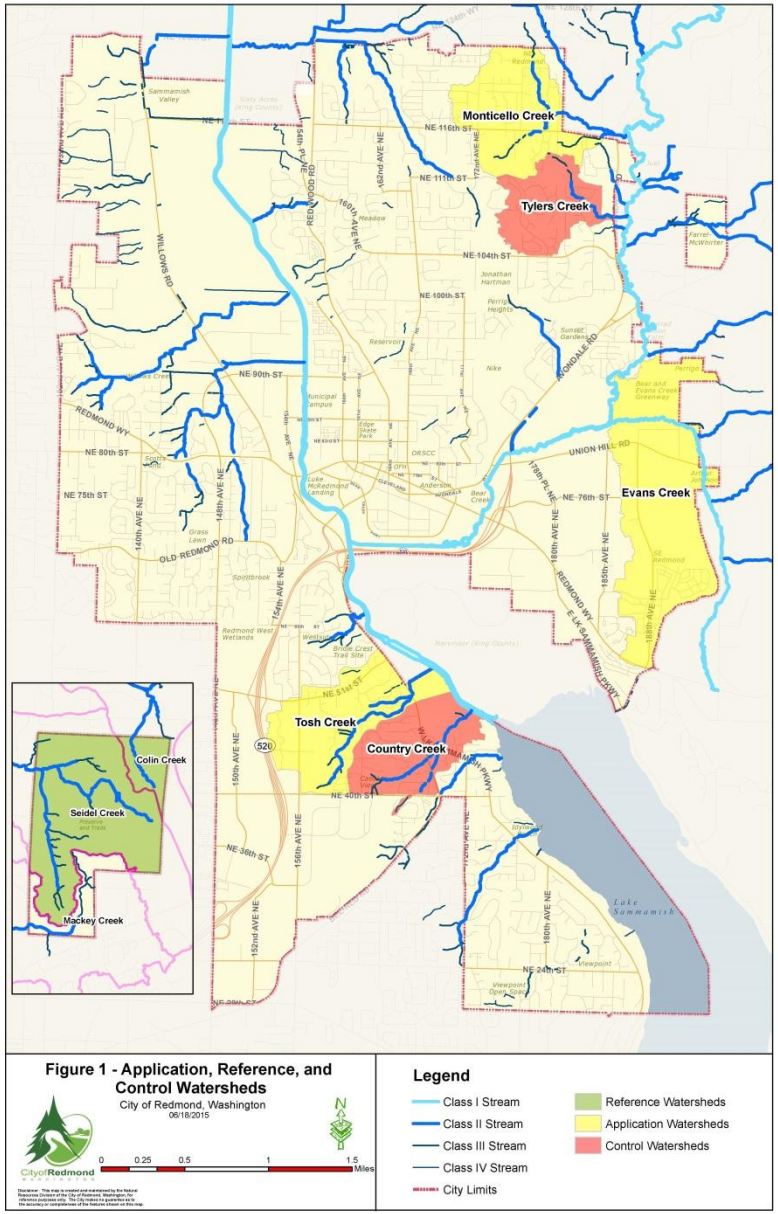
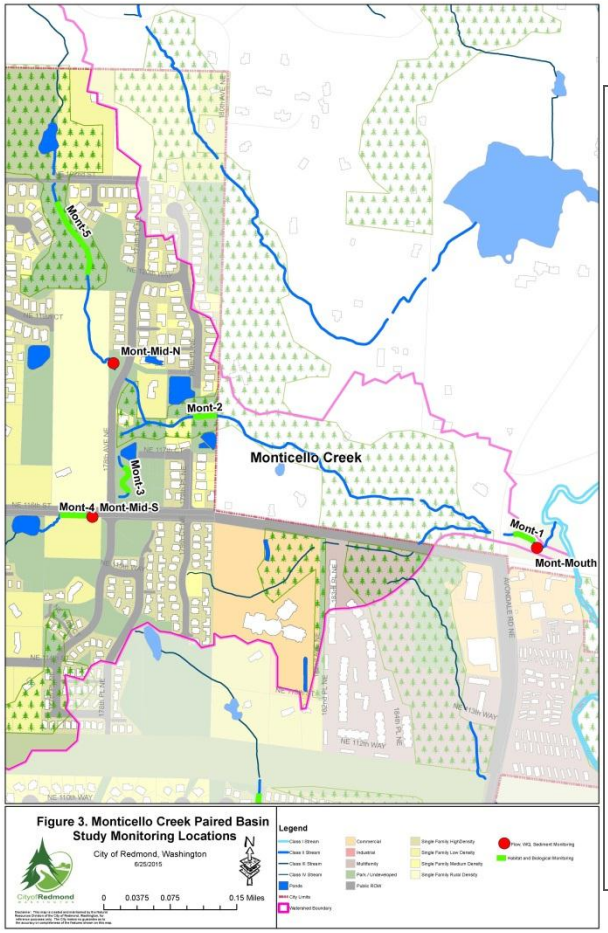
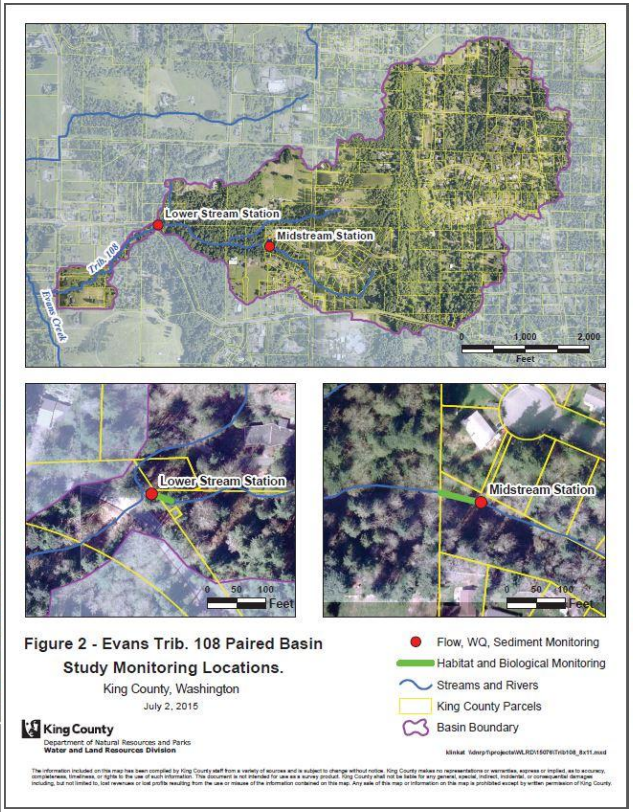
Paired Urban Small Stream Watershed Restoration Effectiveness Study

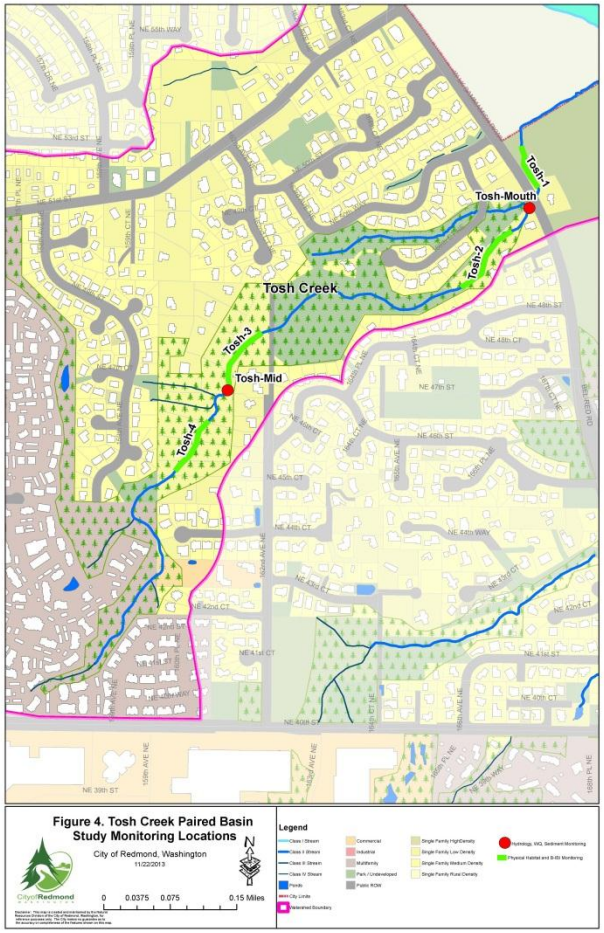
- **Management Actions Studied:** Can beneficial uses be fully restored in small streams that are moderately impacted by urbanization through the focused implementation of stormwater BMPs (structural and nonstructural) in their associated watersheds?
- **Estimated Project Duration: 10 years**
- **Interim results/report:**
  - Monthly progress reports
  - Quality Assurance Project Plan
  - Robust dataset for quantifying stream health based on physical, chemical, and biological indicators
  - Semi-annual data reports
  - Final report
- **2014-2018 Cost: $1,008,366**



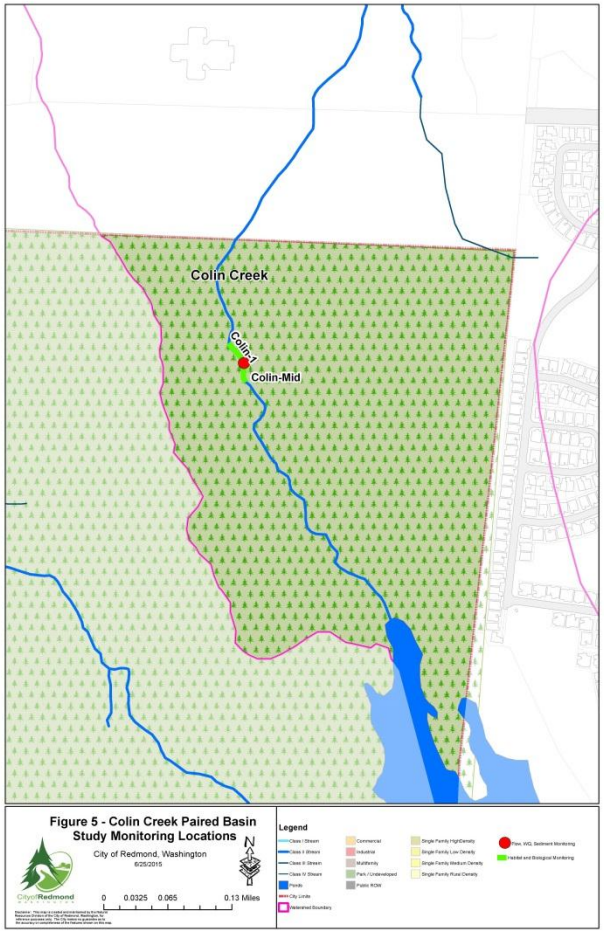
Application Watersheds

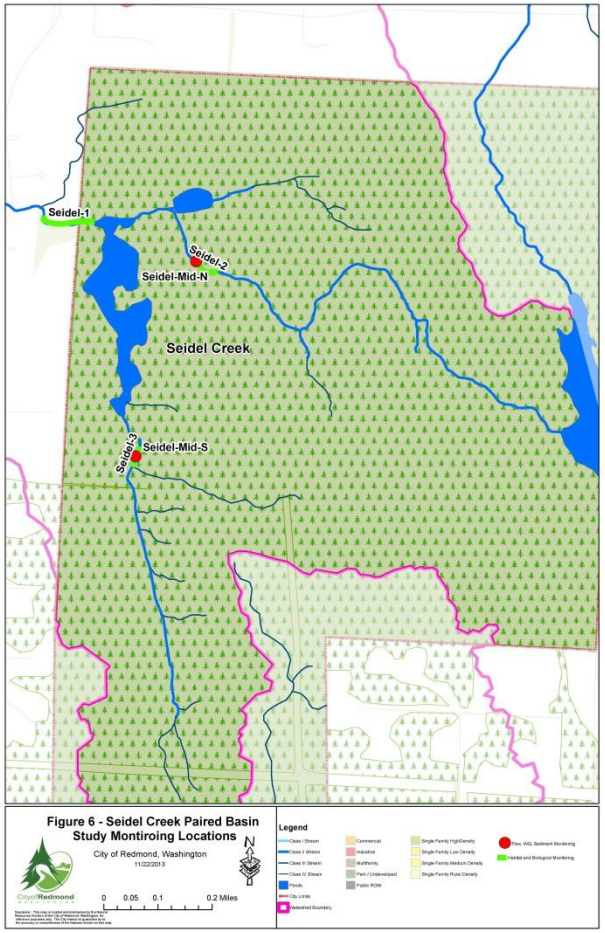




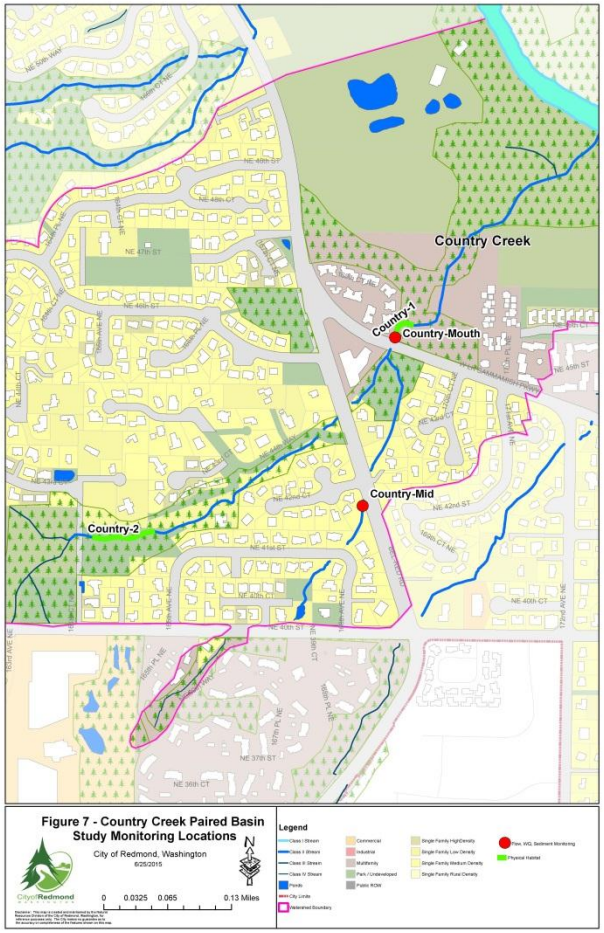


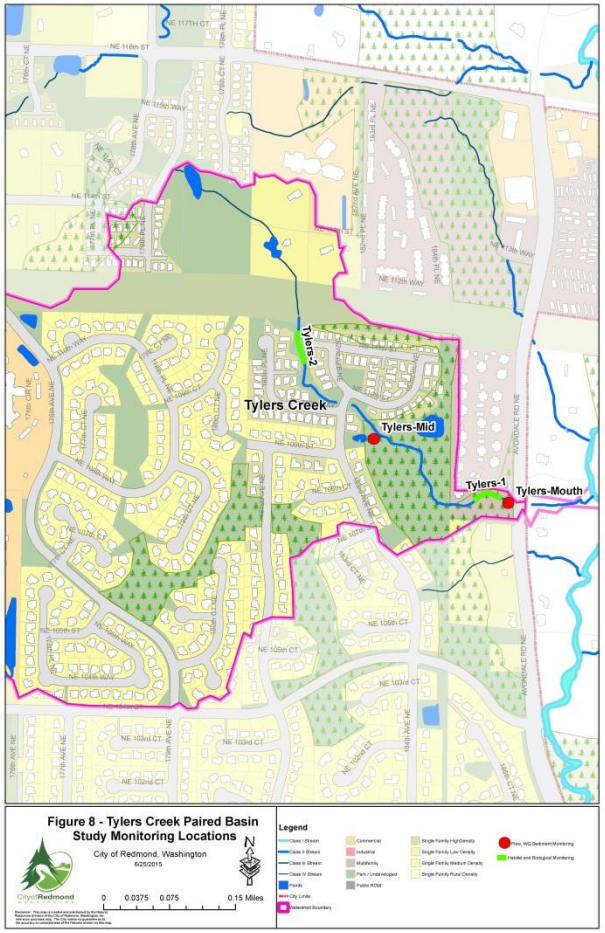
Reference Watersheds





Control Watersheds





Paired Urban Small Stream Watershed Restoration Effectiveness Study

- **Effectiveness Study Question:** How are collective installations of stormwater retrofits working to protect receiving waters at receiving water scale?
- **How we will answer the question:** paired watershed analysis includes 2 control watersheds, 2 reference watersheds, and 3 application watersheds. In-stream measurements at 2 permanent sites in each stream and 2 rover sites (16 sites). Parameter and sample frequencies in table to the right.

Parameter	Frequency
Biological	
Aquatic macroinvertebrates	Annually
Periphyton	
Fish diversity, abundance	Once every five years
Physical Habitat	
Slope and bearing, Longitudinal profile, Wetted width, Bankfull width, Bar width, Residual depth, Channel geometry, Bank stability, Bed scour/deposition, Substrate size, Pool/riffle spacing, Shade, Human influence, Riparian vegetation, Large woody debris	Once every five years
Sediment Quality	
Metals (Cu, Zn, As, Cd, Hg), PAHs, Total organic carbon, Grain Size, Pesticides, Phthalates, PBDEs, PCBs	Annually
Chemistry and Physical Water Quality	
Total phosphorus, Orthophosphate, Total Kjeldahl nitrogen, Nitrate + Nitrite Nitrogen, Ammonia, Total suspended solids, Chloride, Dissolved Cu, Dissolved Zn, Hardness, Dissolved organic carbon, Fecal coliform bacteria, Temperature, Dissolved oxygen, pH, Specific conductance, Turbidity	4 base, 8 storm / year (1 base and 2 storm per quarter)
Temp, Dissolved oxygen, pH, Specific conductance, Turbidity	Continuous
Hydrology	
Flow	Continuous

Paired Urban Small Stream Watershed Restoration Effectiveness Study

Study Outcomes:

- This project aims to quantify the receiving water response to structural and non-structural stormwater controls when applied through a focused, watershed approach.
- This phase of the project (first 3.5 years) will be to establish baseline conditions among application, control, and reference watersheds through monitoring at fixed in-stream stations. This will be useful for other small lowland stream comparisons in western Washington.

Deliverables:

- Monthly progress reports
- Quality Assurance Project Plan
- Robust dataset for quantifying stream health based on physical, chemical, and biological indicators
- Semi-annual data reports
- Final report

How we will share results?:

- Redmond will share the results through presentations to APWA, permit coordinator forums, Stormwater Work Group, WRIA 8 Salmon Recovery Council or the Puget Sound Salmon Recovery Council, and at least one additional professional conference (Salish Sea, NEBC, STORMCON).
- Data will be made available to interested parties on a case-by-case basis.
- Regular meetings and semiannual reports will be posted on Redmond's website.