May 1st, 8:30 AM - 10:00 AM

Measuring Effectiveness of Culvert Replacement: A Case Study
Measuring Change in Structure and Function after Implementation of the Carpenter Creek Restoration Project, Kitsap County WA

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Measuring Effectiveness of Culvert Replacement: A Case Study Measuring Change in Structure and Function after Implementation Phase 1 of the Carpenter Creek Restoration Project

Betsy Cooper, Joleen Palmer, Cindi Nevins
Stillwaters Environmental Center
Salish Sea Conference
May 1, 2014
Importance of Puget Sound
Lowland Streams

Carpenter Creek / Appletree Cove System

2312 acre System includes:
1886 ac Carpenter Creek drainage
39 ac pocket estuary-high marsh complex
102 ac peat/sphagnum bog
426 ac Kingfisher/ Crabapple creek drainages
Stillwaters-Initiated Watershed Planning in Carpenter Creek

• Place-based Environmental Center with Education & Restoration Focus
• Chinook Listing and Salmon Recovery
• Collaboration Initiated
• Watershed Studies Begun
• Funding Sought for Marsh Preservation and Projects
Volunteer Watershed Characterization

- Monitoring began in 2000 – grew to include:
  - Monthly water quality (8 sites)
  - Monthly bird survey (5 sites)
  - Yearly Freshwater Benthic Invertebrate survey (2 sites)
  - Vegetation survey
  - Habitat survey
  - Wildlife survey
  - Fish survey in scour holes
Volunteer - Driven Road to Recovery – Culvert Replacement Project

- Lobbied for Property Acquisition
- Engaged ACOE in 206 Feasibility Study
- Engaged Local, State, Federal Electeds
- Rallied Community Support
- Secured Federal and SRF Board Funding
- Collaborated with County To Complete Design and Construction
Restore Natural Tidal Hydrology
Reclaim Historic Intertidal Habitat
Remove Fish Passage Barriers
Reduce Scour Hole Features and Deposition of Fines
Reduce Fragmentation of Shoreline and Upstream Habitats
Phase 1  Carpenter Creek Restoration

Pre-Project Conditions
10 ft. Culvert
Scour Holes; Flow Restricted

Project Completed  Feb 2012
Culvert Replaced with 90 ft Bridge
Naturalizing Flow Pattern
(photo – June, 2012)
• Continued pre-bridge efforts and added:
  – Vegetation Survey (1 lobe of pocket estuary)
  – Tidal Height Monitoring (1 hobo; bi-monthly data retrieval)
  – Terrestrial Insect Collection (8 locations; 3 sampling events/yr)
  – Fish Presence (multiple seine events and in-water observation)
  – Neuston Tow (yearly)
  – Photo Log (on-going)
  – Sediment Characterization Study (33 samples multiple years)
Sediment sampling was performed in June 2011 and June 2012. Analysis of sediment data indicated significant changes in substrate type had occurred within 4 months of the culvert being removed.
- 5 transects
- 33 quadrats
- 1 sample per quadrat
- Sample from top 4 inch of sediment
- Sample approx. 600 ml
- Same locations sampled pre- and post bridge
Sample Collection and Analysis

• **Samples collected** in quadrat with “mighty grab” or with shovel depending on substrate
• Samples were bagged, labeled and stored for analysis
• **Analysis performed** at Stillwaters by trained volunteers under supervision
• **Size fractions measured:**
  - > 4mm – cobble/pebble
  - > 2mm – granule
  - > 0.5 mm – coarse sand
  - > 0.25 mm – med sand
  - > 0.06 mm – fine/very fine sand
  - < 0.06 mm - silt
Sediment Analysis Findings

• Analysis method can be effectively replicated by multiple volunteers with reasonable precision.
• Significant changes observed after 4 months of culvert removal.
• Significant changes observed both within and between transect.
• Most transects exhibit increase in smaller size fractions as compared to pre-bridge conditions.
• One transect exhibited larger sediment sizes – new thalweg.
• Post-project silt fraction required significantly longer to settle.
• Quantity of marine detrital material larger than expected.
• Eelgrass establishment in new thalweg.
• Sediment changes in Appletree Cove.
• Freshwater creek channels incising.
• Bird usage areas changing.
• Large schools of salmonids observed in estuary.
• Suspected sand lance nesting.
• Ghost shrimp/crab populations changing.
• Sand Dollar colony changes.
• LWD recruitment.
• Overall effect of Phase 2 implementation.
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- Christine Rolfes
- Phil Rockefeller
- Sherry Appleton

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**Other Collaborators**
- WDFW; US Army Corps of Engineers
- WA Sea Grant; Kitsap PUD
- Kitsap Conservation District
- WRIA 15 Lead Entity

**Suquamish Tribe**
- Chris Endresen WDFW; US Army Corps of Engineers
- Christine Rolfes WA Sea Grant; Kitsap PUD
- Phil Rockefeller Kitsap Conservation District
- Sherry Appleton WRIA 15 Lead Entity

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**Restoration Project Team**
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- Cindi Nevins
- Betsy Cooper

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Questions ?