CLERKS OFFICE U.S. DIST. COURT
AT HARRISONBURG, VA
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IN THE UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF VIRGINIA
HARRISONBURG DIVISION

UNITED STATES OF AMERICA, on behalf of UNITED STATES DEPARTMENT OF THE INTERIOR; and COMMONWEALTH OF VIRGINIA, SECRETARY OF NATURAL RESOURCES,	)	
Plaintiffs,	)	CIVIL ACTION NO. 5:16-CV-00082
v.	)	
E. I. du PONT de NEMOURS AND COMPANY,	)	
Defendant.	)	

CONSENT DECREE

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I. BACKGROUND

A. The United States of America ("United States"), on behalf of the United States Department of the Interior ("DOI"), and the Commonwealth of Virginia, acting through its Secretary of Natural Resources ("Virginia"), (collectively, "Plaintiffs"), have filed a Complaint in this action against the defendant, E. I. du Pont de Nemours and Company ("DuPont") pursuant to Section 107 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9607, Section 311 of the Federal Water Pollution Control Law, commonly known as the Clean Water Act ("CWA"), 33 U.S.C. § 1321, and the Virginia State Water Control Law ("SWCL"), Va. Code § 62.1-44.5.

B. The Complaint alleges that DuPont is a responsible or liable party under CERCLA, the CWA, and the SWCL for damages for injury to, destruction of, or loss of natural resources, and costs of natural resource damage assessment and restoration actions that Plaintiffs have incurred or will incur at or in connection with the Waynesboro Facility (as defined below).

C. This Consent Decree (the "Decree") addresses the claims asserted in the Complaint against DuPont for Natural Resource Damages (as defined below).

D. DOI and Virginia (collectively, the "Trustees" and, individually, a "Trustee"), under the authority of Section 107(f)(2) of CERCLA, 42 U.S.C. § 9607(f)(2), and 40 C.F.R. Part 300, serve as trustees for natural resources for the assessment and recovery of damages for injury to, destruction of, or loss of natural resources under their trusteeship.

E. Investigations conducted by the Trustees and the United States Environmental Protection Agency ("EPA") have detected elevated mercury levels in sediments, soils, fish, and wildlife at the Waynesboro Facility, downstream from the Waynesboro Facility for about 24 miles of the South River to the South Fork of the Shenandoah River (the "South Fork"), near

Port Republic, Virginia, and downstream for about 100 miles of the South Fork to Front Royal, Virginia.

F. The Trustees and DuPont have engaged cooperatively in natural resource injury studies, damage assessments, and restoration planning related to the Site since 2005. The Trustees and DuPont entered into two funding agreements dated February 16, 2005 and June 15, 2010, by which DuPont agreed to provide funding for the performance of a natural resource assessment by the Trustees. Under these agreements, all Trustee assessment costs were paid in full through fiscal year 2015.

G. The Trustees have undertaken various natural resource damage assessment activities at the Site and in the affected watershed, which informed a Resource Equivalency Analysis ("REA") and Habitat Equivalency Analyses ("HEA") that, in combination with other assessment techniques, were used to determine the costs of restoration needed to compensate for natural resource injury and recreational fishing loss due to the release of mercury from the Waynesboro Facility.

H. The Trustees determined that the natural resources, including, but not limited to, sediment, fish, birds, mussels and amphibians, sustained ecological injuries attributable to the release of mercury at the Site, and that recreational fishing trips were lost as a result of the same.

I. The Trustees have determined that the Front Royal Regional Fish Hatchery Project set forth herein is appropriately undertaken towards the restoration of the loss of recreational fishing.

J. By entry into this Decree, DuPont does not admit the allegations in the Complaint and does not admit any liability to Plaintiffs arising out of the transactions or occurrences alleged in the Complaint.

K. Plaintiffs and DuPont agree, and this Court by entering this Decree finds, that this Decree has been negotiated by the Parties in good faith; that settlement of this matter will avoid prolonged and complicated litigation among the Parties; and that this Decree is fair, reasonable and in the public interest.

NOW, THEREFORE, it is hereby ORDERED, ADJUDGED AND DECREED as follows:

II. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action pursuant to Sections 107 and 113(b) of CERCLA, 42 U.S.C. §§ 9607 and 9613(b); Section 311(n) of the CWA, 33 U.S.C. § 1321(n); and 28 U.S.C. §§ 1331, 1345 and 1367(a). The Court has personal jurisdiction over DuPont. Solely for the purposes of this Consent Decree and the underlying Complaint, DuPont waives all objections and defenses that it may have to the jurisdiction of the Court or to venue in this District. DuPont shall not challenge the terms of this Consent Decree or this Court's jurisdiction to enter and enforce this Consent Decree.

2. Venue lies in the Western District of Virginia, Harrisonburg Division, pursuant to Section 113(b) of CERCLA, 42 U.S.C. § 9613(b), and 28 U.S.C. §§ 1391(b) and (c).

III. PARTIES BOUND

3. This Decree is binding upon the United States, Virginia, DuPont and their respective successors and assigns. Any change in ownership or corporate or other legal status of DuPont, including but not limited to any transfer of assets or real or personal property, shall in no way alter the status or responsibility of DuPont under this Decree.

4. DuPont shall be responsible for ensuring that its contractors and subcontractors perform any work required hereunder in accordance with the terms of this Decree. With regard

to the activities undertaken pursuant to this Decree, each contractor and subcontractor shall be deemed to be in a contractual relationship with DuPont within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3).

IV. DEFINITIONS

5. Unless otherwise expressly provided herein, terms used in this Decree that are defined in CERCLA, the CWA or in regulations promulgated under CERCLA or the CWA, have the meanings assigned to them in such law or regulations.

6. Whenever the terms listed below are used in this Decree or in any attached appendix, the following definitions shall apply:

a. "Consent Decree" or "Decree" shall mean this Decree, all attached appendices, and any final approved plans required hereunder. In the event of a conflict between this Decree and any attached appendix or plan, this Decree shall control.

b. "Day" shall mean a calendar day. In computing any period of time under this Decree, where the last day falls on a Saturday, Sunday, or federal holiday, the period of time will run until the close of business the next working day.

c. "DOI" shall mean the United States Department of Interior and any of its successor departments or agencies.

d. "DuPont" shall mean E. I. du Pont de Nemours and Company.

e. "Effective Date" shall be the date upon which the approval of this Decree is recorded on the Court's docket.

f. "Front Royal Regional Fish Hatchery Project" or "Fish Hatchery Project" shall mean the fish hatchery project designed and implemented pursuant to Section VIII and Appendix C of this Decree to restore loss of recreational fishing.

g. "Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year. Rates are available online at https://www.epa.gov/superfund/superfund-interest-rates.

h. "Natural Resource" or "Natural Resources" shall mean land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States and/or the State.

i. "Natural Resource Damages" shall mean any damages recoverable by the United States or the State for injury to, destruction of, loss of, loss of use of, or impairment of natural resources at the Site as a result of the release of mercury from the Waynesboro Facility including, but not limited to: (i) the costs of assessing injury to, destruction of, loss of, loss of use of, or impairment arising from or relating to such a release; (ii) the costs of restoration, rehabilitation, or replacement of injured or lost natural resources or of acquisition of equivalent resources; (iii) the costs of planning such restoration activities; and (iv) compensation for injury, destruction, loss, loss of use, or impairment of natural resources.

j. "NRDAR Fund" shall mean the DOI Natural Resource Damage Assessment and Restoration Fund established pursuant to 42 U.S.C. §§ 1474b and 1474b-1.

k. "Paragraph" shall mean a portion of this Consent Decree identified by an Arabic numeral or an upper or lower case letter.

l. "Parties" shall mean the United States, the Commonwealth of Virginia,

and DuPont.

m. "Plaintiffs" shall mean the United States and the Commonwealth of Virginia.

n. "Restoration Plan" shall mean the plan attached hereto as Appendix B, which sets forth the restoration of injured or lost natural resources to be achieved under this Consent Decree.

o. "Section" shall mean a portion of this Consent Decree identified by a Roman numeral.

p. "Site" shall mean the Waynesboro Facility and any area in which mercury released from that Facility may be found.

q. "State" shall mean the Commonwealth of Virginia, its Secretary of Natural Resources, and the Commonwealth of Virginia, Department of Environmental Quality.

r. "Trustees" shall mean DOI and the Commonwealth of Virginia, acting through its Secretary of Natural Resources.

s. "United States" shall mean the United States of America, including all of its departments, agencies, and instrumentalities.

t. "Waynesboro Facility" shall mean the former DuPont acetate fiber manufacturing facility located along the South River in Waynesboro, Virginia. *See* Appendix A.

u. "Waynesboro NRDAR Subaccount" shall mean a segregated subaccount within the NRDAR Fund to be managed by DOI for the joint benefit and use of the Trustees to pay for Trustee-sponsored natural resources restoration projects in accordance with Section VII.

V. GENERAL PROVISIONS

7. Objectives. The objectives of the Parties entering into this Decree are (i) to

contribute to the restoration, replacement, or acquisition of the equivalent of the natural resources allegedly injured, destroyed or lost as a result of mercury releases at and from the Site; (ii) to reimburse natural resource damage assessment costs incurred by the Trustees; (iii) to resolve DuPont's liability for Natural Resource Damages as provided herein; and (iv) to avoid potentially costly and time consuming litigation.

8. Compliance with Applicable Law. All activities undertaken by DuPont pursuant to this Decree shall be performed in accordance with the requirements of all applicable federal, state and local laws and regulations.

9. Permits. Except as provided in Paragraph 18, where permits or approvals are required, DuPont shall submit timely and complete applications to the appropriate permitting authority and take all other actions necessary to obtain all such permits and approvals. DuPont may seek relief under the provisions of Section XI (Force Majeure) for any delay in the performance of the obligations of Section VIII (Front Royal Regional Fish Hatchery Project) resulting from a failure to obtain, or a delay in obtaining, any federal or state permit or approval required for such performance, provided that DuPont has submitted timely and complete applications and taken all other actions necessary to obtain all such permits and approvals.

10. This Decree is not, and shall not be construed to be, a permit issued pursuant to any federal, state or local law or regulation.

VI. PAYMENTS BY DUPONT

11. Payment for Assessment Costs. DuPont shall pay unreimbursed government assessment costs as described below.

a. *Payment of Assessment Costs Incurred by the United States*. Within 30 Days after the Effective Date, DuPont shall pay a total of $211,734.77 to the United States for

unreimbursed assessment costs incurred through fiscal year 2016. The total amount paid by DuPont pursuant to this Paragraph shall be deposited in the NRDAR Fund to be applied toward natural resource damage assessment costs incurred by DOI.

b. *Payment of Assessment Costs Incurred by the State*. Within 30 Days after the Effective Date, DuPont shall pay a total of $2,348.45 to the Commonwealth of Virginia for unreimbursed assessment costs incurred through fiscal year 2016.

12. Payment for Trustee-Sponsored Natural Resource Restoration Projects. DuPont shall pay a total of $42,069,916.78 to the United States for Trustee-sponsored natural resource restoration projects in two installments as provided in this Paragraph. The total amount paid shall be deposited in the Waynesboro NRDAR Subaccount for use as set forth in Section VII.

a. DuPont shall make the first payment of $21,034,958.39 within 30 Days after the Effective Date. The first payment, if timely paid, shall include no interest.

b. DuPont shall make the second payment of $21,034,958.39 within 90 Days of the Effective Date, but no later than December 1, 2017. The second payment shall include an additional sum for interest accrued on $21,034,958.39 calculated from the date of the first payment until the date of the second payment.

c. If DuPont fails to make either payment required by this Paragraph by the required due date, any remaining payment and all accrued interest shall become due immediately upon such failure. If the first payment is not timely made, interest shall accrue from the Effective Date. Interest shall continue to accrue on any unpaid amounts until the total amount due has been received. Interest required by this Paragraph shall be in addition to any stipulated penalties owed pursuant to Paragraph 25.b.

d. For purposes of this Paragraph only, the applicable rate of interest shall be

the Five Year Treasury Bill Rate in effect on the date that the payment is due.

13. Payment Instructions.

a. *Payments to the United States*. DuPont shall make payments to the United States under this Consent Decree at https://www.pay.gov to the United States Department of Justice account, in accordance with instructions provided to DuPont by the Financial Litigation Unit ("FLU") of the United States Attorney's Office for the Western District of Virginia after the Effective Date. The payment instructions provided by the FLU will include a Consolidated Debt Collection System ("CDCS") number, which DuPont shall use to identify all payments required to be made in accordance with this Consent Decree. The FLU will provide the payment instructions to:

Tom Ei
Leader Corporate Remediation Group
E. I. du Pont de Nemours and Company
974 Centre Road - Building 730-3170-5
Wilmington, Delaware 19805

Tom.A.Ei@dupont.com

DuPont may change the individual to receive payment instructions on its behalf by providing written notice of such change to the United States in accordance with Section XXI (Notices and Submissions).

b. *Payments to the State*. DuPont shall make payments to the State under this Consent Decree by Electronic Fund Transfer to the Commonwealth of Virginia, Department of Environmental Quality, in accordance with current EFT procedures and instructions provided to DuPont by the State following lodging of the Decree.

c. *Notice of Payment*. Upon making any payment required under this Consent Decree, DuPont shall send written notice to each Trustee representative in accordance

with Section XXI (Notices and Submissions). Such notice shall reference the CDCS Number and DOJ case number: 90-11-3-09419.

VII. TRUSTEE-SPONSORED NATURAL RESOURCE RESTORATION PROJECTS

14. Management and Application of Funds. All funds deposited in the segregated Waynesboro NRDAR Subaccount under Paragraph 12 shall be managed by DOI for the joint benefit and use of the Trustees to pay for Trustee-sponsored natural resource restoration efforts in accordance with this Decree. All such funds shall be expended by the Trustees in accordance with 42 U.S.C. § 9611(i), for restoration, rehabilitation, replacement, or acquisition of equivalent natural resources pursuant to the Restoration Plan and any amendments thereto.

15. Decisions regarding any use or expenditure of funds from the Waynesboro NRDAR Subaccount shall be made by unanimous agreement of the Trustees, acting through the Trustee Council, pursuant to the Memorandum of Understanding fully executed by the Trustees on April 7, 2008. DuPont shall not be entitled to dispute, in any forum or proceeding, any decision relating to use of funds or restoration efforts.

VIII. FRONT ROYAL REGIONAL FISH HATCHERY PROJECT

16. DuPont shall design and implement the Fish Hatchery Project in accordance with Appendix C (10% Design for Front Royal Regional Fish Hatchery Project), pursuant to the following schedule:

a. Within 60 Days after the Effective Date, DuPont shall submit a 35% design to the Trustees for approval.

b. Within 60 Days after receipt of approval by the Trustees of the 35% design, DuPont shall submit a 65% design to the Trustees for approval.

c. Within 60 Days after receipt of approval by the Trustees of the 65%

design, DuPont shall submit a 95% design to the Trustees for approval.

d. Within 45 Days after receipt of approval by the Trustees of the 95% design, DuPont shall submit a bid package containing the final design to the Trustees for approval.

e. DuPont shall complete the Fish Hatchery Project within 24 months after the later of (i) approval by the Trustees of the final design, or (ii) receipt of all necessary governmental permits or approvals for the projects.

17. DuPont is responsible for all costs of implementation of the Fish Hatchery Project, including the costs of design completion and construction. DuPont is further responsible for timely applying for, submitting all required documentation for, and obtaining, or working with the Virginia Department of Games and Fisheries ("DGIF") to obtain, as applicable, any permits or approvals required for implementing the Fish Hatchery Project, except as provided in Paragraph 18. The State shall use its best efforts to assist DuPont in the permitting process, including execution as owner of any permit or similar applications or instruments, and delegation of supervision and inspection of the Fish Hatchery Project by the State Building Official to the locality in which the Fish Hatchery Project is located. DGIF shall, following reasonable notice from DuPont, provide access to property and information necessary to implement the Fish Hatchery Project, including communication with other state agencies as may be necessary.

18. DGIF shall be responsible for obtaining all required permits and approvals for the Front Royal Regional Fish Hatchery Project. DuPont shall not be required to begin work on the Fish Hatchery Project until DGIF has obtained all required permits and approvals of the project.

19. DuPont shall consult with the State during the vetting and selecting of contractors and other agents utilized by DuPont in completion of the Fish Hatchery Project. All contractors

and other agents involved in the Fish Hatchery Project must agree to abide by reasonable workplace safety and access rules as may be applicable to the location of the Fish Hatchery Project.

20. Within 90 Days following the completion of construction of the Fish Hatchery Project, DuPont shall prepare and submit to the State a post-construction report. The post-construction report shall include the following: (1) a statement signed and sealed by a registered Virginia engineer confirming that the Fish Hatchery Project was built in accordance with the plans and specifications approved by the Trustees; and (2) a builder's warranty from the contractor who completed the Fish Hatchery Project warranting the completed Fish Hatchery Project for a period of not less than one year against defects in workmanship in a form acceptable to the State. The Trustees shall evaluate the post-construction report and the results of any inspection they may undertake, and if the Trustees agree that the construction criteria have been met, then the State shall issue a Certification of Project Completion of the Fish Hatchery Project in accordance with the Decree within the later of 90 Days after receipt of the post-construction report or any joint inspection of the particular project site. If the Trustees do not agree that the post construction report is adequate, the Trustees will arrange a meeting with DuPont to discuss any additional steps needed to meet the completion criteria.

IX. TRUSTEE APPROVAL OF DELIVERABLES

21. Initial Submissions.

a. After review of any deliverable that is required to be submitted for approval pursuant to this Decree, the Trustees shall: (i) approve, in whole or in part, the submission; (ii) approve the submission upon specified conditions; (iii) disapprove, in whole or in part, the submission; or (iv) any combination of the foregoing.

b. The Trustees also may modify the initial submission to cure deficiencies in the submission if: (i) the Trustees determine that disapproving the submission and awaiting a resubmission would cause substantial disruption to the work required; or (ii) previous submission(s) have been disapproved due to material defects and the deficiencies in the initial submission under consideration indicate a bad faith lack of effort to submit an acceptable deliverable.

22. Resubmissions. Upon receipt of a notice of disapproval under Paragraph 21.a (Initial Submissions), or if required by a notice of approval upon specified conditions under Paragraph 21.a, DuPont shall, within 30 Days or such longer time as specified by the Trustees in such notice, correct the deficiencies and resubmit the deliverable for approval. After review of the resubmitted deliverable, the Trustees may: (a) approve, in whole or in part, the resubmission; (b) approve the resubmission upon specified conditions; (c) modify the resubmission; (d) disapprove, in whole or in part, the resubmission, requiring DuPont to correct the deficiencies; or (e) any combination of the foregoing.

23. Any stipulated penalties applicable to the original submission, as provided in Section X, shall accrue during the 30 Day period or other specified period, but shall not be payable unless the resubmission is untimely or is disapproved in whole or in part; provided that, if the original submission was so deficient as to constitute a material breach of DuPont's obligations under this Decree, the stipulated penalties applicable to the original submission shall be due and payable notwithstanding any subsequent resubmission.

24. Implementation. Upon approval, approval upon conditions, or modification by the Trustees under Paragraph 21.a (Initial Submissions) or Paragraph 22 (Resubmissions), of any deliverable, or any portion thereof: (a) such deliverable, or portion thereof, shall be incorporated

into and enforceable under this Decree; and (b) DuPont shall take any action required by such deliverable, or portion thereof, subject only to their right to invoke the Dispute Resolution procedures set forth in Section XII (Dispute Resolution) with respect to the modifications or conditions made by the Trustees. The implementation of any non-deficient portion of a deliverable submitted or resubmitted under Paragraph 21.a or Paragraph 22 shall not relieve DuPont of any liability for stipulated penalties under Section X (Stipulated Penalties).

X. STIPULATED PENALTIES

25. Non-Compliance with Payment Obligations.

a. *Interest*. If DuPont fails to make any payment required by Paragraph 11 (Payment for Assessment Costs) by the required due date, Interest shall be assessed on the unpaid balance. Interest will continue to accrue on the unpaid balance through the date of payment.

b. *Stipulated Penalties*. In addition to the Interest required to be paid under Paragraph 25.a, if any payment required by Section VI (Payments by DuPont) is not made when due, DuPont shall also pay the following through the date of full payment:

Penalty Per Violation Per Day	Period of Noncompliance
$500	1st through 14th Day
$1,000	15th through 30th Day
$3,000	31st Day and beyond

26. Non-Compliance with Front Royal Regional Fish Hatchery Project obligations.

The following stipulated penalties shall accrue per violation per Day:

a. *Failure to meet project completion deadline in Paragraph 16.e*:

Penalty Per Violation Per Day	Period of Noncompliance
$1,500	1st through 30th Day
$3,000	31st Day and beyond

b. *Noncompliance with deliverable requirements in Paragraphs 16 and 20*:

Penalty Per Violation Per Day	Period of Noncompliance
$1,000	1st through 30th Day
$2,000	31st Day and beyond

27. Stipulated penalties are due and payable to the Trustees within 30 Days of the date of the demand for payment of the penalties by a Trustee or Trustees, unless DuPont invokes the Dispute Resolution procedures under Section XII (Dispute Resolution) within the 30-Day period.

28. Stipulated penalties shall accrue as provided in this Section regardless of whether the Trustees have notified DuPont of the violation or made a demand for payment, but the stipulated penalties need only be paid upon demand.

29. All stipulated penalties will begin to accrue on the Day after performance or payment is due and will continue to accrue through the date of performance or payment. However, stipulated penalties shall not accrue: (a) with respect to a deficient submission under Section IX (Trustee Approval of Deliverables), during the period, if any, beginning on the 31st Day after Trustees receipt of such submission until the date that the Trustees notify DuPont of any deficiency; or (b) with respect to judicial review by this Court of any dispute under Section XII (Dispute Resolution), during the period, if any, beginning on the 31st Day after the Court's receipt of the final submission regarding the dispute until the date that the Court issues a final decision regarding such dispute.

30. Nothing in this Decree prevents the simultaneous accrual of separate stipulated penalties for separate violations of this Decree.

31. Penalties shall continue to accrue as provided in Paragraph 29 during any dispute resolution period, but need not be paid until the following:

a. If the dispute is resolved by agreement of the parties or by a decision of the Trustees that is not appealed to this Court, accrued penalties determined to be owed shall be paid to the Trustees within 15 Days after the agreement or the receipt of the Trustees' decision or order;

b. If the dispute is appealed to this Court and the Trustees prevail in whole or in part, DuPont shall pay all accrued penalties determined by the Court to be owed to the Trustees within 60 Days after receipt of the Court's decision or order, except as provided in Paragraph 31.c;

c. If the District Court's decision is appealed by any Party, DuPont shall pay all accrued penalties determined by the District Court to be owed to the Trustees into an interest-bearing escrow account, established at a duly chartered bank or trust company that is insured by the FDIC, within 60 Days after receipt of the Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every 60 Days. Within 15 Days after receipt of the final appellate court decision, the escrow agent shall be directed to pay the balance of the account to the Trustees or to DuPont to the extent that they prevail.

32. If DuPont fails to pay stipulated penalties when due, DuPont shall pay Interest on the unpaid stipulated penalties as follows: (a) if DuPont has timely invoked dispute resolution such that the obligation to pay stipulated penalties has been stayed pending the outcome of dispute resolution, Interest shall accrue from the date stipulated penalties are due pursuant to Paragraph 31 until the date of payment; and (b) if DuPont fails to timely invoke dispute resolution, Interest shall accrue from the date of demand under Paragraph 27 until the date of payment. If DuPont fails to pay stipulated penalties and Interest when due, then either Trustee may institute proceedings to collect the penalties and Interest.

33. Instructions for Stipulated Penalty Payments.

a. Except as provided in Paragraph 33.b, DuPont shall pay 50% of the total stipulated penalty amount due for violations of this Decree to the United States and 50% to the State.

b. DuPont shall pay all stipulated penalties demanded by the United States for violations of Paragraph 11.a (Payment of Assessment Costs Incurred by the United States) to the United States, and all stipulated penalties demanded by the Commonwealth of Virginia for violations of Paragraph 11.b (Payment of Assessment Costs Incurred by the State) to the State.

c. DuPont shall pay stipulated penalties owed to the United States and the State in the manner set forth and with the confirmation notices required by Paragraph 13, except that the transmittal letter shall indicate that the payments are for stipulated penalties and shall state for which violation(s) the penalties are being paid.

34. If Plaintiffs bring an action to enforce this Decree, DuPont will reimburse Plaintiffs for all costs of such action if Plaintiffs prevail, including, but not limited to, costs of attorney time.

35. Payment of stipulated penalties and Interest by DuPont does not alter any of DuPont's obligations under this Consent Decree.

36. Nothing in this Decree shall be construed as prohibiting, altering, or in any way limiting the ability of the Plaintiffs to seek any other remedies or sanctions available by virtue of DuPont's violation of this Decree or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Section 122(l) of CERCLA, 42 U.S.C. § 9622(l), provided, however, that the Plaintiffs shall not seek civil penalties pursuant to Section 122(l) of CERCLA for any violation for which a stipulated penalty is provided in this Decree,

except in the case of a willful violation of this Decree.

37. Notwithstanding any other provision of this Section, either Plaintiff may, in its unreviewable discretion, waive payment of any portion of the stipulated penalties otherwise due it under this Decree. For stipulated penalties accruing for violations of Paragraph 11, the Plaintiff to whom payment is owed may, in its unreviewable discretion, waive payment of any portion of those stipulated penalties that have accrued pursuant to Paragraph 25.

XI. FORCE MAJEURE

38. "Force majeure," for purposes of this Decree, is defined as any event arising from causes beyond the control of DuPont, of any entity controlled by DuPont, or of DuPont's contractors that delays or prevents (hereinafter collectively referred to as "delay") the performance of any obligation under this Decree despite DuPont's best efforts to fulfill the obligation. The requirement that DuPont exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (a) as it is occurring and (b) following the potential force majeure such that the delay and any adverse effects of the delay are minimized to the greatest extent possible. "Force majeure" does not include financial inability to comply with any obligation of this Decree.

39. If any event occurs or has occurred that may delay the performance of any obligation under this Decree for which DuPont intends or may intend to assert a claim of force majeure, DuPont shall orally notify the State Trustee, within three Days of when DuPont first knew that the event might cause a delay. Within 14 Days thereafter, DuPont shall provide in writing to the Trustees an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the

delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; DuPont's rationale for attributing such delay to a force majeure; and a statement as to whether, in the opinion of DuPont, such event may cause or contribute to an endangerment to public health or welfare, or the environment. DuPont shall include with any notice all available documentation supporting their claim that the delay was attributable to a force majeure. DuPont shall be deemed to know of any circumstance of which DuPont, any entity controlled by DuPont, or DuPont's contractors knew or should have known. Failure to comply with the above requirements regarding an event shall preclude DuPont from asserting any claim of force majeure regarding that event, provided, however, that if the Trustees, despite the late or incomplete notice, are able to assess to their satisfaction whether the event is a force majeure under Paragraph 38 and whether DuPont has exercised its best efforts under Paragraph 38, the Trustees may, in their unreviewable discretion, excuse in writing DuPont's failure to submit timely or complete notices under this Paragraph.

40. If the Trustees agree that the delay or anticipated delay is attributable to a force majeure, the time for performance of the obligations under this Decree that are affected by the force majeure will be extended by the Trustees for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure shall not, of itself, extend the time for performance of any other obligation. If the Trustees do not agree that the delay or anticipated delay has been or will be caused by a force majeure, the Trustees will notify DuPont in writing of their decision. If the Trustees agree that the delay is attributable to a force majeure, the Trustees will notify DuPont in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure.

41. If DuPont elects to invoke the dispute resolution procedures set forth in Section

XII (Dispute Resolution) regarding the Trustees' decision, it shall do so no later than 15 Days after receipt of the Trustees' notice. In any such proceeding, DuPont shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that DuPont complied with the requirements of Paragraphs 38 and 39. If DuPont carries this burden, the delay at issue shall be deemed not to be a violation by DuPont of the affected obligations of this Decree.

XII. DISPUTE RESOLUTION

42. Unless otherwise expressly provided for in this Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Decree. The procedures set forth in this Section shall not apply to actions by Trustees to enforce DuPont obligations that have not been disputed in accordance with this Section.

43. Informal Dispute Resolution. Any dispute which arises under or with respect to this Decree shall in the first instance be the subject of informal negotiations between the Trustees and DuPont. The period of informal negotiations shall not exceed 30 Days from the date the dispute arises, unless the Parties agree otherwise in writing. The dispute shall be considered to have arisen when DuPont sends the Trustees a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the Trustees shall be considered binding unless, within 30 Days after the conclusion of the informal negotiation period, DuPont invokes formal dispute resolution procedures as set forth below.

44. Formal Dispute Resolution.

a. DuPont shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the Trustees a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting DuPont's position and any supporting documentation relied upon by DuPont.

b. The Trustees shall serve on DuPont their written Statement of Position within 45 Days of receipt of DuPont's Statement of Position. The Trustees' Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the Trustees.

c. An administrative record of the dispute shall be maintained by the Trustees and shall contain all Statements of Position, including supporting documentation, submitted pursuant to this Section.

d. DuPont and the Trustees each shall identify Formal Dispute Resolution Representatives who shall meet to discuss the matter in dispute at the earliest available opportunity and will work in good faith to resolve the matter in dispute. If the Parties fail to resolve the dispute within 30 Days after the initial meeting of the Formal Dispute Resolution Representatives, then the position advanced by the Trustees in their Statement of Position shall be considered binding upon DuPont, subject to any agreements the Formal Dispute Resolution Representatives may have reached on one or more issues and further subject to DuPont's right to seek judicial review pursuant to Paragraph 45. In such event the Trustees shall within 5 Days of the conclusion of the formal dispute resolution process notify DuPont in writing that the formal dispute resolution process has concluded. DuPont may seek judicial review of the Trustees'

Statement of Position (as modified by any agreements the Formal Dispute Resolution Representatives may have reached) pursuant to Paragraph 45.

45. Judicial Review. DuPont may seek judicial review of the dispute by filing with the Court and serving on the Plaintiffs, in accordance with Section XXI (Notices and Submissions), a motion requesting judicial resolution of the dispute. The motion must be filed within 30 Days of receipt of the Trustees' letter notifying DuPont of the conclusion of the formal dispute resolution process. The motion shall contain a written statement of DuPont's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

46. The Plaintiffs shall respond to DuPont's motion within the time period allowed by the Local Rules of this Court. DuPont may file a reply memorandum, to the extent permitted by the Local Rules.

47. Standard of Review.

a. *Disputes Concerning Matters Accorded Record Review*. Except as otherwise provided in this Consent Decree, in any dispute brought under Paragraph 44 pertaining to the adequacy or appropriateness of plans, procedures to implement plans, schedules, or other deliverables requiring Trustee approval under this Consent Decree; the adequacy of the performance of work undertaken pursuant to this Consent Decree; and all other disputes that are accorded review on the administrative record under applicable principles of administrative law, DuPont shall have the burden of demonstrating, based on the administrative record, that the position of the Trustees is arbitrary and capricious or otherwise not in accordance with law.

b. *Other Disputes*. Except as otherwise provided in this Consent Decree, in

any other dispute brought under Paragraph 44, DuPont shall bear the burden of demonstrating that its position better furthers the objectives of the Consent Decree.

48. The invocation of formal dispute resolution procedures under this Section shall not extend, postpone, or affect in any way any obligation of DuPont under this Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter and obligations contingent on the disputed matter shall continue to accrue from the first Day of noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 31. If DuPont does not prevail on a disputed issue, stipulated penalties shall be assessed and paid as provided in Section X (Stipulated Penalties).

XIII. COVENANTS NOT TO SUE BY THE PLAINTIFFS

49. Covenant by the United States. Except as specifically provided in Section XIV (Reservation of Rights by the Plaintiffs), the United States covenants not to sue or take administrative action against DuPont for Natural Resource Damages at the Site, known as of the date of the lodging of this Consent Decree with the Court. This covenant not to sue shall take effect upon receipt of DuPont's payments pursuant to Section VI (Payments by DuPont). This covenant not to sue is conditioned upon the satisfactory performance by DuPont of all its obligations under this Decree. This covenant not to sue extends only to DuPont and does not extend to any other person.

50. Covenant by the State. Except as specifically provided in in Section XIV (Reservation of Rights by the Plaintiffs), the State covenants not to sue or take administrative action against DuPont for Natural Resource Damages at the Site, known as of the date of lodging of this Consent Decree with the Court. This covenant not to sue shall take effect upon receipt of DuPont's payments pursuant to Section VI (Payments by DuPont). This covenant not to sue is

conditioned upon the satisfactory performance by DuPont of all its obligations under this Decree. This covenant not to sue extends only to DuPont and does not extend to any other person.

XIV. RESERVATION OF RIGHTS BY THE PLAINTIFFS

51. General Reservations. The United States and the State reserve, and this Decree is without prejudice to, all rights against DuPont and with respect to all matters not expressly included within Section XIII (Covenants Not to Sue by the Plaintiffs). Notwithstanding any other provisions of this Decree, the United States and the State reserve all rights against DuPont with respect to:

a. liability for failure by DuPont to meet a requirement of this Decree;

b. liability for injunctive relief or administrative order enforcement under CERCLA Section 106, 42 U.S.C. § 9606;

c. liability under CERCLA Section 107(a), 42 U.S.C. § 9607(a), for costs of removal or remedial action incurred by the United States or the State;

d. liability under Section 107(a)(4)(D), 42 U.S.C. § 9607(a)(4)(D), for costs of any health assessment or health effects study carried out under 42 U.S.C. § 9604(I);

e. liability for any other costs or damages incurred or to be incurred by the United States or the State that are not within the definition of Natural Resource Damages;

f. liability for damages for injury to, destruction of, or loss of natural resources and for the costs of any natural resource damage assessments resulting from releases or threatened releases of hazardous substances outside of the Site;

g. liability arising from any disposal of hazardous substances at the Site by DuPont after the lodging of this Decree, except where such disposal is consistent with government approved workplan(s) or permits or is at the direction or under the oversight of the

U.S. Environmental Protection Agency or the Commonwealth of Virginia, Department of Environmental Quality; and

h. criminal liability.

52. Special Reservations Regarding Natural Resource Damages. Notwithstanding any other provision of this Decree, the United States and the State each reserves the right to institute proceedings against DuPont in this action or in a new action seeking recovery of Natural Resource Damages if conditions are discovered or information is received relating to the Site, not known to the Trustees at the time of lodging of this Decree, that, together with any other relevant information, indicates that there is injury to, destruction of, or loss of natural resources of a type unknown, or of a magnitude greater than was known, by the Trustees as of the date of lodging of this Decree. For purposes of this Paragraph, information and conditions known to the Trustees relating to the Site as of the date of lodging of this Decree shall include only the information and conditions set forth in the DOI and State files for the Site as of the date of lodging of this Decree.

XV. COVENANTS BY DUPONT

53. Covenants by DuPont. DuPont covenants not to sue and agrees not to assert any claims or causes of action against the United States or the State, or their contractors or employees, with respect to Natural Resource Damages or this Decree, including but not limited to:

a. any direct or indirect claim for reimbursement of any payment for Natural Resource Damages from the Hazardous Substance Superfund based on Sections 106(b)(2), 107, 111, 112, or 113 of CERCLA, 42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, or 9613, or any other provision of law;

b. any claim against the United States or the State pursuant to Sections 107 and 113 of CERCLA, 42 U.S.C. §§ 9607 and 9613, relating to Natural Resource Damages; and

c. any claim against the United States or the State pursuant to Section 311 of the CWA, 33 U.S.C. 1321.

54. Except as provided in Paragraph 61 (Waiver of Res Judicata and Other Defenses), these covenants not to sue shall not apply in the event that the United States or the State brings a cause of action or issues an order pursuant to the reservations set forth in Section XIV (Reservation of Rights by the Plaintiffs) other than in Paragraph 51.a (claims for failure to meet a requirement of the Consent Decree) or Paragraph 51.h (criminal liability), but only to the extent that DuPont's claims arise from the same response action, response costs, or damages that the United States or the State is seeking pursuant to the applicable reservation.

55. Nothing in this Consent Decree shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

56. Waiver of Certain Claims Against Other Persons. DuPont agrees not to assert any claims and to waive all claims or causes of action that it may have against all other persons for all matters relating to Natural Resource Damages, including for contribution; provided, however, that DuPont reserves the right to assert and pursue all claims, causes of action, and defenses relating to Natural Resource Damages against any person in the event such person first asserts, and for so long as such person pursues, any claim or cause of action against DuPont relating to Natural Resource Damages. Nothing in this Paragraph shall operate to waive or release any claim or action by DuPont under any contract of insurance. Nothing in this Paragraph shall operate to waive or release any claim or action by DuPont for costs it incurred or will incur that

are not within the definition of Natural Resource Damages.

XVI. EFFECT OF SETTLEMENT/CONTRIBUTION PROTECTION

57. Except as provided in Paragraph 56 (Waiver of Certain Claims Against Other Persons), nothing in this Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Decree. Except as provided in Section XV (Covenants by DuPont) each of the Parties expressly reserves any and all rights (including, but not limited to, any right to contribution), defenses, claims, demands, and causes of action which each Party may have with respect to any matter, transaction, or occurrence relating in any way to the Site against any person not a Party hereto.

58. The Parties agree, and by entering this Decree the Court finds, that this settlement constitutes a judicially approved settlement pursuant to which DuPont has, as of the Effective Date, resolved liability alleged in the Plaintiffs' complaint in this action within the meaning of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Section 113(f)(2) of CERCLA, or as may be otherwise provided by law, for the "matters addressed" in this Consent Decree. The "matters addressed" in this Consent Decree are Natural Resource Damages; provided, however, that if the United States exercises rights under the reservations set forth in Section XIV (Reservation of Rights by the Plaintiffs) other than in Paragraph 51.a (claims for failure to meet a requirement of the Consent Decree) or Paragraph 51.h (criminal liability), the "matters addressed" in this Consent Decree will no longer include those response costs, response actions, or natural resource damages that are within the scope of the exercised reservation.

59. DuPont shall, with respect to any suit or claim brought by it for matters related to this Consent Decree, notify the United States and the State in writing no later than 60 Days prior

to the initiation of such suit or claim.

60. DuPont shall, with respect to any suit or claim brought against it for matters related to this Decree, notify the United States and the State in writing within 10 Days of service of the complaint or claim upon it. In addition, DuPont shall notify the United States and the State within 10 Days of service or receipt of any Motion for Summary Judgment, and within 10 Days of receipt of any order from a court setting a case for trial, for matters related to this Decree.

61. Waiver of Res Judicata and Other Defenses. In any subsequent administrative or judicial proceeding initiated by the United States or the State for injunctive relief, recovery of response costs or Natural Resource Damages, or other relief relating to the Site, DuPont shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States or the State in the subsequent proceeding were or should have been brought in the instant case; provided, however, that nothing in this Paragraph affects the enforceability of the covenants not to sue set forth in Section XIII (Covenants Not to Sue by the Plaintiffs).

XVII. INDEMNIFICATION AND INSURANCE

62. DuPont's Indemnification of the United States and the State.

a. The United States and the State do not assume any liability by entering into this Decree. DuPont shall indemnify, save and hold harmless the United States and the State and their officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of DuPont, its officers, directors, employees, agents, contractors,

subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Decree. Further, DuPont agrees to pay the United States and the State all costs they incur including, but not limited to, attorneys' fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States or the State based on negligent or other wrongful acts or omissions of DuPont, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Decree. Neither the United States nor the State shall be held out as a party to any contract entered into by or on behalf of DuPont in carrying out activities pursuant to this Decree. Neither DuPont nor any such contractor shall be considered an agent of the United States or the State.

b. The United States and the State shall give DuPont notice of any claim for which the United States or the State plans to seek indemnification pursuant to Paragraph 62.a, and shall consult with DuPont prior to settling such claim.

63. DuPont covenants not to sue and agrees not to assert any claims or causes of action against the United States and the State for damages or reimbursement or for set-off of any payments made or to be made to the United States or the State arising from or on account of any contract, agreement, or arrangement between DuPont and any person for performance of work relating to the Site, including, but not limited to, claims on account of construction delays. In addition, DuPont shall indemnify and hold harmless the United States and the State with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between DuPont and any person for performance of work relating to the Site, including, but not limited to, claims on account of construction delays.

64. Insurance. No later than 15 Days before commencing any work, DuPont shall

secure, and shall maintain until termination of this Consent Decree, a comprehensive commercial general liability and automobile liability insurance with limits of two million dollars ($2,000,000), combined single limit. The United States and State shall be named as additional insureds with respect to all liability arising out of the activities performed by or on behalf of DuPont pursuant to this Decree. In addition, for the duration of this Decree, DuPont shall satisfy, or shall ensure that its contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the work on behalf of DuPont in furtherance of this Decree. Prior to commencement of the work under this Decree, DuPont shall provide to the United States and the State certificates of such insurance and a copy of each insurance policy. DuPont shall resubmit such certificates and copies of policies each year on the anniversary of the Effective Date. If DuPont demonstrates by evidence satisfactory to the United States and the State that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering the same risks but in a lesser amount, then, with respect to that contractor or subcontractor, DuPont need provide only that portion of the insurance described above that is not maintained by the contractor or subcontractor.

XVIII. ACCESS TO PROPERTY

65. If the Site, or any other real property where access is needed for purposes of this Decree, is owned or controlled by DuPont, DuPont shall, commencing on the Effective Date, provide the United States and the State, and their representatives, contractors, and subcontractors, with access at all reasonable times to the Site, or such other real property, to conduct any activity regarding this Decree including, but not limited to, the following activities (to the extent applicable under this Decree):

a. Monitoring the implementation of the Decree requirements;

b. Verifying any data or information submitted to the United States or the State under this Decree;

c. Conducting investigations regarding contamination at or near the Sites;

d. Obtaining samples;

e. Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by DuPont or its agents, relating to implementation of this Decree and consistent with Section XIX (Access to Information); and

f. Assessing DuPont's compliance with the Decree.

66. Notwithstanding any provision of the Decree, the United States and the State retain any access authorities and rights they may have under CERCLA and any other applicable statutes or regulations.

XIX. ACCESS TO INFORMATION

67. DuPont shall provide to the Trustees, upon request, copies of all records, reports, documents, and other information (including records, reports, documents, and other information in electronic form) (hereinafter referred to as "Records") within its possession or control or that of its contractors or agents relating to the implementation of this Decree, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information regarding any work required. DuPont shall also make available to the Trustees, for purposes of investigation, information gathering, or testimony, its employees, agents, or representatives with knowledge of relevant facts concerning the implementation of this Decree.

68. Business Confidential and Privileged Documents.

a. DuPont may assert business confidentiality claims covering part or all of the Records submitted to the Plaintiffs to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). DuPont shall segregate and clearly identify all Records or parts thereof submitted under this Consent Decree for which DuPont asserts business confidentiality claims. Records determined to be confidential by the Trustees will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies Records when they are submitted to the Trustees, or if the Trustees have notified DuPont that the Records are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such Records without further notice to DuPont.

b. DuPont may assert that certain Records are privileged under the attorney-client privilege or any other privilege recognized by federal law. If DuPont asserts such a privilege in lieu of providing Records, it shall provide Plaintiffs with the following: (1) the title of the Record; (2) the date of the Record; (3) the name, title, affiliation (e.g., company or firm), and address of the author of the Record; (4) the name and title of each addressee and recipient; (5) a description of the contents of the Record; and (6) the privilege asserted by DuPont. If a claim of privilege applies only to a portion of a Record, the Record shall be provided to the Trustees in redacted form to mask the privileged portion only. DuPont shall retain all Records that they claim to be privileged until the Trustees have had a reasonable opportunity to dispute the privilege claim and any such dispute has been resolved in DuPont's favor.

c. No Records created or generated pursuant to the requirements of this Decree shall be withheld from the Trustees on the grounds that they are privileged or

confidential.

69. No claim of confidentiality or privilege shall be made with respect to any data, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, or engineering data, or any other documents or information evidencing conditions at or around the Site. DuPont may redact documents containing information evidencing conditions at or around the Site but only to remove privileged information, as referenced in Paragraph 68.b, other than the data evidencing conditions at or around the Site.

70. Notwithstanding any provision of this Consent Decree, Plaintiffs retain all of their information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901-6992 ("RCRA"), the CWA, and any other applicable statutes or regulations.

XX. RETENTION OF RECORDS

71. Until ten years after DuPont has fully implemented this Decree, DuPont shall preserve and retain all non-identical copies of Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to (i) the claims alleged in the Complaint, (ii) DuPont's compliance with this Decree, or (iii) potential claims under CERCLA with respect to the Site. In addition, DuPont must retain all Records that relate to the liability of any other person under CERCLA with respect to the Site. DuPont must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above all non-identical copies of the last draft or final version of any Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to implementation of the requirements of this Decree, provided, however, that DuPont (and its contractors and agents) must retain, in addition,

copies of all data generated during the implementation of the requirements of this Decree and not contained in the aforementioned Records required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.

72. At the conclusion of this record retention period, DuPont shall notify the Trustees at least 90 Days prior to the destruction of any such Records, and, upon request by the Trustees, and except as provided in Paragraph 68.b (privileged claims), DuPont shall deliver any such Records to the Trustees.

XXI. NOTICES AND SUBMISSIONS

73. Whenever notice is required to be given or a document is required to be sent by one Party to another under the terms of this Decree, it will be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Parties in writing. Written notice as specified constitutes complete satisfaction of any written notice requirement of this Decree for Plaintiffs and DuPont.

As to the United States:

Chief, Environmental Enforcement Section
U.S. Department of Justice
DJ #90-11-3-09419
P.O. Box 7611
Washington, D.C. 20044-7611

Mark Barash
Office of the Solicitor
U.S. Department of the Interior
One Gateway Center
Suite 612
Newton, Massachusetts 02458-2802

Wendi Weber
Regional Director
Department of the Interior
U.S. Fish and Wildlife Service
300 Westgate Center Drive

Hadley, MA 01035-9589

As to the Commonwealth of Virginia:

Hon. Molly Ward
Secretary of Natural Resources
Commonwealth of Virginia
1111 East Broad Street
Richmond, Virginia 23219

John W. Daniel, II
Deputy Attorney General
Virginia Office of the Attorney General
202 North 9th Street
Richmond, Virginia 23219

As to the Trustees:

Mark Barash
Office of the Solicitor
U.S. Department of the Interior
One Gateway Center
Suite 612
Newton, Massachusetts 02458-2802

Wendi Weber
Regional Director
Department of the Interior
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589

Hon. Molly Ward
Secretary of Natural Resources
Commonwealth of Virginia
1111 East Broad Street
Richmond, Virginia 23219

John W. Daniel, II
Deputy Attorney General
Virginia Office of the Attorney General
202 North 9th Street
Richmond, Virginia 23219

As to DuPont:

Tom Ei
Leader Corporate Remediation Group
E. I. du Pont de Nemours and Company
974 Centre Road – Building 730-3170-5
Wilmington, Delaware 19805

Stephen Rahaim
Chief Environmental Counsel
E. I. du Pont de Nemours and Company
974 Centre Road – Building 721/1164
Wilmington, Delaware 19805

74. Each report, plan, or other document submitted by DuPont pursuant to this Consent Decree or Appendices shall be signed by an official of DuPont and include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

XXII. APPENDICES

75. The following appendices are attached to and incorporated into this Decree:

"Appendix A" is the Waynesboro Facility map

"Appendix B" is the Restoration Plan

"Appendix C" is the 10% Design for the Front Royal Regional Fish Hatchery Project.

XXIII. RETENTION OF JURISDICTION

76. This Court shall retain jurisdiction over this case until termination of this Consent Decree, for the purpose of resolving disputes arising under this Decree or entering orders

modifying this Decree, pursuant to Sections XXIV (Consent Decree Modifications) or XII (Dispute Resolution), or effectuating or enforcing compliance with the terms of the Decree.

XXIV. CONSENT DECREE MODIFICATIONS

77. Any material modification of this Decree shall be made by agreement of the Parties to this Decree and in writing, and shall not take effect unless approved by the Court. Any non-material modification of this Decree, including any schedule extensions, shall be made by agreement of the Parties to this Decree and in writing. Nothing in this Decree shall be deemed to alter the Court's power to enforce, supervise, or approve modifications to this Decree.

XXV. TERMINATION

78. After DuPont has: (a) completed the requirements of Section VIII (Front Royal Regional Fish Hatchery Project) and received a Certification of Project Completion of the Fish Hatchery Project pursuant to Paragraph 20, (b) made all payments required under Section VI (Payments by DuPont), and (c) complied with all other requirements of this Consent Decree, including payment of any accrued stipulated penalties or Interest as required by this Consent Decree, DuPont may serve upon the United States and the State a Request for Termination, stating that DuPont has satisfied those requirements, together with all necessary supporting documentation.

79. Following receipt by the United States and the State of DuPont's Request for Termination, the Parties shall confer informally concerning the Request and any disagreement that the Parties may have as to whether DuPont has satisfied the applicable criteria under Paragraph 78 for termination of this Decree. If the United States and the State agree that the Consent Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating the Decree.

80. If the United States and the State do not agree that the DuPont has satisfied the applicable criteria under Paragraph 78 for termination of this Decree, DuPont may invoke Dispute Resolution under Section XII of this Decree. However, DuPont shall not seek Dispute Resolution of any dispute regarding termination until 60 Days after service of its Request for Termination.

XXVI. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

81. This Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment. The United States reserves the right to withdraw or withhold its consent if comments regarding the Decree disclose facts or considerations which indicate that this Decree is inappropriate, improper, or inadequate. DuPont consents to the entry of this Decree without further notice.

82. If for any reason the Court should decline to approve this Decree in the form presented, or if approval and entry is subsequently vacated on appeal of such approval and entry, this agreement is voidable at the sole discretion of any party and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXVII. SIGNATORIES/SERVICE

83. The undersigned representatives of DuPont, the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice, and the State each certify that he or she is fully authorized to enter into the terms and conditions of this Decree and to execute and legally bind such party to this document.

84. DuPont hereby agrees not to oppose entry of this Decree by this Court or to challenge any provision of this Decree unless the United States has notified DuPont in writing that it no longer supports entry of this Decree.

85. DuPont shall identify, on the attached signature pages, the name, address and telephone number of an agent who is authorized to accept service of process by mail on behalf of DuPont with respect to all matters arising under or relating to this Decree. DuPont hereby agrees to accept service in that manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable local rules of this Court, including but not limited to service of a summons. DuPont need not file an answer to any complaint in this Action unless and until the Court expressly declines to enter this Decree.

XXVIII. FINAL JUDGMENT

86. This Decree and its appendices constitute the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Decree. The Parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Decree. It is the intention of DuPont and the Commonwealth of Virginia that nothing contained in this Decree shall alter or amend the Release between the Commonwealth and DuPont dated June 22, 1984.

87. Upon approval and entry of this Decree by the Court, this Decree shall constitute a final judgment between and among the United States, the Commonwealth of Virginia and DuPont. The Court finds that there is no just reason for delay and therefore enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

SO ORDERED THIS 28th DAY OF July, 2017.

/s/ Michael F. Urbanski

United States District Judge
Western District of Virginia

THE UNDERSIGNED PARTY enters into this Decree in the matter of *United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company*.

FOR THE UNITED STATES

United States Department of Justice
Environment and Natural Resources Division

Date: 12/14/16

JOHN C. CRUDEN
Assistant Attorney General
Environmental & Natural Resources Division
Washington, D.C. 20530

Date: 12/14/16

LAURA A. THOMS
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611

THE UNDERSIGNED PARTY enters into this Decree in the matter of *United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company*.

FOR THE UNITED STATES

Rick A. Mountcastle
Attorney for the United States
Acting Under Authority Conferred by 28 U.S.C. § 515

Date: 12/14/16

Joseph W.H. Mott

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THE UNDERSIGNED PARTY enters into this Decree in the matter of *United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company*.

FOR THE COMMONWEALTH OF VIRGINIA

12/6/2016
Date

Mark R. Herring
Mark R. Herring, Attorney General

12/6/16
Date

John W. Daniel, II, Deputy Attorney General

Dec 6 2016
Date

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THE UNDERSIGNED PARTY enters into this Decree in the matter of *United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company.*

FOR E. I. du PONT de NEMOURS AND COMPANY

December 5, 2017
Date

Richard C. Olson
Richard C. Olson
Senior Vice President, Corporate Services
E. I. du Pont de Nemours and Company
974 Centre Road – Building 730
Wilmington, Delaware 19805

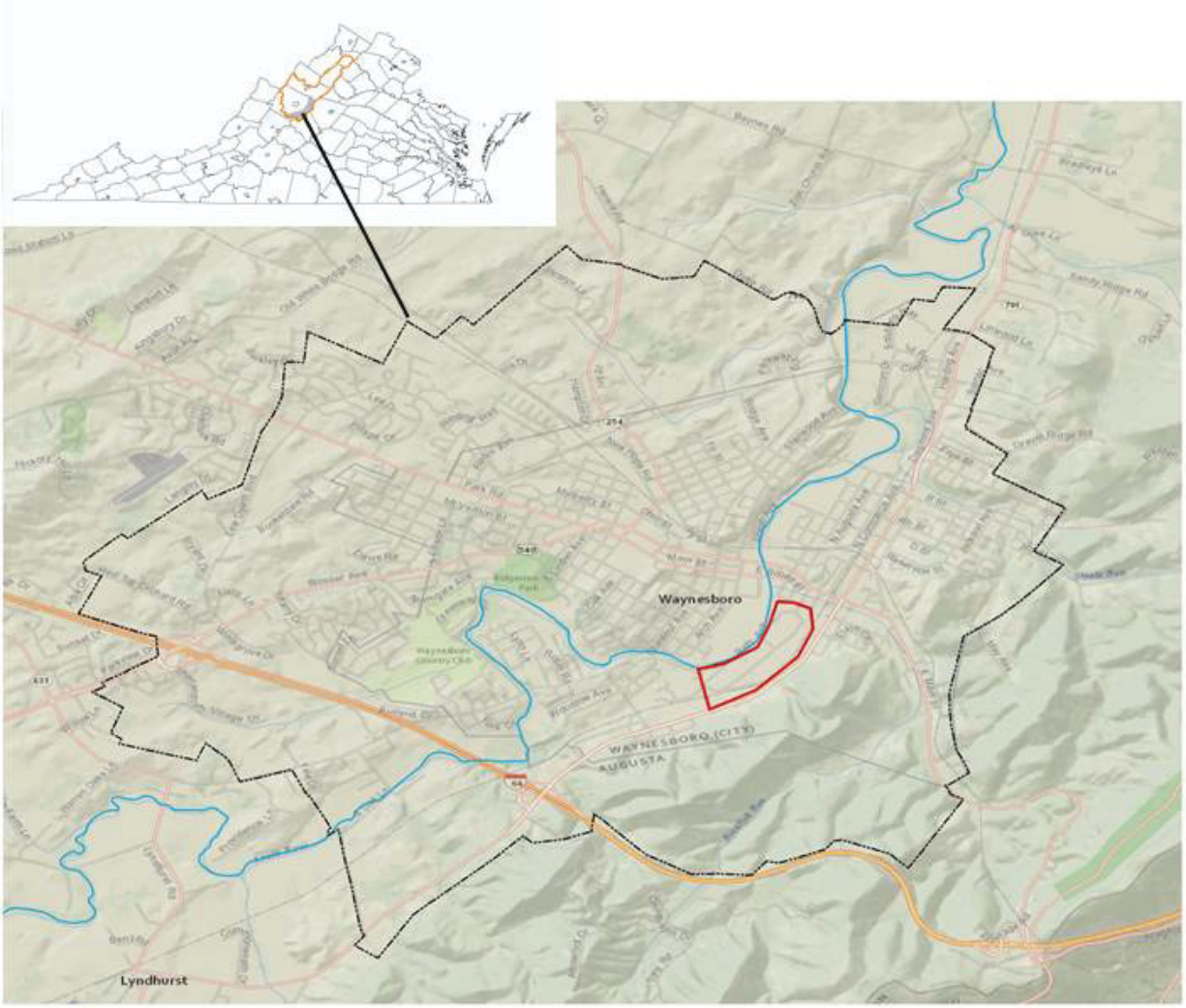
Agent Authorized to Accept Service
on Behalf of Above-signed Party:

Stephen Rahaim
Chief Environmental Counsel
E. I. du Pont de Nemours and Company
974 Centre Road – Building 721/1164
Wilmington, Delaware 19805

APPENDIX A: WAYNESBORO FACILITY MAP

United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company

Appendix A: Waynesboro Facility



Location of DuPont Facility, outlined in red, encompassing 177 acres adjacent to the South River, in Waynesboro, VA.

APPENDIX B: RESTORATION PLAN

United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company

DuPont Waynesboro - South River/South Fork Shenandoah River/Shenandoah River

Natural Resource Damage Assessment and Restoration

Restoration Plan/Environmental Assessment

Draft – October 2016

prepared by:

Natural Resource Trustees:
U.S. Fish and Wildlife Service
Commonwealth of Virginia

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LIST OF ACRONYMS

BMP	Best Management Practice
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
C.F.R.	Federal Code of Regulations
COC	Contaminant of Concern
CWA	Clean Water Act, or Federal Water Pollution Control Act
CWPNAP	Cowbane Wet Prairie State Natural Area Preserve
DOI	U.S. Department of the Interior
DSAY	Discounted Service Acre-Year
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Enviromental Protection Agency
ESA	Endangered Species Act
FCA	Fish Consumption Advisory
FONSI	Finding of No Significant Impact
FRFH	Front Royal Fish Hatchery
FWS	U.S. Fish and Wildlife Service
HEA	Habitat Equivalency Analysis
MCI	Madison Cave Isopod
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NFSR	North Fork Shenandoah River
NMFS	National Marine Fisheries Service
NPL	National Priorities List
NRDAR	Natural Resource Damage Assesment and Restoration
NRCS	Natural Resources Conservation Services
NRDC	Natural Resources Defense Council
PRP	Potentially Responsible Party
PV	Present Value
RCRA	Resource Conservation and Recovery Act
REA	Resource Equivalency Analysis
RP/EA	Restoration Plan/Environmental Assessment
SR	South River
SFSR	South Fork Shenandoah River

SRST	South River Science Team
SWMU	Solid Waste Management Units
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health

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EXECUTIVE SUMMARY

From 1929 to 1950, mercury was used in the manufacturing process at the former E.I. du Pont de Nemours and Company (DuPont) plant located in Waynesboro, VA. Mercury releases from the DuPont plant impacted soil and groundwater on-site, and storm sewers transported mercury to the South River, which continued downstream to the South Fork Shenandoah River and Shenandoah River. Natural resources (*e.g.*, sediments, invertebrates, fish, amphibians, reptiles, birds, and mammals) have been exposed to and adversely affected by the mercury release. Remedial activities are ongoing under the direction of the U.S. Environmental Protection Agency (EPA) and the Virginia Department of Environmental Quality (VDEQ).

Under federal law, through the Natural Resource Damage Assessment and Restoration (NRDAR) process, natural resource Trustees are authorized to assess and recover damages resulting from injuries to natural resources attributable to hazardous substance releases. The Trustees then utilize these recovered damages to plan and implement actions to restore, replace, rehabilitate, and/or acquire the equivalent of injured natural resources and the services they provide. Trustees in this case, the Commonwealth of Virginia, acting through VDEQ and the United States Department of the Interior acting through U.S. Fish and Wildlife Service, developed this Draft Restoration Plan and Environmental Assessment (Draft RP/EA) in accordance with 43 C.F.R. § 11.93 to inform the public as to the types and amount of restoration that are expected to compensate for injuries to natural resources and the services they provide associated with the mercury release from the former DuPont plant.

Under the National Environmental Policy Act, federal agencies must identify and evaluate environmental impacts that may result from federal actions. In this Draft RP/EA, the Trustees describe the purpose and need for action, identify potential restoration alternatives, including a No Action alternative, summarize the affected environment, and describe the potential environmental consequences of proposed restoration activities. The Trustees are soliciting comments on this Draft RP/EA, and will address comments in preparing a final RP/EA wherein the Trustees will identify the Selected Restoration Alternative.

CHAPTER 1 INTRODUCTION AND SUMMARY

1.1 Purpose and Need for Restoration

This Draft RP/EA has been prepared by the Trustees to address natural resources injured and ecological services lost due to releases of mercury from the former DuPont plant located in Waynesboro, VA (the Facility). The purpose of this Draft RP/EA is to present the "Preferred Alternative" restoration project or projects that will accomplish the goal of restoring, rehabilitating, replacing and/or acquiring the equivalent of those natural resources, and the services those resources provide, that have been injured from the mercury release.

For decades, mercury was released into the South River (SR), and transported downstream into the South Fork Shenandoah River (SFSR), Shenandoah River, and associated floodplain and upland habitat. A number of natural resources, including sediments, mussels, fish, amphibians, reptiles, birds, and mammals have been exposed to and adversely affected by mercury released from the Facility. The proposed remedial actions to reduce mercury in the system include stabilizing banks to prevent erosion and re-suspension of contaminated particles in the river (Anchor QEA *et al.* 2013). This strategy will be implemented in stages, likely over a period of more than 10 years. The effectiveness of this technique is unknown and will take many years of monitoring to determine whether there is a reduction in mercury is due to remedial activities. Impacts from mercury exposure are expected to continue into the future, as remedial efforts are not likely to remove all mercury from the system.

The Trustees developed this Draft RP/EA in accordance with 43 C.F.R. § 11.93 to inform the public as to the types and scale of restoration to be undertaken towards compensating for injuries to natural resources. Consistent with the U.S. Department of the Interior (DOI) NRDAR regulations, this Draft RP/EA includes a reasonable number of restoration alternatives and identifies a preferred alternative. Public comments are being sought on this Draft RP/EA and will be considered and incorporated in the final RP/EA as appropriate.

1.2 Trustee Authority and Natural Resource Damage Assessment and Restoration

Under federal law, the Trustees are authorized to act on behalf of the public to assess injuries to natural resources and services resulting from the release of hazardous substances into the environment. The NRDAR process, formalized in the DOI regulations (43 C.F.R. § 11), allows Trustees to pursue claims against responsible parties for monetary damages based on these injuries in order to compensate the public. The goal of this process is to plan and implement actions to restore, replace, or rehabilitate the natural resources that were injured or lost as a result of the release of a hazardous substance, or to acquire the equivalent resources or the services

they provide (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601 *et seq*.; 43 C.F.R. § 11).

The following authorities authorize federal, state and tribal governments to act on behalf of the public as Trustees of natural resources:

- CERCLA, as amended (42 U.S.C. § 9601 *et seq*.)
- Federal Water Pollution Control Act, 33 U.S.C. § 1251, *et seq.* (more commonly known as the Clean Water Act or CWA)
- The Oil Pollution Act of 1990 (33 U.S.C. § 2701-2761 *et seq*.)
- Executive Order 12580 (52 Federal Register (FR) 2923 (January 23, 1987)), as amended by Executive Order 12777 (56 FR 54757 (October 19, 1991)
- National Contingency Plan (40 C.F.R. §§ 300.600 *et seq*.)

As noted previously, the Trustees for the DuPont Waynesboro NRDAR are the Commonwealth of Virginia, represented by VDEQ, and DOI, represented by the U.S. Fish and Wildlife Service (FWS). A Trustee Memorandum of Agreement (MOA) was executed in June 2008, formalizing this collaborative process. The Trustee responsibilities outlined in the MOA include, but are not limited to: assessment of injury to natural resources, restoration planning, developing cost of restoration, replacement, rehabilitation, and/or acquisition of the equivalent, and coordination with response actions.

Under CERCLA, the parties responsible for releases of hazardous substances may be invited to participate in a cooperative NRDAR process (43 C.F.R. § 11.32(a)(2)). Although the final authority regarding determinations of injury and restoration rests solely with the Trustees, cooperative assessments can be beneficial to the public by reducing duplication of effort, expediting the assessment, and implementing restoration earlier than might otherwise be the case. Since 2005, DuPont has worked cooperatively with the Trustees to complete injury assessment studies, and a Cooperative Natural Resource Damage Assessment Funding Agreement (Cooperative Agreement) was signed by all parties in 2005 and 2010. Under the Cooperative Agreement, the parties conducted a series of site-specific studies assessing the exposure of natural resources, such as songbirds, amphibians, turtles, and bats, to mercury and potential effects resulting from that exposure. These studies are discussed in more detail in Chapter 3.

DuPont's active involvement in the damage assessment and restoration planning process also included/s the following:

- Providing funding and assistance for assessment activities;
- Providing data and developing a database of contaminant concentration data;
- Participating in the development of injury assessments of ecological and human use

services,

- Identifying parcels for potential land conservation; and
- Identifying other potential restoration projects.

The Trustees completed a Damage Assessment Plan in 2011, summarizing existing information on natural resource injuries and describing proposed studies to evaluate past, current, and future impacts to natural resources and the services they provide (Industrial Economics, Inc. (IEc) 2011). In addition, the Damage Assessment Plan outlined how information gathered from the studies would be used to determine the types and scale of restoration needed to address these injuries.

1.3 Summary of Settlement

Based on the results of the natural resource injury determination and other legal considerations associated with the Facility, the Trustees lodged a negotiated proposed consent decree with DuPont in the U.S. District Court for the Western District of Virginia on December 15, 2016 to implement various projects to effectuate restoration, replacement, rehabilitation and/or acquisition of the equivalent of the natural resources injured from mercury released from the Facility and/or the services those resources provide.

The proposed Consent Decree (CD) will allocate the settlement as follows: DuPont, working with the Commonwealth, will complete at its expense certain recreational fishing projects; and DuPont will pay $42,069,916.78 into the DOI NRDAR Fund to be expended jointly by the state and federal Trustees to complete restoration projects meeting the requirements of this Draft RP/EA designed to address the injury.

1.4 Facility History and Remediation

The Facility is located on approximately 177 acres on the eastern shore of the SR in Waynesboro, VA (Figure 1; U.S. Environmental Protection Agency (EPA) 2016). DuPont began operations at the Facility in 1929, manufacturing acetate flake and yarn, collectively referred to as acetate fibers. It discontinued production of acetate fibers in 1977. Other products historically manufactured on site included: Orlon®, Lycra®, Permasep®, and BCF Nylon; currently only Lycra is produced at the Facility, now owned and operated by INVISTA (EPA 2016). DuPont continues to own the real estate underlying the Facility.

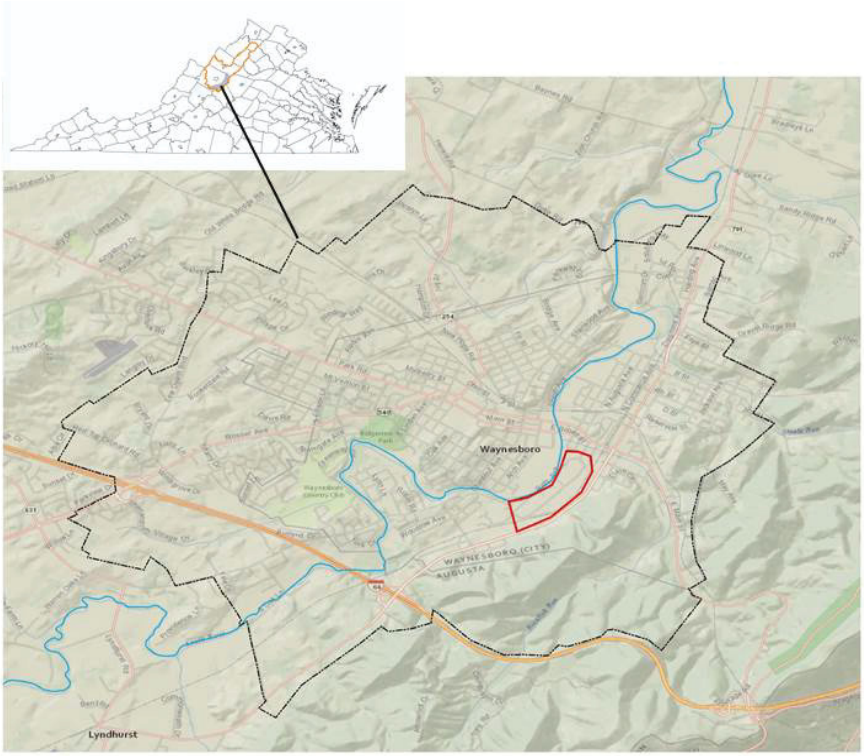


Figure 1. Location of DuPont Facility, outlined in red, encompassing 177 acres adjacent to the SR, in Waynesboro, VA.

From 1929 to 1950, mercury was used in the manufacturing process, and waste sludge was conveyed to an on-site retort facility where the mercury was to be recovered. However, mercury releases occurred, impacting soil and groundwater locally on-site, and storm sewers transported mercury from the Facility to the SR. Mercury continues to be encountered during investigations at the Facility and mercury releases to the SR occur via storm water runoff (VDEQ 2009, URS 2012, Anchor QEA *et al*. 2013). Mercury is transported and re-circulated downstream via surface water, sediments, and floodplain soils to the SFSR and Shenandoah River, and a variety of natural resources have been exposed to Facility-related mercury.

The mercury release was discovered in the 1970s, and a fish consumption ban, then advisory, was enacted in 1977 and 1979, respectively. As of 1999, fish tissue mercury levels had not declined since the early 1980s, as predicted, but instead concentrations remained steady or increased (URS 2012). DuPont and VDEQ discussed the need to assess mercury fate and transport in the SR and SFSR, and founded the South River Science Team (SRST) in 2001 to undertake this work. The SRST is a non-regulatory, collaborative group comprised of representatives from industry, state and federal governmental agencies, environmental groups, independent researchers, and other stakeholders. Since 2001, the SRST has met quarterly to coordinate efforts, identify data needs, collaborate, and share results and information concerning the assessment. Often the resulting studies have been used to support regulatory actions.

In 2005, DuPont entered into a consent decree with Natural Resources Defense Council (NRDC) and the Virginia Chapter of the Sierra Club as a result of lawsuit about the high mercury levels in fish and the associated threat to human health and the environment. It required that DuPont conduct a six-year ecosystem study of the SR watershed to delineate the threat and how to eliminate it, as well as fund abatement measures and propose a remedial plan. A revised consent decree was signed in 2014 that settled the matter with NRDC and Sierra Club.

DuPont has also conducted numerous on-site investigations under the Resource Conservation and Recovery Act (RCRA) Corrective Action Permit (VAD003114832; issued in 1998 and renewed in 2009) managed by EPA and VDEQ. EPA has regulatory authority for the investigation and remediation of contamination on Facility property and VDEQ has the regulatory authority for investigation and remediation of contamination of the rivers and floodplain. A RCRA Facility Investigation was conducted in three phases to characterize solid waste management units (SWMUs) where hazardous substances may have impacted the environment; studies included soil and groundwater sampling at 20 identified SWMUs. DuPont is implementing interim measures (*e.g.*, cleaning sewers) until the final remedy is selected. In 2014, VDEQ approved a Class 2 Permit Modification Request to incorporate the SR and parts of the SFSR (including the floodplain) into VAD003114832. Remedial activities for the rivers are ongoing. A remediation proposal was released in 2013 as required by the 2005 consent decree with NRDC/Sierra Club. The proposal found that a primary mechanism for the continued mercury loading to parts of the SR was through the slow erosion of legacy mercury deposits that currently reside in riverbank soils. Approximately 40 to 60% of the mercury that currently cycles through the food web into smallmouth bass tissue likely originates from eroding bank soils (Anchor QEA *et al*. 2013).

1.5 Relationship to Remedial Activities

NRDAR is a process that occurs in addition to the remedial process conducted by regulatory agencies like the EPA. These two processes have different goals. Remedial action objectives are risk-based, and are developed to protect human health and the environment from further unacceptable harm. The goal of NRDAR is the restoration of resources to their baseline condition, or what their condition would be absent the release of a hazardous substance. Losses resulting from natural resource exposure to released hazardous substances are estimated over time until the resource is restored. These losses can extend beyond the date of remedy completion if contaminants will be left in the environment at levels injurious to natural resources.

There are components of NRDAR and remedial actions that overlap. For example, remedial decisions can include consideration of restoration objectives identified by the NRDAR process. Work to remedy a site may partially or completely restore injured natural resources, and

NRDAR estimates take this into account. In addition, remedial actions may cause "collateral injury" to habitat, and quantification and restoration of this remedy-induced injury is evaluated within the NRDAR process.

For the DuPont Waynesboro NRDAR process, the Trustees have interacted and continue to interact with EPA and VDEQ as they evaluate, select, design, and implement remedies. This coordination provides an understanding of the remedial process and helped the Trustees evaluate how each of the remedial decisions affects estimates of natural resource damages.

1.6 Compliance with National Environmental Policy Act and Other Authorities

Restoration alternatives described in this document will be conducted in compliance with all applicable federal, state, and local regulations.

Federal natural resource and environmental laws, orders, and regulations considered during the development of this Draft RP/EA include but are not limited to the: Endangered Species Act (ESA) of 1973; Farmland Protection Policy Act of 1981; Wild and Scenic Rivers Act of 1968; Migratory Bird Treaty Act of 1918; National Historic Preservation Act of 1966; Archeological and Historic Preservation Act of 1974; Fish and Wildlife Coordination Act of 1934; U.S. Fish and Wildlife Mitigation Policy of 1981; Information Quality Act of 2001; Executive Order 11990 on Wetlands of 1977; and Executive Order 11988 on Floodplains of 1977. Explanation of compliance with these and other federal authorities is found in Section 5.5.

The major state environmental statutes and programs considered during the development of this Draft RP/EA include but are not limited to the: Virginia State Water Control Law, Va. Code § 62.1-44.5; Virginia Agricultural Best Management Practices Cost Share Program, Va. Code § 10.1-2128.1; Virginia Natural Area Preserves Act, Va. Code § 10.1-209 *et seq.*; and Virginia Cave Protection Act, Va. Code § 10.1-1000 *et seq.*

Actions undertaken by the Trustees to restore natural resources or services under CERCLA and other federal laws are subject to the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*) and the regulations guiding its implementation at 40 C.F.R. Parts 1500 through 1517. These authorities outline the responsibilities of federal agencies for preparing environmental documentation. In general, federal agencies contemplating implementation of a major federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. When it is uncertain whether a contemplated action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the

requirements of NEPA, and no EIS is required. For a proposed RP, if a FONSI determination is made, the Trustees may then issue a final RP describing the selected restoration action(s).
In accordance with NEPA and its implementing regulations, this Draft RP/EA summarizes the current environmental setting; describes the purpose and need for restoration actions; identifies alternative actions; assesses their applicability and potential impact on the quality of the physical, biological, and cultural environment; and outlines public participation in the decision-making process.

1.7 Public Participation

Public participation and review is an integral part of the restoration planning process, and is specifically required in the DOI NRDAR regulations (*e.g.*, 43 C.F.R. §11.81(d)(2)). In addition, NEPA and its implementing regulations require that federal agencies fully consider the environmental impacts of their proposed decisions and that such information is made available to the public. To facilitate public involvement in the ecological and recreational restoration planning process, the Trustees have been meeting with interested stakeholders since 2008 (Appendix A).

To continue the Trustees' dedication to public involvement, this Draft RP/EA is available for public review and comment for a period of 45 days in accordance with 43 C.F.R. § 11.81(d)(2). The Trustees will address public comments and will document responses to those comments as part of the final RP/EA.

Comments may be submitted in writing and are due to the Trustees by January 30, 2017. To submit a comment, request a hard copy of the Draft RP/EA, or for additional information, please contact:

Anne Condon
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061
anne_condon@fws.gov

Copies of this document are available online at:
https://www.fws.gov/northeast/virginiafield/news/news.html

As restoration progresses, the Trustees may amend the RP/EA if significant changes are made to the types, scope, or impact of the projects. In the event of a significant modification to the RP/EA, the Trustees will provide the public with an opportunity to comment on that particular amendment.

1.8 Administrative Record

An administrative record consisting of a catalog of all documents Trustees used to develop and make decisions related to the NRDAR process, including this Draft RP/EA, is maintained by FWS at the Virginia Ecological Services Office in Gloucester, VA.

1.9 Organization of the Draft RP/EA

The remainder of this document is organized as follows:

- Chapter 2 describes the affected environment.
- Chapter 3 describes the injury assessment strategy and evaluation for ecological resources and human use / recreational fishing.
- Chapter 4 describes restoration alternatives.
- Chapter 5 evaluates the restoration alternatives, including the environmental impacts.
- Chapter 6 describes the selection of the preferred alternative for ecological and recreational fishing restoration.

CHAPTER 2 AFFECTED ENVIRONMENT – NATURAL RESOURCES / WATERSHED

This Draft RP/EA evaluates restoration options to compensate the public for the natural resource injuries and associated losses in ecological and recreational services resulting from exposure to Facility-related mercury. As part of the evaluation, the Trustees assessed the current physical, biological, socio-economic, and cultural resources of the area within which restoration is likely to occur (the SR and SFSR watershed). This information will assist the Trustees in planning future restoration activities and ensure that potential restoration projects are designed to both maximize ecological and human use benefits while minimizing or eliminating project-related adverse environmental consequences.

This chapter presents a description of the physical, biological, and cultural environment for the waterways and ecosystems adjacent to and in the vicinity of the Facility as required by NEPA (42 U.S.C. § 4321, *et seq*.). The assessment area, the area impacted by the mercury releases and the focus of the injury assessment studies, is contained within the larger affected environment (Figure 2). The majority of restoration activities under this Draft RP/EA would occur in proximity to the same areas.

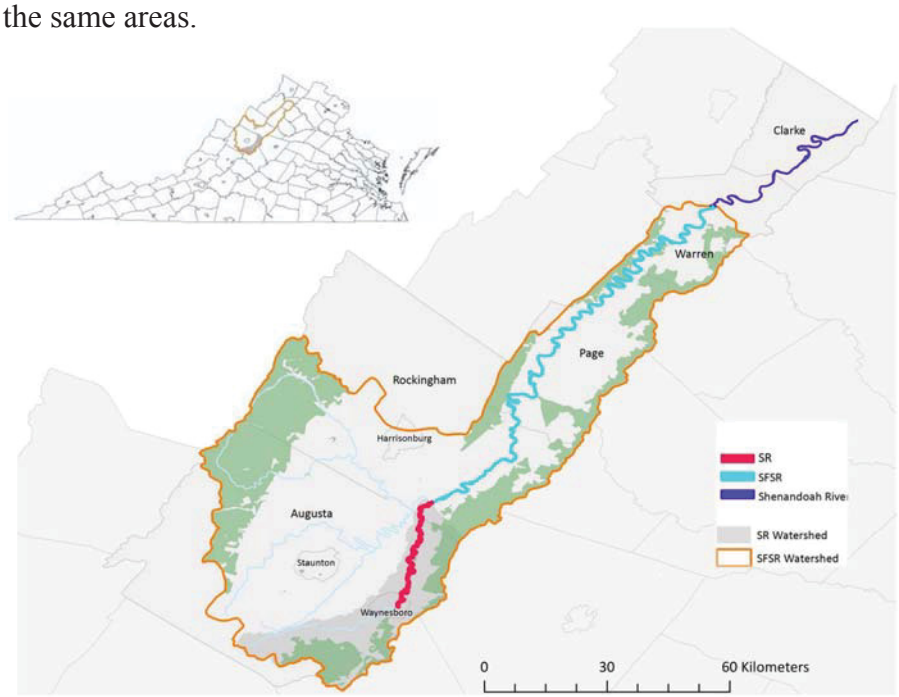


Figure 2. Assessment area includes the aquatic habitat of the SR downstream of Waynesboro, VA (pink), the SFSR (light blue), and for some analyses, the Shenandoah River (dark blue), plus the floodplain and upland habitat within a 300 m buffer around the SR and a 300 ft buffer around the SFSR. The remaining area within the SR and SFSR watershed is considered the affected environment and the area in which restoration is likely to occur. Green shading indicates conservation lands (National Forest, National Park, State Park, or State Natural Area Preserve).

2.1 Watershed

From its headwaters southwest of the City of Waynesboro, the SR flows in a northerly direction for approximately 50.8 miles to the town of Port Republic in Rockingham County. The drainage area of the SR is 235 square miles, with 89% in Augusta County, 6% in the City of Waynesboro, and 5% in Rockingham County (VDEQ 2009). As the SR approaches Waynesboro, large natural springs cool the water and increase flow.

In Port Republic, the SR merges with the North River to form the SFSR, which flows north through Rockingham, Page, and Warren Counties for approximately 100 miles. The SFSR drains approximately 1,700 square miles, and other major tributaries include the Middle River and Christians Creek (VDEQ 2009). There are 20 public access points along the SFSR offering recreational opportunities; the SFSR is a popular destination for canoeing and fishing, attracting thousands of users each year (VDGIF 2016). The majority of the land bordering the SFSR is private property, with the exception of the public access points, the Virginia-owned Andy Guest Shenandoah River State Park, and small sections of the George Washington National Forest on the west bank of the river.

At Front Royal, the SFSR merges with the North Fork Shenandoah River (NFSR) to form the Shenandoah River. This river continues to flow approximately 57 miles through Virginia and West Virginia, joining the Potomac River in Harper's Ferry, WV, and ultimately draining into the Chesapeake Bay. The main stem Shenandoah River is one of the top smallmouth bass rivers in the eastern United States, and the section that runs through Clarke County, VA, is designated as a component of the Virginia Scenic River System (Va. Code § 10.1-417). Most of the land adjacent to the Shenandoah River is privately owned. Numerous anthropogenic and natural barriers exist between the headwaters of the Shenandoah drainage and the Chesapeake Bay; for example, the SFSR has three run-of-river hydropower dams and the Shenandoah River has one (VDGIF 2016a, b).

The SFSR watershed (which contains the smaller SR watershed, hereafter collectively referred to as the SR/SFSR watershed) is within the Valley and Ridge physiographic region. To the southeast of the watershed are the Blue Ridge Mountains and to the west is Massanutten Mountain (Krstolic and Ramey 2012). The area surrounding the SR and the SFSR is mostly forested (55%) and agricultural (30% grass/pasture, 4% row-crop agriculture), interspersed with small urban populations (11%) including the City of Waynesboro and the towns of Grottoes and Elkton (Krstolic and Ramey 2012). The SFSR watershed receives many visitors annually to enjoy river-related activities.

The area enjoys significant natural heritage resources. For example, 17% of Augusta County contains natural heritage resources, such as habitat of rare, threatened, or endangered plant or animal species; unique natural communities; and significant geologic formations (Augusta County 2009). The SR/SFSR watershed supports numerous natural resources such as benthic organisms, fish, reptiles, amphibians, birds, and mammals, including state and federally listed species or species of concern. General descriptions of these resources are provided in Section 2.2 below.

2.1.1 Assessment Area

The assessment area includes the area within the SR/SFSR watershed that was considered in the NRDAR injury assessment to be impacted by mercury contamination from the Facility. The assessment area includes the 24 miles of the SR from Waynesboro to Port Republic, as well as the full extent of the SFSR (Table 1; Figure 2). Certain injury analyses also included the Shenandoah River within Virginia (*e.g.,* recreational fishing, ecological fish). The assessment area is discussed further in Chapter 3.

Table 1. Within the SR/SFSR watershed, the assessment area is a smaller area considered impacted by mercury contamination from the Facility. Below are the associated river miles, acres of aquatic habitat, and acres of floodplain/upland of the assessment area.

	River Miles	Acres of Aquatic Habitat	Acres of Associated Floodplain/Upland
SR	24	272	5,202
SFSR	101	3236	6,177
Shenandoah River	35	1445	NA
Total	160	4,953	11,379

2.2 Natural Resources in the SR/SFSR Watershed

The SR/SFSR watershed hosts a number of natural resources and unique habitats that Trustees considered in the NRDAR injury assessment (see Chapter 3) and when reviewing potential restoration projects.

Aquatic Resources

2.2.1 Mussels

Several species of native freshwater mussels were historically present in the SR, SFSR, Shenandoah River, and tributaries. Mussel surveys of the upper Shenandoah River system, conducted from the early 1900s through the 1970s, recorded nine species (Ortmann 1919, Johnson 1970, Clark 1981, Chazal and Roble 2011). Species composition is quite similar among the forks of the upper Shenandoah River, and also to other major tributaries of the Potomac River basin, like the Cacapon River in West Virginia, and Broad Run near Manassas, VA (Garst *et al*. 2014), indicating that most mussel species are widely distributed throughout the Potomac River basin. However, mussel surveys of the SFSR and NFSR systems conducted in the 1990s, early 2000s, and from 2008-2009 by biologists from the Virginia Department of Conservation and Recreation (VDCR), documented only three live species (triangle floater (*Alasmidonta undulata*), Eastern elliptio (*Elliptio complanata*), and creeper (*Strophitus undulatus*)) and showed that mussel abundance was very low in both the SFSR and NFSR (Chazal and Roble 2011). Surveys conducted in 2013 in the SR identified these same three species at survey locations upstream of Waynesboro (Garst *et al.* 2014).

2.2.2 Fish

The SR/SFSR watershed supports a diverse fishery. The fish assemblage in the Shenandoah drainage comprises 40 native species and subspecies and 18 introduced species (Jenkins and Burkhead 1994). Common taxa in the SR and SFSR rivers include smallmouth and largemouth bass (*Micropterus dolomieu* and *M. salmoides*), redbreast sunfish (*Lepomis auritus*), fallfish (*Semotilus corporalis*), shiners (*Cyprinella* spp. and *Notropis* spp.), dace (*Rhinichthys* spp.), white sucker (*Catostomus commersoni*), northern hogsucker (*Hypentelium nigricans*), darters (*Etheostoma* spp.), and sculpins (*Cottus* spp.). The American eel (*Anguilla rostrata*) migrates up the Potomac and Shenandoah Rivers from the Sargasso Sea and uses the SFSR and SR as elver and adult habitat.

As the SR approaches Waynesboro, several large springs enter the river providing an increase in flow and decrease in temperature. With the removal of the Rife-Loth Dam in 2010, this cold-water area now extends further downstream into the City of Waynesboro, creating suitable habitat for trout. Stocked species include: brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*). A year-round trout fishery now exists several miles upstream of Waynesboro and downstream through most of Waynesboro City limits, creating a destination trout fishery for many anglers. As the SR warms downstream, habitat becomes more suitable for warm-water fish species; community composition varies

between upper and lower reaches of the SR reflecting the changes in habitat and water temperature (URS 2012).

2.2.3 Reptiles and Amphibians

Over 40 species of reptiles and amphibians occur in different areas within the SFSR watershed in wetland, riverine, and upland habitats. Some common reptile species along the SR include: snapping turtle (*Chelydra serpentine*), painted turtle (*Chrysemys picta*), stinkpot (*Sternotherus odoratus*), ratsnake (*Pantherophis alleghaniensis*), and northern watersnake (*Nerodia sipedon*). Common amphibians include: southern two-lined salamander (*Eurycea bislineata*), red-backed salamander (*Plethodon cinereus*), and American toad (*Bufo americanus*). Species of conservation concern found in the watershed include, but are not limited to: tiger salamander (*Ambystoma tigrinum*; state listed endangered), pine snake (*Pituophis melanoleucus*; state species of concern), and Big Levels salamander (*Plethodon sherando*), a woodland salamander endemic to the SR watershed, ranked as globally and state rare, and found in the Big Levels area within the George Washington National Forest/Blue Ridge Parkway.

Floodplain/Upland Resources

2.2.4 Birds

Both resident and migratory birds utilize habitat within the SR/SFSR watershed for breeding, feeding, and roosting. These include waterfowl, waterbirds, raptors, and songbirds. Surveys conducted in 2011 and 2012 in the upper SFSR watershed identified 113 species in various habitat types and elevations (Cristol 2012, unpublished data). Many of these species are neotropical migratory birds, breeding in or migrating through the watershed and wintering in Central or South America or the Caribbean. See Appendix B.

Species in the assessment area that are listed as species of greatest conservation concern (Tier I-IV) on the Virginia 2015 Wildlife Action Plan include, but are not limited to: belted kingfisher (*Megaceryle alcyon*), black and white warbler (*Mniotilta varia*), brown thrasher (*Taxostaoma rufum*), Canada warbler (*Cardellina canadensis*), chimney swift (*Chaetura pelagica*), eastern kingbird (*Tyrannus tyrannus*), eastern meadowlark (*Sturnella magna*), eastern towhee (*Pipilo erythrophthalmus*), eastern wood-pewee (*Contopus virens*), field sparrow (*Spizella pusilla*), gray catbird (*Dumetella carolinensis*), and wood thrush (*Hylocichla mustelina*).

2.2.5 Mammals

Several species of mammals have been recorded in the SR/SFSR watersheds utilizing aquatic, floodplain, and terrestrial habitats. For example, muskrats (*Ondatra zibethicus*) forage on

shellfish in the river, and shrews (*Sorex* spp) prey on insects in the floodplain. Other species that use habitat in the watershed for feeding or breeding include river otters (*Lontra canadensis*) and mink (*Neovison vison*). Bats are also present in the watershed, foraging over the SR and SFSR, and roosting in caves, trees, and barns in the area. Bat species found in the watershed include big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*). Federally listed endangered Virginia big-eared bat (*Corynorhinus townsendii virginianus*) and Indiana bat (*Myotis sodalis*), federally and state listed threatened northern long-eared bat (*Myotis septentrionalis*), and state listed endangered little brown bat (*Myotis lucifugus*) and tri-colored bat (*Perimyotis subflavus*) may also be present in the watershed.

Unique Species and Features

2.2.6 Madison Cave Isopod

The Madison Cave isopod (*Antrolana lira*; MCI) is a federally listed threatened, free-swimming, sightless, subterranean crustacean that lives in karst aquifers. It is endemic to the northern Shenandoah Valley, VA, and Jefferson County, WV, and to date has been found exclusively in Cambrian/Ordovician aged carbonate bedrock (Orndorff and Hobson 2007). Until 1990, this rare isopod was known from only Madison Saltpetre Cave and the adjacent Steger's Fissure at the northeastern end of Cave Hill in Augusta County, VA. MCI abundance at Steger's Fissure is the highest in the species' range, estimated at 2,240-3,420 individuals (Fong 2007). As of 2010, the MCI was known from a total of 16 locations in the Shenandoah Valley from Leetown, WV, to Lexington, VA (FWS 2010).

2.2.7 Wetlands – Sinkhole Ponds

Freshwater emergent, forested, and pond wetland habitat is present throughout the watershed. The SFSR watershed also contains a unique group of depression wetlands, known as the Shenandoah Valley sinkhole ponds (Fleming and Van Alstine 1999). These sinkhole ponds occur on deep alluvial fans in Augusta, Rockingham, and Page Counties that were deposited over carbonate rocks along the foot of the Blue Ridge Mountains during the Pleistocene (see Figure 3 for locations of some of these sinkhole ponds). Solution of the underlying rock and reworking of surficial material by streams resulted in the development of numerous natural ponds varying in size from less than 0.1 acre to more than 3.7 acres. Pollen profiles from bottom sediments in two Augusta County ponds demonstrate the continuous existence of wetlands over the past 15,000 years (Craig 1969). Most ponds in the Shenandoah Valley complex experience seasonally fluctuating water levels. The hydroperiods of many ponds are irregular and unpredictable, varying with the size and depth of the basin, degree of shading, and local groundwater conditions. Three rare and apparently endemic community types occur in the Shenandoah Valley ponds, and their flora is notable for its high percentage of rarities.

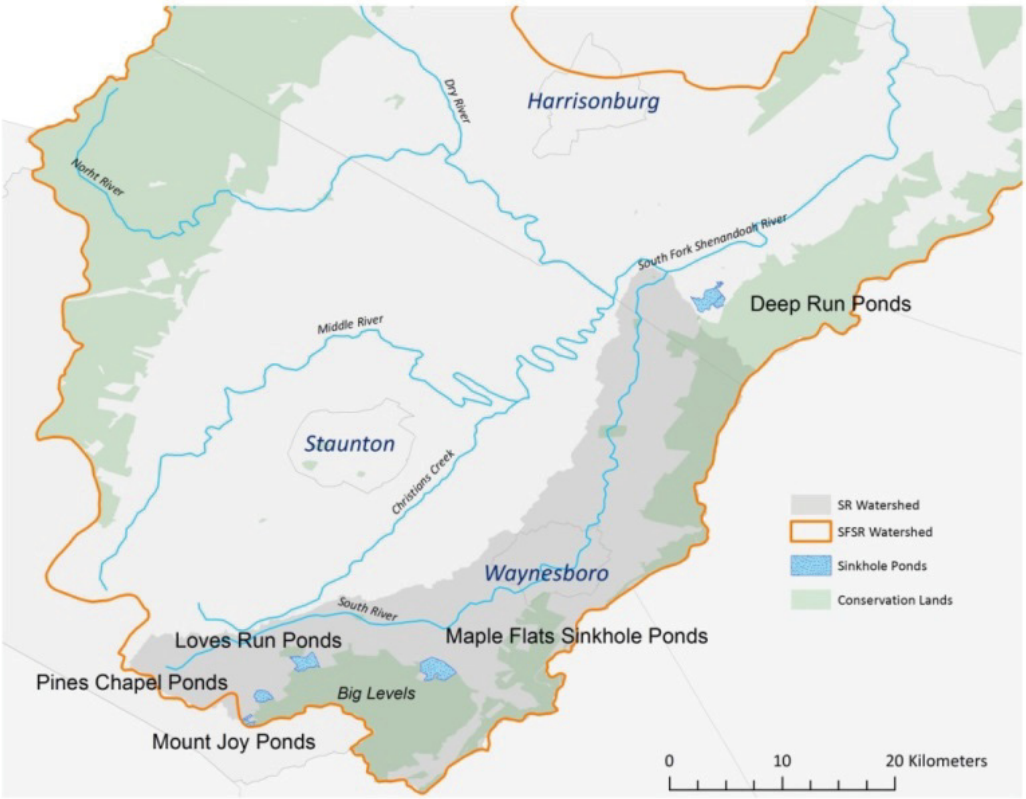


Figure 3. Sinkhole pond areas in Augusta and Rockingham Counties within the SR/SFSR watershed.

2.2.8 Limestone Cave Habitat

The SFSR watershed contains a number of historically and geologically significant limestone caves, including Grand Caverns, a National Natural Landmark located along the SR. The karst terrain, a landscape of sinkholes, sinking streams, and caverns, was formed by groundwater dissolving the limestone and dolostone that underlie the Shenandoah Valley floor. Several of the caves in the SFSR watershed are designated as significant under the Virginia Cave Protection Act, and provide habitat for the MCI and bat species (VDCR 2015).

2.3 Cultural and Historic Resources

The area contains significant historical and cultural resources, including Civil War battlefields and related historic sites, many of which are protected through Shenandoah Valley Battlefields Foundation (SVBF) and other partners (SVBF 2015).

2.4 Ecological Stressors

Ecological stressors in the SR/SFSR watershed include point source pollutants and industrial wastes, inadequately treated sewage, and agricultural and urban run-off and erosion from poor sedimentation control (FOSR 2013). The SFSR was listed as an impaired river in 1998 on Virginia's Section 303(d) Total Maximum Daily Load (TMDL) Priority List and Report, and again in 2002, 2004, 2006 and 2008 (Engineering Concepts, Inc. 2009). The impairment was due to exceedances of fecal coliform and bacteria standards. The SR, SFSR and Shenandoah River are also on the 303(d) list because of the mercury contamination. Many other streams within the watershed are listed as impaired; thirty streams in Augusta County (553.38 miles) have water quality impairments based on TMDLs for pollutants such as fecal coliform, bacteria, pH, and other contaminants (Augusta County 2009).

The SFSR watershed is home to dairy and beef cattle farms, with over 8,000 pairs of beef cattle and almost 3,000 dairy cattle as of 2009, and many have access to streams in the watershed (Engineering Concepts, Inc. 2009). The SFSR watershed also has chicken and turkey operations, and poultry litter is applied to cropland and pasture throughout the watershed. Augusta County, which contains most of the SR and its headwaters, is the second leading agricultural county in Virginia (Augusta County 2009). The county's watersheds, including the SR watershed, are experiencing excessive levels of soil erosion from farmland which can have negative impacts on stream quality and long term agricultural productivity (Augusta County 2009), particularly tributaries to the Middle River such as Christians Creek.

Areas within the watershed are experiencing increased human population growth and development in recent decades. In Augusta County, the growth rate for the decade 1990-2000 was 11.6%, the largest increase since 1960-1970 (Augusta County 2009). The population of Augusta and Rockingham Counties is expected to increase by 3% between 2015 and 2040 and more significant increases are predicted for cities and towns (*e.g.*, 37% expected increase in Waynesboro) (VDEQ 2015).

These stressors are important when evaluating restoration projects and areas – to help identify what projects to prioritize and what areas within the watershed to target – most in need of restoration, areas most at risk, where restoration will be most likely to succeed, etc. The existing stressors are also considered the evaluation of injury when establishing the baseline conditions of the area (see Chapter 3).

CHAPTER 3 INJURY ASSESSMENT

The natural resources listed in Chapter 2 provide a variety of services. Services are "the physical and biological functions performed by the resource, including the human uses of those functions, [that result from the resource's] physical, chemical, or biological quality" (43 C.F.R. § 11.14 (nn)). For example, ecological services provided by benthic invertebrates and mussels include foraging opportunities for fish and birds, nutrient cycling, and water filtration. Wetland soils provide services by supporting healthy vegetation and diverse plant communities that in turn provide animals with foraging opportunities, nesting or denning areas, and protective cover. Examples of human use services provided by natural resources include opportunities for fishing, boating, and wildlife viewing and appreciation.

Injury has occurred when a resource's viability or function is impaired such that the type and/or magnitude of services provided by that resource is reduced as a result of contamination (43 C.F.R. § 11.14 (v)). Determination of injury requires documentation that: (1) there is a viable pathway for the released hazardous substance from the point of release to a point at which natural resources are exposed to the released substance, and (2) injury of exposed resources (*e.g.*, surface water, sediment, soil, groundwater, biota) has occurred as defined in 43 C.F.R. § 11.62. The first condition is satisfied based on clear documentation of direct historical discharge of mercury, the contaminant of concern, from the Facility into the SR, and ongoing releases from the banks of the SR (VDEQ 2009, Anchor QEA *et al*. 2013; See Section 3.2). The second condition is satisfied because measured concentrations of mercury in various resources within the assessment area displayed associated effects, or exceeded levels at which the literature reports adverse effects on endpoints such as reproduction, growth, and survival as well as the presence of a fish consumption advisory.

3.1 Contaminant of Concern

The contaminant of concern (COC) in a NRDAR assessment area is a hazardous substance (as defined by Section 101(14) of CERCLA) to which trust resources have been exposed as a result of a release. Mercury is considered to be the primary COC for this assessment, listed in Table 302.4, the List of Hazardous Substances and Reportable Quantities under CERCLA, and as a toxic pollutant pursuant to 40 C.F.R. § 401.15, as amended.

As mercury cycles through the environment, it can be present in several different forms. "Quicksilver," or mercury-zero, is metallic, elemental mercury (such as the mercury released from the Facility), and is less toxic than other forms. Once released into the environment, elemental mercury is converted to methylmercury, the most common, and most toxic, organic mercury compound, mainly by microscopic organisms in water, soil, and sediment. Methylmercury is lipid soluble, allowing it to cross biological membranes and to enter the food

web, where it is bioaccumulated and biomagnified in upper trophic level organisms such as fish and birds.

Mercury is primarily a neurotoxin, but can also cause biochemical, enzymatic, immunological, genetic, and reproductive effects on biota. For example, in adult mammals, methylmercury can cause ataxia difficulty in locomotion, impairment of hearing or vision, general weakness, and death (Eaton *et al*. 1980; Wren *et al*. 1987a,b). Symptoms of acute mercury poisoning in birds include, but are not limited to, reduced food intake leading to weight loss; progressive weakening in wings and legs; difficulty flying, walking and standing; and death (Wolfe *et al*. 1998). Reductions in egg laying and territorial fidelity are also associated with mercury exposure in birds (Barr 1986).

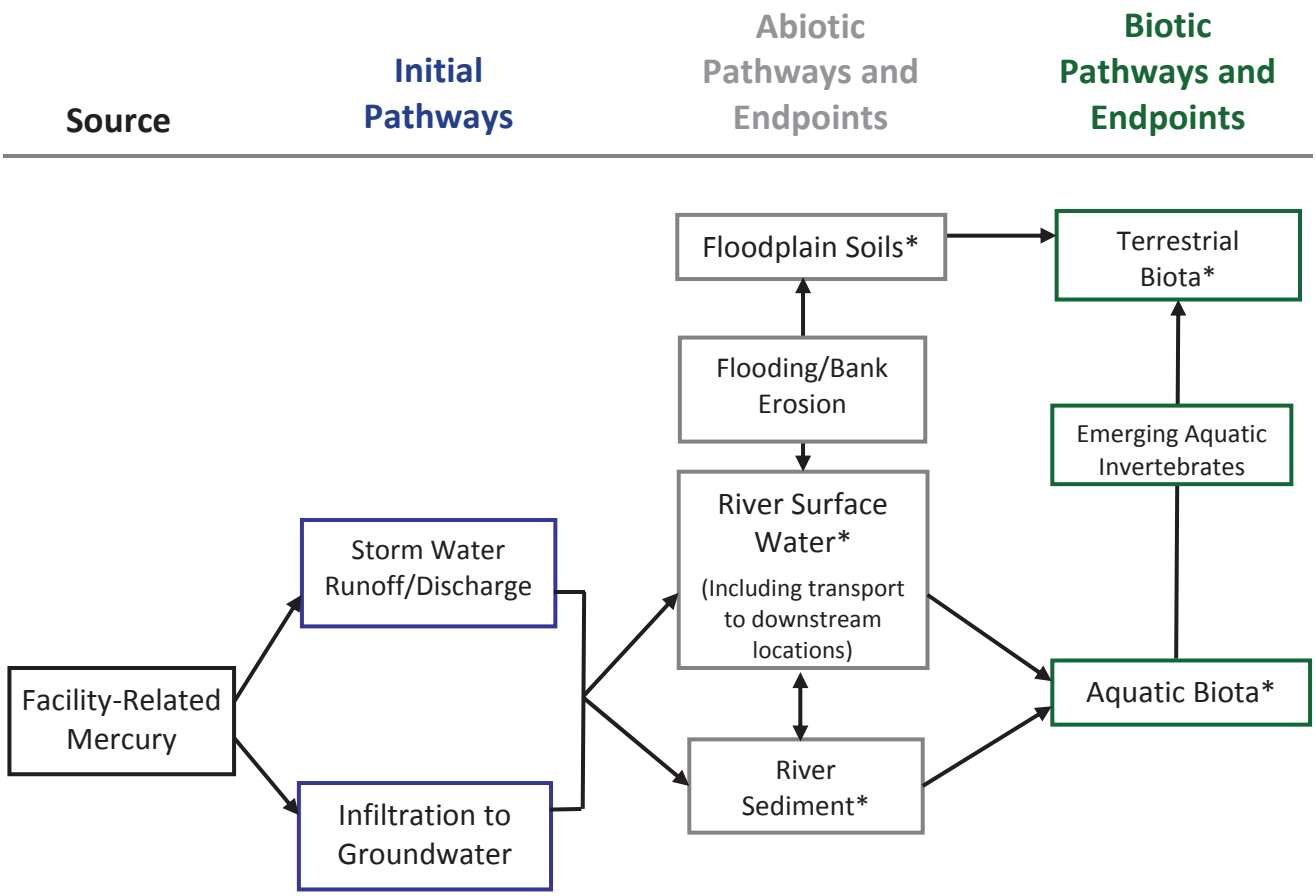
3.2 Pathway

Pursuant to 43 C.F.R. § 11.14 (dd), a pathway is defined as:

> *The route or medium through which…a hazardous substance is or was transported from the source of the discharge or release to the injured resource.*

Facility-related mercury has been identified in on-site storm water outfalls and continues to be discharged to the river via the outfalls (Anchor QEA *et al.* 2013). There are multiple pathways, historic and current, from the Facility to trust resources, including through surface runoff, groundwater, permitted point-source discharges, movement in surface water and abiotic and biotic pathways (Figure 4).

Once mercury has been released to surface water and underlying sediments, it can be transported downstream via surface water flow. During periods of flooding, when heavy rains cause the SR and SFR to overtop their banks, mercury can be deposited on floodplain soils. Furthermore, contaminated floodplain soils in this study area can be transported back into the river via bank erosion processes (Eggleston 2009). Mercury in sediment and floodplain soils can be taken up by biota at the base of the food web and transported to higher trophic organisms via their diet (*e.g*., snapping turtles and screech owls; Bergeron *et al.* 2007, Cristol *et al.* 2008). As such, aquatic and terrestrial biota may also serve as pathways in addition to being endpoints.



* Indicates a Trust resource being assessed in the DuPont Waynesboro NRDAR process.

Figure 4. Diagram of pathways from Facility-mercury to biological endpoints (adopted from IEc 2011).

3.3 Injury Assessment Strategy

The goal of the injury assessment is to determine the nature and extent of injuries to natural resources and to quantify the resulting resource and service losses, providing a basis for evaluating the need for, type of, and scale of restoration actions. Injury to biological resources has resulted from the release of a hazardous substance if the concentration of that substance is sufficient to:

> *Cause the biological resource or its offspring to have undergone at least one of the following adverse changes in viability: death, disease, behavioral abnormalities, cancer, genetic*

mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations (43 C.F.R. § 11.62 (f)(1)(i)).

or

Exceed levels for which an appropriate State health agency has issued directives to limit or ban consumption of such organism (43 C.F.R. § 11.62 (f)(1)(iii)).

As described in Chapter 1, this assessment process is guided by the NRDAR regulations under CERCLA. The injury assessment process occurs in two stages: 1) injury evaluation and 2) resource and service loss quantification. To evaluate potential injury to resources, the Trustees reviewed site-specific injury studies, as well as existing information, including remedial investigation data, ecological risk assessments, and scientific literature.

Based on information from all these sources and with an understanding of the function of the terrestrial and aquatic ecosystems at and near the Facility, the Trustees evaluated injury to natural resources and determined the expected magnitude and severity of effects of mercury on trust resources. The Trustees considered several factors throughout injury assessment, including, but not limited to the:

- specific natural resource and ecological services of concern;
- evidence indicating exposure, pathway and injury;
- mechanism by which injury occurred;
- type, degree, spatial and temporal extent of injury; and
- types of restoration actions that are appropriate and feasible.

3.3.1 Geographic Scope

The assessment area is based on the geographic scope within which trust resources have been directly or indirectly affected by the releases of hazardous substances from the Facility (43 C.F.R. §11.14 (c)). For the purposes of this Draft RP/EA, Figure 2 depicts the geographic scope of the assessment area, which includes the:

- SR from the Facility in Waynesboro downstream to Port Republic (24 river miles, 272 acres).
- SFSR from Port Republic downstream to Front Royal (101 river miles, 3,237 acres).
- Shenandoah River to the West Virginia border (35 river miles, 1,446 acres; only applicable for the fish analyses – ecological and recreational injuries).
- Floodplain areas adjacent to the SR and SFSR (11,379 total acres, including 240 acres of wetlands).

3.3.2 Temporal Scope

Within the assessment area, natural resource exposure to Facility-related hazardous substances has been documented at least since the 1970s and is expected to continue into the future. Damages are calculated beginning in 1981, in accordance with case law related to the promulgation of CERCLA, and are estimated into perpetuity, unless otherwise specified. Injury and corresponding damages with regard to recreational fishing losses were assumed to persist until 2030.

Recovery scenarios may change with the implementation of additional remedial activities in the assessment area or with long-term environmental recycling of contaminants remaining after remedy implementation (*e.g.,* through resuspension of contaminated sediments). Because remedial activities are ongoing, and because there is a high amount of uncertainty regarding effectiveness and success, Trustees assumed that the injury would remain unchanged for a long period of time.

3.4 Injury Evaluation / Resource and Service Losses

Each of the resources impacted by the release of mercury, including surface water, sediment, and the organisms that utilize the riverine and associated wetland and floodplain or upland habitats (*e.g.*, fish, birds, reptiles, amphibians, mammals), is a trust resource. Over the years, these resources have been exposed to mercury from the Facility and have suffered adverse effects. Below are the trust resources likely impacted/exposed to mercury contamination including both aquatic and floodplain resources:

- Surface Water and Sediment
- Soil
- Mussels
- Fish
- Reptiles/Amphibians
- Human Use/Recreational Fishing
- Migratory Songbirds
- Piscivorous Birds/Mammals
- Waterfowl
- Bats
- Madison Cave Isopod

Injured trust resources within the assessment area sustained some loss in ecological services due to contamination. A reduction in the ability of a resource to provide these services, as compared to the baseline level of services or that which existed but for the contamination, is considered a service loss. The severity and magnitude of these potential losses are quantified, where possible, to establish a basis for scaling restoration (*e.g.,* damages). In the sections below, the

methodologies and assumptions used to quantify injury for the representative resources are discussed.

The representative resources for injury to riverine, floodplain, and wetland habitats and resources were **fish, mussels, migratory songbirds, amphibians**; and for the lost human use, **recreational fishing**. The decision to focus the injury assessment on these resources was primarily driven by the amount and type of data available for analysis and the overlapping restoration needs for multiple resources (see Table 2). Data regarding contamination of surface water were limited, or indicated that injury to this resource was unlikely, and therefore the Trustees determined that no further assessment of surface water was necessary. Data for sediment and soil exist and these resources were included in the broader analysis of floodplain and aquatic biological resources.

To address the wide range of service losses at the site, the Trustees developed a multi-pronged approach to damages determination: (1) habitat equivalency analysis for the loss of riverine, floodplain, and wetland resources; (2) resource equivalency analysis for the loss of migratory songbirds; (3) mussel propagation and replacement analysis; (4) recreational fishing losses using trip-equivalency analysis.

Table 2. Major habitat types within the assessment area, associated resources, and the representative resource used in the analysis of injury and scaling of restoration.

Major Habitat Types	Associated Resources	Representative Resource Used in Analysis
Aquatic / Riverine – SR, SFSR, Shenandoah River	Surface Water Sediment Mussels Aquatic Invertebrates Fish Amphibians and Reptiles Migratory Songbirds Piscivorous Birds and Mammals Bats Recreational Fishing	• Fish • Mussels
Floodplain / Upland – Habitat adjacent to SR and SFSR	Soil Surface Water Sediment Mussels Aquatic Invertebrates	• Migratory Songbirds

	Fish Amphibians and Reptiles Migratory Songbirds Piscivorous Birds and Mammals Bats Recreational Fishing	
Wetlands	Soil Surface Water Sediment Mussels Aquatic Invertebrates Amphibians and Reptiles Migratory Songbirds Piscivorous Birds and Mammals Bats Recreational Fishing	• Amphibians

Habitat Equivalency Analysis

Habitat Equivalency Analysis (HEA) is a service-to-service or resource-to-resource approach to natural resource valuation that can account for changes in baseline while estimating interim losses (Unsworth and Bishop 1994, Jones and Pease 1997). The fundamental concept is that compensation for lost ecological services can be provided by restoration projects that provide comparable services (compensatory restoration). HEA responds to the question "What, but for the release, would have happened to the injured area?" In this case, what services would the injured habitats have provided? With HEA, the replacement services are quantified in physical units of measure such as acre-years.[1] The selected projects, or project types, are scaled so that the quantity of replacement services equals the quantity of lost services in present value terms. Potentially responsible parties (PRPs) implement or pay for restoration projects that are sufficient to cover the public's interim losses. HEA involves three basic steps:

(1) Assess the present value of lost services (% service losses over time) relative to baseline. This "debit" is measured in discounted services acre-years (DSAYs).
(2) Select appropriate compensatory restoration projects (% restored services). The "relative productivity" of a proposed restoration project compared to what was injured is measured in the number of DSAYs restored for every acre included in the project.

[1] An acre-year refers to all natural resource services provided by one acre for one year. This measure of natural resource services is specific to the type of land and its associated habitats since different habitats in varying locations provide different services.

(3) Identify the size of the project (scaling) that will equate the total discounted quantity of lost services to the total discounted quantity of replacement services to compensate the public's losses. The "credit" is measured in acres owed or DSAYs restored by a proposed project of an identified size.

CERCLA (43 C.F.R. § 11.83) explicitly allows consideration of HEA as an economic tool to estimate damages in NRDAR cases. Following the process outline above, the Trustees determined the loss of riverine, floodplain, and wetland resources from mercury. To compensate for this loss, the amount of acquisition and enhancement needed was estimated using HEA. The assessment area is quite large with a variety of habitats. In collaboration with DuPont, Trustees identified the habitat types, reviewed the literature on natural resource injuries, and estimated service losses relative to baseline. Where restoration options were determined to provide multiple ecological services, the Trustees factored these additional service gains into the HEA crediting process.

Resource Equivalency Analysis

When there are injuries to non-marketed species, like migratory songbirds, their value can be difficult to quantify in economic terms. An alternative approach to economic valuation is resource equivalency analysis (REA) (variation of HEA based on Unsworth and Bishop 1994, and Jones and Pease 1997). A REA responds to the question, "What, but for the incident, would have happened to the injured species if it had not been killed by the oil spill or release of hazardous substances?" REA is a resource-to-resource approach that assumes services lost and restored are comparable. Specifically, the losses and replacement services are quantified in physical units of measure such as bird-years.[2] Restoration projects are scaled so that the quantity of replacement services equals the quantity of lost services in present value (PV) terms.[3] PRPs pay for or implement restoration projects sufficient to cover the public's interim losses. Because the services provided by compensatory restoration projects are qualitatively equivalent to the services lost due to the spill or release, REA can avoid valuation altogether. When PRPs are

[2] A bird-year refers to all services provided by 1 bird for 1 year. This measure of services is specific to the type of bird since different birds provide different services (the replacement services for 20 bird-years could be 20 birds for only one year, one bird over 20 years, or something in between).

[3] Services provided in the future are discounted at an appropriate rate to reflect the social rate of time preference, the rate at which society is willing to substitute between present and future consumption of natural resources. The real rate of interest and the government borrowing rate are recommended in the economics literature as the best measures of the social rate of time preference. OMB Circular A-4 and empirical evidence supports a 3% discount rate (*e.g.*, Freeman 1993; NOAA 1999). Federal rulemakings also support a 3% discount rate for lost natural resource use valuation (61 FR 453; 61 FR 20584). The annual discount factor may be calculated as $(1+r)^{P-t}$, where r is the discount rate, P is the present time period, and t is the time period of lost services. In 2016, for example, the discount factor is 1.0, because any number raised to the zero power equals 1.0 ($1.03^{(2016-2016=0)} = 1.0$).

interested in providing a payment rather than performing an in-kind restoration project, the estimated project costs may be used to develop a final claim for damages. The first REA was developed as part of the North Cape oil spill settlement in 1999 (see Sperduto *et al*. 2003).

CERCLA (43 C.F.R. § 11.83) explicitly allows consideration of REA as an economic tool to estimate damages in NRDAR cases. Following the process outline above, the Trustees determined the loss of songbird-years from mercury. To compensate for this loss, the amount of acquisition and enhancement needed was estimated using an understanding of songbird restoration that incorporates the full life-cycle of the bird (*e.g*., breeding, migration, or wintering habitat protection or enhancement).

3.4.1 Fish (Ecological or Eco-Fish)

Though this analysis was focused specifically on eco-fish, it more broadly represents injury to the aquatic habitat and other resources that use that habitat such as piscivorous birds and mammals. The assessment area for the eco-fish injury analysis included a total of 4,954 acres of the SR (272 acres), SFSR (3,237 acres), and Shenandoah River (1,446 acres). To demonstrate injury due to mercury, site-specific toxicity information was reviewed and contaminant concentrations in fish tissue were compared to literature-based adverse effects thresholds. This analysis was a cooperative effort between the Trustees and DuPont and is summarized in this section.

Fish species reviewed in the analysis include, among others, smallmouth bass, largemouth bass, black crappie (*Pomoxis nigromaculatus*), rock bass (*Ambloplites rupestris*), bluegill (*Lepomis macrochirus*), common carp (*Cyprinus carpio*), and channel catfish (*Ictalurus punctatus*). The final database included over 6,000 whole body fish mercury concentrations from 14 species of fish collected between 1981 and 2007. These species were classified as piscivores, omnivores, or invertivores. Peer-reviewed literature was evaluated, including, but not limited to, studies that examined the effect of mercury (not inorganic mercury); studies that described an effect on growth, reproduction, and/or survival (not short-term exposure); and studies focused on similar species to those found in the assessment area (*e.g*., studies on saltwater fish or arctic/rainforest species were excluded). Based on these studies, Trustees were able to determine service losses corresponding with a related mercury concentration. For example, at 0.5 parts per million (ppm) whole body mercury concentration, there was an associated 0% service loss, at 1 ppm, 27% service loss, at 2 ppm, 41% service loss and at 5 ppm, 62% service loss (Table 3).

Table 3. Range of the average mercury concentrations throughout the assessment area for the three different categories of fish species and expected associated service loss level.

Category	Range of average mercury concentrations (1981-2009), parts per million (ppm)	Range of associated service losses
Piscivores	0.07 ppm – 2.27 ppm	0% - 43%
Omnivores	0.09 ppm – 0.94 ppm	0% - 26%
Invertivores	0.04 ppm – 1.46 ppm	0% - 34%

HEA (described above) was used to calculate the present value losses in DSAYs. A combination of different restoration project types will compensate for an equivalent amount of DSAYs, such as riparian habitat buffers, agricultural best management practices (BMPs), and urban BMPs.

3.4.2 Mussels

Though also an aquatic resource, mussels were analyzed separately from fish due to the specific restoration needs (propagation and reintroduction activities) of these organisms. Mussel injury was analyzed directly and restoration was scaled to that loss. As part of the cooperative assessment, and for settlement purposes, the restoration for mussels is assumed to fully compensate for the other benthic organisms that were likely injured due to mercury contamination of sediment.

Trustees limited the geographic scope of the injury analysis to the SR where there is the most compelling evidence of injury to mussels (*e.g.,* no mussels exist below Waynesboro in the SR). Mussels have likely been extirpated for decades downstream of Waynesboro as no live mussels or fresh-dead shells were collected during the 2013 survey and only a few old, weathered shells were observed, all indicating live mussels have not existed in this reach for decades (Garst *et al*. 2014). Mussel survival and habitat may be impacted by physical stressors such as sedimentation and degradation of water quality from bank erosion, stream channel alteration, and land-use practices such as agriculture and urbanization. Urban areas can also contribute wastewater effluent, with elevated nutrients, ammonia, and heavy metals, to a river system. Research has shown reduced or absent mussel populations below urban areas (Gangloff *et al.* 2009). Chemical stressors, such as mercury, also impact mussel survival and habitat quality. Mercury can bioaccumulate in freshwater mussel tissue and may cause hormonal changes and shifts in energy allocation (Naimo 1995).

Trustees did not conduct studies to determine the precise cause of the lack of mussels below Waynesboro in the SR and SFSR. However, through literature review and expert consultation,

Trustees determined the likely proportion of injury expected from urban inputs (Waynesboro) and the proportion from mercury contamination (service loss attributable to mercury released from the Facility). In 2013, mean mussel density across sites sampled in the Cacapon River (WV), Broad Run (VA), and SR upstream of Waynesboro, was 2.26 mussel per square meter (m^2) – a reasonable expected density for suitable habitat throughout the SR watershed, including downstream of Waynesboro. Trustees expected a lower density of 1.0 mussels/m^2 below Waynesboro given the urban inputs and considering the mix of habitat types (*e.g.*, unsuitable, such as bedrock, and suitable, such as cobble) that exist in the SR below Waynesboro. Using these density estimates, Trustees were able to parse the difference between the injury expected from urban inputs (56%) and the expected loss due to mercury (44%). Applying this estimated loss of density to the affected area resulted in a loss of up to 650,000 mussels. Therefore, the Trustees concluded a multi-year propagation program is necessary to restore the mussels lost from mercury contamination.

3.4.3 Migratory Songbirds

The assessment area supports many species of songbirds and other migratory birds, including waterfowl, wading birds, and raptors. For the purposes of claim development, Trustees focused on migratory songbirds due to the extensive site-specific data on contaminant concentrations and effects. Trustees also used songbird data to inform the analysis for the floodplain injury (see Section 3.4.4). Because of the specific restoration needs of migratory songbirds throughout their full life cycle and within their migratory flyway, Trustees did a separate analysis to determine injury specifically to neotropical migratory songbirds. Of the 75 species evaluated, 44 species are considered medium- or long-distance migrants, 17 species are considered short-distance migrants or seasonal migrants, and 14 are considered resident species. In consultation with experts, the Trustees determined that the neotropical migratory subset consists of up to 68% of the representative species in the assessment area, a significant proportion of the injured bird population.

Studies on exposure and effects of mercury on birds have been conducted in and around the assessment area and in the laboratory over a period of several years (*e.g.*, Brasso and Cristol 2008; Cristol *et al*. 2008; Hallinger *et al*. 2010; Hallinger *et al.* 2011; Jackson *et al.* 2011a, b; Varian-Ramos *et al.* 2014). These studies examined mercury exposure in multiple species and life stages, contamination of prey items, and geographic extent of elevated mercury levels. Cristol *et al.* (2008) described mercury levels in several songbird species that were as high, or higher, than fish-eating species from the site – illustrating that mercury contamination of the aquatic environment had moved to the terrestrial system and food web. Prey items, specifically spiders, had mercury levels higher than fish prey species. Several site-specific and laboratory studies examined effects to survival, reproduction, immune/endocrine system function, and other sublethal effects, such as song learning (*e.g.*, Brasso and Cristol 2008, Hawley *et al.* 2009, Wada

et al. 2009, Hallinger *et al.* 2010, Hallinger *et al.* 2011, Hallinger and Cristol 2011, Jackson *et al.* 2011a, Bouland *et al*. 2012, Carlson *et al.* 2014, Varian-Ramos *et al*. 2014, Henry *et al.* 2015).

Key findings of these studies link mercury to adverse reproductive effects, most notably in Carolina wren (*Thryothorus ludovicianus*) and tree swallow (*Tachycineta bicolor*). Hallinger and Cristol (2011) showed that mercury levels in tree swallows within the SR assessment area (mean ± SE: 3.03 ± 0.15 ppm) were significantly elevated compared to swallows breeding on reference sites (mean ± SE: 0.16 ± 0.005 ppm), and that these high levels of mercury were associated with reduced hatching and fledgling success. Contaminated birds produced approximately 1 less fledgling than reference birds, translating to a 20% reduction in nest success. Jackson *et al.* (2011a) used an information-theoretic approach to analyze the Carolina wren reproductive data collected in the assessment area. This model showed that blood mercury concentration of the adult female was a strong predictor of nest success, and enabled Trustees to relate mercury level with a loss in reproduction. Average blood mercury levels were available for the 75 songbird species within the assessment area, ranging from 0.02 to 6.2 ppm on the SR and 0.01 to 1.5 ppm on the SFSR. Based on the model from Jackson *et al.* (2011a), these concentrations translated to a 0.06 – 99.9 % likelihood of nest failure on the SR and 0 – 24.2% on the SFSR, depending on the species.

Because density estimates for each of the 75 species were available within the watershed, the Trustees were able to estimate the population (number of individuals) of songbirds within the 11,379-acre assessment area, and apply the appropriate loss estimates per species. These inputs were used in a REA to generate a number of lost bird-years and to estimate the number of wintering habitat acres necessary to compensate for the injury.

3.4.4 Non-wetland Floodplain (represented by songbirds)

Trustees selected songbirds as a representative resource for the floodplain and upland habitat. Because of the comprehensive songbird studies that support a quantifiable reduction in services (in this case, reproduction), songbirds were elected as the "umbrella" resource to inform the analysis for the floodplain/upland resources.

To quantify injuries, the baseline condition of the affected resources and associated services must be established. Baseline is "the condition or conditions that would have existed at the assessment area had the…release of a hazardous substance…not occurred" (43 C.F.R. § 11.14 (e)), taking into account natural processes and changes resulting from human activities. Baseline conditions include all environmental parameters, not only concentrations of COCs. For example, other impacts to water quality and physical changes to the habitat (the stressors discussed in Section 2.3) are incorporated into the determination of baseline conditions. As described in the

DOI regulations, establishing baseline requires either pre-release data or data from suitable reference locations.

There are multiple landcover types within the assessment area (developed, row crop, pasture/hay, riparian forest, upland forest and early successional), each of which provide different baseline services for songbirds in the assessment area. Based on expert consultation and literature reviews, baseline services were determined for each landcover type (related to songbirds specifically), ranging from 15-100%, and achieving maximum services in the riparian forest landcover type. When determining the baseline levels for each landcover type, Trustees considered the level of urbanization, habitat fragmentation, agricultural practices, use of pesticides or other chemicals, diversity of vegetation type and structure, and other factors that may influence bird use and habitat quality.

Trustees reviewed literature on mercury effects/exposure as weight-of-evidence, but focused on site-specific data to inform the injury quantification. At the time of assessment, the data generated from studies on this site provided more information than existed in the literature. Injury was determined by the reproductive loss expected for different regions of the assessment area such as riparian SR, upland SR, or riparian SFSR, which was determined using site specific studies and Trustee expertise. The maximum level of injury was 20% reproductive loss based on the site-specific studies (see above Section 3.4.3; Hallinger and Cristol 2011). A certain level of impairment was expected from the mercury contamination (5-20%), but some habitat types were already impaired for other reasons (agricultural activities, fragmentation, etc.). The total service loss was calculated by factoring the baseline services into the injury estimate, and service losses ranged from 0-20% for the various landcover types in the assessment area.

HEA was used to calculate DSAYs owed for the injury to floodplain habitat (up to 69,000 DSAYs). Restoration projects that will compensate for this injury amount will include protecting or enhancing habitat in the watershed. The exact amount of acres depends on the type of land (*e.g.*, agricultural, riparian, forested) and quality of habitat (whether, for example, it is contiguous, disturbed, fragmented), and how much active restoration may be required. This analysis was driven by bird data, but more broadly represents injury to floodplain resources, as the types of restoration that will restore floodplain and riparian habitat will have benefits to other resources as discussed in Section 4.3.4.

3.4.5 Wetland Floodplain (Amphibians)

The assessment area supports a variety of amphibian and reptile species. For the purposes of claim development, Trustees focused on amphibians due to their specific habitat requirements of ephemeral ponds for breeding, and because the Trustees had a considerable amount of data on amphibians (toads). To demonstrate injury to amphibians/wetland habitat within the assessment

area, Trustees used site-specific toxicity and effects data, as well as population models developed from these data.

Bergeron *et al.* (2010) collected adults from three amphibian species – red-backed salamander (*Plethodon cinereus*), northern two-lined salamander (*Eurycea bislineata*), and American toad (*Anaxyrus americanus*) – and larvae from the latter two species along a contamination gradient on the SR. Total mercury concentrations in the contaminated area were 3.5 to 22 times higher than in the reference area. Subsequent field and lab studies examined the effects of the elevated mercury levels on amphibian survival, reproduction, and behavior (*e.g.*, Burke *et al.* 2010; Bergeron *et al.* 2011a, b; Todd *et al*. 2012; Willson *et al*. 2012). Multigenerational studies on the impacts of elevated mercury levels in American toad were conducted over several years, generating some of the key findings used in the injury analysis (Bergeron *et al.* 2011a, b; Willson *et al.* 2012; Willson and Hopkins 2013). These studies informed a landscape-scale population model, which showed that in a mercury-contaminated network of wetlands, annual American toad productivity is reduced 68% relative to an uncontaminated network (Willson and Hopkins 2013).

These studies informed the HEA model used to estimate the amount of DSAYs owed for the acres of wetland habitat in the assessment area (up to 6,000 DSAYs). Restoration compensating for the wetland injury will include protecting or enhancing wetland habitat in the watershed, or creating new wetland habitat. The exact number of acres required depends on the quality and expected benefits of the project.

3.4.6 Recreational Fishing

In addition to the ecological services, natural resources within the assessment area provide recreational services. For example, the aquatic habitat and fishery resources of the assessment area provide anglers with extensive opportunities for recreational fishing. The SR and SFSR support a regionally significant recreational fishery, with smallmouth bass being the most sought-after game fish. Though trout fishing occurs in some areas along the SR, trout are stocked and safe for consumption, so the trout fishing was not part of this injury analysis. This section describes the Trustees' approach to quantifying the losses in recreational fishing resulting from contaminant-related Fish Consumption Advisories (FCAs) due to mercury.

FCAs in the assessment area have been in place since 1977, and limit consumption of certain types of fish on the SR, SFSR, and the Shenandoah River (Virginia Department of Health (VDH) 2013). Advisories due to mercury range from "Eat no more than one meal per month – certain species" to "Eat none – all species." Table 4 provides a summary of the FCAs within the assessment area from 1977 to the present.

The selected approach for quantification of damages was estimation of the total lost and diminished recreational fishing trips in the assessment area during the time period of 1981 through 2030, calculated in "present value trip equivalent losses." This approach involves first estimating fishing pressure, and the number of "avoided trips," those that were lost due to anglers who avoid fishing waters with FCAs, and "diminished trips," those with a diminished experience due to the FCA. The analysis relied upon Virginia fishing license data and site-specific creel surveys (Bowman 1997, Reeser 2011) to provide estimates of the annual fishing pressure. From these data, Trustees estimated the number of trips that occurred in the assessment area between 1981 and 2030 (*e.g.,* baseline trips). To help facilitate settlement, the Trustees accepted a literature-based assumption that 10% of the baseline trips were avoided due to the FCA. Diminished trips were calculated using the results of Jakus *et al*. (1997) to adjust Trustees estimate of fishing trips into lost trip equivalents based on a percentage loss in value due to the presence of contamination. Based upon this review, lost trips were estimated at no more than 1.3 million present value trip-equivalents.

Table 4. Mercury FCAs on the SR, SFSR, and Shenandoah River (adapted from VDH 2013).

Waterbody and Affected Boundaries	Affected Localities	Species	Advisories/Restriction
South River from the footbridge at E. I. DuPont Co. in Waynesboro approximately 24 miles to the confluence with the North River at Port Republic (6/7/77; modified 3/29/01)	Waynesboro City, Augusta Co., and Rockingham Co.	All species except trout	DO NOT EAT. Stocked trout have been tested and are safe for consumption.
South Fork Shenandoah River downstream from Port Republic to the confluence with North Fork Shenandoah River, North Fork Shenandoah River from mouth of the river upstream to Riverton Dam, and Shenandoah River from the confluence of North and South Forks to Warren Power Dam just north of Front Royal. These river segments comprise approximately 105 miles. (6/7/77; modified 3/29/01)	Warren Co., Page Co., Rockingham Co., and Augusta Co.	All species	No more than two meals/months.

CHAPTER 4 PROPOSED RESTORATION ALTERNATIVES – ECOLOGICAL AND RECREATIONAL

To compensate the public for injuries (*e.g.,* service losses) to natural resources resulting from releases of mercury from the Facility, the Trustees are required to develop alternatives for the "restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the natural resources and the services those resources provide" (42 C.F.R. §11.82 (a)). DuPont's settlement with the Trustees for natural resource damages includes a cash payment of approximately $42 million to be utilized in funding these types of projects as well as renovation of the Front Royal Fish Hatchery (FRFH) to be performed directly by DuPont (as part of recreational fishing compensation).

This chapter describes the Trustees' restoration objectives and proposed restoration alternatives to compensate for the ecological and recreational injuries. Several restoration projects were proposed to the Trustees that are: 1) not expected to provide natural resource services similar to injured/lost services, or to provide services in a cost-effective way; 2) already required or funded in non-NRDAR contexts; and/or 3) lacks sufficient detail to permit analysis. These projects are summarized in Appendix C.

Below, the Trustees outline the following restoration alternatives:

Alternative	Description
A	• No Action, no projects implemented
B	• Projects to improve water quality and fish habitat • Mussel propagation • Neotropical migratory songbird full life cycle restoration • Land protection, property acquisition, and recreational and wildlife enhancements. • Recreational fishing improvement projects
C	• All components of **Alternative B**, and • Trout stocking and management

Trustees evaluated the alternatives to determine if they provide sufficient type, quality, and quantity of ecological services to compensate for those lost due to contamination in the context of both site-specific and regulatory evaluation criteria (43 C.F.R. §11.82 (d)) and compliance with potentially applicable laws. The Trustees may implement restoration projects that are not specifically identified in this Draft RP/EA, but are similar to those projects identified and consistent with restoration objectives. Any project not reviewed within the Draft RP/EA will be evaluated against the site specific and regulatory criteria, and if a project uses alternative techniques other

than described below, a project-specific NEPA determination will be made and public notice will be given to provide details on the new project proposal.

4.1 Restoration Objectives

The Trustees' overall ecological restoration objective is to compensate the public for past and expected future ecological losses due to Facility-related contamination in the assessment area. DuPont is currently designing and implementing remedial actions along the SR; however, the remedy is expected to take many years to complete and the effectiveness is yet unknown, so losses are expected to continue indefinitely into the future. The release of mercury has impacted the ability of trust resources to provide their baseline level of ecological services. Therefore, the Trustees focused on restoration projects that will compensate the public by providing additional (*e.g.,* above and beyond baseline) ecological services in or near the assessment area.

The Trustees' overall recreational fishing restoration objective is to compensate the public for interim and expected future recreational fishing losses due to mercury contamination in the assessment area. Since 1977, a FCA has been issued for rivers in the assessment area due to mercury contamination, and is expected to continue well into the future. The FCA has impacted recreational anglers by reducing the quality of fishing opportunities in the assessment area. Therefore, the Trustees focused on restoration projects that will compensate recreational anglers by creating new or improving existing fishing opportunities in or near the assessment area.

The following sections describe the no action alternative, as well as the characteristics and benefits of restoration alternatives evaluated as part of this process to compensate for both ecological and recreational fishing injuries.

4.2 Alternative A: No Action Alternative (Natural Recovery)

As required under NEPA, the Trustees considered a restoration alternative of no action. Under this alternative, the Trustees would rely on natural recovery and would take no direct action to restore injured natural resources or compensate for interim lost natural resource services. This alternative would include the continuance of ongoing monitoring programs, such as those initiated by VDEQ for fish, but would not include additional activities aimed at reducing contamination, reducing potential exposure to contaminants, or enhancing ecosystem biota or processes. Under this alternative, no compensation would be provided for interim losses in resource services.

Under the no-action alternative, no habitats would be preserved, restored, or enhanced beyond what agencies and organizations are already doing in the area with limited existing resources. Aquatic and riparian habitats would continue to be degraded along the SR and SFSR and in adjacent habitats. Water quality would continue to be impaired. Neotropical migratory birds would continue to decline because of continued contamination and threats to wintering habitat. Fishing and boating recreational opportunities would continue to be limited by access points and impaired fishing stocks. Local citizens would not benefit from improved recreational opportunities and increased education and stewardship.

4.3 Alternative B: Preferred Restoration Alternative

The Trustees considered a broad set of restoration alternatives that could potentially improve ecological services and recreational fishing services relevant to the assessment area. These restoration alternatives are expected to provide natural resource services similar to the services that the injured habitat would have provided but-for the mercury contamination. In addition to those proposed by Trustee agencies, alternatives were solicited from DuPont through cooperative discussion, and from stakeholders through meetings and discussions with local governments, conservation organizations, and academic researchers (see Appendix A).

The broad categories of proposed restoration alternatives are listed below, and are expected to increase habitat quality and quantity, promote habitat connectivity, create new public use opportunities, and benefit trust resources within the SR/SFSR watershed.

4.3.1 Projects to improve water quality and fish habitat

These projects would include agricultural BMPs that would improve 35-foot riparian zones along the SR, SFSR, and tributaries, and could include exclusion fencing, natural channel design projects, as well as urban BMPs such as stormwater pond improvements and impervious cover management. These projects would benefit small mammals, birds, amphibians, reptiles, and fish by providing habitat and improving water quality through reducing erosion and runoff.

4.3.2 Freshwater Mussel Restoration

These projects would focus on improving the mussel community in the SR, SFSR, and tributaries. Projects would focus on mussel propagation and restocking efforts. Because of the depauperate mussel community in the SR and SFSR, propagation efforts are necessary to increase numbers and re-establish stable mussel populations of nine species, which would otherwise not be achieved through habitat improvements alone. Riparian habitat improvement will also benefit mussels, but by itself would not return populations to healthy numbers. Mussel restoration projects have ancillary benefits to fish and wildlife species by improving water

quality, stabilizing sediment, enhancing bottom structure, and increasing food abundance (Vaughn and Hakenkamp 2001, Vaughn *et al*. 2008).

4.3.3 Neotropical Migratory Songbird Full Life Cycle Restoration

These projects would focus on habitat protection, enhancement, and/or restoration specific for migratory songbirds, and may include restoration activities located throughout their full life cycle (*e.g*., breeding, migration, or wintering habitat protection or enhancement). Because of the importance of wintering habitat on the health, migration, and breeding success of neotropical migrants (*e.g.*, Marra *et al*. 1998, Bearhop *et al*. 2004, Norris *et al*. 2004), the Trustees will give specific consideration to projects that protect wintering habitat.

4.3.4 Land protection, property acquisition, and recreational and wildlife enhancements

This project category focuses on protection, enhancement, and/or restoration of riparian and floodplain habitat within the SR/SFSR watershed. Biologically and/or ecologically important land(s) would be purchased and held in perpetuity for public benefit. Such land(s) should benefit the same natural resources that were injured from Facility releases; reduce habitat fragmentation; directly support or benefit key biological resources, including wildlife and fish habitat, rare species occurrences, natural communities, wetland features, or other sensitive or unique attributes; and will be receive additional consideration if under threat of development, in close proximity to Virginia-owned lands or other protected lands, or of interest to environmental and international organizations. Enhancement activities on the subject parcels may include, but are not limited to: converting row crop and pasture/hay to forest (riparian or upland), invasive species control, wetland restoration and grassland creation (in certain areas). Actions related to habitat creation will maximize the use of low impact techniques as to not create additional disturbances.

Currently, one specific parcel is known to be available for acquisition, Cowbane Wet Prairie State Natural Area Preserve (CWPNAP) – Willets Tract Addition and Forest Restoration. This parcel is evaluated as a potential restoration site in Section 5.3.4. Additional properties are not yet identified; opportunities for land acquisition and protection will be evaluated as they arise, prioritizing those that contain the following features and opportunities:

- *Wetland Acquisition, Enhancement, and/or Restoration*. Protection, enhancement, and/or restoration of wetlands, with specific emphasis on ephemeral/sinkhole pond habitat of amphibians, that would provide benefits to a wide array of birds, amphibians, reptiles, mammals and fish and also serve as floodwater retention and groundwater recharge areas.

This could include planting buffers around existing wetlands or restoring hydrology to impacted wetlands, among other activities.

- *Amphibian and Reptile Habitat Enhancement and/or Restoration*. Habitat protection, enhancement, and/or restoration with specific emphasis on turtle breeding habitat. This may include creating in-stream basking habitat, or planning restoration to include characteristics of desirable breeding habitat.
- *Bat Habitat Enhancement and/or Restoration*. Habitat protection, enhancement, and/or restoration with specific emphasis on bat habitat, such as protecting hibernacula or known breeding habitat, and related activities such as surveys or outreach.
- *Waterfowl Habitat Enhancement and/or Restoration.* Habitat protection, enhancement, and/or restoration with specific emphasis on waterfowl breeding habitat. This may include addition of nest boxes for wood ducks, or targeting properties with existing waterfowl habitat for protection or restoration.
- *Recreational Fishing Access*. These projects include creating new and/or improving existing access to the river for recreational opportunities, specifically fishing.
- *MCI Habitat Protection/Restoration.* These projects would focus on protecting/restoring habitat used by the federally listed threatened MCI.

4.3.5 Recreational Fishing Improvement Projects

Recreational fishing projects will be prioritized that accomplish the following:

- Restore numbers of fishing trips
- Increase the value of individual trips
- Provide alternate fishing experiences with options for safe consumption
- Include outreach and mercury education efforts to inform public of actual risks and provide improved river access and opportunities for high quality water-contact recreation

This category will include the modification and improvement of the Virginia Department of Game and Inland Fisheries (VDGIF) FRFH located in Shenandoah County, VA. The FRFH is currently used to produce a variety of cool-water and warm-water fish species; however, the FRFH is an older facility, and requires modifications and updates to improve its ability to produce warm-water fish such as smallmouth bass, a sport fish highly valued by the public in the SR/SFSR watershed.

This category will also include creation of new or improvement of existing recreational fishing access points. The access point establishment may co-occur with land acquisition opportunities whenever possible, and greatest consideration will be given to those projects that provide significant enhancement of recreational fishing opportunities. However, there may be projects to

create or improve river access on the SR and SFSR that would effectively restore or increase the value of a fishing trip, but would not restore other resources, nor be compatible with the prioritization defined for land acquisition. The Trustees will also evaluate potential fishing access points separately from other land acquisition projects as opportunities are identified along the SR and SFSR.

4.4 Alternative C: Non-preferred Restoration Alternative

Alternative C includes all components of Alternative B (see Section 4.3 for descriptions), as well as enhanced trout management or increased trout stocking in the SR. In this Alternative, funding for projects to improve water quality and fish habitat (*e.g.*, agricultural and urban BMPs in the SR/SFSR watershed) would be reduced to allow funding for the trout management project.

4.4.1 Recreational Fishing Improvement Projects – trout stocking or management

This project will focus on improving trout fishing opportunities in the SR that allow safe consumption, where allowed by regulation, of harvested fish. The SR has well-established seasonal trout fisheries in and around Waynesboro and Grottoes. A special-regulation, year-round trophy section exists on the SR upstream of Waynesboro. This project would aim to expand stocking in the SR, through purchase of more and/or larger fish, or through development and construction of a grow-out and holding facility. This project would provide narrow benefits to trout anglers, or possibly anglers with no preferred target fish, in certain sections of the SR.

CHAPTER 5 EVALUATION OF ALTERNATIVES

The Trustees' primary goal in this chapter is to identify a preferred restoration alternative that compensates the public for natural resource injuries and associated losses resulting from the mercury releases within the assessment area. Trustees assess the environmental consequences of *Alternative A: No Action/Natural Recovery*, *Alternative B: Preferred Restoration Alternative*, and *Alternative C: Non-preferred Restoration Alternative* to determine whether implementation of either of these alternatives may significantly affect the quality of the human environment, particularly with respect to physical, biological, socio-economic, or cultural environments. This chapter also evaluates readily available information on environmental consequences of the preferred restoration alternatives and potential impacts on the quality of the physical, biological and cultural environment, and thus serves as a draft EA for the DuPont Waynesboro NRDAR Preferred Restoration Alternative.

The following definitions will be used to characterize the nature of the various impacts evaluated in this Draft RP/EA:

- *Short-term or long-term impacts.* In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.

- *Direct or indirect impacts.* A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action.

- *Minor, moderate, or major impacts.* These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively inconsequential effect. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth under NEPA (40 C.F.R. § 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.

- *Adverse or beneficial impacts.* An adverse impact is one having unfavorable or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.

- *Cumulative impacts.* Cumulative impacts are defined as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

5.1 Evaluation Criteria

To ensure the appropriateness and acceptability of restoration options addressing ecological losses, the Trustees evaluated each option against site-specific restoration requirements. These site-specific requirements were developed through discussions with natural resource managers at each of the Trustee agencies and with input from DuPont. Projects were also evaluated against the restoration criteria listed in the DOI damage assessment regulations (43 C.F.R. § 11.82).

Below are the criteria used to evaluate potential restoration projects as part of the DuPont Waynesboro NRDAR process. The criteria were developed by the Trustees, and reflect the "factors to consider when selecting the alternative to pursue" (NRDAR factors) as described in 43 C.F.R. § 11.82(d)(1-10).

<u>Primary criteria</u>:

- Relationship to the injuries giving rise to the claim for natural resource damages
    - Similarity in attributes to the injured natural resource, *e.g.,* same type and quality
    - Proximity to the SR/SFSR watershed
    - Scale of benefits (quantitative and qualitative) should be similar to the injured natural resource (*e.*g., increase in acres/species/services)

- Likelihood of success and technical feasibility
    - Can be accomplished with the available technology
    - Similar projects have succeeded in the past
    - Costs are reasonable related to expected benefits

- Regulatory and policy considerations
    - Federal, state and local law compliance
    - Site ownership and access
    - Not otherwise required by federal, state, or local laws, regulations, permits, or licenses
    - Consistency with Trustee policy, management goals and objectives, as well as local, regional, and national restoration goals and initiatives

- Elimination rationale
    - Benefits are unlikely to result in restoration benefits in advance of the natural recovery period
    - Significant adverse environmental impacts, and such impacts are not adequately mitigated
    - Potential for significant adverse effects to human health and safety, and such effects are not adequately mitigated

Secondary criteria:

- Consistency with local, regional, and national restoration goals and initiatives
- Timeframe of potential benefits
- Self-sustainability
- Integration with existing management programs/leverage potential
- Habitat connectivity (*e.g.,* result is larger individual habitat parcels rather than multiple, smaller, disconnected parcels)
- Proximity to lands with protected status
- Benefits to protected species or sensitive or unique habitats
- Opportunities for education and outreach
- Provides measureable results – monitoring component

Additionally, actions undertaken to restore natural systems are expected to have long-term beneficial and sometimes short-term adverse impacts to the physical, biological, socio-economic, and cultural environments. In the analysis below, the Trustees examine the likely beneficial and adverse impacts of Alternatives A, B, and C on the quality of the human environment. If the Trustees conclude that the actions associated with the preferred alternative will not lead to significant adverse impacts, then the Trustees will issue a FONSI. If significant impacts are anticipated, the Trustees will proceed with an EIS to evaluate a reasonable range of restoration alternatives and the environmental consequences of those alternatives. The Trustees will continue to evaluate environmental impacts as specific projects are identified, designed and implemented. The following sections evaluate anticipated environmental consequences of the restoration alternatives in light of the NRDAR factors listed above.

5.2 Evaluation of Alternative A: No Action/Natural Recovery

The No Action/Natural Recovery Alternative would not initiate any restoration action outside of the currently funded remedial program. Instead, the ecosystem would attenuate to background conditions based on natural processes only, with no assistance from active environmental restoration. The Trustees considered the changes in ecological services from natural recovery and found that the No Action/Natural Recover Alternative:

- **Does not restore injured resources to baseline**. Remediation is expected to span many years and include years of monitoring after the bank stabilization actions are completed. Currently there is no guarantee that the remedial actions will reduce the continued inputs of mercury to the SR and SFSR from bank erosion. Lack of restoration beyond remedial actions will reduce the potential for resources to fully recover to baseline conditions.
- **Does not compensate the public for interim losses**. Because remedial activity will not improve the site above baseline conditions, interim losses have and will continue to accrue from continued ecological and human use injury due to mercury.

While the No Action Alternative does not *create* additional adverse impacts to the environment, and is technically feasible and cost-effective, it does not provide the ecological, recreational, and socio-economic benefits described under Alternative B. Given the long time frame until natural attenuation of mercury in the system is achieved, under the No Action Alternative adverse environmental consequences from mercury (*e.g.*, ecological and human use injuries) are expected to continue into the future and would not be mitigated through restoration actions. Otherwise stated, the No Action Alternative may result in adverse impacts to fish and wildlife, as well as reductions in the ecological and human use services, due to the lack of additional habitat functionality provided through restoration and/or preservation actions in the assessment area. Therefore, the No Action Alternative is not a favorable restoration alternative when evaluated against the NRDAR factors. This Alternative serves as a point of comparison to determine the context, duration, and magnitude of environmental consequences resulting from the implementation of Alternative B and C.

5.3 Evaluation of Alternative B: Preferred Restoration Alternative

Alternative B includes a suite of restoration projects that compensate for interim ecological losses and satisfy the NRDAR factors listed above (5.1). These projects will be located within the SR/SFSR watershed (Figure 5) when feasible and appropriate and include the following:

Project Category	Potential Locations	Estimated Cost
Projects to improve water quality and fish habitat – A*gricultural and urban BMPs in the SR/SFSR watershed* (5.3.1)	Headwaters of SR, tributaries to SR or SFSR, sites within the City of Waynesboro	$ 10 million
Freshwater mussel restoration – *Propagation program* (5.3.2)	Freshwater Mollusk Conservation Center at Virginia Polytechnic Institute and State University; Virginia Fisheries and Aquatic Wildlife Center at Harrison Lake National Fish Hatchery	$ 4 million
Neotropical migratory songbird full life cycle restoration – *Habitat restoration* (5.3.3)	Various locations	$ 2.5 million
Land protection, property acquisition, and recreational and wildlife enhancements – *CWPNAP – Willets Tract addition and forest restoration* (5.3.4)	Property adjacent to CWPNAP	$ 1.3 million
Land protection, property acquisition, and recreational and wildlife enhancements – *Additional properties, prioritizing those adjacent to SR or SFSR, creating contiguous protected land corridors* (5.3.5)	Locations upstream or within the City of Waynesboro, adjacent to the SR or tributaries to the SR or SFSR	$ 18.2 million
Recreational fishing improvement projects – *Restoration of the VDGIF FRFH* (5.3.6)	Front Royal, VA	DuPont fund directly
Recreational fishing improvement projects – *Recreational fishing access creation/improvement* (5.3.7)	Locations on SR, SFSR, NFSR, or Shenandoah River, or tributaries	$ 2.5 million

Project attributes, resource benefits, potential environmental impacts, social consequences, and costs are provided in the sections below. These projects provide compensation for the ecological injuries, at a cost of approximately $38.5 million (the cash settlement for ecological damages). The remaining funds will be used for project restoration planning, oversight, and administration.

Restoration planning will include evaluation of these projects with input and feedback from the public as described in Chapter 1.

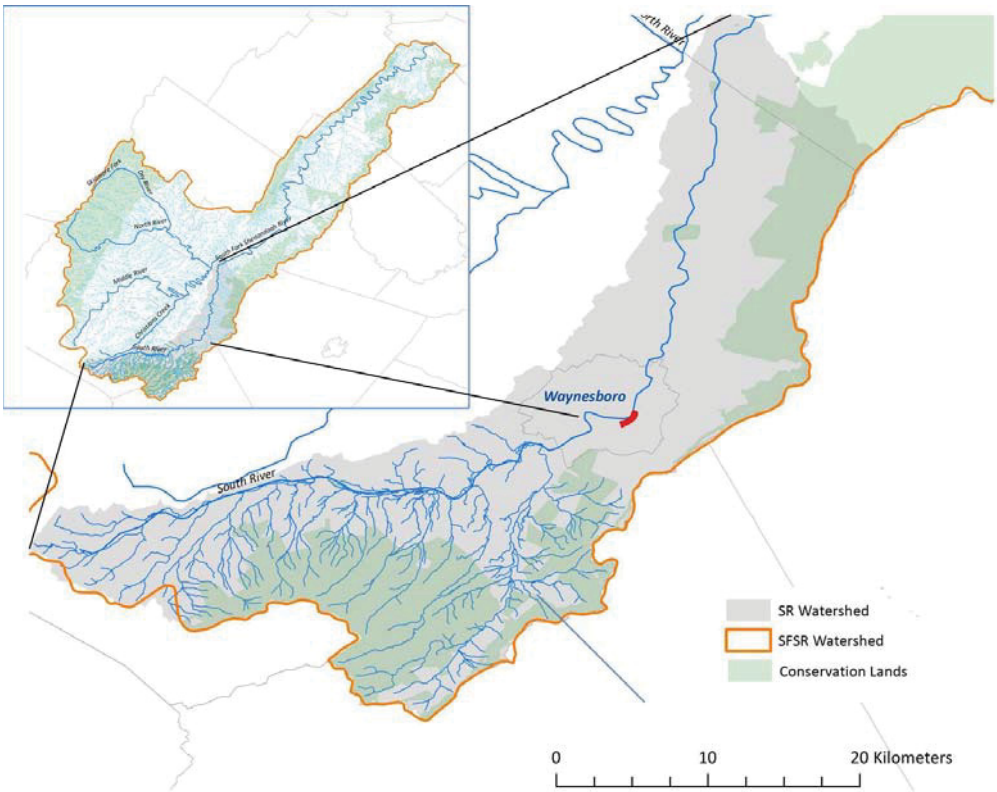


Figure 5. Map of major rivers and tributaries of SR/SFSR watershed (inset), and upstream of Waynesboro in the SR watershed (large map, shaded gray). Restoration may occur within the boundaries of these watersheds in riparian areas. Restoration activities in the headwater areas of the SR watershed (large map) will likely receive prioritization.

5.3.1 Projects to improve water quality and fish habitat - agricultural and urban BMPs in the SR/ SFSR watershed

Projects will be identified that improve water quality and habitat for native fish in the watershed through restoration actions such as planting riparian vegetation, stabilizing eroding banks, sedimentation control devices, improving in-stream habitat, installing alternative watering sources, excluding cattle from accessing the streams and other such agricultural BMPs. Other projects will be identified that improve water quality and habitat for native fish in the watershed through improvements to stormwater ponds and impervious cover management (*e.g.*, urban BMPs).

Location:
Candidate streams for agricultural BMP restoration activities will be those where riparian vegetation is degraded or absent, preferably in the headwaters of the SR (see VDCR 2010). Headwaters will be prioritized because restoration in those areas is likely to have the greatest positive impact on the overall stream and habitat quality. Other locations may include areas along tributaries to the SR or SFSR, including those within the City of Waynesboro. To maximize the effectiveness and coverage of implementing agricultural BMPs, Trustees may partner with existing programs to identify and prioritize locations and projects.

Possible locations for urban BMPs may include any of the towns and cities along the SR and SFSR, especially the City of Waynesboro. Waynesboro has identified potential restoration projects within the city limits, focusing on urban BMPs that are not already required by other laws or regulations.

Project Description:
Possible agricultural BMPs may include erecting livestock exclusion fencing, installing alternative watering sources, planting stream-side buffer vegetation, stabilizing eroding stream banks, sedimentation control structures, natural stream channel design, and/or implementing riparian zone conservation easements. Riparian habitat protection projects provide potential to restore riverine habitats and facilitate the recovery of aquatic fauna, like mussels, within impacted watersheds (Sweeney 1993). Implementation of the habitat protection and enhancement measures can restore the natural riparian structure and function, reduce nutrient and sediment input, provide organic debris as energy source, moderate and restore naturally occurring temperature regimes, and enhance natural recovery of biota (Horwitz *et al*. 2008, Sweeney and Newbold 2014). Projects will follow the Erosion and Sediment Control Handbook (VDEQ 1992) and the Natural Resources Conservation Services (NRCS) Field Office Technical Guidelines when appropriate. Urban BMP projects may include stormwater pond restoration or impervious cover management, such as bioswales, vegetative filter strips or constructed wetlands, or pervious paving techniques.

Improving riparian buffer zones and working with local landowners on implementing agricultural BMPs within the SR/SFSR watershed will provide the benefit of improving water quality and the overall health of the aquatic ecosystem. Urban BMPs will improve water quality in the SR and SFSR as well as quality and quantity of stormwater runoff from urban areas into the rivers. Stormwater runoff may contain soil, sediment, suspended solids, or other contaminants if there is no effective erosion protection in place. Sediment and suspended solids may be detrimental to fish breeding habitat as increased turbidity reduces light penetration, increases water temperature and impacts the level of oxygen in the water. Taking action to improve stormwater runoff will improve water quality and aquatic habitat for fish and other organisms.

For this restoration category, there is flexibility to select from a variety of beneficial and appropriate restoration activities and several potential partners in the watershed to maximize the benefits and scope of these types of activities. Projects may involve establishing landowner agreements for the protection of a buffer area, or may involve easement or fee simple acquisition. The Trustees will prioritize projects with willing landowners who agree to protect the riparian buffer long-term.

Estimated Cost:
The Trustees will allocate approximately $10 million to implement and monitor agricultural and urban BMP projects.

Expected Impacts:
Intact riparian ecosystems provide many functions, including nutrient uptake, filtering runoff, capturing sediment, canopy and shade, regulation of stream water temperature, bank stability, and input for aquatic food webs. Mature riparian vegetation contributes woody material to the stream system through deadfall, which improves in-stream habitat, reduces stream velocities, and promotes bank and substrate stabilization (Sweeney and Newbold 2014). These functions are essential to maintaining water quality, flood mitigation, aquatic species survival, and biological productivity. Additionally, riparian buffers provide or improve habitat for aquatic and terrestrial species like songbirds and bats. Riparian buffer establishment and restoration is an efficient and cost-effective approach to protect and maintain water quality, and improve aquatic habitat for fish and other organisms. Cattle exclusion provides improvements in water quality through decreased nitrogen and sedimentation, even on a small scale. These activities will replace lost resources or provide additional natural resources and services by protecting and enhancing riparian areas in the upper SR/SFSR watershed, improving recreational fishing as a result. These types of projects have the additional benefit of potential removal from the CWA 303d list if a stream segment is impaired for nutrients and/or fecal coliform. Monitoring data post- project implementation can confirm that benefits are being provided by these activities.

Some restoration activities within this category may cause minor, short-term, direct or indirect impacts, however the long-term benefits listed above are expected to outweigh any of these impacts. For example, riparian planting may cause short-term, localized impacts as existing vegetation is trampled or removed prior to planting, and there may be a period of low ecological value of the area as plants grow to their full maturity. However, long-term impacts to water resources and riparian flora and fauna would occur due to the reduced erosion and increased shelter provided by these plants, and beneficial impacts would span a large geographic area downstream. Most of the riparian restoration activities (*e.g.*, cattle fencing, planting, alternate water sources) are not expected to create potential for causing additional impacts to natural

resources, or human health and safety. Many activities within this category qualify as a categorical exclusion under NEPA (40 C.F.R. § 1508.4), and do not individually or cumulatively have a significant effect on the human environment (*e.g.*, the installation of fences and the planting of seeds or seedlings and other minor re-vegetation actions). If more substantial stream bank stabilization or construction work is required, other short-term, moderate, localized impacts are expected from grading activities, equipment use, and temporary erosion into the river(s). For more substantial stabilization or other construction projects, Trustees would follow appropriate permitting processes and environmental review, and would not pursue a project that would have significant adverse environmental impacts.

Another consequence is that any lands potentially protected by conservation easements will no longer be available for commercial, residential, or economic development (potentially affecting the market value of other properties in the area). Restoration activities and acquisition of property or establishment of conservation easements will be consistent with federal and state policies and laws promoting the conservation and protection of fish and wildlife resources.

Resources Benefited:

Aquatic Resources and Supporting Habitat				Aquatic/Floodplain		Floodplain Resources and Supporting Habitat		
Sediment/ Invertebrates	Madison Cave Isopod	Surface Water	Fish	Amphibians / Reptiles	Piscivorous Birds / Mammals	Migratory Birds	Bats	Soil / Invertebrates
✓	✓	✓	✓	✓	✓	✓	✓	✓

5.3.2 *Freshwater Mussel Restoration*

This restoration category focuses on restoring the mussel assemblage in the SR and SFSR. Mussel restoration has several expected ecological benefits: improving water quality through filter feeding activity; stabilizing river and stream bottoms and adding to the general biotic integrity and diversity of the river system; enhancing habitat heterogeneity; and providing important substrate and refuge for mussel host fish and sport fish eggs and providing habitat for prey items, such as insect larvae (Vaughn and Hakenkamp 2001, Vaughn *et al*. 2008). These benefits also extend to the sport fish in the river. The restored mussel assemblage will provide vital aquatic ecosystem functions such as nutrient cycling, conversion of food resources into forms readily assimilated by other organisms, and long-term storage and release of important elements such as calcium, phosphorous, and nitrogen (Nedeau *et al.* 2000).

Project Location:
Propagation activities will take place at the Freshwater Mollusk Conservation Center at Virginia Polytechnic Institute and State University as well as the Virginia Fisheries and Aquatic Wildlife

Center at Harrison Lake National Fish Hatchery. The Trustees will focus augmentation efforts within the SR and SFSR and their tributaries where habitat is suitable.

Project Description:

Because of the depauperate mussel community in the SR and SFSR, propagation is necessary to increase and establish mussel populations at multiple sites throughout the watershed. Between the two facilities, a plan will be developed to produce, release, and monitor target mussel species, and suitable sites will be identified in the SR and SFSR for introducing the propagated mussels into the rivers. Target species may include those listed in Table 5. The process for propagating listed and non-listed mussels has been developed and refined over the past two decades and is currently at a state where most mussel species can be propagated (O'Beirn *et al.* 1998, Henley *et al.* 2001, Jones *et al.* 2005, Barnhart 2006). Propagation and culture technology has greatly improved for mussels in the last 5 years, making population restoration at a large-scale possible (Carey *et al*. 2015). Each of the facilities can produce thousands of mussels per year for stocking. Propagation efforts will include collecting gravid females from the wild, artificially infecting host fish with mussel larvae in the laboratory, then collecting and holding transformed juvenile mussels. Mussels and host fish are held in the laboratory in recirculating systems for the majority of this process. Juvenile mussels are held in captivity for 1-3 years to improve the survival rate of the released cohort.

In addition to propagation, adult mussels of several species may be translocated from other areas within the watershed to facilitate restoration of the mussel assemblage. Mussel translocation by itself is not considered to be a viable option for mussel population restoration as it does not produce a net gain in mussels in the river. However, translocation of some species could potentially enhance the rate at which mussel restoration is achieved by creating conditions that are supportive of a stable mussel assemblage. Several issues must be considered in a restoration plan before any mussel translocation could take place. Surveys would be required to identify appropriate source populations. These surveys must include baseline information such as size/age structure and sex ratios to assess possible impacts of removing adult mussels from donor sites (*e.g*., Cacapon River). Some work may be required to address concerns about the genetic relatedness, or lack thereof, of certain source populations and mussel populations within the SR/SFSR watershed.

Mussel translocation projects have met with mixed success (Sheehan *et al.* 1989, Cope and Waller 1995, Carey *et al*. 2015), therefore, a translocation plan would have to be developed that includes protocols for yearly monitoring to determine success and detect potential problems and provide assurance that those issues would be rectified. It is likely that several years of translocation efforts would be necessary for each species that meets predetermined criteria for translocation.

Table 5. Mussel species targeted for restoration in the Shenandoah River system as part of the DuPont NRDAR, along with a short description of propagation difficulty and notes on distribution and conservation status.

Species	Propagation Difficulty	Notes
Eastern elliptio, *Elliptio complanata*	Difficult; host fish are poorly understood, especially for juvenile mussel production in a hatchery setting.	This is a keystone species due to its high abundance and filtering capacity.
Northern lance, *Elliptio fisheriana*	Moderately Difficult; host fish are known for this species, but utilization for juvenile mussel production in a hatchery will need to be improved.	Species is of conservation concern in Virginia, extremely rare in Shenandoah River system, but strong populations occur in other Potomac River tributary streams (*e.g.* Broad Run)
Triangle floater, *Alasmidonta undulata*	Moderately Difficult; host fish are known for this species, but culture techniques for juveniles in the Anodontine mussel group needs improvement.	Widely distributed species but generally locally uncommon. Obtaining gravid female mussels may be challenging.
Plain pocketbook, *Lampsilis cardium*	Easy; host fish are well known and juvenile production capacity is high.	Technically feasible.
Green floater, *Lasmigona subviridis*	Moderately Difficult; host fish are known, but their utilization for juvenile mussel production in a hatchery will need to be improved. Host fish may not be necessary since glochidia can transform to the juvenile stage directly in gills of the female mussel. However, culture of juveniles in the Anodontine mussel group needs improvement.	Species is of conservation concern in Virginia, extremely rare in Shenandoah River system, but strong populations occur in other Potomac River tributary streams (*e.g.* Cacapon River).
Brook floater, *Alasmidonta varicosa*	Moderately Difficult; host fish are known, but culture techniques for juveniles in the Anodontine mussel group needs improvement.	Species is of conservation concern in Virginia, extremely rare in Shenandoah River system, but strong populations occur in other Potomac River tributary streams (*e.g.*, Cacapon River).
Creeper, *Strophitus undulatus*	Moderately Difficult; host fish are known, but their utilization for juvenile mussel production in a hatchery will need to be improved. Host fish may not be necessary since glochidia can transform to the juvenile stage directly in gills of the female mussel. However, culture of juveniles in the Anodontine mussel group needs to be improvement.	Widely distributed species but generally locally uncommon. Obtaining gravid female mussels may be challenging. However, a population occurs in the SR upstream of Waynesboro, VA.
Yellow lampmussel, *Lampsilis cariosa*	Moderately Difficult to Easy; host fish are well known and juvenile production capacity is high.	Species is of conservation concern in Virginia, extremely rare in Shenandoah River system, but populations occur outside the Potomac River system (*e.g.* lower Nottoway River, VA). Obtaining gravid female mussels may be challenging.

Eastern floater, *Pyganodon cataracta*	Moderately Difficult to Easy; host fish are well known and juvenile production capacity is high. However, culture of juveniles in the Anodontine mussel needs improvement.	Species is extremely rare in Shenandoah River system, but is widely distributed and common in the lower reaches of Atlantic Slope Rivers, including the Potomac and Rappahannock rivers.

All mussel restoration projects must be monitored during and beyond the propagation phase to document that the mussels reach sexual maturation and to document recruitment–an important indicator of a successful restoration. Monitoring is also needed to ensure that augmented individuals within a population reach ages similar to those found in the watershed. Mortality, recovery, and fitness indicators such as, growth and fecundity, may also be monitored for each species.

Propagation of these species is technically possible; several of them have been propagated successfully at the facilities in Virginia. Expected challenges for those species that have not yet been propagated include locating broodstock, and other standard challenges with propagation. Due to the experience of staff at each of the facilities, there is a high probability of identifying and managing challenges associated with propagation of new species.

Estimated Cost

Anticipated cost is $4 million for a multi-year propagation program at two mussel facilities.

Expected Impacts:

The environmental consequences of propagating freshwater mussels to restore populations are positive. Augmentation activities provide several benefits in addition to reestablishing substantially extirpated populations. Propagation and release of mussels help to: 1) increase the re-colonization rates of species into suitable habitat, 2) increase the likelihood of recruitment into currently occupied habitat, 3) increase the chance of species' continued existence in currently occupied river reaches, and 4) stabilize declining populations of non-listed species which in turn may preclude the need for future federal or state listing actions. The reintroduction of native, formerly native, or established species into suitable habitat within their historic or established range, where no or negligible environmental disturbances are anticipated is an activity that qualifies as a categorical exclusion under NEPA (40 C.F.R. § 1508.4), and does not individually or cumulatively have a significant effect on the human environment.

Resources Benefited:

Aquatic Resources and Supporting Habitat				Aquatic/Floodplain		Floodplain Resources and Supporting Habitat		
Sediment / Invertebrates	Madison Cave Isopod	Surface Water	Fish	Amphibians / Reptiles	Piscivorous Birds/ Mammals	Migratory Birds	Bats	Soil / Invertebrates
✓		✓	✓		✓			

5.3.3 *Neotropical Migratory Songbird Full Life Cycle Restoration – through Habitat Restoration*

Additional land protection that will specifically benefit the habitat of neotropical migratory songbirds impacted in the assessment area, including warblers, flycatchers and thrushes, will be another preferred restoration component. Because these species migrate along the Eastern Flyway and make bi-yearly journeys across the United States, impacts stemming from the DuPont Facility result in reductions throughout the flyway, where they feed and rest and provide enjoyment to numerous bird watchers along the way. To restore these migratory birds for the benefit of both the area where the injury occurred in Virginia and throughout the flyway, the Trustees propose to support restoration activities that would consider their full life cycle (*e.g.*, breeding, migration, or wintering habitat protection or enhancement).

Effective restoration efforts for neotropical songbird migrants should include both breeding and wintering habitats. Protecting wintering habitat is especially important as winter food limitations cause mortality on wintering grounds as well as increase mortality during migration (Holmes 2007). Studies describe measurable carry-over effects that poor quality wintering habitat may have on a songbird's health and migration timing, breeding success, survival rates, and ultimately population changes (*e.g.*, Marra *et al*. 1998, Sillett *et al.* 2000, DeSante *et al.* 2001, Bearhop *et al*. 2004, Norris *et al*. 2004, Saracco *et al.* 2008), further emphasizing the need for wintering habitat protection to fully restore these species.

Full life cycle habitat restoration supports other DOI efforts to protect migratory birds such as the National Park Service Park Flight Program and FWS Neotropical Migratory Bird Conservation Program, as well as state-led efforts like the Association of Fish and Wildlife Agencies Southern Wings Program.

Project Location:
Trustees will focus on opportunities with demonstrated connectivity of the location(s) with the species that breed in the SR/SFSR watershed.

Project Description:
Projects would focus on protecting habitat for species found in the SR/SFSR watershed during the breeding season. Potential projects will likely include acquisition and long-term protection of existing habitat, with little active restoration needed. Trustees would target those properties with evidence of supporting shared migratory bird species that are adjacent to protected lands, and may be owned by an established organization that will provide oversight and monitoring.

Other projects may include restoration and rehabilitation of degraded tropical forests to improve wintering habitat or working within farming communities to promote sustainable agriculture to provide wildlife habitat. These would involve encouraging agroforestry over intensive clearing and traditional agriculture which provide very limited habitat benefits to migratory birds and require significant quantities of pesticides and fungicides. Extensive monitoring has shown that the abundance, richness, and diversity of neotropical migrant species in agroforestry systems are significantly greater than in agricultural monocultures or pastoral areas (Perfecto *et al*. 1996, Estrada and Coates-Estrada 2005, Harvey and Gonzalez Villalobos 2007), and that agroforestry systems provide important refugia for resident and migrant birds.

Projects in this category will be evaluated with the following considerations:

- an associated U.S. non-profit or organization will manage/oversee transaction and manage/oversee in-country efforts
- property is adjacent to already protected land
- there is high risk of development
- acquisition is cost-effective
- there is a high benefit to species, and documented overlap in species composition
- long-term monitoring is possible

Estimated Cost:
Trustees anticipate that this project will cost no more than $2.5 million.

Expected Impacts:
For projects that only involve acquisition and protection of existing habitat, beneficial impacts are expected. Land would be protected rather than converted to agriculture or developed, providing high quality wintering habitat for migratory songbirds.

Enhancement activities are likely to include planting of forest (encouraging agroforestry) or invasive species management. These actions are expected to cause minor, short-term, localized impacts to existing resources and resource services, and result in moderate long-term benefits across a broad geographic scope.

Some restoration activities may, depending upon availability and suitability and life cycle needs of the species found in the SR/SFSR, occur outside of Virginia. Any activity will take in to account the nature of the linkage to related species adversely affected by the mercury contamination and potential positive impact to those populations. Bird injury was both a driver of the floodplain analysis, and a significant stand-alone injury requiring focused restoration activities,

5.3.4 CWPNAP - Willets Tract Addition and Forest Restoration

The primary goal of this restoration project is to protect and restore habitat along the SR that will benefit multiple resources and expand the area of already protected Virginia-owned lands. This project is evaluated separately from the category of "Land protection, property acquisition, and recreational and wildlife enhancements" because it is known to be available for acquisition at the time of preparing this Draft RP/EA.

Project Location: Augusta County, VA, along the south bank of the SR and adjacent to CWPNAP (Figure 6)

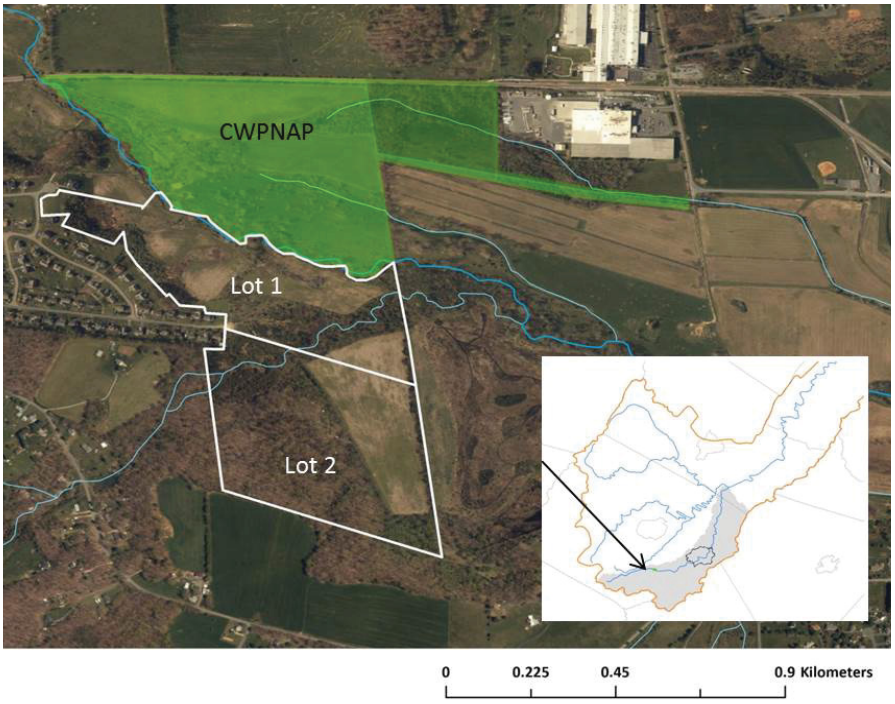


Figure 6. Willets Tract addition and forest restoration outlined in white (Lot 1 and 2), and CWPNAP in green shading.

Project Description:

CWPNAP is a 63-acre property along the north bank of the SR, owned and managed by the Virginia Department of Conservation and Recreation (VDCR) in Augusta County, VA. This property is part of a larger conservation site known as the "South River Wet Prairies" which has been assigned the highest possible biodiversity rank ("B1") a site can receive in the Commonwealth. This rank stems from the presence of King Rail (*Rallus elegans*), an assemblage of documented rare plants (currently 17 taxa) and four distinct natural communities, including one of the last known examples of fire-maintained Shenandoah Valley natural grassland communities. At least 77 bird species have been recorded from the site (eBird 2016). At least one FWS Focal Species, the King Rail, and an additional bird species, the Grasshopper Sparrow (*Ammodramus savannarum*) considered to have "high regional threats" (Rosenburg 2003), are documented here. This area also overlaps with the potential ranges of federally listed endangered smooth coneflower (*Echinacea laevigata*) and Indiana bat, as well as federally listed threatened species such as swamp pink (*Helonia bullata*), Virginia sneezeweed (*Helenium virginicum*), MCI, and northern long-eared bat. The high quality prairie, wet meadows, and associated open habitats provide benefits for declining species which require such habitats, while wooded riparian forests provide benefits for other species which prefer these habitats.

Adjoining the VDCR owned and managed CWPNAP is an approximately 15 acre preserve managed jointly by VDCR and The Nature Conservancy. Prescribed fire is a critical management tool used across both ownerships to conserve the unique and outstanding biodiversity present. Continued use of prescribed fire at the site will require protecting adjacent parcels to serve as buffers from nearby smoke sensitive residential development. Moreover, a Virginia Conservation Vision Development Vulnerability model maps these adjacent parcels, and the entire perimeter of this conservation site, in the high degree of threat from development (Hazler *et al*. 2016). Thus, acquiring buffer parcels is a timely and critical need for maintaining habitat quality and supporting necessary management activities.

Two tracts are under negotiation and are currently available for acquisition and addition to the CWPNAP. These comprise ~84 acres directly adjacent to the existing state Natural Area Preserve and share approximately ½ mile of common boundary. In addition to providing critical fire management buffers, these parcels would expand habitat connectivity across the SR creating contiguous riparian area protection for approximately 2,037 ft on both sides of the SR, as well as along approximately 2,095 ft of currently unprotected riparian area along both sides of the riparian area along Stony Run, a main tributary of the SR.

The subject parcels have been zoned for residential development, and the current owner has proposed to use the parcels to expand a subdivision which has already been developed immediately to the west. Currently these tracts consist of a mix of active agricultural fields

(approximately 29%), mostly within the floodplain, fallow fields partially reverted to scattered trees/shrubs (approximately 28%), and existing, primarily upland forest (approximately 43%). If acquired, all existing forest would be maintained. Reverting fallow fields would be improved by reducing invasive species presence and all recently cropped fields (approximately 25 acres) would be restored to native hardwood forest. Restored and managed hardwood forests will provide water quality and retention benefits, as well as improved cover, foraging, and nesting habitat for many bird species throughout the year. Taken together, this project would expand opportunity for ecological restoration, increase riparian area protection, buffer the core Natural Area Preserve from external threats, and expand protection for at least one bird species of special concern as well as the other significant natural heritage resources present.

Parcels to be acquired include Lot 1 and 2, identified on Figure 6 above.

Estimated Cost:
Cost for acquisition: $1,053,000 for Lot 1, Parcel ID 083C2 1 (34 acres) plus Lot 2, Parcel ID 083C2 1B (50 acres). Cost for restoration and monitoring activities: $265,779.

These costs include acquisition of the parcel, plus purchase and establishment of oak and walnut seedlings and tree shelter, weed control activities prior to planting, and invasive plant monitoring and control.

Expected Impacts:
The acquisition of real property is an activity that qualifies as a categorical exclusion under NEPA (40 C.F.R. § 1508.4), and does not individually or cumulatively have a significant effect on the human environment. The restoration activities will result in direct and indirect, short-term, localized minor impacts on natural resources such as soil, sediment and vegetation. Impacts will be primarily related to weed control and elimination of agricultural crops prior to converting to forested habitat*, e.g.,* a short period of limited or no vegetation cover, some impacts from machinery, and temporary soil erosion in construction areas. The potential adverse effects are outweighed by the potential long-term direct and indirect benefits of creating riparian forested habitat adjacent to CWPNAP as discussed above. In summary, restoring riparian habitat from fallow fields to forest will improve water quality and retention, provide habitat for many bird species throughout the year, and provide protection for a significant natural heritage site long-term. No cultural resources are expected to be impacted; no soil disturbing activities are planned for the CWPNAP addition. Table 6 and 7 contain additional analysis of the anticipated beneficial impacts of the proposed acquisition.

Resources Benefited:

Aquatic Resources and Supporting Habitat				Aquatic/Floodplain		Floodplain Resources and Supporting Habitat		
Sediment / Invertebrates	Madison Cave Isopod	Surface Water	Fish	Amphibians / Reptiles	Piscivorous Birds/ Mammals	Migratory Birds	Bats	Soil / Invertebrates
✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 6. Evaluation Criteria for CWPNAP restoration/addition.

RELATIONSHIP TO THE INJURIES (giving rise to the claim for natural resource damages)

1. SIMILARITY IN ATTRIBUTES TO THE INJURED NATURAL RESOURCE, same type and quality 2. LOCATION - proximity to SR/SFSR watershed 3. SCALE OF BENEFITS OF THE PROPOSED PROJECT - quality/quantity benefits provided by project (increase in acres, species, etc.)	Similar, or more diverse, natural resources to those that were injured in the assessment area. Location within the same watershed, upstream on SR. Project would create an increase of acres of highly valued, protected area.

LIKELIHOOD OF SUCCESS AND TECHNICAL FEASIBILITY

4. PROVEN TECHNOLOGY - can project be accomplished with available technology? 5. DOCUMENTED SUCCESS - has a similar project succeeded in the past? 6. COST EFFECTIVENESS - are costs reasonable related to expected benefits?	No advanced technology required for restoration activities. Standard restoration methods would apply. Similar projects have been successful, e.g., regular restoration activities at CWPNAP. Cost effective, as VDCR will provide in-kind contributions.

REGULATORY AND POLICY CONSIDERATIONS

7. FEDERAL, STATE AND LOCAL LAW COMPLIANCE 8. SITE OWNERSHIP AND ACCESS - do we have permission for the project? 9. PROPOSED PROJECT IS NOT "OTHERWISE REQUIRED" - by federal, state, local laws, regulations, permits, licenses 10. CONSISTENCY WITH TRUSTEE POLICY, MANAGEMENT GOALS, AND OBJECTIVES	No violation of any laws, and not required as part of any other law. Site is for sale, "shovel-ready", property owner has been cooperative.

GROUNDS FOR PROJECT ELIMINATION

1. BENEFITS OF PROJECT ARE UNLIKELY TO RESULT IN RESTORATION BENEFITS IN ADVANCE OF THE NATURAL RECOVERY PERIOD 2. PROJECT HAS SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACTS 3. POTENTIAL FOR SIGNIFICANT ADVERSE EFFECTS TO HUMAN HEALTH AND SAFETY 4. POTENTIAL FOR SIGNIFICANT ADVERSE SOCIOECONOMIC EFFECTS	Benefits would not accrue if this land is not protected/restored, as this site would be developed otherwise. Short-term environmental impacts may be expected during restoration, but nothing of lasting significance. No anticipated adverse effects to health or safety. No adverse socioeconomic effects are anticipated.

SECONDARY CRITERIA

1. CONSISTENCY WITH LOCAL, REGIONAL, AND NATIONAL RESTORATION GOALS AND INITIATIVES 2. TIME FRAME OF POTENTIAL BENEFITS 3. SELF-SUSTAINABILITY OF THE RESTORATION PROJECT 4. INTEGRATION WITH EXISTING MANAGEMENT PROGRAMS / LEVERAGE POTENTIAL 5. HABITAT CONNECTIVITY (*e.g.*, creating contiguous habitat) 6. PROXIMITY TO LANDS WITH PROTECTED STATUS. 7. BENEFITS TO PROTECTED SPECIES / SENSITIVE OR UNIQUE HABITATS 8. EDUCATION AND OUTREACH OPPORTUNITIES	This is consistent with state priorities (VDCR). The potential benefits are expected to start immediately for some of the restoration (protection of existing forest) and will increase over time for other (*e.g.*, conversion of crop fields to forest), which otherwise would not happen. Because of the proximity to CWPNAP, this project will become part of that existing management program. This project will not only increase acreage of contiguous habitat, but will also provide a buffer between CWPNAP and neighboring residential areas, allowing for fire management to continue at the prairie without impacts. Education opportunities may be combined with existing programs using CWPNAP.

MONITORING

1. MONITORING - will there be measurable results?	Monitoring/control of invasive species activities will be part of project, and will be undertaken by VDCR.

Table 7. Additional evaluation of CWPNAP restoration/addition, using acquisition-specific criteria.

SURROUNDING LAND USE AND LAND PROTECTION STATUS

Does the parcel provide opportunity to avoid habitat fragmentation or protect a corridor? Does surrounding land use threaten the resource value of a parcel? Nature and likelihood of development threats	Acquisition of this parcel will increase the size and contiguous area of CWPNAP and provide critical buffer from development. If developed, opportunity for riparian forest restoration will be lost, existing mature forest will be converted, and habitat fragmentation will increase. In addition, development will threaten continued prescribed burning practices at CWNAP. Prescribed burning is a critical part of maintaining the unique habitat at CWPNAP, and implementation will be severely hampered by development of a residential area due to the smoke dispersal.

PRIORITY

Has the parcel been identified as high priority for protection in existing local/regional land-use planning docs?	Long-standing VDCR priority due to rare species and natural communities, and designation as a high threat to development per the VDCR Conservation Vision Development Vulnerability model.

TYPES AND CONDITION OF NATURAL RESOURCES BENEFITED	
Is there evidence of rare species or habitat? Are there exemplary natural communities? Does it protect warm-water fisheries?	Tracts are part of a conservation site with outstanding (highest ranking) biodiversity significance, based on a large collection of rare plants, natural communities, and at least two bird species of conservation concern. Riparian buffer for more than 4,100 ft of the SR and a main tributary, Stony Run, will be protected.
COST OF PROTECTION	
Would this be acquisition, land transfer? Can the parcel be protected at a fair price for size and location? Is there opportunity for leveraging additional resources	Tracts will be acquired by VDCR at fair market value. The restoration costs will be leveraged with greater than 30% of the costs provided by VDCR matching funds. If successful acquisition is completed, it is likely that the owner of an adjacent 'Phase 2' high priority parcel will agree to work with VDCR as well.
LONG-TERM MAINTENANCE AND MANAGEMENT NEEDS	
Will public access be allowed? If so, is the management and degree of public access consistent with resource protection? What is potential for future management problems and costs? Are there on-site resources that need to be preserved (cultural, archaeological)?	Public access will be allowed, and will be consistent with VDCR's overall Natural Area Preserve guidelines seeking to balance public access and necessary management for the resources. Considering the management actions underway on existing protected lands, the VDCR and partners will maximize opportunities for efficient and expedited management activities. No cultural or archaeological resources are known on the site.

5.3.5 Land protection, property acquisition, and recreational and wildlife enhancements – riparian habitat along the SR or SFSR

Additional land acquisition will be targeted adjacent to the SR, SFSR, Shenandoah River and their tributaries to restore, enhance, or create contiguous areas of high-quality habitat for the same types of natural resources that were injured. Parts of the watershed are experiencing development pressure and have high levels of agricultural use, resulting in decreased water quality and habitat fragmentation. The purchase of lands (or conservation easements) may be accompanied by restoration and/or enhancement actions that will improve or increase habitat for a diversity of wildlife, and improve water quality through buffering impacts on sedimentation and run-off. These lands will remain protected in perpetuity.

The Trustees intend to solicit agencies, nonprofit organizations, and private citizens for proposed parcels for acquisition, and will select parcels for acquisition funding based on the priority criteria they established for acquisition and funding limitations. Project sponsors would need to identify the agency or nonprofit organization that would hold the easement or acquire the land in fee title. The Trustees have already identified one candidate parcel, described above (5.3.4).

Project Location:
Specific locations have not been determined, but potential acquisitions (with willing landowners) will be prioritized if they:

- are available for purchase within the desired timeline of the Trustees;
- are adjacent to already protected land;
- are at risk of development;
- are not already contaminated;
- provide habitat for state or federally protected species, or contain rare or unique habitat features;
- provide opportunities for wetland protection, enhancement, or restoration, that would specifically benefit amphibians that use ephemeral pond complexes for breeding;
- provide opportunities to protect or restore turtle breeding habitat, or in-stream basking habitat;
- provide opportunities to protect or restore bat habitat – hibernacula or breeding habitat;
- provide opportunities to restore or enhance waterfowl habitat, such as installation of wood duck box network;
- provide opportunities to protect quality habitat of the federally listed threatened MCI within its range in the northern Shenandoah Valley of Virginia and parts of West Virginia;
- increase public access for anglers or increase water-based recreation opportunities for the public; or
- provide opportunities to engage public in outreach activities.

Additional criteria are set forth in Table 7.

Project Description:
Examples of appropriate projects would include but not be limited to: restoring riparian forest habitat to benefit migratory birds, mammals, and amphibians/reptiles; converting hay/pasture/row crop to forest habitat; restoring or creating wetland habitat; restoring wet prairie habitat; or creating riparian buffer and stream stabilization. In some cases no additional enhancement work will be necessary.

Property acquisition will be targeted to specifically benefit amphibians, reptiles, bats, waterfowl, MCI, and wetland habitat – if these resources do not benefit from a suggested property

acquisition, that property will not be considered. Parcels acquired through this settlement will benefit at least one or all of the listed resources. When possible, river access points may be included in the restoration of a property – either by creating new access or improving existing access. However, river access will also be pursued separately from the land acquisition restoration category to ensure compensation of recreational fishing losses and to allow flexibility to capture unique opportunities that may provide significant additional benefit to recreational fishing.

A monitoring plan must be developed for selected projects to ensure long-term success. Because specific properties have not yet been identified, the evaluation criteria tables (see above Table 6 and 7) are not presented in this Draft RP/EA. Each project will be reviewed in detail as it is identified following these criteria. A general review of impacts/effects is presented below.

Estimated Cost:
Trustees anticipate that the land protection component will cost approximately $18.2 million.

Expected Impacts:
The acquisition of real property is an activity that qualifies as a categorical exclusion under NEPA (40 C.F.R. § 1508.4), and does not individually or cumulatively have a significant effect on the human environment. Some of the enhancement activities will result in direct and indirect, short-term, localized, or major impacts on natural resources such as soil, sediment, and vegetation. Existing habitat may in some cases be substantially modified to create the hydrology, grade, soil type, and vegetation necessary for the successful development of wetland habitats. This will likely involve the use of heavy machinery and construction equipment, which may result in soil compaction, emissions from heavy equipment, removal or crushing of understory vegetation, and increased soil erosion in the immediate area of construction operations. However, the long-term direct and indirect benefits expected from this type of restoration activity outweigh the potential adverse impacts. The creation of wetland habitat will provide significant benefit to amphibians and reptiles, and other species. For example, ephemeral ponds provide key breeding habitat for amphibians whose tadpoles and larvae are especially vulnerable to fish predation (fish cannot survive in ephemeral ponds). These ephemeral ponds also provide prey for species such as turtles, birds, small mammals, and predatory insects.

Other potential restoration actions may include planting, revegetation of riparian or upland forest, invasive species control, bank restoration, and erosion reduction. These actions are expected to cause minor, short-term, localized impacts to existing resources and resource services, and result in moderate long-term benefits across a broad geographic scope. Wetland, riparian, and upland planting may cause short-term, localized impacts to existing vegetation at the restoration site (*e.g.,* as existing vegetation is trampled or removed). During planting, which

may last for more than one year, the resource services provided by that area are likely to be reduced through physical disturbance over some time period, as the vegetation grows. However, long-term, moderate beneficial impacts to aquatic resources and associated flora and fauna are expected due to the reduced erosion and increased shelter provided by wetland and riparian plantings. Grassland restoration typically involves removal of existing vegetation through physical or mechanical means, replanting native grassland species, and conducting frequent maintenance (*e.g.*, mowing or burning) to ensure the grassland does not convert to a more shrub-dominated or forested habitat type. The adverse impacts of these actions are expected to range from direct, short-term, localized, minor impacts to indirect, long-term, localized, minor impacts. For example, the short-term impacts associated with revegetation are similar to those described above. The long-term minor impacts are associated with the continued maintenance of the habitat such as emissions from equipment or noise from mowing. However, the long-term direct and indirect benefits of grassland restoration outweigh the potential adverse impacts. Grasslands are increasingly threatened by agriculture and development, yet are a crucial habitat for birds and other wildlife. For example, migratory songbirds rely on grassland habitat for foraging and nesting during the summer, and small mammals such as voles and mice make their homes in grassland areas, and are an important food source to many birds of prey.

Incorporating river access as part of these projects may have short-term impacts, due to clearing vegetation, creating vehicle pull-off sites or parking lots, or increased foot traffic along the stream banks. Trustees will prioritize projects with minimal construction needs related to river access. Trustees do not anticipate any adverse impacts to historical or cultural resources, and will complete a full review of anticipated impacts to historic resources as properties are identified and evaluated, in accordance with Section 106 of the National Historic Preservation Act of 1966.

These projects would more likely benefit cultural or historical resources through the long-tern protection they will provide. Beneficial ecological impacts are expected for benthic invertebrates/mussels, fish, birds, mammals, amphibians and reptiles.

Resources Benefited:

Aquatic Resources and Supporting Habitat				Aquatic/Floodplain		Floodplain Resources and Supporting Habitat		
Sediment / Invertebrates	Madison Cave Isopod	Surface Water	Fish	Amphibians / Reptiles	Piscivorous Birds/ Mammals	Migratory Birds	Bats	Soil / Invertebrates
✓	✓	✓	✓	✓	✓	✓	✓	✓

5.3.6 Restoration of the VDGIF FRFH – Recreational Fishing Improvement Project

The hatchery was built in the 1930s for the purpose of producing game fish for area rivers. The smallmouth bass is the most sought-after game fish in the Shenandoah River system and reproduces naturally in these waters. The restored hatchery would provide consistent production of smallmouth bass to supplement the river populations during years with poor natural reproduction. Restoration of the hatchery will generate increased numbers of higher quality fishing trips. A restored hatchery could also eventually produce other highly-desirable coolwater game fish for stocking, including walleye and muskellunge.

Project Location:
The FRFH is located near Front Royal, VA in Shenandoah County.

Project Description:
The renovated FRFH would improve consistency of year-class strength for smallmouth bass in area rivers through hatching, rearing, and stocking of fingerlings. A renovated facility could also provide facilities and opportunities for mercury-related environmental education for little additional cost. Effective outreach and education would help communicate potential risks associated with human exposure to mercury as well as safe activities available in the watershed These would address the stigma associated with mercury contamination, which decreases the appeal of these rivers in the minds of many users. In short, the renovated hatchery could "bring people back to the river" through stocking programs and education.

The FRFH needs major reconstruction – including pond, raceway and building upgrades. Renovations are described in more detail in Appendix C to the proposed CD. Evaluation criteria for the FRFH are presented in Table 8.

Estimated Cost:
DuPont will perform all renovation directly. Initial costs of hatchery renovation have been estimated to be up to $10 million. Staffing and operation costs will be covered by VDGIF.

Expected Impacts:
This project will renovate existing structures and will not involve any expansion of construction activities to new areas, so the Trustees anticipate minimal adverse impacts. Some short-term, localized, direct and indirect impacts may occur from construction activities and use of heavy machinery, such as soil compaction, emissions from heavy machinery, and potential soil erosion. Trustees do not anticipate any adverse impacts to historical or cultural resources, and will complete a full review of anticipated impacts to historic resources as properties are identified and evaluated, in accordance with Section 106 of the National Historic Preservation Act of 1966.

Expansion of the FRFH will generate additional fishing trips while also increasing the quality of fishing trips taken.

Table 8. Evaluation of the FRFH.

RELATIONSHIP TO THE INJURIES (giving rise to the claim for natural resource damages)	
1. SIMILARITY IN ATTRIBUTES TO THE INJURED NATURAL RESOURCE, same type and quality 2. LOCATION - proximity to SR/SFSR watershed 3. SCALE OF BENEFITS OF THE PROPOSED PROJECT - quality/quantity benefits provided by project (increase in acres, species, etc.)	The project focuses on restoring smallmouth bass, an injured resource in the assessment area. Location is within the same watershed. Project would also benefit smallmouth bass fisheries state-wide
LIKELIHOOD OF SUCCESS AND TECHNICAL FEASIBILITY	
4. PROVEN TECHNOLOGY - can project be accomplished with available technology? 5. DOCUMENTED SUCCESS - has a similar project succeeded in the past? 6. COST EFFECTIVENESS - are costs reasonable related to expected benefits	Proposed renovations are standard and have been used at other Virginia hatcheries with success. Because DuPont is performing activities directly, the costs are expected to be reasonable. VDGIF will provide in-kind contributions of staff salaries.
REGULATORY AND POLICY CONSIDERATIONS	
7. FEDERAL, STATE AND LOCAL LAW compliance 8. SITE OWNERSHIP AND ACCESS - do we have permission for the project? 9. PROPOSED PROJECT IS NOT "OTHERWISE REQUIRED" - by federal, state, local laws, regulations, permits, licenses 10. CONSISTENCY WITH TRUSTEE POLICY, MANAGEMENT GOALS, AND OBJECTIVES	No violation of any laws, and not required as part of any other law. This project is consistent with state priorities.
GROUNDS FOR PROJECT ELIMINATION	
1. BENEFITS OF PROJECT ARE UNLIKELY TO RESULT IN RESTORATION BENEFITS IN ADVANCE OF THE NATURAL RECOVERY PERIOD 2. PROJECT HAS SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACTS 3. POTENTIAL FOR SIGNIFICANT ADVERSE EFFECTS TO HUMAN HEALTH AND SAFETY 4. POTENTIAL FOR SIGNIFICANT ADVERSE SOCIOECONOMIC EFFECTS	Short-term environmental impacts may be expected during restoration, but nothing of lasting significance. No anticipated adverse effects to health or safety. No adverse socioeconomic effects are anticipated.

SECONDARY CRITERIA

1. CONSISTENCY WITH LOCAL, REGIONAL, AND NATIONAL RESTORATION GOALS AND INITIATIVES 2. TIME FRAME OF POTENTIAL BENEFITS 3. SELF-SUSTAINABILITY OF THE RESTORATION PROJECT 4. INTEGRATION WITH EXISTING MANAGEMENT PROGRAMS / LEVERAGE POTENTIAL 5. HABITAT CONNECTIVITY (*e.g.*, creating contiguous habitat) 6. PROXIMITY TO LANDS WITH PROTECTED STATUS. 7. BENEFITS TO PROTECTED SPECIES / SENSITIVE OR UNIQUE HABITATS. 8. EDUCATION AND OUTREACH OPPORTUNITIES	This is consistent with state priorities. The potential benefits are expected to start immediately and will increase over time for other. VDGIF will continue to staff this hatchery.

MONITORING

1. MONITORING - will there be measurable results?	Monitoring activities will be part of project, and will be undertaken by VDGIF.

5.3.7 Recreational fishing access creation/improvement

This project would focus on identifying safe and convenient river access for anglers and recreational users within the SR/SFSR watershed. For river float trips, the goal is to have access at intervals of 5-7 miles. Areas that will provide bank fishing and wading access are also desirable.

Project Location:
Various locations along SR, SFSR, NFSR, North River, and Shenandoah River. VDGIF and VDEQ have identified some potential access point needs in the SR/SFSR watershed; however, exact project location(s) will depend upon property suitability and availability.

Project Description:
VDGIF and VDEQ have identified several opportunities to improve or add access within the watershed that would meet the goal of access points every 5-7 river miles, or would provide additional bank fishing or wading access.

Estimated Cost:
Trustees have allocated no more than $2.5 million to pursue access points either as component of property acquisition that will also benefit other resources, or separately. Costs will be highly variable between sites. Factors include whether ownership is public or private, size of tract, whether lease or purchase, local road access, topography, susceptibility to flooding, and degree of development proposed (canoe launch, boat ramp, walk-in access, etc.).

Expected Impacts:
Adding access points within the SR/SFSR has been identified as a need by Virginia natural resource agencies and stakeholders. Additional access to these rivers can provide more fishing and recreational opportunities and can also enhance trips by providing more conveniently located access, more options and varieties of trip types and lengths, by providing better services (ease of launching, parking, personal safety, nearby conveniences, etc.).

Incorporating river access may have short-term impacts, due to clearing vegetation, creating vehicle pull-off sites or parking lots, and increased foot traffic along the stream banks. Trustees will prioritize projects with minimal construction needs related to river access. Trustees do not anticipate any adverse impacts to historical or cultural resources, and will complete a full review of anticipated impacts to historic resources as properties are identified and evaluated, in accordance with Section 106 of the National Historic Preservation Act of 1966.

5.4 Evaluation of Alternative C: Restoration that Satisfies Site-Specific Criteria

Alternative C includes a suite of restoration projects that compensate for interim ecological losses and satisfy the NRDAR factors listed above (5.1). These projects will be located within the SR/SFSR watershed (Figure 5) when feasible and appropriate and include the following categories:

Project Category	**Potential Locations**	**Estimated Cost**
Projects to improve water quality and fish habitat – *Agricultural and urban BMPs in the SR/SFSR watershed* (refer to 5.3.1)	Headwaters of SR, tributaries to SR or SFSR, sites within the City of Waynesboro	$ 7.5 million
Freshwater mussel restoration – *Propagation program* (refer to 5.3.2)	Freshwater Mollusk Conservation Center at Virginia Polytechnic Institute and State University; Virginia Fisheries and Aquatic Wildlife Center at Harrison Lake National Fish Hatchery	$ 4 million
Neotropical migratory songbird full life cycle restoration – *Habitat restoration* (refer to 5.3.3)	Various locations	$ 2.5 million

Land protection, property acquisition, and recreational and wildlife enhancements – *CWPNAP – Willets Tract addition and forest restoration* (refer to 5.3.4)	Property adjacent to CWPNAP	$ 1.3 million
Land protection, property acquisition, and recreational and wildlife enhancements – *Additional properties, prioritizing those adjacent to SR or SFSR, creating contiguous protected land corridors* (refer to 5.3.5)	Locations upstream or within the City of Waynesboro, adjacent to the SR or tributaries to the SR or SFSR	$ 18.2 million
Recreational fishing improvement projects – *Restoration of the VDGIF FRFH* (refer to 5.3.6)	Front Royal, VA	DuPont fund directly
Recreational fishing improvement projects – *Recreational fishing access creation/improvement* (refer to 5.3.7)	Locations on SR, SFSR, NFSR, or Shenandoah River, or tributaries	$ 2.5 million
Recreational fishing improvement projects – *Trout management project* (5.4.1)	Appropriate locations within the SR	$ 2.5 million

Project attributes, resource benefits, potential environmental impacts, social consequences, and costs are provided in the sections above (5.3) and below (5.4.1).

5.4.1 Trout management project

This project would focus on improving and increasing trout fishing opportunities on the SR to allow safe consumption of fish. Trout have been stocked at multiple locations along the SR starting in 1989 (Bugas 2011). Although trout were not an injured resource, and trout anglers were not impacted by the FCA or mercury contamination, stakeholders and state agencies identified this project for consideration due to angler interest in trout fishing on the SR and the opportunity to provide alternative fishing experiences with options for safe consumption.

Project Location:
Appropriate locations along SR, within the existing trout fishery in Waynesboro and Grottoes areas or in new areas with suitable habitat.

Project Description:
The goal of this project is to increase stocking frequency and size of fish and expand the area of trout stocking. Components of this project may include purchasing additional trout at larger

sizes for stocking, and/or constructing a grow-out facility to house trout, allowing them to reach desirable size.

Estimated Cost:
If this Alternative was selected, no more than $2.5 million would be redirected from "projects to improve water quality and fish habitat," that may also have potential benefits to trout, in order to complete the trout stocking/management project.

Expected Impacts:
Expanded trout stocking and higher quality fish will attract a greater number of trout anglers to the SR, and will provide greater numbers of safe-to-consume fish for those anglers. Environmental impacts of trout stocking are primarily beneficial, and likely have minimal impact on native fish assemblages. Possible impacts may include some competition with local species and introduction of disease.

If construction of a grow-out or holding facility becomes part of this project, there may be some short-term impacts from construction activities. Trustees do not anticipate any adverse impacts to historical or cultural resources, and will complete a full review of anticipated impacts to historic resources if a construction project is pursued, in accordance with Section 106 of the National Historic Preservation Act of 1966.

5.5 Compliance with NEPA and other potentially applicable laws

Upon completion of the public comment period, and if warranted, an Environmental Action Statement and a FONSI will be circulated for signature by the DOI Authorized Official upon publication of the notice of availability of the final RP/EA in the Federal Register. These documents will remain within the administrative record for this matter.

Coordination and evaluation of required compliance with specific federal acts, executive orders, and other policies for the preferred restoration plan is achieved, in part, through the coordination of this document with appropriate agencies and the public. All ecological restoration projects will be in compliance with all applicable federal statutes, executive orders, and policies, including, but not limited to: NEPA, 42 U.S.C. § 4321 *et seq*.; ESA, 16 U.S.C. § 1531, *et seq*.; the National Historic Preservation Act of 1966, 16 U.S.C. § 470 *et seq*.; the Fish and Wildlife Coordination Act, 16 U.S.C. § 661 *et seq.*; the Rivers and Harbors Act of 1899, 33 U.S.C. § 403 *et seq.*; the Federal Water Pollution Control Act, 33 U.S.C. § 1251 *et seq.*; Executive Order 11990, Protection of Wetlands; and Executive Order 11988, Flood Plain Management. Compliance with the laws cited above, and any necessary permitting, will be undertaken during specific restoration project planning stages, and will completed early in the project planning

process. See below for descriptions of relevant laws, regulations and policies, and how the proposed restoration alternative is in compliance.

State permits may be required to implement certain activities within the proposed restoration alternatives, depending upon the exact nature of proposed work. Proposed restoration activities in wetland and floodplain habitats would need to meet the requirements of the U.S. Army Corps of Engineers (USACE) Nationwide and/or General Permits. Any restoration work occurring within streambeds would require subaqueous bottom land permits from the Virginia Marine Resources Commission.

Federal Trustees are also required under Executive Order Number 12898, 59 C.F.R. § 7629, to identify and address any policy or planning impacts that disproportionately affect the health and environment in low income and minority populations. Since the restoration alternatives will result in changes that benefit trust resources throughout the SR and SFSR watershed, including in and near Waynesboro, the federal Trustee has concluded that there would be no adverse impacts on low-income or minority communities due to implementation of the restoration alternatives.

Anadromous Fish Conservation Act

The Anadromous Fish Conservation Act (16 U.S.C. § 757a, *et seq*.) provides authority to conserve, develop, and enhance anadromous fishery resources.

Compliance: The proposed restoration would conserve and enhance anadromous fishery resources.

Clean Air Act

The Clean Air Act (42 U.S.C. § 7401, *et seq*.) directs EPA to set limits on air emissions to ensure basic protection of health and the environment. The fundamental goal is the nationwide attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). Primary NAAQS are designed to protect human health. Secondary NAAQS are designed to protect the public welfare (for example, to prevent damage to soils, crops, vegetation, water, visibility and property).

Compliance: All construction activity would be conducted with conventional equipment in compliance with all local ordinances and NAAQS.

Clean Water Act (Federal Water Pollution Control Act)
The Clean Water Act (33 U.S.C. § 1251, *et seq*.) is the principal law governing pollution control and water quality of the Nation's waterways. Section 404 of the law authorizes a permit program for the beneficial uses of dredged or fill material in navigable waters. The USACE administers the program.

Compliance: Coordination with the USACE would be completed pursuant to Section 404 of this Act before any site specific restoration action under this proposed plan could be undertaken. All joint federal/state permits would be obtained prior to the start of any site specific construction activities. All construction activity will be done in compliance with Section 404 of the law.

Endangered Species Act
The ESA (16 U.S.C. § 1531, *et seq*., 50 C.F.R. Parts 17, 222, 224) directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the ESA. Under the ESA, National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and FWS publish lists of endangered and threatened species. Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species.

Compliance*:* The Trustees would conduct necessary Section 7 consultations with NMFS and FWS prior to implementation of any future restoration project proposed under this plan. Such consultations would be initiated before selection of a specific project, but may be completed and/or updated during a project's design phase.

Farmland Protection Policy Act
The Farmland Protection Policy Act of 1981 (7 U.S.C. § 4201 *et seq*.) aims to minimize the effect of federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural use.

Compliance: The Trustees would coordinate with NRCS to minimize impacts to farmland if applicable.

Fish and Wildlife Conservation Act
The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. § 2901 and 50 C.F.R. § 83) provides for protection and management of non-game fish and wildlife and their habitats.

Compliance: The intent of the NRDAR process is restore, replace, enhance, and/or acquire equivalent natural resources (fish, wildlife, and their supporting habitats) and resource services as were injured by releases of hazardous substances. The Trustees believe the restoration

activities described in the Draft RP/EA will enhance habitats and fish and wildlife, thereby benefiting natural resources.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. § 661, *et seq*.) states that wildlife conservation shall receive equal consideration with other features of water-resource development. This Act requires federal permitting and licensing agencies to consult with NOAA/NMFS, FWS, and state wildlife agencies before permitting any activity that in any way modifies any body of water to minimize the adverse impacts of such actions on fish and wildlife resources and habitat.

Compliance: For restoration projects to be implemented under this plan, the Trustees would be consulting with agency regulatory staff in the future during the Clean Water Act Section 404 permitting process to minimize any potential impacts to fish and wildlife resources and habitat.

Information Quality Guidelines issued pursuant to Public Law 106-554

Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of such information (*e.g*., the objectivity, utility and integrity of such information).

Compliance: This Draft RP/EA is an information product covered by information quality guidelines established by NOAA and DOI for this purpose. The quality of the information contained herein is consistent with the applicable guidelines.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. § 715, *et seq*.) provides for the protection of migratory birds. This statute does not specifically protect the habitat of these birds but may be used to consider time-of-year restrictions for activities on restoration sites where it is likely migratory birds may be nesting and/or to stipulate maintenance schedules that would avoid the nesting seasons of migratory birds.

Compliance: Consultation with the FWS constitutes compliance with this Act. If future restoration activities under this plan are deemed to adversely impact migratory birds, appropriate measures will be implemented to avoid impacts.

National Environmental Policy Act

Congress enacted the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321 *et seq*.) in 1969 to establish a national policy for the protection of the environment. NEPA applies to federal agency actions that affect the human environment. Federal agencies are obligated to comply

with NEPA regulations adopted by the Council on Environmental Quality (CEQ). NEPA requires that an Environmental Assessment be prepared to determine whether the proposed restoration actions will have a significant effect on the quality of the human environment. If an impact is considered significant, then an Environmental Impact Statement (EIS) is prepared. If the impact is considered not significant, then a FONSI is issued.

***Compliance**:* The Trustees have integrated an analysis of the environmental consequences of the Preferred Alternative into this Draft RP/EA to comply with NEPA and CEQ processes and requirements. This integrated process allows the Trustees to meet the public involvement requirements of NEPA and CERCLA concurrently. Further NEPA analysis, tiered to the programmatic analysis herein, will occur when specific restoration activities are identified and proposed. Based on the analysis described in this document, the Trustees do not believe an EIS will be required for any projects within the scope of the Proposed Action.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. § 470 *et seq*.) requires federal agencies to take into account the effects of its actions on historic properties by identifying historic properties, assessing adverse effects and resolving adverse effects.

Compliance: In the area proposed restoration activities could occur, the Trustees do not expect any restoration project to have an interaction with historic sites, buildings, objects and antiquities of national significance. However, coordination with the Virginia Department of Historic Resources would occur in the future to ensure that specific restoration actions under this plan avoid impacting any such properties.

Preservation of Historic and Archeological Data Act

The purpose of the Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. § 469, *et seq*.) is to provide for the preservation of historic American sites, buildings, objects and antiquities of national significance, and for other purposes by specifically providing for the preservation of historical of archeological data which might otherwise be lost or destroyed.

***Compliance**:* In the area proposed restoration activities could occur, the Trustees do not expect any restoration project to have an interaction with historic sites, buildings, objects and antiquities of national significance. However, coordination with the Virginia Department of Historic Resources would occur in the future to ensure that specific restoration actions under this plan avoid impacting any such data.

Rivers and Harbors Act

The federal Rivers and Harbors Act (RHA; 33 U.S.C. § 401, *et seq.*) regulates development and use of the Nation's navigable waterways. Section 10 of this Act prohibits unauthorized obstruction or alteration of navigable waters and vests the USACE with authority to regulate discharges of fill and other materials into such waters.

***Compliance**:* Coordination with the USACE would be completed pursuant to Section 10 of this Act before any site specific restoration action under this proposed plan could be undertaken. Future restoration actions under this plan that require Section 404 Clean Water Act permits are likely to meet the requirements of the USACE's Nationwide and/or General Permits. All joint federal/state permits would be obtained prior to the start of any site-specific restoration activities, including for compliance with Section 10 of the law where applicable.

Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act of 1968 (16 U.S.C. § 1271 *et seq.*) preserves certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition.

Compliance: Trustees do not intend to include dam construction or other instream activities that would harm a river's free-flowing condition, water quality or outstanding resource values, as part of the restoration activities.

Executive Order 11514 Protection and Enhancement of Environmental Quality, as amended by Executive Order 11911 Relating to Protection and Enhancement of Environmental Quality

Executive Orders 11514 and 11991 require that federal agencies monitor, evaluate and control their activities to protect and enhance the quality of the Nation's environment to sustain and enrich human life; inform the public about these activities; share data gathered on existing or potential environmental problems or control methods; and cooperate with other governmental agencies.

Compliance: Releasing this Draft RP/EA, and any subsequent proposed site specific plans, for restoration for public review and comment is consistent with the intent of this Executive Order.

Executive Order 11990 Protection of Wetlands

Executive Order 11990 (40 C.F.R. § 6392 (a) and Appendix A) requires federal agencies to avoid the adverse impacts associated with the destruction or loss of wetlands, to avoid new construction in wetlands if alternatives exist, and to develop mitigative measures if adverse impacts are unavoidable.

Compliance: The Preferred Alternative includes alternatives for restoration that will preserve and enhance existing wetlands and restore wetlands degraded by past logging, forestry,

agricultural, and fire exclusion activities and practices. No long-term, significant adverse impacts to wetlands are anticipated.

Executive Order 11988 Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Compliance: The Preferred Alternative includes alternatives for restoration that will preserve and enhance existing floodplains or restore floodplain habitat degraded by past agricultural activities and practices. No long-term, significant adverse impacts to floodplains are anticipated.

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and Executive Order 12948 Amendment to Executive Order No. 12898

Executive Orders 12898 and 12948 require each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations.

***Compliance*:** The Trustees have concluded that no low-income or ethnic minority communities would be adversely affected by any restoration activities that would occur under the Preferred Alternative.

Executive Order 12962 Recreational Fisheries

Executive Order 12962 requires that federal agencies, to the extent permitted by law and where practicable, and in cooperation with states and tribes, improve the quantity, function, sustainable productivity, and distribution of the Nation's aquatic resources for increased recreational fishing opportunities.

Compliance: The restoration activities that would occur under the Preferred Alternative will benefit fish populations in ways that could improve recreational fisheries.

Executive Order 13112 Invasive Species

The purpose of Executive Order 13112 is to prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

Compliance: The Preferred Alternative includes activities for management of invasive species. Surveys for invasive species and actions to control them, should they be present on acquired or state-owned restoration areas, would be performed.

Executive Order 13653 Preparing the United States for the Impacts of Climate Change
The purpose of Executive Order 13653 is to give federal agencies direction to support community-based preparedness and resilience efforts by establishing policies and prioritizing investments that promote preparedness, protect critical infrastructure and public resources, support science and research needed to prepare for climate impacts, and ensure that federal operations and facilities continue to protect and serve citizens in a changing climate. Specifically, Section 3 and 5 of Executive Order 13653 call for federal agencies to manage their lands and waters for climate preparedness and resilience and plan for climate change related risk.

***Compliance*:** Under the Preferred Alternative, the Trustees would consider regional climate information in planning and design of future habitat restoration projects that should allow for more resilient habitats in the face of changing climate.

CHAPTER 6 SELECTION OF PREFERRED ALTERNATIVE

The Trustees evaluated three restoration alternatives. Of these, Alternative B best addresses natural resource injuries and service reductions resulting from the release of mercury within the assessment area, and includes the majority of the project categories originally suggested by stakeholders. Based on the Trustees' evaluation of the environmental consequences of Alternatives A, B, and C, the NRDAR factors described in 43 C.F.R. § 11.82(d), and the potential for greater restoration project opportunities, the Trustees selected **Alternative B** as their Preferred Alternative.

Alternative A provides no restoration options, and is therefore insufficient to compensate for natural resource injuries.

Alternative C provides all of the opportunities for restoration contained in Alternative B, as well as a trout management component. The trout project was considered because it is supported by stakeholders, provides a safe-for-consumption fishing alternative, and benefits a certain portion of the SR angler population. However, the benefits are almost exclusively directed at trout anglers, a population that did not suffer a direct negative impact from the mercury contamination in the watershed.

Redirection of funds to complete a trout-only project would decrease funds available for restoration projects to improve water quality and fish habitat that would benefit all resources impacted by mercury. Those projects, agricultural and urban BMPs in the upper SR, headwater streams, and within the City of Waynesboro, will improve riparian and aquatic habitat, benefitting multiple resources including fish. Alternative B would allow for more funding to be allocated to those types of projects.

Because there are three differently managed stocked fisheries in the SR that are already popular destinations (Bugas 2011), the benefits of additional trout stocking and management are not sufficiently clear. Trout stocking impacts are too narrow, given the more broad benefits expected from the other restoration projects proposed in Alternative B, to devote substantial resources to the proposed trout project. Finally, the recreational fishing access improvement projects contained in Alternative B will provide substantial benefits to anglers of all fish species in the SR and SFSR, including trout anglers.

The Trustees believe that the Preferred Alternative, Alternative B, represents cost-effective and beneficial means by which to restore or replace the injured natural resources and the services they provided. After this Draft RP/EA is finalized, the Trustees will begin to identify and evaluate additional specific project options based on the restoration alternative the Trustees

select in the final RP/EA. Compliance with the laws cited above, and any necessary permitting, will be undertaken during the planning stages of specific restoration projects.

The Trustees may implement restoration project alternatives that are not specifically identified in the Draft RP/EA, but are consistent with our restoration objectives. Each project will be evaluated against the same restoration priorities and factors described above, and, if needed, a further review of environmental consequences will be conducted. Any selected projects that are expected to have non-negligible impacts will be subject to a project-specific NEPA analysis prior to implementation. In addition, Section 7 consultation (under the ESA) will be completed for restoration projects that may affect threatened or endangered species or their designated critical habitat and Section 106 of the National Historic Preservation Act will be followed for each restoration project that will be implemented.

A summary of the injury categories and associated restoration and resource benefits is presented in Table 9.

Table 9. Summary of injury and restoration categories.

Injury Category:	**Representative Resource:**	**Preferred Restoration Categories:**	**Other Resources That Benefit:**
Fish (Aquatic)	Fish (Section 3.4.1)	• Land protection, property acquisition, and recreational and wildlife enhancements – riparian habitat along the SR or SFSR • Agricultural and urban BMPS • Fish production (FRFH) • Mussel propagation	• Sediment/Surface Water • Soil • Mussels • Amphibians/Reptiles • Songbirds • Piscivorous Birds and Mammals • Bats • Recreational Fishing
Mussels	Mussels (Section 3.4.2)	• Mussel propagation	• Sediment/Surface Water • Fish • Piscivorous Birds and Mammals • Recreational Fishing

Migratory Birds	Songbirds (Section 3.4.3)	• Protection of songbird habitat throughout life cycle	• Migratory Songbirds
Non-Wetland Floodplain	Songbirds (Section 3.4.4)	• Land protection, property acquisition, and recreational and wildlife enhancements – riparian habitat along the SR or SFSR	• Sediment/Surface Water • Soil • Fish • Mussels • Amphibians/Reptiles • Piscivorous Birds and Mammals • Bats • Recreational Fishing
Wetland Floodplain	Amphibians (Section 3.4.5)	• Land protection, property acquisition, and recreational and wildlife enhancements – riparian habitat along the SR or SFSR	• Sediment/Surface Water • Soil • Mussels • Amphibians/Reptiles • Songbirds • Piscivorous Birds and Mammals • Bats • Recreational Fishing
Recreational Fishing	Fishing Trips (Section 3.4.6)	• FRFH renovation and fish production • Access point creation/improvement • Agricultural and urban BMPs	• Mussels • Piscivorous Birds and Mammals

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APPENDIX A. SUMMARY OF STAKEHOLDER PARTICIPATION.

From 2008 until the present, Trustees held multiple meetings or calls with federal and state natural resource agencies and other stakeholders to discuss the Natural Resource Damage Assessment and Restoration (NRDAR) process, injury assessment, and restoration ideas. Some of these meetings are listed below.

Date of meeting or call	Stakeholder groups (with Trustees)	Topics covered
September 25, 2008	• South River Watershed Steering Committee (multiple groups represented)	NRDAR overview
April 21, 2009	• DuPont • Virginia Department of Conservation and Recreation (VDCR) • The Nature Conservancy (TNC)	Restoration discussion; site visit to Cowbane Wet Prairie State Natural Area Preserve
April 30, 2010	• Virginia Department of Game and Inland Fisheries (VDGIF)	Restoration discussion
June 1, 2010	• Trout Unlimited (TU)	Restoration discussion
July 1, 2010	• TNC • VDCR • VDGIF	Restoration discussion
August 8, 2011	• VDCR • VDGIF	Restoration discussion – bats, Madison cave isopod
September 21, 2011	• VDGIF	Restoration discussion– recreational fishing
February 15, 2012	• VDCR	Restoration discussion
February 16, 2012	• VDGIF • DuPont	Front Royal Fish Hatchery tour
April 13, 2012	• VDGIF • Virginia Tech	Site visit to sinkhole ponds, emphasis on herpetofauna
April 16, 2012	• City of Waynesboro	NRDAR
May 25, 2012	• Shenandoah Riverkeeper • DGIF	Restoration discussion – recreational fishing
June 19, 2012	• Belize Foundation for Research and Environmental Education • Smithsonian Migratory Bird Center • University of North Carolina - Wilmington	Restoration discussion – migratory songbird

August 10, 2012	• VDGIF	Restoration discussion – recreational fishing
September 6, 2012	• VDGIF	Site visit to properties upstream of Waynesboro
September 24, 2012	• VDGIF • VDCR	Restoration discussion – properties, mussels, bats; and injury discussion
January 29, 2013	• Shenandoah Riverkeeper • Friends of the North Fork • VDGIF • TU • James Madison University	NRDAR overview; and restoration discussion – recreational fishing
February 1, 2013	• TNC	Restoration discussion
March 28, 2013	• TNC	Restoration discussion
April 11, 2013	• NRCS • City of Waynesboro	Restoration discussion
May 15, 2013	• Valley Conservation Council (VCC) • VDGIF	Restoration discussion
June 10, 2013	• Augusta County	NRDAR overview
July 24, 2013	• Friends of the Shenandoah River • Friends of the North Fork • TU • VDGIF • City of Waynesboro	Restoration discussion; and NRDAR update
August 21, 2013	• VDGIF • DuPont	Site visit to Front Royal Fish Hatchery
August 26, 2013	• VDGIF	Restoration discussion – recreational fishing and ecological
August 29, 2013	• Friends of the North Fork • Potomac River Smallmouth Club	Restoration discussion – recreational fishing
January 9, 2014	• City of Waynesboro	NRDAR review
February 5, 2014	• VDCR	Site visit to Cowbane Wet Prairie State Natural Area Preserve and surrounding area
April 21, 2014	• VDGIF	Restoration discussion; and NRDAR update
May 8, 2014	• VDGIF	Site visit to Virginia Fisheries and

		Aquatic Wildlife Center at Harrison Lake National Fish Hatchery
June 11, 2014	• Shenandoah Riverkeeper	NRDAR update
July 3, 2014	• City of Waynesboro	Restoration discussion
July 16, 2014	• Department of Forestry • VCC • Virginia Outdoor Foundation	NRDAR overview; and restoration discussion
July 24, 2014	• City of Waynesboro	Restoration discussion
August 13, 2014	• Whitescarver Natural Resources Management LLC	NRDAR overview; and restoration discussion
August 21, 2014	• Watershed Stewardship Inc.	Restoration discussion
November 19, 2014	• US Forest Service • Appalachian Mountain Joint Venture	NRDAR overview; and restoration discussion
January 22, 2015	• VCC • Virginia Outdoor Foundation	NRDAR update; and restoration overview
February 9, 2015	• Virginia Tech	Restoration discussion – amphibian/wetlands

APPENDIX B. BIRDS OBSERVED DURING THE 2011-2012 SURVEYS IN THE SR/SFSR WATERSHED.

Common Name	*Scientific name*
Acadian Flycatcher	*Empidonax virescens*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Barred Owl	*Strix varia*
Belted Kingfisher	*Megaceryle alcyon*
Black Vulture	*Coragyps atratus*
Black-and-White Warbler	*Mniotilta varia*
Blackburnian Warbler	*Setophaga fusca*
Black-capped Chickadee	*Poecile atricapillus*
Black-throated Blue Warbler	*Setophaga caerulescens*
Black-throated green warbler	*Setophaga virens*
Blue Grosbeak	*Passerina caerulea*
Blue Jay	*Cyanocitta cristata*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Blue-headed Vireo	*Vireo solitarius*
Bobolink	*Dolichonyx oryzivorus*
Broad-winged Hawk	*Buteo platypterus*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Molothrus ater*
Canada Goose	*Branta canadensis*
Canada Warbler	*Cardellina canadensis*
Carolina Chickadee	*Poecile carolinensis*
Carolina Wren	*Thryothorus ludovicianus*
Cedar Waxwing	*Bombycilla cedrorum*
Cerulean Warbler	*Setophaga cerulea*
Chestnut-sided Warbler	*Chaetura pelagica*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Grackle	*Quiscalus quiscula*

Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Cooper's Hawk	*Accipiter cooperii*
Dark-eyed Junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Downy Woodpecker	*Picoides pubescens*
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wood Pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Fish Crow	*Corvus ossifragus*
Golden-crowned Kinglet	*Regulus satrapa*
Grasshopper Sparrow	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Great Crested Flycatcher	*Myiarchus crinitus*
Great-blue Heron	*Ardea herodias*
Great-horned Owl	*Bubo virginianus*
Green Heron	*Butorides virescens*
Hairy Woodpecker	*Picoides villosus*
Hooded Warbler	*Setophaga citrina*
Horned Lark	*Eremophila alpestris*
House Finch	*Haemorhous mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*
Kentucky Warbler	*Geothlypis formosa*
Killdeer	*Charadrius vociferus*
Louisiana Waterthrush	*Parkesia motacilla*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Bobwhite	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Mockingbird	*Mimus polyglottos*
Northern Parula	*Setophaga americana*

Orchard Oriole	*Icterus spurius*
Ovenbird	*Seiurus aurocapilla*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Warbler	*Setophaga pinus*
Prairie Warbler	*Setophaga discolor*
Purple Martin	*Progne subis*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-eyed Vireo	*Vireo olivaceus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Pigeon	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruffed Grouse	*Bonasa umbellus*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Sharp-shinned Hawk	*Accipiter striatus*
Song Sparrow	*Melospiza melodia*
Swainson's Warbler	*Limnothlypis swainsonii*
Tree Swallow	*Tachycineta bicolor*
Tufted Titmouse	*Baeolophus bicolor*
Turkey Vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Wild Turkey	*Meleagris gallopavo*
Willow Flycatcher	*Empidonax traillii*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Yellow Warbler	*Setophaga petechia*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-breasted Chat	*Icteria virens*
Yellow-throated Vireo	*Vireo flavifrons*

APPENDIX C. PROJECTS THAT DO NOT SATISFY SITE-SPECIFIC CRITERIA

Trustees did not evaluate these projects, because the actions proposed will not address natural resources injuries in a specifically designed, cost-effective way.

Project	Rationale for Unsuitability
Acquisition of properties located within other watersheds in Virginia	Insufficient information on the nexus to injured resources. Projects within SR/SFSR watershed will be prioritized, especially related to fish restoration. Restoration for migratory birds and other migratory species may occur outside the SR/SFSR watershed.
Acquisition of upland properties (no riparian connection)	Insufficient information on the nexus to injured resources. No nexus to riparian habitat. Projects with a riparian connection within SR/SFSR watershed will be prioritized.
Dam removal in SFSR watershed	Insufficient information is currently available on potential projects and expected benefits. Projects may be considered for future restoration.
South River Greenway Construction	Does not directly restore injured resources or resource services. However, projects under Alternative B may coordinate well with Greenway construction and property acquisition that may include access for greenway construction and recreation.
Education and outreach programs, tools, and facilities	Does not directly restore injured resources or resource services. However, projects under Alternative B are expected to include educational components and outreach opportunities (*e.g.*, signage, outreach programs related to migratory songbirds).
White-nose syndrome research	Does not restore injured resources or resource services.
Aquatic education center and staff	Does not restore injured resources or resource services. Projects under Alternative B are expected to have educational components and outreach opportunities such as signage at access points
Lake Shenandoah renovation (Rockingham County / Harrisonburg area)	Insufficient information currently available on potential projects and expected benefits.
Stocking catchable channel catfish in lower SR	Insufficient information currently available on potential projects and expected benefits.
Angler (creel) surveys – to evaluate long-term success of stocking, fisheries management, and environmental education	Does not directly restore injured resources or resource services. May be incorporated as part of monitoring for options in Alternative B.

Coursey Springs Hatchery improvements	Insufficient information is currently available on potential project. Does not restore injured resources or resource services.

APPENDIX C: 10% DESIGN FOR THE FRONT ROYAL REGIONAL FISH HATCHERY PROJECT

United States of America and Commonwealth of Virginia v. E. I. du Pont de Nemours and Company

APPENDIX C: 10% DESIGN FOR THE
FRONT ROYAL REGIONAL FISH HATCHERY PROJECT

1.0 INTRODUCTION

The following are initial (10%) design specifications for the modifications and improvements to the Front Royal Fish Hatchery (FRFH), and were developed by HDR Inc. for DuPont. Future refinements to this initial design may be prepared by DuPont or a different contractor; however, DuPont will provide the Trustees with each new and refined design for their review and comment. Detailed design figures and drawings specific to this Plan will be provided in the 35%, 65%, 95% and 100% design documents.

The existing FRFH and proposed improvements are shown, as applicable, in Figures SMB-1, SMB-2, and SMB-3. These figures are incorporated into and made a part of this Appendix C.

Figure SMB-1. Cover Sheet and Location Map.

Figure SMB-2. Front Royal Fish Hatchery Existing Conditions.

Figure SMB-3. Improvements Site Plan.

2.0 INITIAL DESIGN COMPONENTS FOR THE FRONT ROYAL REGIONAL FISH HATCHERY PROJECT

The Front Royal Regional Fish Hatchery Project will be designed to produce from 22,000 to 37,500 small mouth bass (SMB) annually. Smallmouth bass rearing requires several different rearing vessels to accommodate all the life-cycles. The features needed for SMB rearing are presented in the following table.

Life Cycle	**Recommended Rearing Unit**
Spawning	Harvest Raceways
Incubation	Incubation Jars
Hatching/Swim Up/Marking	Indoor Tanks
Phase 1 (up to 1.5”)	Ponds (feed-zooplankton)
Fathead Minnow (FHM)	Ponds (feed for Phase 2 SMB)
Phase 2 (1.5-3”)	Ponds (feed-FHM)
Harvest	Harvest Raceways
Broodstock	Ponds or Harvest Raceways

2.1 It is estimated that 18 to 24 months will be required for design and construction of the Front Royal Regional Fish Hatchery Project. The improvements and other design elements required to meet the goal of producing 22,000 – 37,500 SMB per year are listed below and illustrated on Figure SMB-3. Improvements Site Plan:

2.1.1. Pond Renovation

To meet SMB production goals for both Phase 1 and Phase 2 rearing, four acres of ponds are required. Ponds N1-N3 (which shall be created by consolidation and renovation of existing Ponds 1-6 and 13-18) will be used for SMB rearing (3 ponds at a total of 4 acres). In addition, it is assumed that one pond (Pond 20 – 0.86 AC) will be needed for fathead minnow (FHM) production for the Phase 2 rearing. Pond renovation will include reconfiguration of Ponds 1-6 and 13-18 into Ponds N1-N3, and reconfiguration of Pond 20, demolition of existing concrete water supply flumes, regrading, compaction, membrane lining, new water supplies, harvest structures, aeration, and individual outlet structures.

2.1.2. New Pond Water Supply

New pond water supply will be created by trenching, backfilling, and adding bedding for new water supply piping system to provide individual pond filling. Piping will include piping, fittings and interconnection valves.

2.1.3. New Harvest Kettles, Outlet Structures and Drain Piping

Each pond will be equipped with a concrete U-shaped fish harvest kettle, concrete outlet structure, kettle access stairway, and dual offset drain slide gates.

2.1.4. Pond Aeration System

Power will be distributed to a new central low pressure subsurface aeration system. Each pond will be equipped with a colorite floating diffuser connected to a new central air distribution system.

2.1.5. Site Electrical Service Improvements

Three-phase power will be provided to the site and the power distribution will be upgraded. Two diesel engine-generator standby power systems with outdoor enclosures will be installed.

2.1.6. Raw Water Intake Renovation

Raw water intake will be renovated by installing, into the existing concrete intake box, two 1,000 gpm vertical traveling screens with backwash. A slide gate will be added to the dam.

2.1.7. Filtration of Influent River Water

Two drumfilters (150 micron) for further filtration and treatment will be installed, with sumps, piping, and power. The drumfilters will be housed in a metal building. Proposed design flow is 1,000 gpm and the filters will be 50% redundant.

2.1.8. Filtration Backwash Effluent Treatment

Filtration backwash effluent treatment will be provided for by dredging and re-grading existing Pond 28 and installing a new concrete water control structure, fittings and piping. Backwash from the new drumfilter will be connected to the effluent pond.

2.1.9. Fertilizer and Equipment Storage Building

Pre-engineered 40'x30' metal pole barn type building (1 bay) will be constructed, with minimal electrical (lighting and receptacles) supplied throughout.

2.1.10. Alarming and Instrumentation

Auto-dialers will be installed in the Pavilion and at the drum filters to alarm for up to eight abnormal conditions. Dissolved oxygen aerator panels will be provided at the SMB and FHM ponds.

2.1.11. Harvest and Incubation Pavilion

Incubation building will include 900 sf (30'x30') enclosed metal frame structure with metal insulated roof and 2,000 sf open air pavilion to house four 40'x6' fiberglass hatching tanks. The enclosed portion of the building will house 12 McDonald hatching jars, four feed training troughs (10' long), a mechanical/electrical room, low pressure blower, and water treatment using stacked disc filters (assumed 20 micron), UV disinfection (assumed 40 mJ/cm^2 at 80% UV light transmittance) and water heating (5 degree F. rise, 20 hp heat pump) for flow of 76 gpm. One half of the existing concrete raceway bank will need to be demolished to accommodate this new building.

2.1.12. Smallmouth Bass Spawning Raceways

Utilize remaining harvest raceways (four 40'x6' raceways, see Item 2.1.11) to accommodate both harvesting and SMB spawning functions.

2.2 Summary Design Elements of SMB Rearing

Initial design and specifications are included below. **Note: quantities may be refined as the design progresses.** Detailed drawings and other design specifications will be provided with the 35%, 65%, 95% and 100% designs.

ID	Item Description	No of Units	Unit Meas.
A1	**Pond renovation**		
	Site Demolition	1	LS
	Clearing and Grubbing, Rock Removal	4.86	AC
	Piping Demolition	1	LS
	Earthwork (Exc.)	3,750	CY
	Earthwork (BF)	3,750	CY

ID	Item Description	No of Units	Unit Meas.
	Road Aggregate and Seeding	4.86	AC
	Regrading and Liner Preparation	4.86	AC
	Underdrain System	4.86	AC
	Sand Liner	4.86	AC
	Geotextile	4.86	AC
	Combine and Divide Ponds	2,000	CY
	Liner (52,000 SF/AC)	4.86	AC
A2	**New pond water supply**		
	18" C905 DR 25 PVC Pipe bedded & backfilled 4' deep	850	LF
	16" C905 DR 25 PVC Pipe bedded & backfilled 4' deep	35	LF
	Miscellaneous supply main fittings and restraints	1	LS
	Supply pipe leak testing larger than 10" size up to 2000 LF	1	LS
	18" buried Butterfly Valve w/box for flushing main	1	EA
	12" buried Butterfly Valve w/box for flushing main	1	EA
	Shallow End Delivery Piping, Splash Blocks and Fittings	4	EA
A3	**New harvest kettles, outlet structures and drain piping**		
	Concrete - 27 CY ea	4	EA
	Kettle Supply Plumbing for 1-acre pond	4	EA
	1-acre Drain branch, slide gate, drain valve, wye & wall adapters	4	EA
	Miscellaneous Metals - Screens, Embedments, Grating	4	EA
	21" SDR 35 PVC Drain bedded and buried 10' deep	90	LF
	15" SDR 35 PVC Drain bedded and buried 10' deep	160	LF
	12" SDR 35 PVC Drain bedded and buried 10' deep	800	LF
	Misc. drain pipe fittings & structure adapters	1	LS
	Leak test larger than 10" pipe up to 500' between manholes	1	LS
	Manhole 4' dia. 11' deep with dig, backfill, steps & lid	3	EA
	Manhole 5' dia. 11' deep with dig, backfill, steps & lid	1	EA
A4	**Pond aeration system**		
	Low Pressure Air Blower (7.5 hp)	2	EA
	LPA Concrete Pad	2	EA
	LPA Manifold	1	EA
	LPA Discharge Hose (2" ID)	100	LF
	Buried Air Pipe	750	LF
	Pond Aeration Units (Double Units)	3	EA
	Pond Aeration Units (Single Units)	1	EA
	Service Entrance Panel, 125A	1	EA
	Grounding	1	EA
	Motor Controls and VFD	2	EA
	100AF, 50AT, 3P Branch Circuit Breaker	2	EA
	Blower Building Electrics	1	LS
	Outdoor Equipment Support Structure	1	LS

ID	Item Description	No of Units	Unit Meas.
	Surge Arrester	1	LS
A5	**Site electrical service improvements**		
	West Side		
	Rebuild Utility OH Primary Line to 3 Phase	1	MI
	400A, 120/2080V, 3Ph, 4W Utility Service	1	LS
	Feed from Storage Building to Harvest Pavilion, 150 A, 3 PH	50	Lin Ft
	Feed from Storage Building to Hatchery, 400A	40	Lin Ft
	40kW Outdoor Generator w/ Sub-base Fuel Tank	1	EA
	ATS	1	EA
	West Side		
	125A, 120/208V, 3Ph, 4W Utility Service	1	LS
	Outdoor Electrical Equipment Support Structure	1	LS
	40kW Outdoor Generator w/ Sub-base Fuel Tank	1	EA
	ATS: 125A, 120/208V, 3Ph, 4 Pole	1	EA
	Service Ground Field	1	LS
A6	**Raw water intake renovation**		
	Traveling Screen		
	Traveling Screen & Conveyor with Training	2	EA
	Backwash Pump & Accessories	2	EA
	Backwash Strainers & Accessories	2	EA
	3-Way PVC Ball Valves	2	EA
	Installation of Traveling Screens	1	LS
	O&P for Screen, Conveyor, Backwash & Installation	1	LS
	Freight/Delivery	1	LS
	New Maintenance Valve		
	48" Slide Gate to facilitate sediment removal from dam	1	EA
	Dewatering for slide gate installation	1	LS
	Removal of sediment from dam and intake box	1	EA
	New Electrical to Equipment		
	Power Feeder	1,500	LF
	Handhole	2	EA
	Panelboard: 100A MCB NEMA 4XSS	1	EA
	FVNR Combination Starter, NEMA Sz. 1, NEMA 4XSS	2	EA
	Branch Circuit Conduit & Wire	200	LF
	60AF, 3P Branch Circuit Breaker	2	EA
	100AF, 3P Distribution Circuit Breaker	1	EA
A7	**Filtration of influent river water**		
	Sump and Foundation	700	SF
	Building	700	SF
	1500 gpm (total, 750 gpm each) 120 micron Drumfilter w/wash for 40 ppm TSS (matl.)	2	EA
	Microscreen installation	2	EA

ID	Item Description	No of Units	Unit Meas.
	Subcontractor Markup	2	LS
	Plumbing	1	LS
	Electrical	1	LS
A8	**Filtration backwash effluent treatment**		
	Dredge Pond	1,875	CY
	Regrade Pond	1	EA
	Concrete Structure	1	EA
	Outlet Structure slide gate and piping	1	LS
	Shallow End Delivery Piping, Splash Blocks and Fittings	1	EA
	Effluent Drain to Settling Pond for BW	2,100	LF
	Manholes	5	EA
	Miscellaneous Piping	1	LS
A9	**Fertilizer and equipment storage**		
	New Storage Building (1 bay, 40'x30' ea)	1,200	SF
	Electrical	1,200	SF
A10	**Alarming and instrumentation**		
	Alarms Auto-Dialer	2	EA
	New telephone service to Drum Filter	1	LS
	Level Switch	3	EA
	Temperature Switch	1	EA
	Diff Pressure Switch	1	EA
	Flow Switch	2	EA
	DO Monitoring	4	EA
	Alarm Conduit & Wire	800	LF
A11	**Harvest and Incubation Pavilion**		
	New Road - Bituminous Surface	278	SY
	New Road - Base Course	278	SY
	Earthwork	1	LS
	Foundation	2,900	SF
	Building - Pavilion	2,000	SF
	Building - Incubation/Early Rearing	900	SF
	Fence	2,000	LF
	Fiberglass Holding Tanks	4	EA
	Incubation	1	EA
	Incubation Treatment Heat Pump	1	LS
	Incubation Treatment Filtration	1	LS
	Incubation Treatment UV System	1	LS
	Incubation Treatment Pumps and Misc. Piping	1	LS
	Low Pressure Air Pumps and Piping	1	LS
	Plumbing Holding	2,000	SF
	Plumbing Incubation	900	SF

ID	Item Description	No of Units	Unit Meas.
	Drains	2,900	SF
	HVAC	900	SF
	Building Site Drain	150	LF
	Manholes	2	EA
	6" PVC Pipe bedded & backfilled 4' deep, Site gravity supply	120	LF
	Building Electrical	2,900	SF
A12	**Demolition of Raceways**		
	Fill and Grading	1,000	CY
	Demolish 6 raceways	1	LS

3.0 CONSTRUCTION CRITERIA

Modifications and improvements to the FRFH will utilize current engineering standards and will be constructed utilizing high quality materials.

4.0 PROPOSED SCHEDULE

DuPont will provide the Trustees with design submittals according to the schedule outlined in Section VIII of the Consent Decree.

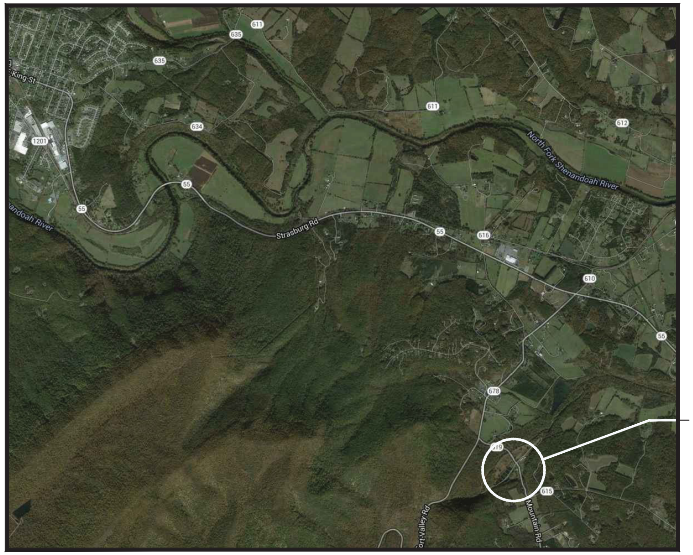
EXPECTED ELEMENTS OF 100% DESIGN FOR
FRONT ROYAL REGIONAL FISH HATCHERY PROJECT

The 100% Design for the Front Royal Regional Fish Hatchery Project is expected to contain the following elements, modified as may be appropriate in light of developments during completion of the Design.

1. Overall Site Plan and Plan Drawing
    a. Property Usage Description
    b. Location Map and Design Map
    c. Overall Facility Layout
    d. Vehicle Parking, ADA Accessible Parking, Walkways (if required for project)
    e. Vehicle and Pedestrian Access and Circulation
    f. Project Materials of Construction and Construction Specifications
    g. Storm Water Drainage Features
    h. Identification of Non-typical Site Features Such As Wetlands
2. Site Modification Plan
3. Overall Dimension Plan
4. Overall Site Grading Plan
5. Enlarged Site Grading Plan(s) (if applicable)
6. Hatchery Modifications and Improvements
    a. Detailed Plans, Sections and Materials Descriptions
    b. Detailed Plans for New Construction of Buildings or other Infrastructure
    c. Detailed Plans for Decommissioning of Some Existing Infrastructure
7. Site Pavement and Miscellaneous Site Details (if required for project)
8. Storm Water Management Details (if required for project)
9. Erosion and Sedimentation Control Notes and Details
10. Written technical specifications for all site construction activities.

FRONT ROYAL FISH HATCHERY SMALLMOUTH BASS REARING

FRONT ROYAL, VIRGINIA



LOCATION MAP
NOT TO SCALE

SITE MAP
NOT TO SCALE

INDEX OF SHEETS

SMB–1 COVER SHEET AND LOCATION MAP
SMB–2 FRONT ROYAL EXISTING CONDITIONS
SMB–3 IMPROVEMENTS SITE PLAN

HDR
HDR Engineering, Inc.
5201 South Sixth Street Road
Springfield, IL 62703

ISSUE	DATE	DESCRIPTION
1	07/21/16	DRAWINGS SUBMITTAL

PROJECT MANAGER	T. McPARLAND
PROJECT BIOLOGIST	T. JOHNSON
STRUCTURAL	B. BRADLEY
ELECTRICAL	G. ROSCETTI
MECHANICAL	T. TALSMA
CADD DRAFTER	P. DAUGHTON
PROJECT NUMBER	10034375

DUPONT

VIRGINIA DEPARTMENT OF GAME AND INLAND FISHERIES

FRONT ROYAL FISH HATCHERY
SMALLMOUTH BASS REARING

COVER SHEET AND LOCATION MAP

0 1" 2"

FILENAME	SMB–1.dwg
SCALE	NONE
SHEET	SMB-1

SYMBOLS

- EXPOSED UTILITY
- BURIED UTILITY
- ? – SEE SERVICE ABBREVIATIONS
- GATE VALVE
- VALVE
- CAP OR PLUG
- PIPE OPENING
- DRAINAGE LINE
- REARING UNIT OR WATER BODY
- ROADS
- TREE LINE
- TREE OR BUSH
- STRUCTURE
- FENCE
- POWER POLE
- TRANSFORMER, POLE MOUNTED
- LIGHT FIXTURE
- UTILITY METER
- PANELBOARD
- DUPLEX RECEPTACLE
- AERATOR RECEPTACLE

SERVICE ABBREVIATIONS

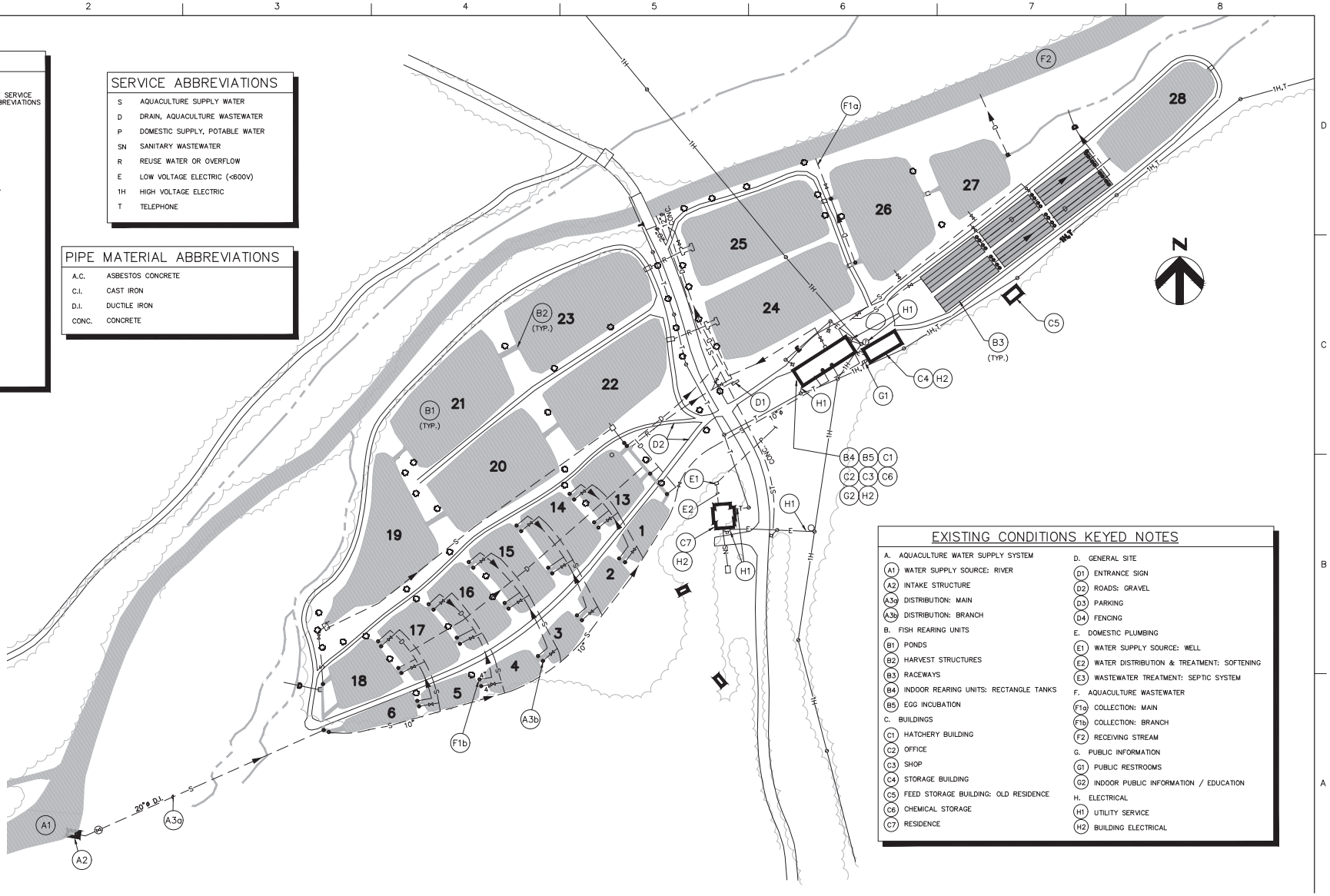
S	AQUACULTURE SUPPLY WATER
D	DRAIN, AQUACULTURE WASTEWATER
P	DOMESTIC SUPPLY, POTABLE WATER
SN	SANITARY WASTEWATER
R	REUSE WATER OR OVERFLOW
E	LOW VOLTAGE ELECTRIC (<600V)
1H	HIGH VOLTAGE ELECTRIC
T	TELEPHONE

PIPE MATERIAL ABBREVIATIONS

A.C.	ASBESTOS CONCRETE
C.I.	CAST IRON
D.I.	DUCTILE IRON
CONC.	CONCRETE

Existing Pond Sizes

Pond No.	Acreage
1	0.17
2	0.17
3	0.14
4	0.16
5	0.14
6	0.15
13	0.33
14	0.39
15	0.40
16	0.41
17	0.38
18	0.32
19	0.81
20	0.86
21	0.89
22	0.83
23	0.99
24	0.96
25	0.91
26	0.87
27	0.42
Total	10.67
Effluent (28)	0.58



EXISTING CONDITIONS KEYED NOTES

A. AQUACULTURE WATER SUPPLY SYSTEM
- A1 WATER SUPPLY SOURCE: RIVER
- A2 INTAKE STRUCTURE
- A3a DISTRIBUTION: MAIN
- A3b DISTRIBUTION: BRANCH

B. FISH REARING UNITS
- B1 PONDS
- B2 HARVEST STRUCTURES
- B3 RACEWAYS
- B4 INDOOR REARING UNITS: RECTANGLE TANKS
- B5 EGG INCUBATION

C. BUILDINGS
- C1 HATCHERY BUILDING
- C2 OFFICE
- C3 SHOP
- C4 STORAGE BUILDING
- C5 FEED STORAGE BUILDING: OLD RESIDENCE
- C6 CHEMICAL STORAGE
- C7 RESIDENCE

D. GENERAL SITE
- D1 ENTRANCE SIGN
- D2 ROADS: GRAVEL
- D3 PARKING
- D4 FENCING

E. DOMESTIC PLUMBING
- E1 WATER SUPPLY SOURCE: WELL
- E2 WATER DISTRIBUTION & TREATMENT: SOFTENING
- E3 WASTEWATER TREATMENT: SEPTIC SYSTEM

F. AQUACULTURE WASTEWATER
- F1a COLLECTION: MAIN
- F1b COLLECTION: BRANCH
- F2 RECEIVING STREAM

G. PUBLIC INFORMATION
- G1 PUBLIC RESTROOMS
- G2 INDOOR PUBLIC INFORMATION / EDUCATION

H. ELECTRICAL
- H1 UTILITY SERVICE
- H2 BUILDING ELECTRICAL

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VIRGINIA DEPARTMENT OF GAME AND INLAND FISHERIES

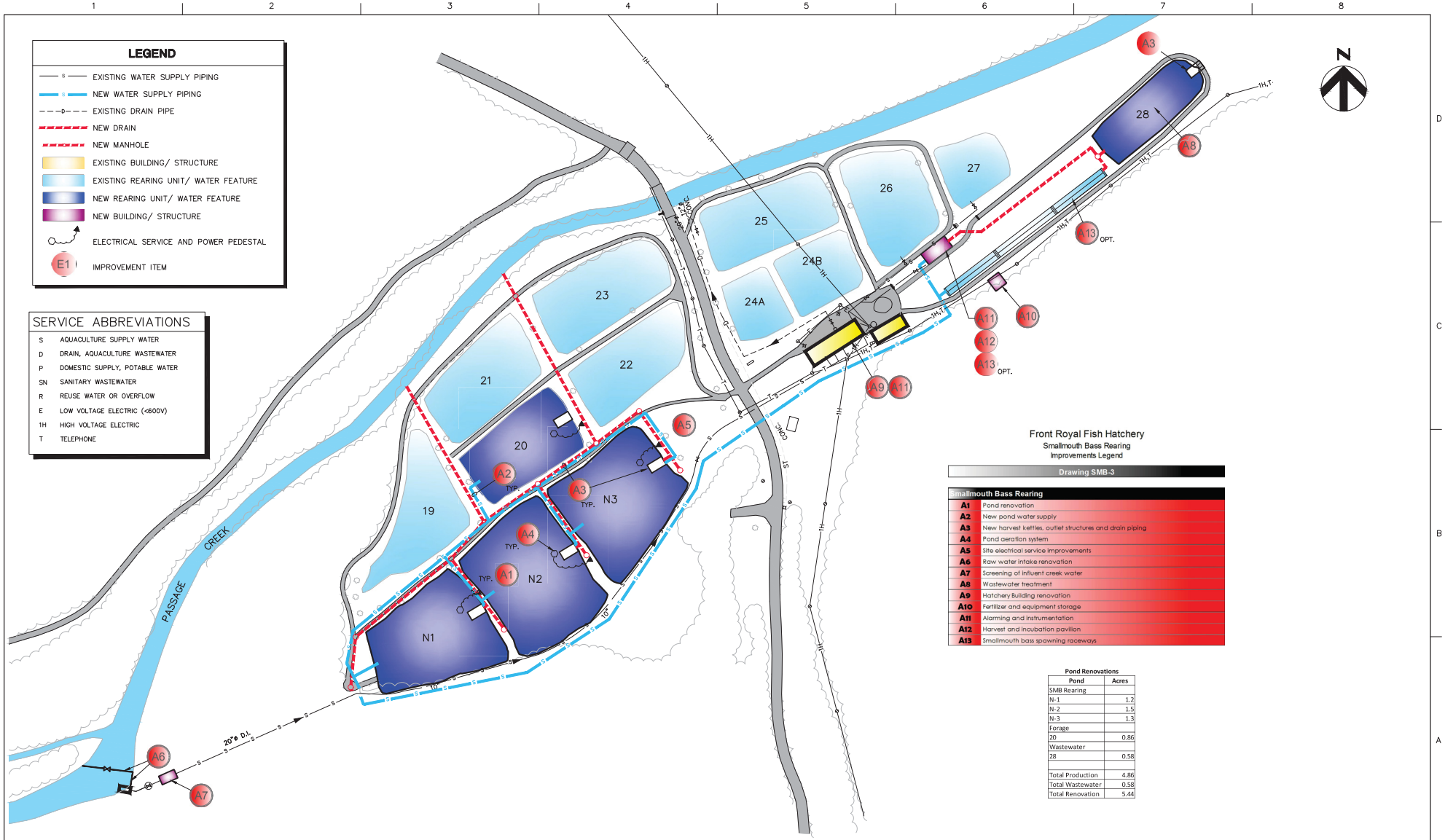
FRONT ROYAL FISH HATCHERY
SMALLMOUTH BASS REARING

FRONT ROYAL EXISTING CONDITIONS

0 1" 2"

FILENAME	SMB-2.dwg
SCALE	1"=100'

SHEET **SMB-2**



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FRONT ROYAL FISH HATCHERY
SMALLMOUTH BASS REARING

IMPROVEMENTS SITE PLAN

0 1" 2"

FILENAME SMB-3.dwg
SCALE 1"=100'
SHEET SMB-3