

Washington Salmon Recovery Funding Board

Reach Scale Effectiveness  
Monitoring Program

Summary for Salmon Habitat Conference

April 26, 2007



Project Partners



University of Washington



## Agenda:

1. Program Overview
2. Description of Summary Statistics
3. Sample Projects and Data
4. Analysis
5. Cost Effectiveness
6. Project Enhancements
7. Summary

## Program Overview

### Outcomes of Reach Scale Effectiveness Monitoring

- **Results provide data to the Washington State Salmon Recovery Funding Board to quantify the effectiveness of projects and project categories and inform funding decisions.**
- **Results provide accountability for expenditures in the form of physical and biological results of salmon habitat improvement efforts.**
- **Results can be used to improve the design of future projects submitted by project sponsors.**

## Program Overview

### Restoration vs. Habitat Protection

- **Restoration Projects – Monitoring has BACI Design with control and impact reaches; EMAP sample reach; Uses t-test to look for differences before and after implementation (5-10 years).**
- **Habitat Protection Projects – Monitoring focuses on trends in ecological health through time (12 years).**

## Project Types

### Restoration Projects

- Fish Passage Projects
- Instream Structure Projects
- Riparian Planting Projects
- Constrained Channel Projects
- Channel Connectivity Projects
- Spawning Gravel Projects
- Diversion Screening Projects\*

### Habitat Protection Projects

- Preservation without additional actions
- Existing high quality habitat
- Maintain or improve ecological condition

## Fish Passage Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 5
Passage Design (Yes/No )	Measure of whether passage design criteria are met (Success = 80% of projects are meeting criteria)
Stream Length (km)	Affected stream length includes meander length affected by the project; the length of stream upstream from the barrier
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled
Juvenile Fish (Chinook, coho, steelhead) (fish/m <sup>2</sup> )	Measure of juvenile (year 0) and yearling abundance within the study reach on juvenile survey form divided by the surface area sampled (Success = increase > 20%)
Adult Fish (Number of adults/km)	Measure of spawner abundance within the study reach (Success = increase > 20%)
Redds (Number of redds/km)	Measure of redds counted within the study reach (Success = increase > 20%)

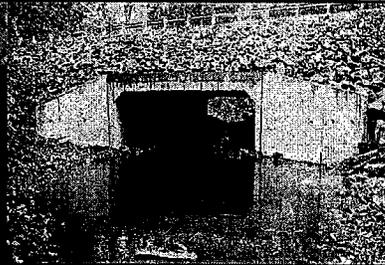
## Fish Passage Projects

### 02-1530 Tributary to the Salmon River

Variable	Year 0 (2004)		Year 1 (2005)		Year 2 (2006)	
	Control	Impact	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>						
Stream Length (m)	N/A	N/A	N/A	1,287	NA	1,287
Reach Length (m)	150	150	150	150	150	120
Reach Width (m)	8.01	2.82	10.10	3.48	9.38	3.19
<b>Fish Data</b>						
Steelhead Parr (fish/m <sup>2</sup> )	0.485	0.019	0.010	0.021	0	0
Coho Juvenile (fish/m <sup>2</sup> )	0.050	0	0.023	0.036	0.351	0.183
Coho Adult (fish/km)	53.33	0	73.33	173.33	20.00	6.67
Coho Redds (redds/km)	66.67	0	6.67	6.67	0	6.67
<b>Fish Passage</b>						
Passage Design (y/n)	N/A	N/A	N/A	Yes	N/A	Yes

## Fish Passage Projects

02-1574 Malaney Creek



Variable	Year 0 (2004)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	4,023
Reach Length (m)	210	210	210	210
Reach Width (m)	3.28	2.65	3.66	2.72
<b>Fish Data</b>				
Coho Juveniles (fish/m <sup>2</sup> )	0.010	0	0.003	0
Steelhead Parr (fish/m <sup>2</sup> )	0.028	0.007	0.003	0
Coho Adults (fish/km)	53.33	0	20.00	6.67
Coho Redds (redds/km)	6.67	0	0	6.67
Chum Adults (fish/km)	0	0	200.0	140.0
Chum Redds (redds/km)	0	0	26.67	0
<b>Fish Passage</b>				
Passage Design (y/n)	N/A	N/A	N/A	Yes

## Fish Passage Projects

04-1689 Lucas Creek  
Barrier Correction



Variable	Year 0 (2005)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	4,484
Reach Length (m)	168	168	168	168
Reach Width (m)	4.37	3.85	5.04	3.39
<b>Fish Data</b>				
Chinook Juveniles (fish/m <sup>2</sup> )	0	0	0	0
Coho Juveniles (fish/m <sup>2</sup> )	0	0.022	0	0.033
Steelhead Parr (fish/m <sup>2</sup> )	0.087	0.045	0.222	0.051
Chinook Adults (fish/km)	0	0	4.76	2.38
Chinook Redds (redds/km)	0	0	14.29	0
<b>Fish Passage</b>				
Passage Design (y/n)	N/A	N/A	N/A	Yes

## Fish Passage Projects – Composite Data

Variable	Statistically Significant?	Percent Change	Successful? (<20 %)
Coho Adults (fish/km)	No	177%	Yes
Coho Redds (redds/km)	No	109%	Yes
Coho Juveniles (fish/m <sup>2</sup> )	No	269%	Yes
Chinook Juveniles (fish/m <sup>2</sup> )	No	1441%	Yes
Steelhead Parr (fish/m <sup>2</sup> )	No	71%	Yes

## Instream Structure Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 10
Artificial Instream Structures (#)	Measure of the number of instream structures within the study reach (Success = >50% of structures present)
Mean Vertical Pool Profile Area (m <sup>2</sup> per reach)	Mean thalweg vertical profile area for the study reach (Success = increase > 20%)
Mean Residual Pool Depth (m <sup>2</sup> per 100 m)	Mean thalweg residual depth within the study reach (Success = increase > 20%)
Large Woody Debris Volume (m <sup>3</sup> )	Volume of large woody debris of all sizes within the study reach (Success = increase > 20%)
Stream Length (km)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled
Juvenile Fish (Chinook, coho, steelhead) (fish/m <sup>2</sup> )	Measure of juvenile (year 0) and yearling abundance within the study reach on juvenile survey form divided by the surface area sampled (Success = increase > 20%)

# Instream Structure Projects

## 02-1463 Salmon Creek



Variable	Year 0 (2004)		Year 1 (2005)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	1,609
Reach Length (m)	180	180	180	180
Reach Width (m)	3.01	5.20	3.10	4.63
Mean Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	12.40	17.28	9.96	17.89
Mean Residual Pool Area (m <sup>2</sup> /100m)	7.18	9.60	5.57	9.99
Log <sub>10</sub> (Volume of LWD) (m <sup>3</sup> /100m)	1.13	0.41	1.03	1.40
<b>Fish Data</b>				
Chinook Juveniles (fish/m <sup>2</sup> )	0	0.010	0	0
Coho Juveniles (fish/m <sup>2</sup> )	0.179	0.631	0.083	0.113
Steelhead Parr (fish/m <sup>2</sup> )	0.020	0.068	0.013	0.060
<b>In-Stream Structures</b>				
AIS Present (#)	N/A	N/A	N/A	13

# Instream Structure Projects

## 02-1561 Edgewater Park Off-Channel Restoration



Variable	Year 0 (2004)		Year 1 (2005)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	318
Reach Length (m)*	220	220	318	318
Reach Width (m)	5.28	2.70	5.57	14.79
Mean Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	0.00	0.00	0.00	21.72
Mean Residual Pool Area (m <sup>2</sup> /100m)	0.00	0.00	0.00	6.83
Log (Volume of LWD) (m <sup>3</sup> /100m)	0.96	0.74	0.79	1.58
<b>Fish Data</b>				
Chinook Juveniles (fish/m <sup>2</sup> )	0	0	0	0.222
Coho Juveniles (fish/m <sup>2</sup> )	0	0	0	0.0004
Steelhead Parr (fish/m <sup>2</sup> )	0	0	0	0
<b>In-Stream Structures</b>				
AIS Present (#)	N/A	N/A	N/A	208

# Instream Structure Projects

## 04-1448 Grays River PUD Bar Habitat Enhancement

Variable	Year 0 (2005)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	322
Reach Length (m)	320	320	320	320
Reach Width (m)	29.37	23.67	25.28	27.31
Mean Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	56.22	85.20	64.89	159.86
Mean Residual Pool Area (m <sup>2</sup> /100m)	17.57	26.63	20.28	49.96
Log <sub>10</sub> (Volume of LWD) (m <sup>3</sup> /100m)	1.42	0.98	1.14	0.80
<b>Fish Data</b>				
Chinook Juvenile (fish/m <sup>2</sup> )	0	0	0.0002	0
Coho Juvenile (fish/m <sup>2</sup> )	0	0	0.007	0.005
Steelhead Parr (fish/m <sup>2</sup> )	0.013	0.018	0.092	0.003
<b>In-Stream Structure</b>				
AIS Present (#)	N/A	N/A	N/A	27

# Instream Structure Projects

Variable	Statistically Significant?	Percent Change	Successful? (<20 %)
Mean Thalweg Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	Yes	601%	Yes
Mean Residual Pool Area (m <sup>2</sup> /100m)	Yes	698%	Yes
Log <sub>10</sub> of the Volume of Wood (m <sup>3</sup> )	Yes	518%	Yes
Chinook Juveniles (fish/m <sup>2</sup> )	No	128%	Yes
Coho Juveniles (fish/m <sup>2</sup> )	No	-97%	No
Steelhead Juveniles (fish/m <sup>2</sup> )	No	-151%	No

## Riparian Planting Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 10
Number of Plantings (#)	Proportion of planted plants remaining alive in the impact area (Success = > 50 % by Year 10)
Riparian Area Planted (acres)	The area planted with riparian vegetation
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer) (Success = increase > 20%)
Riparian Vegetation Structure (%)	Proportion containing (>10%) of all 3 layers of riparian vegetation (Success = increase > 20%)
Bank Erosion (%)	Proportion of the reach containing actively eroding stream banks (Success = decrease > 20%)
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled



Variable	Year 0 (2004)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	4,828
Reach Length (m)	150	150	150	150
Reach Width (m)	7.0	3.00	1.0	1.5
<b>Riparian Characteristics</b>				
Canopy Density (1-17)	0	0	0	9.33
Riparian Vegetation Structure (%)	0	10.0	0	0
Bank Erosion (%)	0	0	0	0
<b>Riparian Plantings</b>				
Number of Plantings (total)	N/A	N/A	N/A	3,510
Area Planted (acres)	N/A	N/A	N/A	6
% Plants Living	N/A	N/A	N/A	96.3

**Riparian Planting Projects**

**02-1623 Snohomish River Confluence Reach Restoration**

# Riparian Planting Projects

## 04-1649 Salmon/Snow Lower Watershed Restoration

Variable	Year 0 (2005)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	2,286
Reach Length (m)	150	150	150	150
Reach Width (m)	4.0	3.00	4.00	3.00
<b>Riparian Characteristics</b>				
Canopy Density (1-17)	16.77	13.00	16.78	13.15
Riparian Vegetation Structure (%)	100	4.5	77.8	23.1
Bank Erosion (%)	19.75	0	23.25	0
<b>Riparian Planting</b>				
Number of Plantings (total)	N/A	N/A	N/A	17,597
Area Planted (acres)	N/A	N/A	N/A	29
% Plants Living	N/A	N/A	N/A	96.4



# Riparian Planting Projects

## 04-1711 Lower Klickitat Riparian Restoration

Variable	Year 0 (2005)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	200
Reach Length (m)	200	200	200	200
Reach Width (m)	15	15	20	20
<b>Riparian Characteristics</b>				
Canopy Density (1-17)	6.82	4.91	4.41	4.65
Riparian Vegetation Structure (%)	18.2	9.1	18.2	27.3
Bank Erosion (%)	0	40	0	31
<b>Riparian Planting</b>				
Number of Plantings (total)	N/A	N/A	N/A	4,733
Area Planted (acres)	N/A	N/A	N/A	5.2
% Plants Living	N/A	N/A	N/A	90.5

<b>Riparian Planting Projects</b>			
<b>Variable</b>	<b>Statistically Significant?</b>	<b>Percent Change</b>	<b>Successful? (&lt;20 %)</b>
Linear Proportion of Actively Eroding Banks (%)	No	40%	Yes
Riparian Vegetation Structure (%)	Yes	55%	Yes
Canopy Density (1-17)	No	-34%	No

<b>Livestock Exclusion Projects</b>	
<b>Indicator Abbreviation</b>	<b>Description and Success Criteria by YEAR 10</b>
Exclusion Design (y/n)	The number of livestock exclusions meeting the design criteria for excluding livestock from the stream (Success = 80% of projects are meeting criteria)
Area of Exclusion (acres)	The area excluded with fencing
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer) (Success = increase > 20%)
Riparian Vegetation Structure (%)	Proportion of the reach containing (>10%) of all 3 layers of riparian vegetation (Success = increase > 20%)
Bank Erosion (%)	Proportion of the reach containing actively eroding stream banks (Success = decrease > 20%)
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled

# Livestock Exclusion Projects

## 02-1498 Abernathy Creek Riparian Restoration

Variable	Year 0 (2004)		Year 1 (2005)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	4,023
Reach Length (m)	240	240	240	240
<b>Riparian Characteristics</b>				
Canopy Density (1-17)	16.68	15.55	16.55	15.41
Riparian Vegetation Structure (%)	100	100	100	100
Bank Erosion (%)	2	2	0.25	2.5
<b>Riparian Livestock Exclusions</b>				
Exclusion Design (y/n)	N/A	N/A	N/A	Yes
Area of Exclusion (acres)	N/A	N/A	N/A	84.0

# Livestock Exclusion Projects

## 04-1655 Hoy Livestock Exclusion

Variable	Year 0 (2005)		Year 1 (2006)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	3,218
Reach Length (m)	210	210	210	210
<b>Riparian Characteristics</b>				
Canopy Density (1-17)	16.73	6.0	16.64	3.09
Riparian Vegetation Structure (%)	59.1	18.2	50.0	0
Bank Erosion (%)	37.5	47.5	55.25	50.0
<b>Riparian Livestock Exclusions</b>				
Exclusion Design (y/n)	N/A	N/A	N/A	Yes
Area of Exclusion (acres)	N/A	N/A	N/A	38.0

## Livestock Exclusion Projects

Variable	Statistically Significant?	Percent Change	Successful? (<20 %)
Linear Proportion of Actively Eroding Banks (%)	No	-140%	No
Riparian Vegetation Structure (%)	No	-24%	No
Canopy Density (1-17)	No	-22%	No

## Constrained Channel Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 10
Bankfull Height (m)	Mean bankfull height within the study reach
Bankfull Width (m)	Mean bankfull width within the study reach
Mean Vertical Pool Profile Area (m <sup>2</sup> per reach)	Mean thalweg vertical profile area for the study reach (Success = increase > 20%)
Mean Residual Pool Depth (m <sup>2</sup> per 100 m)	Mean thalweg residual depth within the study reach (Success = increase > 20%)
Mean Bankfull Cross-Sectional Area (m <sup>2</sup> )	Study reach bankfull channel capacity (Success = increase > 20%)
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Channel Constraint Removed (Yes/No)	Determination as to whether the setback is still in place

## Constrained Channel Projects

### 02-1625 South Fork Skagit Levee Setback and Acquisition

Variable	Year 0 (2004)		Year 1 (2005)	
	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>				
Stream Length (m)	N/A	N/A	N/A	777
Reach Length (m)	500	500	500	500
Bankfull Width (m)	172.7	143.1	183.67	122.4
Mean Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	296.98	587.77	359.87	519.30
Mean Residual Pool Area (m <sup>2</sup> /100m)	59.40	117.55	71.26	103.86
<b>Channel Constraint</b>				
Constraining Structure Height at Bankfull (m)	2.0	2.2	2.0	2.2
Mean Bankfull Cross-Sectional Area (m <sup>2</sup> )	345.4	314.81	367.3	269.24
Channel Constraint Removed (y/n)	N/A	N/A	N/A	Yes*

## Channel Connectivity Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 5
Mean Vertical Pool Profile Area (m <sup>2</sup> per reach)	Mean Thalweg vertical profile area for the study reach (Success = increase > 20%)
Mean Residual Pool Depth (m <sup>2</sup> per 100 m)	Mean Thalweg residual depth within the study reach (Success = increase > 20%)
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer) (Success = increase > 20%)
Riparian Vegetation Structure (%)	Proportion containing (>10%) of all 3 layers of riparian vegetation (Success = increase > 20%)
Juvenile Fish (Chinook, coho, steelhead) (fish/m <sup>2</sup> )	Measure of juvenile abundance within the study reach on juvenile survey form divided by the surface area sampled (Success = increase > 20%)
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Channel Connected (Yes/No)	Measure of whether the channel has remained connected to the stream

# Channel Connectivity Projects

## 02-1561 Edgewater Park Off-Channel Restoration



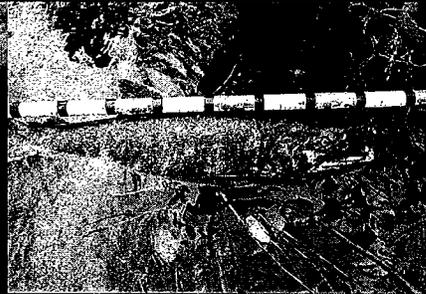
Variable	Year 0 (2004)		Year 1 (2005)		Year 2 (2006)	
	Control	Impact	Control	Impact	Control	Impact
<b>Stream Physical Characteristics</b>						
Stream Length (m)	N/A	N/A	N/A	318	N/A	318
Reach Length (m)*	220	220	318	318	318	318
Reach Width (m)	5.28	2.70	5.57	14.79	5.5	7.95
Mean Residual Pool Vertical Profile Area (m <sup>2</sup> /reach)	0	0	0	21.72	0	89.40
Mean Residual Pool Area (m <sup>2</sup> /100m)	0	0	0	6.83	0	27.94
<b>Riparian Characteristics</b>						
Canopy Density (1-17)	16.75	16.86	16.96	10.23	15.85	7.02
Riparian Vegetation Structure (%)	100	100	4.5	59.1	0	0
<b>Fish Data</b>						
Coho Juveniles (fish/m <sup>2</sup> )	0	0	0	0.0004	0	0
Chinook Juveniles (fish/m <sup>2</sup> )	0	0	0	0.022	0	0.012
<b>Channel Connectivity</b>						
Channel Connected? (y/n)	N/A	N/A	N/A	Yes	N/A	Yes

# Spawning Gravel Projects

Indicator Abbreviation	Description and Success Criteria by YEAR 10
Area of Gravel (m <sup>2</sup> )	Measure of gravel present after placement
Percent Fines (%)	Mean percent of the study substrate in fines (Success = decrease > 20%)
Percent Embedded (%)	Mean percentage of the substrate that is embedded (Success = decrease > 20%)
Adult Fish (Number of adults/km)	Measure of spawner abundance within the study reach (Success = increase > 20%)
Redds (Number of redds/km)	Measure of redds counted within the study reach (Success = increase > 20%)

## Spawning Gravel Projects

04-1209 Chico Creek Restoration



Variable	Year 0 (2005)	
	Control	Impact
<b>Substrate Data</b>		
Gravel Present after Placement (m <sup>2</sup> )	N/A	N/A
% Study Substrate in Fines	0	0
Mean % Substrate Embeddedness	26.6	32.6
<b>Fish Data</b>		
Chum Redds (redds/km)	265	615
Chum Spawners (fish/km)	4,260	8,580

## Diversion Screening Projects

Indicator Abbreviation

Description and Success Criteria by YEAR 5

Screen Design (%)

Proportion of design elements in screen diversion structure that meet design criteria (Success = >80% meeting criteria)

**\*No control structure established**

**\*Tests for function of the screen (yes/no vs. t-test)**

## Diversion Screening Characteristics

Characteristic
Parallel to river flow
Approach velocity <0.20 ft/s
Uniform flow
Sweep velocity > approach velocity
Sweep velocity does not decrease
Screen mesh size is compliant
Screen media is corrosion resistant
Gap size is compliant
Water withdrawal does not exceed maximum
Sweep velocity is sufficient to sweep away debris
Clearance is within compliance

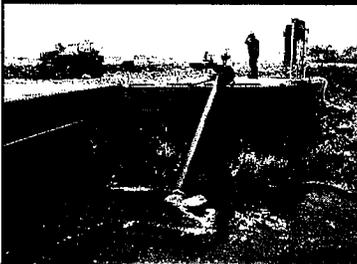
NOAA Fisheries Criteria

## Diversion Screening Projects



### 02-1543 Walla Walla Fish Screening Project

Screen Design (%)	100
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### 02-1656 Dry/Cabin Creek Fish Screening Project

Screen Design (%)	91
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<b>Habitat Protection Projects</b>	
<b>Indicator</b>	<b>Description and Success Criteria by YEAR 10</b>
<b>Upland Habitat</b>	Percent cover of non-native vascular plant species (%)
	Percent cover of non-native shrub species (%)
	Basal area of conifers per acre (ft <sup>2</sup> /acre)
	Stem count of conifers per acre (#/acre)
	Basal area of deciduous trees per acre (ft <sup>2</sup> /acre)
	Stem count of deciduous trees per acre (#/acre)

<b>Habitat Protection Projects</b>	
<b>Indicator</b>	<b>Description and Success Criteria by YEAR 10</b>
<b>Estuary Habitat (only)</b>	Percent of the length of the intertidal transect with algae (%)
	Linear extent of algae along the intertidal transect (m)
	Percent of the length of the intertidal transect with vascular plants (%)
	Linear extent of vascular plants along the intertidal transect (m)
	Percent slope from mean high tide to mean low tide or low water (%)
	Percent of the length of the intertidal transect with fine sediment (%)
	Linear extent of fine sediment along the intertidal transect (m)

# Habitat Protection Projects

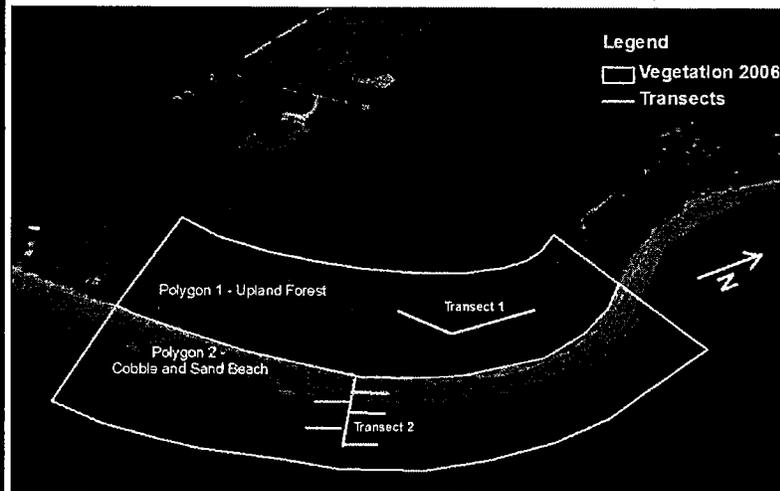
## 04-1335 Piner Point on Maury Island



Variable	Year 0 (2006)
<b>Estuary Characteristics</b>	
Percent Cover of Marine Algae (%)	39.83
Length of Marine Algae Along Transect (m)	19.91
Percent Cover of Non-native Herbaceous Vascular Plants (%)	0
Length of Non-Native Herbaceous Vascular Plants Along Transect (m)	0
Slope (%)	10.0
Percent fines (%)	0
Length of Fines Along Transect (m)	0
<b>Upland Plant Characteristics</b>	
Percent Cover of Non-native Herbaceous Vascular Plants (%)	0
Percent Cover of Non-native Shrubs (%)	11.32
Basal Area - Conifers (ft <sup>2</sup> /acre)	30.60
Stem Count - Conifers (stems/acre)	22.0
Basal Area - Deciduous (ft <sup>2</sup> /acre)	232.57
Stem Count - Deciduous (stems/acre)	66.0

# Habitat Protection Projects

## Piner Point 04-1335 Estuary Acquisition



## Cost Effectiveness

- Life Expectancy = Time over which the project is expected to function
- Cost per Year of Life Expectancy = Total cost of the project divided by the Life Expectancy
- Percent change in a given parameter is calculated using the following:

(Control Year 0 – Impact Year 0) = Difference Year 0

(Control Year 1 – Impact Year 1) = Difference Year 1

$$\frac{\text{Difference Year0} - \text{Difference Year1}}{\text{Difference Year0}} \times 100$$

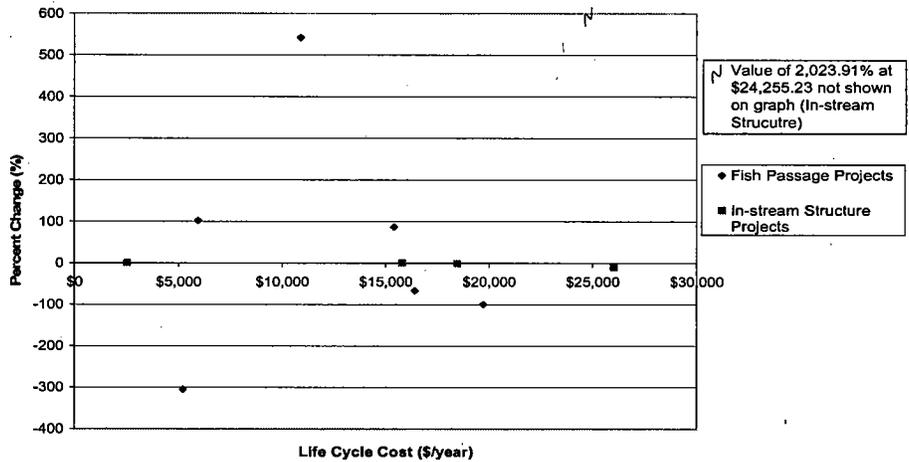
## Cost Effectiveness – Life Expectancy

SRFB Category	Longevity for MC (years)
Fish Passage Projects (MC-1)	10-50+
In-Stream Habitat Projects (MC-2)	5-20
Riparian Planting Projects (MC-3)	10-50+
Riparian Livestock Exclusion Projects (MC-4)	10-50+
Constrained Channels (MC-5)	10-50+
Channel Connectivity, Off-Channel Habitat, and Wetland Restoration Projects (MC-6)	10-50+
Spawning Gravel Projects (MC-7)	No Information
Instream Diversion Projects (MC-8)	10-50+
Habitat Protection Projects (MC-10)	Decades-Centuries

Source: Roni et al. 2002

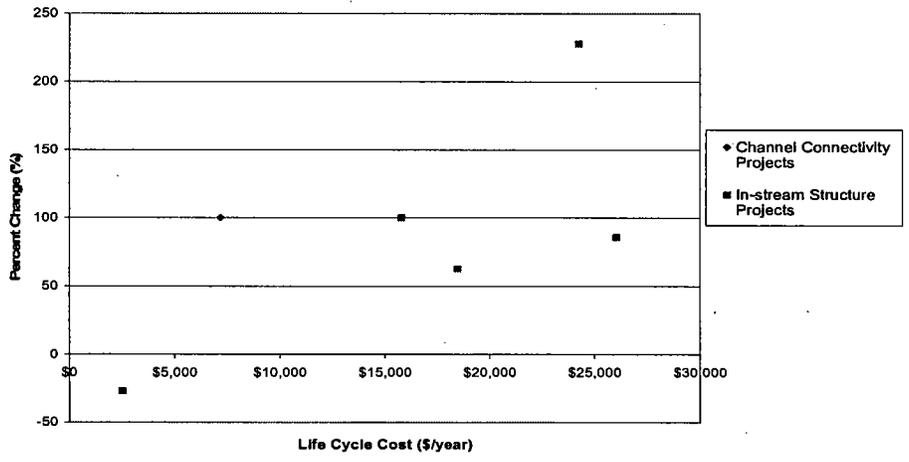
# Cost Effectiveness

## Percent Change in Steelhead Parr Density vs. Cost/Life Expectancy

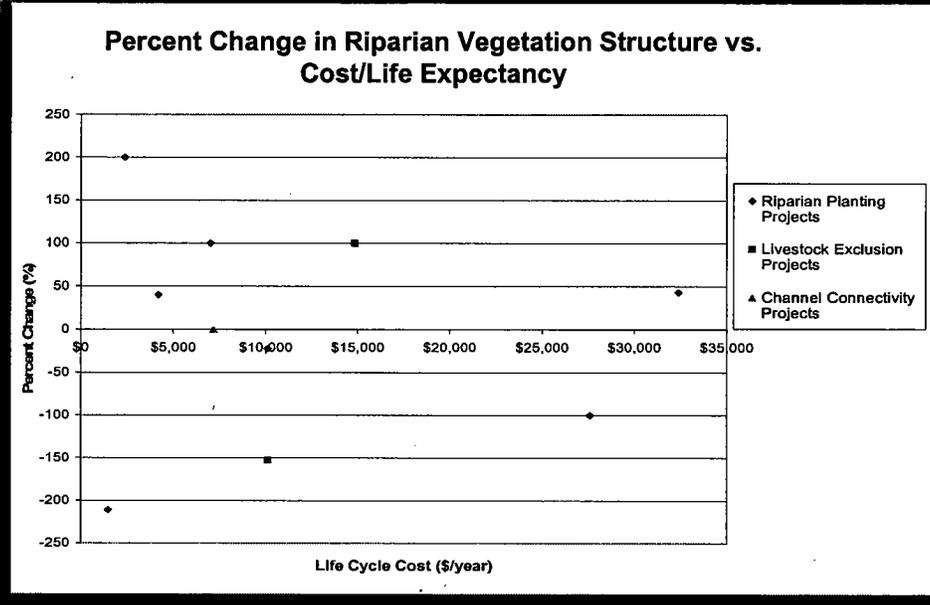


# Cost Effectiveness

## Percent Change in Mean Thalweg Vertical Pool Profile Area vs. Cost/Life Expectancy



## Cost Effectiveness



## Project Enhancements

- Upland Vegetation and Estuary Habitat Protocols
- GIS Analysis of vegetation condition
- Additional Substrate Protocol Analysis
- Additional Studies – University of Washington

Independent QA/QC Analysis

Study on Fish Response to Changes in Microhabitat

### Additional Evaluation – Recommendations

- Detailed data collection based on project design
- Segregate similar project types for evaluation
- Evaluate project types with a suite of metrics monitored under high and low flows
- Assess if project designs create accessible habitat utilized by local fish species

### IMPLEMENTATION

- Post-treatment Study – Coupled to the SRFB Program, Supplementary Data, Local Approach

### SUMMARY:

- Preliminary findings from first three years of data collection.
- Able to see differences for some variables in 2006. Other variables will take longer to show meaningful change – need for a long-term program.
- Results provide data to the Washington State Salmon Recovery Funding Board to quantify the physical and biological effectiveness of project categories.
- Monitoring provides data on which projects and project categories are producing the greatest results and are most cost effective.

## Questions?

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