Decommissioning of Hibernia Dam
- Decommissioning with Nonstructural and Other Non-Structural Measures (Flood-Proofing in the Inundation Areas)
- Variations of Dam Rehabilitation Alternative

Two of these alternatives (FWOP and Rehabilitation to a High Hazard Class dam) merited detailed evaluation. The Chester County Water Resources Authority selected on April 17, 2013 their preferred alternative to be the rehabilitation of the dam as identified by NRCS; with the understanding that the rehabilitation items will be developed during the design phase to minimize disturbance, construction cost, and operation and maintenance costs as best as possible. Thus the Rehabilitation Alternative is the Preferred Alternative of both NRCS and the Sponsor.

The Hibernia Dam (PA-436F) Supplemental Watershed Work Plan No. 7 - Environmental Evaluation meets all applicable USDA-Natural Resources Conservation Service and Commonwealth of Pennsylvania dam safety and performance standards and extends the useful life of the Hibernia Dam beyond its original evaluated life expectancy.

The Economic and Environmental Principles and Guidelines for Planning Water and Land Related Resources Implementation Studies require the evaluation of a National Economic Development Alternative. This alternative is defined as that which maximizes the net economic benefits, consistent with protecting the Nation's environment. The Rehabilitation to a High Hazard Dam Alternative meets the tests of completeness, effectiveness, efficiency and acceptability. The Preferred Alternative is the NED Alternative with net annual economic benefits of \$2,774,900 and a Benefit/Cost ratio of 14.7 to 1.0.

### 7.2 MEASURES TO BE INSTALLED

Based on review of the Project Purpose and Project Need, the overall impacts on human and natural environmental resources, and consideration of the NED Alternative, the Preferred Alternative is to rehabilitate Hibernia Dam (PA-436F) to NRCS and Commonwealth of Pennsylvania High Hazard Class dam design criteria and extend the service life by 50 years. The Preferred Alternative will sustain the present level of flood protection and reduce the threat to public health and safety. The Preferred Alternative (See Figure B-4 - Project Site Map in Appendix B) includes the following modifications to the dam:

- Maintain the axis of the dam at the present location.
- Raise the auxiliary spillway control section.
- Widen the auxiliary spillway and provide for uniform, consistent flow. To accomplish this, construct a flow splitter dike as needed to divide the spillway into bays of less than 200 feet.
- Install a concrete cutoff wall at the crest of the auxiliary spillway and along the left side of the exit channel.
- Install a filtered toe between the impact basin and the existing rock toe, and any surface condition improvements between the right groin to the existing rock toe.
- Regrade berm on downstream face of embankment to provide positive drainage toward the downstream toe.

- Plant trees to replace 0.6 acres of trees removed to widen auxiliary spillway.

The alternative to rehabilitate Hibernia Dam to meet NRCS and Commonwealth of Pennsylvania High Hazard Class dam criteria would require construction and modification in three locations of the dam: the auxiliary spillway, the downstream toe, and the downstream berm. No drawdown of the reservoir will be required to construct the planned rehabilitation measures.

**Auxiliary Spillway** - One of the rehabilitation efforts would include raising the control section of the auxiliary spillway to elevation 588.23 feet and widening the auxiliary spillway to 260 feet. To meet current NRCS design criteria for uniform flow within the earthen spillways, this planning study evaluation anticipates a flow splitter dike to be constructed as needed to divide the spillway into bays of less than 200 feet. If the flow splitter dike is needed, the exact size will be determined during design. In addition to raising and widening the auxiliary spillway, a concrete cutoff wall would be constructed along the upstream edge of the control section and along the left side of the exit channel to prevent head cut erosion from undermining the earthen embankment and/or breaching the spillway crest. Borrow soils if needed to construct the proposed splitter dike would come from the Auxiliary Spillway widening. Spoil areas if needed would be in the adjacent "Borrow Area #1" used during the construction of the dam.

**Downstream Toe** - Another rehabilitation effort would include the installation of a filtered toe between the impact basin and the existing rock toe. Design considerations of the filtered toe should include filter configuration, extent into foundation soils, and height. The construction technique should also be evaluated as potential options include, but are not limited to, a weighted filter placed upon the existing slope or a filter installed within an excavation at the toe, and construction aspects to consider include excavation dewatering and wetland impacts. The owner has recently advised of seasonal saturated conditions on the embankment south of the existing rock toe. This area should be evaluated during design to determine whether any surface condition improvements are warranted, such as extending the filtered toe in a southerly direction into this adjacent area.

**Downstream Berm** - The final rehabilitation effort needed is to re-grade the berm on the downstream face of the dam to promote positive drainage toward the toe and eliminate water ponding and infiltrating into the embankment. The planning study identified re-grading the berm with a 10H:1V positive slope toward the downstream face as the desired solution.

Detailed information for Preferred Alternative is provided in Table 7-1.

**Table 7-1  
 Preferred Alternative Design Features<sup>1</sup>**

Resource	Unit	Existing Condition	Rehabilitate To NRCS High Hazard Class Dam
Elevation, Crest of dam	MSL <sup>2</sup>	596.50 feet	596.50 feet
Elevation Crest of auxiliary spillway	MSL <sup>2</sup>	587.57 feet	588.23 feet
Elevation, Principal spillway inlet	MSL <sup>2</sup>	580.00 feet	580.00 feet
Dam crest length	Feet	700 feet	700 feet
Auxiliary spillway type	Type	Vegetated Earth	Vegetated Earth
Auxiliary spillway bottom width	Feet	200 feet	260 feet
Principal spillway type	Type	Reinforced Concrete Pipe	Reinforced Concrete Pipe
Sediment storage <sup>3</sup>	Acre-Feet	23.9	86.1
Municipal water supply storage	Acre-Feet	1174.9	1055.6
Detention storage	Acre-Feet	813.4	899.7
Surcharge storage	Acre-Feet	1420.8	1225.2
Total storage capacity - top of dam	Acre-Feet	3433.0	3266.5

November-2013

<sup>1</sup> Information in this table is based on the results of the planning study and may vary from the General Work Plan and As-Built Drawings.

<sup>2</sup> Mean Sea Level, NGVD29

<sup>3</sup> Required sediment storage capacity based on 50-year rehabilitated service life and 4 years for planning design, and construction.

After implementation of the Preferred Alternative, the Dams will meet all current NRCS and PADEP dam safety and performance standards.

### 7.3 MITIGATION

The local government municipality, West Caln Township, may require tree planting to replace trees removed (approximately 0.6 acres) to widen the spillway. Tree planting will be onsite with the exact location to be determined during the design phase. The site will be chosen to avoid impacts on cultural resources, Endangered and Threatened Species, Migratory Birds/Bald and Golden Eagles and wetlands. All construction will be conducted to minimize erosion and sedimentation, including the development of an erosion and sediment control plan as part of the permitting process. Vegetation will be established immediately following construction on all land disturbed by construction activities. Appropriate plants for erosion control and wildlife habitat will be selected based upon the installation season, soils, surrounding vegetation, and the Sponsor's preference.

In order to take precautions regarding introduction of invasive species as disturbed areas are being re-vegetated, the construction contract will include standards and specifications drawn from the NRCS Field Office Technical Guide requiring mechanical and/or chemical means of control.

All needed measures will be taken to mitigate (avoid, minimize, and compensate) any adverse impacts during construction and may include timing of the work, sediment controls such as seeding, mulching and silt fences and wetting construction areas to reduce dust.

## 7.4 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS

All applicable local, state, and federal laws will be complied with in the installation of this project.

### ***Commonwealth and Federal Regulations, Permits, and Compliance***

- ***Dam Permit and General Permits***

The Dam Owner, Chester County Water Resources Authority, will be responsible for obtaining a Dam Permit, or other appropriate authorization from Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering, prior to commencing construction. At this time no work is planned downstream of the principal spillway plunge pool, therefore no General Permit 3 (GP3) will be required. There will likely be no fee or minimal fees for these permits based on a possible exemption for local government.

- ***Section 402 of the Clean Water Act – National Pollutant Discharge Elimination System (NPDES) Permit***

The Phase I NPDES discharge program requires all operators of large construction activities which will disturb five or more acres of land to obtain permit coverage. More recently, NPDES Phase II regulations added permit coverage for small construction activities that disturb one to less than five acres. Effective December 7, 2002, PADEP integrated the federal Phase II NPDES requirements into the existing Pennsylvania Phase I NPDES permit for stormwater discharges associated with construction activities (NPDES Construction Permit). An important distinction between Phase I and II is that the small construction activities only require permit coverage when the activity disturbs one to less than five acres and will result in a point source discharge to surface waters of the Commonwealth. CCWRA will be responsible for obtaining a NPDES permit from PADEP.

- ***Other Federal Statutes and Interagency Coordination***

Formal consultation with and/or permit acquisition from other federal and state agencies is not known to be required for the project, since the planned project will not permanently alter or adversely impact reaches of Birch Run and Brandywine Creek downstream of the dam. No Clean Water Act Section 404 Permit is required based on the planned project measures since the project involves no dredge or fill activities in Waters of the United States. As per the Pennsylvania State Programmatic General Permit (PASPGP-4) issued by the USACE, PA DEP has been given the authority to review projects such as the Hibernia Dam (PA-436F) for the Section 404 Clean Water Act requirements. CCWRA will be responsible for obtaining the necessary permits from PA DEP.

- ***Pennsylvania Clean Streams Law***

CCWRA will be responsible for preparing and submitting an Erosion & Sediment Control Plan to the Chester County Conservation District to comply with Title 25 Chapter 102, the Clean Streams Law of Pennsylvania.

### ***Local Permits and Compliance Actions***

- The Project may be subject to local permits and compliance actions. West Caln Township regulates development and construction activities.

## 7.5 COSTS AND COST SHARING

Estimated installation costs for the Preferred Alternative are shown in Table 1 and Table 2. Total annualized costs are shown in Table 4. The costs shown in Tables 1, 2 and 4 and throughout the document are based on standard cost accounting practices required of federal watershed planning agencies, such as NRCS. The cost accounting guidance is Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council, 1983). The basis for cost sharing between NRCS and the Sponsor is different and is based on the provisions of the dam rehabilitation amendments

(PL-106-472) of the Watershed Protection and Flood Prevention program. Cost-sharing for authorized projects under the dam rehabilitation amendments is based on the following (USDA-NRCS, National Watershed Program Manual, December 2009):

Total eligible rehabilitation project costs for the purpose of cost sharing includes: all costs associated with construction, acquisition of property rights, easements or rights-of-way, non-federal project administration and contracting, and non-federal technical and engineering assistance for project planning, design, and installation. Technical engineering and project administration assistance provided by NRCS shall not be considered as part of the total cost. Sponsor shall be responsible for the cost of all water, mineral and other resource rights and all required permits. These costs shall not be considered part of the total cost. Federal funds will be 65% of the above defined costs, not to exceed 100% of the construction costs. The Sponsor shall be responsible for 35% of the calculated total cost of the rehabilitation project based on the above definitions using non-federal funds. In-kind contributions and the value of property rights acquired may be counted as agreed to under a separate Memorandum of Understanding (MOU) between the Sponsors and NRCS dated October 14<sup>th</sup>, 2010.

The estimated cost sharing allocation for the planned project is shown below.

Cost-sharing: Dam Rehabilitation	PL-566 Funds (65%) \$1,460,000	Other Funds (35%) \$786,000	Total (100%) \$ 2,246,000
-------------------------------------	-----------------------------------	--------------------------------	------------------------------

(See Watershed Agreement Item 5 for additional details)

## 7.6 INSTALLATION AND FINANCING

The works of improvement for rehabilitation of the Dam are planned for installation in year one of the evaluation period. The actual installation period is contingent on the availability of funds for design and installation.

If possible, installation should be completed in one construction season in order to minimize the disturbance to plant, wildlife, and human communities. During construction, equipment will not be allowed to operate when conditions are such that soil erosion and water, air, and noise pollution cannot be satisfactorily controlled. NRCS will provide assistance to the Sponsor. The Sponsor has the needed authorities to carry out the Plan and has agreed to use them.

**NRCS Responsibilities.** NRCS is responsible for the following implementation components of the Preferred Alternative:

- Design of the dam rehabilitation and preparation of construction drawings and construction specifications.
- Execute a Project Agreement with the Sponsor before either party initiates work. This Agreement sets forth detailed financial and working arrangements and other applicable conditions.
- Verify the Memorandum of Understanding with the Sponsor that allocates cost-share funding is up to date.
- Execute an updated O&M Agreement for the Dam. This Agreement is based on the NRCS National Operation and Maintenance Manual.
- Determine that an Emergency Action Plan is prepared prior to the execution of fund obligating documents for construction of the structure.
- Provide contract administration technical assistance
- Provide construction management technical assistance (Inspector and Contracting Officer Technical Representative)
- Provide engineering support, technical assistance, and approval during the design and construction of the Project.

- Providing financial assistance equal to 65 percent of project costs, not to exceed 100 percent of actual construction costs, as appropriations become available under the Watershed Rehabilitation component of the Watershed Protection and Flood Prevention Act (PL 83-566)
- Certifying, in conjunction with DEP, Bureau of Waterways Engineering, completion of all installed measures.

**Sponsor Responsibilities.** CCWRA is responsible for the following implementation components of the Preferred Alternative:

- Providing written assurance that they have the legal authority and sufficient funding; that they are willing and able to obtain all necessary land rights, easements, permits and that they will be responsible for ensuring the operation, maintenance and replacement of installed measures.
- Ensuring communities downstream of the dam continue to remain in compliance with federal floodplain management and flood insurance programs, prior to construction
- Updating/completing at an appropriate time an Emergency Action Plan based on the planned changes for Hibernia Dam (PA-436F).
- Securing all needed permits, easements, and rights for installation, operation, and maintenance.
- Executing any needed updates to the Memorandum of Understanding with NRCS which provides a framework within which cost-share funds are credited.
- Executing an Operation and Maintenance Agreement for Hibernia Dam (PA-436F) with NRCS.
- Executing a Project Agreement or similar implementation agreement with NRCS to obligate funds for cost-share payments.
- Being responsible for all buried waste found during construction activities, if any, and all associated costs, although such costs could be included for in-kind credit at the Sponsor's request.
- Providing financial assistance or qualifying in-kind services at a rate equal to, or greater than, 35 percent of project costs using non-federal funds.
- Providing local administrative services necessary for installation of the project.

**Other Organizations Responsibilities.** No organizations other than the CCWRA and NRCS have any responsibilities in implementation of this plan.

## 7.7 EMERGENCY ACTION PLAN

Prior to construction, the sponsors shall prepare an updated Emergency Action Plan (EAP) for the dam or similar structure where failure may cause loss of life or as required by state and local regulations. The EAP shall 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 shall be reviewed and updated by the sponsors as required by the Pennsylvania Department of Environmental Protection.

## 7.8 CONTRACTING

The project will be installed by means of a federal contract administered by NRCS, as requested by the Sponsor. Other contracting arrangements will be agreed to between NRCS and the Sponsor before either party commences work activities. A project or other implementation agreement between NRCS and the Sponsor will detail the work activities and financial responsibilities for both parties.

## 7.9 REAL PROPERTY

Based on planning estimates and land rights previously acquired for the Dam, it is estimated that no additional land rights will be needed. In addition, no relocation of persons is needed in conjunction with the project.

## 7.10 SOLID AND HAZARDOUS WASTES

There are no known solid or hazardous wastes identified in the project area. If such wastes are discovered during construction, the Sponsor will ensure that such wastes are identified and disposed of in accordance with all applicable federal, state and local rules and regulations. The Sponsor will be responsible for waste identification and disposal, and if warranted, testing of soil and ground water and remediation plans. These activities will generally require the services of a hazardous waste consultant certified by the Pennsylvania Department of Environmental Protection, Bureau of Waste Management.

## 7.11 CULTURAL RESOURCES

In April 2013, the Pennsylvania State Historical Preservation Office (SHPO) confirmed there are no known cultural resources located in the construction, borrow, and spoils areas for the rehabilitation of Hibernia Dam. If during the design phase it is determined that other areas will be impacted during construction, consultation with PHMC will be done prior to completion of design. If cultural resources are discovered during installation, NRCS will require construction stop. Follow policy contained in NRCS General Manual, 420 Part 401 and only mitigate when determined in consultation with required consultative parties that mitigation is necessary. If mitigation is required, it will be in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the regulations (36 CFR 800) of the Advisory Council on Historic Preservation. In the case of a discovery during construction, NRCS will work closely with the PHMC, State Historical Preservation Office (SHPO) to reduce project effects on cultural resources.

## 7.12 FINANCING

The NRCS share of installation costs will be provided from funds appropriated under the Watershed Protection and Flood Prevention Act (PL 83-566), Watershed Rehabilitation. This is not a fund-obligating document, and federal assistance is subject to the availability of Congressional appropriations. The Sponsor has analyzed their financial requirements for carrying out the plan, including components that are not eligible for Federal assistance as part of this plan. The Sponsor will arrange for funds to be available, when needed, from donations, non-Federal grants, cash reserves, tax revenues and other non-Federal sources. Credit for in-kind contributions will be as specified in the Memorandum of Understanding.

The cost, if any, of all water, mineral and other resource rights and all required permits are not eligible for Federal financial assistance. These costs shall be borne, in full, by the Sponsor. The Sponsor also understands that they will be fully responsible for costs incurred for the operation, maintenance and replacement of installed measures.

## 7.13 OPERATION, MAINTENANCE, AND REPLACEMENT

Measures installed in this plan, and previously installed measures, will be operated and maintained by the Sponsor with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new O&M agreement will be developed for Hibernia Dam (PA-436F) utilizing the NRCS-National Operation and Maintenance Manual, and will be executed when the implementation agreement is executed. The new O&M agreement will be for the evaluated life of the rehabilitation project, which is 50 years. CCWRA will be fully responsible for all operation, maintenance, repair and replacement of installed measures until such time that the structure is formally decommissioned in accordance with applicable laws and regulations.

The O&M agreement will specify responsibilities of the Sponsor and include detailed provisions for retention, use, and disposal of property acquired or improved with PL 83-566 cost sharing, requirements for operation and inspection, financial plan for conducting O&M activities, consultation requirements for modifications to works of improvement, notification requirements for emergency situations, policy related to violations of the agreement, recurring review and update of the agreement, preparation and review requirements for an Emergency Action Plan, recordkeeping requirements, and other such requirements. Provisions will be made for free access of Sponsor, state, and federal representatives to inspect all structural measure and their appurtenances at any time.

The Operation and Maintenance costs for the Preferred Alternative are based on Table 7-2.

**Table 7-2**  
**Annual Operation and Maintenance Costs<sup>1</sup>**

Item	Cost	Amortization Rate <sup>4</sup> (%)	Return Period (Years)	Annual Cost
Routine Annual O&M Costs (Every year)	\$ 78,100			\$ 78,100
Non-Routine Engineering Costs (one-time) <sup>2</sup>				
Operation, Inspection & Maintenance Manual <sup>2</sup>	\$ 3,625	3.75%	15	\$ 320
Minor Repairs to Concrete End Wall <sup>2</sup>	\$ 4,500	3.75%	15	\$ 398
Review of Piezometric Data <sup>3</sup>	\$ 8,800	3.75%	1	\$ 9,130
Non-Routine O&M Costs				
Emergency Action Plan (Every 5 years)	\$ 14,500	3.75%	5	\$ 3,234
Outlet Works Inspection (Every 10 years)	\$ 18,000	3.75%	10	\$ 2,192
Drain Conduit Inspection (Every 20 years)	\$ 22,500	3.75%	20	\$ 1,619
<b>Total Annual Operation and Maintenance Cost</b>				<b>\$ 94,993</b>
				November-2013
<sup>1</sup> Price base 2013.				
<sup>2</sup> Return Period based on 1-year installation time and 50-year operational life.				
<sup>3</sup> Return Period based on annual performance throughout the life of the project.				
<sup>4</sup> Amortized O&M costs over return period at 3.750% interest rate based on Water Resources Discount Rate: <a href="ftp://ftp-fc.sc.gov.usda.gov/Economics/priceindexes/Data/PPPI_CPI_CCI.xls">ftp://ftp-fc.sc.gov.usda.gov/Economics/priceindexes/Data/PPPI_CPI_CCI.xls</a>				

**Table 1**  
**Total Estimated Project Installation Cost<sup>1</sup>**

<b>Preferred Alternative</b>	<b>Source</b>		<b>Total Estimated Installation Costs</b>
	<b>PL 83-566 Funds</b>	<b>Other Funds</b>	
Rehabilitate to NRCS High Hazard Class Dam	\$2,056,000	\$362,000	\$2,418,000

November-2013

<sup>1</sup> Price base 2013

**Table 2**  
**Estimated Cost Distribution**

Works of Improvement	Installation Cost - Public Law 83-566 <sup>1</sup>				Installation Cost - Other Funds <sup>1</sup>								Total Installation Costs
	Construction <sup>2</sup>	Engineering	Project Administration	P.L. 83-566 Funds	Construction <sup>2</sup>	Engineering	Real Property	Natural Resource Rights	Relocation Payments	Permits	Administration	Total Other	
Rehabilitate to NRCS High Hazard Class Dam	\$1,460,000	\$506,000	\$90,000	\$2,056,000	\$311,000	\$25,000				\$1,000	\$25,000	\$362,000	\$2,418,000

November-2013

<sup>1</sup> Price base 2013.

<sup>2</sup> Includes tree planting costs.

**Table 3  
 Structure Data<sup>1</sup>**

Item	Unit	Hibernia Dam (PA-436F)
NRCS Hazard Class		C
Seismic zone		1
Uncontrolled drainage area	Square mile	4.68
Controlled drainage area	Square mile	0
Total drainage area	Square mile	4.68
Runoff curve number (1-day) (AMC II)		69
Time of concentration (Tc)	Hours	1.89
Elevation Top of Dam	Feet <sup>2</sup>	596.50
Elevation crest auxiliary spillway	Feet <sup>2</sup>	588.23
Elevation crest principal spillway	Feet <sup>2</sup>	580.00
Auxiliary spillway type	Type	Vegetated Earth
Auxiliary spillway bottom width	Feet	260
Auxiliary spillway exit slope	Percent	3.6
Maximum height of dam	Feet	70.00
Total capacity		
Sediment <sup>4</sup>	Acre feet	86.1
Beneficial use (Municipal Water Supply)	Acre feet	1055.6
Floodwater retarding	Acre feet	899.7
Surcharge	Acre feet	1225.2
Total storage capacity	Acre feet	3266.5
Surface Area		
Sediment Pool	Acres	15.1
Municipal Water Supply Pool	Acres	95.4
Floodwater Retarding Pool	Acres	127.6
Surcharge Pool	Acres	173.2
Principal spillway design		
Rainfall volume ( 1-day)	Inches	7.4
Rainfall volume ( 10-day)	Inches	11.1
Runoff volume ( 1-day)	Inches	2.5
Runoff volume ( 10-day)	Inches	5.0
Capacity of Principal Spillway	cfs	228.3
Dimensions of conduit	Inches	36
Type of conduit	Type	Reinforced Concrete Pipe
Auxiliary spillway hydrograph		
Percent Chance of Use	Percent	<1
Rainfall volume	Inches	10.68
Runoff volume	Inches	6.70
Storm duration	Hours	6
Maximum velocity of flow (Ve)	Feet/second	20.27
Maximum reservoir water surface elevation	Feet	596.47
Freeboard hydrograph		
Rainfall volume	Inches	34.57
Runoff volume	Inches	29.71
Storm duration <sup>2</sup>	Hours	24
Maximum reservoir water surface elevation	Feet	596.47
Capacity equivalents		
Sediment volume	Inches	0.34
Beneficial use volume (Municipal Water Supply)	Inches	4.23
Floodwater retarding volume	Inches	3.60
Surcharge volume	Inches	4.91
Total volume	Inches	13.09

November-2013

<sup>1</sup> Information in this table is based on the results of the planning study and may vary from the General Work Plan and As-Built Drawings for structures.

<sup>2</sup> The 6-hour and 24- hour storms were evaluated and the 24-hour storm duration controlled the design.

<sup>3</sup> Mean Sea Level, NGVD29

<sup>4</sup> Required sediment storage capacity based on 50-year rehabilitated service life and 4 years for planning design, and construction.

**Table 4**  
**Estimated Average Annual NED Costs<sup>1</sup>**

<b>Item</b>	<b>Rehabilitate to High Hazard Class Dam</b>
<b>Annual Costs<sup>2</sup></b>	
Amortized Installation Costs	\$ 107,800
O&M and Replacement Costs	\$ 95,000
<b>Total Average Annual Costs</b>	<b>\$ 202,800</b>

November-2013

<sup>1</sup> Price base 2013

<sup>2</sup> Amortized over 50 years at 3.750% interest rate.

**Table 5**  
**Average Annual Flood Damage Reduction Benefits<sup>1</sup>**

Condition	Average Annual Ag-related Flood Damage <sup>2</sup>		Damage Reduction
	Without Project	With Project	
Flood Damage			
Residential, Commercial and Transportation	\$ 956,400	\$ 767,700	\$ 188,700
<b>Total</b>	<b>\$ 956,400</b>	<b>\$ 767,700</b>	<b>\$ 188,700</b>

November-2013

<sup>1</sup> Price base 2013.

<sup>2</sup> Agriculture-related damage includes damage to rural communities.

**Table 5A**  
**Estimated Average Annual Non-Flood Benefits<sup>1</sup>**

Item	Average Annual Agriculture-Related Non-Flood Benefits <sup>2</sup>
Municipal Water Supply	\$ 495,300
Recreation	\$ 2,167,400
FWOP Costs Avoided	\$ 126,300
<b>Total</b>	<b>\$ 2,789,000</b>

November-2013

<sup>1</sup> Price base 2013.

<sup>2</sup> Agriculture-related benefits include benefits to rural communities.

**Table 6**  
**Comparison of NED Benefits and Costs<sup>1</sup>**

<b>Works of Improvement</b>	<b>Direct Benefits<sup>2</sup></b>	<b>Other Benefits<sup>3</sup></b>	<b>Average Annual Benefits<sup>2</sup></b>	<b>Average Annual Costs<sup>4</sup></b>	<b>Benefit/Cost Ratio</b>
Rehabilitate to NRCS High Hazard Class Dam	\$ 2,851,400	\$ 126,300	\$ 2,977,700	\$ 202,800	14.7 to 1.0

November-2013

<sup>1</sup> Price base 2013.

<sup>2</sup> From Table 5 and Table 5a.

<sup>3</sup> Per Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 1.7.2 (b) (3) - the avoided cost of the most likely alternative to the planned action.

<sup>4</sup> From Table 4.

## 8.0 REFERENCES

- Brandywine Conservancy Environmental Management Center, "West Brandywine Township Comprehensive Plan." October, 2005.
- Chester County Department of Facilities/Parks and Recreation, Hibernia County Park – Park Trails and Roadways map, dated June 13, 2012.
- Chester County Parks and Recreation, Hibernia County Park website accessed August 27, 2012 at <http://www.chesco.org/ccparks/cwp/view.asp?a=1550&q=616010>.
- Chester County Water Resources Authority, CCWRA – Hibernia Park Rehabilitation Planning Study website accessed September 4, 2012 at <http://www.chesco.org/water/cwp/view.asp?a=3&Q=656211&PM=1>.
- Chester County Water Resources Authority, CCWRA, "Brandywine Creek Watershed Action Plan." December 2002.
- Chester County Water Resources Authority, CCWRA, "Hibernia Dam Rehabilitation Planning Study Fact Sheet Brandywine Creek Watershed." March 2012.
- Gannett Fleming, Inc., June 2011, "Dam Safety and Water Resources, Engineering Services Task Order 122, Hibernia Dam (PA-436F), Subsurface Investigation and Embankment Stability Evaluation, Chester County, Pennsylvania," Gannett & Fleming, Harrisburg, PA.
- Gannett Fleming, Inc., September 2011, "Dam Safety and Water Resources, Engineering Services Task Order 130, Hibernia Dam (PA-436F), Maximum Surcharge Pool Seepage and Slope Stability Engineering Analysis, Chester County, Pennsylvania," Gannett & Fleming, Harrisburg, PA.
- Gannett Fleming, January 3, 2007, "Dam Safety and Water Resources, Engineering Services Task Order 41 (2006), Hibernia Dam, Bench Drainage," Gannett & Fleming, Valley Forge, PA.
- National Register of Historic Places, May 2013, <http://nrhp.focus.nps.gov>
- National Wild and Scenic Rivers System, May 2013, <http://www.rivers.gov/rivers/pennsylvania.php>
- Pennsylvania Fish and Boat Commission, Pennsylvania Wild Trout Waters (Natural Reproduction) - July 2013, [http://www.fish.state.pa.us/trout\\_repro.pdf](http://www.fish.state.pa.us/trout_repro.pdf)
- Pennsylvania Geologic Survey, 1981. Atlas of Preliminary Geologic Quadrangle Maps of Pennsylvania, Map 61, Wagontown.
- Pennsylvania Natural Diversity Inventory, PNDI Review of Hibernia Dam – Project Search ID 20120726365593, dated July 26, 2012.
- United States Census Bureau, "EJView Census 2000 Summary Report." American Community Survey 2006-2010.
- United States Census Bureau, Census 2010.
- United States Department of Agriculture Soil Conservation Service, 1963. Soil Survey of Chester and Delaware Counties, Pennsylvania. Series 1959, No. 19, W. M. Kunkle.
- United States Department of Agriculture, Economic Research Service, Stock No. 87012. Value of Land & Building Per Acre. January 1995. Download 87012.zip
- United States Department of Agriculture, National Agricultural Statistic Service, Quick Stats Ad-hoc Query Tool.

- United States Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey National Cooperative Soil Survey, Chester County, Chester County Pennsylvania. Accessed on August 29, 2012 at <http://websoilsurvey.nrcs.usda.gov/>.
- United States Department of Agriculture, Natural Resources Conservation Service, National Engineering Manual.
- United States Department of Agriculture, Natural Resources Conservation Service, National Operation and Maintenance Manual.
- United States Department of Agriculture, Natural Resources Conservation Service, National Planning Procedures Handbook.
- United States Department of Agriculture, Natural Resources Conservation Service, Technical Release 60 – Earth Dams and Reservoirs.
- United States Department of Agriculture, Natural Resources Conservation Service, Water Resources Site Analysis Computer Program, SITES Integrated Development Environment.
- United States Department of Agriculture, Natural Resources Conservation Service, National Resource Economic Handbook, July 1998
- United States Department of Agriculture, Natural Resources Conservation Service, National Watershed Program Manual, December 2009.
- United States Department of Agriculture, Natural Resources Conservation Service, National Watershed Program Handbook, January 2010.
- United States Department of Agriculture, Natural Resources Conservation Service, National Resource Economic Handbook, July 1998
- United States Department of Agriculture. 2003. National Environmental Compliance Handbook. USDA and NRCS. All U.S. Government Documents (Utah Regional Depository). Paper 163.
- United States Department of Agriculture. 2009. 2007 Census of Agriculture. Pennsylvania Commonwealth and County Data, July 21, 2011.
- United States Department of the Army, Corps of Engineers, 31 Oct 2003, "Engineering Manual (EM) 1110-2-1902, Slope Stability," DEPARTMENT OF THE ARMY, U.S. Army Corps of Engineers, CECW-EW, Washington, D.C.
- United States Department of the Army, Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, River Analysis System Computer Model (HEC-RAS), Davis, CA.
- United States Department of the Interior, National Park Service, National Register of Historic Places, NPS Focus.
- United States Department of the Interior, U. S. Geological Survey, Scientific Investigations Report 2005-5039, Occurrence of Fecal-Indicator Bacteria and Protocols for Identification of Fecal-Contamination Sources in Selected Reaches of the West Branch Brandywine Creek, Chester County, Pennsylvania, Peter J. Cinotto.
- United States Department of the Interior, U. S. Geological Survey, 2012, Water-resources data for the United States, Water Year 2011: U.S. Geological Survey Water-Data Report WDR-US-2011, site 01480399, accessed at <http://wdr.water.usgs.gov/wy2011/pdfs/01480399.2011.pdf>.

- United States Department of the Interior, U.S. Geological Survey, Senior, L.A., and Sloto, R.A., 2010, Groundwater-quality monitoring program in Chester County, Pennsylvania, 1980–2008: U.S. Geological Survey Scientific Investigations Report 2010-5087.
- United States Department of the Interior, U.S. Geological Survey, Chester County Ground-Water Atlas, Chester County, Pennsylvania, Russell A. Ludlow and Connie A. Loper, Open-File Report 03-442.
- United States Department of the Interior, U.S. Geological Survey,  
<http://pa.water.usgs.gov/reports/wrir/01-4026.pdf>
- United States Department of the Interior, U.S. Geological Survey, National Water Information System website. Accessed on August 29, 2012 at  
<http://nwis.waterdata.usgs.gov/nwis/qwdata?>.
- United States Environmental Protection Agency, Health Statistics – Health Service Area for Philadelphia, PA – Montgomery, PA, website accessed October 2, 2012 at  
<http://ofmpub.epa.gov/envjust/getHealthStats>
- United States Environmental Protection Agency, Mid Atlantic Water, Pennsylvania TMDL, Christina River Basin High-Flow TMDL Revisions, [http://www.epa.gov/reg3wapd/tmdl/pa\\_tmdl/ChristinaMeetingTMDL/NutrientLDO/Sec4-CR Nutrient TMDL-20060925-Errata.pdf#page=10](http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/ChristinaMeetingTMDL/NutrientLDO/Sec4-CR_Nutrient_TMDL-20060925-Errata.pdf#page=10)
- United States Environmental Protection Agency, Mid-Atlantic Water, TMDL Quick Finder, Christina River Basin High-Flow TMDL,  
[http://www.epa.gov/reg3wapd/tmdl/pa\\_tmdl/ChristinaMeetingTMDL/index.htm](http://www.epa.gov/reg3wapd/tmdl/pa_tmdl/ChristinaMeetingTMDL/index.htm)
- United States Environmental Protection Agency, NEPAAssist Report – Hibernia Dam, accessed on August 29, 2012 at <http://nepassistool.epa.gov/NEPAVEtoolsPublic/report/analysis.aspx>.
- United States Federal Emergency Management Agency, Flood Insurance Rate Map Number 42029C0135F, Chester County, Pennsylvania dated September 29, 2006.
- United States Federal Emergency Management Agency, May 2013, Communities Participating in the National Flood Insurance Program. Federal Insurance Administration,  
<http://www.fema.gov/fema/csb.shtm>
- United States Water Resources Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 10, 1983.
- Virginia Department of Conservation and Recreation, Division of Soil and Water Conservations, 2004, Virginia Stream Restoration & Stabilization Best Management Practices Guide
- West Brandywine Creek Drainage Phase I and Phase II Cultural Resources investigations on Three Proposed Dam Locations.
- West Caln Township Comprehensive Plan Task Force. “West Caln Township Comprehensive Plan Update”. March 25, 1998.
- West Caln Township, “West Caln Township Open Space, Recreation, and Environmental Resources Plan.” January 1995.
- West Caln Township, Municipal Zoning Map, dated July 14, 2008.
- West Caln Township, Zoning Ordinance, 2005.

## 9.0 LIST OF PREPARERS

Table 9-1 List of Preparers

Name	Present Title	Education	Years Experience
<b>NRCS Staff</b>			
Walter Hosea Latshaw, PE	State Conservation Engineer	BS Agricultural Engineering Pennsylvania State University	38
Tim Ridley, PE, PS	Hydraulic Engineer	BS Civil Engineering West Virginia University	34
John Metrick	Natural Resource Specialist	BS Outdoor Recreation Pennsylvania State University	30
Jeff McClure, PG	Geologist	BA Biology, BA Geology, BS Geology West Virginia University	28
<b>Capital RC&amp;D Council</b>			
Jeffrey D. Mahood	Environmental Planning Specialist	BS Environmental Resource Management Pennsylvania State University	34
<b>Chester County Water Resources Authority</b>			
Janet L. Bowers	Executive Director	BA, Geology Catawba College, NC MS, Geology / Hydrogeology West Virginia University	33
Craig Thomas	Field Engineering and Operations Manager	BS Agricultural Engineering Virginia Tech	17
<b>KLA Environmental Services, Inc.</b>			
Kevin L. Shamburg, PE	Project Administrator	BS Civil Engineering Kansas State University	34
Frank C. Mercurio, PE	Senior Engineer	BS Environmental Resources Engineering Humboldt State University	35
Elliott R. Harris, PE	Project Engineer	BS Fisheries and Wildlife Biology BS Agricultural Engineering Kansas State University	11
Jarred D. Green, PE	Staff Engineer	BS Civil Engineering Kansas State University	7
Eldon R. Colson, Jr.	Project Technician	AS Natural Resources Hutchinson Community Junior College	19
<b>AMEC</b>			
Joseph V. Bellini, PE, PH, D.WRE, CFM	Associate, Water Resources Engineering	MS Civil Engineering	24
Matthew S. Lehrer, PE, CFM	Senior Civil/Water Resources Engineer	BS Environmental Resources & Forest Engineering	13
Petr Masopust, PE, CFM	Senior Water Resources Engineer	MS Civil & Environmental Engineering	9
Doug Tate, PE	Geotechnical Engineer	BS Engineering Science	34
Brian P. Sariano, PE	Environmental Resource Specialist	BS Environmental Engineering	26
Phil Perhamus, PWS	Wetland Scientist	BS Ecology	24
Ghazoll Motlagh	Water Resources Engineering Professional	BS Civil Engineering	4
Charles Richardson	CADD/Surveyor	ASS Applied Science	15
Mohamed Agnaou, EIT	Civil Engineering Professional	BS Civil and Environmental Engineering	13
James Barbis, EIT, CFM	Water Resources Professional	MS Water Resources and Environmental Engineering	4

## 10.0

## INDEX

- acceptability*, 23, 45
- Affected Environment*, 6
- agreement*, vi, vii, ix, x, xi, xii, xiii, 50, 51, 52
- aquatic resources*, S-11, 3
- archived files*, D-2
- authority*, vi, ix, S-1, 1, 44, 48, 50, 51
- auxiliary spillway*, v, S-2, S-7, S-12, 4, 15, 16, 17, 18, 20, 28, 29, 31, 43, 45, 46, D-2, D-4, D-6, D-8, D-9
- bacteria*, 4, 5, 9, 12
- bathymetric survey*, D-4, D-5, D-6
- beneficiary*, S-6
- benefit area*, S-11, 4, 26, 29, D-2, D-3
- benefit/cost ratio*, D-3
- benefits*, v, S-3, S-6, 3, 15, 23, 25, 27, 28, 29, 30, 32, 45, D-2, D-3, D-4
- breach inundation zone*, 1, 8, 12, 13, 27, 28, 43, D-5
- breach routing*, 22
- categorical exclusions*, 33
- categorically excluded*, 33
- CCWRA*, S-3, S-4, 19, 20, 27, 28, 29, 43, 44, 48, 50, 51, 59, D-5, D-6, D-7, D-8
- Chambers Lake*, v, S-2, S-11, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 26, D-5
- chemical*, 9, 47
- Coatesville*, v, S-3, S-6, S-8, S-11, 4, 6, 10, 12, 13, 27, 28, D-3
- completeness*, 23, 45
- compliance*, v, vii, viii, x, xiii, S-12, 12, 25, 43, 48, 50
- Congressional District*, S-1, S-4, E-2
- constructed breach*, S-7
- contract*, xi, xii, 47, 49, 50
- contracting*, 49, 50
- controversy*, S-12
- coral reefs*, 3
- cost sharing*, 48, 49, 52
- costs*, v, vii, viii, ix, S-9, 25, 26, 27, 28, 30, 45, 48, 49, 50, 51, 52, D-3, D-9
- cost-share*, viii, ix, 49, 50
- cultural resources*, 3, 12, 44, 47, 51
- dam failure*, 20, 22, 25, 27, D-9
- dam safety*, v, ix, S-2, 8, 20, 21, 23, 43, 45, 47, 50, D-7
- decommissioning*, 26, 27, D-9
- design and safety criteria*, 1, 2, 26, 29
- development*, v, vii, S-8, 3, 10, 11, 23, 25, 27, 47, 48, D-3, D-5, D-6, D-9
- drainage area*, 10, D-3, D-5
- drawdown*, 18, 22, 29, 46, D-7
- EAP*, ix, 27, 50, D-5
- economic*, v, S-3, 3, 10, 23, 30, 45, D-2, D-3, D-4
- effectiveness*, 23, 28, 45, D-8
- efficiency*, 11, 23, 28, 45, D-8
- Emergency Action Plan*, ix, 27, 49, 50, 52, D-5
- employment*, xi
- erosion*, 7, 8, 17, 18, 19, 20, 26, 29, 31, 33, 46, 47, 49, D-2, D-6, D-8
- failure*, ix, xii, 20, 21, 22, 25, 27, 50, D-9
- fire protection*, v, S-2, 2
- fish*, S-3, 4, 10, 12, 59
- flood control*, 6, 25, D-3
- flood damage reduction*, v, S-2, 1, 26, 27, D-3, D-9
- flood damages*, vii, 5, 26, 29, D-2, D-3
- flood proofing*, 27, D-9
- flood protection*, v, S-11, S-12, 2, 4, 5, 12, 13, 23, 25, 26, 29, 45
- floodplain*, viii, S-7, 4, 13, 23, 26, 27, 50, D-3, D-9
- floodwater*, D-2
- forest*, 10, D-5
- foundation*, v, 8, 15, 21, 22, 28, 29, 43, 46, D-6, D-8, D-9
- FWOP*, 23, 25, 45, D-2, D-8
- habitat*, v, S-2, S-3, S-11, 1, 2, 3, 4, 10, 13, 15, 22, 47, D-2
- hazard*, 1, 2, 22, 23, 26, 27, 43, D-9
- hazardous waste*, 51
- historical aerial photography*, D-3
- human*, v, S-2, S-3, S-11, 1, 5, 25, 27, 30, 32, 33, 45, 49, D-9
- impact basin*, S-2, 15, 17, 18, 19, 22, 28, 29, 31, 45, 46, D-7, D-8, D-9
- index*, 61, D-3, D-4, D-7

*inflow*, 8  
*in-kind contributions*, 51  
*installation*, vii, viii, ix, xiii, 28, 29, 46, 47, 48, 49, 50, 51, D-8  
*invasive species*, 4, 47  
*labor*, S-12, 5, 12  
*land rights*, 50, 51  
*land use*, S-4, 4, 10, 11, 12, D-2, D-3, D-5  
*land values*, S-3  
*liability*, 2  
*location*, xiii, S-2, S-3, 11, 19, 22, 31, 45, 47, 49, D-5  
*loss of life*, ix, S-11, 1, 2, 4, 8, 26, 50, D-9  
*migratory*, 2, 4, 10, 14  
*mitigation*, 2, 10, 14, 28, 51  
*municipal water supply*, 8, 15, 20, 27, D-3, D-6  
*National Historic Preservation Act*, v, 1, 51  
*NED*, S-2, S-3, S-7, 3, 23, 25, 30, 32, 45, 56, 58, D-4  
*need*, v, S-2, 1, 13, 23, 25, 27, 28, 29, D-9  
*NEPA*, 33, A-1  
*nonstructural measures*, 23  
*NPDES*, 48  
*NRCS-CPA-52*, 30, 33, 34, 44, D-2  
*O&M*, ix, 49, 51, 52, E-3  
*opportunities*, 2, 6, 11, 13, 14, 23, 24, 43  
*PADEP*, S-2, 1, 2, 8, 9, 20, 26, 28, 29, 44, 47, 48  
*permits*, ix, 14, 17, 44, 48, 49, 50, 51  
*piezometer*, 8, 19, 20  
*plant*, xiii, S-11, 3, 12, 13, 49  
*population*, S-6, 10, 12, 13  
*precipitation*, S-3, 9, 20  
*preferred alternative*, 45  
*principal spillway*, 15, 16, 17, 18, 20, 22, 26, 28, 33, 43, 48, D-4, D-6, D-7, D-9  
*proposed action*, S-1, S-6, 3, 14, 33  
*public health and safety*, v, S-2, S-12, 1, 5, 45  
*public meetings*, 3  
*purpose*, v, ix, S-2, 1, 4, 6, 8, 11, 13, 23, 25, 28, 49, D-3, D-4, D-9  
*recreation*, S-7, S-8, S-12, 5, 6, 11, 13, 15, 23, 25, 26, 27, 28, D-3, D-4, D-6  
*rehabilitation*, v, vi, vii, x, xi, S-1, S-7, S-11, 1, 19, 28, 29, 45, 46, 48, 49, 51, D-3, D-8  
*relocation*, 23, 27, 51, D-9  
*remediation*, 51  
*resource concerns*, S-10, 3, 14, 30, D-2  
*riparian*, v, S-2, S-11, 1, 2, 11, 13, 14  
*riparian areas*, S-11  
*riser*, 15, 17, 18, 19, 22, D-7, D-8  
*risk*, v, vii, S-2, S-3, S-11, 1, 5, 14, 20, 21, 22, 25, 26, 27, 32, 33, 43, 44, D-9  
*runoff*, 8, 18, 20, 26, D-6  
*scientific resources*, 5  
*scoping*, S-10, 3, 43, D-2  
*scour*, 17, 19, 22, D-6  
*screening*, 24  
*sediment*, S-12, 4, 5, 7, 8, 9, 12, 13, 15, 18, 19, 20, 22, 26, 28, 29, 31, 47, D-2, D-5, D-6, D-7, D-9  
*sedimentation*, 8, 13, 20, 25, 26, 29, 33, 47  
*seepage*, 8, 15, 17, 20, 21, D-7  
*seismic*, 20, 22  
*service life*, v, S-1, S-2, S-12, 1, 2, 8, 29  
*SHPO*, 44, 51  
*slope stability*, 21, D-7  
*snowfall*, S-3  
*social*, 3, 5, 10, 27, 28  
*social issues*, 5  
*soil types*, 6, D-5  
*sole source aquifer*, 5, 14  
*sponsor*, ix, xiii, D-8  
*storage capacity*, 8, 18, 25, 26, 28, 29, 31, D-4, D-5, D-9  
*storage pool*, 21, D-2  
*subsurface*, 8, 19, 20, 21, D-6  
*surficial*, 19, 22  
*temperature*, 9  
*topography*, S-3, 6, 9  
*trees*, v, S-2, S-11, S-12, 19, 29, 31, 46, 47  
*vegetation*, 4, 10, 14, 21, 47  
*video*, 18, 22, D-7, D-8  
*water*, v, viii, xii, xiii, S-2, S-3, S-7, S-8, S-11, S-12, 1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 31, 46, 49, 51, 59, 60, 61, D-3, D-6, D-7, D-8, D-9

*water quality*, S-3, 3, 5, 8, 13, 22, 25

*water resources*, 5

*wetlands*, 2, 5, 10, 11, 14, 47, D-2, D-5

*wildlife*, v, S-3, 2, 15, 47, 49

*works of improvement*, vi, vii, viii, ix, 49, 52

## Appendix A

### COMMENTS AND RESPONSES

This activity is Categorically Excluded under the provisions of NEPA. Public and interagency input was received during project planning as described in Consultation, Coordination, and Public Participation. No comments were received on the draft document.

# Appendix B

## MAPS

### Figure B-1 Project Location Map

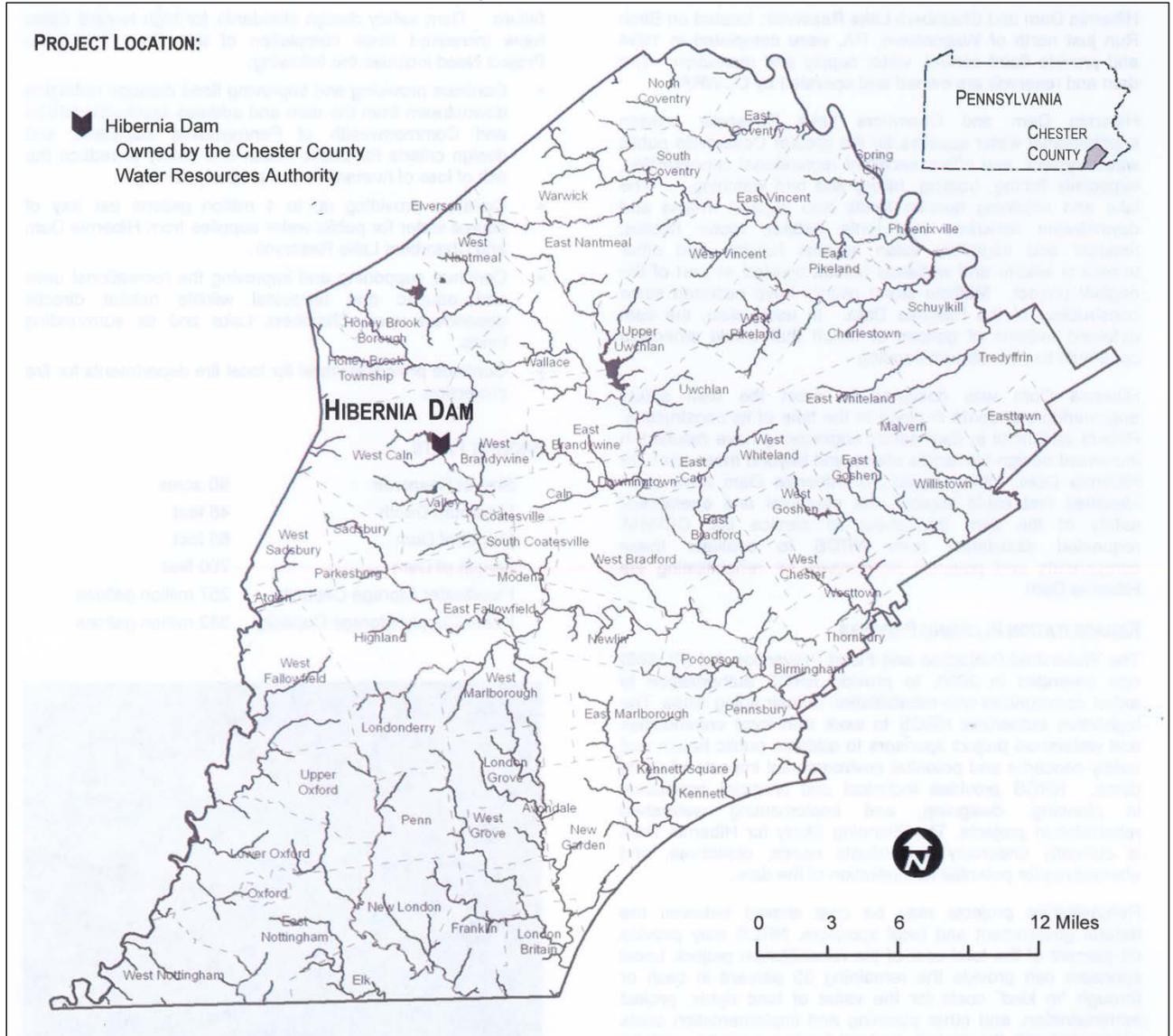
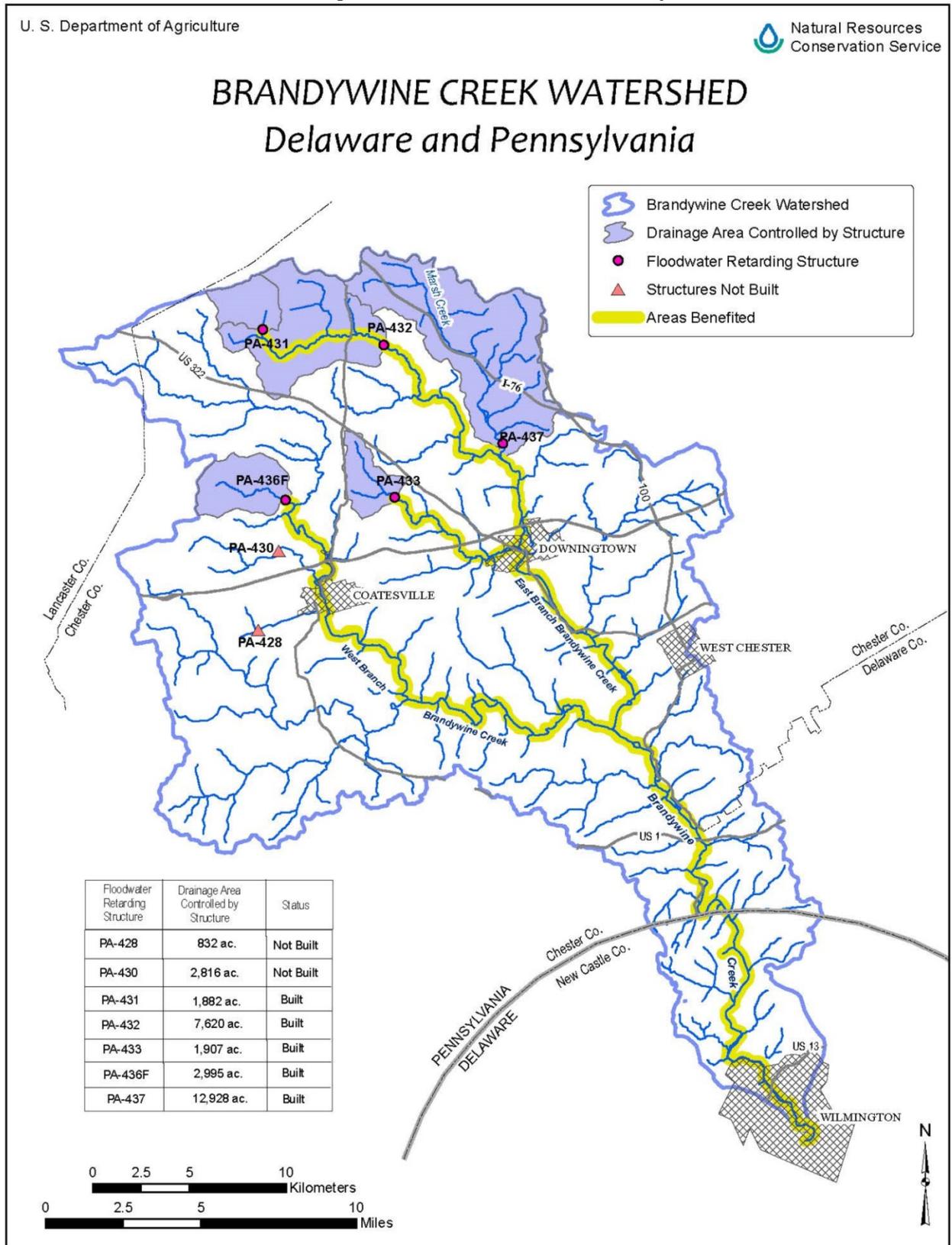
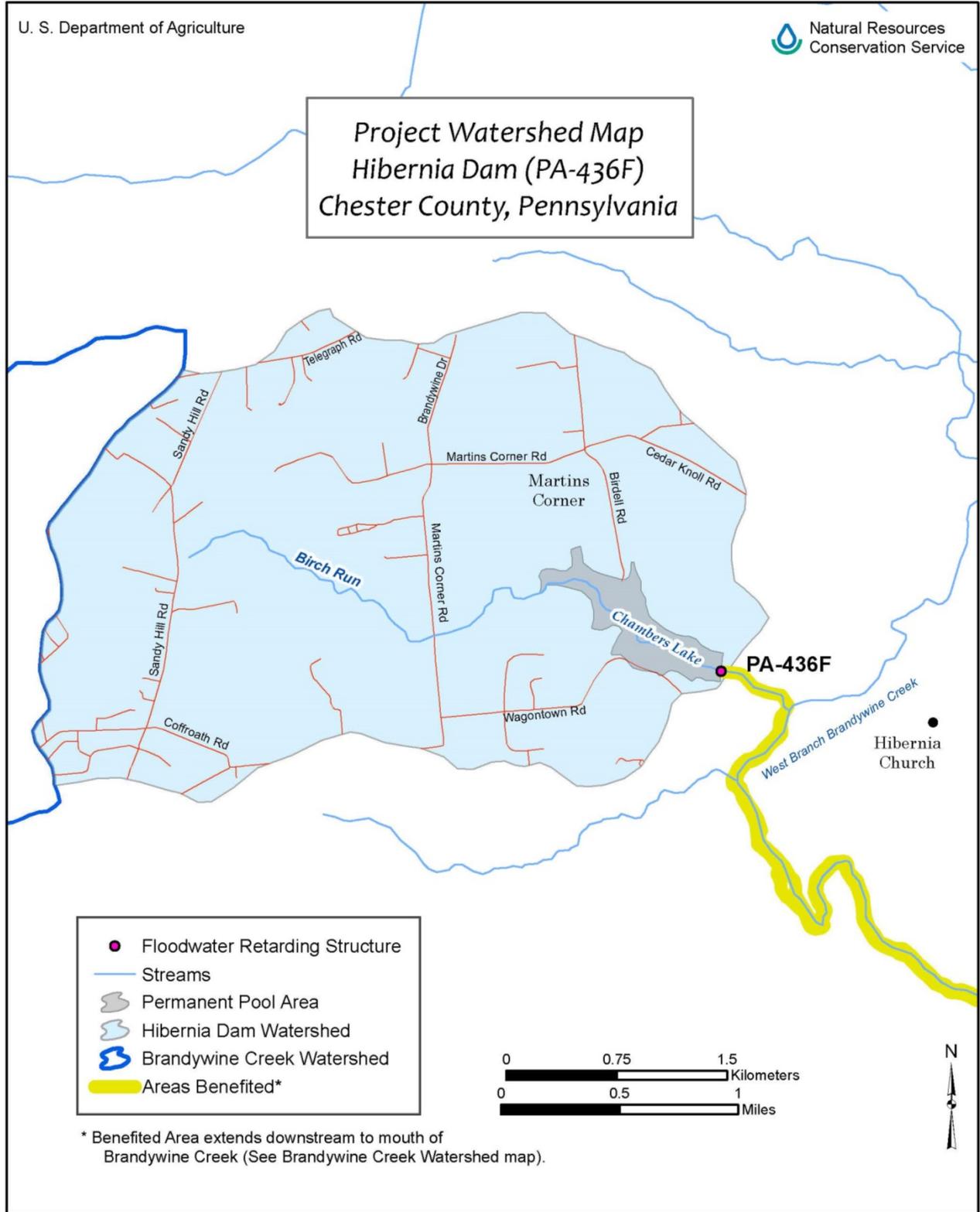


Figure B-2  
 Brandywine Creek Watershed Map



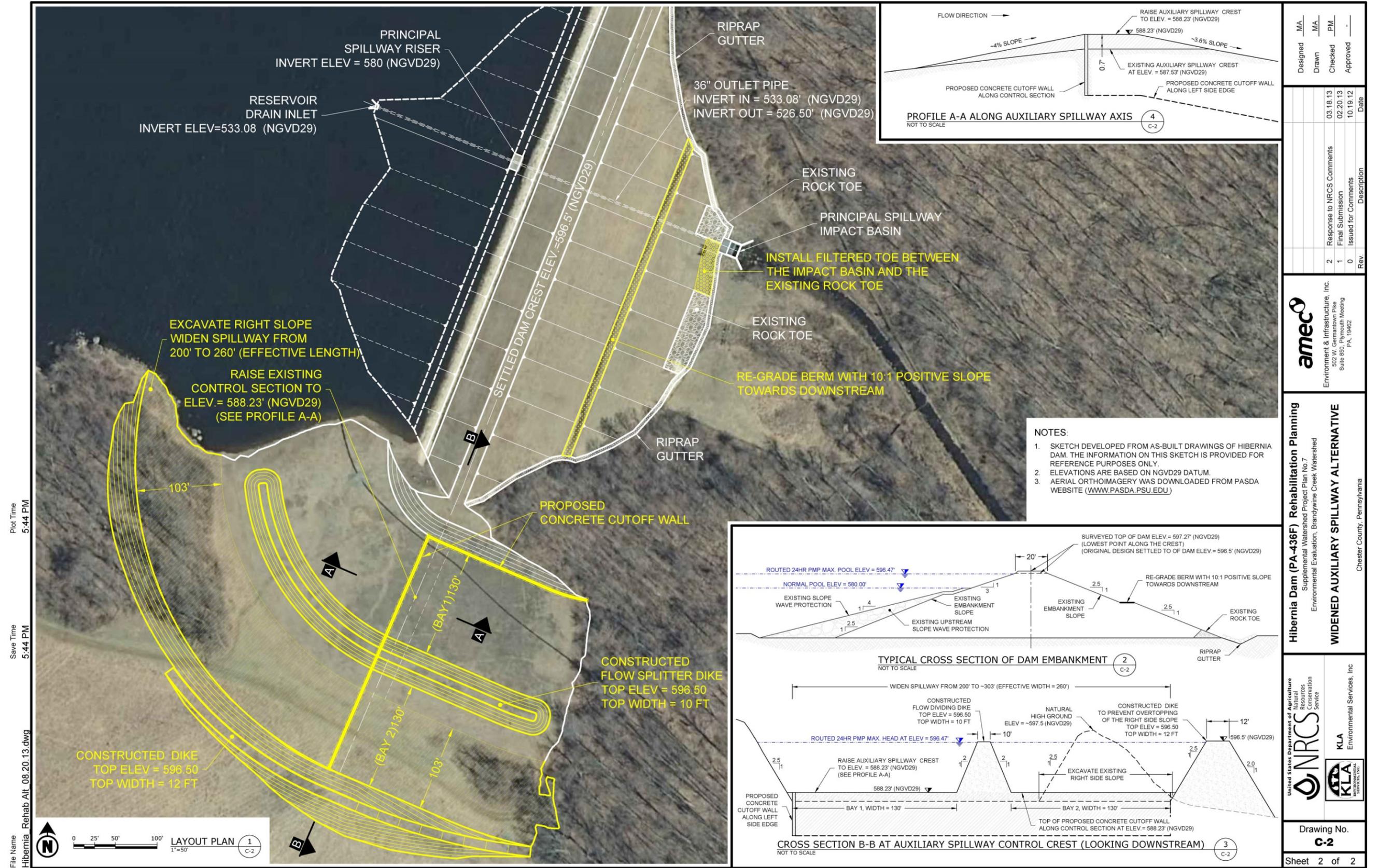
November 2013

### Figure B-3 Project Watershed Map



November 2013

Figure B-4 – Project Site Map



Designed	MA
Drawn	MA
Checked	PM
Approved	-

Rev.	Date	Description
2	03.18.13	Response to NRCS Comments
1	02.20.13	Final Submission
0	10.19.12	Issued for Comments

**ameco**  
 Environment & Infrastructure, Inc.  
 502 W. Germantown Pike  
 Suite 850, Plymouth Meeting  
 PA, 19462

**Hibernia Dam (PA-436F) Rehabilitation Planning**  
 Supplemental Watershed Project Plan No. 7  
 Environmental Evaluation, Brandywine Creek Watershed

**WIDENED AUXILIARY SPILLWAY ALTERNATIVE**

Chester County, Pennsylvania

United States Department of Agriculture  
**NRCS**  
 National Resources Conservation Service

**KLA Environmental Services, Inc.**

Drawing No. **C-2**  
 Sheet 2 of 2

# Appendix C

## SUPPORT MAPS

Figure C-1 – Approximate Breach Inundation Map

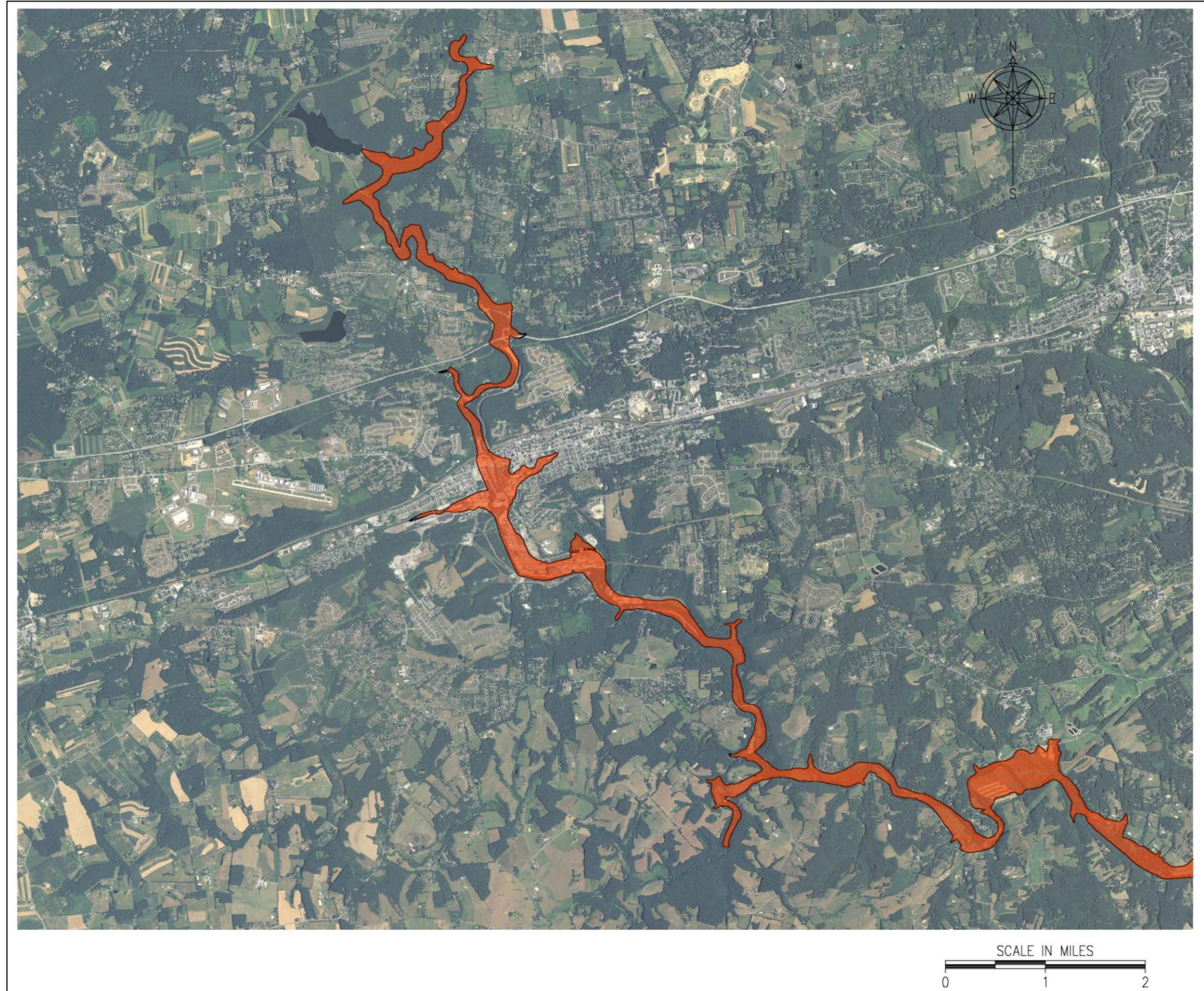




Figure C-3 – FEMA Map – 100-year and 500-year Floodplain

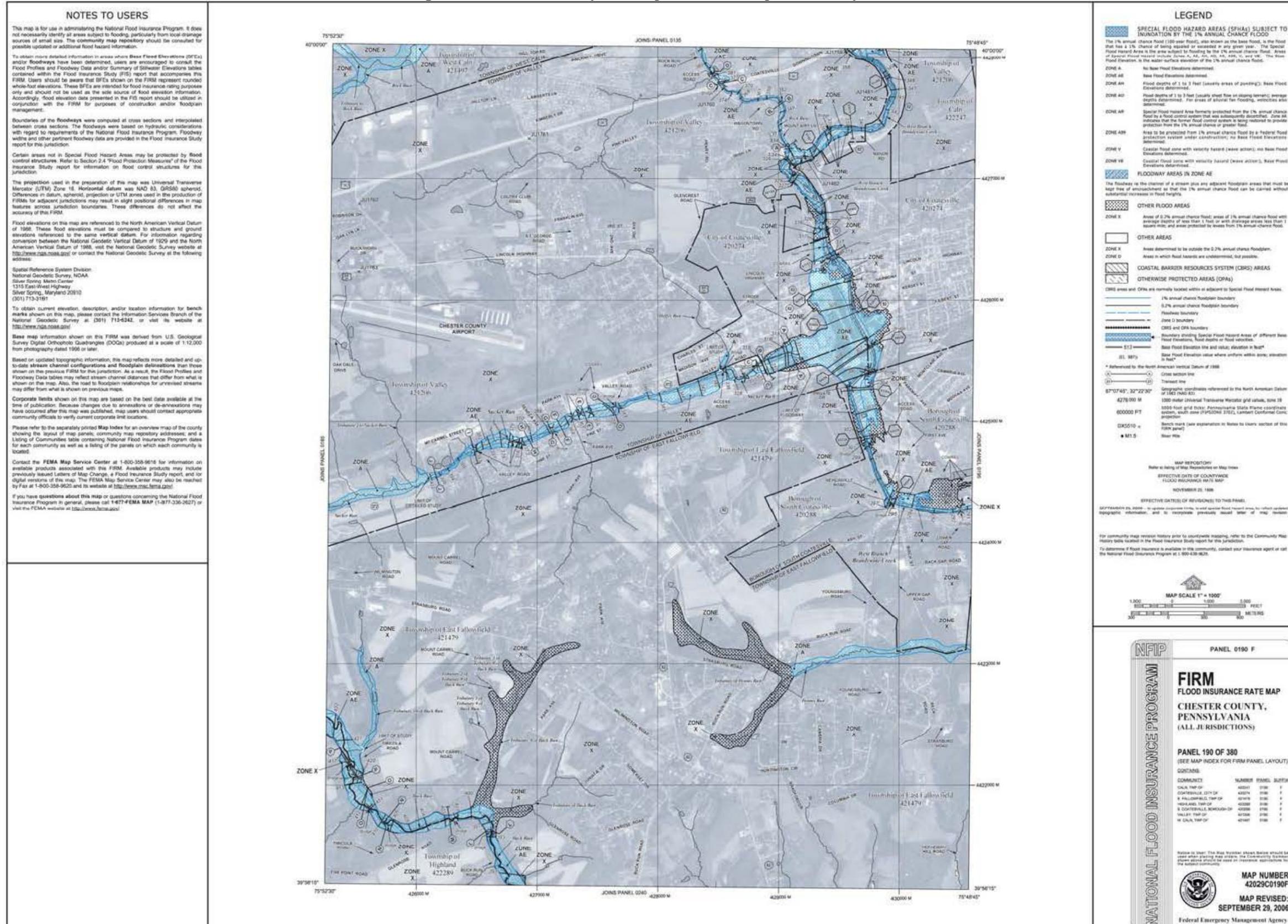


Figure C-4 – FEMA Map – 100-year and 500-year Floodplain

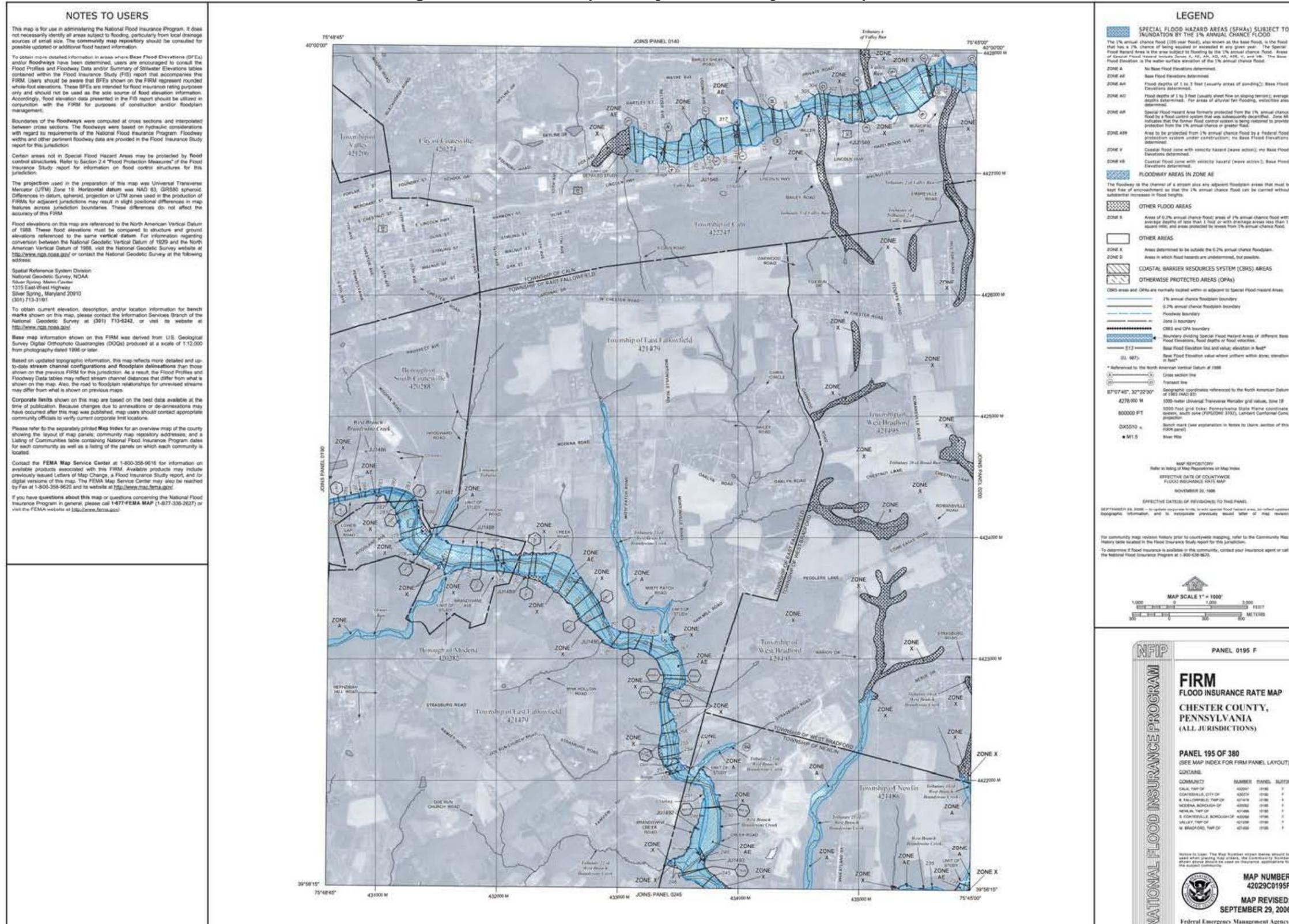


Figure C-5 - Existing Conditions

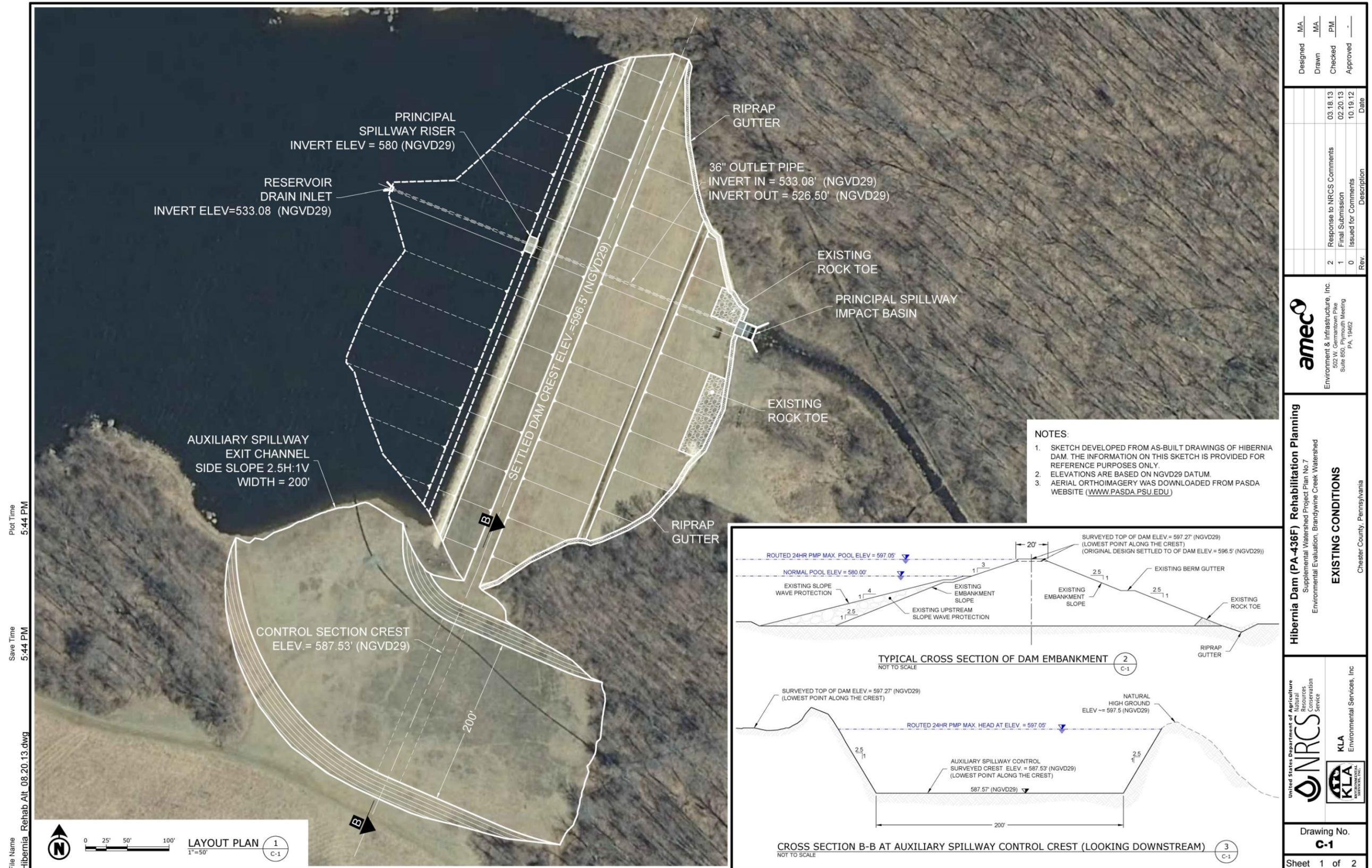
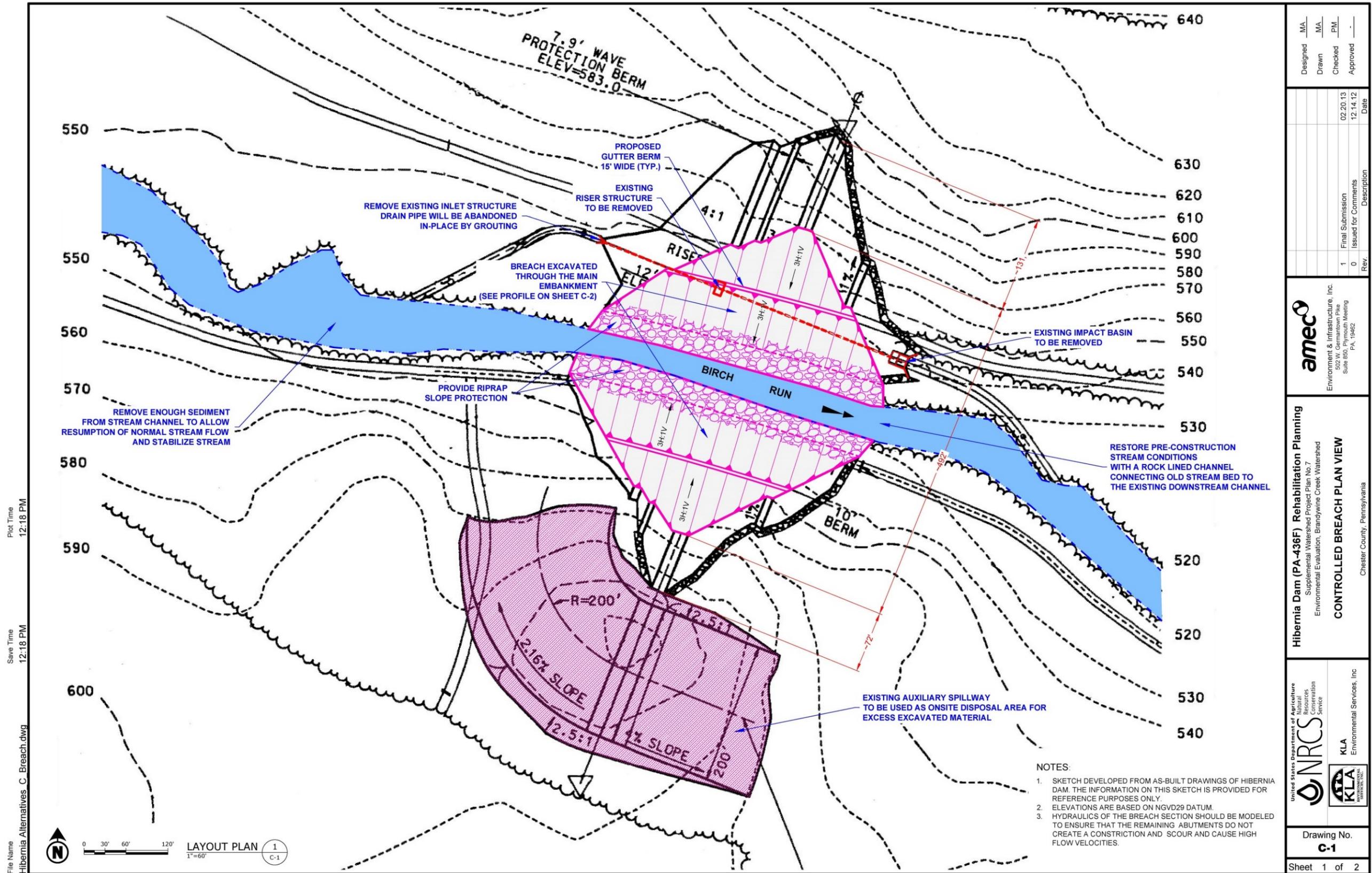


Figure C-6 – Future Without Project Alternative



Rev.	Description	Date
1	Final Submission	02.20.13
0	Issued for Comments	12.14.12

**ameco**  
 Environment & Infrastructure, Inc.  
 502 W. Germantown Pike  
 Suite 850, Plymouth Meeting  
 PA, 19462

**Hibernia Dam (PA-436F) Rehabilitation Planning**  
 Supplemental Watershed Project Plan No. 7  
 Environmental Evaluation, Brandywine Creek Watershed  
**CONTROLLED BREACH PLAN VIEW**  
 Chester County, Pennsylvania

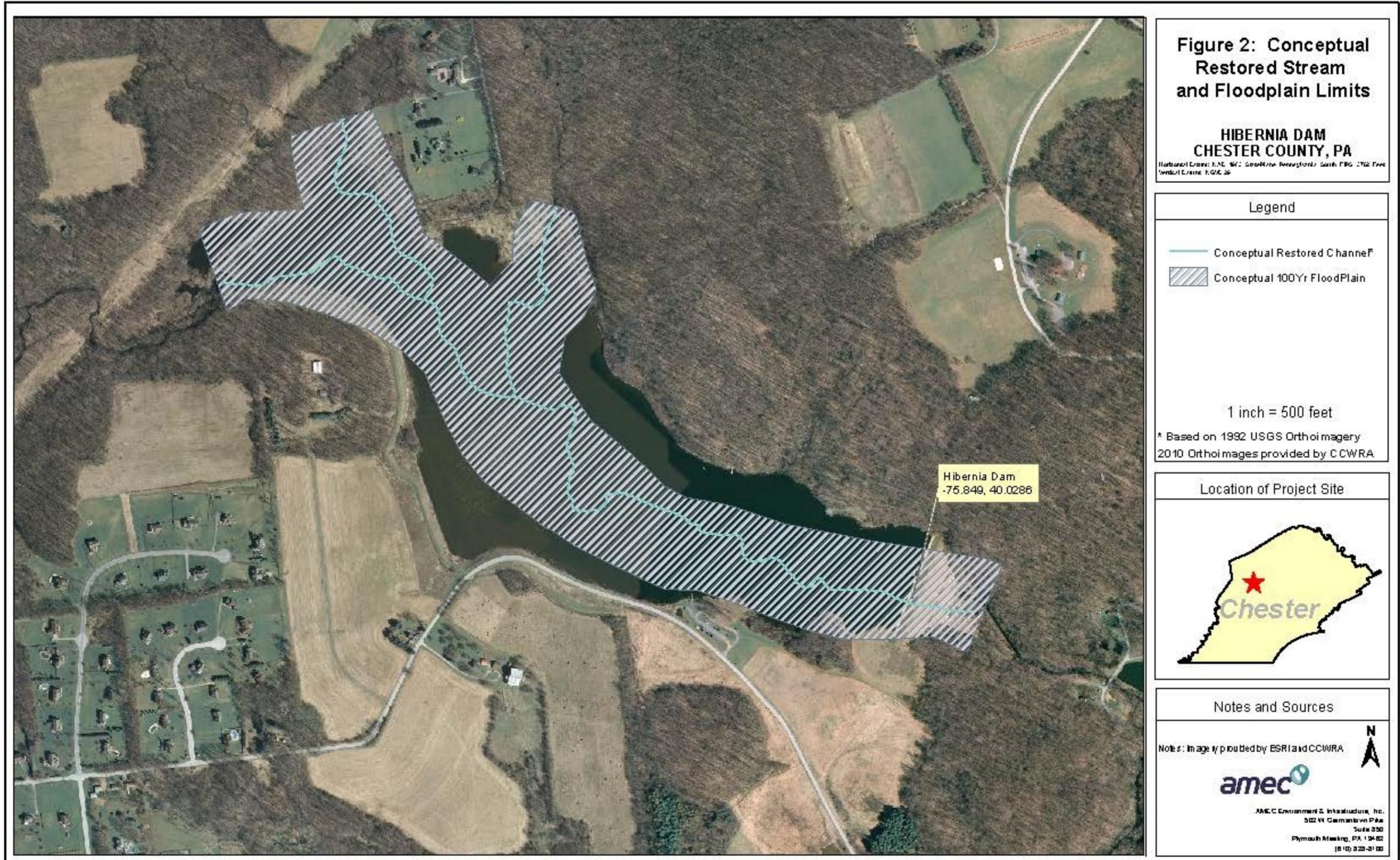
United States Department of Agriculture  
**NRCS**  
 National Resource Conservation Service

**KLA**  
 Environmental Services, Inc.

Drawing No.  
**C-1**  
 Sheet 1 of 2

- NOTES:
1. SKETCH DEVELOPED FROM AS-BUILT DRAWINGS OF HIBERNIA DAM. THE INFORMATION ON THIS SKETCH IS PROVIDED FOR REFERENCE PURPOSES ONLY.
  2. ELEVATIONS ARE BASED ON NGVD29 DATUM.
  3. HYDRAULICS OF THE BREACH SECTION SHOULD BE MODELED TO ENSURE THAT THE REMAINING ABUTMENTS DO NOT CREATE A CONSTRICTION AND SCOUR AND CAUSE HIGH FLOW VELOCITIES.

Figure C-7 – Decommissioning Alternative



**Figure 2: Conceptual Restored Stream and Floodplain Limits**

**HIBERNIA DAM  
 CHESTER COUNTY, PA**

Hatched Lines: 1:10, 1/4" = 500 Feet; Restored Stream: 1:10, 1/4" = 500 Feet  
 Hatched Lines: 1:10, 1/4" = 500 Feet

**Legend**

-  Conceptual Restored Channel
-  Conceptual 100Yr FloodPlain

1 inch = 500 feet

\* Based on 1992 USGS Orthoimagery  
 2010 Orthoimages provided by CCWRA

**Location of Project Site**



**Notes and Sources**

Notes: Image provided by ESRI and CCWRA



AMEC Environment & Infrastructure, Inc.  
 502 W. Germantown Pike  
 Suite 350  
 Plymouth Meeting, PA 19082  
 (610) 823-3100

# Appendix D

## INVESTIGATIONS AND ANALYSES REPORT

## D.1 INTRODUCTION

This Appendix provides supplementary information regarding the investigations and analyses conducted for the Project. The administrative record contains additional information relevant to each of the sections in this Appendix.

## D.2 EXISTING DATA

NRCS provided the following existing data from its archived files to the Project Team:

- As-Built Plans
- Detailed Report of Geology Investigations
- Soil Mechanics Reports
- Breach Inundation Studies
- Stream Hydrology Studies
- Design Documentation
- General Work Plan & Supplements
- Watershed Work Plans
- Supporting Documentation
- Environmental Studies

## D.3 EFFECTS ANALYSIS

Ecological, cultural and socio-economic effects of alternatives were evaluated using the NRCS-CPA-52 - Environmental Evaluation form. This analysis was conducted with consideration to the public participation scoping requirements set forth in the National Watershed Program Manual (NWPM) by considering the potential occurrences of and/or project impacts/risks to the list of 31 natural resources and other issues of concern presented in Section 501.24 Part B of the NWPM. The information presented in the Plan-EE is an overview of the relevant watershed characteristics compiled from existing information. In addition various websites, as referenced, were used to provide information on natural resource conditions at the site. Onsite observations were made to ground truth and supplement the compiled site information presented in this report.

Once alternatives were formulated, the Project Team evaluated the effect of each alternative on relevant resource concerns and special environmental concerns. The Dam Rehabilitation alternative involves minimal changes to the existing features and functions of the dam and the construction will be confined to the existing dam and auxiliary spillway.

The No Action/Future Without Federal Project (FWOP) includes removal of a portion of the existing embankment to allow flood flows to pass unimpeded and consequently would impact the hydrology upstream and downstream from the dam resulting in transport of sediment downstream of the dam. The hydrologic changes would have some effect on wetlands located in the existing reservoir storage pool, by changing the depth and duration of floodwater. The change would also increase flood flow depth and duration downstream, including increased streambank erosion and increased flood damages. The portion of the dam removed with the FWOP has little or no habitat value, so the primary on-site effects will be small improvements in habitat value at the site of the embankment.

## D.4 ECONOMIC AND SOCIAL EFFECTS

**Benefit Analysis Summary.** This analysis was completed to represent current conditions according to Attachment 3, Resource and Economic Evaluation in the Project Statement of Work. Changes to the land use composition of the benefit area since the last supplement were incorporated and evaluated by prorating the original benefits to the revised land use composition based on a ratio of areas for each land use.

After updating based on land use changes, the original benefits for the project were indexed to current dollars (2013) and prorated for the study area based on the ratio of controlled area of each flood damage reach.

The Project Team observed the dam sites, the contributing drainage areas above the dams, and the flood impact zones below the dams. The predominant land uses in the benefit area were qualitatively inventoried and the changes observed from the original plan and supplements were noted. The previously formulated flood damage benefits were adjusted consistent with the increase in flood plain development observed since the original evaluation. After adjusting the flood damage reduction benefits based on the changes in land use, all benefits were indexed to reflect current values. Indexing was completed using procedures consistent with National Watershed Program Handbook 604.1 (B).

After allocating the original benefits, adjusting flood damage benefits based on the observed land use changes, and updating all benefits to current values, the relative benefit/cost ratio will be determined for each project alternative by comparing the average annual benefit with the amortized rehabilitation costs.

The following is brief outline of the project benefit analysis:

1. Inventory the previous Supplemental Watershed Plans and determine the most recently calculated benefits.
2. Evaluate substantial changes in number of houses and businesses with reduced flood damages; substantial differences from the Watershed Plan in water supply, recreation and other benefits; and other pertinent factors.
3. Allocate the Watershed Work Plan benefits to the appropriate project (Hibernia Dam).
4. Determine the appropriate economic index for each benefit purpose.
5. Calculate all economic indexes for each price base.
6. Update the flood damage reduction benefits allocated to the Hibernia Dam to current values.
7. Update the municipal water supply benefits for the Hibernia Dam to current values.
8. Update the added recreation benefits for the Hibernia Dam to current values.

The flood damage reduction benefits were allocated based on the flood control contribution noted in the previously developed (August 1996) but unapproved Supplemental Watershed Work Plan No. 7 for Brandywine Creek Watershed.

**Flood Damage Benefit Area Review.** The Watershed Work Plan for Brandywine Creek Watershed considered four dams in the Brandywine West Branch. Of the four dams planned, the Hibernia Dam (PA-436F) is the only P.L. 566 Project dam constructed in the Brandywine West Branch.

The Project Team reviewed land use changes within the floodplain beginning with the area delineated by the Coatesville Frequency Map found in Figure 3 on page 71 of the Brandywine Creek Watershed Work Plan (April 1962). The analysis included a review of historical aerial photography of all stream reaches downstream from the Hibernia Dam (PA-436F). The FEMA Zone A regions were overlaid on 1958 and 2010 historical aerial photography of the downstream flood damage reduction benefit areas for each stream reach. Developed areas were delineated and measured for both years. The flood damage benefits formulated with the unapproved Supplemental Watershed Work Plan Agreement No. 7 for Brandywine Creek Watershed were adjusted consistent with the increase in flood plain development observed during the evaluation period.

**Economic Index.** Principles & Guidelines (P&G) section 1.7.2(a)(4)(ii) and 2.1.1(b)(2) allows abbreviated procedures to evaluate project benefits. Consequently, indexing was used instead of hydrologic and economic evaluation for updating the benefits for those areas where no substantial land use changes have occurred. The original and supplemented Project Benefits were indexed to Price Base 2013 consistent with the tools provided at the NRCS Economics Web Site:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/tools>

The project benefits were last updated in 1996 (Price Base 1995) via the unapproved Supplemental Watershed Work Plan No. 7 for Brandywine Creek Watershed. Additional

recreation benefits for recreation facilities at Hibernia Dam were estimated in Supplemental Watershed Work Plan No. 6 for Brandywine Creek Watershed using Cost Basis of 1993. These additional benefits were indexed to current Cost Price Basis of 2013 and added to the updated and allocated benefits from the unapproved Supplemental Watershed Work Plan No. 7 for Brandywine Creek Watershed.

Table D-1 summarizes the indexes used to update the project benefits for each project purpose.

**Table D-1 - Benefit Index Assignment**

Project Purpose	Index
Flood Damage Reduction	Consumer Price Index from 1995
Municipal Water Supply	Consumer Price Index from 1985
Recreation	Consumer Price Index from 1993

The Consumer Price Index used in the analysis is the Consumer Price Index-All Urban Consumers and was acquired for the Price Base Years from the Excel Worksheet at the following Web Address:

[ftp://ftp-fc.sc.egov.usda.gov/Economics/priceindexes/Data/PPPI\\_CPI\\_CCI.xls](ftp://ftp-fc.sc.egov.usda.gov/Economics/priceindexes/Data/PPPI_CPI_CCI.xls)

Table D-2 summarizes the price and cost index values used to update the project benefits.

**Table D-2 - Price and Cost Indexes**

Item	1985 Base	1993 Base	1995 Base	2013 Value	Index from 1985	Index from 1993	Index from 1995
Consumer Price Index	107.6	144.5	152.4	229.601	2.134	1.589	1.507

**NED Analysis.** The Economic and Environmental Principles and Guidelines from Planning Water and Land Related Resources Implementation Studies were used to determine the National Economic Development Alternative (NED). This alternative is defined as that which maximizes the net benefits consistent with protecting the Nation’s environment. The economic evaluation was performed in accordance with Chapter 2, Section 4 of the NRCS National Watershed Program Manual (Parts 501.11 A(2); 501.12 C; 505.35 B (1) (iii)-(1V); 505.35 E-F).

## D.5 ENGINEERING

**Surveys.** The topographic survey included one profile along the axis of the dam crest, one profile of the auxiliary spillway (inlet channel, control section, and exit channel) and one profile through the dam embankment at the principal spillway. Survey point elevations were obtained using a survey grade GPS receiver with an OPUS solution. The horizontal datum was based on the North American Datum of 1983 (NAD83) using the Pennsylvania State Plane coordinate system, South Zone. The vertical datum was based on the National Geodetic Vertical Datum of 1929 (NGVD29) and a benchmark as depicted on as-built drawings ("Brandywine Creek Watershed", sheet 5 -71).

A Bathymetric survey was conducted at the reservoir area in November 2011. AMEC, with assistance from the Park Service, performed the bathymetric survey using a boat equipped with a fathometer, and a survey grade GPS. Horizontal and vertical positions along with the fathometer readings (depth of reservoir) were recorded at various locations on the lake surface, shore to shore. A dropped 100-foot tape method was used at various locations to verify the fathometer readings. The positions were laid out on the reservoir surface in a grid pattern and were spaced less than 200 feet apart from each other. This survey provided information on the current storage capacity below the normal pool elevation at 580 ft. In order to derive the storage

values above the pool elevation, LiDAR survey Data from PASDA, dated 2008, was combined with the bathymetric survey and sampled sediment depths taken at the time of the bathymetric survey. Drawings of the reservoir area showing contours used to calculate storage were prepared.

**Population-At-Risk.** The Population-at-Risk (PAR) was obtained from the Risk Analysis Worksheet that was completed for Hibernia Dam (PA-436F) (Aug 2010). These values were determined by conducting a GIS analysis of the dam breach inundation zone that was obtained from the approved Emergency Action Plan (EAP) for the dam. The analysis revealed the inundation zone contains 600 houses, 3 schools and 45 businesses, as well as roads and a railroad line. It was estimated that on average there are 2.5 residents per house, plus approximately 800 students/staff in the 3 schools plus an additional 2,700 people in the 45 businesses, roads and railroad in the breach zone for a total PAR of 5,000.

**Flood Storage Capacity.** The flood storage capacity was determined by evaluating the cumulative storage capacity above the normal pool elevation. The Project Team compared the flood storage capacity based on the current bathymetric survey and the flood storage capacity based on the design drawings.

**Runoff Curve Number.** The Runoff Curve Number (RCN) development for the Hibernia Dam watershed followed TR-55 methodology. Arc Hydro tools, in conjunction with the USACE HEC-GeoHMS software, were used to combine land use data with corresponding soil types and develop a weighted RCN for the entire watershed.

Input data included a raw DEM of the watershed with  $\pm 1.3$  feet vertical accuracy obtained from PASDA. The Arc Hydro tools use the DEM to delineate the boundaries of the watershed and to develop stream lines that would naturally form in the terrain. Using the detailed DEM and Arc Hydro tools, the drainage area to Chambers Lake was refined resulting in a drainage area of 4.6 square miles, which is greater than drainage area of 4.5 square miles, as indicated in the Final Engineering Design Report. Further processing of available data included the joining of SSURGO soils data obtained from the NRCS with tables indicating the hydrologic soil groups associated with the known soil types. The soils data was then merged with a 2005 land use layer provided by the CCWRA and updated with roadways and new housing based on the 2010 aerial photography. In addition, field truthing was conducted by AMEC on December 12, 2011 to verify that correct land use categories were used in the RCN calculations. A detailed summary of the RCN calculations is provided in the "Hibernia Dam RCN" spreadsheet. Additional field truthing on January 27, 2012 by AMEC confirmed that areas of forest with B and C HSG type soils, southwest of the impoundment at Hibernia Dam, should not be classified as wetlands. The curve number for this area was adjusted accordingly.

**Time of Concentration.** The Time of Concentration ( $T_c$ ) was developed using the segmental/velocity approach, described in TR-55, and the USACE HEC-GeoHMS software. An automated tool in HEC-GeoHMS uses the terrain to determine the paths with minimal slope for shallow concentrated flow, sheet flow, and open channel flow. The HEC-GeoHMS tool develops a preliminary Longest Flow Path using the DEM, which can be then manually edited by the user. The edits include identifying the locations of flow-type transitions from sheet flow to shallow concentrated flow, and from shallow concentrated flow to channel flow. AMEC conducted field verification of the location where shallow concentrated flow transitions to channel flow on January 27, 2012.

**Precipitation Data.** Precipitation data for the Hibernia Dam watershed was derived using the following sources:

- Hydrometeorological Report 51 – Probable Maximum Precipitation (PMP) Estimates, United States East of the 105th Meridian, which provides PMP values for various storm durations.
- NOAA Atlas 14, Volume 2 (Ohio River Basin and Surrounding States) – Provides rainfall depth-duration-frequency data for 13 Mid-Atlantic and central states.

These rainfall depths were used to develop design hydrographs and evaluate the principal spillway capacity; stability and integrity of auxiliary spillway; and dam capacity (top of dam elevation).

TR-60 design criteria require that the principal spillway capacity be evaluated by routing the Principal Spillway Hydrograph (PSH) with a combined 1-day/10-day 100-year return period rainfall. Two methods for estimating runoff volumes were used: (1) the runoff curve number procedure and (2) runoff volumes based on stream gage studies (TR-60, Figures 2-1(a) and 2-1(b)). The procedure that results in the higher auxiliary spillway crest elevation, when the PSH is routed through the structure, was used. The top of dam elevation and integrity of the auxiliary spillway (i.e. head-cutting and breaching) was evaluated by routing the Freeboard Hydrograph (FBH). For High Hazard Class dams, such as the Hibernia Dam, the FBH is generated by a PMP storm. Both a short duration (6-hour) and a long duration (24-hour) storm were analyzed to determine the discharge capacity and integrity of the auxiliary spillway, as required by Technical Release Number 60. The duration of both design storms was longer than the time of concentration for the watershed. The stability of the auxiliary spillway (i.e. erosion and scour along the exit channel) was evaluated by routing the Stability Design Hydrograph (SDH), which is generated by using rainfall depth computed from the following equation:

$$SDH = P_{100} + 0.26(PMP - P_{100})$$

Per TR-60, the rainfall depths are temporally distributed using the standard NRCS 6-hour storm distribution (for the SDH and 6-hour FBH), the NRCS 5-point rainfall curve (for the 24 hour FBH), and the NRCS 1-day/10-day distribution (for the PSH). The 1-day/10-day and 6-hour distributions are applied by SITES directly. The 5-point rainfall curve is a critically stacked distribution, which is developed using PMP data for 6-, 12-, and 24-hour PMP storms. The 6-hour PMP is applied uniformly in the second increment of the stacked distribution. Each of the remaining incremental rainfalls is applied uniformly in adjoining 6-hour increments. A site-specific 5-point rainfall curve for Hibernia Dam was developed using a guidance document/spreadsheet ("5-point 24-hour NRCS Dimensionless Rainfall Distribution & TR-60 SDH/FBH Hydrologic Criteria") provided by the NRCS.

**Storage Volume.** Sediment volume currently deposited was calculated using the sampled sediment depths taken at the time of the bathymetric survey. The dam pool configuration and capacities were re-evaluated. As a result of the detailed evaluation, the water supply, recreation, flood detention and sediment capacities were updated to reflect existing conditions. There has been no notable change to the municipal water supply since the dam was constructed. There has been no notable change to the water-based recreation since the development of Supplemental Watershed Work Plan No. 6.

**Site Walk.** The Project Team conducted a site visit to document the current conditions of Hibernia Dam, located in Chester County, Pennsylvania on December 2, 2011. The site visit included a visual review and photographic documentation of the exposed areas of the dam and associated structures. At the time of the site visit, the dam and associated structures were found to be in functional condition.

**Geology.** No detailed geologic investigation of the existing dam embankment was conducted. The geology of the dam and foundation are based on the investigations and analyses conducted during the original design of the dam, and subsequent investigations and analyses commissioned by CCWRA.

Connelly Drilling (Connelly) of Frederick, Maryland performed the subsurface exploration along the centerline path of the auxiliary spillway between November 17, 2011 and November 30, 2011. All work was observed by AMEC's onsite representative. A representative from Chester County Water Resources Authority (CCWRA) was periodically onsite to observe the work. The borings were conducted at locations surveyed and staked prior to mobilization. Boring locations that had to be adjusted in the field were located by measuring distances from known Site reference points.

Boring locations and elevations should only be considered accurate to the degree implied by the method of measurement used.

The borings were advanced with 3 ¼" augers to refusal. Each boring was sampled in accordance with ASTM D1586 (Penetration Testing and Split Spoon Sampling of Soil) at five foot intervals to auger refusal at bedrock. The final 10-feet of each boring were cored into bedrock. The split-spoon soil samples and rock samples were visually examined and logged by AMEC's onsite representative.

Each completed boring was covered with a traffic cone to mark and protect it until the end of drilling operations. Groundwater was allowed to equilibrate within the borings and depth to groundwater was measured in each boring in one event on the last day of drilling (November 29, 2011). All borings were tremie-grouted using the grout mixture (4 pounds of 200-mesh dry powdered bentonite for 94 pounds of cement) requested by CCWRA. Connelly removed all excess soil cuttings from the Site and disposed of the cuttings in an appropriate manner. Drilling water was controlled with a combination of temporary hay bale diversions, level spreaders, and sediment traps. Areas impacted by drilling activities and egress were restored to as close to pre-existing conditions as practical by Connelly, AMEC, and CCWRA. Restoration efforts included raking disturbed areas to restore pre-existing grades and covering the areas with leaves/straw. Disturbed grass areas were additionally seeded and strawed.

The soil samples were delivered to Geotechnical in King of Prussia, Pennsylvania for visual classification and testing. The laboratory testing for this project included soil classification (ASTM D2487), specific gravity (ASTM D854), sieve/gradation (ASTM D422), percent clay (ASTM D422), plasticity index (ASTM D4318), and dry density (ASTM D4531). The laboratory test data was provided and the results are summarized. The field classifications were confirmed or modified, as necessary. The soil samples were disposed of in an appropriate manner. All rock core samples were provided to CCWRA for their use and storage.

***Slope Stability and Seepage Analyses Review.*** AMEC performed a review of three reports provided by Chester County Water Resources Authority, written by Gannett Fleming, Inc., to evaluate the slope stability and seepage of Hibernia Dam:

- Bench Drainage, dated January 3, 2007;
- Stability Evaluation, dated June 2011; and
- Maximum Surcharge Pool Seepage and Slope Stability Engineering Analysis, dated September 2011.

Gannett Fleming, Inc., analyzed the dam for slope stability using soil seepage and strength parameters developed by laboratory and field tests and correlations with published information. The slope stability and seepage analyses indicate that the dam may be marginally stable when loaded to the maximum design flood case and that uncontrolled seepage can compromise dam safety.

***Principal Spillway Video Inspection.*** AMEC conducted a televideo (TV) inspection of the principal spillway as part of the documentation of the current conditions of Hibernia Dam, located in Chester County, Pennsylvania on December 14, 2011. A memorandum provided observations, joint gap measurements, and videos to document the current conditions of the principal spillway.

The objectives of the inspection were to document the current condition of the principal spillway outlet pipe and riser structure, measure the joint gap at each pipe segment, and identify any potential issues. AMEC used the T76 Camera Tractor and Orpheus Camera to perform the inspection. This equipment provided video by crawling through the outlet pipe. Measurements were obtained within the pipe by utilizing the integrated laser measurement tool with an accuracy of 0.01 mm.

Prior to beginning of the inspection, the lake was drawn down by CCWRA to obtain a no-flow condition. However, due to a leak in the drawdown sluice gate, there were about 2 inches of flow in the outlet pipe at the time of inspection. The pipe was accessed from the outlet in the impact basin and inspected to identify for any deformities, sags, cracks, or other items of note.

Measurements of the gap spacing were taken at each joint in the outlet pipe at four points (looking upstream): the 12 o'clock, 3 o'clock, 6 o'clock, and 9 o'clock positions; or as close to these positions as is possible. Due to the low flow in the pipe, the 6 o'clock position measurement was taken closer to the 5 o'clock and 7 o'clock positions, as noted. The low flow in the pipe limited the video inspection and measurements at and near the concrete riser due to splashing on the camera and lasers. The video was then evaluated to document notable observations.

Using the on-board laser measurement device on the TV crawler, AMEC measured the joint gaps of each of the 14 joints where visible. Overall, the joint measurements ranged from 0 mm (0") to 2 mm (~1/12"), which is less than the maximum gap of 3/4".

**Alternative Formulation.** The Project Team completed a conceptual/preliminary engineering analysis to determine the alternatives to be evaluated in detail. The alternatives considered included the following:

Future Without Project (FWOP) (no action) – The FWOP alternative was identified in coordination with NRCS and the Sponsors and is also known as the no action alternative. The FWOP alternative is a minimum level Sponsor breach of the dam, as directed by Pennsylvania Department of Environmental Protection. According to the National Watershed Program Handbook, FWOP is based on the course of action that the Sponsor is most likely to take in the event that no federally financed rehabilitation work were to be undertaken. The sponsor requested the following FWOP statement: "The Sponsor has indicated that a minimum level breach of the dam, such as the removal of a portion of the earthen embankment, as directed by the Pennsylvania Department of Environmental Protection, would be the FWOP approach conducted by Chester County Water Resources Authority."

Rehabilitation to a High Hazard Dam – The alternative to rehabilitate Hibernia Dam would require construction and modification in three locations of the dam: the auxiliary spillway, the downstream toe, and the downstream berm.

**Improvements within the Auxiliary Spillway:** One of the rehabilitation efforts would include raising the control section of the auxiliary spillway to elevation 588.23 feet MSL and widening the auxiliary spillway to 260 feet. To meet current NRCS design criteria for uniform flow within the earthen spillways, this planning study evaluation anticipates a flow splitter dike to be constructed to divide the spillway into bays of less than 200 feet. In addition to raising and widening the auxiliary spillway, a concrete cutoff wall would be constructed along the upstream edge of the control section and along the left side of the exit channel to prevent head cut erosion from undermining the earthen embankment and/or breaching the spillway crest. The cutoff will extend as needed along the left side of the exit channel should it be necessary.

**Improvements to the Downstream Toe:** Another rehabilitation effort would include the installation of a filtered toe between the impact basin and the existing rock toe. Design considerations of the filtered toe should include filter configuration, extent into foundation soils, and height. The construction technique should also be evaluated as potential options include, but are not limited to, a weighted filter placed upon the existing slope or a filter installed within an excavation at the toe, and construction aspects to consider include excavation dewatering and wetland impacts. The owner has recently advised of seasonal saturated conditions on the embankment south of the existing rock toe. This area should be evaluated during design to determine whether any surface condition improvements are warranted.

**Improvements to the Downstream Berm:** The final rehabilitation effort needed is to re-grade the berm on the downstream face of the dam to promote positive drainage and eliminate water ponding and infiltrating into the embankment. The planning study identified re-grading the berm with a 10H:1V positive slope toward the downstream toe as the desired solution.

The Project Team formulated a matrix of dam features, deficiencies and potential solutions to explore alternatives for dam rehabilitation. Alternatives were evaluated in consultation with CCWRA and based on effectiveness, efficiency, constructability and compatibility with the

purpose and need for the Project. Rehabilitation alternatives considered but dismissed from further evaluation included the following:

- Remove sediment from the reservoir to provide an additional 50 years of sediment storage capacity.
- Raise the dam crest, auxiliary spillway crest and principal spillway crest to provide additional sediment storage capacity.
- Regrade the berm gutter to drain toward the abutments and install drain trench filled with drainfill wrapped in geotextile to address the standing water on the berm gutter.
- Install a filtered toe between the impact basin and the existing rock toe to address the minimum factor of safety for embankment stability.
- Install a French Drain to address the standing water on the berm gutter.
- Grout the "window" of untreated foundation soils beneath the dam.
- Install a fuse plug auxiliary spillway to provide additional detention capacity and to reduce the frequency of auxiliary spillway discharge.
- Increase the height of the embankment by installing additional fill, PVC sheet piling or a parapet wall to provide additional freeboard and prevent dam overtopping during the Probable Maximum Precipitation event.
- Install a labyrinth weir to increase the effective width of the auxiliary spillway.

Dam Decommissioning – The Decommissioning alternative was formulated to restore the stream by reconnecting the upstream and downstream channel in a non-erosive manner and restoring the stream/river. The entire dam embankment would be excavated to allow normal flows and up to 100-year flood flows through the site in a non-erosive manner. Accumulated sediment would not be removed. The decommission alternative was developed in consideration of guidance in NRCS National Engineering Handbook, Part 653, Stream Corridor Restoration: Principles, Processes, and Practices. The decommissioning alternative would eliminate flood storage and protection provided by the dam, which could possibly expose downstream properties to an increased risk of flooding, property damage, and loss of life. As a result, the decommissioning alternative alone would not meet the objective to maintain the downstream flood damage reductions provided by the existing project. To meet this objective, the decommissioning alternative would have to be supplemented by other measures such as flood proofing or relocation of structures located within the 100-yr floodplain.

Dam Decommissioning with Nonstructural and Other Measures - This alternative includes Decommissioning as noted above and removing all structures within the 100-year floodplain. Estimated costs include relocation, property acquisition, demolition, and site stabilization/restoration along with decommissioning utilities, septic structures, wells and similar facilities.

Acquisition/Relocation of At-Risk Structures and Other Non-Structural Measures (Flood-Proofing in the Inundation Areas) - These alternatives were formulated to remove the downstream hazard and allows the Hibernia Dam to be reclassified as a Low Hazard Class dam. Land use restrictions were considered to prevent future upgrades to High Hazard Class dam due to downstream development within the breach inundation area. The threat to human life from sudden dam failure would be reduced by relocating the residential and commercial structures and raising and/or relocating the roadways within the potential breach inundation.

**Cost Estimates.** The Project Team prepared predictions of probable costs for all alternatives. The predictions of probable costs are intended for comparing the alternatives. Unless otherwise noted predictions of probable costs were prepared using the RS Means method for engineering cost estimation.

# Appendix E

## PROJECT DATA

<b>PL-83-566 Project Information</b> <b>Brandywine Creek Watershed Supplemental Watershed Plan/EE</b> <b>Hibernia Dam (PA-436F)</b> <b>West Caln Township, Chester County, PA</b>	
<b>Rehab General Description Data</b>	
Project Number	2012
Hydrologic Unit Area:	02040205
Longitude (decimal format):	75.848539
Latitude (decimal format):	-40.028922
Area of Project (acres):	2,995
Project Evaluation Life:	50 Years
Project Discount Rate:	3.75%
Price Base:	2013
B/C Ratio:	14.7 to 1.0
Total Cost (Table 1):	\$2,418,000
Total PL 83-566 Cost:	\$2,056,000
Dam Number	PA-436F
National Inventory of Dams (NID):	PA01505
Congressional District of dam:	07-PA
FIPS Code of dam:	42029
# Single-Purpose Floodwater Retarding Structures Planned:	0
# Multi-Purpose Structures Planned:	1
Rehab Project Purposes:	Flood Control, Water Supply, and Recreation

<b>PL-83-566 Project Information</b> <b>Brandywine Creek Watershed Supplemental Watershed Plan/EE</b> <b>Hibernia Dam (PA-436F)</b> <b>West Caln Township, Chester County, PA</b>	
Sponsor Data	
Organization:	Chester County Water Resources Authority and Chester County Board of Commissioners
Sponsor Representative (optional):	Jan Bowers
Sponsor Title:	Executive Director
Sponsor Type:	County
Address:	801 Westtown Road P.O. Box 2747
City:	West Chester
State:	Pennsylvania
Zip:	19380-0990
Phone:	610.344.5400
Email:	<a href="mailto:jbowers@chesco.org">jbowers@chesco.org</a>
Fax:	610.344.5401
O&M Responsibility (Yes/No):	Yes

<b>PL-83-566 Project Information</b>	
<b>Brandywine Creek Watershed Supplemental Watershed Plan/EE</b>	
<b>Hibernia Dam (PA-436F)</b>	
<b>West Cain Township, Chester County, PA</b>	
<b>Rehab Budget Request Data</b>	
Failure Index:	174
Population at Risk:	5,000
Price Base:	2013
Estimated Installation Cost (Watershed Agreement):	\$2,246,000
Priority - State Dam Safety Agency:	Medium
Number of Municipal Water Supply Users:	38,371

<b>PL-83-566 Project Information</b> <b>Brandywine Creek Watershed Supplemental Watershed Plan/EE</b> <b>Hibernia Dam (PA-436F)</b> <b>West Caln Township, Chester County, PA</b>	
<b>Rehab Subset of Benefits Data</b>	
Price Base:	2013
Total Funds Needed (FA/TA) (Table 1): PL-83-566 NRCS	\$1,460,000/\$596,000
Other Than PL-83-566:	\$362,000
Agricultural Related Flood Damage Reduction Benefits (Average Annual):	\$188,700
Non-Agricultural Related Flood Damage Reduction Benefits (Average Annual):	\$ -
Agricultural Related Non-Flood Damage Reduction Benefits (Average Annual):	\$ 2,789,000
Non-Agricultural Related Non-Flood Damage Reduction Benefits (Average Annual):	\$
Beneficiaries (No.):	499,000
Visitor Days (Optional):	151,500
Farms and Ranches Benefited (No.):	Not Evaluated
Bridges Benefited (No.):	42
Public Facilities Benefited (No.):	2
Businesses Benefited (No.):	15
Homes Benefited (No.):	197
Reduced Erosion (Tons/Yr.):	0
Reduced Sedimentation (Tons/Yr.):	3,125
Streams/Corridors Enhanced/Protected (Miles):	42
Lakes/Reservoirs Enhanced/Projected (Surface Acres):	90
Domestic Water Supplies Benefited (No.):	1
Incidental Recreation Benefited (No. of Water Bodies/Stream Segments):	2
Groundwater Recharge (Acre-Feet):	0
Wetlands Created, Enhanced, or Restored (Acres):	0
Upland/Riparian Habitat Created/Enhanced (Acres):	0
Threatened and Endangered Species Benefited:	0
Population with Reduced Risk:	5,000