Coos Bay Lowland Assessment and Restoration Plan
Chapter 2:
North Slough Sub-basin Assessment

North Slough pasture wetland area above main stem tide gate. Photo CoosWA, 2006.

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North Slough Sub-basin

Introduction

Landform

North Slough is the northern-most sub-basin in the Lowland assessment area. The sub-basin is oriented northeast to southwest (see Figure NS-1), and is a dendritic, or tree-like, fifth order stream system consisting of two main tributaries - Bear Creek and North Slough Creek.

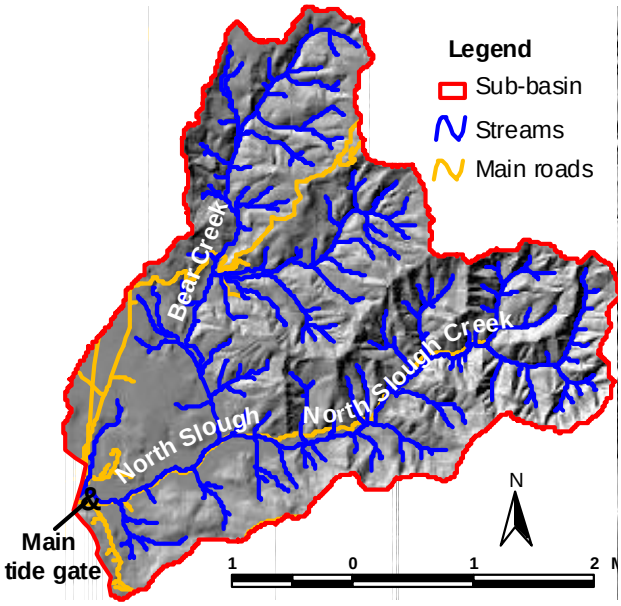


Figure NS-1 General Sub-basin

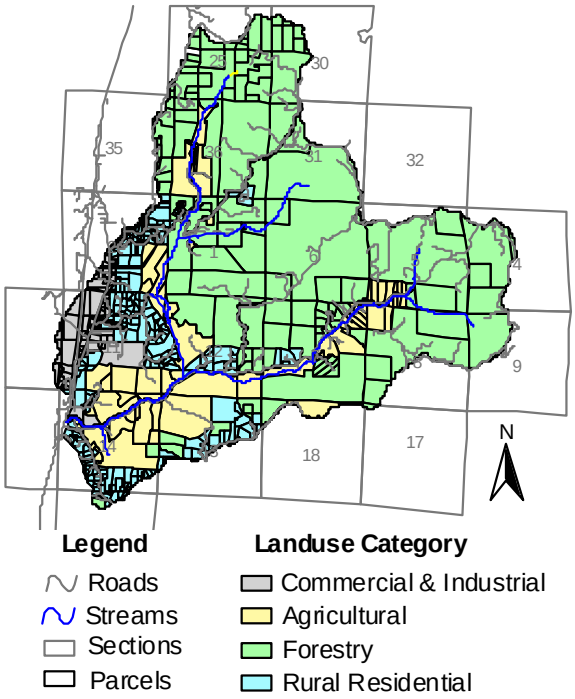
A unique characteristic of North Slough is the 2.6 mile area of tidal estuarine salt marsh below the tide gate. Although this area has been altered by the construction of Highway 101 and a railroad, and has been dredged in the past, it still provides productive estuarine nursery habitats for salmon, trout and other aquatic species.

North Slough, the second largest sub-basin in the assessment area, drains approximately 7,401 acres (11.5 miles^2) including 52 miles of streams - from mainstem to small headwater streams. The mainstem of North Slough is approximately 1.5 miles long from the tide gate at U.S. Highway 101 to the Bear Creek-North Slough Creek confluence. The main channels of Bear Creek and North Slough Creek are approximately 4.6 and 4.3 miles long respectively. The elevation in the basin ranges from 0 to 960 feet above sea level. (OWRD, 2005).

The main types of underlying geology in the North Slough sub-basin are Tyee silt/sandstone (50%), Tuffaceous siltstone/sandstone (24%), Holocene Terrace (10%), and Holocene Alluvial (16%). North Slough differs in its soils from the other sub-basins considered in this assessment. It is the only one dominated by the very soft, highly erosive sandstones of Dune Land-Waldport-Haceta, and Bullards-Bandon-Blacklock soils (Haagen, 1989).

Land Use and Ownership

Figure NS-2 Land Use Distribution



Land use in the North Slough sub-basin (see Figure NS-2 and Table NS-2) is primarily forestry (66%) which is second largest for forestry use in the assessment area. Agricultural use (18%) is largely dedicated to grazing and hay production and found mostly in the bottom land along the mainstems of North Slough Creek and Bear Creek. Rural residential land use is 12% of the area with the majority clustered around the small town of Hauser. Commercial and industrial land use (4%) is located along Highway 101. An industrial wood treatment plant is located near the mouth of North Slough, and another one is west of the tide gate.

Table NS-1 Land Use Area

Land Use	Acres	Percent
Commercial & Industrial	321	4
Agricultural	1287	18
Forestry	4787	66
Rural Residential	875	12
Total	7269[1]	

[1] Note: Totals differ between the county assessors parcel aggregate areas and the sub-basin area. The county assessors database has many duplicate records which were removed based on identical areas, map numbers, and parcel numbers, and may not include area of roads or streams.

Hydrology

Precipitation

Annual precipitation is 67 inches at the lowest elevations in the North Slough sub-basin. Due to the west-facing orientation, rainfall gradually increases as the elevation increases to a maximum of 73 inches, averaging 71 inches for the whole sub-basin (OCS, 2003). The precipitation intensity for a 2-year event is 3.0 inches in 24 hours (OWRD, 2005).

Stream Flow

Annual peak stream flow for North Slough was obtained using the Peak Flow Estimation Program (OWRD, 2005). They use hydrologic prediction equations and physical watershed characteristics to estimate peak flows. Figure NS-3 shows the estimated peak discharge at the mouth of North Slough for storm events at two to five hundred year reoccurrence intervals. The bankfull storm event is estimated to be 663 cubic feet per second (CFS). On the other extreme, a maximum discharge of 2660 CFS is estimated for a 500-year storm event.

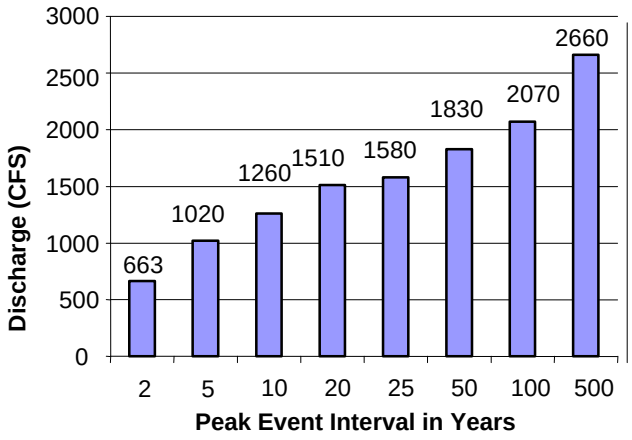


Figure NS-3 Peak Discharge Estimate (OWRD, 2005)

Miscellaneous summer flow measurements were collected on North Slough sub-basin during 1999 (OWRD), and in 2003 and 2004 (Coos WA). Table NS-2 shows the summer flow in the sub-basin. In 2003, a measurement was taken in the main valley reach. On August 18, there was a discharge of 0.59 CFS, and on September 24, there was 1.12 CFS at this site. In 2004, two measurements were taken at an upper and a lower location on a tributary to Bear Creek. The Lower Bear Tributary location reported 0.98 CFS, and 1.56 CFS was re-

Location	Year	Date	CFS
Main Tidal	1999	8-Jun	2.89
		8-Jul	2.43
		20-Jul	1.64
		2-Aug	1.34
		16-Aug	1.11
		1-Sep	0.94
Main Valley	2003	18-Aug	0.59
		24-Sep	1.12
Lower Bear Tributary	2004	9-Jun	0.98
Upper Bear Tributary		9-Jun	1.56

Table NS-2 Discharge Measurements for 1999, 2003, and 2004.

ported for the Upper site. Based on these measurements, the base summer stream flow for the main tidal section ranges between 0.94 and 2.89 CFS.

Land Use Effects on Hydrology

Land uses, as they affect 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 peak-flow 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.

The main types of hydrologic soil groups (HSG) present in the agriculture lands are, 71% of HSG Class D, 22% of HSG Class B, and only 7% of HSG Class C. The HSG Class D has very slow infiltration rates and high runoff rates. The HSG Class B has moderate infiltration rates and moderate runoff. 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 North Slough sub-basin, the change in runoff from the background conditions increased by 0.39 inches. Because of this, the potential risk of peak-flow increases is low.

Within the forest use area there are 38.5 total linear miles of forest roads which take up approximately 2.2% of the forested area. The potential risk of significantly increasing peak flows becomes high with when 8% or more of the forested area is roads (OWEB, 1999). Because of this low percentage, the relative potential risk for peak-flow increases in forest use is low in North Slough.

There are approximately 23.25 linear miles of rural roads in the residential area, or 4.2% of the residential area. This percentage ranks the North Slough residential area as a relatively moderate potential risk for peak-flow enhancement.

Water rights

There are three main sources of water rights in North Slough: surface water, groundwater, and instream. According to the OWRD, the most senior water right in North Slough was established in 1931 for irrigation use of surface water. Table NS-3 displays the different types of water use in North Slough. The total storage rights, including ponds and reservoirs, are 21.32 acre feet. Total allocated water rights for the entire watershed are 21.96 CFS. The greatest consumptive use is 0.47 CFS in the month of July. The instream rights were established in 1992 and extend 1.34 river miles from the tide gate at Highway 101 to the confluence of North Slough Creek and Bear Creek. The instream water rights were established by ODFW for the purpose of anadromous and resident fish rearing.

Type of Use	CFS	Acre Feet
Domestic	0.31	21.32
Instream	20.00	0.00
Industrial	0.59	0.00
Agriculture	1.06	0.00
Total	21.96	21.32

Table NS-3 Water Use

Water Availability

Water availability for the mouth of North Slough sub-basin is estimated using the Water Availability Report System (OWRD, 2005). The average of water available is based on the 50 percent exceedance level. The expected flow, shown in Table NS-4, is derived from subtracting the consumptive uses from the estimated natural stream flow. According to this information, North Slough is expected to have low flows of 1.56 CFS in the month of September and average winter flows of 10.96 CFS in February. According to OWRD, the consumptive water use has increased by more than 10% in July to September since 1993, which has had a direct effect on water availability.

Month	Natural Flow	Consumptive Uses	Reserved Instream Flow	Expected Flow (CFS)
Jan	66.50	0.24	20.00	66.26
Feb	71.20	0.24	20.00	70.96
Mar	51.30	0.20	20.00	51.1
Apr	34.30	0.19	20.00	34.11
May	16.70	0.22	16.70	16.48
Jun	8.96	0.35	8.92	8.61
Jul	4.45	0.47	4.40	3.98
Aug	2.33	0.41	2.29	1.92
Sep	1.82	0.26	1.78	1.56
Oct	2.25	0.16	2.21	2.09
Nov	15.80	0.15	15.70	15.65
Dec	55.60	0.22	20.00	35.40

Table NS- 4 Monthly Net Water Available (OWRD, 2005)

Aquatic Habitat

Aquatic habitat surveys were used to evaluate habitat unit type, substrate type, riffle sediment, pool depth, large wood, and bank stability (bank stability is presented in Sediment Sources).

The lowland portion of the North Slough sub-basin is characterized by a wide floodplain crossed by the largely unconstrained channel of North Slough, which is restricted in places by dikes and other structures. In the upper basin, the hill-slope constrained valleys become narrower and V-shaped. Channel gradients are very low throughout the sub-basin (0% to <3% for the first 20 river miles) and, therefore, most reaches are fish accessible. Only the headwater tributaries have steep bedrock cascades that prevent fish passage. See Appendix A for specific channel morphology metrics.

Aquatic habitat surveys were conducted on most of the North Slough Creek's mainstem, portions of two small tributaries to North Slough Creek, and portions of a tributary to Bear Creek. The aquatic habitat study reach locations are shown in Figure NS-4. These reach names will be used to describe locations within the North Slough sub-basin throughout this assessment.

Figure NS-4 Aquatic Habitat Study Reaches

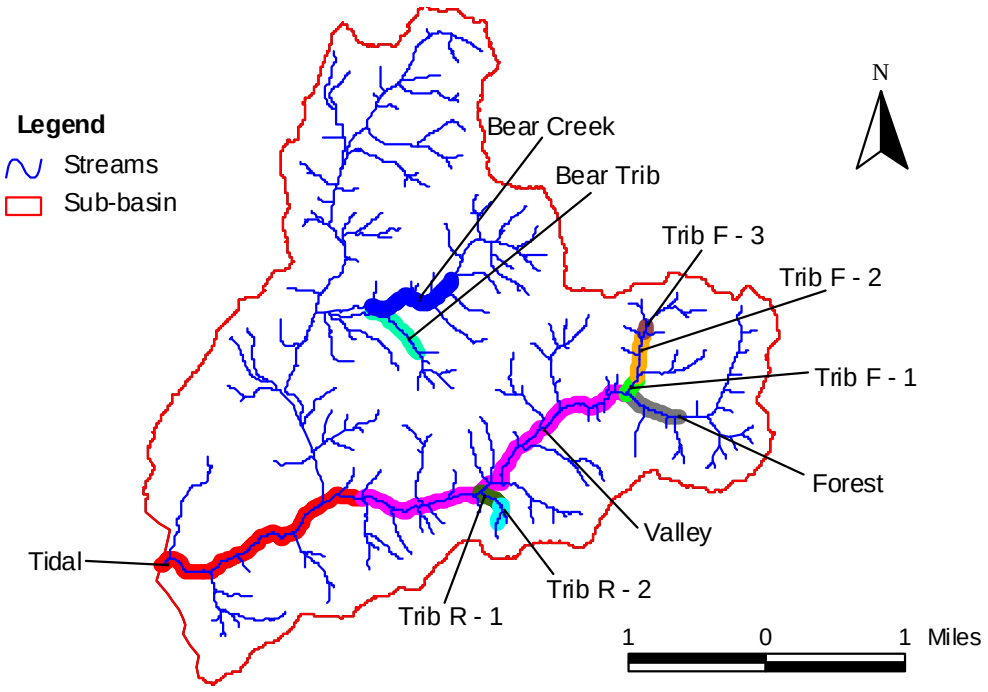


Figure NS-5, unit types, shows the percentage of unit types within each reach surveyed. A moderate portion of North Slough is considered tidal slough or tidal glide (green). Tidal glides are very similar to small estuarine channels, as described by the Oregon Watershed Assessment Manual. Riffles increase in the tributary reaches and higher on the mainstem. Trib R-1 has a large amount of dry units.

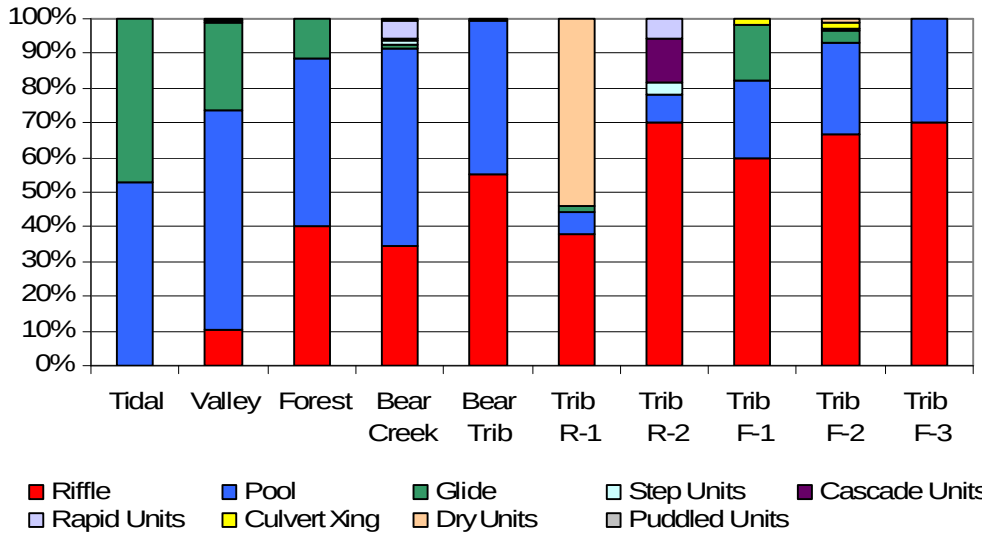


Figure NS-5 Unit Types

Figure NS-6, substrate types, shows the percentage of each substrate within the reaches. These typically correspond with the unit types. This sub-basin contains high percentages of silt and sand, especially in the mainstem reaches and increasing to more than 60% in the Tidal reach. Conversely, the proportion of gravel increases in the tributary reaches.

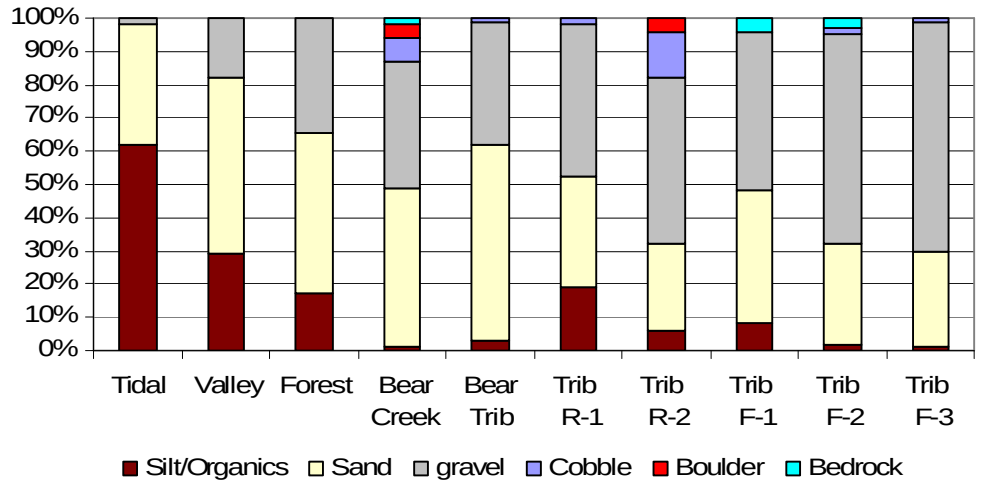
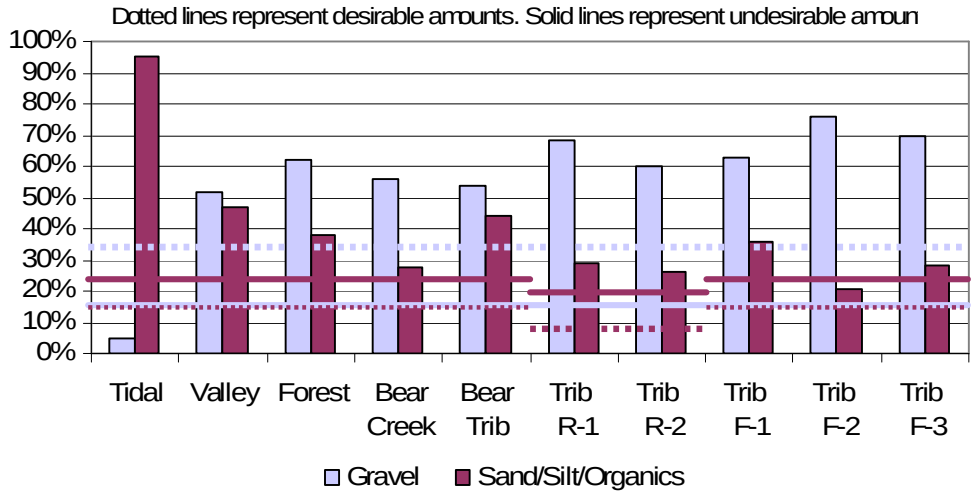


Figure NS-6 Substrate Types

Figure NS-7, riffle sediment, shows that the North Slough sub-basin contains a desirable amount of gravel in all reaches except the Tidal reach, which has only 5% of gravel and extremely high amounts of fine sediment. All other reaches have very high amounts of gravel, however, fine sediment also exceeds undesirable levels in all reaches except Trib F-2.

Figure NS- 7 Riffle Sediment



As shown in Figure NS-8, average pool depths and residual average pool depths for this sub-basin are intermediary throughout most of the reaches - falling below the desirable benchmark. The Valley reach has very good pool depths, while the Tidal reach has significant pool area, but the depths are undesirable given the channel size. Trib F-1 has good pool depths.

Figure NS- 8 Pool Depths

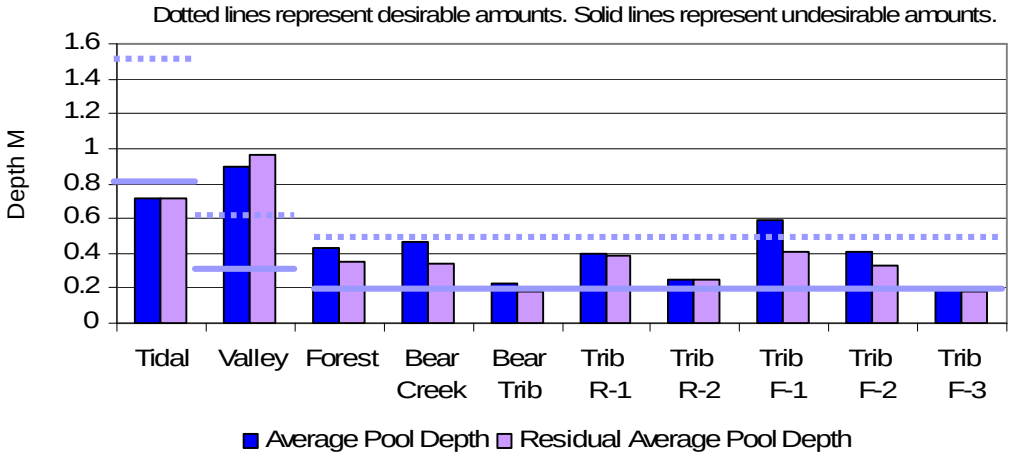


Figure NS-9 shows the amount of large wood per 100 meters of primary channel, including number of pieces, volume, and number of key pieces (key pieces are greater than 60 centimeters in diameter and over 10 meters long). According to the surveys, only Tributary F, Reach 3 had desirable amounts of wood volume. All other reaches were found to contain less than desirable amounts of wood in all categories.

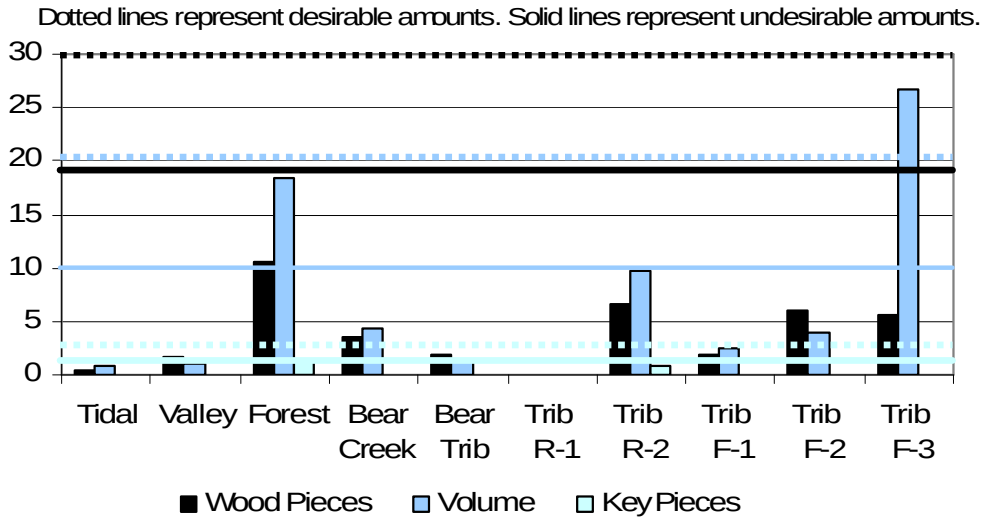


Figure NS-9
Large Wood

Wetlands

Wetlands in the North Slough sub-basin are shown in Figure NS-10, below. The historic wetland extent areas were designated by the National Wetland Inventory based on soil characteristics and vegetation type. The majority of these wetlands (72%) in the North Slough sub-basin are characterized as Emergent – Seasonally Flooded. Emergent means they are dominated by rooted herbaceous plants. The types and acreages of wetlands in the historic wetland National Wetland Inventory are shown in Table NS-5, below. The current wetland extent shown in Figure NS-10 is based on areas that currently (2005) are dominated by wetland vegetation determined using aerial photography analysis. Historic wetland area not currently in wetland use are potentially prime areas for restoration projects. Wetland restoration is discussed in more depth later in Chapter 4.

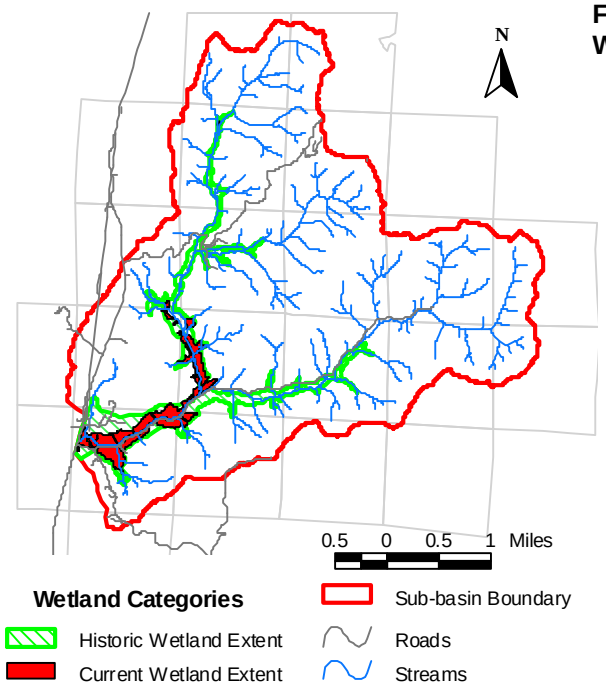


Figure NS-10
Wetlands

Wetland Type	Acres
Aquatic Bed - Permanently Flooded	12
Emergent - Temporarily Flooded	72
Emergent - Seasonally Flooded	318
Forested - Temporarily Flooded	1
Forested - Seasonally Flooded	19
Scrub Shrub - Temporarily Flooded	1
Scrub Shrub - Seasonally Flooded	19
Unconsolidated Bed - Permanently Flooded	1
Riverine Unconsolidated Bed (Tidal)	2
Total Wetland Area	444

Table NS-5
Wetland Areas

Sediment Sources

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

Bank Stability

Bank stability surveys are conducted as part of the aquatic habitat surveys. Figure NS-11 shows the bank stability ratings for each aquatic habitat reach. The North Slough bank stability survey indicates that most of the stream system has fair bank stability, however, Bear creek and its main tributary both have over 20% unstable banks. Most covered unstable banks are dominated by Reed canarygrass (*Phalaris arundinacea*).

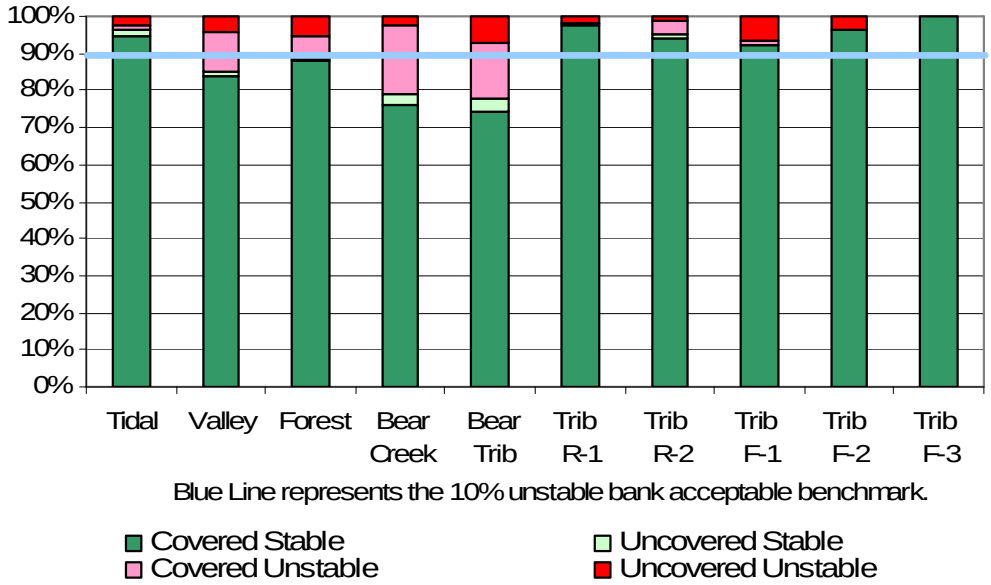


Figure NS-11
Bank Stability

Slope Stability

The slope analysis, shown in Figure NS-12, determined that 89.9% of the area in the sub-basin is in the low risk category for landslide potential, 8.7% is at moderate risk, 0.8% is at high risk, and 0.6% is at

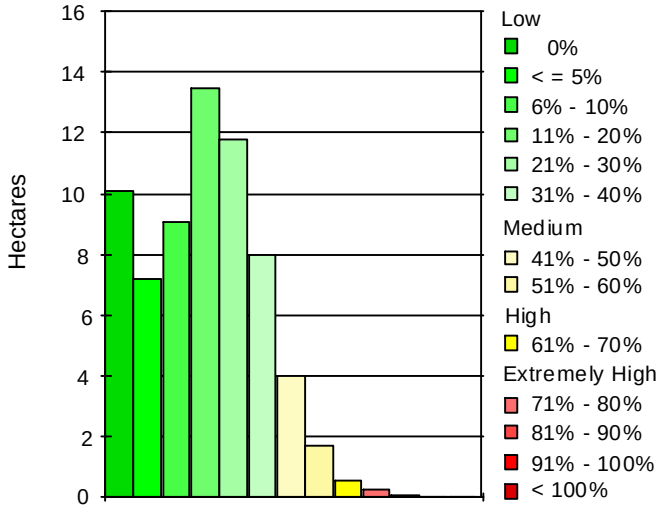


Figure NS-12
Slope Stability

extremely high risk. The most unstable slopes are located in the headwaters of North Slough Creek, in the highest elevations at the eastern end of the sub-basin. The highest slopes are found in areas of Tyee silt/sandstone, which means that there is high potential for slope failure in these areas.

Road-Related Erosion

The North Slough sub-basin road and landing survey was conducted between January 2001 and August 2004. The survey was divided into two groups - county roads and private roads. The county survey started at the junction of North Bay Road and North Way Lane and ended at the 3.9 mile marker on North Way Lane. The Shutters Landing Lane county road system included another 3.9 miles of roads. All private roads were surveyed where landowner permission was granted.

Table NS-7 Road and Landing Survey Results

Site Type	Sites	Contributing Ditches	Ditch Lengths(ft)
Stream Crossing	52	71	Avg. 387 Min. 40 Max. 1900
Ditch Relief	78	95	Avg. 352 Min. 40 Max. 1110
Ditch Out	110	127	Avg. 413 Min. 70 Max. 1600
Potential Landslide	4	6	Avg. 576 Min. 100 Max. 2200
Ponding/Gullied Road Surface	5	4	Avg. 231 Min. 116 Max. 220
Totals	244	303	

Table NS-7 provides a summary of the data collected. Thirty-two miles of road were surveyed in the North Slough sub-basin. The average number of drainage sites per mile was 7.4. A total of 52 stream crossings, 78 ditch relief culverts, 110 ditch outs, four potential landslides and five road surface sites were surveyed.

Stream Crossing Drainage Evaluation

The 53 stream crossing culverts studied in the road and landing survey were also ranked for their ability to properly drain the area upstream during a 50-year peak rain event (see Table NS-8 below). Twenty-two, or 41.5% of the stream crossings in this survey area were undersized for the 50-year peak flow and at risk of washing out.

At-risk culverts were ranked in Table NS-8 for failure risk based on the amount that a 50-year rainfall event would exceed the stream crossing's capacity. Undersized stream crossings were listed according to the amount of road fill that would deliver to the stream if the crossing

washed out. Knowing the delivery potential of an undersized crossing is another critical component in prioritizing stream crossing upgrades.

Table NS-8 Stream Crossing Failure Risk and Fill Volume

50-Year 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	Yds^3
Low	1	5	1	21	1	91	1	125	-	-
Moderate	-	-	1	39	-	-	2	177	-	-
High	-	-	3	56	1	62	2	522	-	-
Very High	-	-	5	119	1	75	2	336	1	2133

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}.

In the North Slough sub-basin, nine of the 22 at-risk culverts ranked Very High risk for potential failure. If all Very High risk crossings failed 2,663 yards^3 of fill would be delivered to the stream. Most of this fill is related to a single stream crossing site. Six sites ranked High risk, potentially releasing 640 yards^3, three ranked Moderate risk, potentially releasing 216 yards^3 of fill, and four ranked Low risk, potentially releasing 242 yards^3 of fill downstream. These stream crossings contain a total of 3,811 yards^3 of fill that could be deposited downstream as sediment during a 50-year rain event.

Stream Temperatures

Water temperature recorders were placed at eight different sites during the two years of study. Two sites were replicated in both years, while the six other sites were unique to one year or the other. Two units were placed on the North Slough Creek mainstem, one slightly upstream of the tide gate and one in the mid-valley, just below the confluence of the tributary. Two units in 2004 were also placed on Bear Creek near the Hauser Substation. Bear Creek enters the mainstem near Saint Dennis Road.

Table NS-9 Temperature Summary and Exceedance of Standards

Site	Year	7-Day averages			Days >64°F	Days >70°F	Hours >64°F	Hours >70°F
		Max.	Min.	Daily D T				
Site 1	2003	64.9	56.5	8.4	19	0	64.0	0.0
Site 2	2003	66.2	60.3	6.0	38	0	278.5	0.0
Site 3	2003	71.5	59.2	12.4	68	16	578.0	47.0
Site 4	2003	69.7	60.2	9.5	64	4	605.0	9.0
	2004	66.6	60.8	5.8	40	0	269.0	0.0
Site 5	2003	73.8	64.6	9.3	76	26	933.0	61.5
Site 6	2003	76.7	66.3	10.3	102	59	1693.0	458.0
	2004	78.9	69.0	9.9	99	65	1892.0	589.0
Trib-Upper	2004	64.7	57.0	7.7	19	0	80.0	0.0
Trib Lower	2004	65.4	56.5	8.9	27	0	87.5	0.0

Table NS-9, above, 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 in the North Slough sub-basin. Exceedance of standards is shown in Figure NS-13, below. The data indicate that during the hottest 7-day period of the season, the average minimum temperature never dropped below 64°F. All sites on North Slough in 2003 and 2004 exceeded the state standard for 7-day maximum temperatures of 64°F.

Figure NS-13 7-Day Moving Averages of Daily Maximum Temperatures

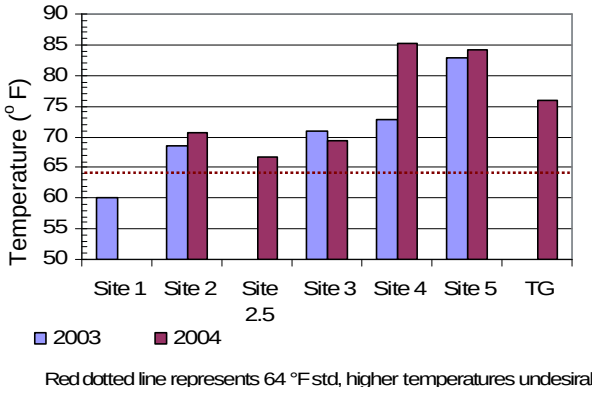


Figure NS-13 illustrates the temperature trends within the sub-basin using 7-day average maximums, and colors them according to salmonid suitability. The map shows the temperature trends over the length of the stream, displaying the

temperature increases from 55°F at the headwaters to 76.7°F near the mouth in 2003. The Bear Creek Tributary data is from 2004. On North Slough Creek in 2003, the average daily high water temperature downstream from the Upper site to the mouth increased 0.52°F per 1000 ft. This represents the difference between the average daily highs at the uppermost mainstem site (Site 1), and Site 6, near the tide gate. The change in temperature between the individual sites for 2003 was less than 1°F per 1000 ft for all segments except between Sites 3 and 4, where the stream temperature changed -13.35 °F per 1000 ft, meaning temperatures actually decreased in this segment. Based on the data, the tributary would appear to be a cooling influence, but the temperature logging site is over 2 miles up the tributary. Without a temperature unit measuring the tributary shortly before it meets the mainstem, as well as a site just upstream of the confluence on the mainstem, it is not possible to draw exact conclusions on the influence of the tributary on mainstem water temperature. Unit placement was largely dictated by landowner permissions for access.

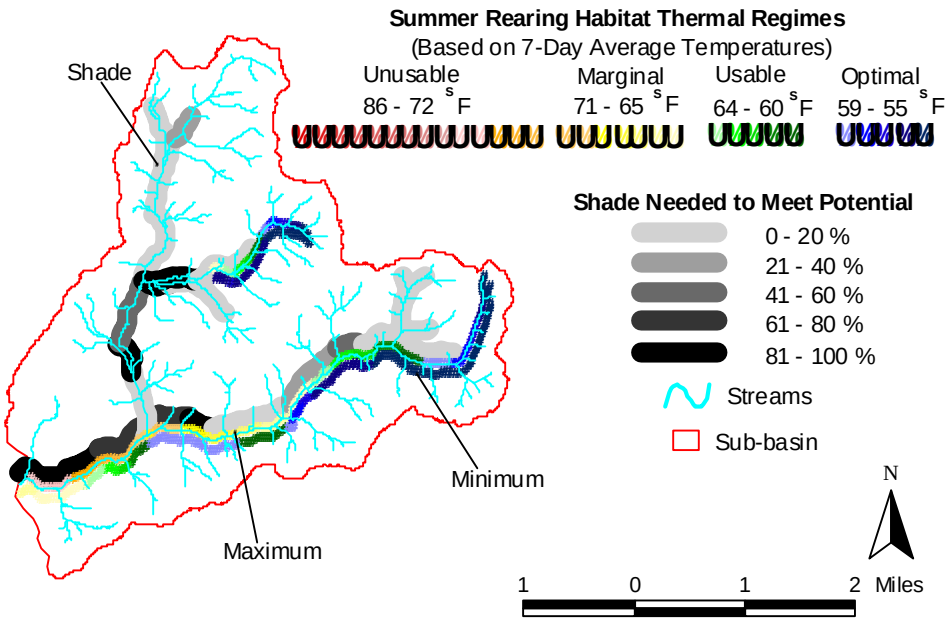


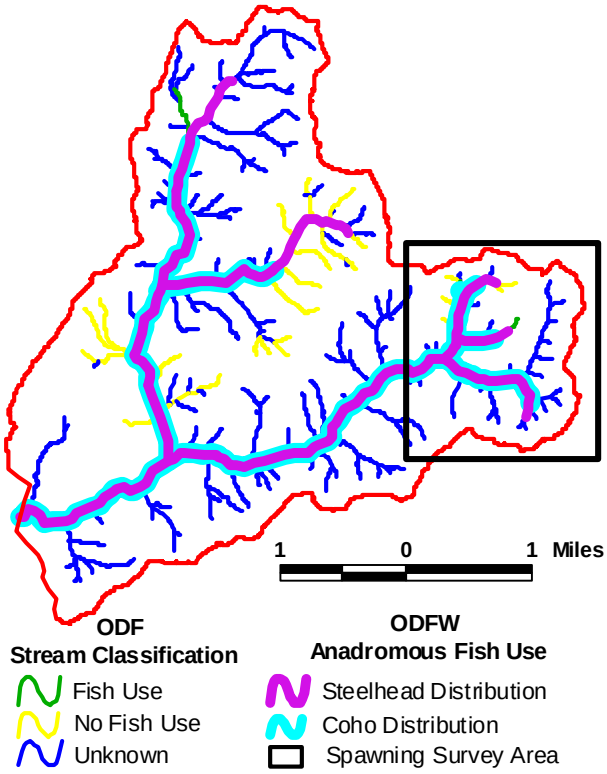
Figure NS-14 Temperature Trends and Riparian Shade Conditions

Riparian Shade

The difference between current and potential shade is shown in Figure NS-14, above, and is expressed as shade needed to meet potential. Current and potential shade values in the North Slough sub-basin are 89% and 98%, respectively, in the upper-most, steep canyon areas. The upper valley area has 61% and 98% respectively, and the lower valley currently has only 18% compared to the potential of 87%. North Slough creek's current lower valley shade is the lowest of the six sub-basins.

Salmonid Distribution

Figure NS-15 Salmonid Distribution



Coho and winter steelhead distribution, according to ODFW, is shown in Figure NS-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 NS-15. There is little historical information on the fish usage in the basin.

Natural fish barriers in the basin are due to the steep gradient of the channel in the headwater reaches. In most cases, these barriers consist of shallow water flows over steep bedrock cascades. Three artificial fish passage barriers at stream crossings were fixed in the summer of 2004 by Coos WA, when two culverts were removed indefinitely and another one was replaced to improve fish passage. There is also a dam on the Bear Creek tributary, which has a fish ladder, but blocks juvenile fish passage.

Stocking Records

Table NS-10 Stocking Records

Creek	Species	Year	# of Juveniles Released
North Slough	Coho	1981	12,000
North Slough	Steelhead	1982	16,150
North Slough	Steelhead	1984	13,925
			42,075

Records show that there were three releases of juvenile salmonids into North Slough Creek since 1978. In 1981, 12,000 coho fry were released, and in 1982 and 1984, steelhead fry were released (see Table NS-10).

Spawning surveys conducted in 1986 and 1987 by ODFW indicate a small coho escapement and a large Chinook escapement. However, no chinook spawners were observed during the recent spawning surveys, and the channel characteristics in this area are not typical of chinook

habitat. The 1980's Chinook runs likely reflect hatchery influence and not natural fish populations.

Spawning Surveys

Coos WA conducted coho spawning surveys from 2002 to 2004 in upper North Slough Creek and a tributary to North Slough Creek (see Figure NS-16).

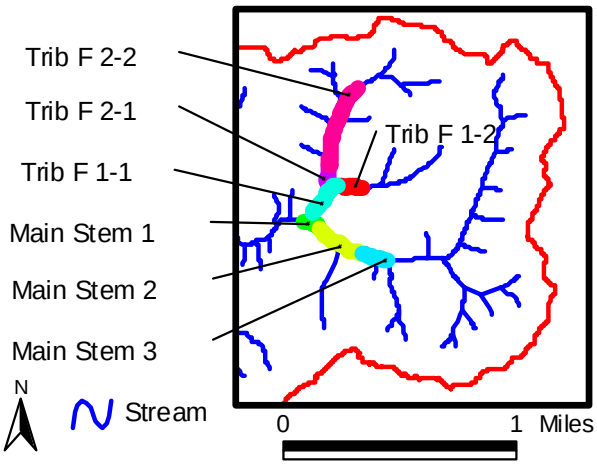


Figure NS-16 Coho Spawning Survey Area

In 2002, the mainstem reaches 1 to 3 (see Figure NS-17) were surveyed. Of these reaches, Main Stem 3 had a significantly higher spawning density (837 coho AUC/Km, see Table NS-11) than the downstream reaches. The high number of spawning coho per square meter of gravel (3.1 m^2 gravel per female) indicates that spawning habitat may be limited in this sub-basin. The high spawning density resulted in superimposition of redds (Coos WA surveyors notes).

In 2003 and 2004, spawning surveys were conducted on Trib F. In 2003 the peak count of coho was 64 for all four reaches combined. Trib F 2-1 had the highest spawning density with 359 coho AUC/km. In this reach only 2.6 m^2 of gravel was available per female. In 2004 a peak count of 89 spawning coho was observed in Tributary F. The highest

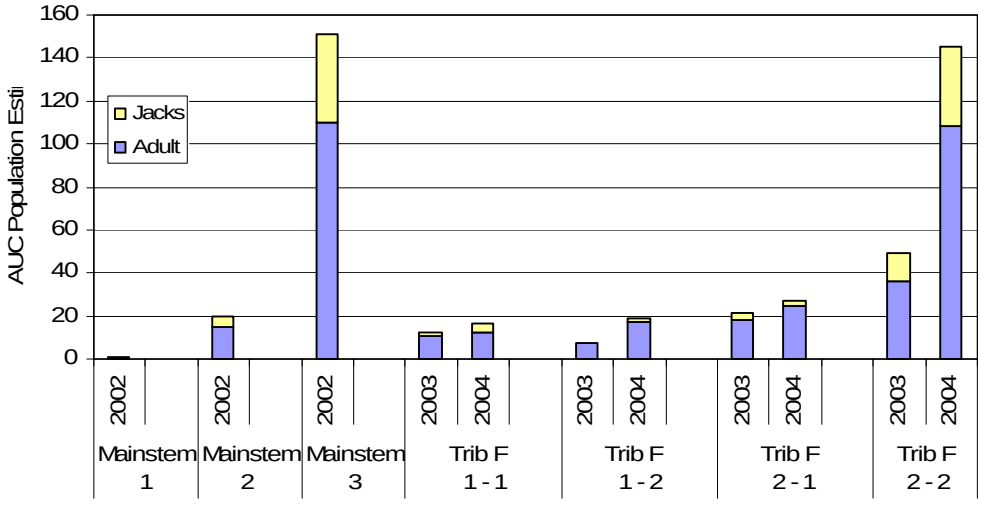


Figure NS-17 Coho Spawning Survey AUC Population Estimate

spawning density in 2004 was 454 AUC/km found in Trib F 2-1. Although there were more total spawning coho in Trib F 2-2, the short length of Trib F 2-1 resulted in the high spawning density in this reach.

Historic records from ODFW indicate peak spawning counts in 1987 of five adult coho (live and dead) and eight chinook. Peak counts in 1985 were one chinook and 26 adult coho. The historic data are not a reliable measure of suitable habitat based on fish productivity, however, because the stream was hatchery-influenced at the time. According to ODFW data sources, the last stocking of coho was in 1981, of 12,000 emergent fry from a hatch box (see Table NS-10, above). Conversely, during the 2002 survey, only one coho was observed with a clipped adipose fin, which was probably a stray from a nearby hatchery.

The 2002 - 2004 surveys show a high density of spawning fish in a limited amount of suitable habitat (see Table NS-11). Aquatic habitat inventory surveys indicate less gravel, fewer riffles and more sand/silt/organics in the Main Stem reaches 1-3 than in Tributary F. Although the quality of habitat in Tributary F is below ODFW habitat benchmarks in all criteria except total wood volume, it supports a large population of spawning coho.

Table NS-11 Spawning Density

Reach		Year	Total AUC/ Km	Gravel m^2	Gravel m^2/ female
Main Stem	1	2002	6	0	0
	2	2002	61	16	2
	3	2002	837	84	2
Tributary F	1 - 1	2003	87	16	3
		2004	118	105	18
	1 - 2	2003	46	72	21
		2004	119	52	4
	2 - 1	2003	359	24	3
		2004	454	71	6
	2 - 2	2003	74	112	6
		2004	217	229	4

From 2003 to 2004, the number of spawning coho observed in all Tributary F reaches increased by 135%. Fish passage and habitat projects were implemented during the summer of 2004 between these spawning seasons. These projects included the removal of a perched culvert that had impeded passage to reach 2-2, and the replacement of a culvert that impeded passage to reach 1-2. Enhancement projects also included a riparian road decommission and large wood placement along Tributary reaches 2-1 and 2-2. After these projects, the AUC per kilometer in all reaches of Tributary F increased, especially above culverts in the upper reaches. These projects improved access to spawning habitat, and the large wood should, over time, capture gravel suitable for spawning and help scour pools for juvenile rearing.

Coho Habitat Limiting Factors

The limiting factors analysis (based on Reeves et al., 1989), shown in Table NS-12, indicates that spring, summer and winter rearing habitats are all limited given the potential summer population. However, summer habitat was found to be the bottleneck to coho smolt production. The current usable summer rearing habitat is 22% of the area needed to support potential populations. The reduction in usable area is primarily due to high temperatures making the Tidal reach unfit for salmonids (see note below). If the temperatures were low enough that coho could utilize all summer habitat, winter rearing habitat would be the limiting factor. According to this analysis, spawning area, based on spawning gravel estimates taken during coho spawning surveys, was more than sufficient for potential populations.

Table NS-12 Limiting Factors to Coho Populations

North Slough Habitat Component	Potential Summer Population	Area/ Survival Factor	Area Needed (M^2)	Current Usable Area (M^2)	Smolt Factor	Smolts Produced
Spawning	31,168	0.006	187	441	95.5	42,116
Spring Rearing	31,168	0.3	9,350	7,637	1.7	12,983
Summer Rearing	31,168	0.6	18,701	4,058	0.9	3,653
Winter Rearing	31,168	0.4	12,467	4,285	1.2	5,142

[Note: The Tidal reach was over 25°C for 7 days in 2003, and 6 days in 2004. It also was over the minimum daily temperature of 22°C for 3 days. This reach was removed from the Useable Area because of the multiple days over 25°C. Even if the coho juveniles could survive the high temperatures, they would need large amounts of easily available food (which are not expected to be there) in order to survive for very long (Giannaco 2005).]

Resource Issues

As is the case with most streams in the assessment area, water elevations in the inlet scour pool above the tide gate are influenced by the tide gate's operation – rising when the gate is closed during high tides, and falling when the gate opens at low tide. Leakage through the gate allows brackish water to enter the inlet scour pool during high tides, and which also increases the water elevation of the pool behind the tide gate.

Low elevation streams in the North Slough sub-basin have been managed primarily for agriculture. Consequently, dredging, straightening, removal of woody material and diking have occurred widely on the system. Because of the low gradient of the stream and because of the tide gate, the lower reaches of North Slough Creek do not adequately flush sediment. Therefore, the need for dredging to reduce flooding is an ongoing management issue. During the high flows of the winter, and often into spring, much of the bottom land is inundated.

Landowner Concerns and Desired Future Conditions

At a community meeting, or Coffee Klatch, held in May of 2005, residents of North Slough expressed what they would like to see in the future of the North Slough area. Their visions include forming a new drainage district to manage drainage maintenance activities and form collaborative permit applications. Residents also would like to see minimal development, drier pastures, paved roads, restored streams, abundant wildlife, and bigger trees.

Figure NS-18 Landowner Concerns

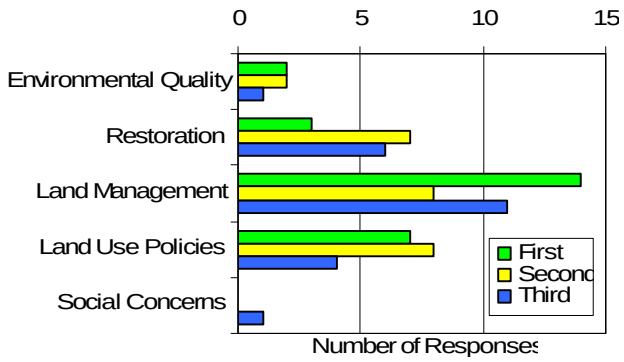


Figure NS-18 shows landowners' top three concerns in the North Slough sub-basin identified during meetings with landowners on May 19, 2005. Land management issues such as maintenance of culverts, tide gates, and county roads, and land use policies such as the difficult dredging permit process are priority concerns.