Meeting Agenda

10:00 – 10:05  Introductions and Meeting Goals

10:05 – 10:15  Project Background and Watershed Planning Process

10:15 – 11:15  Summary of Watershed Conditions

11:15 – 11:20  Next Steps

11:20 – 11:45  Questions and Discussion

11:45 – 12:00  Closing Remarks and Adjourn
Introductions

Project Team

- Wood-Pawcatuck Watershed Association
- Fuss & O’Neill, Inc.

Project Steering Committee

- Municipal representatives from the most heavily-impacted watershed communities
- State and federal agencies
- Other organizations
Meeting Goals

1. Describe the watershed planning process and work completed to date
2. Summarize study findings and preliminary recommendations
3. Provide a forum for public input and discussion
   • Issues of concern
   • Local priorities
   • Project ideas
Hurricane Sandy Coastal Resiliency Grant

- U.S. DOI & National Fish and Wildlife Foundation (NFWF) competitive grant program
  - Communities affected by Hurricane Sandy
  - Increase flood resilience
  - Focus on strengthening natural ecosystems that also benefit fish and wildlife

- NFWF Grant awarded to Wood-Pawcatuck Watershed Association in June 2014
  - “Flood Resiliency Management Plan” for the Wood-Pawcatuck watershed
  - $720K grant award and $200K matching funds
What is Flood Resilience or Resiliency?

A community’s ability to plan for, respond to, and recover from floods
Project Goals

- Assess the vulnerability of the Wood-Pawcatuck Watershed to flooding

- Develop a watershed-based management plan
  - Enhance flood resilience
  - Strengthen natural ecosystems
  - Improve/protect water quality
Technical Assessments
Evaluate current conditions and opportunities for restoration and protection projects that will enhance flood resiliency and provide related benefits.
Watershed Planning Process

- Stakeholder and Community Involvement
- Collaborative Process with WPWA and Project Stakeholders
  - Steering Committee Workshop Meetings
  - Watershed Planning Survey
  - Community Meetings
  - Municipal Training and Outreach
Timeline for Work Completed

- **Project Start**: March 2015
- **Steering Committee Meetings**: March & November 2015, April 2016
- **Field Work**: Summer/Fall 2015
- **Data Analysis & Reporting**: Spring - Fall 2016
Watershed Conditions and Issues
Watershed Baseline Assessment

- Document existing watershed conditions
- Build upon previous and ongoing work in the watershed
  - USGS-FEMA Risk MAP Project
  - USACE Pawcatuck River Flood Risk Feasibility Study
  - RI River & Stream Continuity Project
  - Pawcatuck Dam Removals
  - USFWS Wild & Scenic Reconnaissance Survey
  - RIDEM Water Quality Basin Planning
  - Local Hazard Mitigation Planning

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Wood-Pawcatuck Watershed

- 317 square miles in RI and CT
- Major portions of 11 municipalities
- 84,000 population
- 380 stream miles
- Drains to Pawcatuck River Estuary and Little Narragansett Bay
Subwatersheds

- Pawcatuck River
- Wood River
- Beaver River
- Queen-Usquepaug River
- Chickasheen Brook
- Chipuxet River
- Ashaway River
- Wyassup Brook
- Shunock River
Land Use

- Mostly rural, forested, and agricultural land
- 80% undeveloped
- 60% forested
- Development concentrated in lower watershed and town/village centers
Impervious Cover

- Less than 5% of land area overall
- Indicative of healthy streams and good water quality
- 20% IC in Lower Pawcatuck, water quality issues
Water Quality

- High Quality Surface and Groundwater
- Supporting Cold-Water River habitat
- Sole Source Aquifer
- Threats from Nonpoint Source Pollution
  - Development potential
  - Stormwater discharges
Natural Resources

- High diversity of habitat and species
- Intact, unfragmented forests
- Large wetlands ("Great Swamp")
- Under Study for Wild & Scenic Designation
Wood-Pawcatuck Watershed
Flooding in the Wood-Pawcatuck

- History of flooding in the watershed
- The Great Flood of 2010 (>“500-Year Flood”)

Source: Tom Boving, URI
Wood River, Hope Valley, RI
Pawcatuck River, Ashaway, RI
Factors Related to Increased Flooding

- Floodplain development
- Channel encroachment (dams, bridges, culverts)
- Channel straightening
- Watershed impervious cover
- Climate change: more frequent and intense storms
River & Floodplain Development
Dams
Undersized Stream Crossings
More Frequent Extreme Storms

- Rhode Island Flood of 2010
- Tropical Storm Irene 2011
- Hurricane Sandy 2012
- Severe Winter Storm 2013
- 2015 Blizzard

Problems with Road Stream Crossings

Hydrologic/Flooding
Problems with Road Stream Crossings

Geomorphic
- Sediment
- Woody debris
- Culvert blockage/failure
- Channel adjustment
Problems with Road Stream Crossings

Ecological

- Barriers to physical passage by aquatic organisms
  - Perched culverts
  - Excessive velocities
  - Insufficient water depths
  - Inadequate openness

Source: The North Atlantic Aquatic Connectivity Collaborative, S. Jackson
Bridges and Culverts - Analysis

How can decision-makers prioritize the repair and replacement of stream crossing infrastructure to increase flood resiliency and enhance aquatic organism passage?
Wood-Pawcatuck Bridges and Culverts

- 573 structures identified using GIS
  - Intersected roads, rails, and trails with mapped streams
  - Reviewed aerial imagery
  - RI Stream Continuity Project

- 421 structures were inspected (May – September 2015)
Bridges & Culverts Assessment Approach

- Adapted from Vermont’s Stream Geomorphic Protocols and others used in the Northeast
- Information gathered
  - Site characteristics (e.g. sketch, street name, stream name)
  - Structure dimensions needed to assess hydraulic capacity
  - Deficiencies and condition of the structure
  - Upstream and downstream geomorphic conditions
Bridges & Culverts - Assessment Criteria

Hydraulic Capacity
- Conveyance
- Design Storms
- Climate Change

Aquatic Organism Passage
- Inlet/Outlet
- Substrate
- Physical Barrier

Geomorphologic Vulnerability
- Invert/Bed Material
- Culvert/Channel Width
- Culvert Material/Condition

Flooding Impact Potential
- Development/Land Use
- Road Crossing Type
- Flood Prone Areas

Prioritization
Bridges and Culverts - Findings

- 38% are presently hydraulically undersized (less than 25-year design flow capacity)
- 49% will be undersized under a Year 2070 climate change scenario
- Only 40% of stream crossings provide for full passage of aquatic organisms
Culvert & Bridge Priority Ratings

Chickasheen River Subwatershed Culvert and Bridge Priority Rating

Legend
- Priority Rating
  - High
  - Intermediate
  - Low

Documented Flood Locations
- Riverine Related Flooding
- Dam Related Flooding
- Drainage Related Flooding

- Roads
- Lake
- Wetland
- Rivers

Bridge and Culvert Priority Rating
- High (155)
- Intermediate (175)
- Low (84)
- Subwatersheds
- Town Boundary
- Rivers

Source: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Wood-Pawcatuck Dams

- Initially identified 150 dams
- Identified 70 highest priority dams for visual inspection
- Inspected 43 dams
- Denied access to 27 dams
Dams - Field Inspections

- Dam inspection protocols modified from the Massachusetts Office of Dam Safety (Phase 1 Formal Dam Safety Inspection Checklist)

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<tr>
<th>Inspection Items</th>
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<tr>
<td>Name, Location, Uses</td>
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<td>Size</td>
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<td>Condition and Deficiencies:</td>
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<td>• Concrete Structures</td>
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<td>• Masonry Structures</td>
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<td>• Spillway</td>
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# Dams - Alternatives Assessment

## Evaluation Criteria

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<td>Hazard Classification</td>
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<td>Dam Condition</td>
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<td>Owner’s Ability to Maintain</td>
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<td>Capacity</td>
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<td>Benefits vs Loss of Current Uses</td>
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<td>Ease of Permitting</td>
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<td>Feasibility of Repurposing</td>
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<td>Hydraulic Impacts</td>
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<td>Wetland Impacts</td>
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## Alternatives

- **Removal/Breach**
- **Repair**
- **Repurposing**
- **Aquatic Organism Passage**
- **No Action/ Maintain**
Assessment Recommendations

- Watershed plan will identify prioritized recommendations for bridges, culverts, and dams
  - Recommendations by subwatershed
  - Typical design and permitting considerations
  - Approximate costs
  - Potential funding sources
- More detailed evaluation needed to confirm feasibility of recommendations and to support design and permitting
Geomorphic Assessment

John Field, Field Geology Services
Green Infrastructure Assessment

- Identify Opportunities for Green Infrastructure (GI) Retrofits
  - Enhance resiliency
  - Provide water quality and ecosystem benefits

- Approach
  - GIS Screening evaluation
  - Field inventories
  - Concept designs

Parcel or Site-Based Retrofits

ROW/ Street Retrofits
82 sites visited

Design concepts developed for 30 sites
Retrofit Site 272A - Westerly Senior Center Bioretention
State Street, Westerly, Rhode Island

Site Description
The proposed retrofit concept is located at the Westerly Senior Center near the intersection of Westminster and State Streets in Westerly, RI. The site consists of an asphalt parking lot divided into multiple parking areas. There is a swale located between two sections of the parking lot, and some runoff is directed to the swale but no overflow or formal BMP exists, nor does the swale capture all of the runoff that could be directed to it.

Proposed Concept
Retrofit the current swale as a bioretention/infiltration practice. The practice would be designed to accept runoff from the surrounding parking lot and additional areas of the site and parking lot. If desired, an overflow structure could be incorporated into the design and connected to current stormwater drainage infrastructure located on Westminster Street.

Image 1: Close-up view of proposed bioretention/infiltration area.

Retrofit Concept Summary
- Total Drainage Area: 1.2 acres
- Total Impervious Area: 1.0 acres
- Total Water Quality Volume: 3,794.0 ft³
- Runoff Reduction Volume: 379.4 ft³

Estimated Pollutant Removal
Bioretention Area
- Total Phosphorus: ~0.5 lbs/year
- Total Nitrogen: 10.5 lbs/year
- Total Suspended Solids: 410.2 lbs/year
- Bacteria (FC): 307.5 billion colonies/year

Estimated Cost
Bioretention Area: $51,032

Image 2: Rendering of a typical bioretention area. (Image source: Johnson County Soil and Water District)

Image 3: View of proposed bioretention/infiltration area and some of the parking area that would drain to it.
Watershed Wetlands Assessment

- Wetlands can provide flood mitigation, habitat, water quality, and other functions
- Identify and prioritize conservation and restoration opportunities
  - GIS-based screening
  - USFWS NWI Plus Dataset for RI and CT
  - Rhode Island Freshwater Wetland Restoration Strategy (Miller and Golet, 2001- URI)
Watershed Wetlands Assessment

- 80 wetland complexes with flood protection function and human modification
- 24 assessed in the field for functions and values
- Several impoundments/dams with high conservation potential (Hazard Pond, Dolly Pond, Kasella Farm Pond)
- Other wetland restoration opportunities identified
Watershed Plan Development

- Integrate findings and recommendations of technical assessments (see the boards around the room)
- Integrate input from the municipalities and the public
- Develop actions, schedule, lead groups, costs, funding sources, etc.

Potential Management Actions

- Land use regulatory controls
- Active restoration
  - Elevating and flood proofing structures
  - Dam removal
  - Aquatic connectivity obstruction removal
  - Bridge and culvert retrofits and replacements
- Passive restoration
  - Riparian buffer restoration and protection
  - Stream bank stabilization
  - Corridor easements
- Reach-scale river restoration
- Green infrastructure stormwater management
- Wetland and habitat restoration
- Related water quality mitigation
Next Steps

- Draft technical assessment reports are available for download and review
- Comments are welcome and encouraged
Questions and Discussion

1. What are your main concerns regarding the Wood-Pawcatuck watershed?

2. What would you most like to see as outcomes of the Wood-Pawcatuck Watershed Flood Resiliency Management Plan?

3. Do you have any specific project ideas or recommendations for your area of the watershed?
Project Contacts

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