Washington State
Fish Passage Barrier Removal Projects








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Washington State Department of Transportation

WSDOT Fish Passage Program

Partnership with WDFW starting in 1991

Fish barrier inventory and prioritization

Statewide (as of 8/14):

7,033 culverts evaluated
1,982 barriers identified
(including 1,537 with significant habitat)

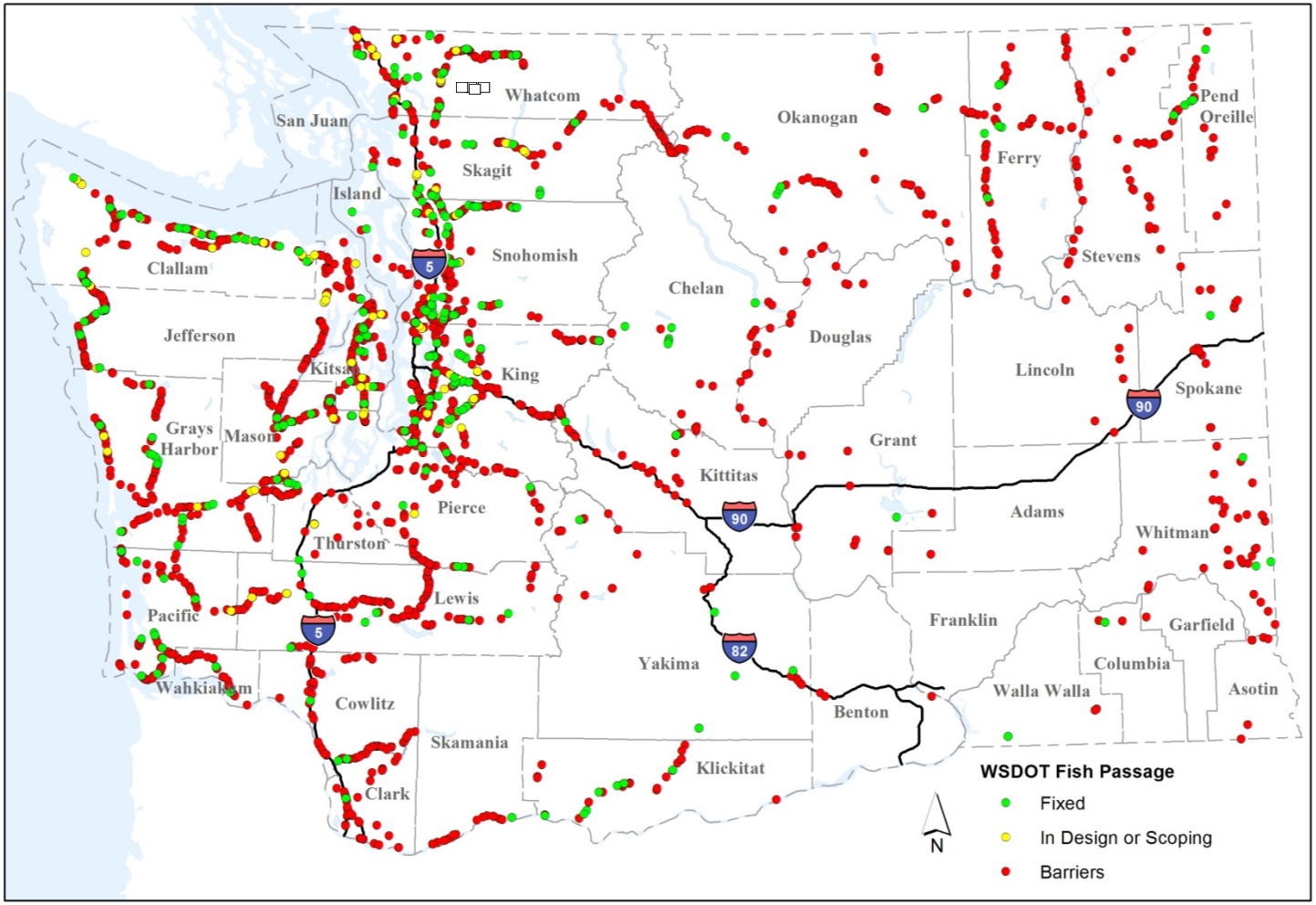
Correction of barriers through:

-stand alone prioritized projects
-part of highway projects
-part of some maintenance activities

282 barrier corrections have been made opening 976 miles of potential habitat (as of 8/14)

SR 548 Terrell Creek Northwest of Ferndale

WSDOT Statewide
Fish Barrier Culverts



Washington State Department of Transportation

Culvert Case

SR 112 Trib to Pysht River
West of Port Angeles

US v WA Background

- 1850's Stevens Treaties: Tribes ceded lands but reserved fishing rights
- 1974 Boldt Decision: Treaties entitle Tribes to a fair share of fish and a related decision raised the question of the State's responsibilities to prevent habitat degradation
- In 2001, Twenty-One Western WA Tribes filed suit against the State claiming culverts were blocking substantial amounts of salmon habitat and reducing the salmon available for harvest
- In 2007, Federal District Court Judge Martinez agreed to the claim and said the State was in breach of the Tribes' treaty rights
- In October 2009, the court convened a trial to determine a remedy
- On March 29, 2013, Judge Martinez issued a permanent injunction for the State to fix barrier culverts in the case area

WSDOT culverts in the US v. WA Case area

Who? State of Washington

WSDOT, WDNR, WDFW, Parks

Where? Case area

Western Washington WRIA's 1-23

How many are there?

	Summer 2013	Summer 2014*
Total Case Area barrier culverts	1,014	989
Culverts with significant habitat *(>200 m upstream)*	847	825

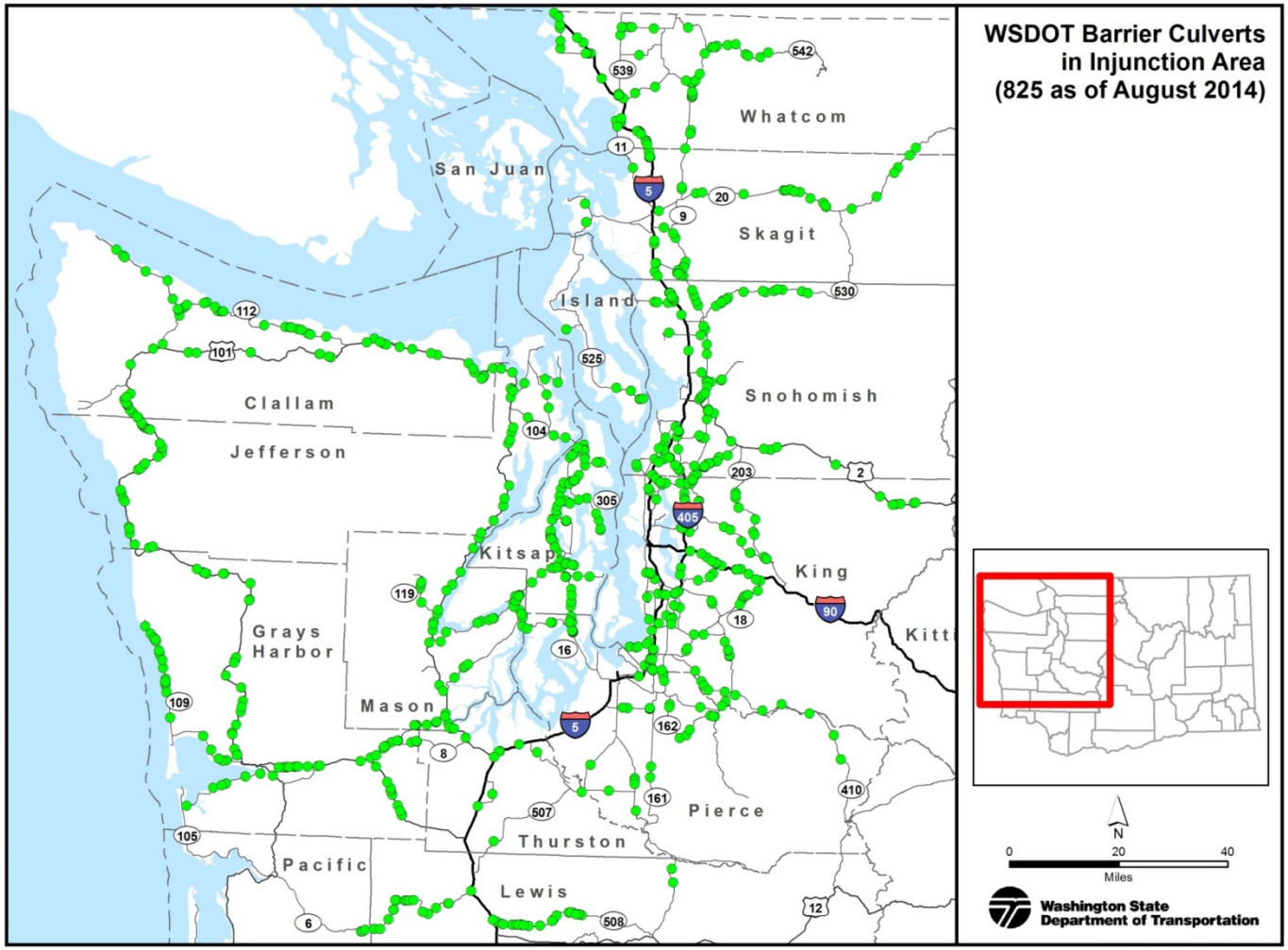
*****Since summer 2013, 6 barriers were corrected, 22 determined not to be barriers, 3 new barriers identified. Numbers will be updated annually.*

Culvert Injunction: Key Points

SR 21 Curlew Creek
Near Curlew Creek State Park

- **Sept 2013**: Develop culvert barrier list in consultation w/ Tribes
- Use bridge or stream simulation design for barrier corrections
- **Oct 2016**: WDFW, DNR, & Parks to fix all their culverts.
- **March 2030**: (16 years) WSDOT to fix barriers with significant habitat (≥ 200 meters upstream)
- WSDOT can defer corrections up to 10% of the total upstream habitat until end of culvert's useful life
- WSDOT to correct culverts with <200 meters upstream habitat at end of useful life or though larger transportation projects
- Ongoing effort to identify & assess barriers, monitor effectiveness & maintain culverts
- Notify Tribes of State's activities with time for comments

WSDOT culverts
in the US v. WA Case area



Current Barrier Correction Effort

- **Fish Passage Program funding in 13-15 – $36 Million.**
- **$20 Million of that directed to ramping up scoping and design**
- **Formed 4 Specialty Fish Passage Design Teams in 3 regional offices**
- **Goals:**
  - Designing 34 projects
  - Scoping 75 additional projects

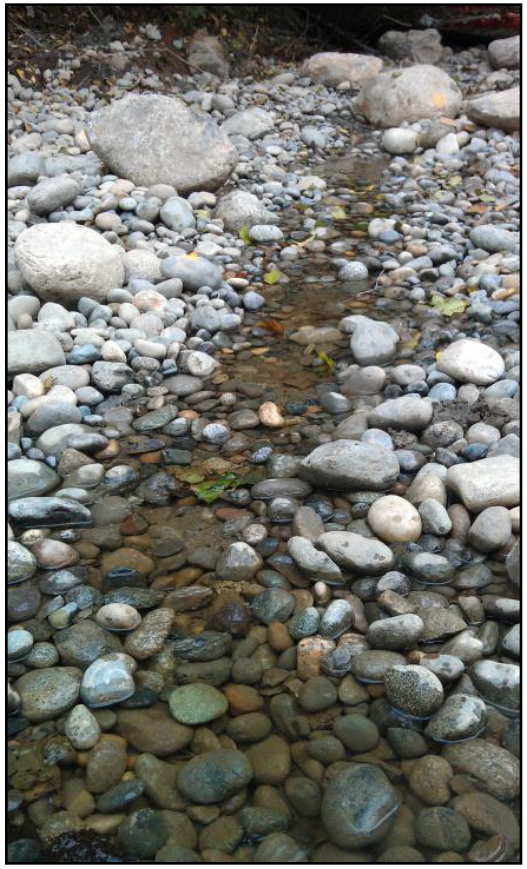
SR 112 Nelson Creek near Port Angeles

Fish Passage Project Selection

Past - Projects selected based on a priority index (PI).

Present - Regions assist to select projects based on some of the following criteria:

- Upstream habitat
- Location of barrier compared with other WSDOT barriers
- Future WSDOT safety/mobility project inclusion
- Future local agency project relationship
- Project grouping efficiencies
  - Traffic impacts during construction
  - Combined construction
- Maintenance issues and structure condition
- Estimated cost (High, Medium, Low)
- Tribal priorities
- Partnership opportunities
- ESA “take” allowance for listed species



Fish Passage Program
HQ Hydraulics Deliverables to Region

- 25% Technical Memorandum - Contains supporting documentation
  - Site Reconnaissance
  - Hydrology
  - Hydraulics
  - Required Structure Span
  - Streambed material type/size

- 25% Design – Used for design “check-in” with WDFW and Permit Drawings
  - Plan View
  - Profile
  - Typical Sections

Fish Passage Program
HQ Hydraulics Deliverables to Region

- 60% Design
  - Scour Analysis (Data received from Bridge/Geotech)
  - Substructure elevations determined based on substructure type and scour depth

- Specialty Report (Stamped Basis of Design Report)
  - Contains engineering calculations to support 100% PS&E

- 100% PS&E
  - Stream Design (Plan, Profile, Section and Details)
  - Scour Countermeasures
  - Water Crossing Design
  - Streambed Material Design

Fish Passage Barrier Culvert Conditions

Excessive Water Surface Drop

High Velocity

Shallow Water Depth

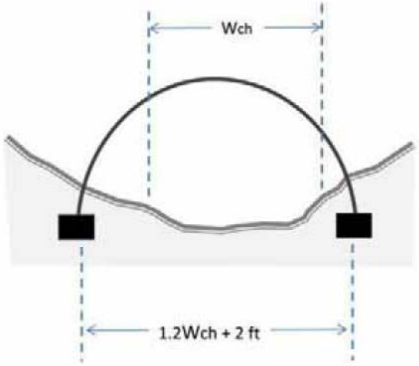
Fish Passage Barrier Culvert Conditions

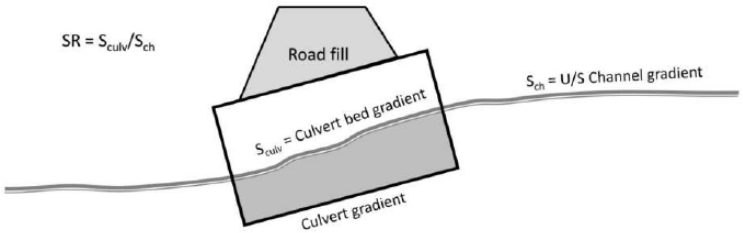
Culvert Plugged with Sediment or Debris

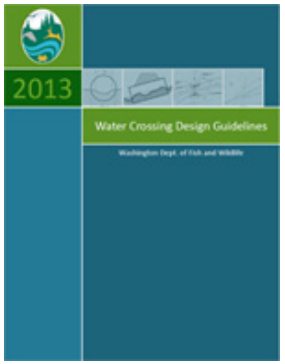
Deteriorating Culverts

Fish Passage Crossings
Statewide Design Options

- **Stream Simulation** – mimics natural channel processes through the crossing
- **Hydraulic Design** – hydrologic and hydraulic analysis to determine suitable conditions for fish
- **No Slope** – properly sized culverts set at zero gradient
- **Retrofit** – series of steps facilitate passage of fish through, over, or around an instream barrier







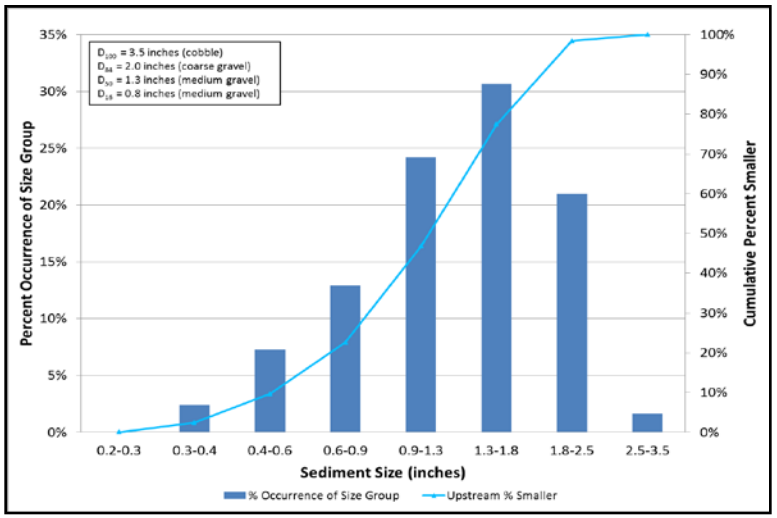
2013 WDFW Water Crossing Design Guidelines

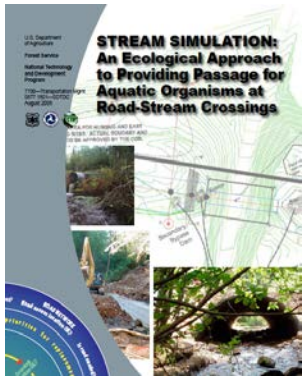
Fish Passage Crossings
Federal Injunction Case Area Design Options

- **Stream Simulation** – mimics natural channel processes throughout the crossing

- **Bridges** – bridges facilitate habitat connection for fish and wildlife

2003 WDFW Water Crossing Design Guidelines





2008 Forest Service Aquatic Road-Stream Crossing Design Guidance

Fish Passage Crossings Design Methods

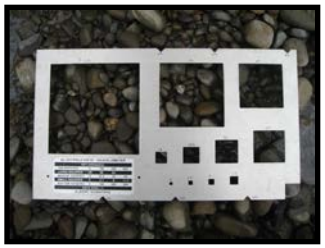
Size	Flow Event	Flow (cfs)	Culvert WSE (NAVD88)	Max Channel Depth At Culvert Inlet (feet)	Channel Velocity At Culvert Inlet (ft/s)
Proposed 20 Foot Box	FP Q-Low	17.4	8.2	1.3	1.9
	FP Q-High	56.8	**8.9**	1.9	**2.7**
	2-year	188	9.9	3.0	4.4
Proposed 26 Foot Box	FP Q-Low	17.4	8.2	1.3	1.9
	FP Q-High	56.8	**8.9**	1.9	**2.6**
	2-year	188	9.9	2.9	4.0

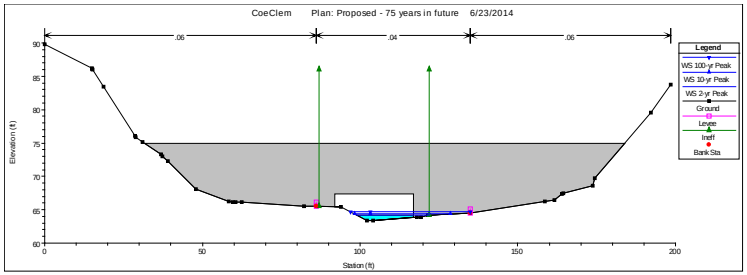
Modified Shields Equation

$$\tau_{c_i} = \tau^*_{D_{50}} (\gamma_s - \gamma) D_i^{0.3} D_{50}^{0.7}$$

Critical Unit Discharge (Bathurst)

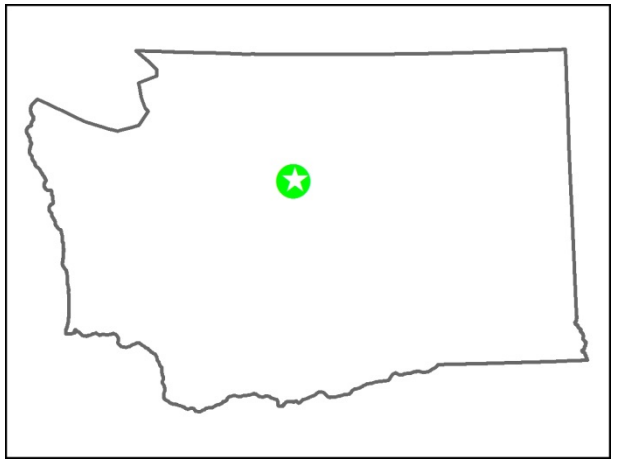
$$q_{cD_{50}} = \frac{0.15 g^{0.5} D_{50}^{1.5}}{S^{1.12}}$$





9-03.11(2) Proposed (Percent Smaller)					
Approximate Size	**4**	**6**	**8**	**10**	**12**
12					100
10				100	70-90
8			100	70-90	
6		100	70-90		
5		70-90			30-60
4	100			30-60	
3	70-90		30-60		
2		30-60			
1.5	20-50				
0.75	10 Max	10 Max	10 Max	10 Max	10 Max

US 2 - Mill Creek



US 2 near Stevens Pass

Before – 11 foot CMP was a velocity barrier

After – 37 ft arch constructed in 2006

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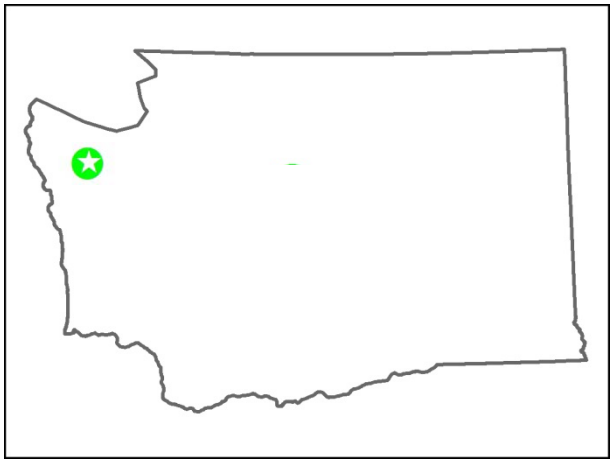
SR 106 Twanoh Falls Creek

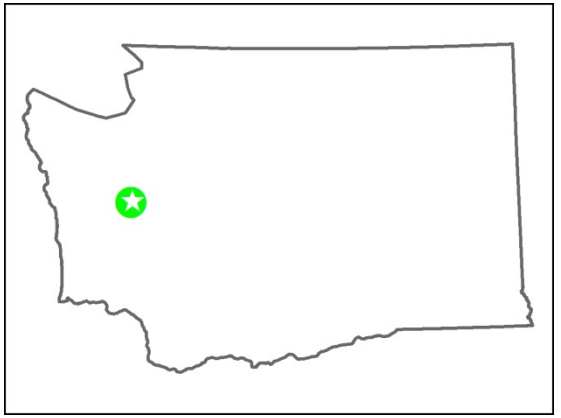


Before – 5 foot concrete box

After – 20 foot 3-sided strucutre constructed in 2013

SR 106 Twanoh Falls Creek under construction

SR 104 – Unnamed Tributary to Squamish Harbor



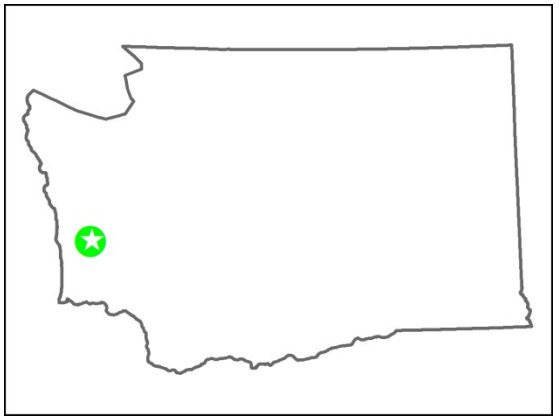
SR 104 near Hood Canal Floating Bridge

Before – 2.5 foot CMP with 2 foot drop

After – 12 foot 3-sided constructed in 2009

US 101 – Mosquito Creek

Before – 4 foot CMP

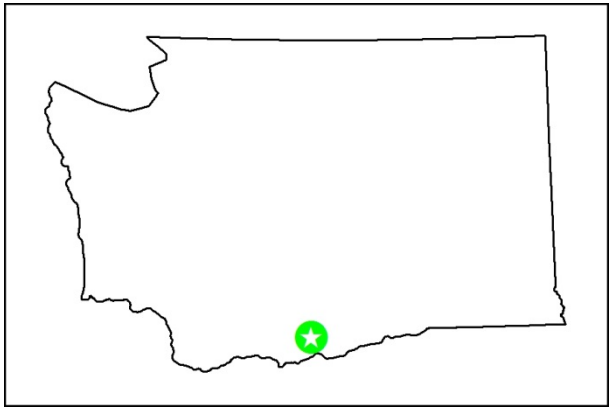


US 101 south of Aberdeen, WA

After – 16 foot Concrete Culvert constructed in 2009

US 97 – Butler Creek

Before – 10.5 foot CMP

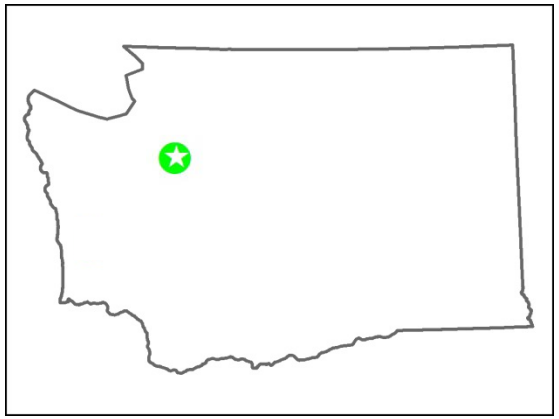


Goldendale, WA

US 97 – Butler Creek

After – 65 foot bridge constructed in 2012

I-90 – East Fork Issaquah Creek



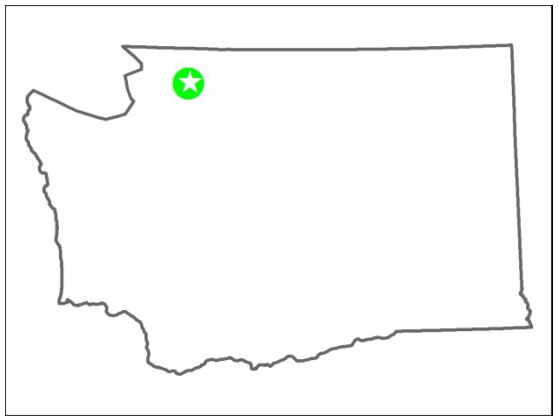
Issaquah, WA

Before – 12 foot CMP with failed downstream sakrete weirs

After – 34 foot bridge project completed in 2012

SR 9 – NPCreek

Before – 8 foot concrete box



Wickersham, WA

After – 17 foot concrete box constructed in 2013

Partnership Example
I-5 Squalicum Creek

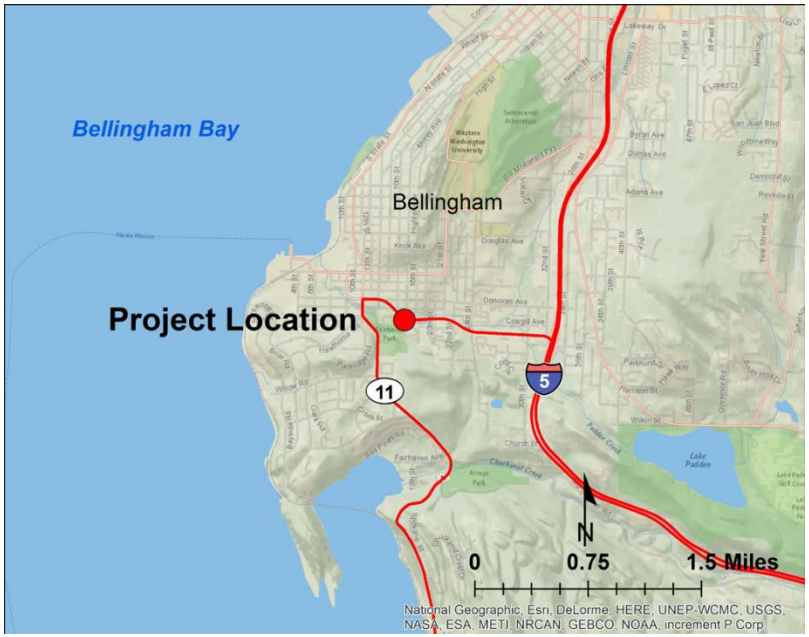
- WSDOT partnered with the City of Bellingham, WDFW, the WA Department of Ecology, and others to restore Squalicum Cr, which flows to Bellingham Bay.
- In 2013, WSDOT constructed an open, fish-friendly stream crossing to open ~ 22 miles of salmon habitat upstream while also protecting the existing I-5 bridges
- In 2015, the stream will be rerouted by the City of Bellingham under the I-5 bridges into an old, historic channel.

Before

After

Partnership Example
SR 11 Padden Creek

- WSDOT partnered with the City of Bellingham, WDFW, the WA Department of Ecology, and others to restore a 0.50 mile reach of Padden Cr along SR 11 that runs through a brick tunnel built in the 1890's.
- In 2013, WSDOT constructed a small bridge on SR 11 with a new stream alignment near the existing culverts which will assist in opening ~7 miles of upstream salmon habitat
- In 2014, the City will reroute the stream out of the tunnel into a new stream channel.



Before

After

Questions?

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