



FINAL WATERSHED PLAN AND ENVIRONMENTAL IMPACT STATEMENT

Pocasset River Flood Damage Reduction Project
Providence County, Rhode Island



PREPARED BY

United States Department of Agriculture
Natural Resources Conservation Service

IN COOPERATION WITH

City of Cranston
Town of Johnston

JANUARY 2020



**Final
Watershed Plan and Environmental Impact Statement
For
Pocasset River Flood Damage Reduction Project
of the
Pocasset River Watershed
Providence County, Rhode Island**

Prepared By:

U.S. Department of Agriculture Natural Resources Conservation Service

In Cooperation With:

City of Cranston
Town of Johnston

AUTHORITY

This Watershed Plan-Environmental Impact Statement (Plan-EIS) was prepared under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended.

ABSTRACT

The Pocasset River floods portions of the Town of Johnston and the City of Cranston, with flooding becoming more frequent and widespread in recent years. Property damages are recurrent and costly where severe flooding occurs. The purpose of the project is to reduce flood damages in the Town of Johnston and the City of Cranston and adjacent unincorporated areas resulting from floods on the Pocasset River for magnitudes up to and including the one-percent annual-chance (100-yr) flood event. The major flooding-related problems include damage to residential, commercial, and industrial properties, increase in local government cost, and damage to roads and bridges. Other losses include decreased property value in flood prone areas and loss of potential sites for commercial and industrial development. Flooding impacts the health and safety of residents in inundated areas, by limiting the access of emergency vehicles. The area's surface and groundwater resources are also impacted from flooded on-site septic systems and sewer systems. Rehabilitation of the site will require flood prevention works of improvements and the acquisition of floodplain conservation easements; specifically: the installation of sheet pile floodwalls along two sections of the Pocasset River; the acquisition of approximately 140 properties located within the floodplain and demolition of the 134 structures located on the properties; dry-floodproofing 25 structures; installation of bypass culvert along Simmons Brook; and removal of a debris dam in the Pocasset River. The estimated cost of the Preferred Alternative is \$48,455,590 of which \$48,318,090 would come from Public Law 83-566 (PL 566) funds.

COMMENTS AND INQUIRIES

Submit comments and inquiries to: R. Phou Vongkhamdy, State Conservationist, USDA-NRCS, 60 Quaker Lane, Suite 40, Warwick, Rhode Island, 02866-0111 (401-828-1300).

NON-DISCRIMINATION STATEMENT

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

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

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Pocasset River Watershed Watershed Plan Agreement

between the

**City of Cranston
Town of Johnston**

(Referred to herein as Sponsors)

and the

**UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE**

(Referred to herein as NRCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for works of improvement for the Pocasset River Watershed, State of Rhode Island, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012); and

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

Whereas, there has been developed through the cooperative efforts of the Sponsors and NRCS a watershed project plan and environmental impact statement for works of improvement for the Pocasset River Watershed, State of Rhode Island, hereinafter referred to as the watershed project plan or plan, which plan is annexed to and made a part of this agreement;

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

- 1. Term.** The term of this agreement is for the installation period and evaluated life of the project (50 years) and does not commit NRCS to assistance of any kind beyond the end of the evaluated life.
- 2. Costs.** The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto will be the actual costs incurred in the installation of works of improvement.
- 3. Real Property.** The Sponsors will acquire such real property as will be needed in connection with the works of improvement. The amounts and percentages of the real property acquisition costs to be borne by the Sponsors and NRCS are as shown in the cost-share table in section 5 hereof.

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

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

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

Works of Improvement Cost-Shareable Items	NRCS		Sponsors		Total
	Percent	Cost	Percent	Cost	Cost
Floodwall Construction	100	\$7,384,000	0	\$0	\$7,384,000
Culvert Construction	100	\$977,600	0	\$0	\$977,600
Dry Floodproofing	100	\$650,000	0	\$0	\$650,000
Floodplain Restoration	100	\$4,468,100	0	\$0	\$4,468,100
Real Property Acquisition	100	\$32,004,950	0	\$0	\$32,004,950
Relocation ¹	50	\$137,500	50	\$137,500	\$275,000
Sponsors Engineering Costs	0	\$0	100	\$0	\$0
Subtotal (Cost-Shareable Items)	—	\$45,622,150	—	\$137,500	\$45,759,650
Non-Cost-Shareable Items²					
NRCS Engineering/TA	100	\$2,695,940	0	\$0	\$2,695,940
Project Administration ³	—	—	—	—	—
Water, Mineral, Resource Rights ⁴	0	\$0	100	N/A	N/A
Permits ⁴	0	\$0	100	N/A	N/A
Real Property Rights ⁴	0	\$0	100	N/A	N/A
Relocation (Beyond Required) ⁵	0	\$0	100	N/A	N/A
Non-Project Costs	0	\$0	100	N/A	N/A
Subtotal (Non-Cost-Shareable)	—	\$2,695,940	—	\$2,695,940	\$2,695,940
Total	—	\$48,318,090	—	\$137,500	\$48,455,590

¹ Relocation payments includes replacement in kind, and payments necessary to meet decent, safe, and sanitary provisions.

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

³ The Sponsors and NRCS will each bear the costs of project administration that each incurs. Sponsor costs for project administration include relocation assistance advisory service.

⁴ The Sponsors will acquire with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the Sponsors' share of the works of improvement costs. In no case will the amount of an in-kind contribution exceed the Sponsors' share of the cost for the works of improvement. The maximum cost eligible for in-kind credit is the same as that for cost sharing.

⁵ Relocation payments for the cost of improvements beyond decent, safe and sanitary requirements is a non-project cost ineligible for assistance under the act.

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

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

8. Water and Mineral Rights. The Sponsors will acquire or provide assurance that landowners or resource users have acquired such water, mineral, or other natural resources rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

9. Permits. The Sponsors will obtain and bear the cost for all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

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

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

12. Amendments. This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the Sponsors have failed to comply with the conditions of this agreement or when the program funding or authority expires. In this case, NRCS must promptly notify the Sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by NRCS must be in accordance with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the Sponsors having specific responsibilities for the measure involved.

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

14. Operation and Maintenance (O&M). The Sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with an O&M agreement. An O&M agreement will be entered into before Federal funds are obligated and will continue for the project life (50 years). Although the Sponsors' responsibility to the Federal Government for O&M ends

when the O&M agreement expires upon completion of the evaluated life of measures covered by the agreement, the Sponsors acknowledge that continued liabilities and responsibilities associated with works of improvement may exist beyond the evaluated life.

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

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

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

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

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

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

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

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

Certification:

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

- (1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition.
- (2) Establishing an ongoing drug-free awareness program to inform employees about:
 - (a) The danger of drug abuse in the workplace;
 - (b) The grantee's policy of maintaining a drug-free workplace;
 - (c) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.
- (3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1).
- (4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee must:
 - (a) Abide by the terms of the statement; and
 - (b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than 5 calendar days after such conviction.
- (5) Notifying the NRCS in writing, within 10 calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice must include the identification numbers of each affected grant.
- (6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4)(b), with respect to any employee who is so convicted:
 - (a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
 - (b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

- (7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6).
- B. The Sponsors may provide a list of the sites for the performance of work done in connection with a specific project or other agreement.
- C. Agencies will keep the original of all disclosure reports in the official files of the agency.

18. Certification Regarding Lobbying (7 CFR Part 3018).

- A. The Sponsors certify to the best of their knowledge and belief, that:
 - (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
 - (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned must complete and submit Standard Form LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
 - (3) The Sponsors must require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients must certify and disclose accordingly.
- B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by U.S. Code, Title 31, Section 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

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

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

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

20. Clean Air and Water Certification.

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

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

- B. The project sponsoring organizations signatory to this agreement agree as follows:

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

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

- (1) The term “Air Act” means the Clean Air Act, as amended (42 U.S.C. Section 7401 et seq.).
- (2) The term “Water Act” means Federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et seq.).
- (3) The term “clean air standards” means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in section 110 of the Air Act (42 U.S.C. Section 7414) or an approved implementation procedure under section 112 of the Air Act (42 U.S.C. Section 7412).
- (4) The term “clean water standards” means any enforceable limitation, control, condition, prohibition, standards, or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. Section 1342), or by a local government to assure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. Section 1317).

- (5) The term “facility” means any building, plan, installation, structure, mine, vessel, or other floating craft, location or site of operations, owned, leased, or supervised by a sponsor, to be utilized in the performance of an agreement or subagreement. Where a location or site of operations contains or includes more than one building, plan, installation, or structure, the entire location will be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

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

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

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

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

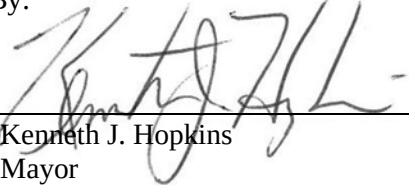


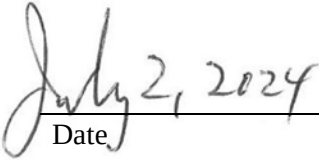
23. Signatures.

CITY OF CRANSTON

869 Park Avenue
Cranston, RI 02910

By:


Kenneth J. Hopkins
Mayor


Date

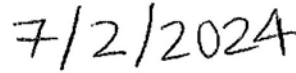
TOWN OF JOHNSTON

1385 Hartford Avenue
Johnston, RI 02919

By:



Joseph M. Polisen, Jr.
Mayor

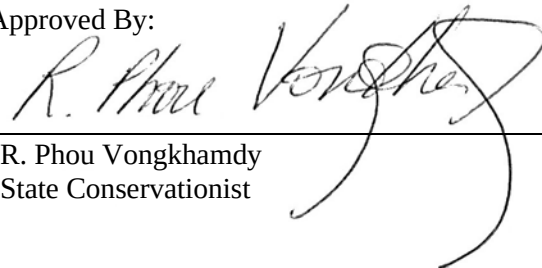

Date

U.S. DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

60 Quaker Lane, Suite 40
Warwick, RI 02886

Approved By:


R. Phou Vongkhamdy
State Conservationist


Date



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SECTION 1

SUMMARY

Project Name: Pocasset River Flood Damage Reduction Project

County: Providence

State: Rhode Island

Sponsors: City of Cranston, RI
Town of Johnston, RI

Purpose and Need:

The Pocasset River floods portions of the Town of Johnston and the City of Cranston, with flooding becoming more frequent and wide spread in recent years. Property damages are recurrent and costly where severe flooding occurs. Recognizing this, the affected municipalities and NRCS embarked on the Pocasset River Watershed Project in 2001. This project, funded under the authority of the Watershed Protection and Flood Prevention Act (PL 83-566), requires the preparation of a Watershed Plan and Environmental Impact Statement (Plan-EIS). The Watershed Plan is a combined planning document and Environmental Impact Statement (EIS) for the project. This Watershed Plan/Environmental Impact Statement (Plan-EIS) documents the extent of the flooding problems, identifies potential/preferred measures, evaluates potential measures to alleviate property flooding, and assesses the environmental impact of the proposed flood control measures. The purpose of the project is to reduce flood damages resulting from the Pocasset River in High Hazard Areas not built to withstand high hazard conditions in the Town of Johnston and the City of Cranston for magnitudes up to and including the one-percent annual-chance (100-yr recurrence) flood event.

The major flooding-related problems include damage to residential, commercial and industrial properties, damage to roads and bridges, and increase in local government cost, due to infrastructure repair and disruption to the local economy. Other losses include decreased property value in flood prone areas and loss of potential sites for commercial and industrial development. Average annual damages from flooding exceed \$3.2 million, affecting 432 residential properties (individual homes and apartment dwelling units) and 49 commercial/industrial sites. Flooding impacts the health and safety of residents in inundated areas, by limiting the access of emergency vehicles. The area's surface and groundwater resources are also impacted from flooded on-site septic systems and sewer systems.



Resource Information:

- **100-Year Floodplain size:** 1.5 square miles
- **100-Year Floodplain Land Use (Acres):**

High Density Residential	31	3.20%
Medium-High Density Residential	20	2.07%
Medium Density Residential	8	0.86%
Commercial	44	4.56%
Commercial/Industrial Mixed	5	0.56%
Industrial	39	4.00%
Institutions and Cemeteries	39	4.02%
Developed Recreation	24	2.50%
Waste Disposal	4	0.42%
Power Lines	8	0.81%
Transitional and Brush Land	35	3.59%
Agricultural	11	1.15%
Vacant Land	2	0.17%
Forest	350	36.04%
Wetland	86	8.87%
Water	264	27.17%
TOTAL	971	100%

Watershed size: 20.6 square miles

- **Watershed Land Use (Acres):**

High Density Residential	960	7.28
Medium-High Density Residential	1,780	13.50
Medium Density Residential	1,222	9.27
Commercial	710	5.38
Industrial	507	3.84
Institutions and Cemeteries	406	3.07
Developed Recreation	167	1.27
Waste Disposal	587	4.45
Mine or Quarry	68	0.52
Roads	400	3.03
Power Lines	83	0.63
Transitional and Brush Land	182	1.38
Agricultural	723	5.48
Forest	3,630	27.53
Wetland	1,363	10.34
Water	400	3.03
TOTAL	13,188	100%

- **Land ownership:** 97% Private, 3% State-Local, 0% Federal
- **Number of farms:** 15
- **Average farm size:** 46 acres
- **Prime and important farmland:** 990 acres in watershed.
- **Number of minority farmers:** 15
- **Number of limited resource farmers:** 75
- **Project Beneficiary Profile**

<u>Characteristic</u>	<u>Johnston</u>	<u>Cranston</u>	<u>Rhode Island</u>
Population of 65 ¹	20.5%	16.2%	15.8%
Per Capita Income ²	\$32,166	\$30,553	\$31,904
Median Home Value ³	\$209,400	\$212,200	\$238,200

Source: 2012-2016 American Community Survey 5-Year Estimates.

- **Land use changes:** Minimal - The project would result in a total of approximately 48 acres of land use change. Detail provided in Section 6.1.1 of Watershed Plan-EIS
- **Environmental values changed or lost:** Approximately 38.5 acres of wetland/vegetated floodplain area created
- **Issues to be resolved:** There are no known issues to be resolved



Project Location:

Specific areas along the Pocasset have been the sites of considerable flooding during wet weather events (see Figure 2-2 for locations of critical flooding areas within the watershed). High hazard areas are based on consideration of depth and velocity of flood flows and resulting appropriate flood proofing measures adopted by the Local Sponsoring Organization (Cranston and Johnston). The following areas have been identified as high hazard areas, and are not built to withstand high hazard conditions and are therefore considered for flood damage reduction:

- Rotary Drive,
- South Bennett Drive,
- Simmons Brook Culvert,
- Fletcher Drive,
- Reservoir Avenue,
- Riverview Terrace,
- Willow Brook Apartments,
- Second Mill Street Bridge,
- Morgan Avenue Bridge,
- Morgan Mill Road Bridge,
- Plainfield Street Bridge,
- Reservoir Avenue Bridge, and
- Garden City Bridge.

Other problem areas of flooding do exist upstream of the areas mentioned above, but do not meet the criteria for high hazard area. The Town of Johnston is currently examining flood damage reduction strategies for areas not considered to be high hazard including: Atwood Avenue in Johnston, where the Pocasset crosses under the roadway; FM Global office park at the corner of Central Avenue and Atwood Avenue, where the Dry Brook discharges into the Pocasset River; and, the Second Mill Street Bridge, where Simmons Brook jumps its banks.

Description of Preferred Alternative:

The Preferred Alternative addresses the repeated flooding that prevails along portions of the Pocasset River during localized 25 and 50-year rainfall events and watershed size 100-year rainfall events, and the associated property damages that result. The Preferred Alternative includes the following activities:

- The installation of sheet pile floodwalls along two sections of the Pocasset River, totaling approximately 2,400 feet in length, including associated interior drainage infrastructure (pumping stations and detention ponds).
- The acquisition of approximately 140 properties located within the 100-year floodplain and demolition of structures located on the properties, totaling 134 structures.
- Dry-floodproofing 25 structures
- Installation of bypass culvert along Simmons Brook
- Removal of a debris dam in the Pocasset River.

The flood damage reduction measures to be installed at each High Hazard Area are summarized as follows.

Rotary Drive: The Preferred Alternative will include acquisition of 17 properties located within the floodplain in this neighborhood and the restoration of the topography to a floodplain area.

South Bennett Drive: The Preferred Alternative will include the acquisition of the Park Place Apartment Complex and 27 other lots that include 28 buildings and the restoration of the acquired land to a floodplain area and dry-floodproofing of 9 structures.

Simmons Brook Bypass Culvert: The Preferred Alternative will include construction of a bypass culvert around the Mill building under which the Simmons Brook currently flows.

Fletcher Avenue: The Preferred Alternative will include acquisition of 41 properties located within the floodplain in this neighborhood and the restoration of the acquired land to a floodplain area. Seven (7) structures will be dry-floodproofed. The portion of the Rich Box building that is located within the floodplain in the Town of Johnston has previously been floodproofed and is therefore not included in the plan.

Reservoir Avenue: The Preferred Alternative will include a steel sheet pile floodwall of approximately 1,210-feet long and up to 11 feet in height from the Pocasset River stream crossing at Reservoir Avenue to an upland area along Knollwood Avenue. Several structures are located riverward of the proposed floodwall and are proposed to be acquired, including properties owned by Forest Hill Nursery (City of Cranston Plat 9, Lots 3497, 3208, and 3455) and several single-family homes located on Knollwood Avenue. The acquired property could be converted into recreation fields. A pump station collection system will be required.



Riverview Terrace: The Preferred Alternative will include acquisition of 39 properties located within the floodplain in this neighborhood and the restoration of the acquired land to a floodplain area.

Willowbrook Apartments: The Preferred Alternative will include a steel sheet pile floodwall that will be approximately 1,200 feet long, with an average height of 9 feet, and a pump station collection system for interior drainage.

Morgan Avenue Bridge, Morgan Mill Road Bridge, Plainfield Street Bridge, Reservoir Avenue Bridge, and Garden City Bridge: Modeling simulations were conducted in which these five structures were removed to simulate the effects of the removal of potential constraints to flood flows. Results suggested that the structures affect water elevations independently of each other and effects of constraint removal were minimal downstream. Benefits from bridge/culvert modification are low compared to the high cost of bridge/culvert construction and because of this, potential measures involving modifications to the bridges described above were not pursued further. See Section 5.1.1, Evaluation of Potential Measures, for more detail on the evaluation of the bridge/culvert modification.

Other Measures: The Preferred Alternative will include debris dam removal near the confluence of the Pocasset River and Simmons Brook. Several structures that are located outside of the high hazard area neighborhoods described above will be dry-floodproofed:

- Area 4 (Figure 6-8) in the Town of Cranston, Plat Number 12, Lots Numbered: 3138, 3140 and 3141.
- Map Area 6 (Figure 6-11) in the Town of Cranston, Plat Number 9, Lots Numbered: 2754, 3466, 3359 and 2694.

Options Considered at Each Project Site:

At each project area, a series of potential measures were evaluated in addition to the No Action Alternative. Measures which were evaluated in formulation of the preferred measures for each site and Preferred Alternative for overall project include:

- Buyout and/or relocation of affected properties,
- Creation of floodway,
- Wetland restoration/creation,
- Dam rehabilitation,
- Sediment removal/channel dredging,
- Constraint removal,
- Dry floodproofing,
- Elevation,
- Earthen berm dike, and
- Floodwalls.

Impacts Analysis and Mitigation:

- *Properties* – The Preferred Alternative includes the demolition of existing industrial, commercial and residential structures and relocation of businesses and people. This is necessary for the protection of life and property and overall public safety. Relocation assistance will be provided to affected property owners as required. Relocations will be accomplished by the Sponsor under the guidelines established in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646). Relocation payments cover incidental costs associated relocations (i.e. moving costs, etc.).
- *Wetlands* - The Preferred Alternative will have no negative long-term impacts on wetlands. In areas where floodplain restoration is proposed, some of these areas may transition to wetlands over time dependent on soil and hydrology features.
- *Floodplains* – The Preferred Alternative will result in the net restoration of approximately 38.5 acres of floodplain. The two proposed floodwalls will result in a loss of 9.5 acres and the acquisition and demolition of structures throughout the watershed will result in 48 acres of restored floodplain area. This lost area (9.5 acres) consists of the area behind the proposed floodwalls that currently flood and are currently urbanized (i.e., occupied by roadways, buildings, industrial activities, etc.). These areas currently have low, if any, habitat value.
- *Wildlife / Threatened and Endangered Species* – Fish and wildlife resources will not be significantly affected by the proposed floodplain alterations, though temporary effects may occur during construction activities. The Pocasset River riparian corridor runs through densely urbanized neighborhoods of Cranston and Johnston, and thus provides the only essential cover, water, and feeding areas for much of the wildlife found in the areas of proposed actions. Removing anthropogenic structures from the floodplain, flood proofing structures that will remain, and restoring floodplain storage will result in net benefits to aquatic and riparian dependent wildlife. When the Pocasset River rises to levels where it floods roads, industrial and commercial properties, and residential properties, hazardous solid wastes, sewage, sedimentation, and other pollutants are indiscriminately discharged directly into the river and deposited downstream. This ongoing problem is likely affecting the quality of fish and wildlife habitat along the river. Temporary effects of proposed construction activities, may temporarily disturb wildlife, but will be significantly offset by the benefits of increasing floodplain functions and values through the proposed actions.

The Rhode Island Department of Environmental Management (RIDEM) Natural Heritage Program indicated only one state-listed endangered species (Purple Clematis (*Clematis occidentalis*), is located in the northern portion of the watershed (Snake Den). This area is located upstream of the project area and RIDEM has determined that flood control measures will have no effect on their population or habitat.

- *Cultural Resources* – Preliminary consultation with the State Historic Preservation Office (SHPO) has identified several project areas that may be of archeological significance. All of these project sites will be further reviewed by NRCS for archeological resources. NRCS will perform file research, reconnaissance surveys, and archeological investigations of the identified project sites, as needed. Additional consultation with SHPO will be completed for each suspected project site as implementation proceeds.
- *Water Quality* - The constructed floodwalls will prevent floodwaters from inundating septic tanks and sewer systems in the critical areas of the project. This will significantly improve water quality within the watershed.
- *Other Project Impacts* – Construction of each flood damage reduction strategy may cause short-term, minor, adverse impacts to air, noise, water quality, and soils at the construction site. These would be short-term beneficial impacts to the local economy from construction job creation. This project complies with the General Conformity Rule for Federal projects in nonattainment air quality regions (ozone in all of Rhode Island). Long-term beneficial impacts of the project include improved surface and groundwater quality.
- *Proposed Mitigation* – Since construction of various flood control structures have the potential to impact the surrounding environment, measures will be incorporated to minimize these impacts. Such measures will include working with the communities and property owners, developing sediment and erosion control plans and stormwater pollution prevention plans, adhering to local codes addressing noise pollution, conducting preconstruction surveys, providing aesthetically compatible floodwall construction, and other necessary measures. No compensatory mitigation is anticipated to be needed.

Project Costs:

The estimated cost of the Preferred Alternative is \$48,455,590 of which \$48,318,090 would come from Public Law 83-566 (PL 566) funds. The project construction is estimated to be completed in 5 years. A yearly schedule of maintenance and repair will need to be followed in order to maintain the system’s effectiveness. Estimated project costs are provided in Table 1-1, below.

Table 1- 1: Summary of Project Costs

PL-566 Component	%	PL 566 Funds	%	Other Funds	Total
Construction for Flood Prevention ¹	100%	\$13,479,700	0%	\$0	\$13,479,700
Technical/ Engineering/ Permitting/ Administration ²	100%	\$2,695,940	0%	\$0	\$2,695,940
Real Property Rights/ Property Acquisition ³	100%	\$32,004,950	0%	\$0	\$32,004,950
Relocation Costs ⁴	50%	\$137,500	50%	\$137,500	\$275,000
Total		\$48,318,090		\$137,500	\$48,455,590

1. Construction for Flood Prevention costs include construction of the floodwalls, demolition, and site restoration plus a 30% contingency.

2. Technical/ Engineering/ Permitting/ Administration costs include engineering consulting firm efforts, processing applications, landowner notifications, travel & transportation costs, salvage sales (if any), processing of closing documents, overhead costs, etc.

3. Real Estate Property Rights/ Property Acquisition includes the cost of purchasing Fletcher Avenue, Rotary Drive, Riverview Terrace, and South Bennett Drive, properties as well as 5% administration fee. Also included in the acquisition fee for construction at Reservoir Avenue.

4. Relocation costs include moving expenses for homeowners. NRCS will provide funding for 50% of relocation costs.

5. Operation and Maintenance costs are not included in the above installation costs, and are summarized in Section 8.

6. Cost values in 2017 dollars.

Project Benefits:

Project benefits in terms of annual cost savings are estimated in Table 1-2, below.

Table 1- 2: Summary of Project Benefits

PL 566 Component	Average Damages Without Project	Percent Damage Reduction with Project
Residential	\$2,381,328	96%
Industrial/Commercial	\$856,960	99%
Total	\$3,238,288	97%

Notes:

1. Flood damage annual equivalent estimates from HEC-FDA model.

2. Cost values in 2017 dollars.

3. Acquisitions result in a 100% reduction of damage.

Summary:

The Preferred Alternative is the least environmentally damaging alternative for providing one-percent annual-chance (100-yr recurrence) flood damage protection. There are no known areas of controversy. The state of Rhode Island, Providence County, the Town of Johnston and the City of Cranston collectively support the project.

SECTION 2

PURPOSE AND NEED FOR FEDERAL ACTION

The Pocasset River floods portions of the Town of Johnston and the City of Cranston, with anecdotal accounts suggesting flooding has become more frequent and wide spread in the last twenty-five years. Property damages are recurrent and costly where severe flooding occurs. Recognizing this, the affected municipalities and NRCS embarked on the Pocasset River Watershed Project in 2001.

Newspaper reports and personal accounts from local residents show that flooding in the Pocasset River Watershed has been a problem since the 1950's. "The Great Flood of '79" occurred on January 31, 1979 and is recorded to have caused flood damages in excess of \$900,000, with Fletcher Avenue being one of the hardest hit sections of the City of Cranston. The Fire Department had to respond to over 250 water emergencies. In 1982, a storm of slightly less than six inches of rainfall caused some of the most serious flooding in the history of the City of Cranston. Having incurred 1.5 million dollars of flood damages within the City, the then Governor J. Joseph Garrahy declared Cranston to be a disaster area. In March 2001, two significant flood events occurred within a ten-day period. Storm events in 2005 and most recently in December of 2008; have also caused substantial flood damages.

The major flooding-related problems include damage to residential, commercial and industrial properties, increase in local government cost, and damage to roads and bridges. Other losses include decreases in potential sites for commercial and industrial development. Average annual damages from flooding exceed \$3.2 million, affecting 432 residential dwelling units (individual homes and apartment dwelling units) and 49 commercial and industrial properties.

This project, funded through the Watershed Protection and Flood Prevention Act (PL 83-566), requires the development of a Watershed Plan (WP). The Watershed Plan documents the sponsoring local organization decisions and serves as the Environmental Impact Statement (EIS) for the project. This Watershed Plan/Environmental Impact Statement (Plan/EIS) documents the extent of the flooding problems, identifies potential/preferred measures, evaluates alternatives to alleviate property flooding, and assesses the environmental impact of the proposed flood control measures.

- The Watershed Plan and Environmental Impact Statement for the Pocasset River Flood Damage Reduction Project are combined into this single document. The purposes of the Project are to prevent flooding within the critical areas of the watershed and simultaneously protect lives and property. The critical areas of the watershed are considered to be:
 - o Rotary Drive
 - o South Bennett Drive
 - o Simmons Brook Culvert
 - o Fletcher Drive (including the Rich Box Company)
 - o Reservoir Avenue
 - o Riverview Terrace
 - o Willowbrook Apartments

2.1 Floodplain Management Study

The Pocasset River Floodplain Management Study was completed in 2007 and released in 2008. The study provided the baseline for the technical work relied upon in this Plan-EIS. It sets forth the current and future conditions related to flooding in the Pocasset River Watershed. All hydrology, hydraulics and watershed modeling were conducted in this phase of the project. As part of the study, damage reach maps were developed that provide a simple tool for property owners to determine if their property will flood and the frequency of each occurrence.

2.2 Summary of Hydrology/Hydraulics Model

The NRCS completed a comprehensive investigation of both the existing and potential flooding conditions within the Pocasset River watershed through the development of two computer simulation models. TR-20 was used to calculate direct runoff produced from various wet weather events and to route this runoff through the various streams and reservoirs through the watershed. HEC-RAS was used to estimate surface water profiles, and in turn, estimate flooding caused by rainfall events. Floodplain maps and flood damage reduction strategies were developed using a 100-year, 24-hour duration storm for the region (7.0 inches over 24 hours with a SCS Type III rainfall distribution). Alternatives were developed that would maximize flood damage reductions using the 100-year flood conditions based on the existing “Comprehensive Land Management Plans” for the Town of Johnston and City of Cranston. The 100-year flood was selected in the formulation process because it is consistent with the communities’ objectives. Using the 100-year storm event addresses the criteria used in the National Flood Insurance Program, Federal Emergency Management Agency programs, and flood plain ordinances. The Natural Resources Conservation Service interim standard “Flood-Proofing Measure” being reviewed by the RI Emergency Management Agency is based on the 100-year event.

A third computer simulation model, HEC-FDA, was used to estimate the average annual damages from flooding, which were used to evaluate cost/benefit ratios for the various scenarios. Further discussion about model development can be found in Appendix D, Investigations and Analyses Report.

2.3 Watershed Problems and Opportunities

This section discusses the problems that need to be solved and the opportunities that these problems present. Some problems have a quantifiable dollar amount associated with them, such as flood damages. Other problems and opportunities do not have quantifiable dollar damages, but an identified need or opportunity exists to increase the quality and/or quantity of a resource.

Previous floodplain studies have been conducted in parts of the Pocasset Watershed but a comprehensive watershed analysis had not previously been performed. Upon receiving federal funding in 2001, the start of the Pocasset Floodplain Management Study marked the start of NRCS involvement to provide solutions to the flooding and its associated damages.

2.3.1 Flooding Problems

The Pocasset River Watershed is located in a highly urban area. Flooding of commercial and residential properties occurs whenever 10, 25 and 100-year rainstorm events occur within the watershed. Increasing development over the years has increased the frequency and severity of the flooding. The major flooding problems that have been identified are: loss of property values, property damages to commercial and residential properties and increased costs to local government due to repairs required to impacted roads and bridges. The purpose of the Pocasset River Flood Prevention Project is to prevent floodwaters from inundating the properties within the critical areas of the watershed and eliminate the property damages incurred. The critical flooding areas are identified as follows: Rotary Drive, South Bennett Drive and Simmons Brook Mill are the three critical flooding areas located within the City of Johnston. Fletcher Avenue, Reservoir Avenue, Riverview Terrace and Willow Brook Apartments are the critical flooding areas within the City of Cranston.

The planned floodwalls and related flood prevention measures will reduce flood damages by an estimated 97%. Table 8-9 (Estimated Average Annual Flood Damage Reduction Benefits) provides a breakdown of residential and commercial damage reductions; total annual average damages from flooding without project are approximately \$3,238,288. Opportunities exist for flood damage reduction with the watershed; the desired future condition is a significant reduction in flood damage reduction in the watershed.

The severity, duration, and frequency of flooding within the Pocasset River watershed have apparently increased over the past 20 years to a point where, in March of 2001, two significant flood events occurred within a ten day period. The two storms occurred on March 21 and March 30 and had rainfall amounts of 3.11 and 2.88 inches, respectively, as measured at the T.F. Green Airport in Warwick, RI. Appendix F contains photographs of these and other precipitation events that illustrate the severity of the flooding.

Figure 2-2 provides a visual depiction of specific areas within the watershed along the Pocasset that have experienced considerable flooding during wet weather events. The number of documented flooding episodes has become increasingly more common over the years (Flood Plain Management Study, 2006), probably due to the increased imperviousness of the watershed. High Hazard Areas were determined by the Local Sponsoring Organization (Cranston and Johnston), based on the flood proofing measures adopted by the Local Sponsoring Organization.

High Hazard Classification, according to the Local Sponsoring Organization (Cranston and Johnston), is based on a consideration of depth and velocity of flood flows. Areas of floodplain where depth is greater than 3 feet, velocity of floodwater is greater than 5 feet per second, or where the product of the depth and velocity exceeds 7, are included in High Hazard Areas. To be considered a High Hazard Area, the area must be used for overnight occupation. High Hazard Areas were targeted to evaluate opportunities to provide flood protection.

Under normal flow conditions the Pocasset slowly meanders through a number of culverts and roadway bridge openings. During periods of high flows, these features serve to effectively limit flow causing water to back up, creating upstream flood conditions and considerable property damage. There are several sites where existing building foundations are immediately adjacent to the bank of the river, defining the channel banks; thereby impeding overbank flows.

For the scope of this project, the following areas have been identified as High Hazard Areas and are considered for flood damage reduction:

- Rotary Drive
- South Bennett Drive
- Simmons Brook Culvert
- Fletcher Drive
- Reservoir Avenue
- Riverview Terrace
- Willowbrook Apartments
- Morgan Avenue Bridge
- Morgan Mill Road Bridge
- Plainfield Street Bridge
- Reservoir Avenue Bridge
- Garden City Bridge

In terms of numbers of impacted buildings, in the South Bennett Drive project area, there are in excess of 32 residential properties that can be impacted during a flood event. The Park Place Apartments consists of 78 low-income residential units where the lower units experience severe flooding and emergency access is severely curtailed during large storm events. Note that additional isolated areas (individual homes, small groups of homes, etc) have also been identified as High Hazard Areas and are considered for flood damage reduction.

In the South Bennett Drive and River Drive neighborhoods, the 2001 floods caused significant damages to homes. Immediately upstream, at the Morgan Mill Road Industrial Park, flooding occurred during the 2001 floods, but no damage occurred due to previously completed stream bank stabilization projects that repaired damages following flooding in 1999. Flooding at Riverview Terrace, Davis Court, and Autumn Street causes damage to buildings resulting in high cleanup costs and loss of personal belongings from residential properties. The repeating nature of flooding issues in these areas has resulted in decreased property values.

The most severe flooding (both in magnitude and recovery efforts) occurs on Fletcher Avenue in Cranston. The area is a mixture of industrial, commercial, and residential properties. This area sustains some of the highest losses due to flooding in the Pocasset watershed. Losses include property damage, temporary loss of housing, loss of business, loss of wages, and loss of development potential. There are thirty-two commercial and industrial properties affected during a typical flooding event in this area.

Other problem areas of flooding do exist upstream of the areas mentioned above. Street flooding occurs on Atwood Avenue in Johnston, where the Pocasset crosses under the roadway. The Town of Johnston is currently examining flood damage reduction strategies in this area. Flooding also occurs at the FM Global office park at the corner of Central Avenue and Atwood Avenue, where the Dry Brook discharges into the Pocasset River. There are eleven properties that were flooded during recent large storm events, including a commercial development, which contains a supermarket, a commercial storefront, and several restaurants. Economic losses in this area have included a reduction in business, increased police and fire protection costs, and direct property damage. Figure 2-2 shows the Watershed and identifies areas of major flooding. Table 2-1 provides a summary of 24-hour 100-year flood event damages with and without protective measures of the project.

Table 2- 1: Summary of 24-Hour, 100-Year Damages With and Without Project

Type	Number Damaged	Without Project (Dollars) ²	With Project (Dollars) ²	Reduction	Percent Reduction
Residential ³	432	2,888,276	5,456	2,882,820	100%
Commercial/Industrial/Public	49	2,767,331	0	2,767,331	100%
Totals	481	5,655,608	5,456	5,650,152	100%

1. Above figures are for a storm which has a 1-percent chance of being equaled or exceeded in a given year. This table does not include buildings flooded above the 1-percent chance event.

2. Damages adjusted to 2017 values.

3. Relocation costs include moving expenses for homeowners. NRCS will provide funding for 50% of relocation costs.

2.3.2 Flood Damage Reduction Opportunities

High Hazard Areas were targeted to evaluate opportunities to provide flood protection. Each area where flood damage reduction was considered presents a site specific set of feasible alternatives that reflect opportunities and constraints particular to that site. Sections 5 and 6 provide a description of the general alternatives considered for flood damage reduction, as well as those that were removed for consideration and the rationale for removal. Site specific alternatives analysis was also conducted, the details of which are provided in Section 6.13.

2.4 Description of Study Areas

The Pocasset River is located in the southeast corner of Providence County, Rhode Island as shown in Figure 2-1. For the purposes of this plan, the affected area includes the entire 20.6 sq. mi. of the Pocasset River Watershed. There are three municipalities located in the watershed, all having independent governing bodies: the Town of Johnston, the City of Cranston, and the City of Providence. The majority of the watershed is located within the Town of Johnston (70%); the City of Cranston comprises 29% of the watershed, while the City of Providence contains less than 1% of the total watershed area. Flooding is confined to the Town of Johnston and the City of Cranston and areas immediately adjacent to those boundaries. The Pocasset River meanders through a mix of urban, suburban, and rural lands from its headwaters in Johnston to its terminus in the City of Cranston, where it flows into the Pawtuxet River. The Pocasset River originates in the largely undeveloped northwest portion of the Town of Johnston and follows a meandering course, flowing southeast through Johnston and Cranston, until converging with the Pawtuxet just southeast of Pontiac Avenue, approximately 8 miles from its headwaters. The river flows through four large lakes, the Cranston Print Works Pond, an unnamed pond at Factory Mutual Global office park, and the Upper and Lower Pocasset Ponds at Johnston Memorial Park. There are two major tributaries of the Pocasset; Dry Brook, and Simmons Brook. Figure 2-2 provides a view of the watershed and several landmarks.

A total of 481 residential/commercial properties (homes, apartment dwelling units, businesses) are impacted by flooding. Four hundred seventy three (473) of these are located in the major project sites are described below. The remaining eight (8) properties are in areas outside of the major project sites. The following is a brief description of each major project site, beginning at the most upstream area and proceeding downstream. Note that all sites, except as otherwise noted, directly abut the Pocasset River.

- **Rotary Drive:** A residential neighborhood in Johnston located off Atwood Avenue, approximately 800 feet south of the intersection of Atwood Avenue and Central Avenue. Nineteen (19) residential homes are impacted by flooding in this neighborhood. Approximately four years ago, the Town of Johnston installed a new sanitary sewer line and pump station at Rotary Drive at considerable expense.
- **South Bennett Drive:** This site includes residential homes, apartment units (Park Place), and a light industrial business. Park Place Apartments is a low income housing apartment complex, located off Atwood Avenue, approximately 0.5 mile north of the intersection of Atwood Avenue and Plainfield Street. The complex contains 78 individual dwelling units impacted by flooding. Directly across the Pocasset River (to the east) is the South Bennett Drive neighborhood, including River Drive and River Avenue. Collectively, the South Bennett Drive Neighborhood contains 34 residential homes and 9 commercial structures, including a wood truss manufacturing business, impacted by flooding.
- **Simmons Brook Culvert:** A large mill building is located on the Simmons Brook, a tributary of the Pocasset River, along Mill Street in Johnston, approximately 500 feet west of the intersection of Mill Street and Plainfield Street. Currently Simmons Brook runs through a raceway culvert in the Mill building's basement that is overwhelmed when the Pocasset River runs high, flooding the lower floor. An additional 3 residential homes are also impacted during flood conditions.
- **Fletcher Avenue:** An industrial area located in Cranston near the intersection of Plainfield Street and Atwood Avenue. Twenty four (24) commercial and light industrial buildings and 20 residential homes directly abut Fletcher Avenue, on the south side of the Pocasset River are affected.
- **Rich Box Company:** A large mill (referred to as the Rich Box Company), which manufactures cardboard boxes, is located off Plainfield Street in Johnston, across the Pocasset River (to the north) of Fletcher Avenue. This property is eligible for listing on the National Register of Historic Places.
- **Reservoir Avenue:** A commercial/residential area in Cranston, located near the intersection of Reservoir Avenue and Delway Road. Approximately 11 commercial buildings and 3 residential homes directly abut the Pocasset River in this location.

- **Riverview Terrace:** Includes Davis Court and Autumn Street. Riverview Terrace is a residential neighborhood in Cranston, located to the northwest of the intersection of Pontiac Avenue and Fordson Avenue. Approximately 24 apartment dwelling units and 54 residential homes are located in this general area.
- **Willowbrook Apartments:** A one hundred and ninety two (192) residential dwelling unit complex located 350 feet southwest of the intersection of Pontiac Avenue and Fordson Avenue is impacted by flooding; it is directly down river of the Riverview Terrace project site. The complex has both a swimming pool and a tennis court.

2.5 NEPA Requirements

Through the process described in this Plan-EIS, and with support from local and state agencies, NRCS has developed a series of projects that will meet the need, the agency is responding to flood damage reduction in the Pocasset River Watershed. All of these projects have received an analysis to ensure that they are feasible and are capable of providing the flood damage reduction benefits sought through this project. In addition, the EIS discloses impacts of the proposed project.

This Watershed Plan was prepared in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations (40 CFR 1500-1508). NEPA requires that federal agencies evaluate the impacts of projects or programs that have the potential for significant impact to the environment. The environment includes the natural environment (e.g. wetlands, water quality, and wildlife) and the man-made environment (e.g. population, housing, land use).

Public Law 83-566 requires Congressional committee approval for all projects with Federal construction assistance exceeding \$25 million. An EIS is required for all projects that receive such approval and because the Federal financial assistance for this project exceeds \$25 million, an EIS is required.

The general procedures for NRCS programs for compliance with NEPA are in 7 CFR 650, Secretary's Memorandum 1695 (as supplemented), Protecting and Improving the Quality of the Environment, and 7 CFR 3100 further implement the provisions of NEPA.

Furthermore, the NRCS National Watershed Program Manual (2009) provides a framework for integrating Watershed Plans and NEPA requirements into a single joint document. It is this framework that is used for this report.



2.6 Organization of the Plan-EIS

This Plan-EIS follows the format recommended for such documents in the NRCS National Watershed Manual. NRCS developed this format to meet the water resources planning requirements of Public Law 83-566 and the environmental analysis required by NEPA. The elements of the Plan-EIS are:

<u>Section</u>	<u>Description</u>
1. Summary	A brief version (i.e., Executive Summary) of the plan, suitable for use at meetings and presentations to describe the project
2. Purpose and Need for Federal Action	An overview of the Pocasset River Flood Damage Reduction Project with a brief history of the Pocasset River Watershed, study areas, and NRCS and NEPA policies pertinent to the Plan-EIS
3. Scope of the EIS	A summary of concerns raised in the scoping process required by NEPA
4. Affected Environment	A description of the physical, social, cultural, and economic conditions in the Pocasset River Watershed that are pertinent to the project
5. Alternatives	A description of the rationale of plan formulation, from the development and comparison of alternatives to the selection of the preferred alternative
6. Environmental Consequences	A summary of the preferred alternative, including descriptions of the projects selected for implementation and the purposes achieved by those projects in compliance with Public Law 83-566
7. Consultation, Coordination, and Public Participation	Documentation of the opportunities provided to the public for participating in the planning process from the initial request for NRCS assistance to the preparation of the final plan
8. The Preferred Alternative	A compilation of the diagnostic and design drawings depicting the specific project areas and preferred alternative elements
9. References	A list of references used to prepare the portions of the Plan-EIS
10. List of Preparers	A list of the primary preparers of the Plan-EIS and their credentials
11. Index	A list of key terms and the Section in which they are discussed

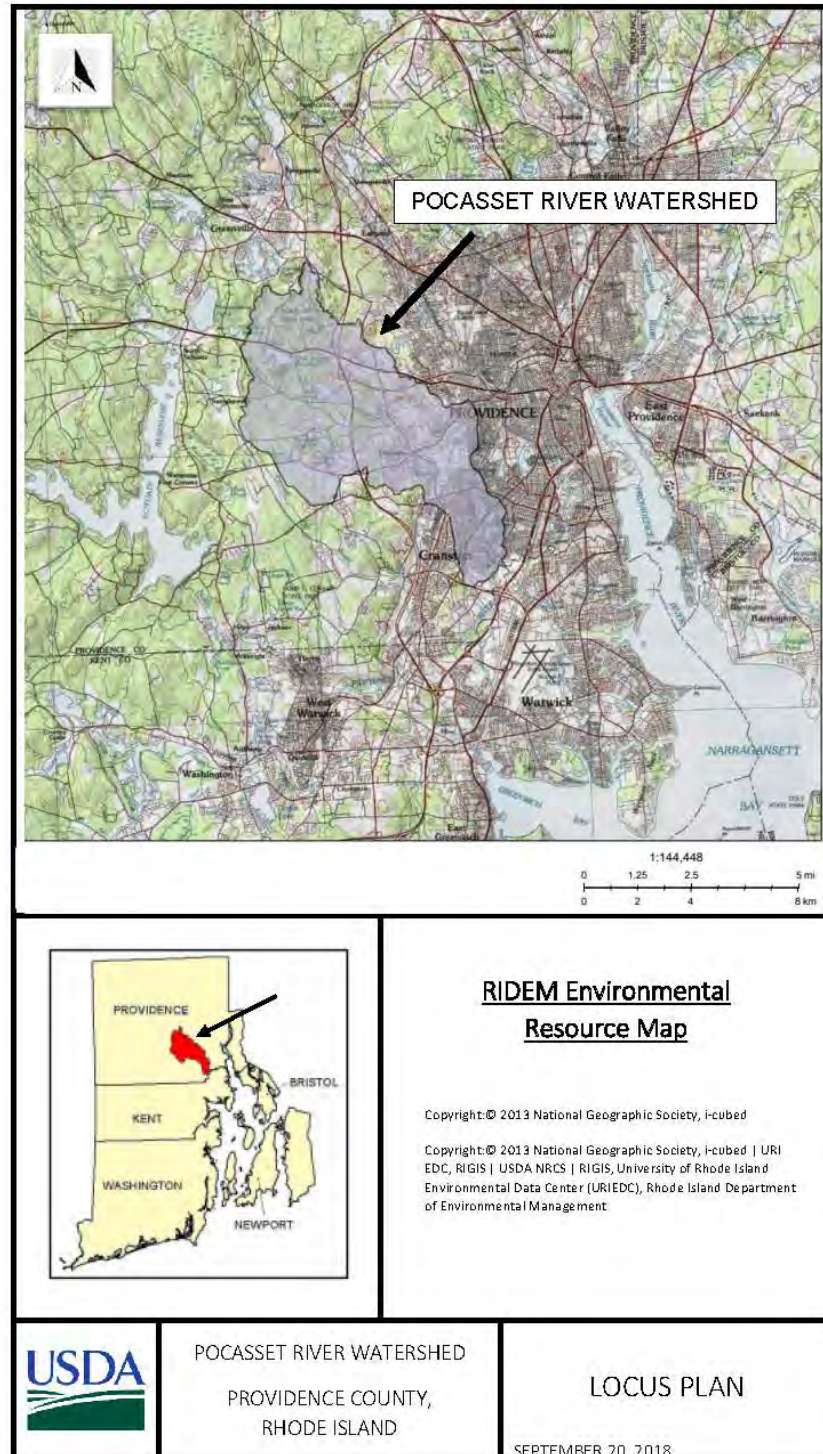


Figure 2-1: LOCUS PLAN

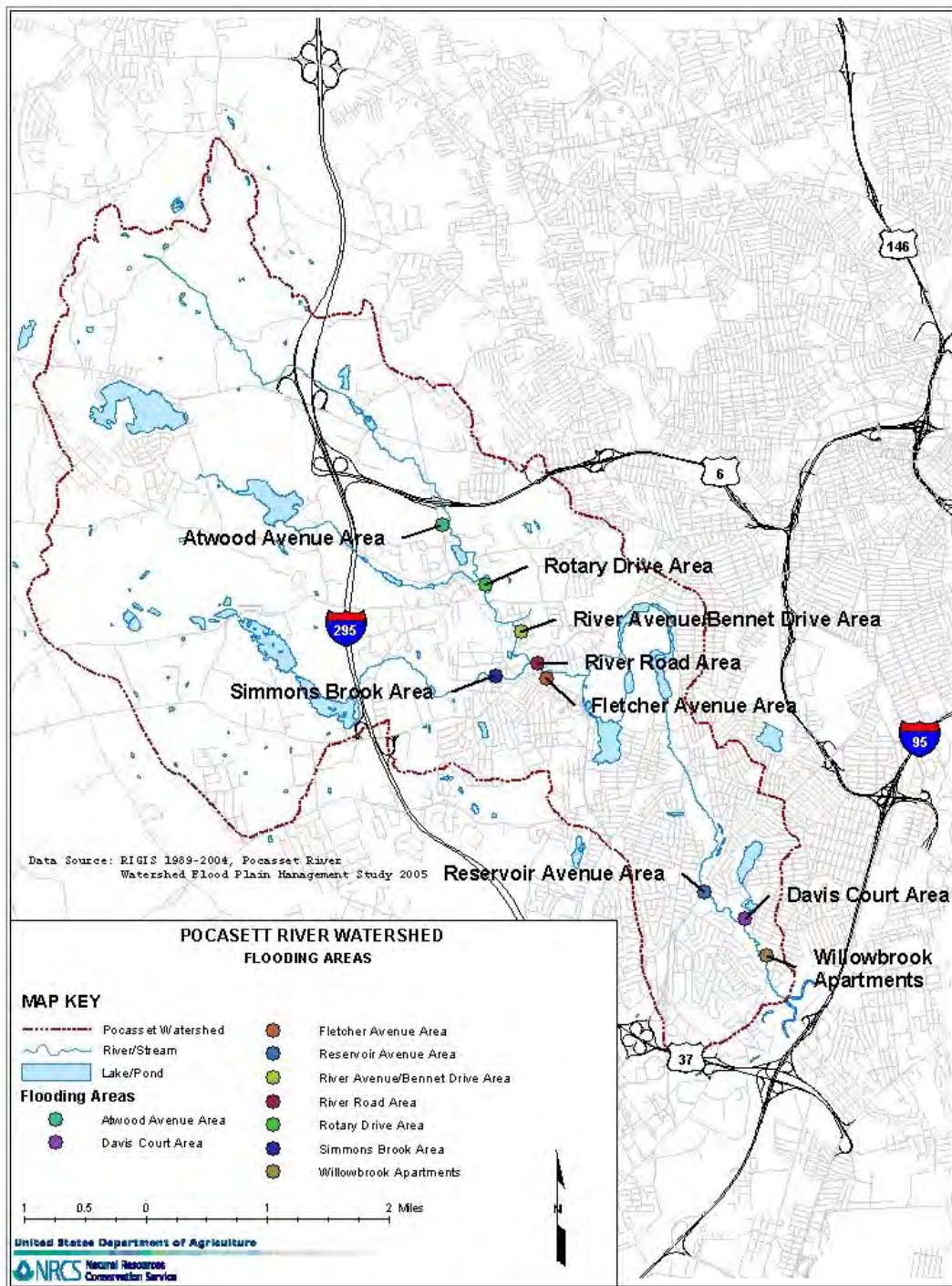


Figure 2-2: Locations of Flooding Areas within the Pocasset River Watershed

Note: See Figures 9-1 through 9-15 in Appendix C for detailed maps for flooding areas contained in the Preferred Alternative (Rotary Drive, South Bennet Drive, Fletcher Avenue, Reservoir Avenue, Riverview Terrace, Willowbrooks Apartments, and Simmons Brook).

SECTION 3

SCOPE OF EIS

NRCS conducted a scoping process to identify concerns of the public, state and local governments, and federal, state, and local agencies, and to meet NEPA requirements for public participation. The first meetings between the NRCS and the Sponsors (Town of Johnston and the City of Cranston) to discuss funding through Public Law 83-556 (the Watershed Protection and Flood Prevention Act) for flood damage reduction in the Pocasset River Watershed were held in 2000. In March of 2005 the Pocasset River Steering Committee met to discuss flooding issues along the Pocasset River. The Committee consisted of residents, federal, state, and local elected officials and their representatives, and representatives from federal, state, and local agencies, including U.S. Army Corps of Engineers, the Environmental Protection Agency, Rhode Island Department of Environmental Management, the Federal Emergency Management Agency, and the Rhode Island Emergency Management Agency. The Committee's role has been to represent the interests of the public during development of the Plan-EIS. In addition to meeting with the steering committee, NRCS has met individually with local officials, congressional staff, other regulatory agencies, and citizens whose homes and businesses are affected by flooding in the Pocasset River Watershed.

Rhode Island NRCS published the notice of intent to prepare an EIS in the Federal Register on July 10, 2009. NRCS held a public meeting on February 20, 2013 at the Cranston Senior Center to seek public input on the Plan-EIS; after NRCS gave an introduction to the project, local citizens and local government officials provided comments.

The concerns identified by the public are listed in Table 3-1 along with concerns that NRCS is required to address through the NEPA process. The 'Degree of Concern' is a relative ranking of the importance attached to the concern by the public, measured by the depth of discussion. The degree of significance is a relative ranking by NRCS of the issues that are important for defining the problems or formulating and evaluating alternative solutions. In rating the 'Degree of Significance', NRCS considered that the purpose of the current plan is flood protection. Concerns that are rated high or moderate in significance are discussed in further detail in this Plan-EIS.



Table 3- 1: Evaluation of Identified Concerns

Economic, Social Environmental, and Cultural Concerns	Degree of Concern ¹	Degree of Significance to the Decision Making ²	Comments	Section of Watershed Plan-EIS where concern is discussed
Water Resource				
Flooding/Surface Water- Water Quantity	High	High	Average Annual Damages of \$2,074,580 Damage Area of 1,000 Acres (Flood Plain) Potential for Loss of Life; Primary Concern of Sponsors	2, 3.7.1, 4, 6.3.7.1
Pocasset River Water Quality	Medium	Medium	Contamination from inundated septic and sewer systems	3.7.1, 6.3.7
Groundwater	Low	Low		3.7.2, 6.3.7.2
Land Resources				
Land Use	Low	Low		3.1.1, 6.3.1.1
Topography, Geology, and Soils	Low	Low		3.6, 6.3.6
Swampbuster	Low	Low		3.6.1, 6.3.6.1
Prime and Important Farmland	High	Low	Evaluated for all NRCS Projects, Not Affected by this Project	3.1, 6.3.1
Highly Erodible Cropland	High	Low	Evaluated for all NRCS Projects, Not Affected by this Project	3.6, 6.3.6
Air Resources				
Air Quality	High	Low	Rhode Island in moderate non-attainment area for 8- hour ozone national ambient air quality standard; analysis required under Clean Air Act	3.5, 6.3.5
Climate	Low	Low		3.5, 6.3.5
Visual Resources				
Aesthetics	High	Low	Aesthetics related to construction of floodwalls	3.3, 6.3.3
Biological Resources				
Fish Habitat	Low	None	Only Incidental Work to Occur in Water Bodies	3.9, 6.3.9
Wildlife Habitat	Low	Low	Project Area Generally Urban	3.9, 6.3.9
Wetlands	Moderate	Moderate	Little to no Impacts; Analysis of Effects Required by Clean Water Act and Executive Order 11990	3.7.3, 6.3.7
Rare, Threatened, and Endangered Species	High	Low	None Known to be Present in project area; Analysis Required by Endangered Species Act	3.9, 6.3.9.2
Loss of Flood Plain	Moderate	Moderate	Concern over possible downstream impacts of lost flood plain, i.e. loss of flood storage	3.7.3, 6.3.7.3
Socio-Economic and Cultural Resources				
Cultural and Historic	High	Moderate	Analysis of Effects Required by National Historic Preservation Act, Discussed in Detail in WP/EIS	3.4, 6.3.4
Human Health and Safety	High	High	Flooding with Threat to Cause Loss of Life; Primary Concern of Sponsors	3.2, 6.3.2
Demographics/Environmental Justice	Moderate	Moderate	Compliance with EO 12898	3.1.2, 6.3.1.2
Economic	High	High	Flood Damages; Primary Concern of Sponsors	3.1.3, 6.3.1.3
Utilities	Low	Low		3.8, 6.3.8
Energy	Low	Low		3.10, 6.3.10

Table 3- 2: Summary of Scoping

• REQUIRED CONCERNS	• USEFUL IN PLANNING
• Air quality; identify environmental air quality standards potentially related to the project	• Current productivity
• Coastal zone management areas	• Damage costs
• Coral reefs	• Enterprise input costs
• Cultural/historic properties	• Identify environmental reviews and consultation requirements of the project
• Ecological critical areas	• Geology
• Environmental justice	• Identify environmental assessments or impact statements that are being prepared or will be prepared that are related to the current project but not part of the scope of the current project assessment or EIS.
• Fish and wildlife resources	• Identify environmental reviews and consultation requirements of the project
• Fish community (including essential habitats)	• Identify non-NEPA laws related to the project
• Identify approved regional water resource plans affecting the project area	• Income per capita
• Invasive species	• Land cost
• National Parks, Monuments, and Historical Sites	• Land use/crop inventory
• Natural areas	• O&M costs
• Parklands	• Plant community
• Prime farmland (Farm land Protection Act)	•
• Riparian areas	• Population demographics
• Scenic areas	•
• Significant scientific features	• Public health and safety
• T&E species	• Soils inventory
• Water bodies (including waters of the U.S.)	• Transportation
• Wetlands	• Water quality
• Wild & scenic rivers	• Water quantities
• Wildlife community (including migratory birds)	• Installation costs
•	• Cost to SLO, in cash
Source: National Watershed Program Handbook, Part 600-Watershed Program Management, Subpart B – Development of Watershed Project Plans, 606. 18 Resource Concerns for Scoping	



SECTION 4

AFFECTED ENVIRONMENT

4.1 Socioeconomics

4.1.1 Land Use

The land use within the Pocasset River watershed is summarized in Table 4-1. The entire watershed consists of 13,188 acres. Ninety-seven percent (97%) of the land in the watershed is privately-owned and three percent (3%) is owned by State or local governments. There is no federally-owned land in the watershed.

The land use within the watershed is diverse. The upper watershed, which is outside the project area, consists primarily of forest land, whereas the middle and lower watersheds are dominated by medium-high density residential, commercial and industrial land uses. There are 15 farms in the watershed and most of those are located in the upper watershed. According to NRCS there are 990 acres of prime farmland soils in the watershed, most of which are in the upper watershed and most of which are forested.

Specific land uses within each flooding area are presented in Section 6.1.1.

The Pocasset River, its tributaries, and large water bodies within the watershed are used for recreation, but mostly in the upper watershed. Fishing takes place in both the streams and reservoirs. Boating takes place on Oak Swamp Reservoir.

Table 4-1: Land Use Within the Pocasset River Watershed.

Land Use	Acres	Percent
High Density Residential	960	7.28
Medium-High Density Residential	1,780	13.50
Medium Density Residential	1,222	9.27
Commercial	710	5.38
Industrial	507	3.84
Institutions and Cemeteries	406	3.07
Developed Recreation	167	1.27
Waste Disposal	587	4.45
Mine or Quarry	68	0.52
Roads	400	3.03
Power Lines	83	0.63
Transitional and Brush Land	182	1.38
Agricultural	723	5.48
Forest	3,630	27.53
Wetland	1,363	10.34
Water	400	3.03
TOTAL	13,188	100%

4.1.2 Socioeconomics, Demographics & Environmental Justice

Approximately seventy percent (70%) of the watershed is located in the Town of Johnston, twenty-nine percent (29%) in the City of Cranston, and less than one percent (1%) in the City of Providence. All three municipalities are within Providence County. According to the 2000 Census, the population within the watershed is approximately 39,000. The total population of Cranston and Johnston is estimated at 109,000 according to the 2010 U.S. Census Bureau Data.

In compliance with Executive Order 12898, impacts to low-income or minority populations as a result of this project need to be assessed. There are no social or economic conditions that exist that will impact the alternatives being considered as part of the proposed project. Table 4-2 presents summary minority population and income data and Table 4-3 presents summary EJ Index data for the three municipalities within the project watershed. Please note that data for Providence is less relevant as only one percent (1%) of the watershed is located within its municipal boundaries and none of this area is prone to flooding. Providence County is also less relevant because Cranston and Johnston only make up 17% of the total population of Providence County.

Both Cranston and Johnston have a relatively low percentage of minorities (non-white) and persons living below the poverty level compared to all of Providence County, the State of Rhode Island, and the entire United States. The median household income of people within these two municipalities is similar to the average for the entire State and the Nation.

An environmental justice analysis is necessary to ensure that EJ groups are protected equally with non-EJ groups and identify potential areas for additional effort to ensure equal access to public meetings for project review and comments (EO 12898). EJScreen Reports were generated using the Environmental Protection Agency (Version 2018) EJScreen Tool to identify potential environmental justice concerns. The EPA suggests that further review is appropriate in areas with national EJ Index percentiles 80 and above. The EJScreen generated reports for the cities of Cranston and Providence and the county of Providence. Since Johnston is classified as a town (the EJScreen Tool does not classify all towns by name), the area was identified for the report using the zip code (all of Johnston is one zip code). No EJ Index percentile for the municipalities of Cranston or Johnston was close to the national 80th percentile. The highest percentile in both was for PM2.5 at 48 and 25, respectively. Although the city of Providence had EJ indexes higher than 80, no further EJ analysis was conducted because no flooding hazard was found to be within the Pocasset Watershed in the City of Providence.

The Flood Plain Management Study identified the areas, including types of properties, in the watershed impacted by flooding. The Park Place Apartments complex consists of 78 low-income residential units (flood damage reduction measures are proposed at this location). Residents were notified and interviewed when the initial scoping was being developed. Notices will be placed directly into a prominent area of the apartment complex when the Public Participation meeting is scheduled.

Table 4-2: Comparison of Affected Communities to Providence County, State of Rhode Island, and the United States

Indicator	Providence	Cranston	Johnston	Providence County	Rhode Island	United States
Non-White Persons	65.0%	25.9%	11.7%	36.3%	26.0%	36.1%
Persons with Income below Poverty Level	28.2%	10.3%	8.1%	17.2%	11.3%	15.1%
Median Household Income	\$37,366	\$61,646	\$58,295	\$50,637	\$58,387	\$55,322

Source: American Community Survey Demographic and Housing Estimates 2012-2016 5-Year Estimates data.

Table 4-3: EJ Indexes USA Percentiles for Communities Within the Watershed

EJ Indexes	Cranston USA Percentile	Johnston USA Percentile	Providence USA Percentile	Providence County USA Percentile
EJ Index for PM2.5	48	25	74	59
EJ Index for Ozone	43	17	78	59
EJ Index for NATA Diesel PM	43	24	80	67
EJ Index for NATA Air Toxics Cancer Risk	45	20	78	61
EJ Index for NATA Respiratory Hazard Index	44	21	77	62
EJ Index for Traffic Proximity and Volume	11	13	92	85
EJ Index for Lead Paint Indicator	24	13	89	76
EJ Index for Superfund Proximity	17	1	87	14
EJ Index for RMP Proximity	18	22	84	76
EJ Index for Hazardous Waste Proximity	27	7	96	90
EJ Index for Wastewater Discharge Indicator	6	15	97	94

Source: EJSCREEN Reports (Version 2018) generated from the Environmental Protection Agency EJScreen Tool on September 20, 2018.

4.1.3 Economics

As depicted in Table 4-2, the per capita income of Johnston was \$58,295, slightly below the Rhode Island average of \$58,387, and the per capita income of Cranston is \$61,646, above the Rhode Island average. Rhode Island’s average per capita income is above the national average of \$55,322.

Agriculture is not a significant industry in the watershed. In Johnston and Cranston, the service, sales, and management sectors account for the majority of jobs. The leading industries are manufacturing, retail and educational, health, and social services.

4.2 Public Health and Safety

Flooding has a significant effect on the health and safety of residents living in close proximity to certain areas of the Pocasset River. Flood events restrict or prevent emergency services from reaching some residences and have the potential to trap people in their homes. Flooding of roadways is a significant hazard to motorists and flooding of homes may cause structural damage to homes or create an environment favorable for mold growth, potentially endangering the homes’ inhabitants. Flooding can also cause sewage backups and power outages.

Emergency services in the two Sponsor communities consist of police and fire departments. The City of Cranston Police Department headquarters is located at 5 Garfield Street in Cranston, RI and there are 6 additional sub stations located throughout the City. The department also owns one mobile resource center. The department consists

of 153 officers, along with 52 civilian staff. The City of Cranston Fire Department has 7 stations, with their headquarters located at 301 Pontiac Avenue in Cranston, RI. The department has 6 engines, 3 ladder trucks, 4 rescue vehicles, and 1 special hazards truck. The Town of Johnston Police Department headquarters is located at 1652 Atwood Avenue, and employs 85 officers. The Town of Johnston Fire Department consists of 4 stations, with the headquarters located at 1521 Atwood Avenue in Johnston, RI. The department owns 4 engines, 1 ladder truck, and 3 rescue vehicles.

4.3 Aesthetic Considerations

The project area consists of a mix of commercial, industrial, and residential land uses. In many areas, commercial and industrial uses adjacent to the Pocasset River have negatively impacted the aesthetic quality of the River and the associated riparian corridor. The Pocasset River near the residential areas is generally more pristine and offers an aesthetic amenity for residents in these areas. The aesthetic impacts of the proposed flood improvements are presented in Section 6.3.

4.4 Cultural Resources (Historical and Archaeological Resources)

The Rhode Island Historical Preservation and Heritage Commission (HPHC) was contacted to provide information on historic structures in the project areas. The Town of Johnston and the City of Cranston were also contacted. The Rich Box Company facility was identified as a property eligible for listing on the National Register of Historic Places. In a letter dated August 17, 2009, HPHC (Appendix C) states that the proposed flood wall proximal to the Rich Box Company will not have an adverse effect on this facility.

In a prior letter dated May 12, 2009 (Appendix C), HPHC stated that there is one site with potential Native American resources and clarifies in their August 17, 2009 letter that completion of an archaeological survey prior to construction is warranted at the location. This site was the location of a proposed detention basin as part of the Reservoir Avenue flood wall that was proposed in an earlier configuration of the flood wall. The detention basin or any other improvements are no longer proposed in that location. As a result, this project is not proposed to impact the site identified by HPHC.

4.5 Climate and Air Quality

Rhode Island has cold winters and hot summers, periodicity of the seasons are influenced by the moderating effect of the Atlantic Ocean. Temperatures average 30 degrees Fahrenheit (F) in winter and 70 degrees F in the summer. The average relative humidity is between 55 and 75 percent.

Total annual precipitation is approximately 43 inches per year, with almost half falling between April and September. Annual precipitation is usually adequate for the common crops of the region. During the winter months snow cover is common, with an average annual snowfall of about 36 inches.

Prevailing annual winds are from the southwest; the highest average wind speed of 13 miles per hour is observed in April.

All of Rhode Island is in an area currently designated by the EPA as a nonattainment area for 8-hour ozone. EPA defines nonattainment as an area that “does not meet the national primary or secondary ambient air quality standard for that pollutant.”

4.6 Topography, Geology, and Soils

The watershed consists of glaciated uplands with relatively low hills separated by narrow valleys. The northern portion has bedrock controlled topography with short steep slopes and wetlands in low areas. Most of the Cranston portion consists of glacial outwash plains and terraces. The stream channels and ponds in the headwaters of the Pocasset River have an elevation of approximately 300 feet above sea level. At its terminus, the confluence with the Pawtuxet River, the elevation is about 5 feet. Most of the hills in the headwaters section of the watershed have an elevation of 400 to 500 feet.

The majority of the watershed consists of well drained to poorly drained sandy soils developed in stony ablation till. Almost all the soils in the watershed formed during glacial drift and have moderate to high permeability. Many of the soils along the river have been manipulated by man; therefore, cuts and fills are common along the channel, particularly in the lower part of the watershed. Soils in the northern portion of the watershed are generally unsorted glacial till. The southern portion of the watershed is made up of primarily sorted sand, gravel, and silt (glacial outwash). The predominant bedrock is Mussy Brook Schist, a green to greenish gray, fine grained rock. Soil and geologic characteristics for each profiled area (i.e., the areas of significant flooding where damage reduction measures are proposed) are given below.

Below is a detailed description of soil types at the major project areas taken from the Rhode Island Soil Survey, dated July 1981.

- Rotary Drive MU (Merrimac-Urban land complex) soils are present at Rotary Drive. MU soil is made up of predominantly sandy loam. State-wide important soils are mapped adjacent to the river channel and extending to the rear of some of the houses on Rotary Drive. State-wide important soils or “Additional Farmlands of Statewide Importance” are soils which are valuable for farm enterprises but are less well suited for intensive farming. They fall into one of the categories of NRCS-mapped soil map units that have state-wide, local, or unique importance as farmland capable of producing food, feed, fiber, forage, and oilseed crops.
- Fletcher Avenue and South Bennett Drive UD (Udorthents-Urban land complex) soils are present at these areas. Udorthents-Urban land complex is a soil made up of well drained cut and fill material. Soil properties and the types of soils are variable, requiring a detailed site investigation to characterize. A narrow bank of State-wide important soils follows the river channel behind these areas.
- Reservoir Avenue The Reservoir Avenue area is made up of the following soil

- types: MU (Merrimac-Urban land complex, 75%), Pp (Podunk fine sandy loam, 15%), Ru (Rumney fine sandy loam, 5%), and UD (Udorthents-Urban land complex, 5%). Podunk fine sandy loam is a well-drained soil, with a moderately high permeability. This is a flood plain soil that is susceptible to flooding when the water table is high. Rumney fine sandy loam is a poorly drained soil present on flood plains. This soil has a low permeability and is susceptible to flooding. It is characterized as a State-wide important soil.
- Riverview Terrace The River View Terrace neighborhood, inclusive of Davis Court and Autumn Street areas, is made up of the following soil types: MU (Merrimac-Urban land complex, 75%), Pp (Podunk fine sandy loam, 10%), HkC (Hinckly gravelly sandy loam, rolling, 5%), Ru (Rumney fine sandy loam, 5%), and UD (Udorthents-Urban land complex, 5%). Hinckly gravelly sandy loam is an excessively drained, high permeability soil that is well suited for community development and is a State-wide important soil.
 - Willowbrook Apartments The following soil types are present in the Willowbrook Apartments area: MU (Merrimac-Urban land complex, 90%) and Ru (Rumney fine sandy loam, 10%).

4.7 Water Resources

4.7.1 Surface Water

Water Quantity

The Pocasset River drainage area defines the project area, and as such is the primary water resource within the watershed. The river is 21.5 river miles long, with approximately 1.62 square miles (1,043 acres) of 1-percent annual-chance (100-yr) floodplain. Impoundments along the Pocasset River include the Upper Pocasset Pond, Lower Pocasset Pond, Insurance Company Pond, and Cranston Print Works Dams. The Pocasset has two major tributaries; Simmons Brook and Dry Brook. There are several reservoirs associated with the Simmons and Dry Brook tributaries which were constructed around 1840 to provide water for the Cranston Print Works.

As described by the Flood Plain Management Study (NRCS, 2007), the Pocasset River begins in the northwestern portion of the Town of Johnston and flows southeast through the Town of Johnston until it passes under Interstate 295. From there it flows east along Route 6 and enters the Johnston Memorial Park. It leaves the park flowing to the south under Route 6, then turns to the southeast towards Route 5. The river crosses under Route 5 approximately one-half mile south of Route 6. The river then flows to the south towards the City of Cranston where it flows under Plainfield Street. The river then meanders through the City of Cranston until it reaches the Cranston Print Works. From the Print Works, the river flows to the south until it discharges into the Pawtuxet River just southeast of Pontiac Avenue. The Pawtuxet River flows to the east 1.7 miles and discharges into Narragansett Bay at Pawtuxet Cove.

The Simmons Brook watershed encompasses 6.9 square miles within the Town of



Johnston. There are two major man-made impoundments on Simmons Brook; Upper Simmons Reservoir (50 acres) and Lower Simmons Reservoir (45 acres). Pierce Pond is also located on Simmons Brook. Simmons Brook flows into the Pocasset River just north of Plainfield Street.

Dry Brook has a watershed of 3.2 square miles within the Town of Johnston. It enters the Pocasset River just south of Central Avenue and east of Atwood Avenue (Route 5). There are several man-made reservoirs along Dry Brook; most notably, Oak Swamp Reservoir (111 acres), and Almy Reservoir (54 acres). The Hughesdale Pond-Fontaine's and the Gross' dams on Dry Brook are also within the study area.

Flooding in the Pocasset River watershed occurs fairly frequently. The river is not gaged, but anecdotal accounts have suggested that the severity and frequency of flooding have increased over the past twenty years. During precipitation events, some as small as 2 to 3 inches of total rainfall, the river rises rapidly and dramatically, causing frequent property damage and stream bank erosion. Channel modification has occurred throughout the

watershed as the area has been urbanized. Bridges, culverts, and concrete/masonry and riprap retaining walls have been constructed throughout the watershed and have altered the natural flow characteristics of the Pocasset River and its tributaries.

The NRCS modeled the hydrology and hydraulics of the Pocasset River to determine the extent and severity of flooding in the Pocasset River watershed. A detailed explanation of the model can be found in the Flood Plain Management Study and its associated Technical Report (NRCS, 2007). The model predicted the flows and water surface elevations for current conditions, as well as the expected increase as a result of full build out of the watershed. Table 4-4 shows the model results for both conditions during the 100-year/24-hour duration storm event.

Table 4-4: Predicted Water Surface Elevations and Discharges in the Pocasset River under Existing Conditions and Watershed Build-Out Without Flood Damage Reduction Measures (100-year, 24-hour, Type III Precipitation Event)

Location	Existing Conditions		Future Build-Out	
	Elevation (ft)*	Discharge (cfs)	Elevation (ft)*	Discharge (cfs)
Atwood	125.8	831	126.1	1027
Rotary	98.4	1038	99.4	1264
Morgan St.	97.3	1038	98.4	1264
Morgan Mill	87.1	1249	87.4	1470
Bennet/Melody	84.4	1305	85.3	1549
Park Place	84.4	1305	85.3	1549
Plainfield Pike	80.6	1927	84.3	2419
Reservoir Ave.	30.4	1739	31.4	2415
Willowbrook	25.9	2116	26.8	2370
Garden City	25.7	1863	26.7	2271

*Elevations are in NAVD 88.

Source: Table 2.5 of the Flood Plain Management Study Technical Report (NRCS, 2007)

Water Quality

Although water quality throughout the river has not been thoroughly characterized, it is influenced by stormwater runoff from paved residential areas, industrial sites, and highways. In addition, the state's Central Landfill is located on a tributary to the Pocasset River.

In 1989, Rhode Island Department of Environmental Management (RIDEM) contracted the US Geological Survey (USGS) to conduct sampling at 13 river stations throughout the state. The Pocasset River was sampled at one station on two dates, September 22, 1989 and November 30, 1989. Physical water quality parameters (DO, temperature, pH, hardness), bacteria (fecal coliform), nutrients, and metals were analyzed. This study indicated that the river had bacteria levels that exceeded the primary contact recreation and swimming criteria.

In 1990, the three communities along the Pawtuxet River (West Warwick, Warwick, and Cranston) contracted Applied Science Associates to characterize selected water quality parameters within the Pawtuxet River as part of the facilities' planning studies for the upgrades at the wastewater treatment facilities. The mouth of the Pocasset River at Pontiac Avenue was sampled during this study. During this project, analyses were conducted for total and dissolved metals, nutrients, and physical water quality parameters. Results indicated exceedances of total copper and total lead criteria and elevated nitrate levels.

From November 1993 to December 1994, the River Rescue project conducted a water quality monitoring study of the Pawtuxet River. The mouth of the Pocasset River at Pontiac Avenue was sampled monthly during this study. Physical parameters and total metals were analyzed under the Pawtuxet River Monitoring Project. Results of this study indicated exceedances of total copper and total lead criteria in the Pocasset River.

In the latest study, early 2018, the Rhode Island Department of Environmental Management's Office of Water Resources prepared an Impaired Waters Report to provide a complete list of all impaired waterbodies in the State of Rhode Island. Waterbodies identified as impaired and requiring development of a Total Maximum Daily Load (TMDL) (known as the 303(d) list) and other impaired waterbodies not requiring development of a TMDL including; waterbodies for which a TMDL has been developed, waterbodies where other pollution control requirements are reasonably expected to result in attainment of water quality standards, and waterbodies having impairments not caused by a pollutant. According to the 2018 report, the Pocasset River and tributaries had impairments caused by bacteria, Benthic-Macroinvertebrate, Chloride, Copper, Enterococcus and in addition, several species of non-native aquatic plants.

The water quality data collected from the studies summarized above were used to list the Pocasset River as impaired in Rhode Island's 1994, 1996, 1998, 2002, and 2018 List of Impaired Waters. Under Section 303(d) of the Clean Water Act, states are required to identify waters for which existing required pollution controls are not stringent enough to

achieve State water quality standards. These waters are referred to as water quality limited or impaired. Once a water body is identified as impaired, Section 303(d) requires that water quality restoration plans, also known as Total Maximum Daily Loads (TMDL), be developed for each pollutant causing the impairment. These restoration plans describe the non-point source and point source pollution controls necessary for the water body to meet water quality standards. In 1998, the TMDL Program in RIDEM's Office of Water Resources conducted a monitoring project of water bodies that were listed as impaired for total metals. Since the State had recently adopted water quality criteria for dissolved metals, the more bioavailable form of metals, it was necessary to determine if each of these water bodies was actually impaired and exceeding the new dissolved metals criteria.

The TMDL staff monitored the Pocasset River at Pontiac Avenue in September, November and December 1998 and April and July 1999. The samples were analyzed for dissolved copper and lead. The data showed no violations of dissolved copper criteria, but three out of the five samples exceeded the dissolved lead criteria. The results of this study were used to remove dissolved copper from the list of impairments on the Pocasset River. The river was targeted for development of a water quality restoration plan for these pollutants in 2010-2012. Regular monitoring on the Pocasset River and all waters of the state will be addressed in the Statewide Monitoring Strategy that is currently under development.

Flooding in the Pocasset River watershed results in bacterial contamination of downstream areas from the flooding of individual sewage disposal systems and sewage backups. Flooding also washes sediments, debris, and associated pollutants into the river from adjacent residential, commercial, and industrial areas. Pollutants likely include oils and greases, metals, nutrients, and other chemicals.

4.7.2 Groundwater

There are no sole source aquifers as defined by U.S. EPA, community well head protection areas, or groundwater reservoirs as defined by RIDEM within the project area. A non-community well head protection area is located within one mile south of the Fletcher Avenue project area. In the areas where floodwalls are proposed, groundwater flows and elevations are likely related to the condition of the Pocasset River and vary accordingly.

Groundwater in all of the project area is classified as either GA (suitable for public or private drinking water use without treatment) or GB (not suitable for public or private drinking water use without treatment due to known or presumed degradation). GB water is typically located in the southern portion of the project area, under the highly urbanized areas with dense concentrations of historic industrial and commercial activity.

Nearly the entire project area receives its water supply from the Scituate Reservoir located in central Rhode Island. Relatively few of the properties utilize groundwater from private or public wells as potable water.

4.7.3 Wetlands and Floodplains

According to the US Fish and Wildlife Service’s (USFWS) National Wetlands Inventory (NWI), there are 1,822 acres of wetlands in the Pocasset River watershed (see Figure 4-1). The majority of wetland resources within the watershed are associated with the Pocasset River and its tributaries and are located in the upper reaches of the watershed, outside of the areas proposed for flood damage reduction. Historic development of the lower watershed, particularly for commercial, industrial and residential uses, has reduced the abundance of wetland resources when compared with pre-settlement conditions.

The distribution of wetland cover types are summarized in Table 4-5 below. As mentioned above, these acreages are primarily within the upper reaches of the watershed, outside of the project area as shown in Figure 4-1.

Table 4-5: Wetland Cover Types Within The Pocasset River Watershed

Wetland Type (Cowardin et al. 1979)	Area (acres)
Palustrine Emergent	119
Palustrine Forested	1,149
Palustrine Open Water	83
Palustrine Scrub-Shrub	140
Riverine Open Water	28
Lacustrine Open Water	303
TOTAL	1,822

Palustrine emergent wetlands within the watershed are dominated by smartweeds (*Polygonum* sp.); pickerelweed (*Pontederia cordata*); and spatterdock (*Nuphar variegata*). The woody species northern arrowwood (*Viburnum dentatum*) is also common in the drier portions of emergent wetland communities. In shallower water areas, reed canary grass (*Phalaris arundinacea*); soft-stemmed bulrush (*Scirpus validus*); and several sedges (*Carex* sp.) are common. Portions of the emergent wetlands associated with the impoundments of the Simmons and Dry Brook watersheds are essentially monocultural stands of the non-native invasive, reed canary grass.

Forested wetlands are dominated by red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), spice bush (*Lindera benzoin*) and ostrich fern (*Matteucia struthiopteris*). Shrub-scrub wetlands are dominated by silky dogwood (*Cornus amomum*); northern arrowwood; speckled alder (*Alnus incana*); and red maple.

Vegetation commonly occurring within open water habitats of the watershed includes coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), mermaid weed (*Proserpinaca palustris*), common bladderwort (*Utricularia vulgaris*), and tape grass (*Vallisneria americana*).



Wetlands within the project area are generally limited to the Pocasset River proper and its immediate stream banks. Because the River is deeply incised, bordering wetland areas, which are typical in less developed areas, are limited. Typically, vegetation along the margins of the River consists of red maple, silver maple (*Acer saccharinum*), willow (*Salix spp.*), dogwood (*Cornus spp.*), spicebush, and poison ivy (*Toxicodendron radicans*). A fair number of invasive plants typical in urban stream areas were noted along the corridor including reed canary grass, phragmites (*Phragmites communis*), and greenbrier (*Smilax sp.*).

Floodplain

There are approximately 1.62 square miles (1,043 acres) of 1-percent annual-chance (100-yr) floodplain within the watershed (as depicted by the HEC/RAS generated floodplain maps shown in Appendix C). Vegetation within the undeveloped floodplain areas of the watershed is typical for the region and consists of a canopy of sycamore (*Platanus occidentalis*), eastern cottonwood (*Populus deltoides*), and silver maple (*Acer saccharinum*). Understory and herbaceous cover is typically sparse due to frequent disturbance from flooding, and is dominated by stinging nettle (*Boehmeria cylindrica*), cinnamon fern (*Osmunda cinnamomea*), and poison ivy (*Toxicodendron radicans*).

Much of 1-percent annual-chance (100-yr) floodplain in the watershed, particularly in the lower portions of the watershed, occurs on developed land. Development within the watershed is likely a major contributor to increased frequency, duration, and intensity of flooding. There has been documentation of flooding within the watershed beginning in the 1950s and in recent years flooding has become more common. The resulting damages to commercial, residential, and industrial property have caused considerable concern within the affected communities, as well as within municipal and state government agencies.

As noted in Section 2.2, in response to trends in the recent flooding events of the Pocasset River, the NRCS prepared the *Pocasset River Watershed: Floodplain Management Study, Providence County, Rhode Island*. Released in 2008, the study documented existing conditions within the watershed, provided updated floodplain maps for present and future conditions, and states potential solutions to mitigate or prevent damages from future flooding caused by the Pocasset River and its tributaries.

4.8 Utilities

4.8.1 Sewer

The City of Cranston has a 30-year contract with Veolia Water, a private company, for the operation and maintenance of the Cranston Wastewater Treatment Facility (WWTF), a 23 million gallon per day facility. The WWTF services the City east of Interstate 295 (I-295) and an area west of I-295 located south of Plainfield Pike and north of Scituate Avenue. Most of western Cranston is serviced by private septic disposal systems and the City does not plan to extend service to these areas. A pressurized sewer line runs through western Cranston, part of the way down Pippin Orchard Road, to connect the Florida Power & Light (FP&L) Plant in Johnston to the WWTF in Cranston. The WWTF discharges to the Pawtuxet River (Cranston Comprehensive Plan Update, veoliawaterna.com).

Rhode Island Geographic Information Systems (RIGIS) has a data layer which indicates the locations of main sewer lines, force mains, or interceptors for public and private sewer systems, provided by RI DOT and updated as of 1996. According to these data, the majority of the Town of Johnston is not serviced by sanitary sewer. Some areas along the Johnston border with Providence and North Providence are serviced, along with limited areas along the pressurized sewer line from the FP&L Plant to the WWTF in Cranston (RIGIS).

In Cranston, the area surrounding the Pocasset River is generally part of the sewered service area. In Johnston, the FP&L pressurized line is near the Pocasset River and crosses the river north of I-195. Sewer lines are present in the vicinity of the Riverview Terrace project area, including one which crosses the Pocasset River. A main sewer line passes very close to the Pocasset River behind the Willow Brook Apartments (RIGIS).

4.8.2 Water

The Providence Water Supply Board delivers treated drinking water from the Scituate Reservoir system to Cranston, Johnston, and other communities in the greater Providence area. Some homes in western Cranston are serviced by private wells. The proposed project areas are within the Providence Water District. In general, water supply lines follow roadway right of ways. Two supply lines cross the Pocasset River in the vicinity of the Reservoir Avenue project area (Cranston Comprehensive Plan Update, RIGIS).

4.8.3 Electrical, Gas, & Telecommunications

Both Cranston and Johnston receive electrical service from Rhode Island-Electric, a subsidiary of National Grid. National Grid also supplies natural gas service to both communities through Rhode Island-Gas. Based on the RIGIS data layers for electrical transmission lines and gas lines, there are no major distribution lines in the vicinity of the proposed project areas.

Cable, telephone, and internet service is provided by Cox or Verizon in Cranston and

Johnston.

4.8.4 Stormwater

Portions of Cranston and Johnston are serviced by traditional stormwater collection systems with catch basins, drainage pipes, and outfalls. The following is a summary of stormwater collection systems within the project areas.

Rotary Drive

Topography in the area between Atwood Avenue and the proposed floodwall slopes to the east, toward the proposed floodwall area. The area to the north of Rotary Drive drains to the Dry Brook. The Rotary Drive drainage area is divided into an upper watershed area (3.2 acres) and a lower watershed area (7.4 acres). The large upper area across Atwood Avenue drains toward Rotary Drive. This area is served by an extensive storm drain network that leads under Atwood Avenue and discharges at the rear of Rotary Drive (toward Alcar Drive), above the river flood stage. A cursory inspection of this pipe revealed it to be approximately 36-inch RCP in poor condition. It also appears the line runs beneath the adjacent home. The remaining lower area drains towards a local subdrain system which exists to the rear of the homes along Rotary Drive and exits to the Pocasset River behind Rotary Drive. Reference Figure 6-4 Rotary Drive for a map of the area and preferred measures to be installed.

South Bennett Drive

There are no traditional drainage collection systems at the Park Place Apartments or in the vicinity. Stormwater runoff flows overland towards the river. A large woodland area across Atwood Avenue presently drains to Atwood Avenue. This section of Atwood Avenue lacks drainage control structures and it is probable that runoff from this area drains towards the river due to the steep roadway that leads from Atwood Avenue to Park Place Apartments. The drainage area for Park Place Apartments is divided into an upper watershed area (6.2 acres) and a lower watershed area (4.3 acres).

East of the river, River Drive is also drained by overland flow towards the river without any stormwater collection systems. South Bennett Drive may have some limited formal drainage systems with outlets to the 36-inch pipe culverted tributary that drains the South Bennett Drive neighborhood. Reference Figure 6-5 South Bennett Drive for a map of the area and preferred measures to be installed.

Fletcher Avenue

The Fletcher Avenue drainage area covers 130.7 acres and was delineated using two-foot topographic mapping. It extends beyond Atwood Ave, as far back as Yeoman Ave. The majority of stormwater travels through the floodplain north to the river, via overland flow, without the use of city infrastructure; however, there is a closed conduit system located within the front parking area of Eastland Foods, adjacent to the river. This system consists of a 36-inch RCP storm drain that collects runoff from the Fletcher Avenue drainage system and conveys it to a drainage channel, east of Eastland Foods building, which finally drains to the river (subwatershed 2). The majority of land use in the watershed is medium to high density residential with commercial/industrial land uses mostly located in the floodplain.

On the other side of the river at the Rich Box site, stormwater flows overland toward the Pocasset River. There are no stormwater control structures within the Rich Box site and stormwater flows overland to the river from the 3.8 acre drainage area. Reference Figure 6-9 Fletcher Avenue for a map of the area and preferred measures to be installed.

Reservoir Avenue

The drainage area behind the proposed floodwall at Reservoir Avenue is delineated by Reservoir Avenue to the south and the floodwall to the north and west and is approximately 8.8 acres. Reservoir Avenue contains formal stormwater drainage collection which conveys stormwater away from the location of the proposed floodwall. The drainage area is relatively flat, with the ground gently sloping northwest toward the river. A topographic ridge separates the northern end of the drainage area from the river. Reference Figure 6-12 Reservoir Avenue for a map of the area and preferred measures to be installed.

Riverview Terrace

Stormwater flows in the southwest direction toward the Pocasset River. Stormwater control structures within the adjacent Pontiac Avenue serve to convey water away from the site and serves as the eastern drainage divide. Stormwater from the Riverview Terrace 32.3 acre drainage area, west of the divide, presently sheet flows along the roadways and enters the river as overland sheet flow and through various existing drainage culverts.

A small unnamed tributary is located to the west of Riverview Terrace, flowing in an easterly direction from Blackmore Pond. Currently the stream flows under the neighborhood through a culvert and discharges to the Pocasset River downstream of the neighborhood. Reference Figure 6-13 Riverview Terrace for a map of the area and preferred measures to be installed.

Willow Brook Apartments

Stormwater flows overland southwest toward the Pocasset River. Storm water control structures exist within the adjacent Pontiac Avenue to convey water away from the site and serve as the eastern drainage divide. Stormwater from the Willow Brook Apartments 15.2 acre drainage area, west of the divide, presently sheet flows along the roadways and enters the river via several drainage swales. Reference Figure 6-14 Willow Brook for a map of the area and preferred measures to be installed.

4.9 Wildlife / Threatened and Endangered Species

Wildlife

Wildlife in the region has been subject to drastic disturbances from European settlement, including the extermination and/or reduction in populations of large predators and vertebrates (e.g., wolf and moose) by hunting and habitat loss (McNab and Avers 1994). Some formerly displaced species have become re-established on abandoned agricultural lands, with the exception of large predators, whose niche has been partially filled by mid-size predators (e.g., coyote) (McNab and Avers 1994). Common wildlife species include the white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), white-footed mouse (*Peromyscus leucopus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and an assortment of resident and migratory birds. River corridors, such as the Pocasset River corridor, provide important conduits for travel and migration for various forms of wildlife.

The value of the impoundment and its associated and immediately fringing wetlands for avian breeding habitats would normally be very high. No breeding bird survey has been conducted, but occasional observation suggests that black duck (*Ana rubripes*) and mallard (*A. platyrhynchos*) make occasional use of the impoundments for summer feeding. Bufflehead (*Bucephala albeola*) have been observed during the winter.

Great blue heron (*Ardea herodias*) and green-backed heron (*Butorides striatus*) have been observed feeding in the impoundment shallows, and belted kingfisher (*Ceryle alcyon*) have occasionally been observed feeding from overhanging trees along impoundment borders. Although no specific survey has been made, a variety of passerines are also likely to feed and nest in the scrub-shrub and forested wetlands along the river corridor.

Mammals directly observed include eastern chipmunk (*Tamias striatus*) and gray squirrel. Red fox (*Vulpes fulva*), raccoon, and coyote (*Canis latrans*) are also likely to utilize remaining habitat within the watershed. Tracks and scat of domestic dog (*Canis familiaris*) and cat (*Felis catus*) are also widely observable.

Several species of bats are considered common throughout the State of Rhode Island, and may be present in the project area. The big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), Eastern red bat (*Lasiurus borealis*), and Northern long-eared bat (*Myotis septentrionalis*) are considered Species of Greatest Conservation Need by the Rhode Island Department of Environmental Management.

Additional small mammals likely to be present in the watershed include white-footed mouse, meadow jumping mouse (*Zapus hudsonicus*), meadow vole (*Microtus pennsylvanicus*), short-tailed shrew (*Blarina brevicauda*), and eastern mole (*Scalopus aquaticus*). Medium-sized mammals also likely to be observed include striped skunk (*Mephitis mephitis*), Virginia opossum, and mink (*Mustela vison*). White-tailed deer is likely the only large mammal present within the watershed.

There is limited fishery information for the reaches of the Pocasset River within the study area. However, the following information on the impoundments in the upper reaches of the watershed can be used to characterize the general fishery resources in the River as a whole. The Pocasset River is reported to support a moderate quality warm water fishery, including largemouth bass (*Micropterus salmoides*), and perch (*Morone americana*), which are extensively used by recreational anglers. Fish surveys conducted in 1996 and 1997 by the Rhode Island Department of Environmental Protection (RIDEM) have documented longnose dace (*Rhinichthys cataractae*), white sucker (*Catostomus commersoni*), American eel (*Anguilla rostrata*), redbfin pickeral (*Esox americanus*), bluegill (*Lepomis macrochirus*), and golden shiner (*Notemigonus crysoleucas*).

Those species of fish that migrate upstream from saltwater to freshwater for breeding purposes (i.e., anadromous fish such as alewife [*Alosa pseudoharengus*], blueback herring [*A. aestivalis*], and shad [*A. sapidissima*]) have limited access to upper reaches of the watershed due to the obstacle formed by the Pawtuxet Falls dam at the mouth of the Pawtuxet River. Restoration of anadromous fish passage is currently being considered at that site. Once passage is restored anadromous fish will have access to the Pocasset River as far upstream as the Cranston Print Works' dam. This will open approximately three river miles of currently inaccessible spawning and nursery habitat to anadromous fish.

Threatened and Endangered Species

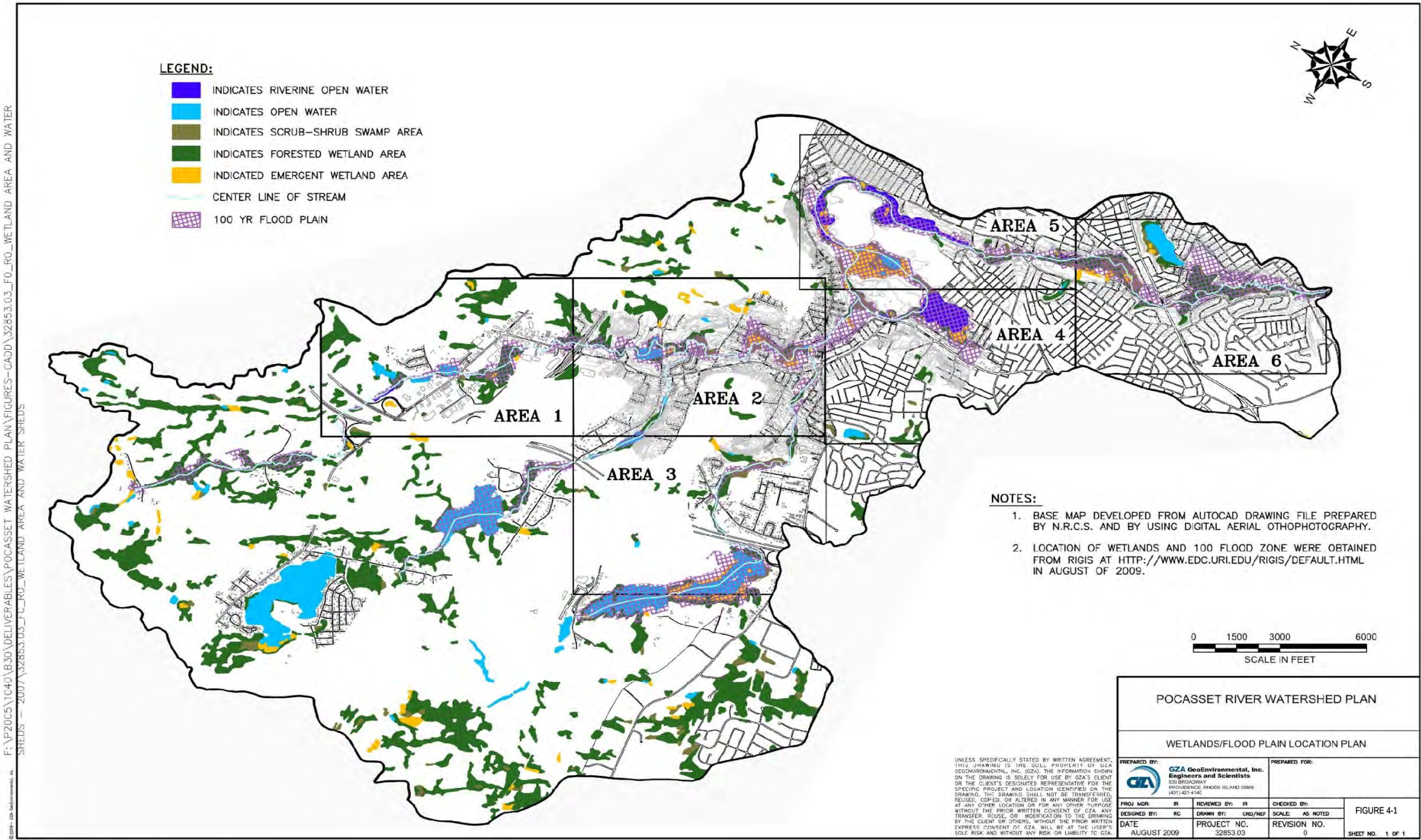
According to the Rhode Island Natural Heritage Program (RINHP), there are several species of plants on the State Rare Species list that have been reported within the watershed. All of these are found within the upland Snake Den State Recreation Area in Johnston, which is in the upper watershed, far removed from the project area. One of these species is purple clematis (*Clematis occidentalis*), which is listed as State Endangered because it is the only known population of this plant in Rhode Island. Consultation with the U.S. Fish and Wildlife Service in Concord, New Hampshire indicated that no federally-listed endangered or threatened species under their jurisdiction were known to occur in the watershed area



4.10 Energy

Flooding incidents in the project area require energy resources in order to protect human health and property and to repair water damage. On a yearly basis and sometimes even more frequently flooding of properties in the project area requires emergency services (fire, police, and ambulance). Energy is expended in the form of fuel to service the vehicles used in emergency operations including fire trucks, rescue vehicles, police cars, generators and pumps. After the flooding subsides, energy is also expended to repair water damaged property.

Figure 4-1: Wetlands/Floodplain Location Plan



SECTION 5

ALTERNATIVES

This section describes the process used to formulate the project alternatives (Section 5.1) and the components of the alternative plans in detail (Section 5.2). Section 6 describes the effects of the alternative plans on the socioeconomic and environmental resources within the project area. A comparison of alternative plans, risk and uncertainty, and rationale for plan selection are discussed in Sections 6.13, 6.14, and 8.2, respectively.

Section 5.1 describes the analysis of the High Hazard areas selected for flood protection and the combination of measures selected to provide flood damage reduction at each area. Table 5-1 compares the feasibility of the various flood damage reduction measures at each site, while Table 8-4 compares the alternatives developed from the feasible measures with respect to resources of medium and high concern and project costs.

Section 5.2, Description of Alternative Plans, summarizes the flood damage reduction measures to be incorporated into the Preferred Alternative. The subsections within Section 5.2 are organized by High Hazard Area to provide a detailed description of the alternative plans proposed at each area. The alternative plans include the Preferred Alternative and the No Action alternative. Various other alternatives are described and evaluated in this section and either determined to not be feasible or scored lower than the Preferred Alternative using the method as presented in Table 8-3, Flood Damage Reduction Option Ranking Matrix.

The effects of alternative plans on socioeconomic and environmental resources are described in Section 6. Section 6 is organized into subsections by resources, where the effects of the Preferred Alternative and the No Action alternative are described. Where applicable, the discussion is broken out by High Hazard area. Indirect and Cumulative Impacts are also discussed in this section.

Comparison of Alternative Plans, Risk and Uncertainty, and Rationale for Plan Selection are included as Sections 6.13, 6.14, and 8.2, respectively. Table 6-4, Summary and Comparison of Alternative Plans, in Section 6, summarizes the major environmental and socioeconomic impacts of the No Action and Preferred Alternative alternatives.

5.1 Formulation Process

NRCS worked with the Rhode Island Emergency Management Agency Floodplain Management Program, Johnston town officials, and City of Cranston officials to identify sites affected by flood water damages and subsequent flooding impacts on human health and safety, economics, and surface water drainage.

The goal of the plan formulation process was to maximize the reduction in Average Annual Damages at the least cost. A cost-benefit analysis was done for each damage reach and project site to achieve greatest benefits for the least cost. For planning purposes, alternatives were developed for each priority site.

All project planning, including evaluation of alternatives, utilized the appropriate guidance manual “National Watershed Program Manual, part 501” (NWPM) (United States Department of Agriculture, 2009) and “Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies” (P&G) (U.S. Water Resources Council, 1983). This document is intended to ensure proper and consistent planning and design of flood damage reduction structures and measures. The alternatives presented in this document were evaluated using the objectives and planning guidelines presented in P&G.

Alternative plans were formulated in a systematic manner to ensure that all reasonable alternatives were evaluated. In keeping with P&G requirements, plan formulation concentrated on alternatives which contribute to the federal water resource objective of National Economic Development (NED). In terms of federal assistance, the most important alternative is that plan which maximizes NED benefits, in this case flood damage reduction. All reasonable alternatives were formulated in consideration of the following four criteria:

Completeness - Provides the opportunity to reduce flood damages for the entire Pocasset River Watershed 100-year floodplain. Alternatives were developed that would maximize flood damage reductions using the 100-year flood conditions based on the existing “Comprehensive Land Management Plans” for the Town of Johnston and City of Cranston. See Section 2.2 Summary of Hydrology/Hydraulics Model for more detail on the selected floodplain.

Effectiveness - Alternatives should provide for the maximum protection from damages.

Efficiency - The alternative is cost-efficient in reducing flood damages relative to other alternatives and if possible provides for net economic benefits.

Acceptability – is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public, and compatibility with existing laws, regulations, and public policies.

In addition to the economic aspects of P&G, alternative plans must also be evaluated in terms of environmental quality, especially the effects on ecological, cultural, and aesthetic attributes of significant natural and cultural resources that sustain and enrich human life. Underlying this process is the requirement that each increment provide benefits at least equal to its cost.



High Hazard Areas were identified by the Local Sponsoring Organization and were targeted to evaluate opportunities to provide flood protection. Using the modeled 100-year, 24-hour flood elevation and the surveyed elevations of each building within the 500-year floodplain, all buildings subject to hazardous conditions were identified. High Hazard Areas were determined by the Local Sponsoring Organization (City of Cranston and Town of Johnston). Seven large High Hazard Areas have been identified and need to be addressed (additional isolated High Hazard Areas were also identified). High Hazard Classification is based on a consideration of depth and velocity of flood flows. Areas of the floodplain where depth is greater than 3 feet, velocity of floodwater is greater than 5 feet per second, or where the product of the depth and velocity exceeds 7, are defined as High Hazard Areas. In addition, to be considered a High Hazard Area, the area must be used for overnight occupation. Other structures subject to High Hazard conditions do exist within the floodplain. These are primarily commercial use buildings and the proposed preferred measures reflect the high hazard conditions (i.e. were chosen to withstand high hazard conditions). For the scope of this project, the following areas were identified as High Hazard Areas and are considered in need for flood damage reduction:

- Rotary Drive,
- South Bennett Drive,
- Park Place Apartments (collocated with South Bennett Drive and discussed as a part of it)
- Simmons Brook Culvert,
- Fletcher Drive,
- Reservoir Avenue,
- Riverview Terrace,
- Willow Brook Apartments,
- Second Mill Street Bridge,
- Morgan Avenue Bridge,
- Morgan Mill Road Bridge,
- Plainfield Street Bridge,
- Reservoir Avenue Bridge, and
- Garden City Bridge.

The present study is built upon a previous report, “The Pocasset River Watershed Flood Plain Management Study,” released by NRCS in 2007, which identified locations of severe flooding and possible solutions to reduce flooding. The formulation process began with the development of a comprehensive list of flood damage reduction options with input from personnel from the Natural Resources Conservation Service (NRCS) National Water Management Center, the NRCS New England Interdisciplinary Resource Technical Team, the NRCS Rhode Island State Engineer, and planning staff from NRCS offices in Rhode Island, New Jersey, and New York. Once the initial list was developed, the potential alternatives were sent for review to the Rhode Island Department of Environmental Management, Rhode Island Emergency Management Agency, United States Environmental Protection Agency, United States Army Corps of Engineers and the United States Fish and Wildlife Service. Public scoping meetings were held to allow the public to provide input regarding potential alternatives.

5.1.1 Evaluation of Potential Measures

Potential flood damage reduction options were analyzed at each site for feasibility and effectiveness in meeting the project goals. The following narrative briefly discusses each specific measure considered at the High Hazard Areas. For clarity, Section 5.1.1 evaluates the feasible alternative measures, which include no action, acquisition of properties, dry floodproofing, construction of floodwalls, and removal of physical constraints (i.e. construction of a bypass culvert and removal of a debris dam). Then, a variety of alternative measures are evaluated which were determined not to be feasible within the project sites, which include construction of a floodway, wetland restoration/creation, dam rehabilitation, sediment removal / channel dredging, bridge removal, elevating structures, and constructing earthen berm dikes, Table 5-1 provides a cost comparison of the feasible alternative measures.

FEASIBLE MEASURES CONSIDERED:

The no action alternative is included to provide a baseline of comparison to the proposed actions in order to determine the relative merits and disadvantages of the alternatives considered. Several properties and structures are located on the fringe of the 100-year floodplain extents and are identified as being within a “Caution Area,” in Figures 6-2 through 6-15. Although no structural mitigation measures are proposed for these structures, the local flood evacuation procedures should be used to reduce the flood mitigation damage to properties and human life during large flood events. The No Action alternative does not meet the project goals of reducing flooding and the associated economic and social impacts.

Acquisition and Demolition of Affected Properties and Structures – The acquisition of properties affected by flooding in the project area would allow residents and businesses to avoid the social and economic impacts associated with frequent flooding, thereby addressing by the human health and safety concern as well as some of the economic concerns. The residents or businesses would be relocated to new locations outside of the 100-year floodplain. The floodplain would be restored to its pre-development state and would allow the conveyance of flood flows without infrastructure damage. In most cases, the acquisition of properties is more cost-effective than the construction of a floodwall barrier or other structural or non-structural measures. Acquisition of properties has many other beneficial impacts to the habitat value by expanding the river corridor and providing increased buffer to adjacent development as well as improving aesthetic values for adjacent neighborhoods by providing additional open space.

In addition, acquisition does not rely on “buy-in” from everyone in neighborhood, so it can be implemented one house at a time and does not rely on the entire neighborhood agreeing to the plan. The construction of floodwalls relies on all property owners’ agreeing to an easement on their property to build a floodwall and will not be feasible if a single owner does not agree. Property acquisition relies on the Town to accept the deeds for the properties.

Acquisition of selected properties was considered at each site with dry floodproofing selected as the most cost-effective alternative for properties with less than 3 feet of flooding depth under the 100-year flood event, as described in the dry flood proofing section below. Dry floodproofing provides flood protection at a much lower cost than acquisition, on average approximately \$20,000 per residential structure.

Flooded property plat and lot information were provided as GIS data by NRCS. Property values for affected properties were obtained from Vision Appraisal Technology Online Databases for Johnston (assessment year 2013) and Cranston (assessment year 2015). This alternative included the purchase price of the real estate (structure and land) as well as relocation of affected people. As indicated in Table 5-1 below, acquisition of selected properties was not found to be feasible at several flood prone sites mainly because of economic considerations.

The physical relocation of buildings was considered at all sites. Unlike property acquisition, relocation typically consists of the physical movement of people and personal property (structures) to sites not affected by flooding. Relocation was evaluated and determined not to be economically feasible due to the high cost and the presence of a lower cost option, which provides the same flood damage reduction, at many of the flood prone sites.

Dry Floodproofing – Dry floodproofing measures primarily address human health and safety concerns and are generally a combination of adjustments and additions to features of buildings that eliminate or reduce the potential for flood damage by keeping floodwaters out of a structure. A typical example of a dry floodproofing measure is the installation of watertight shields for doors and windows. Dry floodproofing is not permitted by the Federal Emergency Management Agency (FEMA) for new, substantially improved, or damaged residential structures located in the floodplain. Dry floodproofing is generally considered not feasible if floodwaters are expected to rise in excess of 3 feet above the base elevation of a structure because of the large hydrostatic pressure forces.

Dry floodproofing was evaluated at all the sites as a means of providing protection outside of areas where collective protection from a floodwall was not available. Dry floodproofing was considered feasible for 71 properties within the project area.

Floodwalls – A floodwall is a wall built parallel to the river to act as a physical flood barrier to address flooding and human health and safety concerns. Floodwalls are commonly constructed of concrete or steel. Poured concrete floodwalls require significant sub-surface foundations to provide an acceptable base (foundation) to support the floodwall. The extensive excavations and the large size of the foundation coupled with the limited available space at opportunity areas made poured concrete floodwalls infeasible. Steel sheet pile flood walls were considered at each site in order to provide a physical barrier to protect life and property from flood flows. Steel sheet pile walls were considered the most feasible design due to the limited space available to implement flood protection measures.

Floodwalls were considered at all project locations. Floodwalls are more economically feasible at apartment building complexes and other multifamily sites. Flood walls were deemed suitable alternatives at two project sites, Willowbrook Apartments and Reservoir Avenue:

- The Fletcher Avenue site floodwall costs are estimated to be approximately \$12.1 million compared to lower acquisition and dry-floodproofing costs of approximately \$9.2 million.
- The Rotary Drive site floodwall costs are estimated to be more than acquisition. The floodwall would involve construction of an up to 7-foot-tall floodwall within feet of each house, the likelihood of buy-in from all residents is unlikely. In addition, the difficulty of construction of a floodwall next to a house would be costly and the siting of the floodwall would likely be on private property.

- The Reservoir Avenue site contains several commercial properties in the floodplain that would be difficult to acquire and not feasible to floodproof, including two restaurants, Spain and McDonald's, and a paint store. A floodwall is a feasible alternative in this location to protect the commercial properties. Several of the residential properties in front of the floodwall would need to be acquired including the nursery property, and a commercial building adjacent to the river would also need to be acquired to construct the floodwall through the property.
- The Willowbrook Apartments site has a single owner, which makes a floodwall feasible at this location. The floodwall measure is also more cost effective and is the preferred alternative to protect these apartments.
- The acquisition costs at Riverview Terrace and South Bennet Drive sites are less than any of the alternative floodwall measures; therefore acquisition is the preferred alternative for these neighborhoods.

Constraint Removal (Debris Dam and Bypass Culvert) – Currently the Simmons Brook runs through a culvert under a mill building near its confluence with the Pocasset River. The culvert is undersized and causes flooding of 4 properties, including the mill building. The acquisition of the existing business is not economically feasible. The proposed remedy for the problem is to construct a bypass culvert that will route high flows around the mill building culvert.

During the field reconnaissance in 2008/2009, a debris dam was observed near the Pocasset River's confluence with Simmons Brook. The debris dam causes the Pocasset River to be routed out of its channel and into a residential backyard, causing the backyard to be flooded, in wet weather as well as dry weather conditions; removal of the debris dam will restore the river to its channel. Benefits from the removal of the debris dam were evaluated to be high compared to the cost and therefore it is included in the Preferred Alternative.

Table 5-1: Comparison of Feasible Alternative Measures – Acquisition/Dry Floodproofing vs Floodwalls

Site	Total Cost Acquisitions	Total Cost Structural Alternative (Floodwall)
Rotary Drive	\$3,280,200	\$3,253,000
South Bennett Drive	\$9,646,370	\$10,606,000
Fletcher Avenue	\$9,277,500	\$20,337,000
Reservoir Avenue	\$5,955,000	\$6,737,480
Riverview Terrace	\$11,676,600	\$12,348,000
Willowbrook Apartments	\$17,843,000	\$5,884,320
Simmons Brook Culvert	N/A	\$1,173,120

Note: Gray shaded costs indicate preferred alternative.

MEASURES EVALUATED AND ELIMINATED FROM CONSIDERATION:

Floodway Creation/Enlargement – A floodway consists of the stream channel and adjacent overbank areas necessary to effectively convey floodwaters in order to discharge the base (100-year) flood without cumulatively increasing the water surface elevation more than one foot. This alternative can reduce unwanted flooding and improve human health and safety concerns related to flooding. Creation of additional channel areas to contain and convey flood flows would require significant tracts of land in strategic locations. The limited amount of land available for channel work around affected bridges and culverts made them infeasible at all sites. At several locations, property acquisitions were required and these were expensive and afforded little benefit according to the computer modeling results.

Wetland Restoration/Creation – Several of the hydrologic and hydraulic model simulations included the creation and restoration of wetland resources to provide flood storage and attenuation functions, which would reduce unwanted flooding and address associated human health and safety concerns. A standard rule of thumb for estimating the storage volume required for minimal reduction in flooding is to consider 1 inch over the watershed area; this amounts to 1,100 acre feet of storage. Due to the urban nature of the watershed, the large amount of open land required for even this minimal flood damage reduction is not available; therefore this alternative was removed from consideration.

Dam Rehabilitation – Several of the hydrologic and hydraulic model simulations included the rehabilitation of industrial reservoirs constructed during the industrial revolution as a means to reduce unwanted flooding and related human health and safety concerns. During the initial alternative development process, NRCS proposed reconstructing several of these dams into flood storage reservoirs in the affected areas. None of the modeled scenarios provided reduction in damages in the areas of concern; therefore this alternative was removed from consideration.

Sediment Removal / Channel Dredging - Several of the hydrologic and hydraulic model runs included the excavation of the channel bed to assess the possibility of providing additional volumetric capacity within the channel and thereby reducing flood elevations and floodplain widths, and addressing the human health and safety concerns tied to the flooding concern. As was anticipated, this alternative did not provide a measurable decrease in flood damages in the affected areas; therefore this alternative was removed from consideration.

Constraint Removal (Bridges) – Certain features of the channel or adjacent structures (i.e., bridge apertures) create limitations to the conveyance of water under certain flow conditions. These constraints can result in higher flood elevations than what would occur if the constraints were removed. However, in some cases, the constraints have little to no impact on the flood elevations due to the overall magnitude of the flood.

A field reconnaissance effort found five potential constraints (4 bridges and 1 culvert) along the Pocasset River. In several instances the modification or removal of these constraining features was evaluated to estimate the impact of each constraint on flood elevations. These evaluations were based on the results of hydraulic modeling with the HEC-RAS model, which included constraint removal. The model simulations were conducted such that these five structures were removed independently of each other, followed by a simulation with all five constraints removed simultaneously. The resulting flood heights were compared to the 100-year flood heights for future build-out conditions with proposed floodwalls and constraints in place, to assess if constraint removal within the system resulted in a drop of flood height. The results of the independent analysis are as follows:

- Morgan Avenue Bridge removed: 0.5 ft water level drop upstream to Central Avenue Bridge.
- Morgan Mill Road Culvert removed: 1.9 ft water level drop 400 ft upstream.
- Plainfield Street Bridge removed: 2 ft water level drop upstream to Morgan Mill Road Culvert.
- Reservoir Avenue Bridge removed: 0.6 ft water level drop 4,000 ft upstream.
- Garden City Drive Bridge removed: 2.5 ft water level drop upstream to Reservoir Avenue Bridge.

In the simulation with all five constraints removed, results were unchanged, suggesting that the structures affect water elevations independently of each other. Effects of constraint removal were minimal downstream. Benefits from bridge/culvert modification are low compared to the high cost of bridge/culvert construction and because of this, alternatives involving modifications to the bridges described above were not pursued further.

Elevating Structures – Elevation is the lifting of a structure above the flood elevation through the use of piles, piers, posts, or columns as a means of addressing human health and safety concerns. Elevation is a FEMA accepted strategy for substantially improved or damaged residential structures located in the floodplain. Since most of the structures in the project area are constructed with a basement, elevating a structure can be costly. Elevation was considered infeasible for all of the apartment building structures and the commercial/light industrial sites. Topographical features in other areas (steep slopes) made elevation difficult. Elevation of six residential properties in the South Bennett Drive area was considered a cost effective strategy and is included in the Preferred Alternative.

Earthen Berm Dike – An earthen berm dike is a physical flood barrier constructed of earthen materials to address flooding and human health and safety concerns. For a typical earthen dike, standard engineering measure recommends a three foot horizontal space to gain one foot in vertical elevation (3:1 slope) as well as a three foot top width. An eight-foot height of protection, to provide at least 3 feet of freeboard against the 100-year flood event, which is typical in many of the flood prone areas along the Pocasset River, requires an earthen berm that is approximately 51 feet wide (24 ft per side, plus a 3 ft top width). This size requirement coupled with limited available space at potential sites makes earthen berms physically infeasible at the majority of locations. Earthen berms were considered through the project area to provide collective protection for groups of properties or for individual homes, but were eliminated for further consideration because of the extensive space requirements and relative high costs.

5.1.2 Selection Criteria and Ranking

In each High Hazard Area, the preferred options involves a combination of feasible measures to minimize cost while meeting the project goal of flood protection. The site rankings for each flood damage reduction alternative, along with the rationale for the ranking system used, are displayed in Table 8-3. The Proposed Action for each project site was developed from the above flood damage reduction alternatives by first analyzing each for physical feasibility (the measure could be constructed and if constructed would control flooding). If an alternative does not provide safe egress from the structure, then it is considered not feasible. If a flood protection measure was deemed feasible for a given site, it was given a ranking from 0 to 3 (with 3 being the highest) in three categories of equal weight:

1. Economic (Project costs, including consideration of the costs for damages under the No Action Alternative)
2. Social (Considerations include human health and safety during flood events, low-income resident displacement, property value changes, and land use impacts)
3. Environmental (floodplain and habitat impacts)

The three categories were then summed and the highest ranking alternative chosen to include in the Proposed Action at each site. Several sites include a combination of measures based on the lowest feasible cost to meet the same objective. For example, dry-floodproofing is proposed along with acquisitions for properties with less than 3 feet of flood water under the 100-year flood event.

5.1.3 Alternative Plans

The Preferred Alternative is the combination of preferred measures for each project site. The Preferred (NED) Alternative and the No Action Alternative are evaluated in Section 5.2 for each project site.

The identified alternatives address the Sponsor’s objective and satisfy the requirements of P&G. The No Action Alternative is included in accordance with National Environmental Policy Act (NEPA) requirements. The computer simulation models were used to evaluate the effectiveness of Alternative 1 (the preferred alternative) as well as the No Action Alternative (Alternative 2) in the context of a full watershed build-out¹.

A matrix (Table 8-4) was developed to provide a concise comparison in narrative form of Alternative 1, the Preferred (NED) Alternative, to the No Action alternative, with respect to certain economic, social, and environmental factors identified in scoping.

5.2 Description of Alternative Plans

This section provides a description of the flood damage reduction measures to be implemented under Alternative 1 the No Action Plan, and Alternative 2, the Preferred (NED) Alternative . Refer to Table 6-4, Summary and Comparison of Alternative Plans, at the end of Section 6 for a comparison of the alternatives.

Under the No Action Alternative, the project areas would remain in their current condition and no flood damage reduction mitigation would be provided. Property damages would continue to occur during flooding episodes.

Alternative 1 (NED Alternative) includes the most cost-effective combination of feasible flood mitigation measures to meet the objective of flood damage reduction. The Preferred Alternative is described in detail in Section 8 and is depicted on the site plans, Figures 6-1 through 6-15. This includes construction of floodwalls at Reservoir Avenue and Willowbrook Apartments.





The floodwalls at each of the proposed locations would be engineered to provide flood protection during a 100-year, 24-hour storm event at full build-out. FEMA guidelines require that three feet of freeboard be included in the floodwall design as a safety measure. All of the proposed floodwall designs incorporate FEMA guidance and requirements.

A total of twenty-five (25) buildings, 16 in Johnston and 9 in Cranston, which are predicted to have flood elevations between 0 and 3 feet above ground surface will be dry flood proofed using standard NRCS procedures.

The following sections provide additional detail of the actions associated with the various alternative plans and other options considered. In general, the description of each alternative plan/other option considered is organized by site location. See Section 8 (Preferred Alternative) for detailed description of the preferred measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

5.2.1 Rotary Drive

Alternative 1- Proposed Action

Rotary Drive is a residential neighborhood located upstream of the Morgan Avenue Bridge in Johnston, Rhode Island. Twenty-two (22) properties (all single family residences) are located within the 100-year floodplain. Costs associated with flooding in this area are primarily damages to residential property and cleanup. The proposed action would involve the acquisition of 16 residential homes, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain, and dry floodproofing 6 structures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

Alternative 2 – No Action

The no action alternative would leave the project area as is and provide for no flood damage reduction. Property damages would continue during flooding episodes.

5.2.2 South Bennett Drive (Park Place Apartments)

Alternative 1- Proposed Action

Park Place Apartments is a large low-income apartment complex located upstream of the Plainfield Street Bridge in Johnston, Rhode Island. The apartment complex is located within the 100-year floodplain and is very close to the Pocasset River. Costs associated with flooding in this area are primarily damages to the apartment complex and cleanup costs. The proposed action would involve the acquisition of the apartment buildings and property, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain.

Across the river from Park Place Apartments are River Avenue and River Drive, which is part of a larger, mainly residential development. Nine buildings along River Avenue and River Drive are within the 100-year floodplain and severely affected by flooding on a regular basis. Costs associated with flooding in this area are primarily damages to the buildings and cleanup costs. The proposed action seeks to acquire and demolish 28 properties along River Avenue, River Drive, La Fazia Drive, and Melody Lane and restore floodplain along River Avenue and River Drive, and move families/business to new locations outside of the 100 year floodplain. The proposal also includes dry floodproofing 9 structures located within the 100-year floodplain.

See Tables 8-3 and 8-4 for the formulation processed used in developing the alternatives and options at South Bennett Drive and a narrative description of the major impacts of each alternative. See Section 8 (Preferred Alternative) for detailed description of the installed measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

5.2.3 Fletcher Avenue

Alternative 1- Proposed Action

Fletcher Avenue is an industrial/commercial area located downstream of the Plainfield Street Bridge in Cranston, Rhode Island. The Pocasset River causes severe flooding during storm events in this area. Fifty-four properties are within the future 100-year floodplain. Costs associated with flooding in this area are primarily damages to industrial/commercial property, lost wages and sales, and cleanup costs.

The proposed action would involve the acquisition of 41 properties, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain, and dry floodproofing 7 structures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

It should be noted that the Rich Box Company is a low lying area located across the Pocasset River from Fletcher Avenue. It is a large industrial mill, which manufactures card board boxes. The structure was reportedly floodproofed by the owner and is not considered a flood risk.

5.2.4 Reservoir Avenue

Alternative 1 - Proposed Action

Reservoir Avenue is a commercial area located adjacent to the Reservoir Avenue Bridge in Cranston, Rhode Island. Twenty-four properties are within the future 100-year floodplain in this area. Costs associated with flooding in this area are commercial property damage, lost sales and wages, and cleanup costs.

The installation of steel sheet pile floodwalls is proposed in order to adequately protect properties along Reservoir Avenue. The floodwall would be approximately 1,350-feet long and up to 11 feet in height from the Pocasset River stream crossing at Reservoir Avenue to an upland area along Knollwood Avenue. Several structures are located waterward of the proposed floodwall and will be required to be acquired, including properties owned by Forest Hill Nursery (City of Cranston Plat 9, Lots 3497, 3208, and 3455) and several single-family homes located on Knollwood Avenue. Most are vacant land or are currently owned by a plant nursery. Following construction of flood protection measures the acquired land is planned to be used as a recreational sports field.

See Section 8 (Preferred Alternative) for detailed description of the installed measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures.

The comparison of economic, social, and environmental impacts is presented in Table 8-4.

5.2.5 Riverview Terrace

Alternative 1 – No action

The no action alternative would leave the project area as is and provide for no flood damage reduction. Property damages would continue during flooding episodes.

Alternative 1- Proposed Action

Riverview Terrace, including the Davis Court and Autumn Street areas form a large residential neighborhood located approximately 2,100 feet upstream of the Garden City Bridge in Cranston, Rhode Island. Costs associated with flooding in this area are primarily damages to residential property and cleanup. The area is primarily single family housing. Fifty seven properties (residential homes and an apartment complex) in this area are located within the 100-year floodplain.

The proposed action would involve the acquisition of 39 properties, the demolition of the structures and infrastructure on the properties to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

Alternative 2 – No action

The no action alternative would leave the project area as is and provide for no flood damage reduction. Property damages would continue during flooding episodes.

5.2.6 Willowbrook Apartments

Alternative 1- Proposed Action

The Willowbrook Apartments are located approximately 390 feet upstream of the Garden City Bridge in Cranston, Rhode Island. The area is relatively flat, causing a large area to be flooded when the Pocasset flow overtop its banks. Current land use includes high density residential developments and associated landscaping and manicured lawns. There are 13 buildings, containing 156 apartment units within the modeled 100-year floodplain in this area. In addition, there are 6 structures located along Pontiac Avenue, one of which will be dry-floodproofed. Costs associated with flooding in this area are primarily associated with damages to the apartment complex and cleanup costs.

In order to adequately provide flood damage protection in this area a steel sheet pile floodwall is proposed. The proposed floodwall will be approximately 9 feet above grade and continue for a total approximate length of 1,200 feet. See Section 8 (Preferred Alternative) for detailed description of the installed measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.



5.2.7 Simmons Brook Bypass Culvert

Alternative 1- Proposed Action

Currently the Simmons Brook runs through a culvert under a mill building near its confluence with the Pocasset River. The culvert is undersized and causes flooding of 4 properties, including the mill building. The proposed remedy for the problem is to construct a bypass culvert that will route high flows around the mill building culvert. See Section 8 (Preferred Alternative) for detailed description of the installed measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures. The comparison of economic, social, and environmental impacts is presented in Table 8-4.

5.2.8 Confluence of Pocasset River and Simmons Brook

Alternative 1- Proposed Action

A small debris dam is located near the confluence of the Pocasset River and the Simmons Brook upstream of River Avenue. This debris dam causes the river to migrate outside of its channel into adjacent areas, including residential yards. We recommend this debris dam be removed to restore the River's flow path. See Section 8 (Preferred Alternative) for detailed description of the installed measures for each critical area. See Table 8-5 for installation costs for structural and non-structural measures. This item is included under non-structural measures.

Alternative 2 – No Action

The no action alternative would leave the project area as is and provide for no flood damage reduction. Property damages would continue during flooding episodes

SECTION 6

ENVIRONMENTAL CONSEQUENCES

In this section, the effects of the Preferred Alternative and the No Action Alternatives on the natural and human environment are evaluated.

The Proposed Action will result in the net restoration of approximately 38.5 acres of floodplain. The two proposed floodwalls will result in a loss of 9.5 acres and the acquisition and demolition of structures throughout the watershed will result in 48 acres of restored floodplain area.

The loss of the 9.5 acres of active floodplain are a result of the construction of two floodwalls which will limit the lateral extent of flood flows. Compensatory flood storage will be provided on a volumetric basis to mitigate the lost storage along the Pocasset River. This compensatory storage may be located at the other sites where land will be required as part of the Preferred Alternative. Floodwalls will protect adjacent residential, industrial, and commercial property from damages caused by flooding. The Proposed Actions will protect life and property along the Pocasset River by remedying flooding in High Hazard Areas of the Pocasset River.

Urban quality of the project area will be enhanced by the Proposed Action through flood protection for residential, commercial, and industry areas through the acquisition and demolition of certain structures, and relocation of residents and businesses to outside of the floodplain. There are several beneficial impacts, including providing restored floodplain areas, which have beneficial environmental and community impact, the acquisition may allow for Towns to create public space to allow neighborhoods to better connect to the river.

The primary objective of the project is flood damage reduction in High Hazard Areas of the Pocasset River watershed. The proposed plan reduces flood damages for the 100 year, 24 hour storm by close to 100% in the High Hazard Areas of the Watershed, the annual equivalent damage reduction is approximately 97%. See Table 8-3 for a breakdown of flood damage reduction effects of the Proposed Action. Project forecasting was based on local planning documents (zoning maps, comprehensive plans, etc.) and anticipated conditions within the Watershed. As much of the Watershed is currently developed, forecasted conditions (as applied in the future build-out Watershed hydrology model), assume development will continue, as described in the comprehensive plans for Johnston and Cranston.

In addition to the impacts described in this section, construction of projects funded under the proposed action alternative in the Pocasset River Watershed Plan may have short-term, minor adverse effects on surface water quality, vegetation, soils, wildlife, noise, and traffic in the vicinity of the construction and potential beneficial temporary impacts to the local economy through the creation of temporary construction jobs. During the construction phase of each plan measure, best management measures would be used to minimize short term, temporary environmental impacts. These impacts, therefore, are not discussed in detail.

The National Environmental Policy Act (NEPA) requires the federal agency preparing an EIS to evaluate the direct, indirect and cumulative impacts of its proposed action. Direct impacts are caused by an action and occur at the same time and place as the proposed action. Indirect impacts are those that are “caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable”. Cumulative impacts are those impacts that result from the proposed project and other known past, present, and future actions in the affected area.

NEPA requires that the direct, indirect (a.k.a. secondary), and cumulative impacts of the proposed action are disclosed and that these are considered in the agency’s decision-making process. Direct, indirect and Cumulative Impacts are discussed below for each resource area as applicable. See Section 4 for a description of existing conditions for of the below topics. A description of future, without project conditions is given under the “No Action Alternative” heading, where applicable, in the following sections.

Publishing this Plan/EIS complies with NEPA requirements and Water Resources Council Guidelines as specified in “Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies” In addition, the Interagency Review, conducted as specified in the National Watershed Manual ensures that the proper coordination has been done in accordance with Executive Order 11988 (Floodplain Management).

6.1 Socioeconomics

6.1.1 Land Use

Preferred Action Alternative

The proposed project will provide for continued use of land within the Pocasset River watershed that is chronically flooded. In some portions of the project area, there will be alterations to existing land use by converting developed residential/commercial to open space/undeveloped. The following is a summary of land use impacts by area. The proposed project areas are located within primarily urban floodplain, and many of the project sites are proposed to be restored to undeveloped conditions with the floodplain restored. Project areas proposing floodwall construction are currently not fully utilized due to frequent flooding; installation of the floodwalls may encourage development in these areas.

Rotary Drive

Rotary Drive is a residential neighborhood located upstream of the Morgan Avenue Bridge in Johnston, Rhode Island (Figure 6-4). Twenty-two properties (single family residences) are located within the 100-year floodplain. Seventeen of these structures would be removed from the floodplain and the land returned to undeveloped. The property could be used as open space and allow the community better access to the river.

South Bennett Drive

The Park Place Apartments consist of 78 units of low income housing, the lower units of which currently experience flooding. The proposed project would involve acquiring and demolishing the buildings and creating a restored floodplain area.

South Bennett Drive and River Drive is a residential neighborhood across the river from Park Place Apartments. Flooding in this area affects 38 structures (2 are in the caution area). The proposed project would result in the removal of 27 structures and dry-floodproofing 9 structures. The 27 structures to be removed would be converted to open space.

Fletcher Avenue

The Fletcher Avenue site lies within a depression area with gentle slopes (Figure 6-9). It is primarily industrial, with large tracts of impervious area. The proposed project involves 7 structures to be dry flood proofed and 41 acquired. The Rich Box Company facility on the north side of the river and a large food processing plant directly across the river has previously been floodproofed and will remain in its existing condition.

Reservoir Avenue

At the Reservoir Avenue site (Figure 6-12), the proposed action would result in the acquisition of properties owned by Forest Hill Nursery and the residential and commercial properties that would be riverward of the proposed floodwall. After the Nursery is relocated, the current site would be converted to recreation fields or other open space use. This floodwall will protect businesses and seven commercial structures along Reservoir and Knollwood Avenues.

Riverview Terrace

For the Riverview Terrace neighborhood (including Davis Court and Autumn Street neighborhoods (see Figure 6-13), the acquisition of the 47 single family residences and three multi-family apartment/condominium units will be converted to open space.

Willowbrook Apartments

Within this area (Figure 6-14), the proposed floodwalls along the Willow Brook Apartment complex would protect 13 residential structures and one outbuilding from flooding during the 100-year storm event. There would be 156 dwelling units protected from flooding. Recreational facilities (tennis courts, playgrounds) within the complex would also be protected. The proposed project also calls for dry flood proofing of one commercial structure immediately downstream of the apartment complex.

The erection of a floodwall would occur along the western edge of the perimeter drive/parking area of the apartment complex, therefore there will no effect on parking or traffic movement as a result of the project. However, during construction, a portion of the perimeter drive may need to be closed. This should only affect traffic internal to the apartment complex and not the local roadway system.

Simmons Brook Bypass Culvert

This area consists primarily of industrial land use, including a mill building (Figure 6-6). Currently the Simmons Brook runs through a culvert under a mill building near its confluence with the Pocasset River. The culvert is undersized and causes flooding of four properties, including the mill building. Construction of a bypass culvert that will route high flows around the mill building culvert will protect four industrial properties in this area. The new culvert will be located underneath an existing parking lot for an industrial business. During construction, there will be a temporary loss of parking. However, ample parking exists on site to accommodate parking needs in the short term.

No Action Alternative

The No Action alternative would not result in any land use changes in the corridor. However, flooding of residential, industrial and commercial properties would continue which, in the long term, could result in some of the buildings being vacated (particularly those commercial and industrial-leased buildings). The No Action alternative will have no impact on prime farmland soils or farmlands.

Indirect and Cumulative Impacts

For the land protected behind proposed floodwalls, generally, the flood-protected land may become more attractive to development because the incidents of flooding will have been reduced. Land use changes may result in areas that are newly protected from flooding.

For the land that is converted to floodplain and open space, the property acquired becomes public property that cannot be redeveloped and must remain open space in perpetuity.

6.1.1.1 Prime Farmland Soils

There are no viable prime farmland soils or active farms that would be impacted by the proposed project. All floodplain areas that are to be alleviated from flooding are developed for residential, commercial or industrial uses except for the Forest Hill Nursery in the Reservoir Avenue area. This business consists of greenhouse and a small outdoor tree/shrub storage area. No in-soil crops are produced there. The conversion of this property to recreational fields would not impact prime farmland soils.

6.1.2 Demographics/Environmental Justice

In compliance with Executive Order 12898, impacts to low-income or minority populations as a result of this project have been assessed. Socioeconomic data from Table 4-2 is used herein to support the conclusions of this Environmental Justice analysis.

The proposed project is located in the City of Cranston, and the Town of Johnston. The percentage of minority individuals living within these two communities is lower than the percentage of minority individuals living within the nation, state, and county. The percentage of both families and individuals living below the poverty line are below the percentages of individuals and families living below the poverty line within the nation, state, and county.

Portions of the project implemented within the City of Providence and Providence County, Rhode Island will affect a higher percentage of non-white persons, persons of Hispanic origin, and persons below the poverty line than the percentages within Rhode Island and the Country. However, the proposed projects would have a net positive impact on the populations within the project area because of reduced flooding and property damage.

Indirect and Cumulative Impacts

The proposed project will decrease the number of residential homes and housing units available within Cranston and Johnston. Since the program is voluntary, it is assumed that for owner-occupied homes, which constitute the majority of the homes with the exception of the Park Place Apartments, the residents would only voluntarily enter the acquisition program if they found comparable housing outside of the floodplain area. As explained further in Section 8, residents of the Park Place Apartments would be eligible for Federal assistance should the apartment building be acquired.

6.1.3 Economics

Preferred Action Alternative

The proposed project will have considerable long term direct economic benefits for the communities; average annual flood damages in the project area will be reduced by approximately 97%, as shown in Table 1-1 and Table 6-1. Flood damage reductions are based on flood damage reduction modeling discussed in Appendix D. This will greatly reduce the economic burden of flooding on property owners and the Sponsor. In addition, the proposed project will have long term indirect economic benefits, including a reduction in hours lost by business and wages lost by workers due to flooding, increased property values within flood zones, and economic benefits from utilization of land formerly inundated periodically by flooding. In addition, time and monetary resources spent by local emergency organizations (fire, police, ambulance) would be lessened as the frequency and severity of flooding would decrease.

Controlling floods of the Pocasset River may contribute to improving the standard of living in the area. Property values, which may have been diminished due to frequent flooding, may increase as flooding becomes less frequent and severe. Costs will not have to be paid for property damage, loss of personal items, and clean up. In addition, local government costs can be expected to decrease due to a reduction in flood damages to roadways and bridges.

No Action Alternative

Under the No Action Alternative severe flooding will continue to occur in the watershed. Damages will continue to occur and burden property owners and the Sponsor. If development in the watershed increases, as it has in recent years, flooding will become more frequent and more severe, potentially increasing long term flood damage costs as outlined in Table 6-1.

Table 6-1: Damage Cost Estimates With and Without Project

Item	Average Annual Damage				Damage Reduction Benefits			
	Without Project		With Project		Without Project		With Project	
	Agricultural Related ³	Non Agricultural Related	Agricultural Related ³	Non Agricultural Related	Agricultural Related ³	Non Agricultural Related	Agricultural Related ³	Non Agricultural Related
Residential	1,366,921	1,014,407	2,464	103,008	0	0	1,364,457	911,399
Commercial	78,019	778,941	2,208	2,976	0	0	75,811	775,965
Totals	1,444,940	1,793,348	4,672	105,984	0	0	1,440,268	1,687,364

1. Price base 2017.

2. Road and bridge damages were not evaluated.

3. Agricultural related damage includes damages to rural communities.

4. Relocation costs include moving expenses for homeowners. NRCS will provide funding for 50% of relocation costs.



6.2 Public Health and Safety

Proposed Action Alternative

Approximately 681 people currently residing in high hazard areas will be protected from flooding up to the 100-year, 24-hour event. Additionally approximately 275 people residing in areas of less severe flooding will be protected, up to the 100-year, 24-hour event. This will reduce the threat to human health and safety (both direct and indirect) posed by flooding. Direct threats include physical harm due to flood waters, building damages, etc., while indirect threats include mold growth due to periodic flooding of buildings and contact with floodwaters contaminated by flooded septic systems, cemeteries, etc. The proposed project will allow egress from homes during flood events and will allow access of emergency vehicles to formerly flood prone areas during flood events. Indirectly, property owners will worry less about impending flood events.

The residents in 134 homes and apartments will be removed from their residences; however they will be provided fair market value for the property, will be offered relocation payments, if applicable, and will be allowed to find a home outside of the Pocasset River floodplain. At this time, it is anticipated that purchased homes will be demolished. This is considered an overall benefit, i.e. the inconvenience of moving is out-weighed by the benefits of relocation to a home outside of a floodplain. Note that at this time, low income and minority populations will not be part of proposed acquisitions and will not be displaced due to the proposed project.

No Action Alternative

Under the No Action Alternative severe flooding will continue to occur in the watershed and continue to pose a threat to human life (directly and indirectly) and continue to limit egress and emergency vehicle access to flood prone areas during flood events. The potential for increase in flooding frequency and severity in the future may increase the future threat to human health and safety.

6.3 Aesthetic Considerations

The portion of the project which converts previously developed land into open space and floodplain area is considered a beneficial impact to aesthetics and may even increase the property values of the surrounding area by providing habitat, river access, and lower density housing.



Residential areas are located closely along the river corridor of the Pocasset River. In certain cases, views and access to the corridor is a significant visual component of the landscape which surrounds the dwellings. In some instances, the river corridor isn't visible due to overgrown, dense vegetation. The construction of the floodwalls along the commercial and multi-family residential areas will have a visual impact to the areas surrounding the river corridor. However, this visual impact is outweighed by the benefits provided by protecting the homes and property from future flood damages. In other locations with single-family homes, floodwalls were considered to be infeasible, in part due to aesthetic reasons and requiring buy-in from all single-family property owners.

Location-specific design measures will need to be taken in order to lessen the visual impact of the floodwalls. These design measures include shrub plantings and hedges, and painting of the walls in neutral colors which will complement the surroundings.

At Willowbrook Apartments the watercourse is located approximately 20 feet away from the roadway in the rear of the apartment complex. The river channel is shaded by trees and views of the water are limited due to the existing shrub and tree growth. The proposed floodwall in this area will be up to 7 feet in height. The floodwall would be painted a neutral color to match the apartments and may be flanked by an earthen berm along the landside edge. Plantings with evergreen shrubs may also be incorporated to deflect views of the wall.

At the commercial area along Reservoir Avenue it is proposed to have a 3 to 8 foot high floodwall. The floodwall would follow the outer edge of the property. The corrugated steel wall would remain the color of natural steel, and the sheet will be left pile-driven. Landscaping may be added to soften the appearance of the steel wall.

No Action Alternative

The No Action alternative would encompass no floodwall construction and, therefore, no potential for visual impacts to residential and historic areas of the River corridor. However, negative visual impacts do occur on a temporary basis as a result of flood damage to buildings and other structures.

6.4 Cultural Resources

Proposed Action Alternative

The Rhode Island Historical Preservation and Heritage Commission (HPHC) was contacted to provide information on historic structures in the project areas. The Town of Johnston and the City of Cranston were also contacted. The Rich Box Company facility was identified as a property eligible for listing on the National Register of Historic Places.

In a prior letter dated May 12, 2009 (Appendix C), HPHC stated that there is one site with potential Native American resources and clarifies in their August 17, 2009 letter that completion of an archaeological survey prior to construction is warranted at the location.

No Action Alternative

The No Action alternative would leave conditions at the Rich Box Company and the potential Native American resource site as is. Therefore no cultural impacts would occur.

6.5 Climate and Air Quality

Proposed Action Alternative

Under the authority of the U.S. Clean Air Act, as amended, the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for concentrations of six air pollutants: carbon monoxide (CO), nitrogen dioxide (NO₂), ozone, particulate matter ten microns or smaller in diameter (PM₁₀, includes particulate matter 2.5 microns or smaller, PM_{2.5}), sulfur dioxide (SO₂), and lead (Pb). Primary standards are established to protect public health; secondary standards are established to protect plants and animals and to prevent economic damage.

The General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality. As of January, 2015, the State of Rhode Island is not designated as a maintenance or non-attainment area for any of the designated NAAQS; therefore, a Conformity Assessment is not required.

Potential construction-related air quality impacts are associated with the use of diesel-powered construction vehicles. Emissions from diesel equipment include carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter (PM₁₀ and PM_{2.5}). Emissions from construction equipment are anticipated to be significantly less than the total emissions from other industrial and transportation sources in the region, and therefore, are expected to be insignificant with respect to compliance with the NAAQS.

Fugitive dust emissions can occur during ground excavation, material handling and storage, movement of equipment, and transport of material to and from the project site. Potential air quality impacts from fugitive dust would be addressed through a variety of mitigation measures incorporated into contract specifications for the project, including reducing exposed erodible earth, stabilizing exposed earth, street sweeping of roads within construction areas, etc.

In addition to construction activities, emissions from the operation of proposed Pump Stations utilizing emergency generators for back-up power would have emissions associated for the life of the project. These are not anticipated to be regionally nor locally significant.

No Action Alternative

None of the proposed construction projects would occur under the No Action Alternative; thus there would be no construction-related air emissions or other permanent emissions increases and therefore no change in air quality.

6.6 Topography, Geology, and Soils

Proposed Action Alternative

The proposed action will have little impact on the overall topography of the watershed. Minimal changes to grades will result from the demolition of structures, installation of the sheet pile floodwalls, and creation of the required compensatory floodplain storage.

Prime Farmland and State-wide Important soils located adjacent to the river channels may be impacted minimally by some reworking of the soils during installation of the floodwalls. The presence of the floodwalls will result in protection of some of the existing Prime Farmland and State-wide Important soils by reducing future development of those areas behind the floodwalls.

No Action Alternative

Under the No Action alternative, impacts to soils as a result of construction for sheet pile installation and changes to grading will not occur. Current soil erosion impacts as a result of flood flows will continue.

6.7 Water Resources

6.7.1 Surface Water

Water Quantity

Proposed Action Alternative

The measures proposed in the Preferred Alternative will not result in any major changes to the surface water elevations. As shown in Table 6-2, surface water elevations remain approximately the same for the preferred alternative, when compared to without project conditions. It should be noted that Table 6-2 provides results for hydraulic modeling computations that included floodwalls to be constructed at each project location, which would be considered a conservative modeling scenario. Therefore, the Preferred Alternative will have less hydraulic impact than that shown in Table 6-2.

Along the proposed Reservoir Avenue floodwall, water surface elevations increase up to approximately 1-foot; this increase continues upstream of the floodwall, with the increase in water surface elevations becoming negligible approximately 3,300 feet upstream of the northern end of the floodwall. Note that a building is located in the HEC-RAS model at river stations 10135.42 and 10279.39 which may be impacted by this increase; these structures have been identified as two residential structures, 27 and 37 Tudor Street in Cranston and the impacts to these two properties should be examined in detail during the design phase.

Water surface elevation increases due to the Preferred Alternative outside of the area discussed above are considered to be minor and insignificant, i.e. on the order of a few tenths of a foot.

No dams will be altered as part of the Preferred Alternative.

Table 6-2: Predicted Water Surface Elevations and Discharges in the Pocasset River Under Watershed Build-Out Without and With Flood damage reduction (100-year, 24-hour, Type III).

Location	River Station Number (approximate)	Without Flood Damage Reduction ¹		With Flood Damage Reduction	
		Elevation (ft)*	Discharge (cfs)	Elevation (ft)*	Discharge (cfs)
Atwood	42821	126.1	1027	126.1	1027
Rotary	36014	99.4	1264	99.4	1234
Morgan St.	34741	98.4	1264	98.4	1234
Morgan Mill	33451	87.4	1470	87.4	1522
Bennett/Melody	32739	85.3	1549	85.3	1582
Park Place	32739	85.3	1549	85.3	1582
Plainfield Pike	29781	84.3	2419	84.1	2443
Reservoir Ave.	7732	31.4	2415	31.4	2334
Willowbrook	2896	26.8	2370	26.8	2360
Garden City	1609	26.7	2271	26.7	2360

*Elevations are in NAVD 88.

¹Source: Table 2.5 of the Flood Plain Management Study Technical Report (NRCS, 2007)

No Action Alternative

The No Action Alternative assumes that nothing is performed to address current or future flooding issues within the Pocasset River watershed. Under the No Action Alternative, severe flooding will continue to occur in the watershed. If development in the watershed increases, as it has in recent years, flooding will become more frequent and more severe. As indicated by Table 4-3 in Section 4, full build out of the watershed will result in increases in the water surface elevation by approximately one foot, with a potential increase of about 3.5 feet at Plainfield Pike, during the 100-year, 24-hour duration storm event. These increases may result in an expansion of the area impacted by flooding, with new properties being affected.

Indirect and Cumulative Impacts

Water surface elevations outside the areas to be protected would remain the same or increase slightly. Computer modeling of the proposed action indicates that such increases would be relatively small and limited to areas that are not developed (forest, lawn, etc.). Slight increases (a few tenths of a foot) in flood elevations should not hinder use of the affected land.



At Reservoir Avenue, a surface water elevation increase of up to 1 foot continues approximately 3,300 feet upstream. Two residential structures, 27 and 37 Tudor Street, may be impacted by this increase. Impacts to these two properties will be examined in detail during the design phase. Impacts may include damage to structures and usability of the backyards. Other impacts upstream of Reservoir Avenue where surface water increases are predicted should be limited to areas that are not developed (forest, lawn, etc.) and should not hinder use of the affected land.

Water Quality

Proposed Action Alternative

The flood damage reduction project in the Pocasset River watershed is anticipated to have a beneficial overall effect on water quality in the Pocasset River. Fewer episodes of high water and flooding to developed areas will prevent bacterial contamination from the flooding of individual sewage disposal systems and sewage backups; approximately 50 individual sewage disposal systems are estimated to be located within the 100-year floodplain. Reduced flooding will also decrease the amounts of sediments and debris washed into the river from adjacent residential, commercial, and industrial areas. This will contribute to the improvement of the water quality of the Pocasset River, which has been placed on Rhode Island's 2018 DEM List of Impaired Waters for bacteria (*Enterococcus*) chloride, copper, non-native aquatic plants, and benthic-macroinvertebrate bioassessments.

No Action Alternative

The No Action Alternative will do nothing to improve the water quality of the Pocasset River. The river has exhibited bacteria levels that exceeded the primary contact recreation and swimming criteria, and exceedances of total copper and total lead criteria and elevated nitrate levels. Continued flooding will result in harmful water quality impacts to the Pocasset River and downstream areas from bacterial contamination due to sewage backups and the washing of pollutants from developed areas into the river by floodwaters.

6.7.2 Groundwater

Proposed Action Alternative

The groundwater in the vicinity of the proposed acquisitions and dry-flood proofing will remain similar to existing conditions. Groundwater conditions in the areas of the proposed floodwalls will be evaluated during the design phase once detailed subsurface information is available at each project area. The potential exists for limited groundwater mounding on the upstream sides of the steel sheet pile floodwalls; however the proposed underdrains on the upstream side of the floodwalls should mitigate this impact. Impacts to river inflow from groundwater due to the sheet pile walls is deemed to be negligible.



Vibration during sheet pile installation is unlikely to impact local wells. The proposed action will likely have little impact on groundwater quality.

No Action Alternative

The No Action Alternative will not result in any significant impacts to groundwater conditions or quality.

6.7.3 Wetlands and Floodplains

Proposed Action Alternative

As stated earlier, the proposed project sites are urbanized. The installation of flood walls and other plan actions are proposed outside of wetlands; however, some are proposed within the jurisdictional area of water bodies, including the Pocasset River. However these buffer zones are primarily within urbanized areas and the loss of vegetated buffer zones would be minimal. In-stream work will have minor short term impacts to wetlands; any wetlands disturbed during these activities will be restored upon the completion of work.

In areas where buildings will be removed, the former foot prints will be restored to natural floodplain; some of these areas may transition to wetlands over time dependent on soil and hydrology features.

The installation of floodwalls throughout the various problems areas would result in areas that are currently designated as floodplain to no longer being floodplain. This is a necessary consequence of correcting flooding problems and protecting property. Floodplains that are also wetlands and floodplains that are used for agriculture rely on periodic flooding events for nourishment. However, the floodplains within the project area are all urbanized areas and the floodplains only functions as reservoirs for flood waters.

Table 6-3 depicts the approximate acreage and land use of the lost floodplain by area.

Table 6-3: Urban Floodplain Changes as a Result of the Preferred Alternative

Site	Change in Urban Floodplain Acreage (acres)*	Current Land Use
Rotary Drive	+4	Converted from medium density, single family residential to floodplain.
Park Place Apartments	+1.5	Converted from multifamily residential to floodplain.
South Bennett Drive	+6	Converted from medium density, single family residential to floodplain.
Fletcher Avenue	+24	Converted from industrial, commercial and some medium density, single family residential to floodplain.
Reservoir Avenue	-4.5	Converted a single commercial (green house) and single family, residential to undeveloped/floodwall.
Riverview Terrace	+12.5	Medium density single family residential
Willowbrook Apartments	-5	Multifamily residential protected by floodwall.
NET TOTAL	+38.5	

* Areas within 100-year floodplain as defined by FEMA; Floodplain lost denoted by a (-) and floodplain area gained denoted by a (+).

The land that is currently occupied by homes within the 100-year floodplain that is proposed for acquisition and demolition, offer the opportunity for approximately 38.5 acres of floodplain restoration. The current developed area (primarily lawns) would be regraded and planted with floodplain vegetation appropriate for the hydrologic regime and soil conditions of the area. This work will be accomplished as part of the overall plan and is part of the Preferred Alternative. Detailed plans will be prepared during the design stage of the project.

No Action Alternative

None of the proposed projects would occur, hence, there would be no effect to wetlands.

Indirect and Cumulative Impacts

There are no known indirect or cumulative impacts.

6.8 Utilities

Proposed Action Alternative

The proposed actions related to acquisition/demolition of properties will involve the decommissioning of the existing utilities on the sites, including water, sewer, gas, electrical, and telecommunications. Any locations where septic tanks are present will be removed and decommissioned. There will be no modifications to the main distribution utility lines to any of the individual properties. Rhode Island Dig Safe will be contacted prior to construction to confirm the presence of utilities within the construction areas.

The installation of the proposed floodwalls has the potential to interfere with underground utilities. The layouts and depths of underground utilities will be surveyed at each project site and indicated on the design plans for construction of the sheet pile floodwalls. The placement of the floodwalls will be planned to avoid interference with underground utilities to the maximum extent practical. In locations where interference cannot be avoided, the design plans will incorporate mitigation strategies. Rhode Island Dig Safe will be contacted prior to construction to confirm the presence of utilities within the construction areas.

Proposed floodwalls will disconnect certain areas of the watershed from the main stream channels and improper drainage controls could flood areas protected by floodwalls. A pump station collection system or a floodwall runoff collection system is proposed behind each floodwall. In many cases these systems include storage and diversion chambers (either above or below ground) to limit the size of the pump stations or diversion of upstream runoff away from floodwalls. In critical areas, emergency back-up generators are recommended along with motorized outlet gates. The intent is to allow for natural drainage to the river during normal conditions and pumping during flood stage. These systems are an integral part of the floodwalls and part of floodwall installation. The nature of these floodwall and stormwater systems will require regular inspection and maintenance programs. Such maintenance will be required to insure that floodways remain clear and pumps and mechanical systems are operational.

The following is a description of the proposed stormwater collection system behind the floodwall at each site.

Reservoir Avenue

A detention basin will be constructed on the inland side of the floodwall to collect run off from the Reservoir Avenue area. In order for the basin to function properly, a 60 foot section of Knollwood Avenue will need to be regraded to drain into this basin. The proposed pump station collection system behind the floodwall will be composed of:

-
- One berm along the inland side of the floodwall.
 - One drain line along the inside of the floodwall.
 - One detention basin integrated into the roadway (to ensure the roadway drains to the detention basin).
 - One outfall with suitable flap or duck motorized gate.
 - One diversion chamber and a pump station with emergency generator.

Willowbrook Apartments

At Willowbrook Apartments, the proposed pump station collection system behind the wall will be composed of:

- One drainage swale located along the inland side of the floodwall to catch overland surface runoff.
- One collection basin located at the central point of the swale exiting to a diversion chamber.
- Five pump diversion chambers to collect gravity stormwater flow.
- Five pump stations with emergency generators.
- Five outfalls with a suitable flap or motorized gate.

No Action Alternative

None of the proposed floodwall projects would occur under the No Action Alternative and existing utilities and drainage patterns would remain unchanged. Without flood protection, flooding of developed areas will continue with a possible increase in frequency and magnitude. Frequent repair of damaged utilities as a result of flooding will continue to be required. Sewage backups, loss of potable water, power outages, and loss of other services will continue on a regular basis.

6.9 Wildlife / Threatened and Endangered Species

6.9.1 Fish Habitat and Wildlife Habitat

Proposed Action Alternative

A net total of approximately 38.5 acres of the existing residential area will be reclaimed as floodplain/wetland which will increase the wildlife habitat potential of the River corridor in this area. The use of floodwalls was minimized to limit the direct impacts to the existing fish and wildlife habitat within and along the banks of the Pocasset River. Currently the proposed project sites are highly urbanized and therefore impacts to fish and wildlife habitat would be minimal if the proposed action alternative is implemented.

Wildlife of many taxa (small mammals, large mammals, amphibians, reptiles) have unique and varying habitat and spatial requirements. Some, such as amphibians, usually require an aquatic environment and an adjacent upland environment to fulfill their full seasonal and life cycle requirements. Placement of a barrier, such as a floodwall near the aquatic system (Pocasset River) may inhibit horizontal wildlife movement in the various project areas where floodwalls are proposed. However, the habitat adjacent to the River in these areas is highly developed and does not offer significant habitat for wildlife, except for typical urban species that are well adapted to these conditions (e.g. skunk, raccoon, squirrel).

In-stream work will be limited to clearing a debris dam, which limits potential impacts to fish. Fish will not be significantly impacted by the proposed project. There will be slight increases in floodwater velocities, but fish should be capable of thriving under these conditions. The floodwalls will be located outside of the streams. During construction, erosion control devices will be installed immediately downgradient of the floodwalls to prevent soil from being eroded and transported into the River. Cumulative Impacts to fish/wildlife habitat will be minimal.

No Action Alternative

None of the proposed projects would occur; thus fish and wildlife habitat would remain unchanged.

6.9.2 Threatened and Endangered Species

Proposed Action Alternative

According to the Rhode Island Natural Heritage Program (RINHP), there are several species of plants on the State Rare Species list which have been reported within the watershed; all occur within the Snake Den State Recreation Area, which is in the upper watershed, far removed from the project area. One of these species is purple clematis (*Clematis occidentalis*), which is listed as State Endangered because it is the only known population of this plant in Rhode Island. According to the RINHP, in a letter dated 27 October 2005, none of these species are aquatic, and their occurrence in the outskirts of the watershed away from any current flooding issues, suggests that any flood control measures would have no impact on these populations or their habitat. The most recent United States Fish and Wildlife Service list of threatened and endangered species was obtained and is provided in Appendix C; no species of concern are located in the watershed. No direct, indirect or cumulative impacts occur to any threatened or endangered species within the Watershed.

No Action Alternative

None of the proposed projects would occur, thus there would be no effect to threatened and endangered species.

6.10 Energy

Proposed Action Alternative

There will be a temporary increase in energy consumption as a result of constructing the floodwalls, detention basins and ancillary structures as well as the demolition of buildings. However, this temporary increase in energy usage will be offset, in the long term, by decreases in the amount of energy needed to respond to emergencies and to effect water-damage repairs that currently occur. Energy use will be required to operate the pumping systems associated with the stormwater collection systems on the landside of the floodwall, during flood conditions.

No Action Alternative

None of the proposed projects would occur, thus there would be no energy consumed implementing the proposed project. However, the long term decrease in the amount of energy needed to respond to emergencies and to effect water-damage repairs that currently occur will not occur because the flooding problems will continue.

6.11 Irreversible and Irretrievable Commitment of Resources

The resources to be committed to this project are the labor, money and energy expended for the construction of the flood damage reduction structures, including flood walls, detention basins, piping and pump stations. These resources are necessary to correct recurring flooding problems in the middle and lower portions of the Pocasset River watershed. These resource expenditures will be offset by the substantial reduction in the amount of labor needed to respond to flooding emergencies and the amount of time and labor necessary for clean-up and repair.

6.11.1 Maintenance and Enhancement of Long Term Productivity

Maintenance and enhancement of long term productivity as defined in the National Watershed Manual relates to agricultural aspects, which may be impacted. Since there are no agricultural operations impacted where the flood damage reduction measures are being installed, there are no impacts to long-term productivity.

6.12 Consistency with Local and Regional Plans

The Sponsor's major resource concern is flood damage reduction. There is no existing River Basin Plan in which this project has been given a priority; however, NRCS has identified this watershed as its highest planning priority in the state.

The City of Cranston and the Town of Johnston are participants in the National Flood Insurance Program (NFIP). This program was established under the Housing and Urban Development Act of 1968 and expanded by the Flood Disaster Protection Act of 1973 to make limited amounts of flood insurance, which was previously unavailable from private insurers, available to property owners and occupiers. In return, the Act requires that state and local governments adopt and enforce land use control measures that will restrict future development in flood prone areas in order to avoid or reduce future flood damages. The Act was most recently revised on May 6, 1988 with an effective date of October 1, 1988.

Several of the structural measures contained in the Preferred Alternative fall within adopted regulatory floodways established by the Flood Insurance Studies. While regulatory programs such as the NFIP and flood prevention projects aimed at reducing existing flood damages are generally considered to be complimentary, prior to October 1, 1988 no provisions existed within the NFIP regulations to specifically distinguish between flood prevention construction (floodwalls, etc) and other development. One of the final rule revisions was made to accommodate situations where proposed floodplain actions can result in reduced flood hazards or have a net public benefit.

As noted earlier, the affected community must apply for a Conditional Letter of Map Revision (CLOMR) from FEMA. The application by the City of Cranston and Town of Johnston for the revision must show the effects on the flood stage due to the flood control measure. Once approval is received, construction may take place. When the project has been installed, the communities must apply for a Letter of Map Revision (LOMR). An approved LOMR is FEMA's modification to an effective Flood Insurance Rate Map (FIRM), or Flood Boundary and Floodway Map (FBFM).

As noted earlier, some of the structural and non structural areas are located in areas regulated by the RIDEM. Wetland permits and water quality certification will have to be received from RIDEM before construction can commence.

The City of Cranston Comprehensive Plan Update makes no specific mention of the Pocasset River flooding issues but does reference the City's Hazard Mitigation Plan. The Comprehensive Plan does recommend increasing recreational access to the rivers in the City, including the Pocasset River.

The conversion of the Forest Hill Nursery in the Reservoir Road area to recreational fields is consistent with the City's goal of providing additional active recreational facilities for its citizens.

The Town of Johnston's Comprehensive Community Plan specifically addresses the flooding issues of the Pocasset River. It states, as one of its land use objectives, "to protect against the loss of life and property damage caused by flooding". Also, it states as Policy NCR-60 to "Continue to promote a cooperative effort between Johnston and the adjacent Towns for the shared responsibility for maintaining and improving the water quality and reducing the flood potential of the Pocasset River". Therefore, this project is consistent with the Town's Comprehensive Community Plan.

6.13 Comparison of Alternative Plans

Justification matrices were developed for all NED plan measures except dry flood proofing and the removal of a small debris dam. Justification matrices (Table 8-3) have been provided to summarize effects and impacts of flood damage reduction options considered at each Site. A justification matrix was not developed for the debris dam removal because the planned measure is in response to a localized condition and the preferred alternative is the only feasible alternative. A justification matrix was not developed for dry flood proofing because areas to be dry flood proofed are located in low hazard areas spread throughout the watershed and outside of critical damage areas.

Table 3-1, Evaluation of Identified Concerns, has previously displayed the economic, social, environmental, and cultural factors that are important to decision making. Table 6-4 summarizes and compares the significant differences between candidate plans with respect to those factors of medium and high significance. Note that the future without project effects (i.e. continued flood damages) were evaluated and are presented for the same period of analysis (5 year installation followed by a 45 year project life span) as was used to evaluate with project effects. A 50-year design period is based on the estimated useful life of 50 years, with proper O&M, for the proposed measures to be installed.

Table 6-4: Summary and Comparison of Alternative Plans

Measure of Effects	Without Project	With Project (NED Plan)
Alternative Components	None	Two floodwalls, other various structural and non-structural measures
Project Investment (all project investment to be used for flood mitigation)	\$0	\$48,455,590
Flooding^{1,2}	No Flood protection measures; severe flooding to continue	Flood protection benefits as shown below
Annualized Costs	3,238,288	2,661,744
Annualized Benefits	0	3,127,632
Net Beneficial Effect	-3,238,288	465,888
Benefit Cost Ratio	0	1.2
Environmental		
Net Urban Floodplain Lost	None	Restoration of a net total of approximately 38.5 acres of floodplain
Economic³		
Annualized Costs, Rhode Island	3,238,288	166,850
Rest of Nation	0	2,494,894
Annualized Benefits, Rhode Island	0	3,127,632
Rest of Nation	0	0
Net Beneficial Effect, Rhode Island	-3,238,288	2,960,782
Rest of Nation	0	-2,494,894
Human Health and Safety³		
Properties Benefited ⁴	0	469
Properties Damaged by 1 Percent Chance Event	481	12
Residential Properties Protected in or Removed ⁵ From the Residential High Hazard Zones	0	423
Damage Reduction (%)	0	97%

1. 2017 dollars, 4.625% discount rate, 45-year analysis period, 5 year installation period. Project investment includes the present value cost of installation, operation, maintenance, and replacement of project measures.

2. Alternatives were evaluated using greatest net benefits and level of flood protection. All proposed flood mitigation features provide protection to project areas for the design storm (full build-out 100 year flood).

3. Benefits to human health and safety defined as number of properties protected from design flood or removed from the design floodplain.

4. Includes single family/multi family homes, apartment units, and commercial/industrial buildings.

5. Counts apartment buildings as one unit.

6.14 Risk and Uncertainty

Issues associated with risk and uncertainty in alternatives analysis is discussed in detail in Appendix D of this report.

SECTION 7

CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

This section documents meetings, public participation and milestones which have taken place during the planning process.

August 1999: NRCS contacted by Town of Johnston to determine if funding was available to restore several eroded stream banks along the Pocasset River and Simmons Brook. Rhode Island NRCS applied to the national office to fund two projects through the Emergency Watershed Program (EWP). The two projects were the restoration of the stream bank at Morgan Mill Road and stabilization of the stream bank on Simmons Brook, located at St. Rocco's Church.

March 2000: Town of Johnston requested federal assistance for watershed protection and flood prevention under provisions of the Watershed Protection and Flood Prevention Act (Public Law 83-566) for the Pocasset River Watershed. Although the Town of Johnston made the application, the policy of NRCS is to address flooding problems on a watershed basis. A large portion of the City of Cranston lies within the Pocasset River Watershed. The City of Cranston was contacted, and they requested to become part of the study.

October 2000: NRCS begins work on Pocasset River Watershed Plan.

March 2002: NRCS contacts Historical Preservation and Heritage Commission and the Narragansett Tribe for information on historic structures/cultural concerns in project area. No historic structures were identified at that time.

Park Place Apartment residents (considered to be low income) were notified and interviewed when the initial scoping was being developed.

April 2002: US Fish and Wildlife and Rhode Island Department of Environmental Management contacted by NRCS to determine if any National or State endangered or threatened species, or their habitats are located within project area. None are identified.

February 2004: Mayors of Cranston and Johnston give comments on Watershed Plan.

March 2004: Cranston planning department gives NRCS comments on Watershed Plan

March 2005: Pocasset River Watershed Project Steering Committee, made up of local officials meets with NRCS, GZA, and EA personnel to discuss project.

October 2005: Large storm event leads to reevaluation and revision of hydrology and hydraulics model.



October 2005: Rhode Island Department of Environmental Management is again contacted to determine if any National or State endangered or threatened species or their habitats are located within project area. None are identified.

May 2006: Final hydrology and hydraulics model is approved by NRCS State Engineer.

June 2007: Rhode Island Office of Statewide Planning signs off on Town of Johnston's completed form SF-424.

September 2007: Final "Flood Plain Management Study: Pocasset River Watershed, Providence County, Rhode Island" Technical and Popular Reports published by NRCS.

November 2007: Rhode Island Office of Statewide Planning signs off on City of Cranston's completed form SF-424.

February 2008: Meeting with officials from NRCS, GZA, Town of Johnston and City of Cranston.

April 2009: Meeting with officials from Johnston, Cranston, RIDEM, RI Emergency Management Association, USEPA-New England, NRICP, NRCS, GZA, and RI Congressional Offices.

February 2013: Public Meeting at the Cranston Senior Center.

SECTION 8

THE PREFERRED ALTERNATIVE

The Preferred Alternative (NED Plan) meets the planning criteria and is selected as the preferred alternative over the No Action Alternative. The project purpose is flood damage reduction, which is met by the Preferred Alternative. The No Action Alternative does not meet the project purpose.

Detailed survey data will be necessary to complete final design. Consequently, these designs may need to be altered based upon topographic or other constraints. Prior to construction of any project for local flood protection, the Sponsors shall agree to participate in and comply with applicable Federal flood plain management and flood insurance programs (Public Law 99-662).

8.1 Purpose and Summary

In summary, the Preferred Alternative will consist of:

- Two floodwalls
- Various non-structural measures (acquisition and dry floodproofing)
- Removal of a debris dam
- Construction of a by-pass culvert

The Preferred Alternative calls for the elimination of all flood damages in the Pocasset River 100-year floodplain, with the exception of insignificant minor damages along Reservoir Avenue.

Table 8-1: PL-566 Component of Preferred Alternative, National Economic Development Account

Components	Measure of Effects	Components	Measure of Effects
4. Relocation costs include moving c:	(Annualized Average Annual Dollars)		(Annualized Average Annual Dollars)
Beneficial Effects		Adverse Effects	
1. Floodwater Damage Reduction	3,127,632	The Value of the Opportunity Costs Associated with the Resources used in Implementing the Plan:	
		1. Construction for Flood Prevention	696,021
		2. Technical/ Engineering/ Permitting	139,204
		3. Real. Property Rights/ Property Acquisition	1,652,569
		4. Relocation Payments	14,200
		5. Operation and Maintenance Cost	159,750
Total Beneficial Effects	3,127,632	Total Adverse Effects	2,661,744
Net Beneficial Effects	465,888		

1. 2017 dollars, 4.625% discount rate, 45-year analysis period, 5 year installation period.

Table 8-2: PL-566 Component of Preferred Alternative, Regional Economic Development Account

Components	Measure of Effects (Annualized Average Annual Dollars) ¹		Components	Measure of Effects (Annualized Average Annual Dollars) ¹	
	Rhode Island	Rest of Nation		Rhode Island	Rest of Nation
Beneficial Effects			Adverse Effects		
1. Floodwater Damage Reduction	3,127,632	0	The Value of the Opportunity Costs Associated with the Resources used in Implementing the Plan:		
			1. Construction for Flood Prevention	0	696,021
			2. Technical/ Engineering/ Permitting	0	139,204
			3. Real Property Rights/ Property Acquisition	0	1,652,569
			4. Relocation Payments	7,100	7,100
			5. Operation and Maintenance Cost	159,750	0
Total Beneficial Effects	3,127,632	0	Total Adverse Effects	166,850	2,494,894
Net Beneficial Effects	2,960,782	-2,494,894			

1. 2017 dollars, 4.375% discount rate, 45-year analysis period, 5 year installation period.

8.2 Rationale for Plan Selection

P&G states that the alternative with the greatest net economic benefit consistent with protecting the Nation's environment is to be selected as the Preferred Alternative. Included in the Preferred Alternative is the sponsor's statutory requirement that flood protection be offered to all occupants in the 1-percent chance floodplain, with acceptance of this offer being on a purely voluntary basis. This is accomplished in the NED (Preferred) Alternative.



Table 8-3: Flood Damage Reduction Option Ranking Matrix

Project Site	Proposed Measure	Ranking Criteria ⁵				
		Feasible (yes/no) ¹	Economic Account ²	Social Account ³	Environ- mental Account ⁴	Total
Rotary Drive	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition	Yes	3	3	3	9
	Floodwall	Yes	2	3	1	6
	Dry Flood Proofing ⁶	No	--	--	--	--
South Bennett Drive/River Avenue ⁷	No Action	Yes	1	0	2	3
	Acquisition of Park Place Apartments and properties along Melody Lane/S. Bennett Drive, individual measures along River Drive and River Avenue (15)	Yes	2	1	3	6
	Floodwall at Park Place Apartments, acquire and demolish buildings at River Avenue and River Drive, individual measures along South Bennett Drive, including raising of roadways	Yes	1	2	0	3
	Buyout and demolish Park Place Apartments, floodwall along River Avenue and River Drive, individual measures along South Bennett Drive, including raising of roadways ¹²	Yes	1	1	1	3
	Floodwall at Park Place Apartments, relocate buildings at River Avenue and River Drive, individual measures along South Bennett Drive, including raising of roadways ¹³	Yes	1	2	0	3
	Floodwall at Park Place Apartments and along River Avenue and River Drive	Yes	2	2	0	4
	No Action	Yes	1	0	2	3
Simmons Brook Mill	Property Acquisition/Structure Demolition	Yes	1	2	3	6
	Construction of Bypass Culvert	Yes	3	3	1	7
	Floodwall	No	--	--	--	--
	Dry Flood Proofing ⁶	No	--	--	--	--
	No Action	Yes	1	0	2	3



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Fletcher Avenue	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition⁸	Yes	2	3	3	8
	Floodwall on Fletcher Avenue Side of River ⁹	Yes	1	3	0	4
	Dry Flood Proofing⁶	Yes	3	2	2	7
Reservoir Avenue	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition⁸	Yes	2	3	3	8
	Floodwall	Yes	1	3	1	5
	Dry Flood Proofing ⁶	Yes	3	2	2	7
Riverview Terrace	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition	Yes	2	2	3	7
	Floodwall	Yes	1	3	0	4
	Dry Flood Proofing ⁶	Yes	3	2	2	7
Willowbrook Apartments	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition	Yes	1	1	3	5
	Floodwall	Yes	2	3	0	5
	Dry Flood Proofing ⁶	No	--	--	--	--
Various Other Sites¹⁰	No Action	Yes	1	0	2	3
	Property Acquisition/Structure Demolition	Yes	2	2	3	7
	Remove Debris Jam¹¹	Yes	3	3	3	9
	Floodwall	No	--	--	--	--
	Dry Flood Proofing⁶	Yes	3	2	2	7

Notes:

Highest ranking alternatives(s) for each project Site is in bold. Several are bolded where the Proposed Action is a combination of measures. The No Action Alternative does not include no action on buildings in the "Caution Area."

1. "Feasibility" means that measure could be constructed and if constructed would control flooding. If an alternative does not provide safe egress from the structure, than it is considered not feasible. The following measures are not feasible as documented in Section 6: floodway creation/enlargement, wetland restoration/creation, dam rehabilitation, sediment removal/channel dredging (with exception of small debris jam at Simmons Brook, see Note 12), constraint removal (bridges), elevating structures, and earthen berm dikes.



2. "Economic Costs" ranking system is as follows: 0 = provide no damage reduction, provides damage reduction at a cost which is not reasonable, or can not be accomplished economically due to material resource restraint, 1 = provides damage reduction with a high relative cost, 2 = provides damage reduction with a moderate relative cost, 3 = provides damage reduction with a low relative cost.
 3. "Social" ranking system is as follows: 0 = Egress to/from protected structures not provided, 1-2 = moderate impacts to human safety during flood events, low-income resident displacement, possible land use impacts, 3 = egress to/from protected structures provided, no low-income resident displacement, property value decreases. A rank of 0 is also given to any option which is not reasonable due to impacts on low income residents.
 4. "Environmental" ranking system is as follows: 0 = loss of over 5 acres of floodplain or major habitat loss, 1 = loss of under 5 acres of floodplain or significant habitat loss, 2 = no change from existing conditions, 3 = restoration of floodplain and any habitat restoration. In addition, a ranking of "0" was given to any option with other severe adverse environmental impacts.
 5. Reasonable options are feasible, economical, and meet project need. Any options with a rank of "0" for any criteria are considered to be not reasonable. Only reasonable alternatives can be chosen as an alternative to be further evaluated.
 6. Dry flood proofing only feasible when flood elevation is less than 3-feet above ground surface.
 7. Due to complexity of area, the only feasible flood mitigation alternatives are the combinations of flood mitigation measures presented here.
 8. Selected property acquisition required to site floodwall.
 9. Rich Box Company building across the Pocasset River from Fletcher Avenue has been floodproofed.
 10. Areas of relative low flood elevations (less than 3 feet above grade) where egress during flood events can be provided for minimum cost.
 11. Only applicable to a small debris dam near confluence of Pocasset River and Simmons Brook.
 12. Considered un Social Account is the approximately 100 low income residents of Park Place Apartments would be displaced; it is unlikely that low income housing for these residents would be found in close proximity to the current apartment complex. Moving from the current vicinity would have an adverse impact on the residents (i.e. distance from places of employment, etc).
 13. Considered un Social Account is that it is unlikely that vacant land for home relocations would be available in the generally vicinity of the existing structures. Movement of homes away from the general area would have an adverse impact on moved residents (distance from place of employment, etc.).
-



Table 8-4. Draft Environmental, Economic, and Social Justification Matrix

South Bennett Drive [River Avenue, River Drive, and Park Place Apartments]

Alternative or Option	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include the acquisition of the Park Place Apartment Complex and 27 other lots to total 28 buildings and the restoration of the acquired land to a floodplain area and dry-floodproofing of 9 structures.	\$1,312,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$9.0M capital cost, \$31,250 operation and maintenance costs yearly.	Mitigate flooding. Probable that suitable and comparable locations for new homes/business will be found in general area (i.e. within the Town or in neighboring communities).	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Approximately 6 acres of floodplain will be restored, which will serve as high value wildlife habitat.
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$1,312,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc.), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris. No floodplain would be restored to its natural condition and no wildlife habitat created.



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Rotary Drive

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include acquisition of 17 properties located within the floodplain in this neighborhood and the restoration of the knoll to a floodplain area.	\$98,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$3.3M capital cost, \$10,000 operation and maintenance costs yearly.	Beneficial impacts are to mitigate flooding at Rotary Drive. Potential adverse impacts include relocation of residents.	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Restoration of 4 acres of floodplain (residential areas along Rotary Drive). Negligible impact on flood storage.
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$98,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.



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Fletcher Avenue

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include acquisition of 41 properties located within the floodplain in this neighborhood and the restoration of the acquired land to a floodplain area. Seven (7) structures will be dry-floodproofed. The portion of the Rich Box building that is located within the floodplain in the Town of Johnston has previously been floodproofed and is therefore not included in the plan.	\$902,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$9.2M capital cost, \$65,000 operation and maintenance costs yearly.	Mitigate flooding. Probable that suitable and comparable location for bought out residents and business will be found in general area (i.e. within the Town or in neighboring communities).	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Restoration of approximately 24 acres of urban floodplain (industrial, commercial, and residential areas along Fletcher Avenue).
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$902,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.



Reservoir Avenue

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include a steel sheet pile floodwall of approximately 1,350-feet long and up to 11 feet in height from the Pocasset River stream crossing at Reservoir Avenue to the upland area along Knollwood Avenue. Several structures are located riverward of the proposed floodwall and will be required to be acquired, including properties owned by Forest Hill Nursery (City of Cranston Plat 9, Lots 3497, 3208, and 3455) and several single-family homes located on Knollwood Avenue. The acquired property could be converted into recreation fields. A pump station collection system will be included.	\$159,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$6.2M capital cost, \$X7,750 operation and maintenance costs yearly.	Mitigate flooding at Reservoir Avenue. Provide new recreation fields to the public. Forest Hills Nursery Owner has expressed interest in selling business. Visual impact from floodwalls mitigated by painting wall, facing wall with stone or brick, or through tree and scrub plantings at front of wall.	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Loss of approximately 4.5 acres of urban floodplain due to the installation of the floodwall. The acquisition and conversion of a commercial property and single-family residential to floodplain offset some of the loss. The floodplain lost is highly urbanized and does not have ecological value. Up to a 1 foot increase in water surface elevations upstream of project area (impact becomes negligible approximately 3,300 feet upstream of floodwall); increase may impact two homes. These potential impacts will be analyzed during the design phase. Negligible (less than 0.5 feet) increase in



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					water surface elevations downstream of project area, compared to existing conditions (i.e. negligible impact on flood storage downstream).
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$159,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.



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Riverview Terrace

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include acquisition of 39 properties located within the floodplain in this neighborhood and the restoration of the acquired land to a floodplain area.	\$487,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$11.4M capital cost, \$31,250 operation and maintenance costs yearly.	Mitigate flooding at Riverview Terrace and surrounding neighborhood. Probable that suitable and comparable location for bought out residents and business will be found in general area (i.e. within the Town or in neighboring communities).	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Restoration of approximately 12.5 acres of urban flood plain (residential areas at Riverview Terrace and the surrounding area).
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$487,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.



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Willow Brook Apartments

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	The Proposed Action will include a steel sheet pile floodwall that will be approximately 1,200 feet long, with an average height of 9 feet, and a pump station collection system for interior drainage.	\$245,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$9.9M capital cost, \$10,500 operation and maintenance costs yearly.	Mitigate flooding at Willow Brook Apartments. Visual impact from floodwalls mitigated by painting wall, facing wall with stone or brick, or through tree and scrub plantings at front of wall.	Water quality impacts due to sewage and debris contaminated flood water would no longer occur. Loss of approximately 5 acres of urban flood plain (grounds of Willow Brook Apartments). The floodplain lost is highly urbanized and does not have significant ecological value. Negligible (less than 0.5 feet) increase in water surface elevations at project area, upstream of project area, and downstream of project area, compared to existing conditions (i.e. negligible impact on flood storage).
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$245,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.



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Simmons Brook

Alternative	Description	Economic Impacts- Benefits	Economic Impacts- Costs	Social Impacts	Environmental Impacts
Alternative 1: NED Plan	Proposed Action; Construct bypass culvert around mill building, through which the Simmons Brook currently flows. Protects 4 industrial and commercial buildings, including the mill.	\$35,000 in average annual flood damage reductions. Increase in wages and business revenue due to flood reductions. Clean up costs greatly reduced.	\$930,118 capital cost, \$3,000 operation and maintenance costs yearly.	Mitigate flooding around mill over Simmons Brook.	Water quality impacts due to sewage and debris contaminated flood water would no longer occur.
Alternative 2: No Action Alternative	No proposed project, existing conditions continue.	None	\$35,000 average annual flood damages. Impacts include lost wages, lost business revenue, and cleanup costs.	Continued flooding; impacts include potential loss of life and potential injury, negative impacts to quality of life (i.e. utilization of building space, etc), negative impacts to property values.	Continued water quality impacts due to floodwater contaminated with sewage and debris.

8.3 Measures To Be Installed

8.3.1 Rotary Drive

The Proposed Action will include the acquisition of 15 residential homes, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain, and dry floodproofing 6 structures for the Rotary Drive area (see Figure 6-4).

There are fifteen (15) three-bedroom residential homes proposed to be acquired and demolished. Site could be used as a compensatory floodplain restoration site both for future floodwall compensation or to further reduce flooding potential in the watershed. The proposed acquisitions are anticipated to occur over time, as residents would voluntarily enter the buyout program. The program does not require buy-in from all residents at one time. Sewer project costs were included at an estimated \$240,000 to account for the payback of the newly constructed sewer lines within the neighborhood.

All buildings proposed to be removed (including the structures discussed in other sections of Section 8) will be purchased at the appraised fair market value at the time of purchase. The residents will not receive relocation assistance since their housing sale would be voluntary. The buildings will be salvaged or demolished, the foundations backfilled and seeded, and utilities capped. Re-vegetation of floodplain soils will follow the Rhode Island Field Office Technical Guide (FOTG)-recommended guidelines as specified by technical standards for the Critical Area Planting conservation measure (Code 342) and any other conservation measures utilized to restore floodplain soils and stabilize stream banks. Compliance with EO 13112 (Invasive Species) will be achieved by adhering to procedures outlined in NECH 610.91. The land acquired will be maintained in a manner that is consistent with federal and state floodplain zoning regulations.

The following lots are proposed to be acquired under the Proposed Action, all of which are located within the Town of Johnston:

- To be Acquired (17) – Plat Number 24, Lots Numbered: 68-78 and 88-93.

The following lots are located within the caution area and there is no action proposed for these properties:

- In Caution Area (5) – Plat Number 23, Lot Number 91 (two buildings);
Plat Number 24, Lots Numbered: 66, 67, 79 and 80.

8.3.2 South Bennett Drive

The Proposed Action for the South Bennett Drive and River Drive neighborhoods on the east side of the Pocasset River (see Figure 6-5) consists of a variety of non-structural measures. The Proposed Action involves the acquisition of Park Place Apartment buildings and property, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain. The Proposed Action also includes the acquisition and demolition of 28 properties along River Avenue, River Drive, La Fazia Drive, and Melody Lane and restore floodplain along River Avenue and River Drive, and the relocation of families/business to new locations outside of the 100 year floodplain. The proposal also includes dry floodproofing 9 structures located within the 100-year floodplain.

One home, 18 Melody Lane, appears to be located within the project defined 100-year floodplain, but based on survey data from a field reconnaissance, is located at an elevation above the floodplain. Due to this, no mitigation measures are planned at this residence, however, this will be re-evaluated at the time of Plan-EIS implementation.

Non structural measures will consist of:

- Removal of 28 properties along River Avenue, River Drive, La Fazia Drive, and Melody Lane, and the Park Place Apartments on Park Street.
- Dry floodproofing of 9 buildings along portions of River Avenue, Plainfield Pike, Morgan Hill Road, Melody Drive, and S, Bennett Drive. .

Approximately 6 acres of floodplain will be restored in the areas described above where buildings will be removed.

In accordance with 49 CFR Part 24 for the Uniform Relocation Assistance, NRCS will provide displaced residents moving reimbursement for moving costs and up to \$5,250 for rental assistance.

The following lots are proposed to be acquired or dry-floodproofed area under the Proposed Action, all of which are located within the Town of Johnston, which includes the Park Place Apartments:

- To be Acquired (28) – Plat Number 3, Lots Numbered: 432 and 434; Plat Number 6, Lots Numbered: 9, 35, 86, 87, 94, 101, 103, 106, 107, 118, 119, 120, 121, 137, 138, 139, 140, 141, 142, 144 and 148; Plat Number 7, Lots Numbered: 71-73, 76 and 86.
- Dry Floodproofing (8) – Plat Number 3, Lot Number 433; Plat Number 6, Lots Numbered: 88, 93, 152, 167, 168 and 626; Plat Number 7, Lot Number 77.

The following lots are located within the caution area and there is no action proposed for these properties:

- Plot Number 3, Lots Numbered 397 and 392.

For the structures in this neighborhood and in the following sections which are proposed to be floodproofed, further refined field analysis will be necessary to evaluate water levels at home openings and to determine if homes can withstand flood forces, including hydraulic pressure on foundations. This is particularly true for dry floodproofing. Evacuation during flood events may not be possible from four homes located outside the future 100-year 24-hour floodplain on River Drive during a flood event, due to flooding on the roadway. These homes will require further evaluation when more detailed designs are developed.

8.3.3 Simmons Brook Bypass Culvert

We recommend the construction of a bypass culvert (see Figure 6-6) around the mill building under which the Simmons Brook currently flows. The bypass culvert will eliminate the constriction at the mill culvert.

A hydraulic analysis using Culvert Master, a Haestad Methods hydraulic program, was used to calculate a preliminary size for the bypass culvert and determine the capacity of the existing mill culvert. The existing mill culvert will remain in place. The capacity of the existing culvert is approximately 217 cubic feet per second (cfs). The total 100-year, 24-hour flow at this location is approximately 1,011 cfs. The difference results in design capacity of approximately 800 cfs for the bypass culvert. It is estimated that a 300-foot long, five barrel, 6-foot by 3-foot box culvert, or equal, would be required. As part of final design of the bypass culvert, rerouting of the stream channel could be examined and substituted for the bypass culvert if it is a more feasible option.

8.3.4 Fletcher Avenue

The proposed action would involve the acquisition of 41 properties, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain, and dry floodproofing 7 structures.

The Rich Box Company is a low lying area located across the Pocasset River from Fletcher Avenue. It is a large industrial mill, which manufactures card board boxes. The structure was previously floodproofed and is not considered a flood risk.

The following lots are proposed to be acquired or dry-floodproofed under the Proposed Action:

- Town of Cranston
 - o To be Acquired (36) – Plat Number 12, Lots Numbered: 366, 381, 382, 383, 386, 387, 390, 391, 394, 395, 407, 410-414, 416-419, 446, 447, 1126, 1703 (State Garage excluded in total purchase cost but included demolition costs), 1706, 2578, 2849, 2851, 2867, 3153, 3156, 3194, 3276-3278 and 3367.
- Town of Johnston
 - o To be Acquired (5) – Plat Number 3, Lots Numbered: 230, 231, 235, 239 and 389.
 - o Dry Floodproofing (7) – Plat Number 3, Lots Numbered: 224, 225, 310, 313 and 391-2 (2nd Building on Lot), 409 and 454.

The following lots are located within the caution area and there is no action proposed for these properties:

- 9 properties in Cranston: Plat Number 12, Lots Numbered: 393, 396, 587, 588, 589, 2845, 2846, 2847 and 3892.

8.3.5 Reservoir Avenue

A steel sheet pile floodwall is recommended for the Reservoir Avenue site (see Figures 6-12 & 6-12A). We recommend that an approximately 1,350-foot long floodwall be constructed, up to 11 feet in height. Several structures are located riverward of the proposed floodwall and will be required to be acquired, including properties owned by Forest Hill Nursery (City of Cranston Plat 9, Lots 3497, 3208, and 3455) and several single-family homes located on Knollwood Avenue. The acquired property could be converted into recreation fields. Access will need to be provided through or around the floodwall. To improve aesthetics, the inside of the floodwall will be planted with trees and shrubs. This floodwall will protect businesses along Reservoir Avenue. Another property, City of Cranston Plat 9 Lot 3453 must be acquired to construct the floodwall. This property is approximately 10 feet from the river and is not beneficial to preserve and protect from flood water.

Reservoir Avenue is a commercial area with large tracts of impervious areas. Reservoir Avenue acts as a major conduit of flow, carrying stormwater away from the floodwall. The drainage area behind the wall is delineated by Reservoir Avenue to the south and the floodwall to the north and west. The area is relatively flat, with the ground gently sloping northwest toward the river. At the approximate end of the drainage area to the east, the ground slopes sharply to the northwest, toward the river. The Reservoir Avenue drainage area is approximately 8.8 acres. A detention basin will be constructed on the inland side of the flood wall to collect run off from the Reservoir Avenue area. In order for the basin to function properly, a section of Knollwood Avenue will need to be re-graded to drain into this basin. A proposed pump station collection system behind the flood wall will be designed and will likely consist of the following components:

- One berm along the inland side of the flood wall
- One drain line along the inside of the floodwall
- One detention basin integrated into the roadway (to ensure the roadway drains to the detention basin)
- One outfall with suitable flap or motorized gate
- One diversion chamber and a pump station with emergency generator

A utility easement is present at Reservoir Avenue that will not interfere with construction. The floodwall will be placed completely along one side of the easement.

A pump station collection system or a floodwall runoff collection system is proposed behind each floodwall. In many cases these systems include storage and diversion chambers (either above or below ground) to limit the size of the pump stations or diversion of upstream runoff away from floodwalls. In critical areas, emergency back-up generators are recommended along with motorized outlet gates. The intent is to allow for natural drainage to the river during normal rainfall conditions and to pump the water during the flood stage. These systems are an integral part of the floodwalls and part of floodwall installation. The nature of these floodwall and stormwater systems will require regular inspection and maintenance programs, as described in Section 8.7. Such maintenance will be required to insure that floodways remain clear and pumps and mechanical systems are operational. Mitigation for specific impacts of the project are discussed in Sections 8.2 and 8.3.

The following lots are proposed to be acquired under the Proposed Action, all of which are located in Cranston:

- To be Acquired (15) – Pat Number 9, Lot Numbered: 2427, 2428, 2430, 2431, 2432, 2433, 2435, 2526, 2576, 2910, 3089, 3208, 3453, 3500 and 3513.

The following lots are located within the caution area and there is no action proposed for these properties:

- In Caution Area (5) – Plat Number 11, Lots Numbered: 2693, 2699 and 2702; Plat Number 9 Lots Numbered 2710 and 2709.

8.3.6 Riverview Terrace

The proposed action would involve the acquisition of the 39 and property, the demolition of the structure and infrastructure on the property to restore the site to floodplain area, and the relocation of the residents to a new location outside of the 100-year floodplain.

The following lots are proposed to be acquired under the Proposed Action, all of which are located within the City of Cranston:

- To be Acquired (39) – Plat Number 9, Lots Numbered: 145, 1874, 1905, 1907-1910, 1920- 1925, 3368, 3419, 3429, 3437-3451, 3454, 3460, 3461, 3462, 3464, 3479, 3480, 3481 and 3486.

The following lots are located within the caution area and there is no action proposed for these properties:

- In Caution Area (18): Plat Number 9, Lots Numbered: 3301-3305; Plat Number 9, Lots Numbered: 1875, 1903, 1911, 1912, 1918, 1919, 2028, 2029, 2031, 2032, 2065, 3417 and 3418.

8.3.7 Willowbrook Apartments

A steel sheet pile floodwall is recommended for the Willowbrook Apartments site as shown on Figures 6-14 & 6-14A. The floodwall will be approximately 1,200 feet long, with an average height of 9 feet. To improve aesthetics, the inside of the floodwall will be painted a neutral color and planted with trees and shrubs. Underground utilities are not known to be present at the proposed construction site.

Stormwater flows overland southeast toward the Pocasset River. Stormwater control structures exist within the adjacent Pontiac Avenue to convey water away from the site and serve as the eastern drainage divide. Stormwater from the Willowbrook Apartments 15.2 acre drainage area, west of the divide, presently sheet flows along the roadways and enters the river via several drainage swales.

At Willowbrook Apartments, the proposed pump station collection system behind the wall is composed of:

- One drainage swale located along the inland side of the flood wall to catch overland surface runoff.
- One collection basin located at the central point of the swale exiting to a diversion chamber.
- Five pump diversion chambers to collect gravity stormwater flow.
- Five pump stations with emergency generators.
- Five outfalls with a suitable flap or motorized gate

The following lots are proposed to be dry-floodproofed under the Proposed Action, all of which are located within the City of Cranston:

- Dry Floodproofing (1) – Plat Number 10, Lots Number 112.

The following lots are located within the caution area and there is no action proposed for these properties:

- In Caution Area (5): Plat Number 9, Lots Number 1692; Plat Number 10, Lots Numbered: 112, 1503, 681, 684 and 663.

8.3.8 Dry Flood Proofing

Seven (7) buildings in Cranston that were not otherwise discussed in the above sections will be dry floodproofed. Further refined field analysis will be necessary to evaluate water levels at building openings and to determine if homes to be dry flood proofed can withstand flood forces, including hydraulic pressure on foundations. The following are properties not otherwise discussed in the above sections which are to be dry floodproofed or are within the caution area (with no proposed action):

Map Area 1 (Figure 6-2) (Town of Johnston)

- In Caution Area (2): Plat Number 44, Lots Numbered 83 and 86.

Simmons Brook (Figure 6-6)

- In Caution Area (1): Plat Number: 4, Lot Number: 296.

Map Area 3 (Figure 6-7) (Town of Johnston)

- In Caution Area (3): Plat Number 28, Lots Numbered 91, 106 and 231.

Map Area 4 (Figure 6-8) (City of Cranston)

- To Be Dry Floodproofed (3) – Plat Number 12, Lots Numbered: 3138, 3140 and 3141.
- In Caution Area (3) – Plat Number 12, Lots numbered: 3142, 3254 and 3244 (pump station on school grounds).

Map Area 5 (Figure 6-10) (City of Cranston)

- In Caution Area (12) – Plat Number 8, Lots numbered: 195, 850, 2770, 2776, 2773, 2774, 1145, 1876, 1877, 2693, 2699 and 2702.

Map Area 6 (Figure 6-11) (City of Cranston)

- To Be Dry Flood proofed (4) – Plat Number 9, Lots Numbered: 2754, 3466, 3359 and 2694.
- In Caution Area (6) – Plat number 9, Lots Numbered: 3358, 2693, 2716 and 3296-3298.

8.3.9 Other Non Structural Measures Not Previously Discussed

Non structural measures not previously discussed include the removal of a debris dam near the Pocasset River's confluence with the Simmons Brook, as shown on Figure 9-3 (estimated total cost to remove of \$60,000).

8.4 Mitigation Features

The National Environmental Policy Act (NEPA) requires that significant impacts from proposed federal agencies on the socioeconomic and natural environment need to be mitigated. The details of the mitigation will be addressed during the permitting phase of the project, but the mitigation measures and strategies are outlined below.

Construction of the various flood control structures, particularly the floodwalls have the potential to temporarily impact the surrounding environment. The following measures will be undertaken to minimize impacts:

- Notify affected property owners of the construction activity scope and duration prior to construction.
- Limit construction to normal working hours as defined by the City of Cranston and Town of Johnston ordinances.
- Implement erosion and sedimentation control measures during construction to ensure that the river and adjacent wetlands are unaffected. This will be done by preparing a Stormwater Pollution Prevention Plan as required by the National Pollution Discharge Elimination System (NPDES) Stormwater Construction General permit.
- Conduct a pre-construction survey of structures in the project area that could be impacted by the vibrations of sheet pile driving. Monitor vibration during construction if needed.
- Work with the communities and property owners in/near construction areas to minimize and mitigate for temporary impacts to parking.
- Provide relocation assistance to affected property owners as required. Relocations will be accomplished by the Sponsor under the guidelines established in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646). Relocation payments cover incidental costs associated relocations (i.e. moving costs, etc).
- Provide aesthetically-compatible floodwall construction in residential and historic areas of the project.

- Conduct Environmental Site Assessment of properties to be purchased by NRCS in accordance with federal and state regulations to ensure that demolition does not release harmful materials to the environment.

NRCS will have an archaeologist onsite during excavation of the detention basin at reservoir Avenue and NRCS will first cause work to cease if cultural resources are discovered during implementation, and then follow policy as outlined in General Manual 420, part 401.

8.5 Permits and Compliance

The Preferred Alternative involves work to be performed within areas that are regulated by a number of Federal, State, and Local Agencies. The list of potentially applicable environmental permits, approvals, and consultations for each plan measure include:

- Rhode Island Department of Environmental Management (RIDEM) Wetlands Permit
- Rhode Island Department of Transportation Physical Alteration Permit
- Rhode Island Pollution Discharge Elimination System Permit
- Stormwater Pollution Prevention Plan for Construction Activities and Notice of Intent to Discharge Stormwater Related to Construction Activities
- RIDEM Water Quality Certification
- US Army Corps of Engineers Programmatic General Permit or other US Army Corps Permits

In addition, the construction of plan measures that alter the location of the Federal Emergency Management Agency (FEMA) 100-yr flood lines will require the submission of a request for a Letter of Map Amendment (LOMA) to FEMA.

8.6 Costs

Costs in this plan are planning estimates. Final costs will be based upon the actual cost of installation. The total installation cost of the Preferred Alternative is estimated to be \$48,455,590. Tables 8-5 through 8-10 summarize cost information, cost sharing amounts, and project benefits. The Watershed Agreement details cost sharing rates. Tables 8-9 and 8-10 break out the damages and benefits into agriculture related damages and non-agriculture damages. Since the Town of Johnston qualifies as a rural community (population less than 50,000 people) damages and benefits in the Town of Johnston are considered agriculture related. The City of Cranston has a population which exceeds 50,000 people; thus damages and benefits in the City of Cranston are considered non agriculture related. There are no direct (damages to farms, etc) agricultural damages.



Table 8-5: Estimate Installation Cost

Installation Cost Item	Unit	Number Nonfederal Land (feet)	Estimated Costs		
			PL 566 Funds (\$)	Other Funds (\$)	Totals 2017 (\$)
PL 566 Component					
Structural					
Reservoir Ave Floodwall Construction	Feet	1,211	6,737,480	0	\$6,737,480
Willowbrook Apartments Floodwall Construction	Feet	1,120	5,884,320	0	\$5,884,320
Simmons Brook Culvert Construction	Feet	300	1,173,120	0	\$1,173,120
Dry Floodproofing	Properties	23	780,000	0	\$780,000
Subtotal Structural			14,574,920	0	14,574,920
Nonstructural					
Fletcher Ave Acquisition	Properties	41	9,277,500	0	9,277,500
Rotary Drive Acquisition	Properties	17	3,280,200	0	3,280,200
Riverview Terrace Acquisition	Properties	39	11,676,600	0	11,676,600
South Bennett Drive Acquisition & Relocation	Properties	28	9,508,870	137,500	9,646,370
Subtotal Nonstructural			33,743,170	137,500	33,880,670
Total PL 566 Component (Recommended Plan)			48,318,090	137,500	48,455,590

Notes:

1. Dollar Amounts Price Base 2017.
2. Floodwall Lengths Round to Nearest Foot.
3. Property values represent Fair Market Values, estimated to be 30% higher than the appraised value.
4. Construction costs include Technical, Engineering, Permitting, and Administration costs.



Table 8-6: Detailed Installation Costs

Cost Item	Installation Cost PL 566 Funds					Installation Cost Other Funds					Total Installation Cost
	Construction	Engineering Services	Property Rights/Acquisition	Relocation Costs	Totals	Construction	Engineering Services	Property Rights/Acquisition	Relocation Costs	Totals	
PL 566 Component											
Structural											
Reservoir Ave Floodwall Construction	\$2,480,400	\$496,080	\$3,761,000	\$0	\$6,737,480	\$0	\$0	\$0	\$0	\$0	\$6,737,480
Willowbrook Apartments Floodwall Construction	\$4,903,600	\$980,720	\$0	\$0	\$5,884,320	\$0	\$0	\$0	\$0	\$0	\$5,884,320
Simmons Brook Culvert Construction	\$977,600	\$195,520	\$0	\$0	\$1,173,120	\$0	\$0	\$0	\$0	\$0	\$1,173,120
Dry Floodproofing	\$650,000	\$130,000	\$0	\$0	\$780,000	\$0	\$0	\$0	\$0	\$0	\$780,000
Subtotal Structural	\$9,011,600	\$1,802,320	\$3,761,000	\$0	\$14,574,920	\$0	\$0	\$0	\$0	\$0	\$14,574,920
Nonstructural											
Fletcher Ave Acquisition	\$2,073,500	\$414,700	\$6,789,300	\$0	\$9,277,500	\$0	\$0	\$0	\$0	\$0	\$9,277,500
Rotary Drive Acquisition	\$318,500	\$63,700	\$2,898,000	\$0	\$3,280,200	\$0	\$0	\$0	\$0	\$0	\$3,280,200
Riverview Terrace Acquisition	\$994,500	\$198,900	\$10,483,200	\$0	\$11,676,600	\$0	\$0	\$0	\$0	\$0	\$11,676,600
South Bennett Drive Acquisition & Relocation	\$1,081,600	\$216,320	\$8,073,450	\$137,500	\$9,508,870	\$0	\$0	\$0	\$137,500	\$137,500	\$9,646,370
Subtotal Nonstructural	\$4,468,100	\$893,620	\$28,243,950	\$137,500	\$33,743,170	\$0	\$0	\$0	\$137,500	\$137,500	\$33,880,670
Total PL 566 Component (Recommended Plan)	\$13,479,700	\$2,695,940	\$32,004,950	\$137,500	\$48,318,090	\$0	\$0	\$0	\$137,500	\$137,500	\$48,455,590

Notes:

1. Dollar Amounts Price Base 2017.
2. Floodwall Lengths Round to Nearest 10 Feet.
3. Relocation costs include moving expenses for homeowners. NRCS will provide funding for 50% of relocation costs.
4. 30% Contingency Applied to Construction Costs.
5. Engineering services assumed to be 20% of construction costs.
6. Landrights include land purchase price, appraisal, survey, title, and other incidental costs related to property acquisition or acquisition of easement.

Table 8-7: Structural Data

Floodwall	Type	River Stationing (feet)	Length of Work (feet)	Average Side Slope (ft)	Average Height (ft)	100 Year Frequency Velocity (ft/s)
Reservoir Avenue Floodwall	Sheet Pile	8935-7605	1,350	Vertical	11	8
Willow Brook Apartments Floodwall	Sheet Pile	2896-1889	1,200	Vertical	9	1.9

Floodway	Type	Stationing	Length of Work (feet)	Average Depth (ft)	100 Year Frequency Depth (ft)	100 Year Frequency Velocity (ft/s)
Simmons Brook Mill Culvert	Bypass Culvert	1574-1368	300	NA	8	5

Table 8-8: Annualized Adverse National Economic Development Effects

Evaluation Item	Project Outlays ¹		Totals
	Amortized Present Value of Installation Costs	Amortized Present Value of Operation, Maintenance, and Replacement Costs	
Reservoir Ave Floodwall Construction	\$347,888	\$7,750	\$355,638
Willowbrook Apartments Floodwall Construction	\$303,836	\$11,500	\$315,336
Simmons Brook Culvert Construction	\$60,574	\$3,000	\$63,574
Dry Floodproofing	\$40,275	Not Applicable	\$40,275
Subtotal Structural	\$752,573	\$22,250	\$774,823
Nonstructural			
Fletcher Ave Acquisition	\$479,042	\$65,000	\$544,042
Rotary Drive Acquisition	\$169,372	\$10,000	\$179,372
Riverview Terrace Acquisition	\$602,919	\$31,250	\$634,169
South Bennett Drive Acquisition & Relocation	\$498,088	\$31,250	\$529,338
Subtotal Nonstructural	\$1,749,421	\$137,500	\$1,886,921
Total	\$2,501,994	\$159,750	\$2,661,744

1. The discounted present value of the installation costs amortized over a 50 year period of analysis (5 year installation period and 45 year project life)-price base 2017 dollars with a 4.625% discount rate value.

Table 8-9: Estimated Average Annual Flood Damage Reduction Benefits

Item	Average Annual Damage				Damage Reduction Benefits			
	Without Project	Non	With Project	Non	Without Project	Non	With Project	Non
	Agricultural	Agricultural	Agricultural	Agricultural	Agricultural	Agricultural	Agricultural	Agricultural
	Related ³	Related	Related ⁴	Related	Related ⁴	Related	Related ⁴	Related
Residential	1,366,921	1,014,407	2,464	103,008	0	0	1,364,457	911,399
Commercial	78,019	778,941	2,208	2,976	0	0	75,811	775,965
Totals	1,444,940	1,793,348	4,672	105,984	0	0	1,440,268	1,687,364

1. Price base 2017.
2. Road and bridge damages were not evaluated.
3. Agricultural related damage includes damages to rural communities.
4. Relocation costs include moving expenses for homeowners. NRCS will provide funding for 50% of relocation costs.

Table 8-10: Comparison of NED Benefits and Costs

Evaluation Item	Agricultural Related Damage Reduction ²		Non- Agricultural Related Damage Reduction		Total	Annualized Costs ¹	Benefit/Cost Ratio
	Residential	Commercial/ Industrial	Residential	Commercial/ Industrial	Benefits		
Structural							
Reservoir Ave Floodwall Construction	\$0	\$0	\$797	\$153,548	\$154,344	\$355,638	0.4
Willowbrook Apartments Floodwall Construction	\$0	\$0	\$142,996	\$0	\$142,996	\$315,336	0.5
Simmons Brook Culvert Construction	\$1,272	\$29,056	\$0	\$0	\$30,327	\$63,574	0.5
Dry Floodproofing						\$40,275	
Subtotal Structural					\$327,668	\$774,823	0.4
Nonstructural							
Fletcher Ave Acquisition	\$0	\$0	\$280,522	\$622,417	\$902,939	\$544,042	1.7
Rotary Drive Acquisition	\$65,589	\$32,667	\$0	\$0	\$98,256	\$179,372	0.5
Riverview Terrace Acquisition	\$0	\$0	\$487,084	\$0	\$487,084	\$634,169	0.8
South Bennett Drive Acquisition	\$1,297,597	\$14,089	\$0	\$0	\$1,311,686	\$529,338	2.5
Subtotal Nonstructural					\$2,799,964	\$1,886,921	1.5
Total					\$3,127,632	\$2,661,744	1.2

1. 2017 dollars, 4.625% discount rate, 45-year analysis period, 5-year installation period. The present value of all costs includes installation, operation, maintenance, and replacement.
2. Agricultural related damage include damages to rural communities.

The Preferred Alternative measures serve the purposes of flood prevention and floodplain conservation easements; therefore, installation costs are allocated entirely to these purposes. Total costs include costs for construction, engineering services, project administration, acquisition/land rights, and relocation payments. Measures in the Preferred Alternative will be installed under federal contract. Construction costs for the floodwalls include estimated contract costs plus 20 percent engineering and construction administration and 30 percent contingency. The acquisition costs include 5% of the total assessed value for coordination of the property acquisitions and the total demolition and site restoration costs include 20 percent engineering and construction administration and 30 percent contingency. All costs are based on estimated quantities and 2017 unit costs. The unit costs are based on bid prices for similar work, current published values, and quotes from manufacturers. Total project costs and are estimated to be approximately \$49.5 million.

Cost estimates are subject to change. Prices of individual components of cost estimates may be subject to large price fluctuations. Drainage cost estimates include site work and drainage structures. Floodwall cost estimates include the structures themselves and site work. Cost estimates for non structural measures are based on information in the FEMA document titled “Engineering Principles and Measures of Retrofitting Flood Prone Residential Structures” dated 2001. Detailed geotechnical investigations, including borings to determine water table depth and bedrock depth, are required before final design. Findings from this could drastically change cost estimates. It is assumed in cost estimates that boulders greater than 5 feet in diameter will not be encountered at any site. This cost estimate assumes that existing utilities will not have to be reset or removed. All cost estimates are at their 2017 value. All cost estimates assume existing utilities will not have to be relocated in order to install plan measures. All cost estimates also assume that no environmental contamination, solid waste, or hazardous waste will be encountered during construction of project measures, and cost estimates assume soil disposal will not be required.

The following assumptions were made when estimating the cost of steel sheet pile walls:

- The depth below ground of the sheeting is double the height above the ground
- Overall sheeting wall is 1 foot wide
- The weight of steel is 22 lb/ft²

Land-rights and building purchase costs include all expenditures to purchase land, buildings, and or easements, permits, utility relocations, and road and railroad modifications. It is assumed that easements to place floodwalls, drainage structures, and culverts will cost no more than \$8,000 each, including incidental costs (survey, closing, etc.) associated with acquiring the land. Land-rights and building purchase costs are estimated to be approximately \$32,004,950.

Relocation assistance payments include moving and related expenses for a displaced person, business, or farm operation, including incidental costs (survey, closing, etc) associated with acquiring the property, if that acquisition is not voluntary. In addition, financial assistance is available for replacement housing for a displaced person who qualifies and whose dwelling is acquired because of the project. Relocation assistance payments were estimated to be \$275,000 for Park Place Apartments.

8.7 Installation and Financing

The NRCS will utilize funds appropriated annually under Public Law 83-566, the Watershed Protection and Flood Prevention Act, as the source of the federal share of the installation cost. The Sponsor will bear the remaining costs for project administration and legal fees utilizing cash reserves, loans, bonds, and/or annual tax revenues appropriated to it by the State.

The period during which all measures in the Preferred Alternative are expected to be installed is 5 years. Table 8-11 shows the planned schedule and funding by year. During the 45-year evaluation, operation and maintenance costs will be incurred and benefits will accrue in years 2 through 50. A 50-year design period (5 year installation, 45 year project life span) is based on the estimated useful life of 50 years, with proper O&M, for the proposed measures to be installed. The planned sequence of installation was developed using the following criteria:

- Prioritizing sites based on flooding frequency, severity, and potential for loss of life
- Potential impacts to other planned project areas

Table 8-11: Planned Funding by Year

Year	Measures	Estimated Costs ¹		
		PL 566 Funds	Other Funds	Total Funds
Year 1	Reservoir Ave Floodwall Engineering & Permitting	2,128,540	0	2,128,540
Year 1	Willowbrook Apartments Floodwall Engineering & Permitting	490,360	0	490,360
Year 1	Fletcher Ave Acquisition	4,638,750	0	4,638,750
Year 1	Dry Floodproofing	260,000	0	260,000
Year 1	Total	7,517,650	0	7,517,650
Year 2	Reservoir Ave Floodwall Engineering & Permitting	2,128,540	0	2,128,540
Year 2	Willowbrook Apartments Floodwall Engineering & Permitting	490,360	0	490,360
Year 2	Riverview Terrace Acquisition	2,919,150	0	2,919,150
Year 2	Rotary Drive Acquisition	1,640,100	0	1,640,100
Year 2	Fletcher Ave Acquisition	4,638,750	0	4,638,750
Year 2	Dry Floodproofing	260,000	0	260,000
Year 2	Total	12,076,900	0	12,076,900
Year 3	Reservoir Ave Floodwall Construction	1,240,200	0	1,240,200
Year 3	Willowbrook Apartments Construction	2,451,800	0	2,451,800
Year 3	Rotary Drive Acquisition	1,640,100	0	1,640,100
Year 3	Riverview Terrace Acquisition	2,919,150	0	2,919,150
Year 3	South Bennett Drive Acquisition & Relocation	3,169,623	0	3,169,623
Year 3	Dry Floodproofing	260,000	0	260,000
Year 3	Total	11,680,873	0	11,680,873
Year 4	Simmons Brook Culvert Engineering & Permitting	195,520	0	195,520
Year 4	Reservoir Ave Floodwall Construction	1,240,200	0	1,240,200
Year 4	Willowbrook Apartments Construction	2,451,800	0	2,451,800
Year 4	Riverview Terrace Acquisition	2,919,150	0	2,919,150
Year 4	South Bennett Drive Acquisition & Relocation	3,169,623	0	3,169,623
Year 4	Total	9,976,293	0	9,976,293
Year 5	Simmons Brook Culvert Construction	977,600	0	977,600
Year 5	South Bennett Drive Acquisition & Relocation	3,169,623	137,500	3,307,123
Year 5	Riverview Terrace Acquisition	2,919,150	0	2,919,150
Year 5	Total	7,066,373	137,500	7,203,873
	Total Project	48,318,090	137,500	48,455,590

1. Price Base 2017



Responsibilities for carrying out the Plan will be shared between the Natural Resources Conservation Service and the Sponsors as follows:

NRCS

- a. Provide overall Project administration.
- b. Provide engineering design and construction inspection for works contracted by NRCS.
- c. Provide engineering designs for works contracted by Sponsors.
- d. Provide funds to Sponsors for preparing engineering designs and construction inspection for works contracted by Sponsors.
- e. Provide 100 percent of the total engineering services costs for structural and non-structural measures.
- f. Provide funds to Sponsors for project management and engineering typically performed by NRCS to implement projects.
- g. Provide 50 percent of the cost of relocation assistance payments.
- h. Provide 100 percent of the building fair market value purchase costs

Sponsors

- a. Responsible for their Project and contract administration costs for installing works of improvement.
- b. Acquire any land rights necessary for installing the works of improvement.
- c. Bear the costs of relocating or modifying utilities.
- d. Secure all required federal, state and local permits.
- e. Provide 10.2 percent of the cost of relocation assistance payments.
- f. Bear the operation, maintenance, and replacement costs for the life of the project.
- g. Provide 25 percent of the building fair market value purchase costs

Property whose acquisition is required for a particular measure (include easements for floodwalls and other plan structures) will be acquired in advance of engineering designs to ensure property acquisition does not impede implementation of project measures. The property to be acquired is listed by Plat and Lot for each project above.

Contracting

For the Preferred Alternative, it is expected that the Sponsors will formally request NRCS to contract for installation of the planned measures utilizing federal contracting procedures.

Land Rights and Relocation

All necessary land rights for installation of the structural measures of the Preferred Alternative will be acquired by the Sponsor at no cost to the federal government. The Sponsor has the needed authority to obtain land rights, including the power of eminent domain.

The land requirement is approximately 55 acres including the area of the floodwalls and the properties to be acquired. Of the relocations described earlier, the majority are single family, residential properties. In Cranston, a total of 18 commercial/industrial properties will be acquired and 2 moderately size apartment complexes. The remaining 69 properties are single family homes. In Johnston, all 47 of the properties are residential; however, 2 empty lots, included for acquisition, have vacant buildings. For all of the properties to be acquired, the business or residents will be relocated, the buildings demolished, and the sites restored.

The relocation and modification of water, gas, sewer, and other utilities; modification to roads or railroads; and costs of legal services, property surveys, and other items necessary for the acquisition of land rights are considered land rights costs. Relocations will be accomplished by the Sponsor under the guidelines established in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646).

Conditions for Providing Assistance

Federal assistance, financial and other to be furnished by NRCS, is contingent on the appropriation of funds for this purpose. Before federal construction funds are made available the Sponsor will:

- a) Provide written assurance that they have the legal authority, sufficient funds, and are willing and able to obtain all necessary land rights, easements, and permits.
- b) Execute an Operation and Maintenance Agreement.
- c) Execute a Project Agreement
- d) Provide written assurance that 65 percent of the residents to be protected by nonstructural measures in the High Hazard Zones will participate in the project.
- e) Prior to construction of any project for local flood protection, the Sponsors shall agree to participate in and comply with applicable Federal flood plain management and flood insurance programs (Public Law 99-662).

All construction will be in accordance with the Occupational Safety and Health Administration Standards. Note that technical and financial assistance will only be provided when it contributes to identified project objectives and does not result in significant adverse impacts.

Other Agency Responsibility

At this time, no other State or Federal agency is expected to aid in installation of any Preferred Alternative measures; this may change in the future.

8.8 Operation, Maintenance, and Replacement

The operation, maintenance, and replacement of the nonstructural measures are the responsibility of the property owner. The operation, maintenance, and replacement of the structural measures are the responsibility of the Sponsor. The open space areas have associated maintenance for mowing and potential trash cleanup. The estimated annualized cost of operation, maintenance, and replacement is approximately \$160,000, as shown in Table 8-12.

Table 8-12: Operation and Maintenance Costs

Plan Measure	Description	Total Yearly O&M Cost ¹
Rotary Drive	Maintenance of Open Space Area (4 ac)	\$10,000
South Bennett Drive	Maintenance of Open Space Area (12.5 ac)	\$31,250
Fletcher Avenue	Maintenance of Open Space Area (26 ac)	\$65,000
Reservoir Avenue	1,350 ft Floodwall; 1 Pump Stations	\$7,750
Riverview Terrace	Maintenance of Open Space Area (12.5 ac)	\$31,250
Willow Brook Apartments	1,100 ft Floodwall; 5 Pump Stations	\$11,500
Simmons Brook Bypass Culvert	Clearing Debris	\$3,000
Total		\$159,750

¹Note: Yearly floodwall operation and maintenance estimated using the following formula: (number of pump stations)x(\$1,000) + (length of wall in feet)x(\$5) = (yearly operation and maintenance cost). Yearly open space maintenance estimated assuming \$2,500 per acre of land.

An operation and maintenance agreement, between NRCS and the Sponsor, will be executed prior to the signing of a land rights, relocation, or project agreement. The term of the operation and maintenance agreement will be 50 years, based on the combined projected project life span and installation period. A typical operation and maintenance agreement used by NRCS is provided in Appendix G. The agreement will contain a reference to the NRCS National Operation and Maintenance Manual. An operation and maintenance (O&M) plan will be prepared for each separate plan measure in accordance with the guidelines in the manual. The O&M plan will specify the responsibilities of the Sponsor, including, but not limited to, the following:

- a) Periodic inspection of measures
- b) Repair of fencing, riprap, vegetated area
- c) Mowing of drainage swales and detention basins
- d) Inspection and maintenance of flap or motorized gates
- e) Testing of pumps and generators
- f) Cleaning of catch basins and detention basins
- g) Installation of closures
- h) Training of people responsible for operation and maintenance



The Sponsor will make inspections annually, after unusually severe floods, and after the occurrence of any other conditions that might adversely affect the plan measures to determine what maintenance is needed. These inspections will continue annually for the life of the project. The NRCS may assist the Sponsor with the inspections at the discretion of the State Conservationist. The Sponsor will prepare an inspection report and send a copy to the NRCS annually.



SECTION 9

REFERENCES

1. Bachand, Joseph A.; Schmidt, Joel; et al, 2006a *Pocasset River Floodplain Management Study, RITP-2006-1*. USDA Natural Resources Conservation Service, Warwick, RI
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4. McNab, W.H.; Avers, P.E. 1994. *Ecological Subregions of the United States: Section Descriptions*. WO-WSA-5. Washington, DC: USDA Forest Service. Variable pagination.
5. RE: Pocasset River Flood Mitigation-Documentation of EA Revisions to Models, June 22, 2005. From Brian Stone (EA Engineering) to Chuck Katuska (EA Engineering). (EA 2005)
6. USDA, Natural Resources Conservation Service, 2009 *National Watershed Program Manual*
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SECTION 10

LIST OF PREPARERS

The Plan/Environmental Impact Statement was prepared in May 2010 jointly by staff at the NRCS Rhode Island Office located in Warwick, RI and GZA GeoEnvironmental, Inc. The document was revised and updated in October 2017 by Fuss & O'Neill (F&O) and the staff at NRCS at the NRCS Rhode Island Office.

Table 10-1, List of Preparers, identifies and lists qualifications of those individuals who were directly responsible for providing significant input to the preparation of the Plan and Environmental Assessment EIS.

Table 10-1: List of Preparers

Name	Organization	Title	Education	Experience
Anja Ryan	GZA	Landscape Architect	BS-Landscape Architecture	Landscape Architect- 5 years
Stephen Andrus	GZA	Assistant Project Manager	BS-Civil and Environmental Engineering	Environmental Engineer- 5 years
Richard A. Carlone	GZA	Project Engineer	BS and MS-Civil and Environmental Engineering	Environmental Engineer- 3 years
Todd R. Greene	GZA	Senior Project Manager	BS-Civil Engineering	Environmental Engineer- 15 years
Igor Runge	GZA	Senior Project Manager	Ph.D.-Civil and Environmental Engineering	Environmental Engineer- 23 years
Philip P. Virgadamo	GZA	Principal	BS and MS-Civil and Environmental Engineering	Environmental Engineer- 42 years
Stephen Lecco	GZA	Senior Project Manager	MS-Environmental Science	Environmental Scientist- 20 years
Rosalie Starvish	GZA	Project Manager	MS-Environmental Engineering	Water Resources Engineer-6 years
Frank Vogel	NRCS	Civil Engineer	BS-Civil Engineering	Civil Engineer- 25 years
Andrew Lipsky	NRCS	State Biologist	BS-Biology	Biologist-10 years
Joseph Bachand	NRCS	Resource Conservationist	BS-Natural Resource Science	Natural Resources- 20 years
Reena Shaw	NRCS	State Economist	Ph.D.-Economics	Economist- 6 years
<i>October 2017 Update:</i>				
Alan Gillespie	NRCS	State Conservation Engineer	BS-Biological Engineering	Engineer – 9 Years
Reena Shaw	NRCS	State Economist	Ph.D.-Economics	Economist - 7 years
Dean Audet	F&O	Senior Vice President	ME–Environmental Engineering	Civil/Environmental Engineer – 30 years
Kristine Baker	F&O	Project Engineer	MS–Environmental Engineering	Environmental Engineer – 9 years
Rachel Schnabel	F&O	Project Engineer	BS – Environmental Engineering	Environmental Engineer – 3 years
Celicia Boyden	F&O	Project Engineer	BS–Environmental Engineering	Environmental Engineer – 2 years



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DISTRIBUTION LIST



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