

Coos Bay Lowland Assessment and Restoration Plan

Chapter 2: Echo Creek Sub-basin Assessment



Echo Creek upstream from the mouth. Photo CoosWA, 2006.

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Echo Creek Sub-basin

Introduction

Landform

The Echo sub-basin (see Figure E-1) is the southern-most, smallest system in the assessment area. It consists of four streams that empty directly into the Cooston Channel, which runs along the eastern side of the Coos estuary mud flats. The Echo sub-basin is bordered on the south by the South Fork Coos River, which converges with the bay at the southern tip of the sub-basin. Tidal marshes extend along the bay north of the mouth of Echo Creek.

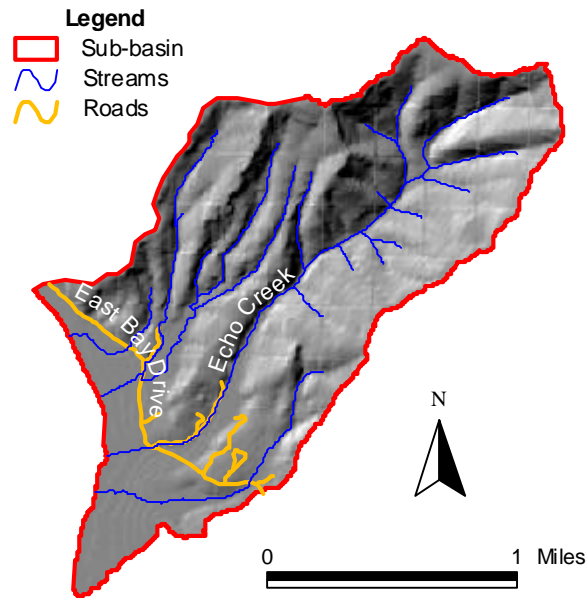


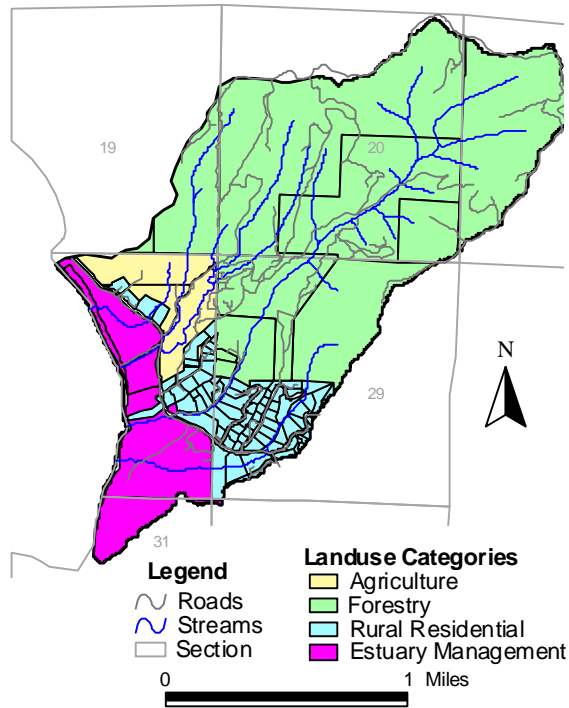
Figure E-1
General
Sub-basin

The Echo sub-basin is a dendritic, third order stream system. The drainage area is approximately 1184 acres (1.85 miles²), which is the smallest in the lowlands assessment area. The total river miles of streams within the Echo Watershed is approximately 10.6 miles. The Echo Creek mainstem is approximately 4.49 miles in length. The elevation in the basin ranges from 0 to 903 feet above sea level, which is the lowest in the area (OWRD, 2005).

The main type of underlying geology in the Echo sub-basin is the Tuffaceous siltstone/sandstone (87%). Other types include Tye silt/sandstone (9%), and Holocene Alluvial (4%). Compared to all of the other sub-basin in the lowlands, Echo has the lowest amount of the Tye siltstone/sandstone. Weathered into this underlying geology are the following three general soil types. The Coquille-Nestucca-Langlois soil is found on the near-shore areas along the Bay and Coos River. This soil drains somewhat poorly, is silty and clayey, and common to flood plains. The Templeton-Salander soil type, most common in the lowlands area, is well-drained and loamy. Steeper areas in the uplands are characterized by the Preacher-Bohannon type which is deep, gravelly to loamy and prone to erosion. (Haagen, 1989)

Landuse and Ownership

Landuse distribution in the Larson sub-basin is shown in Figure E-2. Forest use covers 81% of the area and is primarily managed by large timber operators. Agricultural use, just over 7%, and rural residential use, 11.8%, are clustered along the estuary and main roads. Area of land use categories are shown in Table E-1. The estuary management area is designated under the Coos Bay Estuary Management Plan as agricultural land that may also be used for dredged material disposal or mitigation, and the adjacent channel may be used for subtidal log storage.



**Figure E-2
Landuse
Distribution**

Landuse	Acres	Percent
Agriculture	86	7.3
Forestry	958	80.9
Rural Residential	140	11.8
Unclassified	<1	0.02
Total	1184	

**Table E-1
Landuse
Area**

Hydrology

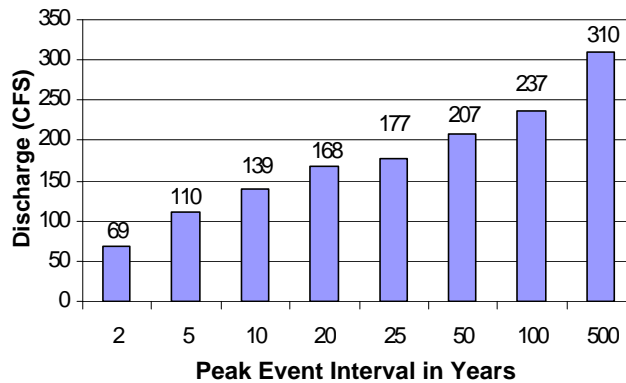
Precipitation

Annual precipitation is 65 inches at the lowest elevations in the Echo sub-basin. Due to the west facing orientation, rainfall gradually increases as the elevation increases to a maximum of 67 inches, but averaging 65 inches for the whole sub-basin (OCS, 2003). The precipitation intensity for a 2-year 24-hour event is 2.8 inches. (OWRD, 2005)

Stream flow

Annual peak stream flow was obtained using the Peak flow estimation program (OWRD, 2005). They use hydrologic prediction equations and physical watershed characteristics to estimate peak flows. Figure E-3 shows the estimated discharge at the mouth of Echo Creek for storm events for two to five hundred year reoccurrence intervals. These values are for 1.11 sq. miles of the Echo sub-basin. The bankfull event is estimated to be 69 cfs. On the other extreme, a maximum discharge of 310 cfs is estimated for a 500-year storm event in Echo Creek.

**Figure E-3
Annual Peak
Discharge
Estimates
(OWRD,
2005)**



On the other extreme, a maximum discharge of 310 cfs is estimated for a 500-year storm event in Echo Creek.

**Table E-2
Discharge
Measurements
2004**

Location	Date	CFS
Valley	16-Jun	0.63
Upper Forest	17-Jun	0.35
Valley	18-Aug	0.24

Miscellaneous summer flow measurements were collected for Echo Creek in 2004 (CoosWA). Table E-2 shows the summer

flow on Echo Creek at two different sites in 2004. The lowest flow recorded was taken with a flume at the Valley site (0.24 cfs). Based on these measurements the base summer stream flow ranges between 0.63 and 0.24 cfs.

Landuse Effects on Hydrology

Land uses, as they affect ground surface conditions, can be used to make general evaluations of the hydrologic condition of a watershed. Of particular concern is the effect of land uses on peak stream flow, since increases in runoff can contribute to flooding, erosion, and culvert failures. The most important determinant for peakflow increases is the ability of soils to absorb rainfall.

The impacts from agriculture on hydrology are dependent on the type of cover and management treatments, as well as the characteristics of the soils (OWEB, 1999). We assessed these factors and compared them to the change in runoff from the background condition. This change will be rated as followed: < 0.5 inches, 0.5 to 1.0 inches, and > 1.5 inches.

All of the area in Echo sub-basin is made up of the hydrologic soil group (HSG) Class D. The HSG Class D has very slow infiltration rates and high runoff rates. Agriculture has a greater affect on runoff in areas where soils have a high infiltration rate compared to areas where soils are relatively impermeable in their natural state (USDA, 1986). In the Echo sub-basin, the change in runoff from the background conditions increased by 0.27 inches. Because of this, the potential risk of peak-flow increases is low.

Forest and Rural land use will be assessed by their percentage of area that is comprised of roads. They will be rated as: low < 4%, medium 4% - 8%, and high > 8%.

Within the forest use area, there are 11.46 linear miles of forest roads. These roads take up approximately 3.4 percent of the forested area. If the percentage of forest area rises above 8 percent, the potential risk of increasing peak-flow moves to high (OWEB, 1999). Because of this low percentage, relative potential risk for peak-flow increases is low.

There are approximately 2.84 linear miles of rural roads in the residential, or 4.2 percent. This percentage ranks the Echo residential area as a relatively moderate potential risk for peak-flow increases.

Overall, Echo sub-basin's potential risks of peak-flow increases from land use impacts are low.

Water rights

There are two types of water rights in Echo Creek, domestic and irrigation. The most senior water right in was established in 1956 for domestic use. There are no storage rights in Echo sub-basin. Total allocated water rights for the entire watershed are 0.225 cubic feet per second. The water rights for domestic use are 0.21 cfs, and .015 cfs for irrigation. There are no instream rights for Echo Creek and the unnamed tributaries within the sub-basin.

Water Availability

For the Echo sub-basin, water availability is estimated using the Water Availability Report System (OWRD, 2005). The average water available is based on the 50% annual exceedance level. The water availability is derived from the estimated natural stream flow shown in Table E-3 below. There is no time of the year in which the allocated rights exceed estimated natural stream flow. Also, the consumptive water use has not increased by more than 10% since 1993.

**Table E-3
Monthly
Net Water
Available
(OWRD,
2005)**

Month	Natural Flow	Consumptive Uses	Instream Flow	Net Water Available (cfs)
Jan	4.80	0.00	0.00	4.80
Feb	5.25	0.00	0.00	5.25
Mar	3.80	0.00	0.00	3.80
Apr	2.41	0.00	0.00	2.41
May	1.11	0.00	0.00	1.11
Jun	0.65	0.00	0.00	0.65
Jul	0.33	0.00	0.00	0.33
Aug	0.17	0.00	0.00	0.17
Sep	0.12	0.00	0.00	0.12
Oct	0.15	0.00	0.00	0.15
Nov	0.98	0.00	0.00	0.98
Dec	3.82	0.00	0.00	3.82

Aquatic Habitat

Aquatic habitat surveys addressed in this assessment include unit type, substrate type, riffle sediment, pool depth, large wood, and bank stability (bank stability is presented in Sediment Sources).

Echo Creek flows out of Echo valley, which is moderately steep, and narrow. The upper reaches are confined by hillslopes which then transition to alluvial fan and finally a small, low-gradient flood plain with constraining terraces. The Beaver Pond is a large wetland area and some surveys were unable to be done there due to lack of visibility. Echo Creek has a tide gate at the mouth and smaller gates on the lower tributaries and other streams in the sub-basin. See Appendix A for specific channel morphology metrics.

The Echo Creek aquatic habitat survey, which is on Echo Creek only, starts at the tide gate at the mouth of the stream. Aquatic habitat survey reaches are shown in Figure E-4. These reach names will be used to describe locations within the Echo sub-basin throughout this assessment.

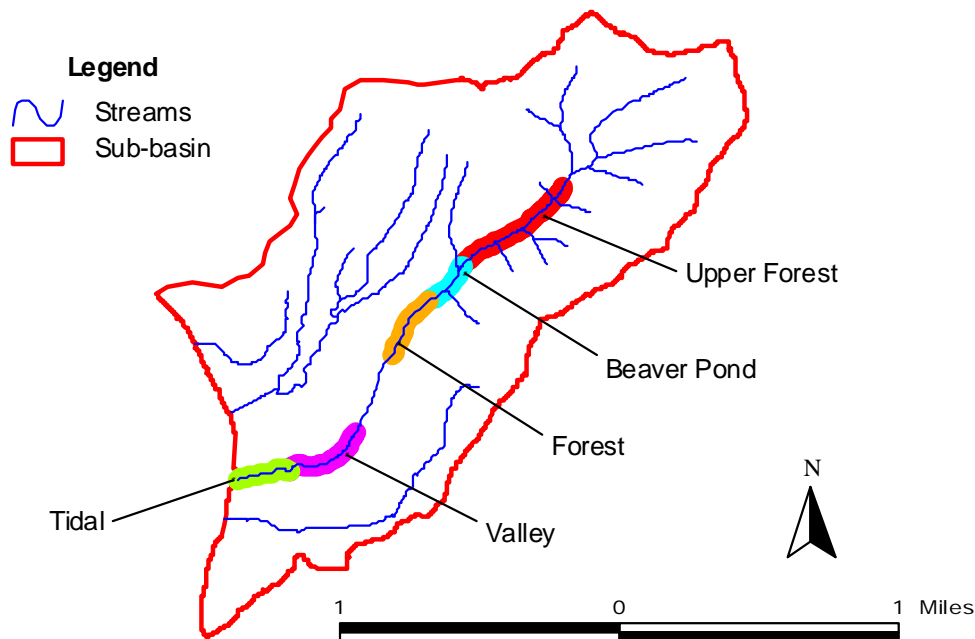


Figure E-4
Aquatic
Habitat Study
Reaches

Figure E-5 shows the percentage of unit area per unit type for each of the five reaches surveyed. The Echo reaches are characterized by pools with increasing riffles further up the valley except for the Beaver Pond reach.

**Figure E-5
Unit Types**

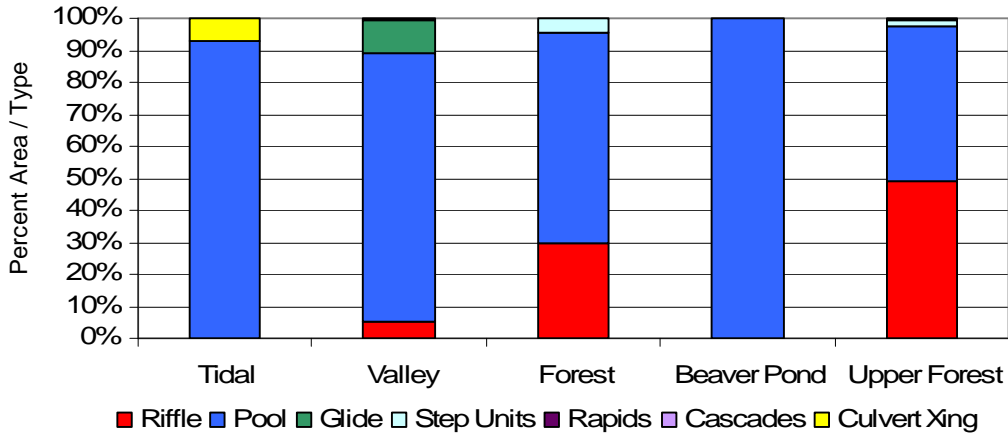


Figure E-6 shows the percent of the different substrate types per reach. These correspond with the unit types. The boulders in the Tidal reach were placed there previously as an attempt to riprap around the culverts and tide gate. It has been dredged to maintain drainage. The Beaver Pond reach may be acting as catch basin for sediment.

**Figure E-6
Substrate Types**

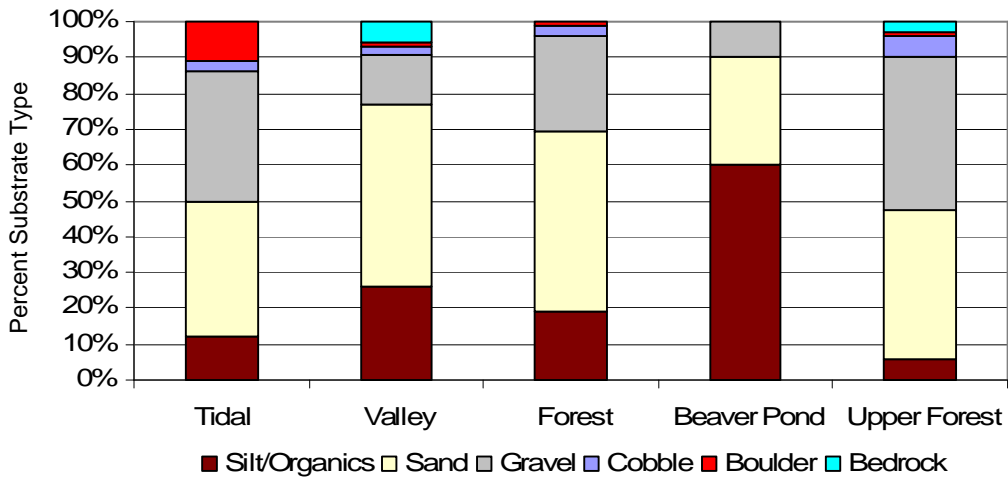


Figure E-7, riffle sediment, analysis for those reaches containing riffle units. (There weren't any riffles for the Tidal and Beaver Pond reaches.) Each of these reaches contains very high amounts of gravel, however, the fine sediment levels are highly undesirable.

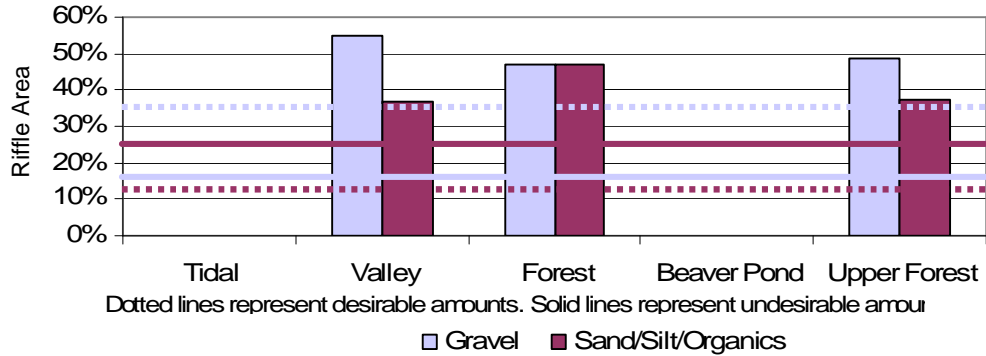


Figure E-7
Riffle
Sediment

Figure E-8 shows average pool depths. None of the reaches had pool depths below the undesirable benchmark, however, the Tidal reach has very poor residual pool depths. Residual pool depth was not surveyed in the Beaver Pond reach due to its overall depth.

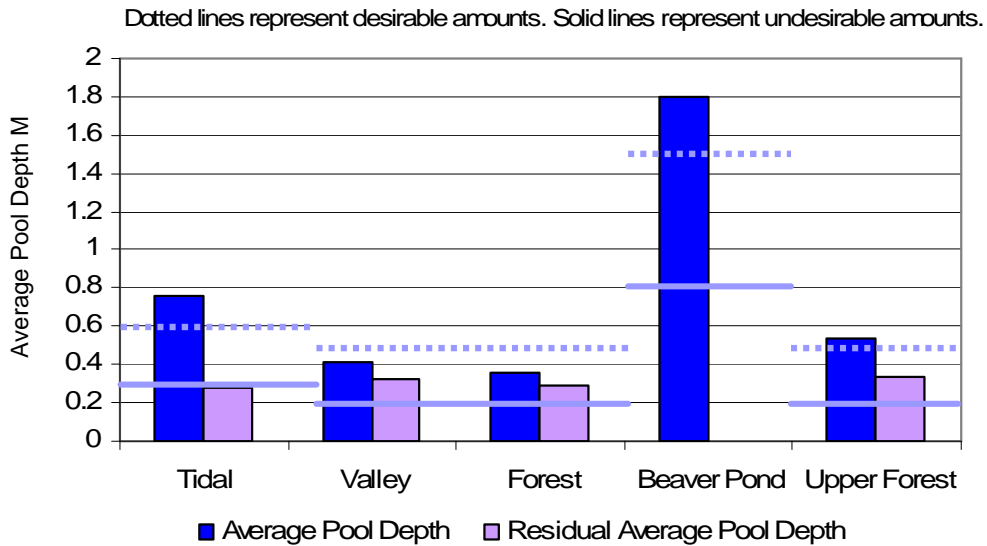
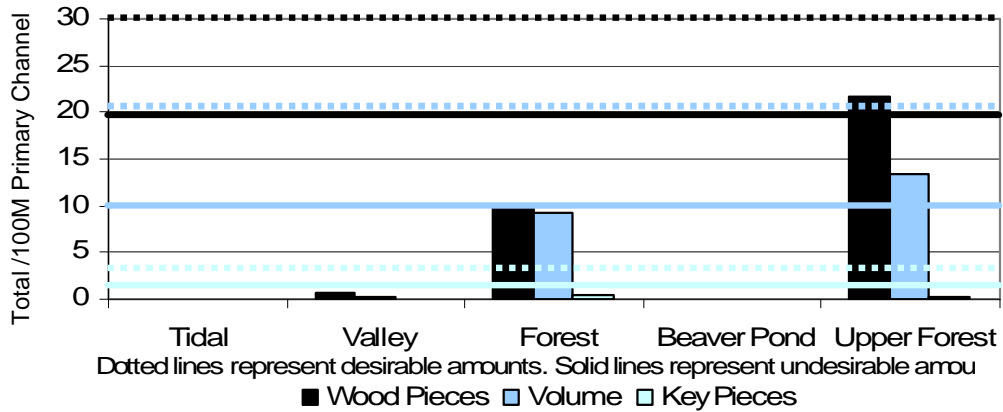


Figure E-8
Pool Depth

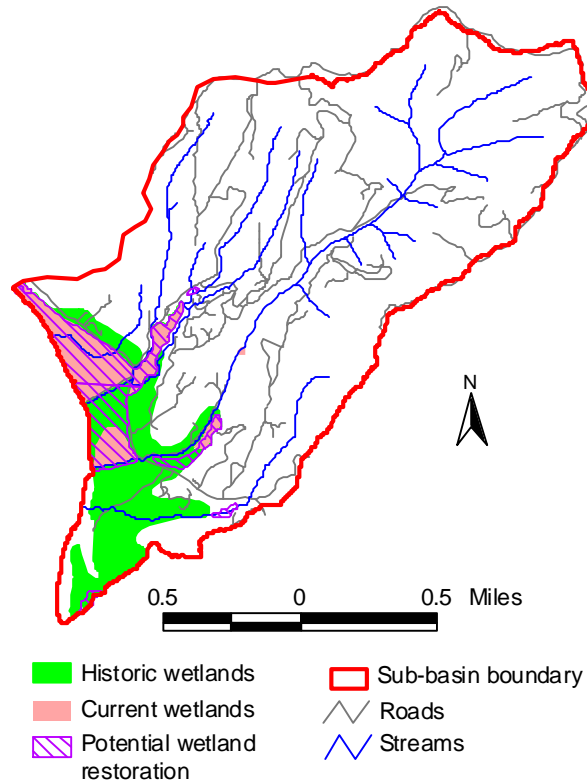
Figure E-9 describes the large wood analysis. The Tidal and Valley reaches had little to no large wood, and the Forest and Upper Forest reaches, had some wood but below desirable levels. Large wood was not visible in the Beaver Pond reach, but approximately one third of its surface is covered with live trees growing in the pond.

**Figure E-9
Large Wood**



Wetlands

Historic, current and potentially restored wetlands in the Echo sub-basin are shown in Figure E-10 and Table E-4. The current (2005) wetland extent, determined by CoosWA using aerial photography analysis, is land presently dominated by wetland vegetation and not showing signs of recent agricultural production. In most cases, however, 'current wetland' is not a properly functioning wetland and is included in the area of potential wetland restoration. The area considered current wetland is 31% of the historic wetland extent in this sub-basin. Historic wetland extents are based on soil type and plant characteristics. Forty-one percent (80 acres) of the historic wetlands in this sub-basin are described in the National Wetland Inventory as 'emergent', meaning they were dominated by rooted herbaceous plants, and are seasonally flooded. It is the emergent seasonally flooded areas, not currently functioning as wetland, that CoosWA recommends for restoration consideration as these areas are often more difficult to manage for crop production. Wetland restoration is discussed in more depth in Chapter 3, and National Wetland Inventory categories are provided in Appendix A.



**Figure E-10
Wetlands**

Wetland Type	Acres
Historic wetlands	194
Current wetlands	60
Potential wetland restoration	83

**Table E-4
Wetland Areas**

Sediment Sources

Sediment sources considered in this assessment include unstable stream banks, unstable slopes, erosion associated with roads, and stream crossings with road fill at risk of failure.

Bank Stability

Bank stability surveys are conducted as part of the aquatic habitat surveys. Figure E-11 shows the bank stability ratings for each aquatic habitat reach. The Valley, Forest and Upper Forest reaches have more than the acceptable amount of unstable banks, while the Beaver Pond reach has all covered, stable banks.

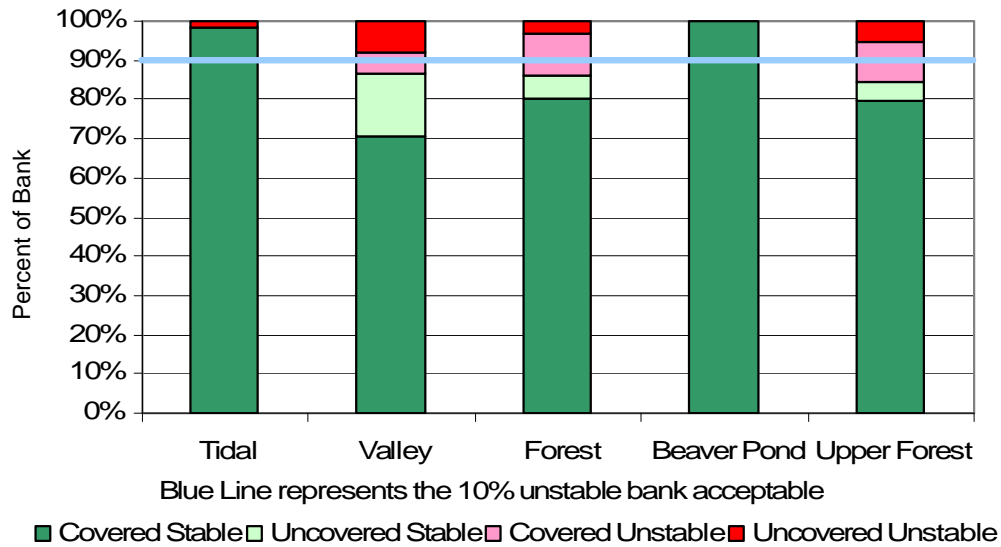


Figure E-11 Bank Stability

Slope Stability

The slope stability analysis (see Figure E-12) shows the amount of sub-basin area within each landslide potential risk classification. According to the analysis, 72.6% of the sub-basin is in the low risk category, 21.1% is at moderate risk, and 3.8% is at high risk. The most unstable slopes are located in the headwaters of Echo Creek, in the highest eleva-

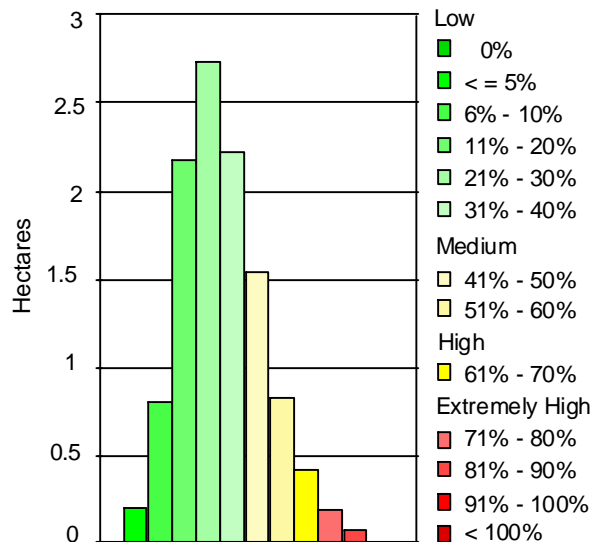


Figure E-12 Slope Stability Risk Classifications

tions of the most northeastern part of this sub-basin. Most of the steepest slopes are found in areas of Tye silt/sandstone, which means that there is high potential for slope failure in these areas.

Road-Related Erosion

The Echo Creek road and landing survey was conducted between June

and July, 2004. All private roads were surveyed where landowner permission was granted. A total of 17.2 miles of roads were surveyed, and there was an average of 3.7 drainage sites per mile. Within the Echo road and landing survey, there were 21 stream crossings, 16 ditch relief culverts, 18 ditch outs, one landslide and seven gullied road surface sites. Table E-5 provides a brief summary of the data collected. See Discussion and Restoration Opportunities for recommended drainage feature upgrades.

**Table E-5
Road and
Landing
Survey
Results**

Site Type	Sites	Contributing Ditches	Ditch Lengths (ft)
Stream Crossing	21	28	Avg.357 Min.20 Max.1130
Ditch Relief	16	19	Avg.546 Min.60 Max.2130
Ditch Out	18	24	Avg. 344 Min.90 Max.1270
Potential Landslide	1	1	Avg.70 Min.70 Max.70
Gullied Road Surface	7	10	Avg.612 Min.10 Max.1550
Totals	63	82	

Stream Crossing Drainage Evaluation

The 21 stream crossing culverts studied in the road and landing survey were also rated for their ability to properly drain the area upstream during a 50-year peak rain event (see Table E-6, below). Of those 21 stream crossings 11 (52.4%) are at risk of failure or improper drainage or failure because they are undersized.

**Table E-6
At-Risk
Stream
Crossing
Evaluation**

50-Yr. Rainfall Fill Failure Risk	Fill Volume Size Class									
	Minimal		Small		Medium		Large		Very Large	
	Sites	Yds ³	Sites	Yds ³	Sites	Yds ³	Sites	Yds ³	Sites	Yrds ³
Low	-	-	2	59	1	96	1	126	-	-
Moderate	-	-	-	-	-	-	-	-	-	-
High	-	-	-	-	-	-	2	542	-	-
Very High	1	2	2	63	2	156	-	-	-	-

Failure Risk, Low = 76% - 100%; Moderate = 51% - 75%; High = 26% - 50%; Very High = 0% - 25%
Fill Volumes, Minimal = ≤ 10 yds.³; Small = 10 - 50 yds.³; Medium = 51 - 100 yds.³; Large = 101 - 500 yds.³; and Very Large = > 500 yds.³.

At-risk culverts are ranked in Table E-6 for failure risk based on the percentage of associated drainage area they can properly drain during a 50-year rain event. The number of culverts in each failure risk level (left column) spread across the table depending on the associated fill volume size class. It is important to consider both failure risk and fill volume since it is the fill that becomes the sediment source upon failure of the crossing.

These 11 at-risk culvert sites contain a total of 1044 yards³ of fill. Of the 11 culverts that were found to be at risk of failure in the Echo sub-basin, five crossings with 221 yards³ of fill ranked as having very high risk of failure, two crossings with 542 yards³ of fill ranked as having high risk, and four crossings with 281 yards³ of fill ranked as having low risk of failure.

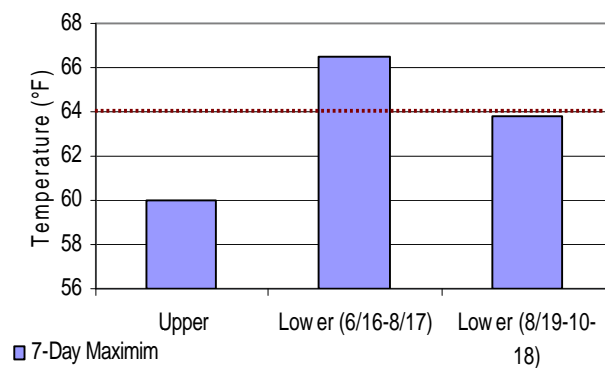
Stream Temperatures

Echo Creek was a new temperature study location in 2004 consisting of two temperature logging sites. One site was in the forested uplands, and the other just upstream of East Bay Drive, slightly east (approximately 300 meters) of where the stream enters the bay. The lower site on Echo was removed and replaced in July due to fear of tampering. The data from both units can be combined and used as one continuous data set but, for accuracy, is kept separate in some graphs.

Site Name	Year	7-Day Average			Days >64°F	Days >70°F	Hours >64°F	Hours >70°F
		Max.	Min.	Daily?? T				
Upper	2004	60.0	57.0	3.0	0	0	0.0	0.0
Lower Combined	2004	66.5	61.3	4.5	33	1	210.5	0.5

**Table E-7
Temperature
Summary and
Exceedance of
Standards**

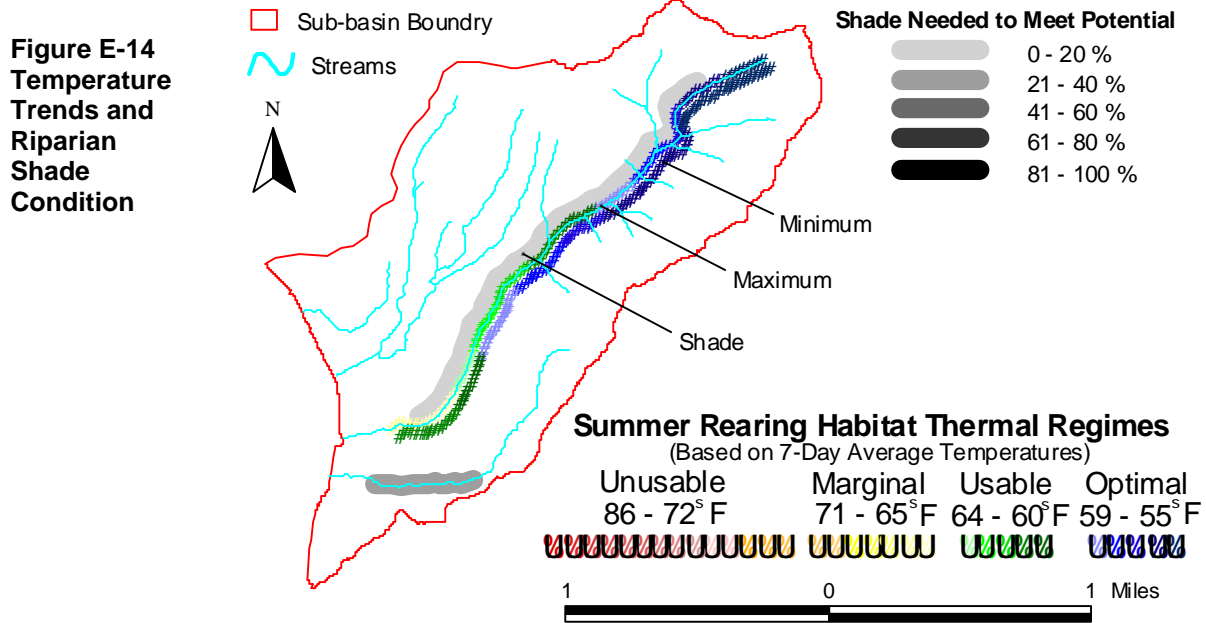
Table E-7 shows the 7-day average maximum and minimum temperatures, and the number of days and hours spent exceeding 64 and 70 °F for each temperature logging site on Echo Creek. Exceedance of the 64 °F standard is shown in Figure E-13, below. The data indicate that the lower site on Echo Creek did exceed the 64 °F standard during the first half of the summer. Both lower units combined recorded a total of 33 days exceeding the standard.



**Figure E-13
7-Day Moving
Averages
of Daily
Maximum
Temperatures**

Red dotted line represents 64 °F std, higher temperatures undesirable

Figure E-14, below, illustrates the temperature trends within the sub-basin using 7-day average maximums, and colors them according to salmonid suitability. The majority of Echo Creek provides optimal or useable temperatures for rearing juvenile salmonids. Temperature increases from 55 °F at the headwaters to 66 °F near the mouth. The average daily high water temperature increased 0.835 °F per 1000 ft. from the upper site to the lower site.



Riparian Shade

The difference between current and potential shade is shown in Figure E-14, above, and is expressed as shade needed to meet potential. The darker riparian areas on the map have the least amount of current shade. Current and potential shade values in the Echo sub-basin are 89% and 94% respectively in the upper-most, steep canyon segments. The upper valley has 85% and 96% respectively, and the lower valley segments have 78% and 99% respectively. The Echo sub-basin holds the highest current shade values in the assessment area in all three geographic categories.

Salmonid Distribution

Coho and winter steelhead distribution, according to ODFW, is shown in Figure E-15. Oregon Department of Forestry (ODF) classifies general fish use streams including cutthroat trout (green line is hidden under the steelhead and coho lines). The spawning survey area is enlarged below in Figure E-16.

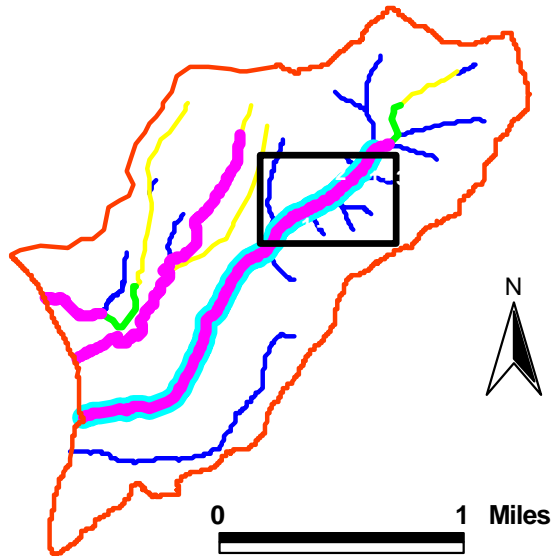
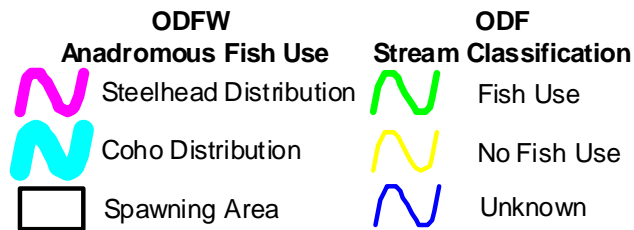


Figure E-15
Salmonid
Distribution

Stocking Records

There were no reports of historic stocking in the Echo sub-basin. Communication with local landowners may provide knowledge of historical, smaller, private stocking history.



Spawning Surveys

The Coos Watershed Association conducted its first Echo Creek spawning surveys in the 2003 season. (see Figure E-16). The start of the first segment of the reach begins at a beaver pond that is a wetland marsh. The first segment enters a forest canopy which provides a lot of shade from shrubs, conifers, and firs. There is a large amount of gravel in the first segment, though no fish were seen during the

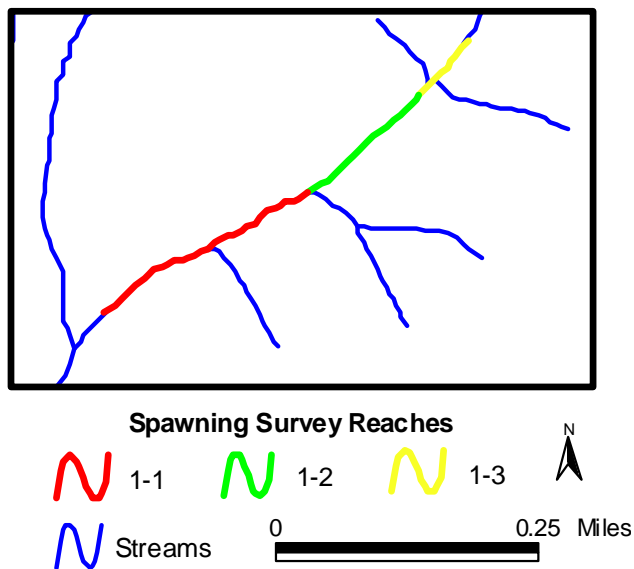
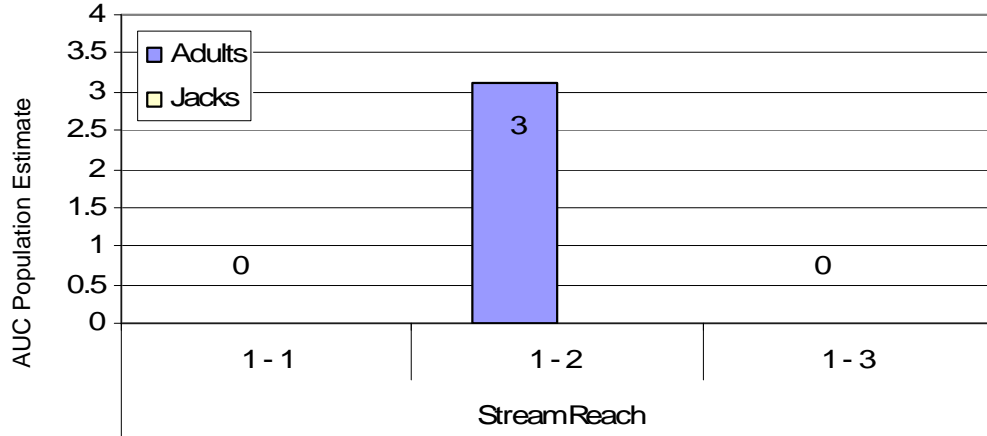


Figure E-16
Spawning Survey

**Figure E-17
Spawning
Survey
AUC
Population
Estimate,
2003**



spawning season. There are several small tributaries that branch from the creek throughout the reach. The dense canopy continues throughout the second and third segments of the reach. The third segment ends at a large pool with a waterfall which is a fish barrier. The upper part of the third segment has much more bedrock and less gravel is visible.

The amount of gravel found in reach 1-3 was significantly lower than in the other two reaches (see Table E-8). No fish were observed in reaches 1-1 or 1-3 (see Figure E-17), however, one redd was observed in segment 1-3. Segment 1-3 showed the highest redds/km, only because one redd was found and it was a short reach (.12 km). Reach 1-2 had 12 adult coho/km with a peak redd/km count of four. There were no other fish observed on the other reaches, and no other species of salmon were observed during the spawning survey season.

**Table E-8
Spawning
Density**

Reach	Total AUC/Km	Gravel (m ²)	Gravel (m ²)/ Female
1 - 1	0	107	0.0
1 - 2	12	107	71.3
1 - 3	0	33	0.0

Echo Creek has many elements of a functioning stream for fish habitat such as adequate gravel, a dense canopy that provides shade, and stream sinuosity.

The fact that more fish were not observed in this system may be related to its small size and narrow valley widths. More surveys are needed to truly understand the spawning activity of this system.

Intrinsic Potential for Coho Smolt Production

The intrinsic potential for streams in the Lowlands area to produce coho smolts was estimated based on digital elevation models, active channel and valley widths, known natural barriers and coho life histories. The values indicate the number of coho smolts supported by historic, pre-settlement stream conditions. Intrinsic potential for the Echo sub-basin, shown in Figure E-18, indicates that Echo Creek has the highest intrinsic potential in the sub-basin – up to 100 smolts per 100 meters of stream almost the entire length up

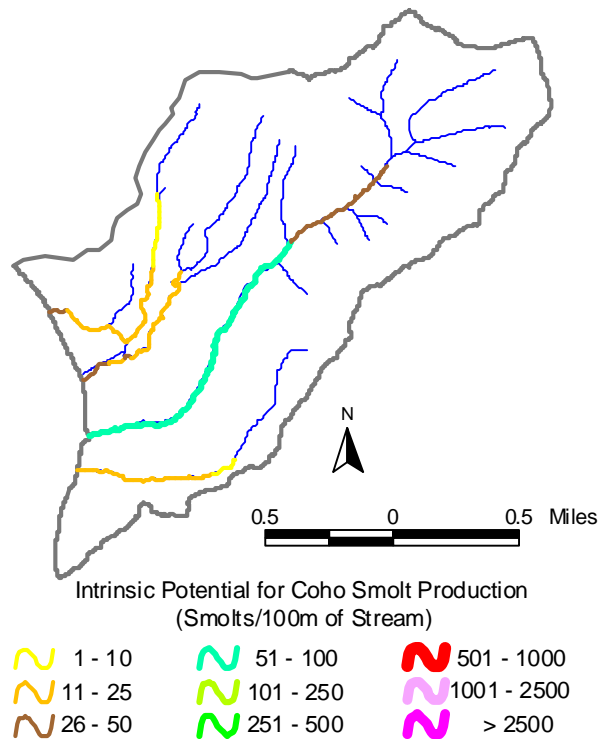


Figure E-18
Intrinsic potential for coho smolt production

to the second tributary. Other streams in the sub-basin indicate intrinsic potentials ranging between 1 and 50 smolts per 100 meters of stream. Intrinsic potentials in the Echo sub-basin are much lower than in other sub-basins, which reach the >2500 range in the main stems. This reflects the coho preference for wider active channel and valley widths than are available in the Echo sub-basin. The thin blue lines, streams, indicate zero intrinsic potential due to gradients above 20% and known natural migration barriers. Understanding intrinsic potential for a particular stream will help to inform restoration efforts and to set realistic coho population goals.

Habitat Limiting Factors to Coho

The limiting factors analysis (based on Reeves et al., 1989), shown in Table E-9 below, indicates habitat limitations for coho in both summer and winter rearing habitats. The analysis showed that the system currently has only 66% of the summer habitat needed to support the maximum number of potential smolts. The analysis also shows that while winter and spring habitat was limiting, they are less of a constrict-

tion in the life history than summer rearing habitat. Summer temperatures were within acceptable parameters.

Echo Habitat Component	Potential Summer Population	Area/ Survival Factor	Area Needed (M ²)	Current Usable Area (M ²)	Smolt Factor	Smolts Produced
Spawning	22,569	0.006	135	247	95.5	23,589
Spring Rearing	22,569	0.3	6,771	8,962	1.7	15,235
Summer Rearing	22,569	0.6	13,541	8,962	0.9	8,066
Winter Rearing	22,569	0.4	9,028	7,955	1.2	9,546

Table E-9
Limiting Factors to Coho Populations

Resource Issues

Landowner Concerns and Desired Future Conditions

Landowners in the Echo sub-basin expressed their concerns about the area at a Coffee Klatch meeting on April 19, 2005. Of the landowners contacted, eleven percent attended the meeting. As shown in Figure E-19, land management issues were the main concern in this sub-basin. Within this category, the topics of tide gate maintenance, drainage structures and flood control were most common. Culvert and tide gate “blow-outs” were discussed as well as the need for dredging of the lower reaches of streams. Infringement of property rights and the difficult permit process for in-stream work were also listed concerns.

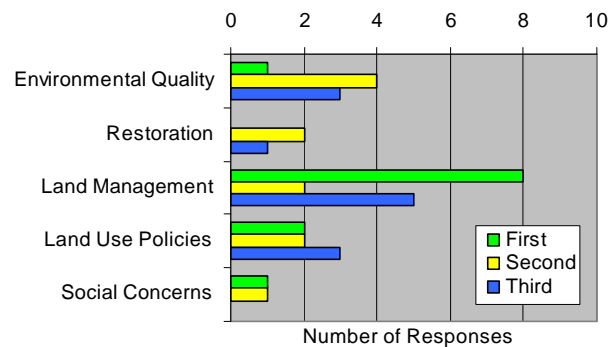


Figure E-19
Landowner Concerns

Landowners also expressed concern about environmental issues including fish and wildlife habitat, and water quality. A wooden dam was mentioned that may be a barrier to fish access. In addition, like other sub-basins, Echo landowners complained of beaver causing damage to dikes, tide gates, and undermining the road. The tide gate functions for tidal exclusion, but the associated culvert is undersized for the drainage and the gate may be an impediment to fish passage.

The residents of the Echo sub-basin have expressed their desires for the future of the area which include restored fish populations, good water quality, and paved roads. There was interest in developing a controlled elk crossing that would reduce erosion to the road and stream bank.