CHAPTER 3. CURRENT CONDITIONS

3.1 AQUATIC ECOSYSTEMS

3.1.1 HYDROLOGIC CHARACTERIZATION

The Trask River watershed is climatically influenced by proximity to the Pacific Ocean and by elevation. Mean annual precipitation in the Trask River watershed ranges from about 85 inches (in.) in lowland areas to over 155 in. within the uppermost portions of the watershed. The median value is about 110 in. Monthly precipitation exceeds 12 in. in November, December, and January (Figure 1.1). Mean annual precipitation in the Trask River subwatersheds ranges from 89 (Middle Fork of the North Fork of the Trask River subwatershed) to 148 in. (East Fork of the South Fork of the Trask River subwatershed).

Air temperatures are mild, especially in close proximity to the ocean. Mean monthly summer air temperatures range only from 56˚F in June to 59˚F in August. Estimated annual evapotranspiration (ET) for Pacific Coast Douglas-fir/hemlock forest is about 30 in. (Chow 1964), ranging from relatively high ET during summer months to about one inch per month in winter (U.S. EPA 2001).

Rain events are the primary peak flow generating process in the Trask River watershed. There is generally little snowpack development below 2000 ft elevation in the Coast Range (U.S. EPA 2001). Snow pack that does develop in the coastal mountains is usually only on the highest peaks and is of short duration.

Snowpack is monitored in the nearby Wilson River watershed at Saddle Mountain and Seine Creek. The Saddle Mountain SNOTEL station is located at approximately 3,200 ft elevation and has a mean snow water content of 6 in. (http://www.wrcc.wri.edu). The snow water content at the Saddle Mountain station only exceeded 15 in. during four years in the period 1979 to 1999, with a maximum of 25 in. The lower elevation site, Seine Creek, located at 2,000 ft, has a mean annual snow content of 2.5 in. and it is periodic in nature. Only 25% of the Trask River watershed is above 2,000 ft elevation and only 1% is above 3,000 ft, suggesting that snow contributions to flooding only occur in extreme snow accumulation years. The hydrologic analysis for this assessment, therefore, focuses on the effects of land use practices on hydrology using rain events as the primary hydrologic process.

Topography in the Trask River watershed is characterized by steep headwaters that lead quickly into low gradient floodplains. The Oregon Coast Range, including the Trask River watershed, is influenced by a strong orographic effect on precipitation as demonstrated by the large differences between lowland and upland precipitation totals (Table 3.1). Because of the limited water storage as snowpack, discharge is seasonal and follows the precipitation cycle. The Trask River has been monitored for discharge by the U.S. Geological Survey (USGS) from 1931 to the present, with a data gap between 1973 and 1995 (http://waterdata.usgs.gov). The gage is located upstream of Cedar Creek, near the City of Tillamook. The Trask River demonstrates a typical coastal river discharge pattern with the majority of discharge occurring from November through April (Figure 3.1). Discharge during individual years sometimes deviates dramatically from the

Table 3.1. Topographic features and precipitation amounts for the Trask River watershed based on GIS calculations. Annual precipitation was estimated from the PRISM model (Daly et al. 1994).				
Subwatershed	Area (mi^2)	Mainstem Length (mi)	Max Elev. (ft)	Ave Precip. (in.)
East Fork of South Fork of Trask River	29	10.5	3412	148
Elkhorn Creek	17	7.6	3419	102
Lower Trask River	22	10.9	1982	94
Middle Fork of North Fork of Trask River	13	7.9	2743	89
North Fork of North Fork of Trask River	13	5.9	3534	102
North Fork of Trask River	29	13.9	3375	110
South Fork of Trask River	23	10.3	3175	121
Upper Trask River	28	14.4	3052	116
Total	175	81.3	3534	110

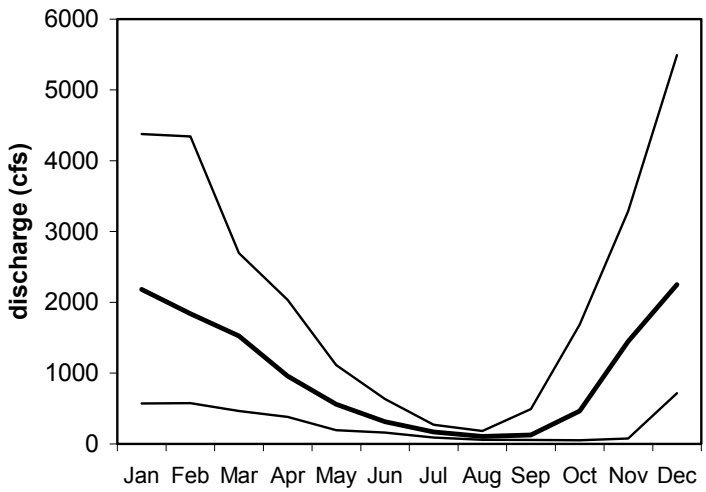

Figure 3.1. Trask River discharge at the USGS gaging station for the period of record (1931 to 1972 and 1996 to 2001) . The top line is the maximum mean daily flow, the center line is the mean daily flow, and the bottom line is the minimum mean daily flow (Data from USGS).

"average" pattern, however. Summer flows are low, averaging generally below 300 cfs. Flood events occur primarily in December through March.

The Oregon Water Resources Department lists peak flow estimates for return periods as follows:

5 yr - 16,500 cfs	50 yr - 25,700 cfs
10 yr - 19,200 cfs	100 yr - 28,700 cfs

Average monthly discharge ranges from 107 cfs in August to 2,188 cfs in December. Low flow during late summer and early fall is an important water quality and fisheries concern. Decreased flow can contribute to seasonal increases in water temperature, decreased pool depth and dissolved oxygen (DO) concentration, and associated detrimental impacts on fish and other aquatic biota.

3.1.1.1 Flooding

Flooding is a natural process that contributes to both the quality and impairment of local environmental conditions. Consequently, flood management attempts to reduce flood hazards and damage while protecting the beneficial effects of flooding on the natural resources of the system. Flooding causes, impacts, and management options are discussed in the Tillamook Bay environmental characterization report (TBNEP 1998a).

Trask River flooding tends to occur most commonly in December and January during periods of heavy rainfall or snowmelt, or a combination of both. River flooding combined with tidal flooding can extend the flood season from November to February. The lowland valleys are the most prone to flooding during these periods. Although rain-on-snow events are infrequent in the Coast Range, these events have contributed to some of the major floods, including the floods of 1955/56, 1964/65, and 1996/97. Large floods (e.g., 10-yr return period) are relatively rare events, however, and we have no data to suggest that current land use practices have exacerbated the flooding effects from rain-on-snow events.

The Trask River watershed has the second largest floodplain area in the Tillamook Bay basin, at almost 6.6 mi^2. Within the Trask River watershed, the Federal Emergency Management Agency (FEMA) 100-yr floodplain occurs only in the Lower Trask River subwatershed, but occupies 29% of the area of that subwatershed. One of the primary natural functions of the floodplain is to reduce the severity of peak flows, thereby reducing downstream impacts and flood hazards. However, much of the floodplain area in the lower sections of the Trask River and adjacent watersheds has been altered. The floodplain has been largely disconnected from the rivers and their tributaries through the construction of dikes and levees, reducing floodplain storage of flood waters.

Flooding is an important management issue in the Trask River watershed. Significant flooding has occurred in the Trask River during 20 years within the last century (Figure 2.1). The highest peak flow recorded during the period of record was 30,000 cfs in 1922. Values above 20,000 cfs were also recorded in 1934, 1956, 1965, 1972, 1996, 1999, and 2000 (no data were collected from 1973 to 1995).

3.1.1.2 Groundwater

There are no designated critical groundwater areas or groundwater-limited areas within the Trask River watershed. Groundwater data specific to Oregon Department of Forestry (ODF) and Bureau of Land Management (BLM) lands within the watershed are not available.

3.1.1.3 Human Impacts on Hydrology

Human activities in the watershed can alter the natural hydrologic cycle, potentially causing changes in water quality and the condition of aquatic habitats. Changes in the landscape can increase or decrease the volume, size, and timing of runoff events and affect low flows by changing groundwater recharge. Important examples of human activities that have affected hydrology in the Trask River watershed are timber harvesting, urbanization, conversion of forested land to agriculture, and construction of road networks. The focus of the hydrologic analysis component of this assessment is to evaluate the potential impacts from land and water use on the hydrology of the watershed (WPN 1999). It is important to note, however, that this assessment only provides a screening for potential hydrologic impacts based on current land use activities in the watershed. Quantifying those impacts would require a more in-depth analysis and is beyond the scope of this assessment.

Increased peak flows in response to management are a concern because they can have deleterious effects on aquatic habitats by increasing streambank erosion and scouring (Furniss et al. 1991, Chamberlain et al. 1991). Furthermore, increased peak flows can cause downcutting of channels, resulting in a disconnection of the stream from the floodplain. Once a stream is disconnected from its floodplain, the downcutting can be further exacerbated by increased flow velocities as a result of channelization.

All subwatersheds were screened for potential land use practices that may be influencing the hydrologic processes that contribute to increased peak flows and streambank erosion (WPN 1999). For this assessment, we focus on the two principal land use activities that can affect the hydrology of upland portions of this watershed: forestry and forest roads. In lowland areas, agriculture and urban or residential development can also be important.

Forestry practices have the potential to influence the magnitude of flooding, but it is difficult to quantify such effects because of the large natural variability in discharge. This difficulty has contributed to over a century of debate in the United States concerning the role of forest conservation in flood protection (Naiman and Bilby 1998). Studies in the Oregon Coast Range found no appreciable increase in the highest peak flows that could be attributed to clearcutting (Rothacher 1971, 1973; Harr et al. 1975). However, current evidence suggests that elevated peak flows and “flashiness” for small to moderate storm events can result from logging and road building activities. Potential effects include reduced evapotranspiration, decreased infiltration and subsurface flow, and increased runoff (Jones and Grant 1996, Naiman and Bilby 1998). Such changes may result in modified peak- and low-flow regimes and subsequent effects on in-stream aquatic habitat quality. However, quantitative information is not available regarding the magnitude of the changes in hydrology of the Trask River that might be attributable to forestry.

Logging can also affect snow accumulation and the patterns and amounts of snowmelt. For a given pattern of snowfall, forested areas are generally expected to release less meltwater, and to release it more slowly, as compared with open areas such as clearcuts (U.S. EPA 2001).

Although large floods are most important from a flood hazard standpoint, smaller magnitude peak flows are also important in shaping the stream channel (Naiman and Bilby 1998). High flows constitute a natural part of the stream flow regime and are largely responsible for transporting sediments and determining channel morphology. Increases in the magnitude of moderate peak flows can contribute to channel incision, bank building, and erosion.

Road construction associated with timber harvest has been shown to increase wintertime peak flows of small to moderate floods in Oregon Coast Range watersheds (Harr 1983, Hicks 1990). The Oregon Watershed Enhancement Board (OWEB) watershed assessment manual evaluates potential road impacts based on road density. Watersheds with a greater than 8% roaded area are considered to have a high potential for adverse hydrologic impact, those with 4 to 8% have a moderate potential, and those with less than 4% have a low potential. Using these criteria, roads in the Trask River watershed were considered to have a low to moderate potential for altering peak flows. Lowest road densities were found in the Middle Fork of the North Fork of the Trask River subwatershed and in the South Fork of the Trask River subwatershed (2.8 mi/mi^2 each). Highest densities (5.6 mi/mi^2 each) were found in the Lower Trask River and the North Fork of the North Fork of the Trask River subwatersheds. However, this analysis was based on geographic information system (GIS) maps which show relatively low road density throughout the watershed. There are many legacy roads that were constructed for salvage logging following the Tillamook Burn that are unmapped, and if accounted for, would probably result in higher road densities. In addition, the density of roads alone is generally a poor predictor of the potential for roads to influence hydrology.

Although road density provides a general impression of the relative area dedicated to roads in a given watershed, it does not distinguish roads on steep slopes from those on flat ground, or roads on hilltops from roads near streams. Road-slope position provides a more detailed view of which roads may be influencing the stream network. ODF has classified its roads into valley, midslope, and hilltop slope positions. In the Trask River watershed, the majority of inventoried ODF roads are on midslope positions. (For a more detailed presentation of this topic, see section 3.2.1.1. Road Density and Hillslope Position).

Past fires, including the Tillamook Burn, were associated with changes in the hydrologic regime (c.f., Coulton et al. 1996). In general, a large proportion of the vegetation must be removed from a watershed before significant increases in peak flows are observed. According to one study, the 1933 Tillamook fire increased the annual peak flow of two watersheds by 45% and the total annual flow by 9% (Anderson et al. 1976). The effects of fire on peak flows generally persist until vegetation is re-established, which is usually within a decade following the fire (Agee 1993). Fires in the past several decades have not burned large areas of the Trask River watershed, so we do not expect that there are significant effects of fire on hydrology in the watershed today.

The Lower Trask River subwatershed has a relatively large area of agricultural land use (51%) and limited urban land use. Land cover in the Tillamook bottomland changed significantly

following Euro-American settlement in the early 1900s (Coulton et al. 1996). It is likely that agricultural practices and urbanization have changed the infiltration rates of the soils in this area, some of which are poorly drained. Existing flood control features used to protect floodplain land uses have simplified natural streamflow processes in many places and reduced the complexity of in-stream habitats that support fish and aquatic organisms. Agricultural areas throughout the lower watershed have been drained by subsurface tile drains. These installations reduce water storage and increase peak flows in lowland areas, but quantitative data are lacking. Loss of historical floodplain acreage and land cover (such as wetlands and forested valley bottoms) have likely had significant impacts on hydrologic conditions. Disconnecting the floodplain from the river has resulted in the loss of flood attenuation capacity, increased peak flows, downcutting of channels, and increased flow velocities in the lower watershed.

3.1.2 WATER QUANTITY

In-stream water rights were established by the Oregon Water Resources Department (OWRD) for the protection of fisheries and aquatic life in five of the Water Availability Basins (WABs) within the Trask River watershed (Table 3.2). In addition, ODFW established in-stream water rights in 1991 in all of the 13 OWRD WABs within the Trask River watershed for the protection of anadromous and resident fish. These in-stream rights are mostly junior to the consumptive water rights in the watershed. A summary of the in-stream water rights data by WAB and by subwatershed is given in Table 3.2. In-stream water allocations during the critical months of July through October are largest in the Trask River above Gold Creek and Trask River at Tillamook Bay WABs.

The OWRD and Oregon Department of Fish and Wildlife (ODFW) have prioritized streamflow restoration throughout Oregon based on salmonid recovery, in support of the Oregon Plan for Salmon and Watersheds. In the Trask River watershed, the mainstem of the Trask River, most of the North Fork, and all of the Middle Fork of the North Fork have been identified as “highest” priority for flow restoration. All other streams in the Trask River watershed were identified as “moderate” priority (www.wrd.state.or.us/programs/salmon/01priorities.pdf).

Consumptive water rights in the Trask River watershed are summarized in Table 3.3. Fish culture, municipal water use, and pollution abatement together represent 84% of the total consumptive water rights. The only other substantial water right category is irrigation (12.9% of total). The Watermaster has needed to regulate water during three years since 1991 (1994, 2001, 2002), in each case towards the end of summer. Irrigation rights run from March through October, but irrigation in the watershed is generally negligible before July. The only significant water use between November and July is municipal use (Greg Beaman, Tillamook County Watermaster, pers. comm., March, 2003). The Trask basin is a municipal watershed for the cities of Tillamook, Hillsboro, Forest Grove, Beaverton, and several smaller communities in Washington and Yamhill counties. Among the subwatersheds of the Trask River watershed, the largest number of water rights (61) is in the Lower Trask River subwatershed, but the largest potential diversion is in the Middle Fork of the North Fork of the Trask River (69 cfs at Barney Reservoir; Table 3.4).

Table 3.2. In-stream water rights in the Trask River watershed, by Water Availability Basin and by subwatershed. (Data from OWRD)

Water Availability Basin (WAB)	Subwatershed[a]	Purpose[b]	Priority	CFS			
				Jul	Aug	Sep	Oct[c]
Bark Shanty Creek	North Fork of Trask River	A	2/13/1991	9	5	5	10
Clear Creek at Mouth	North Fork of Trask River	A	2/13/1991	7	4	4	7
North Fork above Bark Shanty Creek	North Fork of Trask River	A	2/13/1991	81	50	50	91
		S	5/9/1973	15	15	15	40/80
East Fork of South Fork	E. Fork of S. Fork of Trask River	A	2/13/1991	27	19	19	35
Edwards Creek at Mouth	South Fork of Trask River	A	2/13/1991	5	3	2	4
South Fork above E. Fork of S. Fork	South Fork of Trask River	A	2/13/1991	10	6	5	10
South Fork at Mouth	South Fork of Trask River	A	2/13/1991	50	30	28	52
		S	5/9/1973	30	30	30	60/140
Green Creek at Mouth	Lower Trask River	A	2/13/1991	1	0	0	1
Trask River at Tillamook Bay	Lower Trask River/Upper Trask River	A	2/13/1991	157	103	97	170
		S	5/9/1973	85	85	85	150/270
North Fork at Mouth	Upper Trask River	A	2/13/1991	81	50	50	91
		S	5/9/1973	25	25	25	60/120
Trask River above Gold Creek	Upper Trask River	A	2/13/1991	157	103	97	170
		S	5/9/1973	60	60	60	120
Middle Fork of North Fork	M. Fork of N. Fork of Trask River/Elkhorn Creek	A	2/13/1991	28	17	18	31
North Fork of North Fork	N. Fork of N. Fork of Trask River	A	2/13/1991	13	8	8	14

[a] Two of the WABs occur within more than one watershed
[b] A - Anadromous and Resident Fish Rearing; S - Supporting Aquatic Life
[c] The water right changes on October 15th within 4 of the WABs

Table 3.3. Consumptive water rights within the Trask River watershed (Data from OWRD).				
Use	Description	Number of Water Rights	Water Diversion (cfs)	% of Total
AG	Agriculture	1	0.04	0.03
DI	Domestic Irrigation	9	0.1	0.06
DN	Domestic Non-commercial	7	0.1	0.05
DO	Domestic	42	4	2.72
FI	Fish Culture	6	49	34.96
FP	Fire Protection	3	0.1	0.08
ID	Irrigation and Domestic	1	0.1	0.05
IR	Irrigation	46	17	11.89
IS	Irrigation - Supplemental	2	1.3	0.94
LV	Livestock	5	0.1	0.09
MU	Municipal	1	39	27.67
PA	Pollution Abatement	1	30	21.45
Total		124	140	100

Table 3.4. Breakdown of consumptive water rights by subwatershed (Data from OWRD).		
Subwatershed	Number of Water Rights	Diversion (cfs)
East Fork of South Fork of Trask River	1	0.005
Elkhorn Creek	0	-
Lower Trask River	61	30
Middle Fork of North Fork of Trask River	2	69
North Fork of North Fork of Trask River	0	-
North Fork of Trask River	0	-
South Fork of Trask River	23	30
Upper Trask River	37	11
Total	124	140

During dry seasons, water withdrawals may have deleterious effects on in-stream habitats by reducing flows. For example, appropriated water represents 25 to 26% of modeled in-stream flows (based on a 50% exceedence) in the Trask River at the mouth during the months of July and October, and 40% of modeled in-stream flows during August and September. This suggests that the impacts of water appropriation can be substantial if the water rights are fully utilized. At

the 80% exceedence level, half of the expected flow during August and September is allocated to consumptive water use. The Oregon Water Resources Department has developed models to assess the potential impacts of water withdrawals on stream flows (Robison 1991). These model outputs are available to the public on the OWRD website (http://www.wrd.state.or.us). They use predicted water loss based on the type of use for the appropriated water. Losses are then compared to predicted in-stream flows, based on two exceedence levels. We have presented in Table 3.5 both the 50% and 80% exceedence levels, which represent stream flows that would be expected to be this low at least 50% and 20% of the time, respectively (higher flows expected 50% and 80% of the time, respectively). These exceedence levels should provide reasonable benchmarks for evaluating the likelihood of adverse effects of water withdrawal.

There is concern for dewatering in the Trask River watershed in general, based on current water availability model outputs for the 50% exceedence level. Six of the WABs had water rights greater than 25% of the predicted in-stream flows. The mainstem Trask River and the North Fork system (Middle Fork of North Fork, North Fork above Bark Shanty Creek, and North Fork at mouth) exhibited relatively high potential for dewatering.

During the driest months (August and September), the mainstem Trask River at its mouth at Tillamook Bay is only expected to carry about 40 to 43 cfs at the 80% exceedence level and 61 to 64 cfs at the 50% exceedence level, after subtracting out all consumptive water rights. This is not nearly enough to satisfy the in-stream water rights for the protection of fish and aquatic life. In the Middle Fork of the North Fork WAB and the lower elevation WABs (Trask River at Tillamook Bay, Trask River above Gold Creek, and North Fork at mouth), in particular, summer flows are inadequate to meet consumptive and in-stream allocations (Table 3.5). However, in practice not all water rights are utilized.

The largest number of consumptive water rights appropriated in the Trask River watershed is for domestic use (58 water rights), followed by irrigation (49 water rights). Most of the irrigation water rights are appropriated in the Lower Trask River subwatershed, and most of the domestic water rights are appropriated in the Upper Trask River subwatershed. Although irrigation and domestic use account for about 76% of the consumptive water rights, they only represent 16% of the total appropriated water for consumptive purposes (Table 3.3). The largest amount of water storage is in Barney Reservoir (9,900 cubic feet) in the Middle Fork of the North Fork of the Trask River subwatershed, of which 80% is for domestic use by the cities of Hillsboro and Forest Grove, and the remainder for pollution abatement.

3.1.3 STREAM CHANNEL

3.1.3.1 Stream Morphology and Sediment Transport Processes

Stream channel structure is strongly influenced by channel confinement, stream gradient, and stream size (Naiman and Bilby 1998). For example, unconfined channels develop floodplains that disperse energy from high flows, and allow channel migration. Confined channels, on the other hand, translate high flows into higher velocities, resulting in accelerated rates of erosion. These characteristics control stream conditions such as bedload material, sediment transport, and

Table 3.5. Water availability summary for Water Availability Basins within the Trask River watershed. (Source: OWRD WARS database)

Water Availability Basin	Net Water Available (cfs)[a]											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
50% Exceedence Level												
South Fork above E. Fork of S. Fork	20	12	0	0	0	0.1	0.0	0.1	0.1	0.1	0.3	10.9
Edwards Cr. at Mouth	7	3	0	0	0	0.1	0.1	0.1	0.1	0.1	0.3	2.2
Bark Shanty Cr.	63	57	46	20	10	4	0.1	0.1	0.1	0.2	32.1	57.2
South Fork at Mouth	273	236	163	25	-0.1	0.2	0.3	0.2	-1	-88	82.9	245
East Fork of South Fork	227	206	169	91	21	28	4	0.2	0.2	0.4	136	210
Middle Fork of North Fork[b]	-83	-93	-26	-39	-39	-39	-39	-39	-39	-39	-106	-93.4
North Fork of North Fork	44	37	25	0	0	0	0	0	0	0	5.9	36
Clear Cr. at Mouth	28	23	14	0	0	0	0	0	0	0	3.2	23.2
North Fork above Bark Shanty Cr.	375	340	363	222	105	34	10	-14	-14	-47	211	350
North Fork at Mouth	368	318	314	129	-39	-7	-39	-38	-38	-68	146	336
Trask River above Gold Cr.	1030	925	821	465	148	97	21	-33	-35	-80	568	971
Trask River at Tillamook Bay	1020	903	750	320	-41	91	-32	-39	-36	-83	444	959
Green Cr. At Mouth	-0.01	-0.01	-0.01	-0.01	-0.02	-0.07	-0.17	-0.11	-0.03	-0.03	-0.05	-0.01
80% Exceedence Level												
South Fork above E. Fork of S. Fork	-50	-38	-41	-23	-10	-7	-4	-2	-2	-5	-43.1	-45.2
Edwards Cr. at Mouth	-27	-21	-20	-11	-4	-4	-2	-1	-1	-2	-19.1	-24.9
Bark Shanty Cr.	11	21	14	1	1	-1	-3	-1	-2	-5	-6.2	17.9
South Fork at Mouth	-10	36	0	-69	-40	-29	-15	-7	-9	-114	-116	21.8
East Fork of South Fork	65	93	73	35	-6	10	-5	-4	-5	-17	15.2	87
Middle Fork of North Fork[a]	-222	-190	-109	-92	-66	-51	-45	-42	-44	-54	-201	-197
North Fork of North Fork	-13	-3	-10	-22	-11	-6	-3	-1	-2	-7	-32.8	-5.6
Clear Cr. at Mouth	-12	-5	-10	-14	-7	-5	-3	-1	-1	-4	-25.5	-6.4
North Fork above Bark Shanty Cr.	58	119	178	107	48	5	-5	-21	-24	-81	-20.2	112
North Fork at Mouth	-45	30	77	-18	-108	-46	-58	-47	-50	-111	-157	21.1
Trask River above Gold Cr.	259	384	387	209	37	24	-16	-51	-56	-155	6.71	367
Trask River at Tillamook Bay	127	268	253	40	-150	2	-77	-60	-57	-166	-182	228
Green Cr. At Mouth	-4	-3	-2	-1	-0.3	-1	-0.5	-0.3	-0.1	-0.3	-2.04	-3.41

[a] Expected streamflow minus consumptive use and instream water rights
[b] Barney Reservoir is in this subwatershed

aquatic habitat quality. Segregating stream segments into channel habitat types (CHTs), based on stream morphology (i.e., low-gradient confined, very steep headwater, alluvial fan, etc.), provides an overall indication of the quality and distribution of various stream and associated riparian habitats throughout the watershed.

Streams in the Trask River watershed (blue line streams on USGS 1:24,000 topographic maps) were divided into CHTs by Bruce Follansbee and Ann Stark for the Tillamook Bay National Estuary Project (TBNEP) and the Tillamook Bay Watershed Council, using OWEB guidelines (cf. TBNEP 1998b, WPN 1999). Division into habitat types was based on stream characteristics from USGS 1:24,000 topographic maps, and field sampling was conducted to verify habitat types (Bruce Follansbee, pers. comm., 2003). Certain stream reaches which appeared to not have been classified consistent with current OWEB methods were reclassified by ODF personnel. These corrections mostly applied to moderate gradient headwater (MH) channels. Additional field-based assessment will be required for site-specific activities that are dependent on CHT characterization. A map of the CHTs is available on the ODF website.

Topography in the Trask River watershed is characterized by steep uplands that transition abruptly into low-gradient lowlands. The majority of streams (59%) fall into the two steepest categories, steep narrow valley (SV) and very steep headwaters (VH), for all subwatersheds except the Lower Trask (Table 3.6). These CHTs contain steep, flashy, first- and second-order streams, dominated by cobble or bedrock. Waterfalls, cascades, and scour pools are commonly found along these types of streams. Moderate gradient, moderately confined (MC) and moderately steep narrow valley (MV) types are also common, accounting for another 20 to 30% of the stream segments in the upper watershed. These types are characterized by a single, confined channel, with little or no floodplain development. MV streams may contain a moderate amount of large woody debris (LWD), while MC streams in unmanaged watersheds typically contain low amounts of LWD. Substrate may be bedrock, small cobble or coarse gravel.

The upland subwatersheds contain approximately 4 to 7% of moderate gradient, moderately confined (MM) stream channel, which is considered among the most responsive to restoration. MM channels usually are associated with medium to large streams and are found mainly in the middle portion of the watershed. They typically exhibit a complexity of physical conditions, ranging from gravel riffles to large boulders, providing a diversity of habitat opportunities. LWD is expected to be abundant in the absence of removal by debris flows, floods, or human activities. Beaver ponds may be common. The Upper Trask subwatershed contains a notably higher proportion of MM stream channel than the other subwatersheds (15% - essentially the entire mainstem; Table 3.6).

Only the Lower Trask subwatershed has a high proportion of low-gradient channel types, including floodplain channels, such as small, medium and large floodplains (FP1, FP2, and FP3), as well as estuary and ditches. In unmanaged landscapes, floodplain channels are typically sinuous, braided, and dominated by smaller substrate materials such as silt, sand, and gravel.

During surveys of stream channel characteristics and aquatic habitat conducted by ODFW in the Trask River watershed, the percent of actively eroding streambank was recorded (Plate 5, Table 3.7). The highest levels of streambank erosion were observed in the East Fork of the South Fork and Elkhorn Creek subwatersheds, each having an average of 30% streambank erosion. Third

Table 3.6. Channel habitat types in the Trask River watershed, grouped by their sensitivity to watershed disturbance.

Subwatershed	Stream Length (mi)	Percent of Channel Habitat Type in Sensitivity Category[a]											
		Low			Moderate				High				Variable
		%SV	%VH	%LC	%MC	%MH	%MV	%D[b]	%FP1	%FP2	%FP3	%MM	%EL
East Fork of South Fork of Trask River	72.2	26.0	36.2	0.8	8.9	2.7	20.8	0.0	0.0	0.0	0.0	4.6	0.0
Elkhorn Creek	34.8	32.8	27.0	0.0	24.4	12.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Lower Trask River	61.4	7.2	7.8	0.0	0.0	7.9	0.4	4.2	6.3	11.8	43.8	3.6	6.8
Middle Fork of North Fork of Trask River	28.8	39.5	24.2	0.0	26.6	3.1	0.0	0.0	0.0	0.0	0.0	6.7	0.0
North Fork of North Fork of Trask River	29.6	25.8	50.9	0.0	21.2	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
North Fork of Trask River	69.1	27.0	42.6	0.0	18.1	3.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0
South Fork of Trask River	56.5	15.8	53.9	0.0	16.2	0.0	9.9	0.0	0.0	0.0	0.0	4.2	0.0
Upper Trask River	56.5	16.3	51.2	0.0	12.7	0.0	4.5	0.0	0.0	0.4	0.0	15.0	0.0
Total	408.9	22.1	37.0	0.1	14.1	3.4	7.8	0.6	0.9	1.8	6.6	4.5	1.0

[a] CHT designations are: SV-Steep Narrow Valley; VH-Very Steep Headwater; LC-Low Gradient Confined; MC-Moderate Gradient Confined; MH-Moderate Gradient Headwater; MV-Moderately Steep Narrow Valley; D-Ditch; FP1-Low Gradient Large Floodplain; FP2-Low Gradient Medium Floodplain; FP3-Low Gradient Small Floodplain; MM-Moderate Gradient Moderately Confined; EL-Large Estuary

[b] CHT designated as D (ditch) was created by TBNEP personnel rather than a type listed in the OWEB guidelines.

Table 3.7. Average percent streambank erosion for ODFW surveyed stream reaches, by subwatershed.			
Subwatershed	Ave. Percent Bank Erosion	Total Surveyed Miles	Total Stream Length[a] (mi)
East Fork Of South Fork Of Trask River	30	29	177
Elkhorn Creek	30	9	105
Lower Trask River	23	10	89
Middle Fork Of North Fork Of Trask River	4	6	81
North Fork Of North Fork Of Trask River	4	6	77
North Fork Of Trask River	7	16	193
South Fork Of Trask River	12	14	151
Upper Trask River	2	19	197
Total	14	109	1070
[a] Total stream length estimates were taken from the ODF GIS stream layer			

highest was the Lower Trask subwatershed at 23%. In all other subwatersheds, streambank erosion was less than 10%, with the exception of the South Fork subwatershed, at 12%. The Upper Trask subwatershed showed the lowest rate of streambank erosion (2%), although only the mainstem was surveyed. Streambank erosion in the mainstem streams throughout the upper watershed was relatively low, in the 0 to 5% category; higher rates of erosion were more apparent in the small, steep tributary streams. For the Trask River watershed as a whole, streambank erosion averaged 14% (Table 3.7, Plate 5).

3.1.3.2 Effects of Human Influences Upon Stream Morphology

Human activities that have occurred on ODF or BLM lands and influenced stream morphology include log drives, yarding in channels during timber harvest, road construction, beaver eradication, reservoir construction, and stream cleaning. Most of such activities occurred before the land came into public ownership. Log drives occurred most frequently from below river mile (RM) 10 to the bay (Farnell 1980). It is unknown exactly how far upstream log drives were conducted. Logs were stored on the banks until high flows, and then pushed into the rivers and transported downstream to be milled. Impacts associated with log drives included bank erosion, damage to riparian vegetation, mechanical erosion of channel substrate, and sediment deposition (USFS 1985, Coulton et al. 1996).

During the salvage logging following the Tillamook Burn, road construction is reported to have impacted stream channels, although specific locations in the Trask River watershed were not determined. Roads were frequently constructed near streams, resulting in sedimentation of the streams by sidecast material (Coulton et al. 1996, Levesque 1985). Historic photographs show roads constructed directly in the streambed, although it is unknown how common such practices were, and whether they occurred in the Trask River watershed (Coulton et al.1996, photos archived at the Tillamook County Pioneer Museum). In 1990, FEMA determined that many of

the old salvage logging roads in the Tillamook basin had used under-sized culverts, log culverts, or had poor alignment to the natural grade, and were therefore susceptible to erosion. FEMA initiated efforts to repair or abandon old roads (FEMA 1990, Coulton et al. 1996). Sedimentation conditions associated with old roads have improved, and active management of roads to reduce erosion is ongoing. More information on the current status of roads in the Trask River watershed is presented in Section 3.2.1.

Removal of wood from streams has altered stream morphology (Coulton et al. 1996). Large logs, stumps and root wads affect stream morphology by creating debris dams and pools, trapping sediment, and providing physical complexity. These functions create critical habitat for aquatic organisms (Reeves et al. 2002). Unfortunately, we were not able to find specific information regarding stream cleaning activities that occurred historically in the Trask River watershed. Recent surveys of the stream system by ODFW indicate a lack of LWD, and related physical complexity throughout most of the watershed. For a more detailed description of stream habitat conditions, see Section 3.1.6.1.

In the lower watershed outside of ODF and BLM lands, additional human alterations of stream morphology have included channelization, straightening, bank armoring, diking, and dredging. In the 1978 Tillamook Bay Task Force study, 111,288 feet of streambank was evaluated, of which 19% had been rip-rapped. Of the total streambank surveyed, 1.5% was identified as a "Critical Erosion Area".

3.1.3.3 Stream Enhancement Projects

In 1998 and 1999, a major effort was made to improve aquatic habitat for salmonids within the Trask River watershed. Entitled "Operation Stump Drop", almost a million pounds of woody debris (cut stumps and large trees with attached root wads) was strategically placed by helicopter in streams throughout the East Fork of the South Fork of the Trask River subwatershed by ODF and ODFW. The LWD was either anchored in the stream channel or cabled to the streambank to enhance riparian habitat (provide winter refuge, slow stream velocity, stabilize banks, increase pool depth, and retain gravels). The South Fork Trask River, East Fork of the South Fork Trask River, Rock Creek, Headquarters Camp Creek, Stretch Creek, Boundary Creek, Blue Bus Creek, South Creek, Summit Creek, Edwards Creek, Bill Creek, and four unnamed tributaries were included in the restoration efforts.

Monitoring took place in some streams throughout the East Fork of the South Fork of the Trask River subwatershed from July 1998 to May 2000 to assess the effectiveness of the restoration work on salmonid habitat. The effort appears to have had positive impacts on channel habitat complexity and juvenile salmonid survival (Plawman and Thom 2000). Evaluation of data from pre- and post-treatment sites revealed an increase in pools and woody debris (dammed pool area and depth increased and wood pieces and volume increased). The results also suggested that key wood piece density is an important element for overall wood retention in stream systems during high flows. In 2001, the East Fork of the South Fork of the Trask River, Boundary Creek, and Pothole Creek were part of another wood emplacement effort. Additional habitat enhancement

may be conducted in conjunction with future timber sales in accordance with the ODF Forest Management Plan (FMP) and Tillamook/Clatsop Implementation Plan (IP).

The BLM is planning to conduct in-stream habitat enhancement projects in the Elkhorn Creek subwatershed, including placement of LWD and boulders in the stream channel. Because of the mixed land ownership in areas identified for habitat enhancement, opportunities for cooperative projects with ODF and private landowners will be pursued.

3.1.4 EROSION AND SEDIMENT

3.1.4.1 Overview of Erosion and Sediment Processes

In the Trask River watershed, there are two distinct zones of erosional activity: the steep, forested upland, and the broad, lowland floodplain near the river mouth (Plate 1). All subwatersheds, except the Lower Trask subwatershed, are centered in steep, upland terrain. The lowland floodplain of the Lower Trask subwatershed merges with floodplains from the neighboring Wilson and Tillamook rivers near Tillamook Bay.

On the steep slopes and shallow soils of the forested uplands, mass wasting is the dominant erosional process (Skaugset et al. 2002). Generally referred to as landslides, mass wasting includes debris slides, rock slides, and debris flows in steeper terrain, and slumps and earthflows on gentler slopes. A landslide is defined as "the movement of a mass of rock, debris, or earth down a slope" (National Research Council 1996). Landslides often gather large amounts of organic material, such as downed logs and woody debris, as they travel downslope. Debris flows are the primary erosional mechanism responsible for depositing sediment and woody debris into streams (Mills 1997, Skaugset et al. 2002). Earth slides and earthflows are usually slow-moving and highly variable in size, although rapidly moving earthflows have been observed in the Tillamook basin (Mills 1997).

The majority of erosion and sediment movement occurs episodically during infrequent, large flood events. The flood of February, 1996 and smaller floods of 1998 and 1999, which caused extensive damage throughout western Oregon, deposited a large quantity of sediment into Tillamook Bay, and re-focused attention on mass wasting and erosional processes. Although landslides occur under natural conditions, human activities have been shown to increase the rate of erosion in many coastal watersheds in Oregon (WPN 1999, Naiman and Bilby 1998, Robison et al. 1999). In particular, road-cuts may undercut slopes and concentrate runoff along roads, and road-fills on steep slopes may give way, initiating landslides (NRC 1996). Road ditches intercept and redirect the flow of water, sometimes exacerbating erosion and accelerating the rate of runoff. Vegetation removal, such as by logging or wildfire, may also increase the likelihood of landslide occurrence. However, landslide rates vary greatly and predicting landslide occurrence at a given site is difficult.

High levels of sediment deposition associated with landslides and debris flows may negatively impact many aquatic organisms, including threatened salmon species (Skaugset et al. 2002). However, landslides and debris flows can have both positive and negative effects on fish in

streams. A landslide from a forested hillside will generally contain soil, gravel, organic material, and a substantial amount of woody debris. This mixture causes significant changes in the affected stream reach (Chesney 1982). In the short term, a debris flow can scour a channel and remove beneficial prey (benthic macroinvertebrates) and channel structures. Over the long term, these events deliver woody debris, organic matter, and gravel that maintain productive aquatic habitat and serve to reset gravel conditions in the stream ecosystem (Spies et al. 2002).

3.1.4.2 Mass-wasting and Slope Stability in the Trask River watershed

No recent comprehensive aerial photo or on-the-ground inventories of landslides have been conducted in the Trask River watershed. Limited available data on landslide occurrence are presented in Table 3.8. Most records of landslide occurrence are in the East Fork of the South Fork and the South Fork Trask subwatersheds. The most recent and comprehensive information on landslides in the Tillamook basin is ODF's study of the storm impacts and landslides of 1996 (Robison et al. 1999). In this study, 62 landslides were recorded in a 4.5 mi^2 area in the Wilson River watershed. Fifty non-road landslides were identified, with a density of 11.1/mi^2. The average volume of sediment contributed by these slides was estimated to be 11.8 yd^3/ac.

Table 3.8. Landslide activity in the Trask River watershed, based on available data.

Subwatershed	Debris Avalanche	Earthflow	Landslide	Total
East Fork Of South Fork Of Trask River			51	51
Elkhorn Creek			59	59
Lower Trask River		89		89
Middle Fork Of North Fork Of Trask River	1			1
North Fork Of North Fork Of Trask River			1	1
North Fork Of Trask River			43	43
South Fork Of Trask River	1	12	46	59
Upper Trask River		19	11	30
Total	2	120	211	333

A 1978 study by the U.S. Department of Agriculture (USDA), prepared for the Tillamook Bay Task Force, estimated sediment yield for the entire Tillamook Basin. They determined that upland erosion rates in the Tillamook basin increased due to human activities, but the exact amount of increase was unclear. The USDA (1978) study used the Universal Soil Loss Equation (USLE), which results in unreliable estimates of sediment yield on forested land, particularly in locations where the soil has a high infiltration rate, such as is commonly found in the uplands of the Trask River watershed (TBNEP 1998a).

Another study in 1978 used false-color infrared photographs to identify human-induced and natural landslides in the Tillamook area (Benoit 1978). Of the 4,680 landslides identified, 4,440 (95%) were classified as "human-induced". Landslides were considered human-induced if they occurred near roads, fire lines, timber harvest or salvage activities. In the Trask River watershed

1,092 human-induced and 30 natural landslides were recorded. However, the coarse criteria for determining human influence is likely to have resulted in some naturally-caused events having been incorrectly labeled as human induced. Robison et al. (1999) also concluded that aerial photo studies tend to misrepresent landslide rates.

3.1.4.3 Human Impacts on Erosional Processes and Sediment Production

There are two primary sources of human impact on erosional processes and sediment production in the upper Trask River watershed: roads and timber harvest units. Information regarding the current conditions and impacts of roads in the watershed is provided in Section 3.2.1.

We have not found studies that have investigated the effects of clearcutting and timber harvest on erosion in the Trask River watershed, specifically. However, nearly all studies from other watersheds of the effects of timber harvest on the rate of landslides have found higher rates in harvest units than in forest. Studies from elsewhere in the Oregon Coast Range have estimated a two- to four-fold increase in the rate of landslides associated with clearcuts, when compared to forest (Sidle et al. 1985, Robison et al. 1999). ODF data suggested an average increase in the rate of landslides of 42% during the first decade following clearcutting (Robison et al. 1999, Skaugset et al. 2002). Aerial photo-based studies have been found, however, to underestimate the number of landslides under forest canopy (Pyles and Froehlich 1987, Robison et al. 1999). The association between increased rate of landslide occurrence and vegetation removal appears to be strongest in the first 10 years following vegetation removal, declining as the site is revegetated. Also, there is some evidence that debris flows originating in clearcuts are more likely to reach mainstem streams than debris flows of forest origin (May 1998).

There are 12 rock pits in the Trask River watershed, where rock is excavated, primarily for road construction and maintenance. Five rock pits are located in the North Fork of the Trask subwatershed, three in the Upper Trask, two in the East Fork of the South Fork Trask subwatershed, and one each in the Elkhorn Creek and South Fork subwatersheds. Information regarding the influence of rock pits on erosion is not available (Tony Klosterman, pers. comm., 2003).

3.1.4.4 Effects of Sedimentation on Barney Reservoir

We have not been able to find information regarding sedimentation effects on Barney Reservoir. Representatives of the Barney Reservoir Commission and the Joint Water Commission were unaware of any studies or concerns regarding sedimentation for Barney Reservoir. One consulting scientist observed that during his fieldwork above the reservoir he saw very few signs of erosion, and described the terrain as rock-dominated. He was of the opinion that sedimentation issues were not likely to be significant (Forest Olsen, CH2M Hill, pers. comm., 2003).

3.1.5 WATER QUALITY

3.1.5.1 Streams on the 1998 ODEQ 303(d) List

Water bodies or stream segments are placed on the 303(d) list if they fail to meet water quality standards, established to protect designated beneficial uses, after all practicable measures have been taken to treat or control point source discharges. For water bodies included on the 303(d) list, a maximum allowable daily load of the constituent responsible for the listing is determined (the Total Maximum Daily Load, or TMDL) and fractions of that allowable load are allocated to dischargers, both point and non-point, in the basin.

Beneficial uses for the purpose of water quality regulation are determined by the Oregon Department of Environmental Quality (ODEQ) for each of 19 river basins. The Trask River is included in the North Coast basin, and is combined with the Lower Columbia River basin for regulatory purposes (OAR 340-41-202). Beneficial uses for the North Coast basin are:

Public and private domestic water supply[1]
Industrial water supply
Irrigation
Livestock watering
Anadromous fish passage
Salmonid fish spawning and rearing
Resident fish and aquatic life
Wildlife and hunting
Fishing
Boating
Water contact recreation
Aesthetic quality

The water quality requirements to meet these uses differ. For example, the requirements for domestic water supply may be more stringent in some aspects than those for livestock watering. Frequently the most sensitive beneficial use is considered when making decisions regarding designation of a water body as water quality limited. The underlying assumption is that if the water body meets the criteria for the most sensitive use, it will meet criteria for other uses as well. For most of the Trask River watershed, the most sensitive beneficial use would probably be salmonid fish spawning, for which the critical criteria would be temperature and dissolved oxygen. For the upper reaches of the Middle Fork of the North Fork of the Trask River subwatershed, the most sensitive beneficial use is public and private domestic water supply. An additional important water quality consideration for the Trask River is bacteria concentration, because bacterial contamination in the Trask River influences resident aquatic life, including oysters cultivated in Tillamook Bay.

The Clean Water Act regulates discharge of waste to surface water. In order to discharge any waste, a facility must first obtain a permit from the State. ODEQ issues two primary types of

[1]With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards.

discharge permit. Dischargers with Water Pollution Control Facility (WPCF) permits are not allowed to discharge to a water body. Most WPCF permits are issued for on-site sewage disposal systems. Holders of National Pollutant Discharge Elimination System (NPDES) permits are allowed to discharge wastes to waters of the state, directly or indirectly, but their discharge must meet certain quality standards as specified in their permits. Permits set limits on pollutants from industrial and municipal dischargers based on the ability of the receiving stream to absorb and dissipate the pollutants. Industries, municipal wastewater treatment facilities, fish hatcheries, and similar facilities typically have NPDES permits. General permits (GEN) are issued to certain categories of discharger rather than to individual facilities. The current discharge permits for the Trask River watershed are listed in Table 3.9.

Table 3.9. U.S. EPA water discharge permits in the Trask River watershed.

ID #	Common Name	Address	River Mi.	Type
1	ODF – Tillamook District H.Q.	4907 E. Third St.	2.24	GEN12C
2	Tillamook Lumber Company (ABN)	3111 Third St.	0.72	GEN12Z
3	Tillamook STP		1.90	NPDES-DOM-C2a
4	Five Rivers Assisted Living & Retirement	3500 12th St.	1.05	GEN12C
5	Treesource Industries, Inc.	5900 Moffett Rd.	4.50	GEN05
6	Peal Point Oyster Company	1802 1st St.	4.00	GEN09
7	S-C Paving Company – Trask River	9575 Trask River Rd.	8.27	GEN12A
8	ODFW – Trask River Hatchery	15020 Chance Rd.	9.70	GEN03
9	Tillamook Industrial Park STP	4000 Blimp Blvd.	5.20	NPDES-DOM-Db
10	Tillamook Industrial Park STP	4000 Blimp Blvd.	1.96	GEN12Z
11	ODFW – Trask Rearing Pond	26915 Trask River Rd.	0.50 on S.F. Trask	GEN03

Water quality limited water bodies found in the Trask River watershed are listed in Table 3.10. This table includes more stream segments than are on the current 303(d) list. This is because once a TMDL has been approved, a water body is removed from the 303(d) list, even though it may still not meet water quality criteria.

3.1.5.2 Water Quality Data and Evaluation Criteria

Water quality data were collected from 100 sites in the Trask River watershed between October 25, 1960 and September 17, 2002 and are available from ODEQ. However, many of those sites were visited only once or twice. Table 3.11 lists the 33 sites that have been sampled more than two times during the period of record. As can be seen from the table, water quality sampling has been concentrated on a relatively few sites, with only 15 locations sampled more than 10 times during the period of record in the ODEQ database.

Table 3.10. Water quality-limited water bodies in the Trask River watershed prior to approval of the TMDL. (Source: ODEQ)

Waterbody Name	River Mile	Parameter	Season	Criteria	Listing Status
Dougherty Slough	0 to 4.9	Dissolved Oxygen	Year Round	Estuarine: 6.5 mg/l	303(d) List
Hoquarten Slough	0 to 3.1	Dissolved Oxygen	Year Round	Estuarine: 6.5 mg/l	303(d) List
Mill Creek	0 to 3	Dissolved Oxygen	Sept. 15 - May 31	Spawning: 11 mg/L or 95% saturation	303(d) List
Mill Creek	0 to 3	Iron	Year Round	Table 20	303(d) List
Trask River	0 to 10.2	Dissolved Oxygen	Sept. 15 - May 31	Spawning: 11 mg/L or 95% saturation	303(d) List
Dougherty Slough	0 to 4.9	Chlorophyll *a*	Year Round	0.01 mg/l	Potential Concern
Hoquarten Slough	0 to 3.1	pH	Year Round	pH: 6.5 to 8.5	Potential Concern
Mill Creek	0 to 4.1	Biological Criteria		Waters of the state shall be of sufficient quality…	Potential Concern
Dougherty Slough	0 to 4.9	Fecal Coliform	Summer	Geometric Mean of 200, No more than 10%>400	TMDL Approved
Dougherty Slough	0 to 4.9	Fecal Coliform	Winter/Spring/Fall	Geometric Mean of 200, No more than 10%>400	TMDL Approved
Hoquarten Slough	0 to 3.1	Fecal Coliform	Summer	Geometric Mean of 200, No more than 10%>400	TMDL Approved
Hoquarten Slough	0 to 3.1	Fecal Coliform	Winter/Spring/Fall	Geometric Mean of 200, No more than 10%>400	TMDL Approved
Mill Creek	0 to 3	Fecal Coliform	Summer		TMDL Approved
Mill Creek	0 to 3	Fecal Coliform	Winter/Spring/Fall		TMDL Approved
Mill Creek	0 to 4.1	Temperature	Summer	Rearing: 17.8^{o} C	TMDL Approved
Mills Creek	0 to 1.2	Fecal Coliform	Summer		TMDL Approved
Mills Creek	0 to 1.2	Fecal Coliform	Winter/Spring/Fall		TMDL Approved
N Fk of N Fk Trask R.	0 to 7.1	Fecal Coliform			TMDL Approved
N Fk of N Fk Trask R.	0 to 7.1	Temperature	Summer	Rearing: 17.8^{o} C	TMDL Approved
North Fork Trask R.	0 to 4.4	Temperature	Summer	Rearing: 17.8^{o} C	TMDL Approved
Simmons Creek	0 to 0.9	Fecal Coliform	Winter/Spring/Fall		TMDL Approved
Trask River	0 to 18.6	Temperature	Summer	Rearing: 17.8^{o} C	TMDL Approved
E Fk of S Fk Trask R.	0 to 12.3	Flow Modification		The creation of tastes or odors or toxic or other condition	Water Quality Limited; No TMDL
North Fork Trask R.	0 to 11.4	Flow Modification		The creation of tastes or odors or toxic or other conditions	Water Quality Limited; No TMDL
Trask River	0 to 10.2	Habitat Modification		The creation of tastes or odors or toxic or other conditions	Water Quality Limited; No TMDL
Trask River	10.1 to 18.5	Flow Modification		The creation of tastes or odors or toxic or other conditions	Water Quality Limited; No TMDL

Table 3.11 Sites in the Trask River watershed sampled for water quality on more than two occasions, 1960 through 2002.

Station Key	Location[a]	Latitude	Longitude	No. Days	No. Tests
13433	Trask River at Hwy 101	45.42986	-123.82278	165	2914
13430	Hoquarten Slough at Hwy 101 (Tillamook)	45.45917	-123.84444	92	903
13431	Trask River at Netarts Road	45.45639	-123.86000	55	870
13428	Dougherty Slough at Hwy 101	45.46528	-123.84389	40	617
13432	Trask River @ Tillamook Loop Road	45.44664	-123.84272	33	464
13429	Dougherty Slough at Wilson R Loop Rd	45.47083	-123.80917	28	402
13435	Trask River at Panther Creek	45.44467	-123.71261	28	320
13434	Trask River at Trask River Loop Road	45.42692	-123.79417	25	253
13484	Holden Creek at Evergreen Street	45.44944	-123.82778	18	88
13485	Holden Creek at Miller Street	45.44972	-123.83750	17	134
13483	Holden Creek at McCormack Loop Road	45.45417	-123.80000	12	160
13537	Trask River at Sp&S Railroad Bridge	45.42978	-123.80097	12	165
12342	Mill Creek at Rm 1.0	45.42525	-123.79253	11	284
13479	North Fork Trask River at Bridge	45.44028	-123.60806	11	82
13506	Hoquarten Slough at Wilson R Loop Rd	45.46500	-123.80917	10	320
13514	Mill Creek at Magnolia Drive	45.41028	-123.78083	9	42
12841	City Of Tillamook STP Final Effluent	45.45694	-123.85536	8	191
13478	Trask River U/S of Milepost 11	45.44417	-123.61444	8	46
13507	Hoquarten Slough at Headwaters	45.45944	-123.78250	6	39
12829	Trask River @ Tillamook Boat Ramp	45.45408	-123.85669	5	154
13535	South Fork Trask River U/S of Trask R Rd	45.43750	-123.60667	5	16
13536	Green Creek at Trask River Road	45.44111	-123.76000	5	23
13538	Elk Creek at Brickyard Road	45.42000	-123.78000	5	30
11936	Trask River 45 Yds D/S of STP Outfall	45.42969	-123.80147	4	103
13480	Edwards Creek Near Hollywood Camp	45.40972	-123.61333	4	13
13481	East Fork Trask River D/S of Fish Hatchery	45.41611	-123.60167	4	13
13482	East Fork Trask River U/S of Fish Hatchery	45.41583	-123.59889	4	16
13504	Mill Creek at Long Prairie Road	45.41556	-123.76583	4	27
13513	Mill Creek at Brickyard Road	45.41667	-123.77750	4	31
12515	M.F./N.F. Trask River at RM 3.0	45.46508	-123.43572	3	244
12835	Hoquarten Slough @ Mouth	45.46444	-123.86383	3	87
13144	Hoquarten Slough at RR Br (0.7 Mi U/S of Hwy 101)	45.46219	-123.83258	3	32
13146	Dougherty Slough at RR Br (O.9 Mi U/S of Hwy 101)	45.46517	-123.83308	3	32

[a] D/S - downstream; U/S - upstream

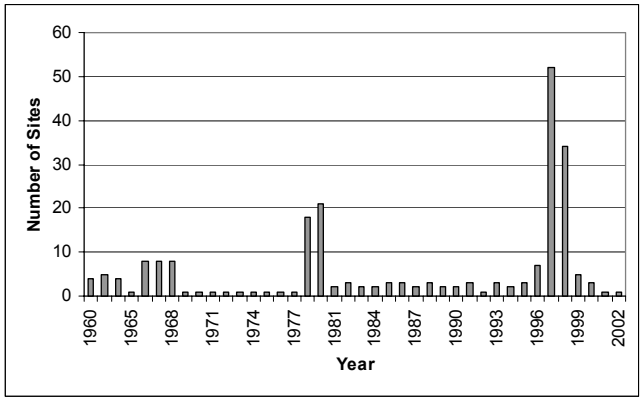

Figure 3.2. Number of sites sampled each year in the Trask River watershed from 1960 to 2002. (Source: ODEQ LASAR database)

Figure 3.2 shows the number of sites from which samples were collected in the Trask River watershed each year between 1960 and 2002, and for which data are available from ODEQ. Sampling intensity has varied considerably from year to year, with many more samples collected in some years than in others. Recently, the number of samples collected (and for which data are available from ODEQ) per year from the watershed has ranged between five and ten. More samples were collected in 1997 and 1998 in conjunction with TMDL development by ODEQ (Figure 3.3).

Table 3.12 shows the percent of samples that exceeded the relevant water quality criteria for the parameters and seasons included on the current 303(d) list of water quality limited water bodies, based on data available from ODEQ.

For stream segments listed with respect to narrative criteria, such a percent calculation is not possible because the criteria are not quantitative. High percent sample exceedences are mainly confined to the lower portions of the watershed, especially Mill Creek and Hoquarten and Dougherty Sloughs. These involve DO, FCB, and pH (Table 3.12). Temperature exceedences are more broadly distributed throughout upland portions of the watershed, mainly along mainstem reaches.

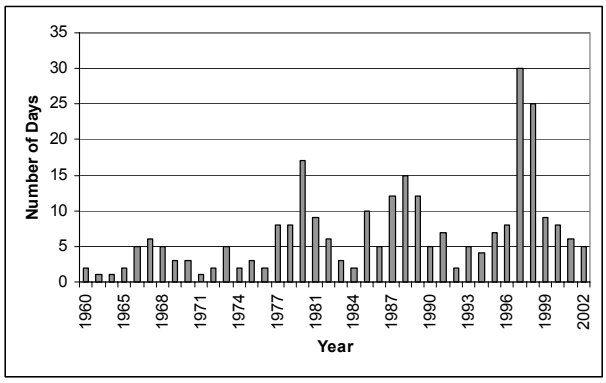

Figure 3.3. Number of days water quality data were collected each year in the Trask River watershed between 1960 and 2002.

The evaluation criteria used for this assessment are based on the Oregon Water Quality Standards for the North Coast Basin (ORS 340-41-205) and on literature values where there are no applicable standards, as for example, for nutrients (WPN 1999). They are not identical to the 303(d) water quality standards in that not all seasonal variations are included. The evaluation criteria listed in Table 3.13 are used as indicators that a possible problem may exist.

The water quality evaluation criteria were applied to the available data by noting how many, if any, of the water quality data exceeded the criteria. If sufficient data were available, a judgment was made based on the percent exceedence of the criteria as shown in Table 3.14. If insufficient, or no, data were available, this was noted as a data gap to be filled by future monitoring. If any water quality parameter was rated as “moderately impaired” or “impaired” using these criteria, water quality in the stream reach in question is considered impaired for purposes of the

Table 3.12. Percent of samples (based on ODEQ data) from water quality limited stream segments that exceeded the relevant water quality criteria.

Waterbody Name	River Mile	Parameter	Season	Criteria	No. sites	No. samples	Percent exceed
Mill Creek	0 to 4.1	Biological Criteria		Waters of the state shall be of sufficient quality……	na	na	na
Dougherty Slough	0 to 4.9	Chlorophyll *a*	Year Round	>0.01 mg/l	2	10	60
Dougherty Slough	0 to 4.9	Dissolved Oxygen	Year Round	Estuarine: <6.5 mg/l	3	95	42
Hoquarten Slough	0 to 3.1	Dissolved Oxygen	Year Round	Estuarine: <6.5 mg/l	5	78	36
Mill Creek	0 to 3	Dissolved Oxygen	Sept. 15 - May 31	Spawning: <11 mg/L or 95% saturation	2	17	29
Trask River	0 to 10.2	Dissolved Oxygen	Sept. 15 - May 31	Spawning: <11 mg/L or 95% saturation	26	427	28
Dougherty Slough	0 to 4.9	Fecal Coliform	All year	> 200 cfu/100 mL	2	86	67
				> 400 cfu/100 mL	2	86	59
Hoquarten Slough	0 to 3.1	Fecal Coliform	All year	> 200 cfu/100 mL	5	203	65
				> 400 cfu/100 mL	5	203	51
Mill Creek	0 to 3	Fecal Coliform	All year	> 200 cfu/100 mL	5	26	58
				> 400 cfu/100 mL	5	26	50
N Fk of N Fk Trask R.[a]	0 to 7.1	Fecal Coliform		> 200 cfu/100 mL	1	2	0
				> 400 cfu/100 mL	1	2	0
E Fk of S Fk Trask R.[a]	0 to 12.3	Flow Modification		The creation of tastes or odors or toxic or other conditions	na	na	na
N Fork Trask R.	0 to 11.4	Flow Modification		The creation of tastes or odors or toxic or other conditions	na	na	na
Trask River	10.1 to 18.5	Flow Modification		The creation of tastes or odors or toxic or other conditions	na	na	na
Trask River	0 to 10.2	Habitat Modification		The creation of tastes or odors or toxic or other conditions	na	na	na
Mill Creek	0 to 3	Iron	Year Round		1	4	50
Hoquarten Slough	0 to 3.1	pH	Year Round	pH: 6.5 to 8.5	6	122	32
Mill Creek	0 to 4.1	Temperature	Summer	Rearing: 17.8 C	5	10	20
N Fk of N Fk Trask R.[a]	0 to 7.1	Temperature	Summer	Rearing: 17.8 C	1	2	0
North Fork Trask R.	0 to 4.4	Temperature	Summer	Rearing: 17.8 C	1	3	67
Trask River	0 to 18.6	Temperature	Summer	Rearing: 17.8 C	9	113	31

[a] The data used to classify this site as water quality limited were not available for this analysis.

Table 3.13. Water quality criteria and evaluation indicators (WPN 1999).	
Water Quality Attribute	Evaluation Criteria
Temperature	Daily maximum of 64° F (17.8° C) (7-day moving average)
Dissolved Oxygen	8.0 mg/L salmonid rearing, 6.5 mg/L estuarine
pH	Between 6.5 and 8.5
Nutrients[a] Total Phosphorus Total Nitrogen	 8.75 μg/L 0.10 mg/L
Chlorophyll *a*	1.9 μg/L[a] 15 μg/L[b]
Bacteria	<u>Water-contact recreation</u> 126 E. coli/100 mL (30-day log mean, 5 sample minimum) 406 E. coli/100 mL (single sample maximum)
	<u>Marine water and shellfish areas</u> 14 fecal coliform/100 mL (median) 43 fecal coliform/100 mL (not more than 10% of samples)
Turbidity	50 NTU maximum (fish feeding impaired) 10 NTU adverse aesthetic effect
Organic Contaminants	Any detectable amount
Metal Contaminants Arsenic Cadmium Chromium (hex) Copper Lead Mercury Zinc	 190 μg/L 0.4 μg/L 11.0 μg/L 3.6 μg/L 0.5 μg/L 0.012 μg/L 32.7 μg/L

[a] Based on current U.S. EPA guidance for nutrients and chlorophyll for Ecoregion II (U.S. EPA 2002).
[b] Based on Oregon DEQ action levels (ORS 340-41-0150).

Table 3.14. Criteria for evaluating water quality impairment (WPN 1999).	
Percent of Data Exceeding the Criterion	Impairment Category
Less than 15%	No impairment
15 to 50%	Moderately impaired
More than 50%	Impaired
Insufficient data	Unknown

assessment. The condition that caused the impairment should be addressed through watershed management or stream restoration activities.

In addition to the ODEQ data, there are data for some water quality parameters available for sites that were sampled in the lower watershed in conjunction with efforts by the TBNEP. From December 1996 to January 2002, E&S Environmental Chemistry, Inc. conducted a river water quality characterization and monitoring effort that included the Trask River. Water samples were collected periodically at the 5th St. dock[2] at RM 1.5, and occasionally at other sites. The monitoring program focused on storm sampling for FCB and TSS, and approximately bimonthly sampling for nitrogen (NO_3^-, NH_4^+, TKN) and total phosphorus. A total of 27 storms were sampled, with typically six to eight samples (plus QA samples) collected and analyzed for FCB and TSS at the primary monitoring site during each storm.

3.1.5.3 Water Quality Parameters

Temperature

The Trask River has been recognized as water quality limited for temperature, and a TMDL has been established through the Tillamook Bay Watershed TMDL (ODEQ 2001). There have been 964 temperature measurements on discrete samples reported from the Trask River watershed since 1960. Of these, 12% exceeded the evaluation criterion of 17.8°C (64°F) for salmonid rearing, and 36% exceeded the evaluation criterion of 12.8°C (55°F) for salmonid spawning (Figure 3.4). The sites with samples that exceeded the evaluation criterion are shown on Figure 3.5.

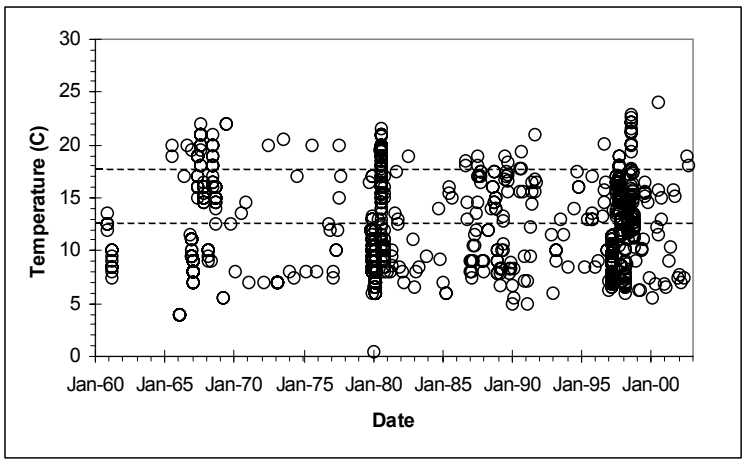

Figure 3.4. Water temperature data measured at various sites in the Trask River watershed between 1960 and 2002. The dashed lines indicate the evaluation criteria of 17.8° and 12.8°C (64° and 55°F, respectively).

Prior to TMDL establishment, the Trask River was 303(d) listed for water temperature from the mouth to the South Fork of the Trask River (19.2 miles). In addition, the North Fork was listed from its mouth to Bark Shanty Creek (4.4 miles), and the North Fork of the North Fork was listed from the mouth to the headwaters.

[2]Initially, the sampling site was the Tillamook Toll Road bridge, but it was moved to 5th St. in 1998 when construction work limited access to the bridge.

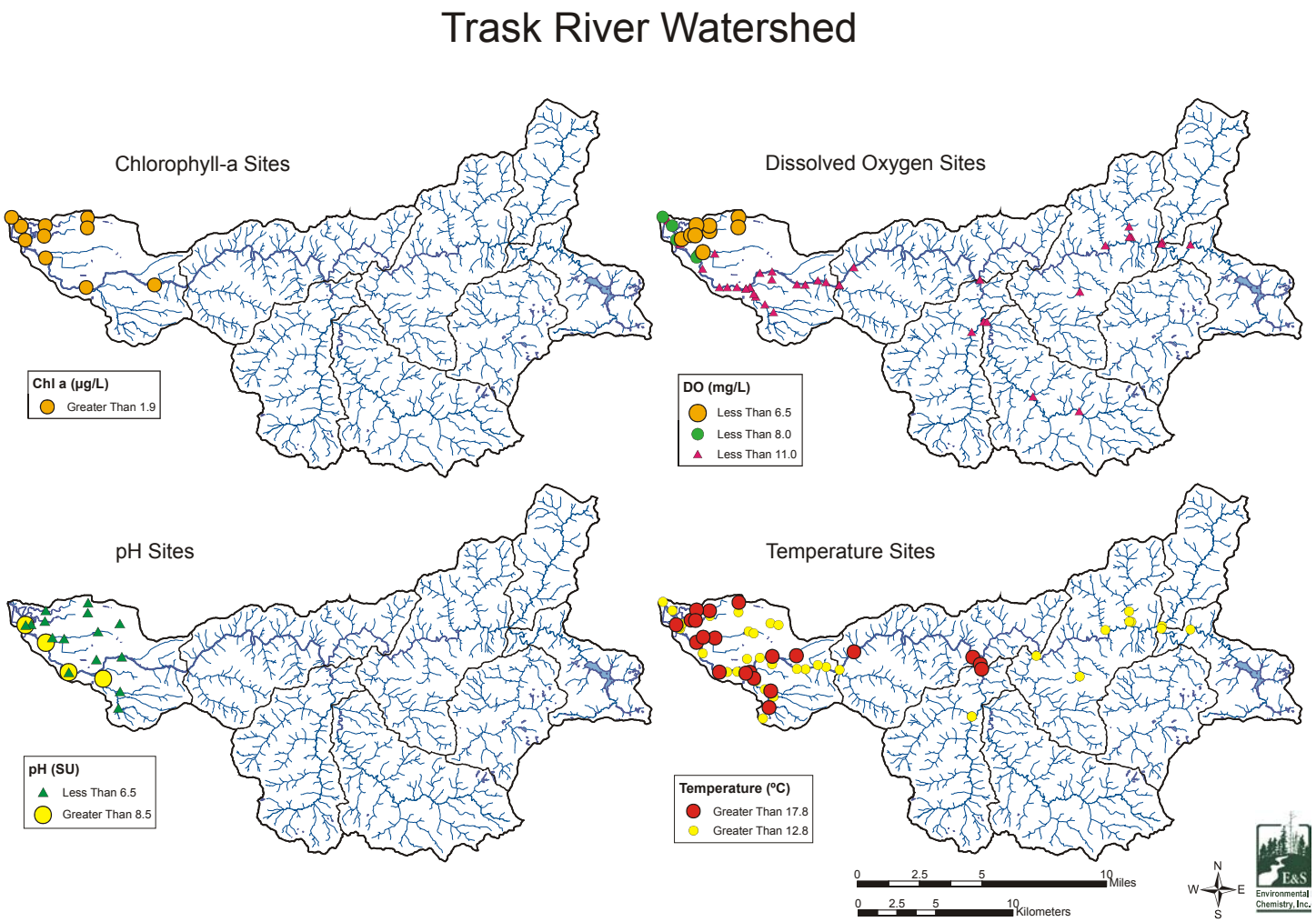

Figure 3.5. Location of sampling sites for which one or more measured value exceeded the criterion for chlorophyll *a*, dissolved oxygen, pH, and temperature.

Continuous temperature monitoring (30 minute intervals) was conducted by ODEQ in 1998 as part of the TMDL process. Figure 3.6 shows the number of days the 7-day mean maximum daily temperature exceeded the relevant criteria at the continuous monitoring sites. All but two of the monitored sites on mainstem reaches of the Trask River and its major tributaries exceeded the 7-day mean maximum daily temperature criterion of 64°F for part of the summer. Highest temperatures are reached in late July and August. Adult migration and holding occurs in the Trask River system during July and/or August for spring and fall chinook, summer steelhead, and cutthroat trout (both resident and sea-run). Rearing occurs in both July and August for all of the salmonid species that are present within the Trask River system, except chum salmon, which do not rear in fresh water (ODEQ 2001).

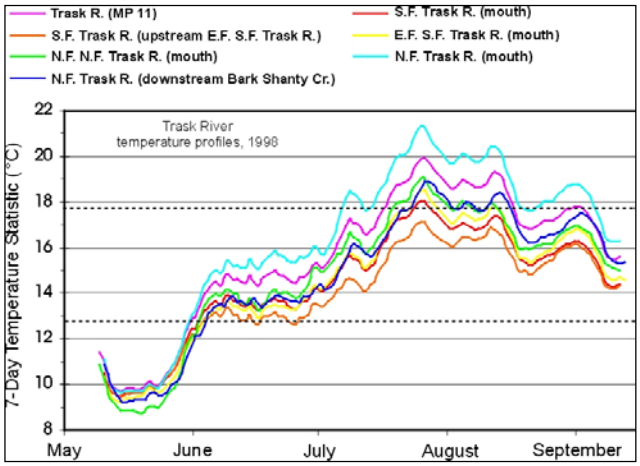

Figure 3.6. Continuous temperature data from the Trask River watershed: 7-day mean maximum daily temperature in 1998. (Source: ODEQ 2001)

Warm point source discharges into the Trask River can be a source of stream heating, but such an effect is not expected to be substantial. Discharge temperature for the Tillamook STP is restricted under the NPDES permit to 71°F, and the flow rate is low (1.64 cfs).

Dissolved Oxygen

Of 417 measurements of DO concentration taken at various sites between 1960 and 2002, 62% were less than the 11 mg/L criterion for salmonid spawning, 20% were below the 8 mg/L criterion for salmonid rearing, and 11% were below the 6.5 mg/L criterion for estuaries (Figure 3.7). However, at the lowland sites that may experience tidal influence, 40% of values were below the 6.5 mg/L criterion. Sites not meeting the evaluation criteria are shown in Figure 3.5. Based on these DO data, the Trask River watershed might be considered impaired with respect to salmonid spawning, and moderately impaired with respect to salmonid rearing. Additional site-specific studies and studies focused on the times of salmonid utilization of the stream system may be required to determine the seasonal and spatial extent of any potential DO limitations.

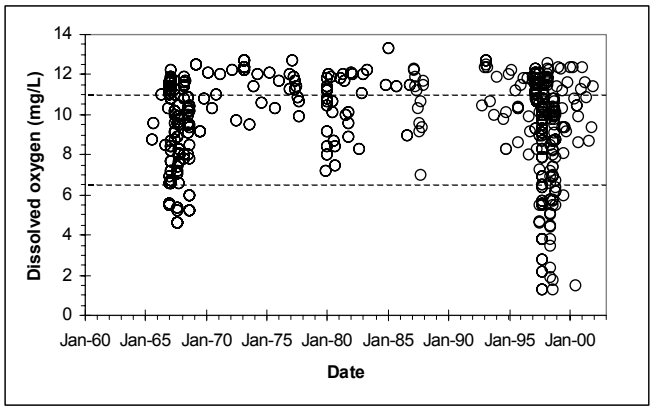

Figure 3.7. Dissolved oxygen measured at various sites in the Trask River watershed between 1960 and 2002. The dashed lines indicate the evaluation criteria of 11.0 and 6.5 mg/L.

pH

There are 843 measurements of pH available from the Trask River watershed between 1960 and 2002. Of these, 10% were below the evaluation criterion of 6.5, but only 0.5% were greater than the upper limit of 8.5 (Figure 3.8). Tributaries of the lower Trask River exhibited a relatively high number of low pH values, but this is not unexpected because of the abundant rainfall received. The natural pH of rainwater can be as low as 5.7, and this is reflected in the low pH found on occasion in some of the smaller tributary streams. Figure 3.5 shows the sites that had pH values outside the range of the evaluation criterion. All were located in the lower watershed. There is no reason to suspect that water quality is impaired with respect to pH.

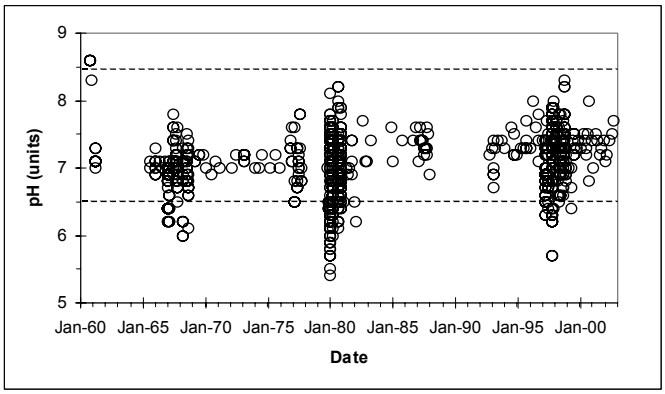

Figure 3.8. pH measured at various sites in the Trask River watershed from 1960 through 2002. The dashed lines indicate the evaluation criteria of 8.5 and 6.5 pH units.

Chlorophyll *a*

The ODEQ established an action level of 0.015 mg/L for chlorophyll *a* in rivers and streams. EPA proposed a guideline value of 0.0019 mg/L for chlorophyll in the Western Forested Mountains ecoregion. Chlorophyll *a* has been measured on 69 samples from the Trask River watershed since 1960 (Figure 3.9). Of these values, 7% exceeded 0.015 mg/L and 43% exceeded 0.0019 mg/L. The Trask River watershed would not be considered impaired with respect to chlorophyll. Figure 3.5 shows sites with chlorophyll *a* values that exceeded the Oregon action level.

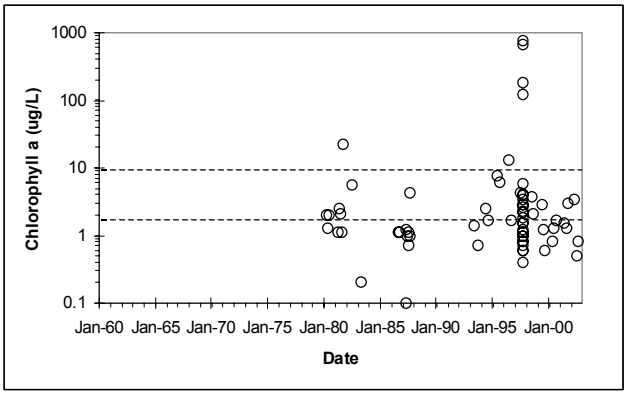

Figure 3.9. Chlorophyll *a* values measured in water samples from the Trask River watershed from 1960 to 2002. Dashed lines represent the Oregon action level (10 μg/L) and the EPA guidance value (1.9 μg/L).

Nutrients

There are currently no State of Oregon standards for nitrogen or phosphorus. The evaluation criteria are based on current (2002) U.S. EPA guidance for nutrients and chlorophyll *a* for Ecoregion II (Western Forested Mountains). The nitrogen criterion is based on total nitrogen, whereas the available data from the Trask River watershed are reported as nitrate-nitrogen. This may cause an underestimate in the number of samples that exceed the criterion, but this bias is expected to be small.

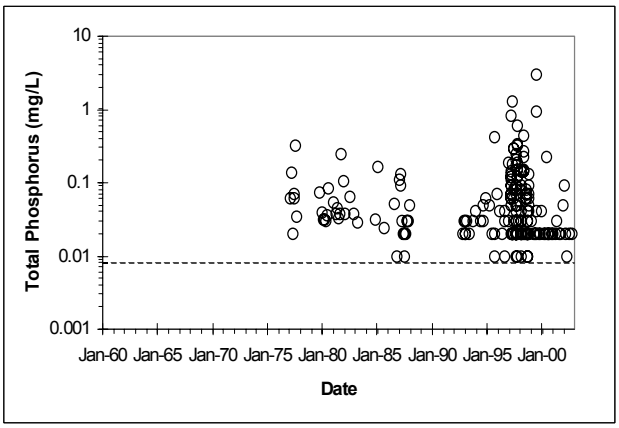

Figure 3.10. Total phosphorus values measured in water samples from the Trask River watershed in 1960 through 2002. The dashed line marks the EPA guidance value of 0.00875 mg/L.

Total phosphorus (TP) was measured on 230 samples from the Trask River watershed from 1960 to 2002. All of these samples exceeded the U.S. EPA guidance value for TP (Figure 3.10). In fact, the guidance level for TP is lower than the reporting limit for the analytical method used to measure TP. This suggests that the Trask River watershed streams are impaired with respect to P or that the guidance level is too low. Studies in neighboring watersheds have reported naturally high P content in some sedimentary bedrock types, although not all sedimentary rock types appear to be high in P (Dave Degenhardt, ODF, pers. comm., 2003). It may require further study to determine the principal source of the P in the Trask River watershed.

Nitrate-nitrogen (NO_3-N) was measured on 286 water samples from the Trask River watershed from 1960 to 2002. Of these samples, 92% exceeded the U.S, EPA guidance value for total N (Figure 3.11). This suggests that the streams in the watershed are impaired with respect to N. However, there are potential natural sources of N in the basin. Bacteria associated with alder trees are capable of fixing atmospheric N, and can be a source of dissolved N in streams draining forested areas. Figure 3.11 suggests that there has been a general increase in nitrate-nitrogen in basin streams between about 1967 and 1977, and perhaps thereafter. This could be consistent with an increased input of nitrogen to the streams from a growing alder forest. It may require further study to determine the source of nitrogen in the Trask River watershed.

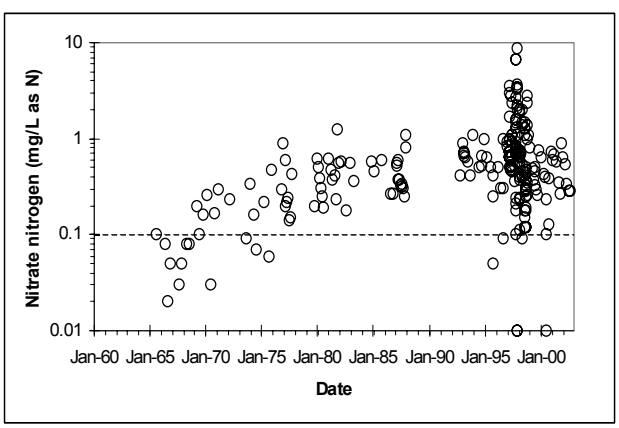

Figure 3.11. Nitrate-nitrogen (as N) values measured in water samples from the Trask River watershed from 1960 to 2002. The dashed line represents the EPA guidance value for total nitrogen.

Bacteria

Two wastewater treatment plants discharge to the Trask River downstream from public lands, although under proper operations and most flow conditions they should not be a source of bacteria to the stream. The Port of Tillamook Bay wastewater treatment plant discharges to the river during the fall-spring period at RM 5.2 and the City of Tillamook discharges year round at RM 1.9 (DEQ 2001).

The indicator bacterium used by ODEQ for evaluating bacterial contamination of recreational waters changed in 1996 from FCB to *E. coli*, a species commonly associated with the digestive tract microflora of mammals and birds. In general, *E. coli* is a subset of FCB, although for measurement purposes both are somewhat operationally defined. In other words, the measurement techniques do not precisely discriminate among bacterial types or species. The change was made because *E. coli* is believed to more directly reflect contamination from sources that also carry pathogens harmful to humans. FCB is still used as the standard for assessing water quality in commercial shellfish harvesting areas, such as in Tillamook Bay. Because there are two standards, both applicable to the Trask River System, that utilize different indicators, ODEQ samples for both. Most data currently available for the Trask River are for FCB. The previous FCB standard for recreation contact in freshwater was:

- geometric mean of 5 samples not to exceed FCB > 200 cfu/100 ml, and
- no more than 10% of samples to exceed FCB = 400 cfu/100 ml.

It has been replaced by the *E. coli* standards for fresh and estuarine waters given in Table 3.13.

The Trask River is not on the 303(d) list for bacteria. However, examination of the available historical data (mostly for the lower river) reveals frequent violations of the applicable criteria. In the lower river, the FCB criterion (no more than 10% of the samples can be greater than 400 counts/100 mL) is exceeded on occasion throughout the year.

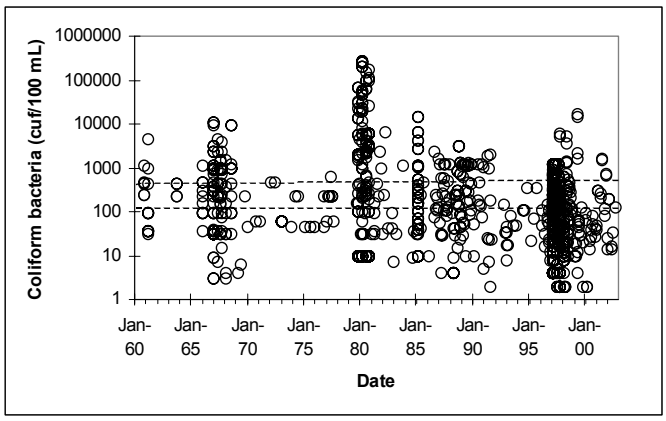

Figure 3.12. Coliform bacteria measured at various sites in the Trask River watershed between 1960 and 2002. Dashed lines indicate the evaluation criteria of 126 and 406 cfu/100 mL.

Concentration of bacteria in the river and in Tillamook Bay are often too high to allow safe use of these waters for recreational swimming/ wading and shellfish harvesting, respectively. Examination of the available ODEQ data shows that 50% of the 836 measurements taken from 1960 to 2002 exceeded 126 counts/100 mL, and 28% exceed 406 counts/100 mL (Figure 3.12). Sites that exceeded 406 counts/ 100 mL are shown in Figure 3.13.

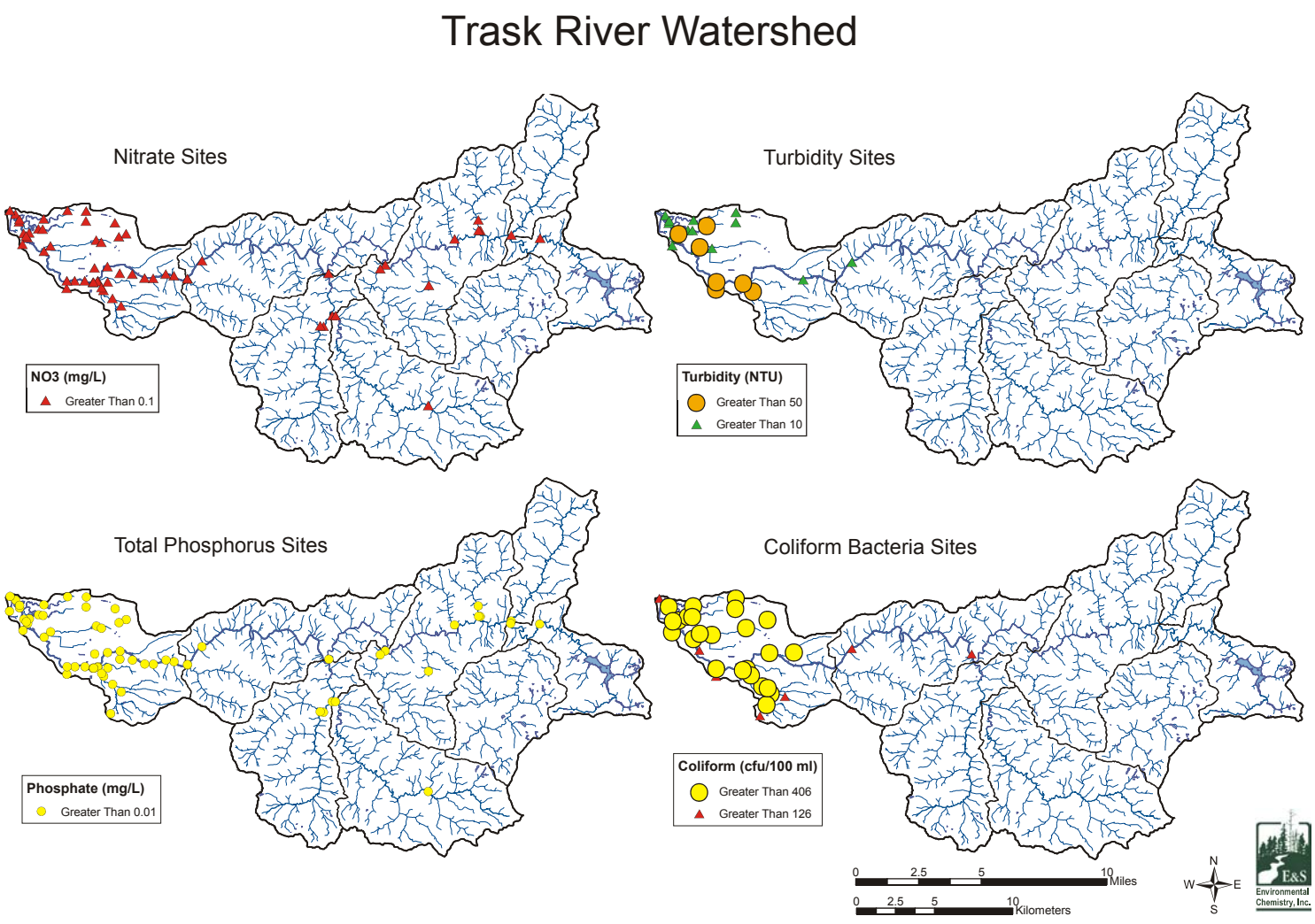

Figure 3.13. Location of sampling sites for which one or more measured value exceeded the criterion for nitrate, turbidity, total phospohrus and fecal coliform bacteria.

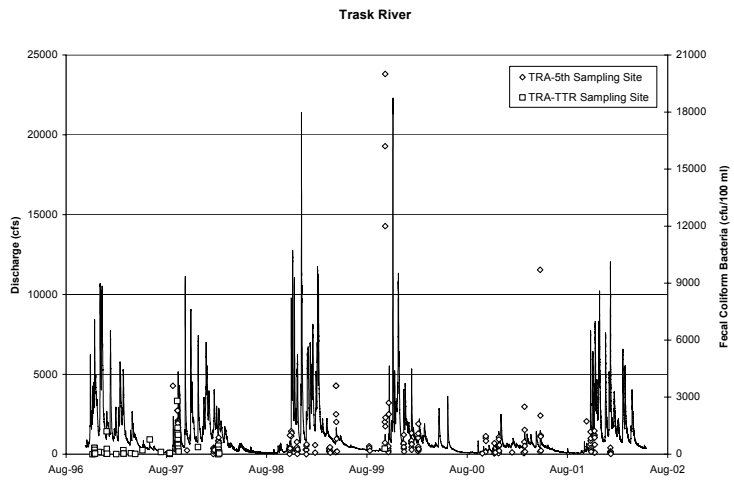

Figure 3.14. Discharge and measured values of fecal coliform bacteria in the lower Trask River throughout the period of monitoring from 1996 to 2002 (Sullivan et al. 2002).

Fecal coliform bacteria concentrations in the lower Trask River mainstem reported from the TBNEP storm sampling project varied annually, seasonally, and episodically, with values ranging from near 0 to over 20,000 cfu/100 ml (Sullivan et al. 2002, Figure 3.14). Concentrations in excess of 500 cfu/100 ml were frequently observed during fall storms. During most years studied, the majority of monitored storms showed storm median and geomean values in the lower river higher than 200 cfu/100 ml (Table 3.15), the previous FCB threshold criterion for human contact recreation. The median measured value in storms in the fall season, during the period December 1996 to January 2002, was more than twice as high as the median measured values during winter or spring. More than 75% of the fall samples (n=87) showed values higher in the lower Trask River than the 200 cfu/100 ml health criterion value. Concentrations were lower during winter and spring, but more than half of the samples during those seasons also exceeded the 200 cfu/100 ml criterion (Table 3.16).

Table 3.15. Percent of monitored storms having median or geomean FCB concentration in the lower Trask River higher than 200 cfu/100 ml. (Source: Sullivan et al. 2002)

Water Year	n[a]	Median	Geomean
1997	2	0	0
1998	5	80	60
1999	6	100	33
2000	5	100	100
2001	5	80	80
2002	3	67	67

[a] number of storms sampled.

Table 3.16. FCB and TSS concentrations by season[a] in the lower Trask River, based on data collected during rainstorms between 1996 and 2002. (Source: Sullivan et al. 2002)						
	FCB (cfu/100 ml)			TSS (mg/L)		
	Fall	Winter	Spring	Fall	Winter	Spring
Number of samples	87	65	58	54	72	36
1st Quartile	205	93	111	5	18	3
Median	560	234	245	15	54	4
3rd Quartile	1153	440	788	51	152	10
[a] Fall was defined as Sept. 1 to Nov. 30, winter as Dec. 1 to Feb. 15, and spring as Feb. 16 to May 31						

Turbidity

The Oregon water quality standard for turbidity does not provide a numerical value, but rather defines a limit of not more than 10% increase as a result of any activity. The evaluation criteria have been set at 50 NTU, a level at which fish feeding might be affected by poor visibility, and 10 NTU, a level that might cause adverse aesthetic effects. Of 360 turbidity measurements, 29% exceeded 10 NTU, and 2.7% exceeded 50 NTU (Figure 3.15). Streams in the Trask River watershed do not appear to be seriously impaired with respect to turbidity.

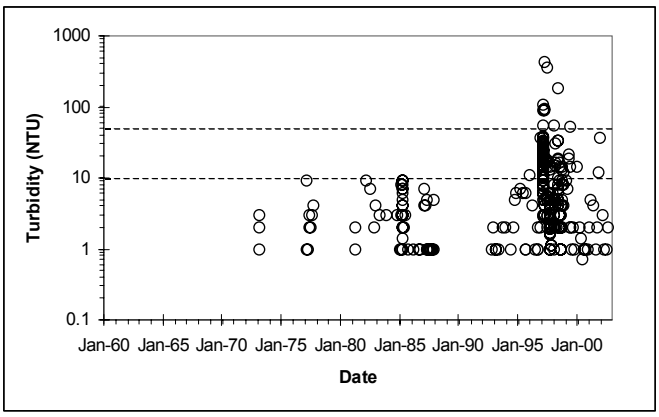

Figure 3.15. Turbidity measurements made on water samples from the Trask River watershed from 1960 to 2002. Dashed lines represent evaluation criteria of 10 and 50 NTU.

Organic Contaminants

Ten sites were tested for 57 organic contaminants in 1998 as part of the Tillamook groundwater study. No organic contaminant was present above the method detection limit at any of the sites.

3.1.5.4 Summary of Water Quality Concerns

The major water quality concerns in the Trask River watershed appear to be temperature, FCB, and DO. The migration, rearing, and spawning of salmonid fish may be put at risk throughout mainstem reaches in portions of the watershed by high water temperatures (those that exceed

64˚F for migration or 55˚F for spawning). The most important factor contributing to elevated water temperature, at least along mainstem reaches, is likely reduction in the extent of riparian shade in response to past logging, fires, and land-clearing activities (ODEQ 2001). The widening of stream channels subsequent to removal of riparian vegetation is also believed to be important in this regard, but conclusive evidence is lacking. It is unclear whether mainstem river temperatures were naturally below criteria values, even under reference conditions. Fecal coliform bacteria, including *E. coli*, are contributed to the Trask River from dairy farming and other agricultural activities, urban land use, rural residential housing, and sewer treatment systems (Jackson and Glendening 1982, Sullivan et al. 1998 a, b). Shellfish (especially oyster) harvest in the bay is dependant on water having very low FCB concentrations. Commericial harvesting is now restricted whenever flow in the adjacent Wilson River exceeds 2500 cfs, due to the increased risk of bacterial contamination. Dissolved oxygen impairment is focused largely on the lowland areas, especially the sloughs. Organic contaminants associated with industrial, agricultural, and urban sources of pollution likely contribute to low DO in these areas, especially those having poor river and tidal flushing. Nitrogen and phosphorus concentrations in the Trask River, including at the transition between forest and agricultural lands, are also high relative to guidance criteria values, most likely due to the abundance of alder in the riparian zone and erosional inputs, respectively.

3.1.5.5 Water Quality Trends

It is difficult to detect trends in water quality data, including the data available for this report, for a number of reasons. Most of the data were not gathered under a statistical framework designed to detect trends; the data may vary seasonally and may be autocorrelated; changes in sampling or analytical methods may have introduced spurious shifts in values; there may be an uneven distribution of data through time, with long gaps having little data interspersed with periods of intense data collection; and so on. We have, however, been able to find trends in such data through a three-step analytical process. The long-term time series data were plotted against day of the year. A curve that minimizes the overall residual was then fit to the data, and residuals (the difference between the calculated value and the actual value) were calculated. The residuals were plotted against the actual collection date, and a linear regression line generated. The slope of this line indicates the direction and magnitude of any long-term trend that may exist in the data after removing any bias associated with sampling seasonality. This process is outlined in Figure 3.16, using stream temperature as an example.

The resulting residual plots for primary variables other than temperature are shown in Figure 3.17. Over the period of record, since about 1960 to 1977 (depending on variable), stream temperature, FCB, ortho-phosphate, and total phosphorus data all suggest declining trends. Nitrate-nitrogen, DO, and turbidity data suggest increasing trends. All of the residual trends were statistically significant at $p \leq 0.05$. The highest r^2 values were for nitrate-nitrogen (0.48) and temperature (0.14). The statistical significance of the DO and turbidity residual plots appear to be attributable to a relatively small number of low DO values measured in the mid 1960s and high turbidity values measured in 1997, respectively. Other water quality trends suggest that temperature, FCB, and phosphorus (total phosphorus and ortho-PO_4) conditions may be

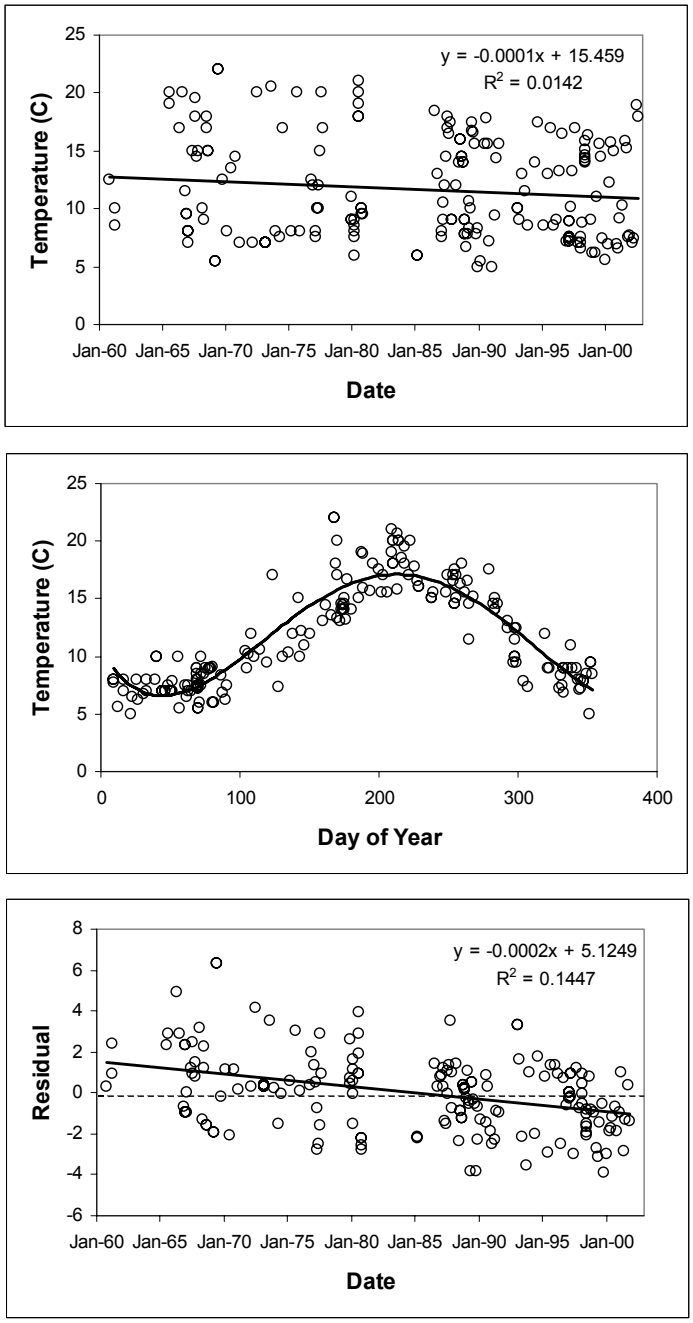

Figure 3.16. Temperature trends analysis for available Trask River temperature data at all measured locations within the watershed, based on ODEQ data. Raw data are given in the top panel; stream temperature versus day of year is given in the middle panel; the residual plot is given in the bottom panel. To account for the possibility of seasonal variation in the data, a three-step process was used to evaluate water quality trends. Available data were plotted against day of the year and a curve was fitted through the data. The calculated residuals were then plotted against date and a linear regression line plotted. The slope (and its statistical significance) of the regression line indicates any trend in the data.

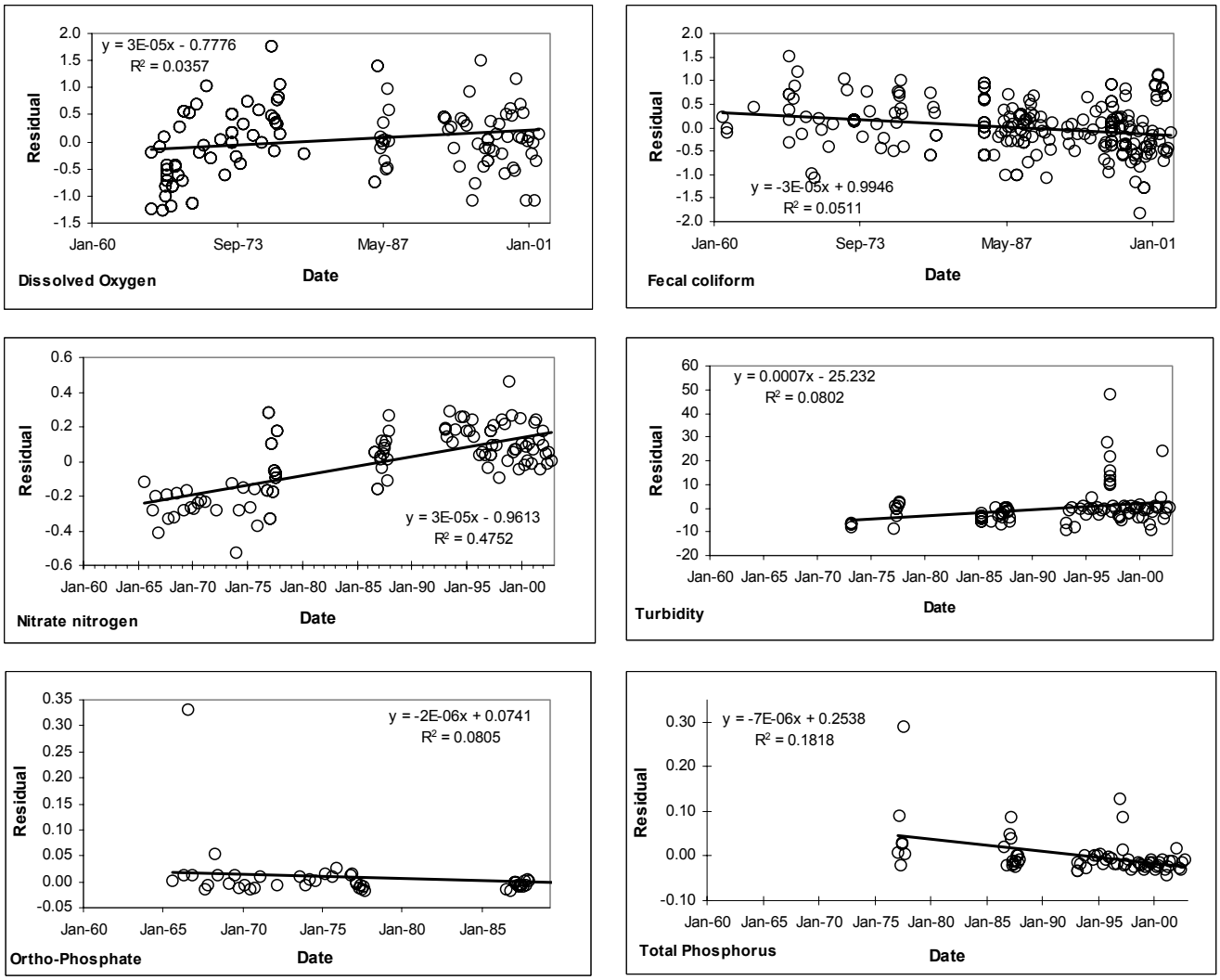

Figure 3.17. Residual plots for dissolved oxygen, fecal coliform bacteria, nitrate-nitrogen, ortho phosphate-phosphorus, total phosphorus, and turbidity. All trends lines shown are statistically significant at $p \leq 0.05$.

improving, whereas nitrate-nitrogen conditions are deteriorating (concentrations are increasing) in the Trask River watershed.

3.1.6 AQUATIC SPECIES AND HABITAT

3.1.6.1 Fish and Fish Habitat

Anadromous salmonid species known to occur in the Trask River watershed include chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), and sea-run cutthroat trout (*O. clarkii*). Although details of their life

histories and habitat requirements differ substantially, all spawn in fresh water, migrate through the estuary, and rear for varying lengths of time in the ocean before returning to their natal streams to complete their life cycle. Resident cutthroat trout are also present throughout the Trask River watershed.

The National Oceanic and Atmospheric Administration (NOAA) fisheries division, has listed coho salmon as Threatened along the Oregon Coast. Coastal cutthroat and steelhead are candidates for listing. Listing for chum and chinook was not warranted as determined by NOAA, although chum is listed as Threatened under the State of Oregon's Endangered Species Act. Coastal cutthroat and Pacific lamprey (*Lampetra tridentate*) are listed as State Species of Concern (Table 3.17). Pacific lamprey, together with three other lamprey species, have recently been included in a petition for T&E listing with the U.S. Fish and Wildlife Service (USFWS).

Table 3.17. Listing status of fish species.

Fish Species in the Trask River watershed	Federal Status	ODFW Status
Chinook Salmon	--	--
Coho Salmon	Threatened	Critical
Chum Salmon	--	Critical
Steelhead	Candidate	Vulnerable
Coastal Cutthroat Trout	Species of Concern	Vulnerable
Pacific Lamprey	Species of Concern	Vulnerable
River Lamprey	Species of Concern	Vulnerable
Sculpin	--	--
Stickleback	--	--

Coho Salmon

Juvenile coho salmon normally spend one summer and one winter in fresh water. They migrate to the ocean in the spring, generally one year after emergence. Most adults mature at 3 years of age (ODFW 1995).

Coho salmon populations along the entire Oregon coast are considered by ODFW to be depressed. The record of coho abundance over the past 52 years shows a trend of decline (Jacobs et al. 2002). Historically, the Trask River was an important producer of coho salmon (TBNEP 1998a), contributing significantly to the Tillamook Bay population. The annual commercial catch for the Tillamook Bay during the 1930s ranged from 25,000 to 74,000. By the late 1980s, the total combined harvest of naturally-produced Tillamook Bay coho was estimated to average 3,500 annually (Bodenmiller 1995). The recreational catch of coho in Tillamook Bay and its tributaries has been estimated since 1975, based on angler salmon/steelhead reporting tag returns. Harvest rates averaged 1,785 fish annually and have shown wide interannual variation (TBNEP 1998a).

The distribution of coho salmon within the Trask River watershed is shown in Plate 6. Recently, there have been signs of improvement in coho population abundance. The number of returning adult spawners has increased in recent years from the historically low levels observed in 1997 and 1998. The number of adult spawners observed in peak counts in the Trask River watershed in 2001 averaged 4.6 per mile, and in 2002 averaged 18.0 per mile. Although an estimate of the

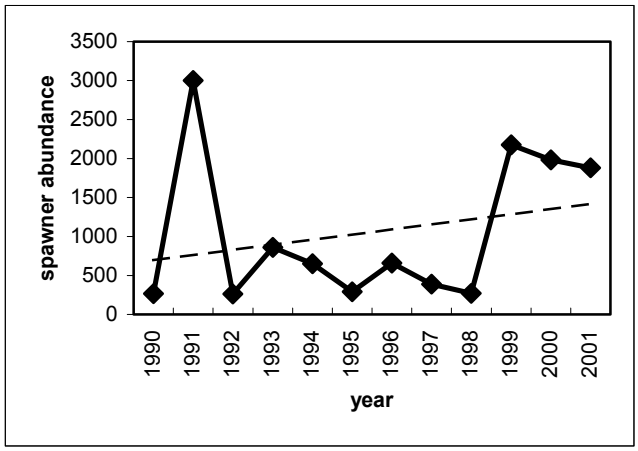

Figure 3.18. Wild coho spawner abundance in the Tillamook Basin, 1990-2001 (Jacobs et al. 2002).

size of the overall wild coho spawner population has not been determined for the Trask River separately from other Tillamook Bay runs, preliminary data for combined Tillamook Bay runs estimated an adult spawner population of 1,956 in 2001 and 2,158 in 2002, in contrast to the record low of 271 in 1998 (Jacobs et al 2002; Figure 3.18).

Medium and large streams throughout the Trask River watershed, including all subwatersheds, provide habitat for coho. Spawning and rearing occur primarily in the mainstem streams in the South Fork, East Fork of the South Fork, and the North Fork subwatersheds.

Chinook Salmon

Both fall and spring chinook salmon are present in the Trask River watershed. Chinook salmon populations exhibit a wider range of life history strategies than coho or chum salmon (Nicholas and Hankin 1989). Generally, subyearling juveniles rear in coastal streams from three to six months and rear in estuaries from one week to five months. Chinook salmon usually enter the ocean during their first summer or fall (ODFW 1995). Mature fall chinook (2 to 6 years of age) return to the Trask River from early September through mid-February. Peak entry into the watershed occurs in mid-October, and spawning from October to January. Spring chinook enter the Trask River from April through June, peaking in May (Nicholas and Hankin 1988). Spawning begins as early as the first week in September and peaks during the last week of September or first week of October (TBNEP 1998a).

In the Tillamook Basin, there has been a declining trend for fall chinook over the past 16 years, in contrast to the increasing or stable trends for populations elsewhere along the Oregon coast. Peak counts for the basin have declined from over 100 spawners per mile to less than 50 per mile from 1986 to 2001 (Jacobs et al. 2002).

Chinook use the mainstem Trask River from the Lower Trask subwatershed high into the upper watershed (Plate 7). Fall chinook are found extensively in the large tributary streams throughout the watershed, spawning and rearing in every subwatershed of the Trask River watershed. Spring chinook are also widespread, spawning and rearing in all subwatersheds except Elkhorn Creek (Plate 7).

Chum Salmon

The chum salmon rears in the Pacific and Arctic oceans. Chum salmon in Oregon require typical low gradient, gravel-rich, barrier-free freshwater habitats and productive estuaries. Most of the chum salmon life span is spent in a marine environment. Adults are strong swimmers, but poor jumpers, and are restricted to spawning areas below barriers, including minor barriers that are easily passed by other anadromous species. Juveniles are intolerant of prolonged exposure to freshwater and migrate to estuarine waters promptly after emergence. A brief residence in an estuarine environment appears to be important for smoltification and for early feeding and growth. Chum salmon mature at 2 to 6 years of age and may reach sizes over 40 pounds (ODFW 1995).

Chum have not been monitored in the Trask River watershed, so population abundance and trend information is not available specific to the Trask. However, ODFW has collected peak counts of spawning chum salmon since 1948 in the Kilchis, Miami, and Wilson River watersheds (Figure 3.19). Despite high interannual variability, the chum population has been declining since 1954, reaching a low of 30 fish per mile in 1996. In 2001, peak counts jumped up to 303 per mile, the highest density in 15 years (Jacobs et al. 2002).

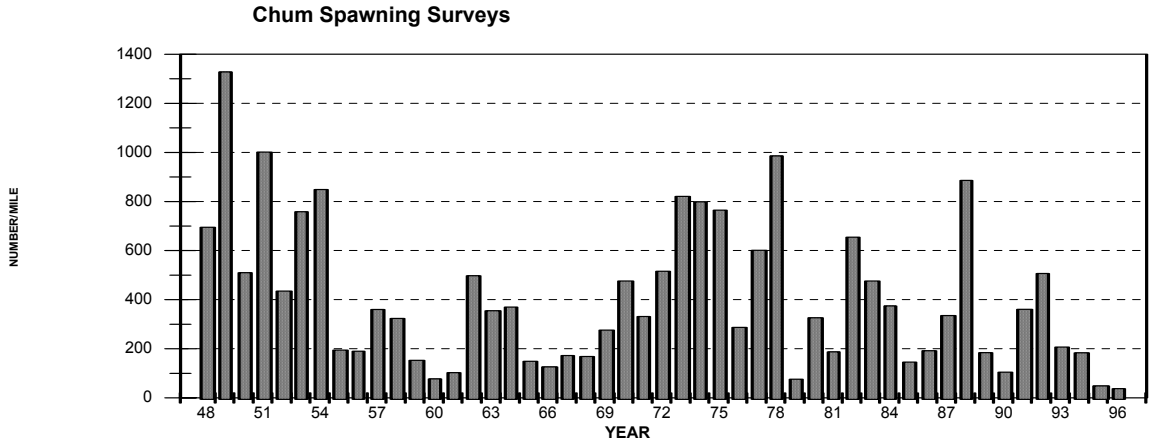

Figure 3.19. Results from chum salmon spawning surveys in the Tillamook Basin. (Source: TBNEP 1998a)

Chum salmon use only the lowest portions of the Trask River watershed, never extending upstream above the Lower Trask subwatershed (Plate 6). Most of the spawning occurs in the lower reaches of the main river channels or in small floodplain streams tributary to the lower river channels (TBNEP 1998a). Recent habitat trend information for these areas is not available.

Coastal Cutthroat Trout

Coastal cutthroat trout exhibit diverse patterns in life history and migration behavior. Populations of coastal cutthroat trout show marked differences in their preferred rearing environment (river, lake, estuary, or ocean); size and age at migration; timing of migrations; age at maturity; and frequency of repeat spawning. Anadromous populations migrate to the ocean (or estuary) for usually less than a year before returning to freshwater. Anadromous cutthroat trout either spawn during the first winter or spring after their return or undergo a second ocean migration before maturing and spawning in freshwater. Anadromous cutthroat are present in most coastal rivers. Resident forms of coastal cutthroat trout occur in small headwater streams and may migrate within the fresh waters of the river network (i.e. potadromous migration). They generally are smaller, become sexually mature at a younger age, and may have a shorter life span than many anadromous cutthroat trout populations. Resident cutthroat trout populations are often isolated and restricted above waterfall barriers, but may also coexist with other life history types.

Less is known about the present status of sea-run cutthroat trout than the other anadromous salmonid species in the Trask River watershed. The smallest of the anadromous salmonids present in the watershed, they have not been fished commercially. Although sea-run cutthroat trout are harvested in the recreational fishery, their numbers are not recorded on salmon/steelhead report tags. Therefore, determination of trends in abundance cannot be made on the basis of catch data. Beginning in 1997, sea-run cutthroat trout angling regulations were changed to "catch and release" only (TBNEP 1998a); in 2003, regulations were changed to "limited catch" only. They spawn in small headwater tributaries in late winter and early spring when water conditions are generally poor for viewing. Age at spawning is highly variable (2 to 10 years) and individual adults may spawn more than once during their lifetime (Emmett et al. 1991).

The only attempt to routinely count sea-run cutthroat has been resting pool counts made by ODFW staff since 1965 in conjunction with summer steelhead counts in the Wilson and Trask Rivers (Figure 3.20). Note that holding pool surveys were not conducted on the Wilson River in 1975 or 1978 or on the Trask River in 1975, 1977, or 1978. The resting hole count results are presented as average number of fish per hole to allow comparison from year to year despite

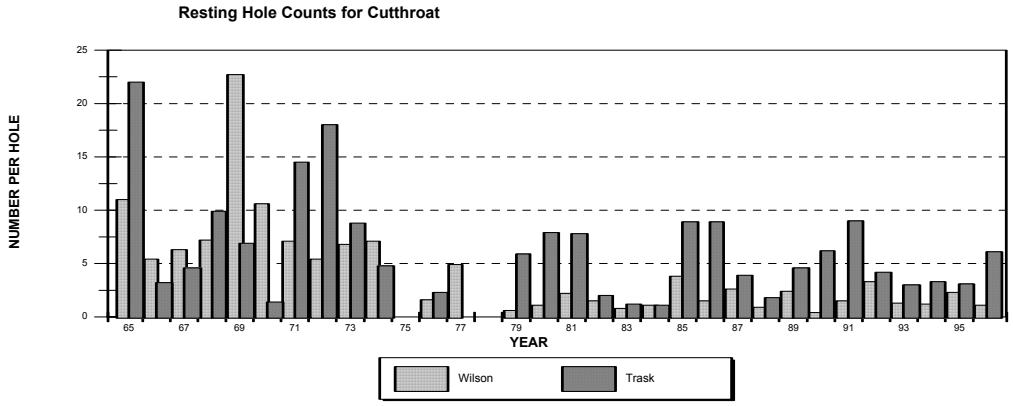

Figure 3.20. Resting hole counts for cutthroat trout (Source: TBNEP 1998a)

differences in the number of holes surveyed. These data suggest that numbers of sea-run cutthroat trout in resting holes may have been somewhat higher before the mid-1970s than they have been since.

Steelhead Trout

Steelhead trout include a resident phenotype (rainbow trout) and an anadromous phenotype (coastal steelhead). Steelhead express a further array of life histories, including various freshwater and saltwater rearing strategies and various adult spawning and migration strategies. Juvenile steelhead may rear one to four years in fresh water prior to their first migration to saltwater. Saltwater residency may last one to three years. Adult steelhead may enter freshwater on spawning migrations year round if habitat is available for them, but generally spawn in the winter and spring. Both rainbow and steelhead may spawn more than once. Steelhead return to saltwater between spawning runs.

Winter steelhead are native to, and are widely distributed throughout, the Trask River watershed. Winter steelhead generally enter streams from November through March and spawn soon after entering freshwater. Age at the time of spawning ranges from 2 to 7 years, with the majority returning at ages 4 and 5 (Emmett et al. 1991). Summer steelhead were introduced in the early 1960s and were supported entirely by hatchery production (TBNEP 1998a).

The only information available for assessing trends in the abundance of steelhead runs in Tillamook Bay streams is angler salmon/steelhead report tags and holding pool counts for summer steelhead. The combined recreational catch of winter steelhead for all five subbasins and Tillamook Bay shows a declining trend since the early 1970s. The recreational catch declined from a high of more than 20,000 in 1970 to fewer than 2,000 in 1993. The trend in the combined catch reflects the trends seen in each of the individual subbasins. However, counts of summer steelhead in resting pools in the Wilson and Trask Rivers since 1965 (Figure 3.21) suggest that numbers of fish in resting pools were at least as high in the late 1980s as they were during much of the 1970s (TBNEP 1998a).

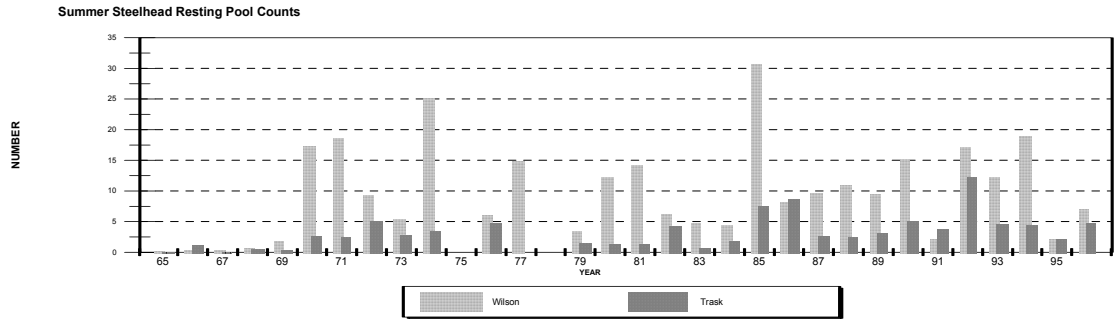

Figure 3.21. Resting pool counts of summer steelhead trout in the Wilson and Trask Rivers. (Source: TBNEP 1998a).

Both winter and summer steelhead use the entire Trask River watershed (Plate 8). Winter steelhead are found in more of the smaller tributaries than summer steelhead, including small tributaries in the upper subwatersheds. Both summer and winter steelhead benefit from structurally complex streams with large in-stream wood, floodplains, beaver ponds, braided channels, and coastal marshes and bogs.

Other Fish Species

Other fish in the watershed include Pacific lamprey, sculpins (*Cottus* sp.), and stickleback (*Gasterosteus aculeatus*). Some sturgeon (*Acipencer sp.*) may enter in tidewater for short periods of time (Keith Braun, ODFW, pers. comm., 2003). There are almost no data regarding population abundance, extent, and distribution of these species in the Trask River watershed. No fish species are known to have been extirpated (Keith Braun and Steve Jacobs, ODFW, pers. comm., 2003).

Hazards and Limiting Factors

Fish that occur within the Trask River watershed face a number of hazards and limiting factors. Particularly important in this regard are likely impediments to fish passage at road crossings, high water temperature, and habitat degradation. There are few documented impediments to fish passage, but there exist many road-stream crossings where poorly designed culverts may constitute barriers, especially to juvenile fish. High temperatures appear to be a problem in mainstem reaches throughout much of the watershed, although summer maximum water temperatures are somewhat cooler in the South Fork mainstem than elsewhere within the watershed. Habitat degradation has occurred basin-wide. In particular, in-stream LWD and future recruitment potential are limited due to past logging and fires and the scarcity of riparian conifers, and the frequency and depth of pools have been reduced. In addition, off-channel refugia and wetland areas, which provide important shelter from high-flow conditions and rearing habitat, have been substantially reduced and/or disconnected from the river system, especially in the lower watershed.

Hatcheries and Fish Stocking

Hatchery coho were stocked in the Tillamook Basin, almost without interruption, from 1902 to the early 1990s. Returns of hatchery fish to the Trask River hatchery for the period 1985 to 1992 ranged from 1,245 to 10,174, with an average of 5,231 (TBNEP 1998a). In 1998, hatcheries began marking all hatchery-raised fish with an adipose fin-clip, making it possible to accurately distinguish returning wild fish from hatchery fish. Results from the past four years for the northern Oregon Coast have shown that wild fish were the dominant component of naturally spawning populations of coho (Jacobs et al 2002).

Fall and spring chinook are also stocked in the Trask River. The Trask River chinook broodstock has been used to stock the Kilchis, Wilson, and Nestucca Rivers, as well. Adipose fin-clips have also shown a low proportion of hatchery chinook on the spawning grounds.

Summer steelhead were introduced to the Trask River watershed, but have not been stocked for approximately 50 years. The present summer steelhead population is composed entirely of hatchery strays from the neighboring Wilson River (Keith Braun, pers. comm., 2003).

Oregon has never had a large chum salmon hatchery program, and there are currently no state hatchery programs for the species. Chum salmon probably have been impacted by coho salmon hatchery programs releasing large numbers of hatchery smolts into estuaries that are used by rearing juvenile chum. Coho salmon juveniles have been shown to be a major predator on chum juveniles in the Northwest (Hargreaves and LeBrasseur 1986). Juvenile chum salmon may also be affected by large releases of fall chinook salmon hatchery fish, particularly pre-smolts, since fall chinook juveniles also rear in estuaries and may compete with chum juveniles (ODFW 1995). Hatchery coho may also have contributed to the decline of wild coho salmon, through competition for food, outbreeding depression, and introduction of disease (Hemmingston et al. 1986, Ryman and Laikre 1991, Nickelson et al. 1986).

Aquatic Habitat Conditions

To assess current in-stream habitat conditions within the Trask River watershed, we have compiled fish habitat survey data collected according to the ODFW protocols (Moore et al. 1997). To interpret the habitat survey data, ODFW has established statewide benchmark values as guidelines for an initial evaluation of habitat quality (Table 3.18). The benchmarks rate conditions as “desirable”, “moderate”, or “undesirable” in relation to the assumed natural regime of these streams. These values depend upon climate, geology, vegetation and disturbance history, and can help to identify patterns in habitat features that are affected by watershed processes.

Table 3.18. Stream channel habitat benchmarks. (Source: WPN 1999)

Parameter	Subfactor	Units	Good	Fair	Poor
Area		% of channel area	>35	>10 and <35	<10
Pool frequency		# of channel widths	>8	> 8 and <20	<20
Pool depth	gradient <3% or <7m (23 ft) wide	meters	>0.5	>0.2 and <0.5	<0.2
	gradient >3% or >7m (23 ft) wide	meters	>1.0	>0.5 and <1.0	<0.5
Gravel available		% of area	>35	>15 and <35	<15
LWD density[a]		# pieces/100m (328 ft)	>20	>10 and <20	<10
LWD volume		cubic m/100m (328 ft)	>30	>20 and <30	<20
Key LWD[b] density		# pieces/100m (328 ft)	>3	>1 and <3	<1

[a] LWD is defined as >50 cm (20 in) diameter and longer than the width of the ‘active’ channel.
[b] Pieces that are at least 0.6 m (2 ft) in. diameter and 10 m (32.8 ft) long.

Since 1996, 23 creeks and rivers have been surveyed in the Trask River watershed, totaling approximately 109 miles of the stream network (Plate 9). The large flood event of 1996 altered LWD conditions in the watershed and probably introduced some new LWD to the stream network. High-velocity peak flows in 1998 and 1999 further altered LWD conditions. Stream channels still lack LWD in general, although this problem has recently been partially alleviated through operation stump drop, which has added LWD, especially to the East Fork of the South Fork. The condition of LWD in the system is dynamic, and while watershed-scale assessments can provide information useful for prioritizing restoration activities, all sites should be field-verified before specific restoration actions are planned.

Figure 3.22 summarizes important measures of stream habitat, following OWEB guidelines and ODFW benchmarks. For each subwatershed, the miles of "desirable", "moderate", and "undesirable" stream conditions are shown for each of the summarized stream habitat characteristics. The percentage of total stream length is displayed at the bottom of each figure.

Overall, pool and gravel conditions are most desirable in the North Fork of the North Fork, the Middle Fork of the North Fork, and the Upper Trask subwatersheds, although LWD conditions are almost completely undesirable in these subwatersheds. The North Fork and South Fork subwatersheds show the greatest proportions of moderate and desirable conditions overall, although approximately a third of the pool depths are undesirable, and undesirable LWD conditions are common. The East Fork of the South Fork is unusual, having far worse pool area and frequency conditions than the other subwatersheds, although LWD volume and density are predominantly desirable and moderate.

In general, LWD conditions are undesirable throughout the Trask River watershed, although there is a high proportion of desirable and moderate LWD volume and density conditions in the Elkhorn and East Fork of the South Fork subwatersheds. The density of key LWD pieces (LWD that is currently providing functional habitat) is predominantly undesirable in every subwatershed in the Trask, even in those which have high proportions of LWD volume and density.

Stream shade conditions throughout the Trask River watershed are desirable overall, with all subwatersheds except the Lower Trask reporting a predominance of high shade conditions. However, the length of the Trask River mainstem from Tillamook Bay to the Upper Trask subwatershed has undesirable shade conditions, ranging from 20 to 44% shaded. Near the Bay, the width of the river limits the potential for stream shading by vegetation, and it is possible that stream shading in the lower reaches of the mainstem did not meet the ODFW "desirable" benchmark in historical times. However, it is also likely that the channel is substantially wider in some places now than it was previously, especially in the lower reaches (U.S. EPA 2001), and this can influence the effectiveness of riparian shade.

In addition to the ODFW data on stream shading, a graduate student was contracted by ODF in 2002 to conduct a study of riparian conditions on ODF lands in the watershed (Falcy 2002). In this study, OWEB procedures were followed to analyze stream shading (or more accurately stream cover) by examination of aerial photographs. OWEB guidelines specify that if streambanks are visible throughout the photos, then the amount of shading is low; if the water surface is visible, but not the banks, then shading is medium; and if the water surface is only

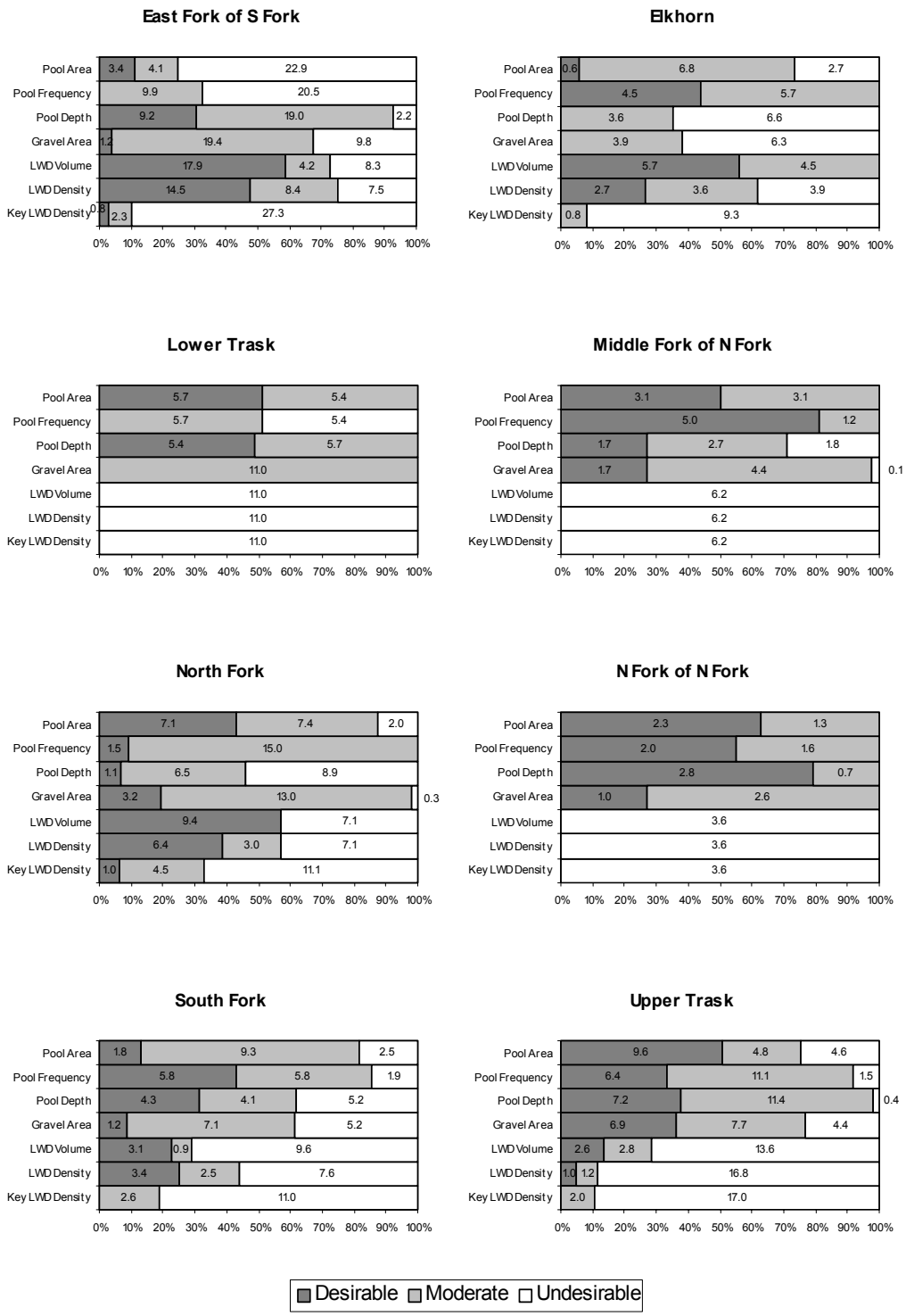

Figure 3.22. Stream habitat conditions, by subwatershed. The numbers within the bars are given in miles of stream length. The numbers along the x-axis reflect percentages of the stream length surveyed.

partially visible, then shading is high (Falcy 2002, WPN 1999). This analysis provided essentially the same result as the ODFW surveys: stream shading was estimated to range from 86 to 98% everywhere except in the Lower Trask subwatershed, where estimated stream shading was 43%.

Large woody debris recruitment potential was rated as undesirable throughout the Trask River watershed, based on ODFW data. The density of large trees was undesirable in all subwatersheds, for both ODFW benchmarks (conifers larger than 20 in. dbh per 1,000 ft of stream, and conifers larger than 36 in. dbh per 1,000 ft of stream). For most surveyed stream reaches, there were no conifers in either of those ODFW size classes.

Large woody debris recruitment was also analyzed by Falcy (2002) for ODF, following the OWEB guidelines (WPN 1999). Riparian vegetation in two parallel zones on each side of the streams was classified by tree size class (dbh), vegetation type (conifer, hardwood, or mixed), tree stand density (dense or sparse), and stream channel constraint (unconstrained, semi-constrained, and constrained). The first riparian zone (RA1) was variable in width, depending on channel constraint and stream size, ranging from 25 ft to 75 ft from the edge of the active channel. The second riparian zone (RA2) extended from 100 ft from the edge of the active channel, regardless of the width of RA1, to the edge of RA1 (e.g., if RA1 is 75 ft, then RA2 is only 25 ft wide; but if RA1 is 50 ft wide, RA2 is also 50 ft wide; Falcy 2002, WPN 1999). Vegetation conditions were then compared with OWEB benchmarks for conditions necessary to provide 'adequate' LWD recruitment (i.e. the ability of the riparian zone to keep the stream channel supplied with LWD). The OWEB benchmark for the "adequate" classification for RA1 was dense, medium-sized (12 to 24 in. dbh) hardwoods. Larger trees, especially conifers, are considered to provide higher quality LWD. The OWEB benchmark for RA2 was dense, large (>24 in. dbh) conifers, except along unconstrained reaches, where dense, large mixed conifers and hardwoods are considered adequate (Falcy 2002, WPN 1999).

In general, LWD recruitment potential was adequate in RA1, and inadequate in RA2, according to OWEB methods (Table 3.19). Adequate LWD recruitment potential accounted for over 90% of the RA1 riparian zones in all of the upland subwatersheds, except for the Upper Trask subwatershed, for which it was 69%. LWD recruitment potential in the Lower Trask subwatershed, on the other hand, was adequate in only 58% of the RA1 riparian zone. Adequate LWD recruitment potential conditions in RA2 ranged from 4% in the Upper Trask subwatershed to 31% in the Middle Fork of the North Fork subwatershed. The Elkhorn Creek subwatershed had the second-highest proportion of adequate LWD recruitment potential in RA2, at 29%. Overall, LWD recruitment potential is probably least in the Lower Trask and Upper Trask subwatersheds (Table 3.19).

Although recruitment potential is considered "adequate" for RA1 based on the OWEB benchmark (medium-sized hardwoods), the lack of large conifers in RA2 indicates a potential overall worsening in LWD conditions in the future, because RA1 contains mainly hardwoods. Large conifers will not be available any time soon from RA2 to provide LWD to the stream channel (Falcy 2002).

Table 3.19. Area and percentage of "adequate" LWD recruitment potential for two riparian zones (RA1 and RA2), based on analyses by Falcy (2002).				
	RA1		RA2	
Subwatershed	Acres	%	Acres	%
East Fork of South Fork of Trask River	1468	96	523	17
Elkhorn Creek	509	93	315	29
Lower Trask River	11	58	4	9
Middle Fork of North Fork of Trask River	447	91	286	31
North Fork of North Fork of Trask River	347	91	130	17
North Fork of Trask River	1552	95	222	6
South Fork of Trask River	1034	95	207	9
Upper Trask River	583	69	80	4
Total	5953	91	1766	13

There are relatively few known barriers to fish passage in the Trask River watershed, other than the Trask River hatchery on Gold Creek and the Barney Reservoir Dam. Several waterfalls are also known passage barriers: two in Bark Shanty Creek, and one in Rock Creek. However, based on the number of road-stream crossings, there may be many culverts that are inhibiting fish passage (Plate 10).

3.1.6.2 Amphibians

Several species of amphibian occur in the Trask River watershed, although no amphibian surveys have been conducted and their distribution is not known. Amphibians are particularly sensitive to environmental change, in part because their complex life cycles expose them to hazards in both the aquatic and terrestrial environments. Most amphibians require cool, moist conditions to maintain respiratory function. Many are highly specialized and have specific habitat requirements, such as association with headwater streams or LWD. The following species (and perhaps others) appear to have suitable habitat, and may occur, within the watershed:

Northern red-legged frog (*Rana aurora aurora*)

This species requires emergent riparian vegetation near deep, still or slow-moving ponds or intermittent streams. These well-vegetated areas are needed for escaping from predators, for providing shade to maintain cool water temperatures, and as shelter, especially during the winter. Red-legged frogs move out of riparian zones into nearby upland forest during non-breeding seasons.

Tailed frog (*Ascaphus truei*)

Tailed frogs are stream dwellers that do not inhabit ponds or lakes. Tadpoles are often numerous and easily found by turning over rocks in streams. At night the frogs emerge and feed upon insects found along the stream and in the moist woods near the stream.

Columbia torrent salamander (*Rhyacotriton kezeri*)

These salamanders live at the edges of clear, cold mountain streams; they can be abundant under gravel at stream edges and in the spray zones of waterfalls. During rainy seasons, they are occasionally found on land away from streams. The Columbia torrent salamander is the only BLM Special Status Species amphibian in the Trask River watershed.

3.1.6.3 Reptiles

No reptile species of concern have been identified in the Trask River watershed. The western pond turtle (*Clemmys marmorata*) has been known to occur in small ponds and marshes in the Coast Range, but there is no documentation of its existence within the Trask River watershed. For a list of other sensitive species, see Table 1.3.

3.1.6.4 Wetland Species and Habitat

Wetland habitats constitute critical sources of biological diversity. The National Wetlands Inventory (NWI) has mapped wetlands within the Lower Trask River subwatershed. While wetlands also exist in the upper areas of the Trask River watershed, they are rare and poorly documented. The FMP provides guidance for the management of wetlands on state lands. Within the Lower Trask River subwatershed, 6.7% of the area has been designated as wetland by NWI. Of the wetland area, the majority (80%) is of palustrine type with most designated as emergent and forested. Other types of wetlands surveyed by NWI are riverine (18%) and estuarine (2%; Table 3.20).

Salmonid species within the Trask River watershed depend on wetland habitat for rearing. In particular, chum salmon spawn primarily in portions of the lower Trask River watershed and may depend heavily on estuarine wetlands. Riparian and wetland areas also provide habitat for many bird species. Seasonal flooding of fields in the lower watershed provides temporary habitat for species such as Aleutian and dusky Canada goose (*Branta canadensis leucopareia; Branta canadensis occidentalis*) and many other species of waterfowl.

Table 3.20. Wetlands from NWI maps. All wetlands are located in the Lower Trask River subwatershed.

System	Subsystem	Class	Water Regime	Other	Acres	Percent
Estuarine	Subtidal	Unconsolidated Bottom	Subtidal	N/A	15	1.6
	Intertidal	Emergent	Regularly Flooded	N/A	4.1	0.4
		Unconsolidated Shore		N/A	0.3	0.03
Palustrine		Aquatic Bed	Permanently Flooded	N/A	0.3	0.03
				Excavated	0.4	0.05
			Permanent-Tidal	N/A	10	1.0
		Emergent	Saturated	N/A	7.5	0.8
			Seasonally Flooded	N/A	107	11
				Partially Drained/Ditched	330	34
				Diked/Impounded	1.4	0.1
			Semipermanently Flooded	Excavated	2.0	0.2
			Seasonal-Tidal	N/A	1.3	0.1
		Forested	Temporarily Flooded	N/A	200	21
			Seasonally Flooded	N/A	51	5.3
			Seasonal-Tidal	N/A	1.4	0.1
		Scrub/Shrub	Seasonally Flooded	N/A	45	4.7
				Excavated	3.5	0.4
		Unconsolidated Bottom	Semipermanently Flooded	N/A	1.4	0.1
				Excavated	0.8	0.1
			Permanently Flooded	N/A	3.6	0.4
				Diked/Impounded	0.5	0.1
				Excavated	4.5	0.5
Riverine	Tidal	Unconsolidated Bottom	Permanent-Tidal	N/A	37	3.8
	Lower Perennial		Permanently Flooded	N/A	118	12
		Unconsolidated Shore	Seasonally Flooded	N/A	16	1.6
Total					962	100

3.2 TERRESTRIAL ECOSYSTEMS

3.2.1 ROADS

3.2.1.1 Road Density and Hillslope Position

In order to provide a general sense of the density of roads throughout the watershed, we calculated the miles of road, by subwatershed. The BLM general transportation GIS layer was used for this analysis, because it includes all ownerships in the watershed, and has a similar density to the ODF roads layer. Based on the GIS analysis, road density ranges from 2.8 mi/sq mi in the Middle Fork of the North Fork subwatershed to 5.6 mi/sq mi in the Lower Trask subwatershed. The average road density in the watershed is 3.7 mi/sq mi (Table 3.21). It should be noted, however, that there are many undocumented legacy roads in the watershed, and therefore the road density might actually have been considerably higher if those roads had been included in the analysis.

Table 3.21. Road density in the Trask River watershed, based on BLM GIS data.

Subwatershed	Area (mi^2)	Road Density mi/mi^2
East Fork of South Fork of Trask River	29	3.6
Elkhorn Creek	17	3.8
Lower Trask River	22	5.6
Middle Fork of North Fork of Trask River	13	2.8
North Fork of North Fork of Trask River	13	5.6
North Fork of Trask River	29	3.0
South Fork of Trask River	23	2.8
Upper Trask River	28	3.2
Total	175	3.7

The road density statistic does not incorporate important characteristics of roads, such as the topographic position of roads in the landscape. A more useful measure of roads from the perspective of sediment and water quality is road slope position. Road slope position information was not available for roads on BLM lands, but was available from the ODF road inventory. Three road slope positions were recorded: valley, midslope and ridge (Table 3.22). For inventoried ODF roads in the Trask River watershed, the majority were midslope roads. The proportion of midslope roads ranged from 47% in the Lower Trask to 77% in the Elkhorn Creek subwatershed. The North Fork had the greatest length of midslope roads (35 mi). Ridge roads were the next prevalent, ranging from 20% in Elkhorn Creek to 53% in the Lower Trask, with an average of 27% for the watershed overall. Valley roads were the least common, ranging from 3% in Elkhorn Creek to 13% in the South Fork of the Trask subwatershed.

3.2.1.2 Condition of Roads

In the Trask River watershed, approximately 148 miles of ODF roads were inventoried, following the guidelines provided in the ODF Forest Roads Manual. Information was gathered in the field, including the condition and location of road fill material and culverts. Since the

Table 3.22. Miles and percent of roads within each subwatershed that were classified as midslope, ridge, or valley topographic position. (Source: ODF road inventory)				
Subwatershed	Miles (%) of Road			
	Midslope	Ridge	Valley	Total
East Fork of South Fork of Trask River	29 (65)	12 (27)	4 (8)	45 (100)
Elkhorn Creek	17 (77)	4 (20)	0.7 (3)	22 (100)
Lower Trask River	0.4 (47)	1 (53)	-	1 (100)
Middle Fork of North Fork of Trask River	0.01 (100)	-	-	0 (100)
North Fork of Trask River	35 (67)	15 (29)	2 (4)	52 (100)
South Fork of Trask River	19 (58)	10 (30)	4 (13)	33 (100)
Upper Trask River	19 (64)	8 (27)	3 (9)	30 (100)
Total	120 (65)	50 (27)	13 (7)	183 (100)

majority of ODF roads in the watershed (and virtually all of the roads on steep slopes) occur within the Tillamook District, and the GIS routing of the road inventory was not complete at the time of this analysis, Forest Grove District roads were not examined here. It should be noted that road maintenance is an ongoing process, and many of the issues recorded in the Road Inventory may have already been addressed.

The Tillamook District Road Inventory provided information regarding the condition of road fill in the watershed (Table 3.23, Plate 12). Fill condition was rated as good or conforming (i.e. fillslope was not excessively steep) for two-thirds of the surveyed road (97.4 mi). Steep fillslopes (i.e., steeper than the natural slope) were by far the most common road fill concern, recorded for 30% of the surveyed road length (44.8 mi). The North Fork, Upper Trask, and South Fork subwatersheds had the most miles of road with steep fillslopes (13.4, 11.1, and 10.0 mi, respectively). The Lower Trask and Middle Fork of the North Fork subwatersheds recorded no steep road fill conditions (Table 3.23).

Approximately 5% of the surveyed road length (5.7 mi) showed indication of water seeping or flowing through the fill. Most of the road found to have water emerging from the fill was in the East Fork of the South Fork subwatershed (5.4 mi). The remaining 0.4 mi was identified in the South Fork of the Trask subwatershed. In one location in the North Fork of the Trask subwatershed, the road fill was recorded as “gone”, which presumably indicates a slide, slump, or gullying.

Road surface drainage conditions were not provided as part of the Road Inventory, so we were unable to assess the conditions of ditches, cutslopes and road surface, or the probability of sediment delivery from surface drainage (c.f., ODF Forest Roads Manual Appendix 1: Protocol for Road Hazard Inventories).

Table 3.23. Surveyed road condition length (miles) by subwatershed								
	Miles of Road Reported in Category							
Designated Category	EF of SF Trask	Elkhorn	Lower Trask	MF of NF Trask	NF Trask	SF Trask	Upper Trask	Grand Total
Fill Condition								
Steep	6.5	3.7			13.4	10.0	11.1	44.8
Water	5.4					0.4		5.7
Gone					0.1			0.1
Conforms	5.8	2.1	0.8		17.2	9.5	8.8	44.2
Good	27.1	0.2			18.8	5.1	2.0	53.2
Downslope Risk								
High	13.7	5.1			12.1	0.8	0.4	32.1
Moderate	20.7	0.6			19.3	16.0	9.4	66.1
Low	10.4	0.2	0.8		18.1	8.2	12.2	49.9
Movement Indicators								
Cracks						3.8	1.5	5.3
Cracks/Drop	0.1				0.6	0.1		0.8
Cracks/Slide							1.4	1.4
Drop	0.5	0.2			9.9		4.7	15.2
Drop/Slide	1.5							1.5
Slide Activity	13.7				20.7	3.3	6.2	43.9
Slide/Crack						3.4		3.4
None	29.0	5.7	0.8		18.5	14.4	8.1	76.6
Total Length	44.8	5.9	0.8	0.0	49.6	25.1	22.0	148.1

3.2.1.3 High Risk Areas for Road-related Slope Failures

The locations of road fill movement indicators, including cracks in the roadbed, drops (sunken grade), slide activity (fillslope sliding or slumping), and various combinations of these indicators were recorded in the Road Inventory (Table 3.23). Almost one-third (32%) of the surveyed roads showed indications of slide activity, drop/slide activity, or slide/crack activity (48.8 mi), with nearly half of these road segments located in the North Fork subwatershed (20.7 mi). The East Fork of the South Fork had the second highest length of fillslope sliding (drop/slide and slide activity, Table 3.23; Plate 12) at 15.2 mi.

Drops in the roadbed were the second most commonly recorded road fill movement indicator, accounting for 10% of the surveyed road length of Trask roads in the Tillamook District (15.2 mi). The majority of the drops in the roadbed (9.9 mi) were in the North Fork subwatershed. Approximately 3.5% of the surveyed road showed cracks in the roadbed (5.3 mi), of which 3.8 mi were in the South Fork subwatershed, and 1.5 mi were in the Upper Trask subwatershed (Table 3.23; Plate 12).

On a percentage basis by subwatershed, the North Fork subwatershed had the greatest number of identified road issues (all movement indicators combined), at 63% (31.2 mi). The Upper Trask

subwatershed was second highest, with 50% of the roads showing indications of movement (10.9 mi), and the South Fork third at 42% (10.6 mi). Although the East Fork of the South Fork had the second highest surveyed road mileage (44.8 mi), it had proportionally the least amount of road with indications of movement (35%; 15.8 mi).

A qualitative evaluation of the likelihood that fill material will reach a stream in the event of a road fill failure (referred to as downslope risk) was also provided in the Road Inventory (Table 3.23). Of the 148.1 miles of surveyed road, 22% (32.1 mi) were considered to pose a high risk of contributing sediment to a stream in the event of a fill failure. Moderate downslope risk accounted for 45% (66.1 mi) of the surveyed roads. The remaining third of the roads were estimated to pose a low downslope risk for sediment contribution (49.9 mi). On a percentage basis by subwatershed, the most road in the high downslope risk category was recorded in Elkhorn Creek (86%), although only 5.9 miles of road were surveyed in the subwatershed. Second highest was the East Fork of the South Fork (31%), with 13.7 miles of high downslope risk. Nearly one quarter (24%) of the roads in the North Fork subwatershed were in the high downslope risk category. In the other subwatersheds, the percentage of high downslope risk was small (i.e. < 4%).

3.2.1.4 Stream Crossings

The Tillamook District Road Inventory recorded 676 culverts in the Trask River watershed, of which 224 (33%) were stream crossings and 375 (55%) were cross drain culverts (Table 3.24). Spring crossings, bridges and log puncheons made up the remaining 77 (12%) culverts (Table 3.24). There were 22 (3%) collapsed or blown out culverts recorded. Culverts showing signs of mechanical damage, rust, sediment blockage, and other types of damage were also recorded. Rusted culverts were the most common (105 culverts; 16%), followed by sediment blockage (72 culverts; 11%). On ODF land, the Upper Trask had the most damaged (mechanical, rust, and sediment) stream crossing culverts in the watershed (21), whereas the fewest were recorded in the Lower Trask subwatershed (3).

Log puncheons were uncommon, except in the North Fork subwatershed, which had 21. All other subwatersheds had fewer than five log puncheons. Bridges were also relatively uncommon. One collapsed/blown out bridge was recorded in the East Fork of the South Fork subwatershed.

3.2.1.5 Access

Private non-commercial ownership in the Trask River watershed is concentrated along the mainstem river, and makes up a small proportion of the watershed. Private commercial ownership is apparent mostly at the edges of the watershed, such as in the upper portions of the North Fork of the North Fork and Elkhorn Creek subwatersheds. The majority of the forested uplands are comprised of large, contiguous blocks of public land. Consequently, road access issues are minimal. Easements allow passage through private lands where necessary for access.

Table 3.24. Number of surveyed culverts and stream crossings and existing condition per subwatershed[a]. (Source: ODF Tillamook District Road Survey)

Sub watershed	Structure/Crossing	Condition of Culvert Structure/Crossing							
		Good	Collapsed/ Blowout	Mechanical	Rusted	Sediment	Other	Unknown	Grand Total
EF of SF Trask	Stream Crossing	12	2	4	6	2	6		32
	Cross Drain	71		12	21	22	1		127
	Spring Crossing	8		3	9	1		2	23
	Log Puncheon		1						1
	Bridge		1				1		2
Total EF of SF Trask		91	4	19	36	25	8	2	185
Elkhorn	Stream Crossing	12		2	13	1	3	4	35
	Cross Drain	7	2	1	4	2		1	17
	Spring Crossing	1							1
	Log Puncheon	3	1				1		5
	Bridge	1							1
Total Elkhorn		24	3	3	17	3	4	5	59
Lower Trask	Stream Crossing				3				3
	Cross Drain				1	2			3
	Spring Crossing			1					1
	Log Puncheon								0
	Bridge								0
Total Lower Trask				1	4	2			7
NF Trask	Stream Crossing	31	5		4	4	8		52
	Cross Drain	50		5	1	9		4	69
	Spring Crossing	3							3
	Log Puncheon	9	9			1	1	1	21
	Bridge	2							2
Total NF Trask		95	14	5	5	14	9	5	147
SF Trask	Stream Crossing	21	4	6	11	2	7		51
	Cross Drain	45		7	15	5			72
	Spring Crossing			1					1
	Log Puncheon	2	2						4
	Bridge	2					1		3
Total SF Trask		70	6	14	26	7	8		131
Upper Trask	Stream Crossing	28		9	10	2	2		51
	Cross Drain	48	2	8	5	18		6	87
	Spring Crossing	3			2			1	6
	Log Puncheon		1			1			2
	Bridge	1							1
Total Upper Trask		80	3	17	17	21	2	7	147
Grand Total		360	30	59	105	72	31	19	676

[a] Not all of the Trask River watershed roads were surveyed

3.2.2 TERRESTRIAL WILDLIFE SPECIES AND HABITAT

The Trask River watershed contains a diversity of wildlife species, although abundance, distribution, and habitat information is lacking for most species. The focus of this section is on species whose populations are uncommon or at risk of being unviable. Terrestrial species in the Trask River watershed that have been federally listed as Threatened and Endangered (T&E) include the northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratusus*), and bald eagle (*Haliaeetus leucocephalus*). Several other species are listed as state T&E species, Survey and Manage Species, BLM Special Status Species, and Species of Concern by the Oregon Natural Heritage Program (ONHP). A list of species of concern is presented in Chapter 1 (Table 1.3). Here we provide descriptions and available population and habitat condition information for key species believed to have suitable habitat in the watershed. In addition, black-tailed deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus elaphus roosevelti*), two common inhabitants of forest lands in the Trask River watershed, represent a valuable resource for hunting and wildlife viewing.

3.2.2.1 Mammals

Voles

Red Tree Vole

The red tree vole (*Arborimus longicaudus*), a small rodent found primarily in old-growth Douglas-fir stands, is an important food source of the northern spotted owl. Red tree voles are nocturnal and live in the canopy of large coniferous trees. They build nests using fir needles and feed primarily on the needles of Douglas-fir trees.

Red tree voles are considered an indicator species and have been designated as a Survey and Manage species by the Northwest Forest Plan (NWFP) ROD. They require large blocks of contiguous habitat or corridors connecting areas of suitable habitat. In the Oregon Coast Range, the average stand size utilized by this species is 475 acres (75 acre minimum; Maser 1981, Huff et al. 1992). Although found in stands as young as 40 years old, it is thought that stands less than 100 years old are unable to maintain viable populations (Carey 1991).

Habitat suitable for red tree voles is very rare in the Trask River watershed. A few patches of old-growth forest are present, such as on the northwestern edge of the Upper Trask subwatershed, although the presence of red tree voles has not been confirmed.

White-footed Vole

Found in mature, coastal forests, the white-footed vole (*Arborimus albipes*) usually inhabits the vicinity of small streams with dense alder and other deciduous trees and shrubs. This species occupies habitat from ground surface to canopy, feeding in all layers. The primary food sources of white-footed voles include the leaves of trees, shrubs, and forbs. Red alder leaves constitute a

major food source. Nests are built on the ground or under stumps, logs, or rocks. They prefer the cover provided by dense vegetation near streams, and generally are found near water.

Bats

All forest dwelling bats in the Pacific Northwest are insectivores, and serve an important role as predators of forest pest species. Bats that concentrate their foraging in riparian areas and fly to upland forests to roost may serve as dispersers of nutrients. Bat populations have been declining, largely due to a lack of sites for roosting and hibernation. The deeply fissured bark of old-growth conifers and loose blankets of bark found on large, decaying logs provide roosting habitat for some sensitive bat species, but such habitat has become very uncommon in the Trask River watershed. Suitable nesting, roosting, and hibernation sites require a narrow range of temperature and moisture conditions.

Silver-haired bat

The silver-haired bat (*Lasionycteris noctivagans*) feeds mainly on moths and other soft-bodied insects and, to a lesser extent, beetles and other hard-shelled insects. They feed very close to (i.e., within 20 ft) forest streams and ponds, and in open brushy areas, using echolocation to locate prey. Roosts are found in hollow trees, snags, buildings, rock crevices, caves, and under bark.

Long-eared myotis

Long-eared myotis (*Myotis evotis*) bats are found predominantly in coniferous forests. They roost in tree cavities and beneath exfoliating bark in both living trees and snags. Pregnant long-eared myotis females often roost at ground level in rock crevices, fallen logs, and even in the crevices of sawed-off stumps, but they generally cannot rear young in such vulnerable locations. Long-eared myotis capture prey in flight, but also glean stationary insects from foliage or the ground. Their main diet consists of moths.

Fringed myotis

Beetles are the primary food for fringed myotis bats (*Myotis thysanodes*), although they also eat moths and arachnids. Foraging flight is slow and maneuverable, and they sometimes utilize wing and tail membranes to capture their prey. They are capable of hovering, and occasionally may land on the ground. Feeding occurs over water and open habitats, and by gleaning from foliage. The fringed myotis roosts in caves, mines, buildings, and crevices.

Long-legged myotis

Long-legged myotis bats are dependent on coniferous forest habitats. Radio-tracking studies have identified maternity roosts beneath bark and in other cavities. Most nursery colonies live in older trees (≥ 100 years) that provide crevices or exfoliating bark. These typically are located in openings or along forest edges where they receive a large amount of sun. Though maternity colonies are most often formed in tree cavities or under loose bark, they also are found in rock crevices, cliffs, and buildings. Long-legged myotis forage over ponds, streams, water tanks, and in forest clearings. Their primary food is moths.

3.2.2.2 Birds

Several federally threatened bird species are known to inhabit, or have been observed in the vicinity of, the Trask River watershed. Although suitable conditions for most of these rare species is very limited in the Trask River watershed, a few patches of adequate forest habitat are present for some species, including the northern spotted owl. Life history information for key sensitive bird species follows.

Marbled Murrelet

The marbled murrelet is a seabird that often uses mature or old-growth coniferous forests within 50 miles of the ocean for nesting. Most inland activity occurs between April and September. Preferred nesting habitat includes trees with large, moss-covered limbs.

No known marbled murrelet nesting sites exist within the Trask River watershed, although suitable habitat exists in a fringe of older timber in the lower watershed. Areas of the watershed impacted by the Tillamook Burn generally do not currently provide suitable habitat, but some stands of young hemlock may provide adequate murrelet habitat (Steve Bahe, BLM, pers. comm. 2003).

Murrelets are usually detected by vocalizations. Sightings are rare, making accurate counts difficult. When surveys detect an occupied area on ODF land, a marbled murrelet management area (MMMA) is established. There are no designated MMMAs on ODF land in the Trask River watershed, but there are some in adjacent watersheds.

Northern Spotted Owl

The northern spotted owl generally requires cool, moist, undisturbed late-successional forests, characterized by multiple canopy layers, fallen trees, trees with broken tops, and mature and over-mature trees. Northern spotted owls nest in cavities and on various types of platforms including abandoned raptor nests, squirrel nests, and debris accumulations.

The spotted owl population within the Oregon Coast Range is extremely low and in significant decline. Between 1994 and 1999 there was a 60% decline in the number of spotted owl pairs in

the northern Coast Range. Researchers cite a number of reasons why spotted owl populations in the north Coast Range are especially at risk. High levels of habitat fragmentation have forced spotted owls to forage over broader territories, making them more vulnerable to predators. Competition with barred owls (*Strix varia*) may have increased. The lack of dispersal habitat has contributed to localized isolation and high rates of mortality; young spotted owls have a 1-in-10 chance of surviving beyond two years. The absence of suitable habitat on surrounding private timberlands serves to further isolate spotted owl populations, and few new spotted owls immigrate into state forests. Consequently, female spotted owls have produced fewer young than in other regions, and in some years have not reproduced at all.

Reserve Pair Areas (RPAs) protect habitat for spotted owls equal to their mean home range area. In the Trask River watershed, all BLM lands within the Upper Trask River subwatershed are in the RPAs of two spotted owl pairs.

Bald Eagle

Bald eagle nest selection varies widely between deciduous, coniferous, and mixed-forest stands. They frequently use snags for roosting and nesting. Bald eagles primarily nest in dominant or co-dominant trees, often located near a break in the forest such as a burn, clearcut, field edge, or water edge. They prefer riparian habitat in close proximity to water to ensure food availability. Habitat occurs primarily in underdeveloped areas with little human activity. Over 95% of Oregon's bald eagle nesting sites fall within five areas, including Tillamook County. Bald eagles are known to be present within the Trask River watershed, although relative abundance is not known (David Nuzum, ODFW, pers. comm., 2003).

Pileated Woodpecker

Pileated woodpeckers (*Dryocopus pileatus*) are year-round residents in the Trask River watershed. They require large snags for nesting and roosting and downed wood for foraging. One study in western Oregon found the highest densities of pileated woodpecker nests in stands 70 years of age and older. Approximately three-quarters of the nests were found in Douglas-fir (*Pseudotsuga menziesii*) snags. Douglas-fir, red alder (*Alnus rubra*), western red cedar (*Thuja plicata*), and big leaf maple (*Acer macrophyllum*) were used for roosting (Mellen 1987). They feed primarily on carpenter ants and other wood boring insects, although they will eat fruits when available. Although pileated woodpeckers are dependent on some components of older forests, they have been observed foraging in riparian areas and young stands or clearcuts when large snags, stumps, or down wood are present. No information is available regarding their distribution and abundance in the vicinity of the Trask River watershed.

Peregrine Falcon

No peregrine falcon (*Falco peregrinus anatum*) active nest sites are currently known on state forest lands. However, preliminary surveys indicate that potential nesting habitat is present in the Tillamook District. Peregrines currently nest in close proximity to state forest lands and

forage in coastal areas. The peregrine falcon is a BLM Special Status species. Populations have been recovering throughout the West. In 1999 the species was removed from the federal Threatened and Endangered species list.

Other Bird Species

The Aleutian Canada goose and dusky Canada goose may use the lower agricultural fields of the Trask River watershed for wintering. Band-tailed pigeons (*Columba fasciata*) are summer breeding residents in the Trask River watershed. The watershed also contains suitable habitat for other species of concern such as purple martin (*Progne subis*), mountain quail (*Oreortyx pictus*), little willow flycatcher (*Empidonax traillii brewsteri*), and western bluebird (*Sialia mexicana*).

3.2.2.3 Abundance and Condition of Habitat

Historically, the forest of the Trask River watershed was characterized by a broad mosaic of conditions. Natural disturbances, such as fires, floods, landslides, windstorms, and insect outbreaks, created a patchwork of stands of different ages, including regenerating stands, young stands, mature forest, and old growth (Spies et al. 2002). Large fires, especially the Tillamook Burn fires, burned most of the forest, and many remaining trees (live and dead) were salvage logged and replanted with Douglas-fir. Consequently, the forest of today is very homogeneous, with little species or age-class diversity. Old-growth forest is currently present at much lower levels than would be expected in the natural range of variability (Spies et al. 2002). Older forest stands in the Trask River watershed are very rare, small, and discontinuous. Consequently, many animal species of concern in the watershed are species that require or prosper in late-successional forest. Habitat characteristics such as snag and LWD abundance, vertical forest structure, and roosting and nesting habitat for sensitive species of bats, birds, and rodents are in short supply in the Trask River watershed. The current predominance of young, even-aged, closed-canopy stands means that habitat conditions provided by other age, structure, and species composition classes are currently less available than during historic times.

Nonetheless, some habitat characteristics for sensitive species may be improved through active management. Measures to improve habitat quality are currently being developed, implemented, and incorporated into management plans. Increases in late-successional forest characteristics, such as tree species diversity, snag and woody debris abundance, and vertical forest structure, may be hastened through management actions. The ODF IPs for the Tillamook and Forest Grove districts and the FMP utilized a structure-based management approach which sets targets for the future distribution of each forest structure class in the landscape. For more on this topic, see section 3.2.3.2 Forest Management, below.

3.2.2.4 ODF Management of Sensitive Species

Threatened and Endangered species on ODF land are currently managed under interim policies until the HCP is completed in 2005. The proposed HCP details specific strategies for managing T&E species, and other species of concern. Detailed information regarding management policies for terrestrial wildlife and bird species and habitats on ODF land is provided in the Tillamook District IP, the Forest Grove IP, and in the Northwest Oregon State FMP.

The FMP outlined a strategy to retain and improve habitat conditions for species of concern using the concept of "anchor habitats", which is expected to be incorporated into the HCP. Anchor habitat areas are intended to allow species of low mobility, limited dispersal ability, or high site fidelity to recolonize new habitat as it is being created. Stationary central blocks of habitat, or "anchors," ensure that newly developed habitat will be readily colonized by species of concern.

3.2.2.5 BLM Management of Sensitive Species

BLM lands are managed according to the standards and guidelines of the NFP. "Survey and Manage" is a component of the NFP, designed as mitigation for the protection of lesser known species thought to remain at risk of loss of population viability despite implementation of the NFP. Survey and Manage requires the BLM (and USDA Forest Service) to survey for certain species whose habitat may be disturbed, prior to the implementation of a project, and to manage known sites of those species found. A list of over 400 species of plants and animals was originally included in the NFP document, of which a portion occur in northwest Oregon. In January 2001, the BLM and Forest Service published the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines Environmental Impact Statement* (Survey and Manage EIS), which amended the Survey and Manage provisions by removing many species from the original list and implementing provisions for annually reviewing the list. The BLM has surveyed over 2,400 acres in the Trask River watershed (primarily in the Elkhorn Creek subwatershed) for Survey and Manage plant species and found none. Two Survey and Manage lichen species, *Platismatia lacunosa* and *Peltigera pacifica*, are known to occur immediately adjacent to the Trask River watershed and most likely also occur within the watershed.

Currently, the BLM and USDA Forest Service are in the process of amending the Survey and Manage EIS to include alternatives to modify the Survey and Manage provisions or to possibly remove the provisions from the NFP Standards and Guidelines completely. If the provisions are removed, the habitat needs of affected rare or little-known species would rely on other elements of the NFP and existing Forest Service Sensitive Species and BLM Special Status Species programs.

The Trask River watershed contains habitat for four terrestrial wildlife species that are covered by the Survey and Manage provisions, three mollusks and one mammal:

- Red tree vole (*Arborimus longicaudus*)
- Oregon megomphix (*Megomphix hemphilli*)
- Puget Oregonian (*Cryptomastix devia*)
- Evening field slug (*Deroceras hesperium*)

In addition to the protections required by the Survey and Manage Species guidelines of the NFP, the BLM has a Special Status Species program to protect sensitive species that do not meet the requirements of the federal and state endangered species acts, and to provide an "early warning" for species likely to be listed in the future (BLM 1990). The Special Status Species program requires "For those species where lands administered by BLM or actions have a significant effect on their status, manage the habitat to conserve the species" (BLM 1990).

Two of the Survey and Manage species, the Oregon megomphix (*Megomyphix hemphelli*) and the evening field slug (*Deroceras hesperium*), are also Special Status Species. Other terrestrial species included in the BLM's Special Status Species program, and for which habitat may be found in the Trask River watershed, include:

- Peregrine falcon (*Falco peregrinus anatum*)
- Common nighthawk (*Chordeiles minor*)
- Purple martin (*Progna subis*)
- Columbia torrent salamander (*Rhyacotriton kezeri*).

3.2.3 VEGETATION SPECIES AND HABITAT

3.2.3.1 Landscape Pattern of Vegetation

We have examined forest vegetation from three primary sources: the ODF Summary Stand Inventory (SSI), the BLM Forest Operations Inventory (FOI), and the Coastal Landscape Analysis and Modeling Study (CLAMS) vegetation map. The SSI and FOI data sets provide detailed information, but only for each respective agency's land holdings, and the data were gathered using different methods and objectives. The CLAMS data set is based on satellite-imagery and field plots, and covers all of the Trask River watershed, making it possible to summarize across land ownerships. However, the CLAMS data are coarse, and species and age information is absent.

The distribution of conifer, hardwood, and mixed conifer-hardwood stands, by size class, is presented in Table 3.25 and Plate 3, based on CLAMS data. Over half of the forest in the Trask River watershed is dominated by conifers (51.5%) of which 91.8% are in the small (< 10 in) and medium (10 to 20 in) size classes. Mixed conifer-hardwood stands of all sizes account for 22.4% of forest in the watershed, half of which is in the small size class. Hardwood stands of all sizes account for 13.4% of the watershed. Other land cover categories (including water, open forest, open non-forest, woodlands and other vegetation types) collectively constitute 12.7% of the Trask River watershed.

Table 3.25. Vegetation type based on DBH (diameter at breast height) and basal area of trees. Numbers represent square miles and percent by subwatershed. Data derived from CLAMS (Coastal Landscape Analysis and Modeling Study) GIS coverages.

		Subwatershed																	
	Size Category (DBH)	EF of SF of Trask		Elkhorn		Lower Trask		MF of NF of Trask		NF of NF of Trask		NF of Trask		SF of Trask		Upper Trask		Grand Total	
Vegetation Type		mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%
Hardwood (>65%)	> 65% Hardwood presence (all sizes)	2.2	7.5	0.7	3.8	3.4	15.3	0.3	2.6	0.4	2.9	4.7	15.9	4.8	20.5	7.0	25.4	23.4	13.4
Mixed (20-65% hardwood)	Small (<10 in)	4.7	16.3	0.4	2.0	0.4	2.0	0.1	1.0	0.3	2.7	2.4	8.1	4.3	18.3	2.3	8.5	15.0	8.6
	Medium (10-20 in)	3.0	10.4	1.3	7.8	0.4	1.6	1.4	10.5	1.0	7.7	4.4	14.9	3.1	13.5	3.1	11.2	17.7	10.1
	Large (20-30 in)	0.5	1.8	0.3	1.9	0.1	0.5	0.3	1.9	0.2	1.2	1.0	3.4	0.6	2.5	1.2	4.3	4.1	2.3
	Very Large (>30 in)	0.3	1.1	0.0	0.2	0.1	0.5	0.0	0.2	0.1	0.6	0.3	0.9	0.4	1.8	1.2	4.4	2.5	1.4
Conifer (>80%)	Small (<10 in)	5.1	17.5	6.7	38.6	1.5	6.8	2.3	17.2	6.6	52.1	6.1	20.8	4.0	17.2	3.7	13.3	35.9	20.6
	Medium (10-20 in)	10.9	37.4	7.0	40.4	0.6	2.9	7.4	56.3	3.5	27.7	8.8	30.0	4.9	20.9	3.4	12.4	46.5	26.7
	Large (20-30 in)	1.9	6.5	0.5	2.8	0.1	0.5	0.6	4.3	0.3	2.4	0.8	2.8	0.9	3.7	0.9	3.2	6.0	3.4
	Very Large (>30 in)	0.1	0.4	0.1	0.3	0.0	0.0	0.1	0.5	0.1	0.4	0.2	0.6	0.1	0.3	0.9	3.3	1.5	0.8
Other[a]		0.3	1.0	0.4	2.3	15.7	70.0	0.7	5.5	0.3	2.3	0.7	2.5	0.3	1.4	3.9	14.0	22.0	12.7
	Grand Total	29.0		17.3		22.4		13.2		12.6		29.2		23.3		27.6		174.4	

[a] Water, open, non-forest vegetation

The CLAMS data show the highest proportion of medium-sized conifers in the Middle Fork of the North Fork subwatershed (56.3%), and the highest proportion of hardwoods in the Upper Trask subwatershed (25.4%). Medium-sized mixed conifer-hardwood stands are fairly evenly distributed throughout most of the watershed, ranging from 7.7% (North Fork of the North Fork subwatershed) to 14.9% (North Fork subwatershed); the Lower Trask subwatershed, which has only 1.6% of the mixed forest type, is the exception.

The distributions of forest stands by dominant tree species and age class on Tillamook District ODF land (SSI data) and BLM land (FOI data) are presented in Table 3.26. Three age class categories were created, based on stand age information present in both of the respective data sets ("age" in SSI and "DK" in FOI). Dominant tree species (Douglas-fir, western hemlock [*Tsuga heterophylla*], red alder, and Sitka spruce [*Picea sitchensis*] was shown from information in each data set, by subwatershed. Both the area and the percentage of each forest type category were calculated.

ODF lands are dominated by Douglas-fir stands 26 to 50 years old (84% of all Tillamook District ODF land within the Trask River watershed). Douglas-fir dominated stands also make up the greatest percentage of BLM lands within the Trask River watershed (65%), but there is a higher diversity of stands dominated by other tree species, such as red alder (23%), western hemlock (5.6%), and Sitka spruce (0.7%). Sitka spruce dominated stands on both ODF and BLM lands exist only within the Lower and Upper Trask River subwatersheds, probably because fog is more prevalent at the lower elevations found in these two subwatersheds.

3.2.3.2 Forest Management

ODF identifies three primary stand types within the Trask River watershed, each requiring different management activities (Tillamook and Forest Grove District Implementation Plans), as follows:

Regeneration Stands result from clearcuts and patch cuts. They are reforested within two years and vegetation management activities are undertaken to ensure sapling release. Pre-commercial thinning or pruning may take place. Larger green trees will be left at harvest, scattered or in clumps, to provide future snags and downed wood. Hemlock, cedar, noble fir, spruce, and Douglas-fir are planted to create species diversity.

Closed Single Canopy stands are a result of reforestation of the Tillamook Burn. Most are dense stands of Douglas-fir, but some are stands naturally regenerated with hemlock as the dominant species. Light to heavy partial cutting will be used in these stand types to promote understory, layering, and older forest structure. Partial cuts will mostly remove non-dominant trees and at times will be used to treat areas of Swiss needle cast (SNC; *Phaeocryptus gaumanni*). Snags will be left or created and down wood will be recruited by leaving cull logs and logging slash.

Understory, Layered, and Older Forest Structure Stands make up a small percentage of the Trask River watershed at this time. The goal of management will be to develop and maintain

Table 3.26. Distribution of forest stands by dominant tree species. Only ODF lands within the Tillamook District are included. Areas expressed as square miles and as a percent of total ODF or BLM land within a subwatershed. Data sources included SSI from ODF and FOI from BLM.

Subwatershed	Age Class (yr)	Dominant Tree Species																All Species			
		Douglas-fir				Western Hemlock				Red Alder				Sitka Spruce							
		ODF		BLM		ODF		BLM		ODF		BLM		ODF		BLM		ODF		BLM	
		mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%	mi^2	%
Lower Trask River	0-25	0.2	56															0.2	56		
	26-50	0.05	10															0.05	10		
	> 50			0.001	26	0.04	8.7							0.03	5.7	0.004	74	0.1	14	0.01	100
	All	0.3	66	0.001	26	0.04	8.7							0.03	5.7	0.004	74	0.4	80	0.01	100
Middle Fork of North Fork of Trask River	0-25																				
	26-50	0.02	100	1.6	80							0.2	8.8					0.02	100	1.7	88
	> 50			0.2	8.7															0.2	8.7
	All	0.02	100	1.7	88							0.2	8.8					0.02	100	1.9	97
North Fork of North Fork of Trask River	0-25																				
	26-50	0.1	100															0.1	100		
	> 50																				
	All	0.1	100															0.1	100		
North Fork of Trask River	0-25	0.7	2.9															0.7	2.9		
	26-50	21	85	1.5	50	1.2	4.7	0.01	0.4	1.7	6.9	0.4	12					24	97	1.9	62
	> 50	0.001	0.003	0.2	7.0							0.6	20					0.001		0.8	27
	All	22	88	1.7	57	1.2	4.7	0.01	0.4	1.7	6.9	1.0	32					25	100	2.7	89
South Fork of Trask River	0-25	0.1	0.5			0.001	0.01											0.1	0.5		
	26-50	17	94	0.5	67			0.03	3.5	0.8	4.4	0.1	12					18	98	0.6	82
	> 50	0.3	1.4	0.1	13													0.3	1.4	0.1	13
	All	18	96	0.6	80	0.001	0.01	0.03	3.5	0.8	4.4	0.1	12					18	100	0.7	95
Upper Trask River	0-25	0.9	6.7	0.04	1.0	0.1	0.6	0.02	0.6									1.0	7.3	0.1	1.6
	26-50	7.3	54	0.1	2.0	0.3	2.2			1.8	13	0.1	3.8					9.5	69	0.2	5.8
	> 50	1.6	12	0.6	17	1.2	8.9	0.6	18	0.1	1.0	1.7	47	0.02	0.1	0.1	2.5	3.0	22	3.0	85
	All	9.9	73	0.7	20	1.6	12	0.6	18	1.9	14	1.8	51	0.02	0.1	0.1	2.5	13	99	3.3	92
All Subwatersheds	0-25	2.6	2.9	0.04	0.3	0.1	0.1	0.02	0.2									2.7	3.0	0.1	0.4
	26-50	74	84	7.3	54	1.5	1.7	0.04	0.3	4.3	4.9	0.8	6.2					80	91	8.2	61
	> 50	3.9	4.4	1.5	11	1.2	1.4	0.7	5.2	0.1	0.1	2.3	17	0.04	0.05	0.1	0.7	5.3	6.1	4.5	33
	All	81	91	8.8	65	2.8	3.2	0.8	5.6	4.4	5.0	3.1	23	0.04	0.05	0.1	0.7	88	100	13	94

complex stand structure, such as by creating small openings or reducing tree density to facilitate improved growth of understory species. Light or moderate partial cutting and/or group selection cutting, as well as underplanting of conifers, is planned.

Forest management on ODF lands in the Trask River watershed for the current planning period (2003 to 2011) will be largely focused on addressing SNC infections, which are severe in approximately 40% of the Tillamook District forest in the Trask River watershed. According to the IP, severely impacted SNC stands will be harvested during the next two decades, and replanted with a diversity of tree species, including hemlock, cedar and spruce. Regeneration (REG) stands in the Tillamook District in the Trask will increase in proportion from <1% to approximately 25% during the planning period. Closed Single Canopy (CSC) will be reduced from 82% to approximately 53%. The desired future condition (DFC) for REG will be 10%, and 15% for CSC. Layered (LYR) and old forest stands (OFS), which currently constitute approximately 1% of the forest each, will be monitored over time, with partial cutting being prescribed if stand densities develop to a point where structure or function becomes limited. The DFC for LYR is 30% and for OFS is 20%.

The BLM utilizes land use allocations (LUA) and the Aquatic Conservation Strategy (ACS) to determine the types of management activities practiced on their land. LUAs provide guidance for the uplands, while the ACS designates Riparian Reserves (RR) for special management near streams and waterbodies. In the Trask River watershed, two LUAs are represented, adaptive management areas (AMA), and adaptive management reserves (AMR). AMAs are areas where new management approaches that integrate ecological and economic health, and restore late successional forest habitat may be developed and tested. AMRs combine late seral reserve (LSR) and AMA guidelines.

The ACS emphasizes management for the protection and restoration of aquatic and riparian habitat. According to the ACS, Riparian Reserves, which are streamsize zones of variable width, are to be managed according to special Standards and Guidelines. For more information on LUAs and the ACS, refer to the NFP and the Salem District Resource Management Plan (RMP).

3.2.3.3 Exotic/Noxious Plants

Exotic weed species exist within both forested and agricultural portions of the Trask River watershed. Such weed species tend to out-compete native plants, diminishing their population size and resulting in reduced plant species diversity. They are typically aggressive colonizers of disturbed soils, and are often found along roadside ditches, on recently harvested forest lands, and in agricultural fields. On both BLM and ODF lands within the Trask River watershed, noxious and other exotic weed species do not currently pose a significant problem, possibly due in part to the extensive canopy cover found on most forested lands (Kurt Heckeroth, BLM, and Susan Nicholas, ODF, pers. comm., 2003). Common exotic plant pest species within the Trask River watershed include Scotch broom (*Cytisus scoparius)*, Himalayan blackberry (*Rubus discolor*), Canadian thistle (*Cirsium arvense*) and bull thistle (*C. vulgare*). Tansy ragwort (*Senecio jacobaea*) is also present along roadsides within the watershed. Another wetland

invader, policeman's helmet (*Impatiens glandulifera*), has been observed within the watershed, but its extent and population size are unknown (Susan Nicholas, ODF pers. comm., 2003).

In agricultural areas, certain weed species can be toxic to livestock, or otherwise damaging to agricultural operations. The ODA designates such plants as noxious weeds. Noxious weeds of concern within the Trask River watershed are Scotch broom, tansy ragwort, Japanese knotweed (*Polygonum cuspidatum*) and giant knotweed (*Reynoutria sachalinensis*).

3.2.3.4 Rare Plants

Four categories of rare plants are managed by ODF are as follows:

1. Federal Threatened & Endangered plants – Plants designated on a federal level by the USFWS through a formal process. These species are protected by federal statute.
2. State Threatened & Endangered plants – Plants designated at the state level by the ODA through a formal process, and protected by state statute.
3. State Candidate plants – Plants designated by a formal process by the ODA. These species are not protected by statute, but ODF policy pledges special consideration.
4. Special Concern plants – Plants designated by ODF for special consideration.

Based on reviews of the Oregon Natural Heritage Program's database of plant locations, consultations with the Oregon Department of Agriculture's Rare Plant Program, and ODF's own work in the basin, the known or potential rare plants in the Trask River watershed on ODF land are listed in Table 3.27.

Table 3.27. Endangered, Threatened, Candidate, and Special Concern plant species on ODF land in the Trask River watershed.

Species	Common Name	Status[a]	Record Exists[b]	Potential to be Present
Threatened and Endangered Plants				
Sidalcea nelsoniana	Nelson's checkermallow	ST, FT		✔
Erythronium elegans	Coast Range fawn-lily	ST		✔
Plants of Special Concern				
Dodecatheon austrofrigidum	Frigid shootingstar	SP	✔	
Candidate Plants				
Sidalcea hirtipes	Bristly-stemmed sidalcea	SC	✔	
Filipendula occidentalis	Queen-of-the-forest	SC	✔	

[a] Status: FT = Federally Threatened; ST = State Threatened; SC = State Candidate; SP = Special Concern
[b] Plants have been observed on or in close proximity to state forestlands.

The BLM's Special Status Species policy includes a number of species in addition to those designated as Survey and Manage (see BLM website for description of the policy). The following is a list of Special Status Species that are known to occur on BLM land in the Trask River watershed:

Frigid shooting star (Bureau Sensitive) - *Dodecatheon austrofrigidum*

Western wahoo (Tracking Species) - *Euonymus occidentalis*

Tall bugbane (Bureau Sensitive) - *Cimicifuga elata*

Weak bluegrass (Tracking Species) - *Poa marcida*

Bog anemone (Assessment Species) - *Anemone organa*

3.2.3.5 Riparian Vegetation

Riparian vegetation was analyzed in the Trask River watershed for ODF by Falcy (2002). Following OWEB riparian assessment guidelines, riparian vegetation was classified by size, density, and vegetation type (i.e. conifer, hardwood, or a mixture of the two) using 1 m digital orthophotos (WPN 1999). Only streams on ODF lands were analyzed.

Ninety percent of the riparian vegetation on surveyed streams was composed of dense, medium-sized (12 to 24 in dbh) trees, of which conifer-dominated stands accounted for 22%, 40% were hardwood-dominated stands, and 38% were stands composed of a mixture of conifers and hardwoods (Table 3.28; Plate 11). The remaining 10% of the surveyed riparian zones were composed of sparse medium-sized conifers, small trees (4 to 12 in dbh), regeneration (<4 in dbh), and non-forest vegetation. Overstory vegetation was predominantly very dense. Large trees (>24 in dbh) were not common (Falcy 2002).

Table 3.28. Percent of conifers, hardwoods, and mixed forest in the riparian zone on ODF lands. (Source: Falcy 2002)

Subwatershed	Conifers	Hardwoods	Mixed
EF of SF Trask	28	39	34
Elkhorn	49	28	24
Lower Trask	12	6	82
MF of NF Trask	53	30	18
NF of NF Trask	28	33	40
NF Trask	9	40	52
SF Trask	16	47	37
Upper Trask	8	53	39
Total	22	40	38

Riparian reserves have been delineated on BLM lands, and are managed to protect and enhance riparian resources, as specified in the NFP and the Salem District ROD and RMP. Riparian reserves occupy 51% of BLM land in the Trask River watershed (6.9 sq mi). The riparian reserve width depends on the presence of fish and duration of flow. Fish-bearing streams have RR widths that are equal to two site-potential tree heights, and nonfish-bearing streams have RR widths equal to one site-potential tree height. In riparian reserves, timber harvest is permitted to acquire desired vegetation characteristics needed to attain ACS objectives, or following a

catastrophic natural event, or for salvage, if LWD is abundant. For detailed information on BLM riparian reserve management guidelines, refer to the RMP.

On ODF lands, riparian areas are managed with variable guidelines from the FMP for the Stream Bank Zone (0 to 25 ft from stream), the Inner RMA Zone (25 to 100 ft from stream), and Outer RMA Zone (100 to 170 ft from stream). Important characteristics include stream size, flow pattern, and fish use. For details of the ODF riparian management policy, refer to the Northwest Oregon State FMP.

3.3 SOCIAL

3.3.1 RECREATIONAL OPPORTUNITIES

Recreational opportunities throughout the Trask River watershed include a wide range of activities. Nonconsumptive activities such as camping, hiking, mountain biking, kayaking, and wildlife viewing generally have low potential for wildlife disturbance, soil compaction, or erosion. These activities are enjoyed on public lands within the Trask River watershed. Trails are prevalent on state lands within the Trask River watershed. Off-Highway Vehicle (OHV) use, a nonconsumptive use with much greater potential to disturb wildlife and result in soil disturbance and erosion, is very popular within the Trask River watershed. Based on the 1993 Tillamook Forest Recreation Plan, Forest Grove and Tillamook Districts have zoned areas that are open to OHV (designated trails only).

Consumptive recreational uses within the watershed include hunting, fishing, and mushrooming. Hunting and mushrooming occur throughout the watershed, from the valley bottoms up into the uplands. Impacts on natural resources are limited to the populations of animal or plant species being extracted, and the small amount of ground and vegetation disturbance resulting from human activity in the woods, which is generally minimal. Fishing from the streambank or from boats can impact fish populations, but has very little impact on other aspects of the watershed.

An additional impact of both consumptive and non-consumptive recreational activities can include the use of roads to access areas within the watershed, increasing traffic, and potentially erosion from road surfaces and the spread of exotic plants.

3.3.2 TIMBER HARVEST

Forest management objectives for both the ODF and BLM include timber harvest methods designed to improve wildlife habitat, forest health, forest structure, and tree species diversity. On ODF lands, desired future conditions, as presented in the Implementation Plan for the Trask Basin in the Tillamook District, include reduction of CSC forest from 82% to 15%. For the ODF Forest Grove District, CSC in the Sunday Creek Basin (the western portion of which is in the Trask River watershed) is targeted to be reduced from 56% to 10%. In the Tillamook District,

many of the CSC stands are affected by SNC (40% of the Tillamook District land in the Trask River watershed), so management options for LYR and OFS are limited in the short term.

During the current planning period (2003 to 2011), approximately 320 to 455 acres of partial cut and 10,160 to 14,515 acres of clearcut are anticipated in Tillamook District lands. Thinning has occurred or will occur on many acres, although the IP does not provide an estimate of the number of acres. The predominance of CSC in the watershed, much of which is affected by SNC, will make it difficult to plan for OFS and LYR stand types. Desired future conditions, which include 30% OFS and 20% LYR, are estimated to be at least 50 to 80 years away. In the Sunday Creek Basin of the Forest Grove District, approximately 350 to 700 acres will be clearcut, to increase the proportion of REG from <1% to 6%, approaching the DFC of 9%. Pre-commercial thinning will also be conducted on 50 to 100 acres.

BLM forest management activities are focused in the Elkhorn Activity Planning Unit (APU). In the Blind Barney lands, 320 acres of commercial thinning and 85 acres of small conifer release in riparian stands are planned. The Flora and Fauna lands include 118 areas designated for coarse woody debris creation, 880 acres of thinning, and a 5 acre botany survey. Finally, the Cruiserhorn lands include 673 acres of thinning, as well as projects identified for botany inventories, CWD treatments, pre-commercial thinning, and riparian release.