APPENDIX I – REVISED WHITE PASS FISHERIES TECHNICAL REPORT AND BIOLOGICAL EVALUATION FOR THE WHITE PASS EXPANSION PROPOSAL

1.0 INTRODUCTION

This Revised Fisheries Technical Report and Biological Evaluation has been prepared to supplement the analysis of fisheries resources for the White Pass Ski Area Expansion Final Environmental Impact Statement (FEIS). The analysis contained in this document has been updated from the Fisheries Biological Evaluation that accompanied the Draft EIS. The biological evaluation is meant to assess the impacts of the Action Alternatives on federal proposed, threatened, and endangered species under the provisions of the Endangered Species Act (ESA). Additionally, U.S. Forest Service sensitive species are included in this analysis per forest plan requirements.

1.1 PROJECT DESCRIPTION

The White Pass Ski Area expansion proposal has specific actions which may potentially affect water quality draining the project area, and thus occupied fish habitat downstream. These actions are detailed in Chapter 2 of the FEIS in Section 2.3. These actions include: full clearing with grading, full clearing with no grading, tree island removal/clearing, tree island retention, forest edge scalloping, and forest edge feathering. Full clearing with grading would occur at all locations where structures are proposed (e.g., lift towers, buildings, parking lot), and along key trails where a smooth surface is necessary. Graded surfaces would be re-vegetated where appropriate (i.e., ski trails). The remainder of actions all entail different levels of clearing overstory vegetation (trees) to create open routes for ski trails while feathering ski trail edges to minimize impacts on scenic quality, and leaving understory vegetation (shrubs, grasses, forbs) intact. Between 28.8 to 90 acres of new ski trails are proposed under the Action Alternatives. Where proposed ski trails intersect and cross stream channels, Riparian Reserves would have various levels of clearing (permanent overstory tree removal). Utilities for lift towers and new buildings would be buried underground within the limits of proposed ski trails, with aerial crossings over streams. Specific details for each of the Action Alternatives can be found in Chapter 2 of the FEIS (refer to Sections 2.3.2 - 2.3.6).

1.2 PROJECT AREA (WHITE PASS STUDY AREA)

The project area encompasses approximately 1,572 acres and lies on the crest of the Cascade Mountains. The project area drains into two river systems, the Cowlitz and Tieton Rivers. The project area includes the current and proposed SUP area of White Pass.

Cumulative Effects Analysis Area

Customized 5th field watersheds were delineated for cumulative effects determinations in each drainage, and to assess potential indirect impacts to fish populations/habitat downstream of the White Pass Study

Area. On the Tieton side, the analysis area includes the Clear Creek and North Fork Tieton River drainages, which join together in Clear Lake, as well as the Indian Creek and South Fork Tieton River – all of which drain to Rimrock Lake. This customized 5th field encompasses 118,204 acres, and is called the Upper Tieton watershed.

On the Cowlitz River side, Millridge Creek and the Clear Fork Cowlitz River drainages at the confluence with the Cowlitz River, excluding Mount Rainier National Park, were included for this analysis. This customized 5th field totals 70,722 acres, and is called the Upper Clear Fork Cowlitz watershed.

2.0 METHODS

A thorough review of available data and literature on fisheries resources for the White Pass project area was completed. Primary sources include the Clear Fork Watershed Analysis (USDA 1998a) and the Upper Tieton Watershed Assessment (USDA 1998b). Additional information containing detailed fish distribution, habitat data and the occurrence of special status species (i.e., threatened, endangered, or Forest Service sensitive) for Millridge Creek and Clear Creek respectively, were collected and reviewed. Other data sources include stream survey reports, previous biological evaluations, and documents as referenced throughout the text.

To assist in making effects determinations to fisheries populations from the proposed actions, the Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale (USDI 1998) will be used.

3.0 FISH DISTRIBUTION

3.1 UPPER TIETON RIVER WATERSHED

Within the Upper Tieton River watershed, only resident fish are known to occur (USDA 1998b). Redband trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), whitefish (*Prosopium williamsoni*), and sculpins (*Cottus spp*.) are typically found throughout the watershed (USDA 1998b). Within Leech Lake, brook trout have been introduced as part of a stocking program. The fish present in Leech Lake represent the only known fish presence within the White Pass Study Area in either the Upper Tieton or the Upper Clear Fork Cowlitz watersheds.

Clear Creek, which drains Leech Lake and flows into Clear Lake, is known to contain populations of brook trout, cutthroat trout, rainbow trout and sculpins (USFS 1997b, 2005). Dog Lake, which flows into Clear Creek, contains rainbow trout (redband) and brook trout (USDA 1998b). Additionally, bull trout are not expected to occur within Clear Creek, as evidenced by the lack of detection during snorkel surveys. Bull trout are known to occur within the North Fork Tieton River and Clear Lake (USFS 1997a, 2004). Rimrock Lake supports a known population of bull trout, however spawning primarily occurs in Indian

Creek and the South Fork Tieton River. Consequently, Clear Lake and the North Fork Tieton River have been proposed as critical habitat for bull trout.

Anadromous fish are excluded from the Upper Tieton River watershed due to the Tieton Dam on Rimrock Lake. Passage of resident fish upstream from Rimrock Lake is limited by a thermal barrier at the fish ladder leading into Clear Lake due to warmer temperatures in the ladder (USFS 1994). This thermal barrier appears to limit bull trout migration out of Rimrock Lake and into the North Fork Tieton River. Within Clear Creek, waterfall barriers to resident fish passage occur at the outlet of Leech Lake and a waterfall below the US 12 crossing (USFS 1994). These natural barriers isolate resident fish populations within Clear Creek.

3.2 UPPER CLEAR FORK COWLITZ WATERSHED

The Upper Clear Fork Cowlitz watershed contains resident populations in addition to several anadromous fish including; Chinook salmon, coho salmon, and steelhead (USDA 1998a). Within the Upper Clear Fork Cowlitz watershed, all fish populations described occur outside of the White Pass Study Area. Bull trout in the Cowlitz River are listed as Threatened under the ESA. The Columbia River Distinct Population Segment includes the upper Cowlitz River. No bull trout are known to occur within the Clear Fork Cowlitz River and their presence is considered unlikely based on the exhaustive sampling conducted by the GPNF with no positive results. The last anecdotal report of native char within the Upper Clear Fork Cowlitz watershed was Dolly Varden (*Salvelinus malma*) and occurred in 1934. The historic sightings of Dolly Varden may have been bull trout, which Cavander (1978) subsequently described as a distinct species (USDA 1998a). Knuppenberg Lake supports a limited brook trout fishery, but heavy fishing pressure and possible emigration downstream out of the lake keeps production minimal. It was thought that brown trout might be more successful and were planted by the Washington Department of Wildlife in 1983, 1987, and 1988 without considerable success (USDA 1998a).

Anadromous fish distribution within the Clear Fork Cowlitz River is limited by a waterfall barrier approximately 8 miles downstream of the White Pass Study Area, at approximately River Mile 1.3. Downstream of the confluence of the Clear Fork Cowlitz River with the Cowlitz River, Tacoma Public Utilities and Lewis County Public Utility District operate three dams that block upstream anadromous fish migration (USDA 1998a). Currently, salmon and steelhead are trapped at hydroelectric projects in the lower reaches and hauled to several release points upstream of the last barrier dam (Cowlitz Falls Dam). Within Millridge Creek, fish distribution is limited by steep gradients associated with headwater tributaries. Knuppenberg Lake is known to have been stocked with brown trout, an introduced species from stocking programs (USDA 1998a). Rainbow trout and brook trout both occur within Millridge Creek (USFS 2004). No fish are known to occur within the White Pass Study Area due to the higher gradient streams that are primarily intermittent.

3.3 SPECIAL STATUS SPECIES

Special status fish species known to occur within downstream reaches of the Upper Clear Fork Cowlitz and Upper Tieton watersheds are listed below in Table 1.

Table 1:
Special Status Species Occurring in the
Upper Clear Fork Cowlitz and Upper Tieton River Watersheds

Species	Status	Presence Within Downstream Reaches	
		Upper Tieton River	Upper Clear Fork Cowlitz
Lower Columbia River Chinook (*Oncorhynchus tschawytscha*)	Federal Threatened	N	Y
Lower Columbia River Steelhead (*Oncorhynchus mykiss*)	Federal Threatened	N	Y
Bull Trout (*Salvelinus confluentus*)	Federal Threatened	Y	N
Lower Columbia River Coho (*Oncorhynchus kistuch*)	Federal Threatened	N	Y
Redband Trout (*Oncorhynchus mykiss sp.*)	USFS Sensitive Species	Y	N

4.0 HABITAT AND DOCUMENTATION OF ENVIRONMENTAL BASELINE

4.1 FISH HABITAT

Fish habitat is characterized by the variables that affect the physical and chemical environment of a water body that the fish inhabit. The physical environment can be characterized by habitat type, stream flow, large woody debris, and stream channel characteristics. In simplest terms, stream habitat types can be described as pool, riffle, or glide. Pools provide resting and cover habitat for fish and also allow fine sediments to settle out due to reduced velocity. Spawning typically takes place in riffle or glide areas, and pool tailouts. A stream may have high quality fish habitat when it has alternating, well distributed habitat units, with an adequate minimum area of each, to support the life cycle requirements of the species present (actual habitat quality also depends on elements such as the complexity or diversity of these units, cover provided, food supplies, etc.). The distribution of habitat units under natural conditions depends on the type of channel, the amount of water, the amount and type of sediment, and the nature of the streamside vegetation. Watershed management activities may therefore alter the distribution of habitat units by disturbing the channel, changing the water or sediment input to the stream, or changing the streamside vegetation. Stream characteristics include the channel type, geometry, geomorphology, dimensions, substrate, bank stability, and riparian zone vegetation.

The chemical environment of a stream is characterized by the water quality. Water quality includes stream temperatures, sediment, and pollutants all of which have the potential to affect fish habitat. Fish exhibit preferences for certain water temperature ranges at various points during their life cycle; incubation, rearing, migration, and spawning (Bjornn and Reiser 1991). Increased sediment levels can cover gravels, reducing available spawning habitat. Additionally, increased sediment can also result in increased water turbidity which affects the ability of fish to forage and navigate. Pollutants can affect fish and other aquatic organisms when concentrations reach threshold levels. Indirect impact to fish habitat could occur when pollutants impact macroinvertebrate communities, an important food base for most fish species.

Streams and ponds within the proposed SUP expansion area (i.e., Hogback Basin) do not support fish due to the steep gradients and ephemeral/intermittent stream channels and ponds. Leech Lake, located in the northeastern corner of the White Pass Study Area, supports the only known fish habitat within the White Pass Study Area. Approximately 30 percent of the White Pass Study Area drains east through Leech Lake and Clear Creek into the Upper Tieton River watershed. Waters draining west from White Pass into the Upper Clear Fork Cowlitz watershed through Knuppenberg Lake and Millridge Creek include the Hogback Basin and approximately 70 percent of the White Pass Study Area.

Upper Tieton River Watershed

In Upper Tieton River watershed, fish habitat within the White Pass Study Area is generally limited to Leech Lake. Streams within the White Pass Study Area are typically intermittent or perennial Rosgen Type A channels, which are typically steep, transport channels (SE Group 2004). Streams characteristics within Clear Creek are typically Rosgen Type B channels, which are primarily transport channels and do not contain high quality fish habitat (USDA 1998b). Access to fish habitat is limited by several barriers, including a waterfall below Leech Lake, and a culvert at the US 12 crossing. Access to off-channel habitat is limited by waterfalls and culverts on several tributaries to Clear Creek. Pool habitat within Clear Creek is currently functioning adequately. Stream surveys of the lower reaches indicate that pool and riffle frequency is approximately 37 pools per mile with the total length of riffle habitat dominating (USFS 1997b). No stream surveys within the White Pass Study Area have assessed pool and riffle habitat. For more information on stream types, see Section 3.3 – Watershed Resources.

Large woody debris (LWD) provides rearing and spawning habitat for fish by creating pools, trapping sediment, stabilizing stream banks, and providing cover. LWD densities within Clear Creek were measured during a stream survey of the lower reaches of Clear Creek and are below the Forest standards (USFS 1997b). The standard for LWD is 100 pieces per mile with a diameter greater than 12 inches. Within Clear Creek, the lower reaches contained approximately 33 pieces per mile (USFS 1997b). Within the watershed, LWD recruitment has been limited due to clearing associated with road development (USFS 2000).

Very little data regarding substrate conditions are available for Clear Creek. Previous assessments have rated this parameter to be at risk due to road crossings and the potential for sediment delivery to the stream (USFS 2000 and 2004). Several road crossings of Clear Creek likely contribute sediment to the system (USFS 1994). A survey of Clear Creek (approximately River Mile 0.0 to 2.2) indicated that pools within the lower reaches are dominated by sand and gravel (USFS 1997b). Clear Creek substrate is predominately cobbles and boulders (USFS 1994).

Riparian vegetation in Clear Creek and the Upper Tieton River watershed is fairly intact (USFS 2004). Therefore riparian vegetation is functioning adequately to provide shade and stream cover for fish species.

As described in Section 3.3 – Watershed Resources, available water quality information is limited. Water temperatures within Clear Creek average 55.3 degrees Fahrenheit. The maximum 7-day average temperature is approximately 52.2 degrees, which meets the standard for bull trout (USFS 2004). There is limited data available on other water quality parameters within Clear Creek (USDA 1998b). Within the White Pass Study Area, water temperatures are primarily influenced through springs and average temperatures are 42 to 45 degrees (USFS 1994). No 303d listed water bodies occur within the watershed (USDA 1988b).

As discussed in Section 3.3 – Watershed Resources, stream flows within the Upper Tieton watershed portion of the White Pass Study Area for the 7-day low flow is approximately 1.23 cubic feet per second (cfs) and the 2-year peak flow is 54.4 cfs. The flow is measured at the mouth of the flow model analysis area which is located at the inlet to Leech Lake.

Upper Clear Fork Cowlitz River Watershed

In the Upper Clear Fork Cowlitz River watershed, streams within the White Pass Study Area are not fish-bearing. Stream characteristics within the White Pass Study Area are typically ephemeral and intermittent Rosgen Type A channels, which are steep transport channels and do not provide high quality fish habitat (SE Group 2004). Millridge Creek contains limited fish habitat. Fish presence in Millridge Creek is assumed to be from stocking programs in Knuppenberg Lake. Stream channels within the mainstem Clear Fork Cowlitz River and Millridge Creek are also predominately Rosgen Type A channels (USDA 1998a). Habitat is highly fragmented within Millridge Creek and lower portions of the Clear Fork Cowlitz River due to fish migration barriers, resulting from natural steep channel gradients, and a high density of road crossings (greater than one per mile).

Quality fish habitat within the Clear Fork Cowlitz River is considered limited due to a lack of pools throughout surveyed reaches (USDA 1998a). In general, a comparison between 1935 and 1991 stream data has shown an overall loss of 36 percent of pool habitat in the Clear Fork Cowlitz River (USDA

1998a). Riffles are the predominant habitat type in Millridge Creek, primarily due the steeper gradient characteristic of a Rosgen A channel type (Type A and Aa).

LWD conditions within the Clear Fork Cowlitz River have been rated as good, indicating that there is a density greater than 80 pieces per mile (USDA 1998a). Forest clearing associated with US 12 has limited LWD input to Millridge Creek and will continue to limit recruitment potential in the future. As such, LWD conditions within Millridge Creek are poor.

The dominant substrate, as characterized by a 1992 stream survey, in the Clear Fork Cowlitz River is cobbles (USDA 1998a). Qualitative descriptions of substrate in Millridge Creek below Knuppenberg Lake indicated mainly a sandy bottom, interspersed with gravel, cobbles, and boulders in steeper sections (USFS 1983). Spawning gravel conditions within Millridge Creek and the Clear Fork Cowlitz River is a known data gap (USDA 1998a). Millridge Creek is somewhat sediment impaired due to road sanding operations on US 12 contributing to an increased percent of fine sediment in the stream. Knuppenberg Lake acts as a natural sediment trap on Millridge Creek, which minimizes downstream sediment transport to known fish habitat in the mainstem Clear Fork Cowlitz River. The percent of fine sediment within the Clear Fork Cowlitz River is low, indicating that impacts to fish habitat (particularly spawning gravel conditions) are less likely to occur (USDA 1998a).

Riparian vegetation within the Upper Clear Fork Cowlitz is relatively intact (USDA 1998a). Therefore riparian vegetation is functioning adequately to provide shade and stream cover for fish species. Previous clearing associated with US 12 adjacent to Millridge Creek has reduced the amount and function of riparian vegetation in these areas. However, no fish have been documented in the portion of Millridge Creek adjacent to US 12.

As described in Section 3.3 – Watershed Resources, available water quality information is limited. Stream temperature within the lower reaches of Millridge Creek averaged 8.5 degrees Celsius (47 degrees Fahrenheit) from point measurements taken during a stream survey (USFS 1983), which meets the 2006 Washington State Surface Water Quality Standard for bull trout (refer to Section 3.3 – Watershed Resources). No 303d listed water bodies occur within the Upper Clear Fork Cowlitz River watershed (USDA 1998a).

As discussed in Section 3.3 – Watershed Resources, streams flows within the Upper Clear Fork Cowlitz watershed portion of the flow model analysis area for the 7-day low flow is approximately 3.12 cfs. The 2-year peak flow is approximately 130.7 cfs.

4.2 ENVIRONMENTAL BASELINE (CEAA)

4.2.1 Upper Tieton River Watershed

4.2.1.1 Population Structure

Steelhead trout occurred in the watershed prior to the construction of Rimrock Dam, but were eliminated when the dam was constructed in 1924, so they will not be included in the following population discussion. There is no confirmed steelhead trout spawning use in the main Tieton River below Rimrock Dam. Spawning and rearing does occur in Oak Creek, a lower river tributary.

Subpopulation Size

Rimrock lake supports a relatively strong but isolated (by Rimrock dam) population of bull trout. Both Indian Creek and the South Fork Tieton Rivers are very important bull trout spawning and rearing streams. Based on 1996 and 2004 snorkel surveys, bull trout are also known to occur in the North Fork Tieton River, but the key spawning areas are unknown (Central Washington University 1996). No bull trout spawning habitat occurs downstream of the White Pass Study Area. Minnow trapping throughout much of Clear Creek, a small amount of electrofishing, and a short snorkel survey on Clear Creek have been conducted, with no bull trout found.

Redd counts have been conducted annually in Indian Creek since 1988 and in the South Fork Tieton since 1994. The Indian Creek redd counts average 142 per year but have decreased in the last three years. South Fork Tieton redd counts average 161 with a low of 95 in 1994 a high of 233 in 1996, and appear stable. A redd count survey occurred in the North Fork Tieton in 2004 (1 bull trout redd found), and a partial survey was conducted in 2006 with negative results (USFS unpublished data). An extensive snorkeling census for bull trout (and other fish species) in the North Fork Tieton River and in Clear Creek was conducted in 2004 and 2005 respectively. Bull trout were found in the North Fork Tieton River, but none were found in Clear Creek. Currently the Bureau of Reclamation and cooperators are preparing a feasibility study to improve fish passage facilities at Clear Lake Dam to restore bull trout access to the North Fork Tieton River and Clear Creek. Subpopulation size is considered to be **functioning adequately** for bull trout.

White Pass SUP Expansion Effects All Alternatives: The proposed activities will **maintain** the functioning adequately rating for bull trout. Actions that clear overstory trees within Riparian Reserves (mostly intermittent stream channels) could have a delayed increase in streambank instability (and sediment movement downstream) as the existing instream large wood gradually breaks down and is flushed downstream. Maintaining permanent ski trails across stream channels will decrease the future available large wood that could fall into stream channels. Large trees cleared in Riparian Reserves will be felled towards stream channels and left in place. This will create an added pulse of large wood for stream channels that will function to keep streambanks stable for an unknown number of years.

Construction of the parking area will disturb soils, and increase localized runoff. Specified stormwater management and other Mitigation Measures will minimize sediment delivery and increased flow to Leech Lake, however. Implementation of the Action Alternatives would result in an increase in low flows to Leech Lake by a range of 0.0 percent under Alternative 2 to 4.6 percent under Alternative 9. This projected increase in low flow would result in an estimated increase of approximately 0.00 cfs (Alternative 2) to 0.06 cfs (Alternative 9) during a low flow event. Likewise, the estimated two-year peak flows to Leech Lake would increase by a range of 0.0 percent under Alternative 2 to 1.1 percent under Alternative 9, resulting in an increase of approximately 0.0 to 0.6 cfs in discharge, respectively, in the Upper Tieton River (refer to FEIS Table 3.3-18). The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Tieton River would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

The increase in sediment delivered to bull trout habitat would likely be immeasurable, particularly below Leech Lake, which would function as a sediment trap. The WEPP model estimated that short-term project-generated sediment detachment within the White Pass Study Area which would potentially reach streams and/or wetlands would increase by a range of 0.0 percent under Alternative 2 to 12.8 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4). Long-term, project-generated sediment yield would increase by a range of 0.0 percent under Alternative 2 to 0.8 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4 and Appendix L – WEPP Technical Report). Management Requirement MR1 would require the implementation of a SWPPP during construction and proper stabilization/treatment of construction activities. The use of silt fences would constitute a short-term measure during construction (silt fences are typically removed after the site stabilizes) and could reduce potential sediment yields to streams by 90 percent, although it has been estimated that actual effectiveness would be 60 to 65 percent. Furthermore, long-term reductions in sediment yield to streams would be reduced through revegetation and other BMPs (e.g., sediment basins). Therefore, with mitigation, sediment delivery due to the parking lot and other construction activities is expected to be negligible.

All proposed activities within the Upper Tieton River watershed drain into Leech Lake before continuing on to reach Clear Creek and Clear Lake. The impact of increased sediment would be localized to non fish-bearing stream channels upstream of Leech Lake, and will not affect the subpopulation size of bull trout in Clear Lake.

Growth and Survival

Growth and survival appears to be **functioning adequately** for bull trout with two spawning populations. Redd counts in Indian Creek have been stable except the last three years, and have been stable in the South Fork Tieton, even with large disturbances such as floods and severe draw-down of Rimrock Lake.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning adequately rating for bull trout and all other resident fish populations, for the same rationale/reasons listed above under Subpopulation Size.

Life History Diversity and Isolation

Migratory bull trout populations are present but are isolated above the Rimrock Lake so life history strategies that utilized the lower Tieton and possibly the Naches River are no longer present in the Upper Tieton. Currently bull trout passage from Rimrock Lake into Clear Lake (and the North Fork Tieton River) is impeded by design limitations of the existing fish ladder. Bull trout are known to migrate from Rimrock Lake up to the base of Clear Lake Dam, but avoid the channel leading to the fish ladder, presumably because surface waters flowing down the ladder are too warm for bull trout. Water flowing through the dam is cold, from deep water release. There is some indication that the Indian Creek and Tieton populations are somewhat distinct. In several years of monitoring, Indian Creek fish have not been observed spawning in the South Fork and vice versa (Paul James, Central Washington University, personal communication). It is not known how well juvenile fish are able to move through Rimrock Lake from their natal streams to possibly refound a population in one stream or the other. Therefore, bull trout Life History and Isolation is considered to be **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This proposal will **maintain** the functioning at risk rating for bull trout because no barriers to fish movement would be added or removed. Bull trout will continue to be isolated above Rimrock Lake, and between Rimrock Lake and Clear Lake/North Fork Tieton River. Competition will continue between historically stocked rainbow and brook trout and native trout regardless of these projects.

Persistence and Genetic Integrity

Two relatively strong bull trout populations exist, the South Fork Tieton and Indian Creek. Fish tagging study data indicate that the spawning populations of Indian Creek and the South Fork Tieton River do not intermix, even though both populations forage in Rimrock Lake. A small bull trout population occurs in the North Fork Tieton River. Because the populations are somewhat isolated, and the ubiquitous presence of brook trout within the upper watershed, bull trout Persistence and Genetic Integrity will be considered **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: These projects will **maintain** the functioning at risk ratings for bull trout for the same reasons as are listed above in the Life History Diversity and Isolation section listed above.

4.2.1.2 Water Quality

Temperature

Both the North Fork Tieton River and Clear Creek are **functioning adequately** as can be seen from the table below. During low flow conditions of summer and fall, the channel of middle Clear Creek goes sub-surface. A large off channel spring approximately 2 miles from Clear Lake produces the entire surface flows that reach Clear Lake during summer low flow periods. The water is very cold (40 degrees Fahrenheit) at the spring.

Table 2:
Stream Temperatures from Recording Thermographs

Stream	Year	# days >61*	# days >58*	# days sampled	Max. Temp.	Max. 7-day Avg.
North Fork Tieton River at Scatter Creek	1997	0	0	41	53.6	51.6
North Fork Tieton River at 1200	1997	0	0		52.7	51.0
	1998	0	0	41	58.7	57.3
	1999	0	0	72	52.4	51.1
	2000	0	0		55.6	54.8
Clear Creek at Rd 1200	1997	0	0	56	55.3	52.2

White Pass SUP Expansion Effects All Alternatives: Streams within the Upper Tieton watershed are functioning adequately and expected to be **maintained** by this project. Thinning and permanent loss of overstory trees is proposed to occur within Riparian Reserves. Most of this area is along intermittent streams that do not flow during mid-summer thru fall, and should not influence downstream water temperatures in reaches supporting fish populations. Surface flows in Clear Creek between the project area and Clear Lake go subsurface during the summer low flow period. Increased growth of shrubs, willows and alders after the overstory canopy is cleared will restore some shading that is lost from the proposed actions.

Sediment

Limited sediment data is available for streams in the Upper Tieton watershed. Pebble counts were conducted in the North Fork Tieton River during the 1998 level II survey. Surface fines <6mm averaged 22 percent within the three survey reaches. Reach 3 is entirely within Wilderness and had the highest percentage of surface fines (average=31 percent) The North Fork Tieton is considered **functioning adequately**, because the majority of this drainage is within Wilderness, and primarily influenced by natural processes. Clear Creek is considered **functioning at risk**, because of the presence of the 840 road in the floodplain which has likely delivered fine sediment above natural levels and increased streambank erosion due to confinement from the road.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current sediment condition ratings for fish bearing streams downstream of the project area for the same rationale/reasons discussed in the Subpopulation Size.

Chemical Contaminants/ Nutrients

No streams in the Upper Tieton watershed are on the 303(d) list and there are no known or suspected sources of contaminants, therefore the Upper Tieton is considered to be **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: This condition will be **maintained** under the proposed actions by following Best Management Practices (USFS 1988), and implementing specific Mitigation Measures in the FEIS.

4.2.1.3 Habitat Access

Physical Barriers

Rimrock dam is a complete migration barrier isolating the Upper Tieton from the rest of the Naches subbasin. Clear Lake Dam isolates the North Fork Tieton from both the South Fork Tieton and the mainstem Tieton. A ladder was constructed at the Clear Lake dam in 1992 in an attempt to provide access for bull trout from Rimrock Lake to Clear Lake and its tributaries. Bull trout have not been using the ladder possibly due to water temperatures. Water through the ladder is 50 degrees Fahrenheit while most of the water being released comes from the bottom of the lake and is 40 degrees Fahrenheit. Adult bull trout do move to the base of the dam, but whether they would migrate over the ladder if water temperatures were suitable, or if they are just feeding on kokanee spawners is unknown. No bull trout observed at the base of Clear Lake appear to be in spawning condition (pers. comm., Cummins). A culvert on Hell Creek (tributary to North Fork Tieton River) at the 1207 road appears to be at least a seasonal barrier to juvenile fish and possibly adults. It is unknown if bull trout rear in Hell Creek. There are no other known man-made barriers located in the Upper Tieton watershed. Overall the Upper Tieton is considered **functioning at unacceptable risk**.

White Pass SUP Expansion Effects All Alternatives: This project will not affect fish passage in any way, so it will **maintain** the functioning at unacceptable risk rating.

4.2.1.4 Habitat Elements

Substrate

Limited sediment data is available for streams in the Upper Tieton watershed. Substrate embeddedness estimates are no longer part of the Region 6 Level II Stream Survey due to the difficulty in achieving consistent survey results. Substrate embeddedness was not surveyed in Clear Creek or the North Fork Tieton River. Pebble counts were conducted in the North Fork Tieton River during the 1998 level II survey. Surface fines <6mm averaged 22 percent within the three survey reaches. Reach 3 is entirely

within Wilderness and had the highest percentage of surface fines (average=31 percent) The North Fork Tieton is considered **functioning adequately**, because the majority of this drainage is within Wilderness, and primarily influenced by natural processes. Clear Creek is considered **functioning at risk**, because of the presence of the 840 road in the floodplain which has likely delivered fine sediment above natural levels and increased streambank erosion due to confinement from the road.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current sediment condition ratings for fish bearing streams downstream of the project area for the same rationale/reasons discussed in the Subpopulation Size.

Large Woody Debris

Forest Plan Standards require >100 pieces of LWD (80 percent >12 inches in diameter and 20 percent >20 inches in diameter) per mile of stream. Reach 1 of the North Fork Tieton River has 63 pieces per mile >12 inches. Several of its small tributaries have had riparian timber harvest, so it is rated **functioning at risk**. Reaches 2 and 3 of the North Fork Tieton River have 51 and 90 pieces of LWD per mile, have had very little timber harvest and other management because of proximity to and inclusion in Wilderness, so they are rated **functioning adequately**. Reaches 1 and 2 of Clear Creek are **functioning at risk**.

Table 3:
Large Instream Wood Counts in Streams within the Analysis Area

Stream	Reach	Large/ Mile	Medium/ Mile	Small/ Mile	Total Wood/ Mile	Large+ Med/ Mile
North Fork Tieton River (1998 Survey)	1	26	37	78	141	63
	2	13	38	87	138	51
	3	36	54	83	173	90
Clear Creek	1	2	30	102	134	32
	2	14	36	80	130	40

White Pass SUP Expansion Effects All Alternatives: Much of the watershed is functioning appropriately (except Clear Creek and Reach 1 of the North Fork Tieton). In the short-term, project actions will increase instream large wood in those areas affected by ski trail creation, as some trees will be felled into intermittent stream channels to create ski trails. In the long-term, instream large wood will decrease in those site specific stream segments that are maintained as ski trail clearings, as the current wood decomposes or is flushed downstream. On the 5th field scale, this project is not likely to adversely affect the current large wood rating, and would not affect instream wood densities in fish bearing streams downstream of the project area. This project will **maintain** the current condition ratings for Clear Creek, as wood transport out of the project area to downstream fish-bearing stream reaches is likely impossible, due to slope position of the ski trail clearing, small size of stream channels, the culvert under US 12, and

the catchment of Leech Lake. Conditions of the North Fork Tieton will not change, because it functions independent of Clear Creek above Clear Lake.

Pool Frequency and Quality

Most streams are considered to be **functioning adequately** for the channel type with deep pools within geomorphic constraints. The watershed is largely unmanaged so streams are **functioning adequately**.

Table 4:
Pool Frequencies

Stream	Reach	Gradient (%)	Pools/ reach	Bankfull width (ft)	BFCW/ pool surveyed	Pools/mile
North Fork Tieton River	1	<1	68	70.0	4.1	18.6
	2	2.1	46	66.6	5.0	15.5
	3	0.01	63	50.5	5.6	18.7
Clear Creek	1	3	70	No Data		35
	2	3	11	No Data		80

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning appropriately rating for pools. Adverse effects to quality pool habitat is largely caused by increased sedimentation, increased peak flows, loss of instream large wood, or floodplain constriction. This project has slight potential to increase sedimentation downstream within the project area. This is not expected to be measurable. Leech Lake is a natural sediment trap that would buffer Clear Creek from increased sedimentation. The project would not change peak flows/timing, floodplain constriction, or large wood densities in downstream stream reaches.

Off-Channel Habitat

Off-channel habitat is **functioning adequately** in the form of side channel habitat, tributaries and beaver dams. The North Fork Tieton has beaver dams, side channels, ponds and marshes present. Side channels were noted in the Clear Creek survey.

White Pass SUP Expansion Effects All Alternatives: This project is not expected to have an impact on off-channel habitat and therefore the functioning appropriately off-channel habitat will be **maintained**.

Refugia

The North Fork Tieton and Clear Creek provide habitat refugia but the presence of introduced rainbow and brook trout may displace native species or make suitable habitat unusable. Refugia for bull trout is considered **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the at-risk rating for refugia in the watershed at the 5th field scale. No measurable change in the quality of fish habitat is expected in Clear Creek.

4.2.1.5 Channel Conditions and Dynamics

Width/Depth Ratio

Overall width/depth ratios appear to be appropriate for the channel types and channel types are appropriate for the geomorphic setting and are **functioning adequately**.

Table 5:
Bankfull Width/Depth Ratios

Stream	Reach	BFCW	BFCD	Bankfull W/D
North Fork Tieton River	1	70.0	2.0	35.0
	2	66.6	1.9	35.1
	3	50.5	1.9	26.6
Clear Creek	1	No Data	No Data	No Data
	2	No Data	No Data	No Data

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current functioning appropriately rating. Adverse effects to width/depth ratios are largely caused by increased sedimentation, increased peak flows, loss of instream large wood, or destabilized streambanks.

This project has slight potential to increase sedimentation downstream within the project area. This is not expected to be measurable. Leech Lake is a natural sediment trap that would buffer Clear Creek from increased sedimentation. The WEPP model estimated that short-term project-generated sediment detachment within the White Pass Study Area, which would potentially reach streams and/or wetlands, would increase by a range of 0.0 percent under Alternative 2 to 12.8 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4). Long-term, project-generated sediment yield would increase by a range of 0.0 percent under Alternative 2 to 0.8 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4 and Appendix L – WEPP Technical Report). Management Requirement MR1 would require the implementation of a SWPPP during construction and proper stabilization/treatment of construction activities. The use of silt fences would constitute a short-term measure during construction (silt fences are typically removed after the site stabilizes) and could reduce potential sediment yields to streams by 90 percent, although it has been estimated that actual effectiveness would be 60 to 65 percent. Furthermore, long-term reductions in sediment yield to streams would be reduced through revegetation and other BMPs (e.g., sediment basins). Therefore, with mitigation, sediment delivery due to the parking lot and other construction activities is expected to be negligible.

The project would not change peak flows/timing, large wood densities, or streambank stability in downstream stream reaches. Implementation of the Action Alternatives would result in an increase in low

flow in the Upper Tieton River by a range of 0.0 percent under Alternative 2 to 4.6 percent under Alternative 9. This projected increase in low flow would result in an estimated increase of approximately 0.00 (Alternative 2) to 0.06 cfs (Alternative 9) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Tieton River would increase by a range of 0.0 percent under Alternative 2 to 1.1 percent under Alternative 9, resulting in an increase of approximately 0.0 to 0.6 cfs in discharge, respectively (refer to FEIS Table 3.3-18). The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Tieton River would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

Streambank Condition

Streambank condition during stream surveys was measured as the percentage of ground cover representing physical (bedrock, boulders or cobbles) or vegetative (shrubs, trees or grasses) armoring against scour from bankfull flow.

In 1998, the total length of eroded streambank for each side of the stream was recorded at measured units. The percentage of streambank that was eroding at these sites was calculated and it is assumed that this percentage is representative of the whole reach. Reach 1 of the North Fork Tieton is rated **functioning at risk** with 70.3 percent of its streambanks being stable, and Reaches 2 and 3 are rated **functioning adequately** with 94.5 percent and 85 percent of their streambanks being stable. Reaches 1 and 2 of Clear Creek are rated **functioning adequately** with 1.33 and 2.8 percent notes as "eroded" respectively.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current functioning adequately rating for streams in the Upper Tieton watershed. Streambank stability will be maintained in downstream reaches, and by retaining understory vegetation along streambanks cleared for ski trails.

Floodplain Connectivity

The Upper Tieton watershed is **functioning adequately** as all streams are well connected with their floodplains, with the exception of Clear Creek. Clear Creek is rated **functioning at risk**, because it is confined in places by the 840 road. Other areas where floodplain function has been altered are the Clear Lake impoundment where the stream floodplains are now inundated. The reservoir has sterile drawdown zones as opposed to floodplains and little littoral zone, making it functioning at unacceptable risk.

White Pass SUP Expansion Effects All Alternatives: Stream channels directly affected by the proposed action are intermittent streams with very limited floodplain potential due to their steepness and current entrenched condition. The loss of overstory trees within Riparian Reserves in the project area would not affect floodplain connectivity in downstream reaches of Clear Creek. Current conditions will be **maintained**.

4.2.1.6 Flow/ Hydrology

Peak/Base Flow

Clear Creek and the North Fork Tieton have had little or no timber harvest and are considered **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: The project will **maintain** the At Risk rating. Overstory clearing would increase the total acres with <10 percent canopy closure in the South Fork Clear Creek subwatershed. Currently, 6.5 percent of the total subwatershed (2,215 acres) is in the <10 percent canopy closure condition. Alternative 9 would result in the greatest amount of overstory clearing in mature forest along perennial channels of any Action Alternative, approximately 20.3 acres, and increase the area of <10 percent canopy closure to 7.5 percent. Typically increases to peak flows are not likely unless 25-30 percent of a subwatershed is in the <10 percent canopy closure condition (Garrigues, personal communication 2004). Implementation of the Action Alternatives would result in an increase in low flow in the Upper Tieton River by a range of 0.0 percent under Alternative 2 to 4.6 percent under Alternative 9. This projected increase in low flow would result in an estimated increase of approximately 0.00 (Alternative 2) to 0.06 cfs (Alternative 9) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Tieton River would increase by a range of 0.0 percent under Alternative 2 to 1.1 percent under Alternative 9, resulting in an increase of approximately 0.0 to 0.6 cfs in discharge, respectively (refer to FEIS Table 3.3-18). The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Tieton River would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

Drainage Network Increase

North Fork Tieton and Clear Creek are considered **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning adequately rating relative to drainage network increase. The proposed action will not construct any new roads or trails. Revegetation of areas disturbed by construction of lift towers will follow Forest Service Best Management Practices to minimize soil erosion until vegetation is re-established.

4.2.1.7 Watershed Conditions

Road Density and Location

Road densities are variable within the Upper Tieton watershed. As can be seen from the table below, the North Fork Tieton and Clear Creek watersheds are **functioning adequately** due to having road densities less than 1.0 mile/square mile.

Table 6:
Road and Stream Densities

Watershed	Total Acres	Total Square Miles	Road Miles	Road Density (mi./sq. mi.)
North Fork Tieton River	31,559	49.3	33.3	0.68
Clear Creek	12,225	19.1	12.2	0.64

White Pass SUP Expansion Effects All Alternatives: No new roads will be constructed or obliterated within the Upper Tieton watershed, so the project will **maintain** the current functioning adequately rating.

Disturbance History

Much of the North Fork Tieton Creek drainage is within Wilderness and not impacted by management activities, so is rated **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning adequately rating. Although some disturbance will occur within Riparian Reserves, listed fish populations downstream would not be affected (refer to sub-population size section). The proportion of forested acres in the South Fork Clear Creek subwatershed with <10 percent canopy cover will approach 7.5 percent, well within accepted thresholds.

Riparian Reserves

North Fork Tieton and Clear Creek watersheds are **functioning adequately** with largely intact (little management) Riparian Reserves.

White Pass SUP Expansion Effects All Alternatives: Although Riparian Reserves will degraded on the site specific scale from permanent loss of overstory trees, the project will **maintain** the adequately functioning rating within the 5th field watershed analysis area.

Disturbance Regime

Most of the watershed is in mesic or wet forest. The fire regime has not been greatly altered. Disturbance regime is **functioning adequately** for Clear Creek and the North Fork Tieton.

White Pass SUP Expansion Effects All Alternatives: The proposed project should not effect the quality of fish habitat downstream, so disturbance regime conditions will be **maintained**.

Integration

Significant bull trout populations exist in the Upper Tieton. The North Fork Tieton is **functioning adequately**. Clear Creek is **functioning at risk** due to the large number of brook trout present.

White Pass SUP Expansion Effects All Alternatives: The White Pass expansion would **maintain** the functioning adequately rating for the North Fork Tieton and Indian Creek, and the at risk rating for Clear Creek since none of the project occurs in these areas.

4.2.2 Upper Clear Fork Cowlitz River Watershed

4.2.2.1 Population Structure

Subpopulation Characteristics (subpopulation size, growth and survival, life history diversity/isolation, persistence/genetic integrity, integration)

Chinook salmon, Coho salmon, steelhead trout, interior redband trout: Several factors combine to limit anadromous and resident fish in the Upper Clear Fork Cowlitz watershed. Natural and human-caused barriers such as bedrock falls, high stream channel gradients, logjams, and road crossings prevent migration of adult spawners and rearing juveniles. Hydroelectric dams on the Cowlitz River currently block volitional passage of anadromous species into the Upper Clear Fork Cowlitz watershed. Currently salmon, and steelhead are trapped and hauled around the hydroelectric facilities in the lower Cowlitz River (USDA 1998a).

White Pass SUP Expansion Effects All Alternatives: The Gifford Pinchot National Forest has insufficient data to rate these indicators. Fish passage records on the Cowlitz River dams cannot be used to evaluate this watershed because fish are collected from all five 5th field watersheds upstream (USFS 2001).

4.2.2.2 Water Quality

Temperature

There is very little water temperature data for this watershed. The existing data show cold water temperatures, but little data has been collected on afternoon or evening temperatures for the Clear Fork Cowlitz River or Millridge Creek. Given the position in the watershed, altitude, relatively undamaged condition of the watersheds and glacial source of these streams it is unlikely that water temperatures exceed 59 degrees Fahrenheit. Based on the available data, streams in the Upper Clear Fork Cowlitz watershed are rated **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: Streams within the Upper Clear Fork Cowlitz watershed are functioning adequately and expected to be **maintained** by this project. Thinning and permanent loss of overstory trees is proposed to occur within Riparian Reserves along intermittent snowmelt channels in a parkland canopy structure with 40-69 percent canopy cover. Most of this area is along intermittent streams that do not flow during mid-summer thru fall, and should not influence downstream water temperatures in reaches supporting fish populations. Maintenance of existing vegetation and increased growth of shrubs, willows and alders after the parkland canopy is thinned will maintain/restore shading that is lost from the proposed actions.

Sediment (in spawning areas)

No data addresses sediment in the manner described by the matrix criteria. However, the sediment regime at the watershed scale reflects near-natural conditions as most of the sediment delivered to the system is generated from natural sources (e.g., glacial systems, natural mass wasting). Many streams were rated for fine sediments under the Clear Fork watershed analysis in 1998. On a local 7th field watershed scale, some streams are sediment impaired (Millridge Creek). US 12 is in close proximity to Millridge Creek, and winter sanding operations are likely increasing fine sediments in that stream. Millridge Creek is considered **functioning at risk**. The Upper Clear Fork Cowlitz is **functioning adequately** because fine sediment is not considered a limiting factor in the watershed as it was mostly rated as Good in the watershed assessment.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current sediment condition ratings for fish bearing streams downstream of the project area. Actions that clear overstory trees within Riparian Reserves (mostly intermittent stream channels traveling through a parkland canopy structure with low LWD potential) could have a delayed increase in streambank instability (and sediment movement downstream) as the existing instream large wood gradually breaks down and is flushed downstream. Maintaining permanent ski trails across stream channels will decrease the future available large wood that could fall into stream channels. Large trees cleared in Riparian Reserves will be felled towards stream channels and left in place. This will create an added pulse of large wood for stream channels that will function to keep streambanks stable for an unknown number of years. The increase in sediment delivered would likely be immeasurable, particularly below Knuppenberg Lake, which would function as a sediment trap. The WEPP model estimated that short-term project-generated sediment detachment within the White Pass Study Area, which would potentially reach streams and/or wetlands within the Upper Clear Fork Cowlitz watershed, would increase by a range of 9 percent under Alternative 6 to 68 percent under Modified Alternative 4 (refer to FEIS Table 3.3 FEIS4). Long-term, project-generated sediment yield would increase by a range of 3 percent under Alternative 9 to 10 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4 and Appendix L – WEPP Technical Report). Management Requirement MR1 would require the implementation of a SWPPP during construction and proper stabilization/treatment of construction activities. The use of silt fences would constitute a short-term measure during construction (silt fences are typically removed after the site stabilizes) and could reduce potential sediment yields to streams by 90 percent, although it has been estimated that actual effectiveness would be 60 to 65 percent. Furthermore, long-term reductions in sediment yield to streams would be reduced through revegetation and other BMPs (e.g., sediment basins). Therefore, with mitigation, sediment delivery due to the parking lot and other construction activities is expected to be negligible. All proposed activities within the Millridge Creek watershed drain into Knuppenberg Lake before continuing downstream into the Clear Fork Cowlitz River. The predicted increase in sediment delivery downstream of the White Pass Study Area would be localized to non fish-bearing stream channels upstream of Knuppenberg Lake. Due to the natural sediment trap at Knuppenburg lake, implementation of BMPs to

reduce sediment delivery to stream channels, and the spatial separation of 8 stream miles between the White Pass Study area and occupied habitat, the project will have no effect to listed fish species.

Chemical Contaminants/ Nutrients

No streams in the Upper Clear Fork Cowlitz watershed are identified in the watershed assessment as water quality limited from contaminants. Therefore, the Upper Clear Fork Cowlitz is considered to be **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: This condition will be **maintained** under the proposed action by following Best Management Practices (USFS 1988), and implementing specific Mitigation Measures in the FEIS.

4.2.2.3 Habitat Access

Physical Barriers

Although the watershed analysis does not identify any known unnatural barriers to fish passage, it does indicate that the Millridge and middle Clear Fork sub-watersheds to be highly fragmented six-field drainages with >1 road crossing (with streams) per mile of stream. Most road crossings are on intermittent non fish-bearing streams. Overall the Clear Fork and Millridge drainages are considered **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This project will not affect fish passage in any way, so it will **maintain** the functioning at risk rating.

4.2.2.4 Habitat Elements

Substrate

Substrate embeddedness estimates are not part of the Region 6 level II stream survey anymore, due to the difficulty in collecting data consistently among surveyors. However, the sediment regime at the watershed scale reflects near-natural conditions as most of the sediment delivered to the system is generated from natural sources (e.g., glacial systems, natural mass wasting). Many streams were rated for fine sediments under the Clear Fork watershed analysis in 1998. On a small scale, some streams are sediment impaired (Millridge Creek). US 12 is in close proximity to Millridge Creek, and winter sanding operations are likely increasing fine sediments in that stream. Millridge Creek is considered **functioning at risk**. The Upper Clear Fork Cowlitz is **functioning adequately** because fine sediment is not considered a limiting factor in the watershed as it was mostly rated as Good in the watershed assessment.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current sediment condition ratings for fish bearing streams downstream of the project area for the same rationale/reasons discussed under Sediment.

Large Woody Debris

Stream survey data indicates that some reaches of the Upper Clear Fork Cowlitz watershed meet the criteria. However, these numbers may be inflated because smaller size standards may have been used when categorizing large wood counts. About 58 percent of the Clear Fork stream length is considered in good condition (80 pieces of LWD per mile). Because of uncertainty of data quality, the Upper Clear Fork Cowlitz watershed is rated **functioning at risk**. Millridge is rated **functioning at risk** because the near proximity of US 12 is limiting the amount of large trees next to the stream and thus future large wood recruitment to the stream.

White Pass SUP Expansion Effects All Alternatives: Although the majority of tree removal will take place in a parkland forest structure with low LWD recruitment potential, in the short-term, project actions will increase instream large wood in those areas affected by ski trail creation, as some trees will be felled into intermittent stream channels. In the long-term, instream large wood will decrease in those site specific stream segments that are maintained as ski trail clearings, as the current wood decomposes or is flushed downstream. On the 5th field scale, this project would not degrade the current large wood rating, and would not affect instream wood densities in fish bearing streams downstream of the project area. This project will **maintain** the current condition ratings for Millridge Creek and Clear Fork Cowlitz River, as wood transport out of the project area to downstream fish-bearing stream reaches is likely impossible, due to slope position of the ski trail clearing, small size of stream channels, and the catchment of Knuppenberg Lake.

Pool Frequency and Quality

The indicator is rated **functioning at risk** for Millridge Creek and Clear Fork Cowlitz River because nearly all of the surveyed stream length lacks pool type habitat and rates fair for pool frequency. A comparison of large pools between 1935 and 1991 shows a loss of 6.7 pools per mile (-36 percent).

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning at risk rating for pools. Adverse effects to quality pool habitat is largely caused by increased sedimentation, increased peak flows, loss of instream large wood, or floodplain constriction. This project has slight potential to increase sedimentation downstream within the project area. The WEPP model estimated that short-term project-generated sediment detachment within the White Pass Study Area, which would potentially reach streams and/or wetlands within the Upper Clear Fork Cowlitz watershed, would increase by a range of 9 percent under Alternative 6 to 68 percent under Modified Alternative 4 (refer to FEIS Table 3.3 FEIS4). Long-term, project-generated sediment yield would increase by a range of 3 percent under Alternative 9 to 10 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4 and Appendix L – WEPP Technical Report). This is not expected to be measurable below the White Pass Study Area. The predicted increase in sediment delivery downstream of the White Pass Study Area would be localized to non fish-bearing stream channels upstream of Knuppenberg Lake. Due to the natural sediment trap at

Knuppenburg lake, implementation of BMPs to reduce sediment delivery to stream channels, and the spatial separation of 8 stream miles between the White Pass Study area and occupied habitat, the project would have no effect to pool habitat occupied by listed fish species. Knuppenberg Lake is a natural sediment trap that would buffer Millridge Creek and the Clear Fork Cowlitz from increased sedimentation.

The project would not measurably change peak flows/timing, floodplain constriction, or large wood densities in downstream stream reaches. Implementation of the Action Alternatives would result in an increase in low flow in the Upper Clear Fork Cowlitz watershed by a range of 0.7 percent under Alternative 9 to 1.6 percent under Modified Alternative 4. This projected increase in low flow would result in an estimated increase of approximately 0.02 (Alternative 9) to 0.05 cfs (Modified Alternative 4) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Clear Fork Cowlitz watershed would increase by a range of 0.2 percent under Alternatives 6 and 9 to 0.4 percent under Modified Alternative 4, resulting in an increase of approximately 0.2 to 0.4 cfs in discharge, respectively (refer to FEIS Table 3.3-18). The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Clear Fork Cowlitz watershed would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

Off-Channel Habitat

The valley types in this watershed are narrow and not conducive to the formation of off-channel habitats. US 12 is likely constricting portions of Millridge Creek from forming off-channel habitat, and is **functioning at risk**. The Clear Fork Cowlitz is relatively unconstrained, and is **functioning adequately** given its naturally narrow valley type.

White Pass SUP Expansion Effects All Alternatives: This project is not expected to have an impact on off-channel habitat and therefore the current conditions for off-channel habitat will be **maintained**.

Refugia

The Clear Fork Cowlitz River does provide refugia for resident populations. This habitat is not accessible to anadromous fish or downstream resident populations. Much of Millridge Creek is likely too steep to provide refugia to native fishes, and is likely inhabitated only by stocked fish that migrated up and down from Knuppenberg Lake. Since habitats are insufficient in connectivity, this indicator is **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the at-risk rating for refugia in the watershed at the 5th field scale. No measurable change in the quality of fish habitat is expected downstream.

4.2.2.5 Channel Conditions and Dynamics

Width/Depth Ratio

Virtually no field data exists to assess this indicator. The Clear Fork Watershed analysis attempts to address this question with aerial photo analysis. The Clear Fork Cowlitz has short sections that were interpreted to have widened since 1973. The weakness of such an exercise is that it totally dependent on the line of vegetation and not channel dimensions. Because of lack of data and limited photo analysis, this indicator is rated **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current functioning at risk rating. Degradation of width/depth ratios are largely caused by increased sedimentation, increased peak flows, loss of instream large wood, or destabilized streambanks. This project has slight potential to increase sedimentation downstream within the project area. The WEPP model estimated that short-term project-generated sediment detachment within the White Pass Study Area, which would potentially reach streams and/or wetlands within the Upper Clear Fork Cowlitz watershed, would increase by a range of 9 percent under Alternative 6 to 68 percent under Modified Alternative 4 (refer to FEIS Table 3.3 FEIS4). Long-term, project-generated sediment yield would increase by a range of 3 percent under Alternative 9 to 10 percent under Alternative 9 (refer to FEIS Table 3.3 FEIS4 and Appendix L – WEPP Technical Report). This is not expected to be measurable downstream of the White Pass Study Area. Knuppenberg Lake is a natural sediment trap that would buffer Millridge Creek from increased sedimentation.

The project would not change peak flows/timing, large wood densities, or streambank stability in downstream stream reaches. Implementation of the Action Alternatives would result in an increase in low flow in the Upper Clear Fork Cowlitz watershed by a range of 0.7 percent under Alternative 9 to 1.6 percent under Modified Alternative 4. This projected increase in low flow would result in an estimated increase of approximately 0.02 (Alternative 9) to 0.05 cfs (Modified Alternative 4) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Clear Fork Cowlitz watershed would increase by a range of 0.2 percent under Alternatives 6 and 9 to 0.4 percent under Modified Alternative 4, resulting in an increase of approximately 0.2 to 0.4 cfs in discharge, respectively (refer to FEIS Table 3.3-18). The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Clear Fork Cowlitz watershed would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

Streambank Condition

No data exists to directly address this habitat condition. The Clear Fork watershed analysis used the data from Pfankuch rating forms, which rate channel stability. This system incorporates many factors including bank stability. The model is more for predicting instability than measuring stability. Since no

6th field watersheds were rated as "good" in the watershed assessment this indicator is rated **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the current functioning at risk rating for streams in the analysis area. Streambank stability will be maintained in downstream reaches, and by retaining understory vegetation along streambanks cleared for ski trails.

Floodplain Connectivity

Based on field observations and post-flood assessment, there appear to be some stream reaches with noticeable channel downcutting (i.e., floodplain abandonment). Road density is moderate within the developed portions of some sub-watersheds. Overall the loss of floodplain connectivity is not considered to be extreme and this indicator is rated *functioning at risk.*

White Pass SUP Expansion Effects All Alternatives: Stream channels directly affected by the proposed action are intermittent streams with very limited floodplain potential due to their steepness and current naturally entrenched condition. The loss of Riparian Reserves overstory trees along intermittent reaches in a subalpine parkland canopy structure in the project area due to thinning would not affect floodplain connectivity in downstream reaches of Millridge Creek and the Clear Fork Cowlitz River. Current conditions will be **maintained**.

4.2.2.6 Flow/ Hydrology

Peak/Base Flow

The analysis area has an Aggregate Recovered Percentage (ARP) value of 95.9 percent (hydrologic maturity). The ARP method calculates a predicted hydrologic recovery for a basin based on stand year-of-origin, tree species, and site class, assuming that a stand is 100 percent hydrologically recovered once it reaches an average diameter at breast height of 8 inches. This is close to natural conditions, and rated **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: The project will **maintain** the functioning adequately rating. The proposed action would decrease the ARP value by less than 1 percent within the analysis area (from 95.9 percent to 95.6 percent). Typically increases to peak flows are not likely unless a watershed is modified to less than 70 percent ARP condition (Garrigues, personal communication 2004). Implementation of the Action Alternatives would result in an increase in low flow in the Upper Clear Fork Cowlitz watershed by a range of 0.7 percent under Alternative 9 to 1.6 percent under Modified Alternative 4. This projected increase in low flow would result in an estimated increase of approximately 0.02 (Alternative 9) to 0.05 cfs (Modified Alternative 4) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Clear Fork Cowlitz watershed would increase by a range of 0.2 percent under Alternatives 6 and 9 to 0.4 percent under Modified Alternative 4, resulting in an increase of approximately 0.2 to 0.4 cfs in discharge, respectively (refer to FEIS Table 3.3-18). The relatively small

projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Clear Fork Cowlitz watershed would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology.

Drainage Network Increase

This indicator is rated **functioning adequately**. The drainage network increase was estimated by counting the number of stream crossings by roads, multiplying the number of stream by an average distance between the crossing and the nearest drainage structure and dividing by the total miles of stream in the watershed. The overall value was 1.7 percent.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning adequately rating relative to drainage network increase. One new permanent road (0.25 mile) is proposed under Alternative 6, and would cross four intermittent stream channels in Riparian Reserves. As mitigation, 0.6 mile of road would be obliterated within the Upper Clear Fork Cowlitz watershed. The proposed action will not construct any new roads or trails aside from re-routing the PCNST (Modified Alternative 4) at the crest. Revegetation of areas disturbed by construction of lift towers or other facilities will follow Forest Service Best Management Practices to minimize soil erosion until vegetation is re-established.

4.2.2.7 Watershed Conditions

Road Density and Location

Overall the road density was 0.69 mile per square mile and Riparian Reserve road density was moderate in the lower Clear Fork watershed (1.5 miles/square mile), and low in the other watersheds within the analysis area. This indicator is rated **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: One new permanent road (0.25 mile) is proposed under Alternative 6, and would cross four intermittent stream channels in Riparian Reserves. As mitigation, 0.6 mile of road would be obliterated within the Upper Clear Fork Cowlitz watershed. Because an equal or greater distance of road will be obliterated in this watershed, the project will **maintain** the current functioning adequately rating. No new roads will be constructed or obliterated under the other Action Alternatives.

Disturbance History

The ARP exceeds 95 percent in the analysis area, therefore this indicator is **functioning adequately**.

White Pass SUP Expansion Effects All Alternatives: This project will **maintain** the functioning adequately rating. Although some disturbance will occur within Riparian Reserves, fish populations

downstream should not be adversely affected. The percentage of the watershed as ARP will decrease by less than 1 percent to 95.6 percent, still well above accepted thresholds (70-75 percent).

Riparian Reserves

There is very little fragmentation of Riparian Reserves from management activities. However Riparian Reserves are fragmented and impacted on Millridge Creek from the adjacent US 12, so this indicator is **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: Although Riparian Reserves will degraded on the site specific scale from permanent loss of overstory trees in a parkland forest along intermittent snowmelt channels, the project will **maintain** the functioning at risk rating within the modified 5th field analysis area.

Disturbance Regime

There have been about 15 ten-year or greater flood events since 1970 on the Cowlitz River. The effects of these floods are less than in the lower watersheds, because this watershed is a relatively unmanaged headwater watershed. However, at least one major channel changing land slide was observed in the Upper Clear Fork Cowlitz sub-watershed after the 1996 flood. This indicator is rated **functioning at risk**.

White Pass SUP Expansion Effects All Alternatives: The proposed project should not effect the quality of occupied fish habitat downstream, so disturbance regime conditions will be **maintained**.

5.0 EFFECTS OF THE ACTION

5.1 FISH DISTRIBUTION

Alternative 1

Under Alternative 1, there would be no impacts to fish presence. White Pass Ski Area would continue to operate within its current SUP area and no construction would occur. Ongoing operations and maintenance of the White Pass Ski Area would continue to occur. These activities typically include trail maintenance during summer months, facility maintenance, and winter ski operations (i.e., grooming). Trail and facility maintenance involves brushing and mowing vegetation. Grooming operations typically extend the persistence of the snowpack later in the spring melt period through artificial compaction. Typically, this results in a one to two week delay in the timing of peak spring melt flows (Stockli and Rixen 2000; Rixen et al. 2001). Indirect impacts to fish presence from the maintenance and operation activities are not expected to be measurable because they occur in areas previously cleared and maintained in a modified condition.

Alternatives 2 and 6

Under Alternatives 2 and 6, White Pass Ski Area would expand its existing ski operations into the Pigtail and Hogback Basins. No direct impacts to fish would occur as there is no fish presence within the streams in the proposed expansion area. No in-water work would occur in Leech Lake or any stream channels.

As discussed in Section 3.3 – Watershed Resources, approximately 17.7 acres (Alternative 2) or 12.6 acres (Alternative 6) of clearing and grading would occur within Riparian Reserves (refer to Table 3.3-14). According to the WEPP model, short-term soil detachment within the Upper Clear Fork Cowlitz watershed would increase by approximately 23 percent under Alternative 2, and 9 percent under Alternative 6. Long-term soil detachment would increase by approximately 4 percent under Alternative 2, and 5 percent under Alternative 6. In the Upper Tieton watershed, short-term soil detachment would increase by 0.0 percent under Alternative 2 and 0.1 percent under Alternative 6. Short-term soil detachment would increase by 0.0 percent under Alternative 2 and 0.8 percent under Alternative 6. Increased sedimentation and decreased water quality could potentially impact fish presence downstream in Leech Lake, Knuppenberg Lake, Clear Creek, and Millridge Creek. Implementation of Mitigation Measure MM3 would reduce trail widths when crossing streams and Riparian Reserves to minimize potential disturbances in these areas. The implementation of Management Requirement MR1 would require the development of a Stormwater Pollution Prevention Plan (SWPPP) and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized.

Implementation of the Alternatives 2 or 6 would result in an increase in low flow in the Upper Tieton River by approximately 0.0 percent under Alternative 2 and 0.7 percent under Alternative 6. This projected increase in low flow would result in an estimated increase of approximately 0.00 (Alternative 2) to 0.01 cfs (Alternative 6) during a low flow event. Likewise, the estimated two-year peak flows in the Upper Tieton River would increase by 0.0 percent under Alternative 2 and 0.2 percent under Alternative 9, resulting in an increase of approximately 0.0 to 0.1 cfs in discharge, respectively (refer to FEIS Table 3.3-18). In the Upper Clear Fork Cowlitz watershed, seven-day low flow would increase by 1.4 percent under Alternative 2 and 0.8 percent under Alternative 6, resulting in an increase of approximately 0.05 and 0.02 cfs respectively. Two-year peak flow would increase by 0.3 percent under Alternative 2 and 0.2 percent under Alternative 6, resulting in an increase of approximately 0.5 and 0.2 cfs, respectively. The relatively small projected increase in low flow and two-year peak flow combined with the typical amount of instrumentation error associated with measuring discharge rates indicates that the estimated increase in stream flow in the Upper Tieton and Upper Clear Fork Cowlitz watersheds would not be measurable at the mouth of the Flow Model Analysis Area with current monitoring technology. Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

Modified Alternative 4

Under Modified Alternative 4, White Pass Ski Area would expand its existing ski operations into the Pigtail and Hogback Basins and new development would take place in the existing SUP area, including a 7-acre parking lot. No direct impacts to fish would occur as there is no fish presence within the streams in the proposed expansion area. No in-water work would occur in Leech Lake or any stream channels.

As discussed in Section 3.3 – Watershed Resources, approximately 25.8 acres of clearing and grading would occur within Riparian Reserves within the White Pass Study Area under Modified Alternative 4 (refer to FEIS Table 3.3-14). As described by the WEPP model, short-term soil detachment in the Upper Clear Fork Cowlitz watershed would increase by approximately 68 percent under Modified Alternative 4. Long-term soil detachment in this watershed would increase by approximately 10 percent. In the Upper Tieton watershed, short-term soil detachment would increase by 0.1 percent, and long-term soil detachment would increase by 0.2 percent. Increased sedimentation and decreased water quality could potentially impact fish presence downstream in Leech Lake, Knuppenberg Lake, Clear Creek, and Millridge Creek. Implementation of Mitigation Measure MM3 would reduce trail widths when crossing streams and Riparian Reserves to minimize potential disturbances in these areas. The implementation of Management Requirement MR1 would require the development of a Stormwater Pollution Prevention Plan (SWPPP) and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized.

Implementation of Modified Alternative 4 would cause increases in the seven-day low flow in the Upper Clear Fork Cowlitz watershed by 1.6, resulting in an increase of approximately 0.05 cfs. Two-year peak flow would increase by 0.4 percent, or 0.5 cfs, in the Upper Clear Fork Cowlitz watershed within. Seven-day low flow within the Upper Tieton watershed would increase by approximately 2.1 percent, resulting in an increase of 0.03 cfs under Modified Alternative 4. Two-year peak flow in the Upper Tieton would increase by 0.5 percent, or 0.3 cfs, under Modified Alternative 4. Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

Alternative 9

Under Alternative 9, White Pass Ski Area would expand ski operations within the existing SUP area through the addition of a new surface lift and trails. No direct impacts to fish would occur as there are no fish present within the SUP area.

Approximately 24.4 acres of clearing and grading would occur within Riparian Reserves (refer to Table 3.3-14 in Section 3.3 – Watershed Resources). Increased sedimentation and decreased water quality could potentially impact downstream fish presence in Leech Lake, Clear Creek, and Millridge Creek. Implementation of Mitigation Measure MM3 would reduce trail widths when crossing streams and Riparian Reserves to minimize potential disturbances in these areas. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measures MM2, MM4,

and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized. Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

5.2 FISH HABITAT

Alternative 1

Under Alternative 1, White Pass would continue to operate without any further development. No additional impacts would occur to fish habitat under Alternative 1. Ongoing operations and maintenance of the White Pass Ski Area would continue to occur. These activities typically include trail maintenance during summer months, facility maintenance, and winter ski operations (i.e., grooming). Indirect impacts to fish habitat from the maintenance and operation activities are not measurable because they occur in areas previously cleared and maintained in a modified condition.

Alternative 2

Under Alternative 2, White Pass would expand the existing ski area SUP into the Hogback Basin. There would be no direct impacts to fish habitat as there is no habitat present within the White Pass Study Area. Indirect impacts to fish habitat could occur in downstream reaches of the Clear Fork Cowlitz River and Upper Tieton River watersheds through increased sediment loading, changes in water quality (i.e., temperature), and changes in flow. Implementation of Mitigation Measure MM3 would reduce trail widths when crossing streams and Riparian Reserves to minimize potential disturbances in these areas. Additionally, Mitigation Measures MM3 would require that trees cut within Riparian Reserves be left on the ground, outside of ski trails but remaining within the Riparian Reserve, to provide future LWD recruitment downstream. The 17.7 acres of clearing and grading within Riparian Reserves under Alternative 2 would immediately reduce any LWD input that these areas currently provide to the streams although the clearing in parkland is not anticipated to result in the loss of large wood, due to the comparatively small tree size class in the parkland community. Since stream channels in the White Pass Study Area are located very high in the watershed and are typically ephemeral and intermittent, it is assumed that LWD in the channel has a low probability of being transported downstream by high water events.

Approximately 17.7 acres of clearing and grading would occur within Riparian Reserves under Alternative 2 (refer to Table 3.3-14 in Section 3.3 – Watershed Resources). Increased sedimentation and decreased water quality could potentially impact downstream fish habitat in Leech Lake, Knuppenberg Lake, Clear Creek, and Millridge Creek. According to the WEPP model, short-term soil detachment within the Upper Clear Fork Cowlitz watershed would increase by approximately 23 percent under Alternative 2. Long-term soil detachment would increase by approximately 4 percent. In the Upper Tieton watershed, short-term soil detachment would increase by 0.0 percent, and long-term soil detachment would increase by 0.0 percent under Alternative 2 (refer to FEIS Appendix L – WEPP). There would be

no impacts to the Upper Tieton watershed because no development would take place in this watershed under Alternative 2. The potential for increased sediment loading would not be measurable above baseline levels. Increased sediment loading would potentially occur from clearing and grading within riparian influence zone on moderate to high erosion potential areas (refer to Section 3.3 – Watershed Resources). Under Alternative 2, no clearing or grading would occur within high erosion potential areas and approximately 2.6 acres would occur on moderate and low erosion hazard areas. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measure MM2 and Other Management Practice OMP5 would require appropriate erosion control Best Management Practices (i.e., silt fencing) and the revegetation of exposed soils to reduce potential erosion and sediment yield to streams. Therefore, the potential for increased sediment loading would not be measurable.

As described in Section 3.3 – Watershed Resources, existing stream shading is approximately 46.5 percent in the Upper Clear Fork Cowlitz watershed (the range of variation is 23 to 70 percent) and 49.5 percent in the Upper Tieton watershed (the range of variation is 25 to 75 percent). There would be no impacts to stream shading within the Upper Tieton watershed under Alternative 2. In the Upper Clear Fork Cowlitz watershed, approximately 17.7 acres of clearing and grading would occur within Riparian Reserves. Stream shading would be reduced by approximately 4.5 percent as a result, therefore the amount of solar radiation reaching the stream would increase slightly, potentially warming the water. Since a majority of the activities would occur adjacent to intermittent and ephemeral streams, no impacts to water temperature are anticipated because no water would be present during summer months when solar radiation is at it highest point. The implementation of Mitigation Measures MM3 and MM10 would retain riparian understory vegetation to the greatest extent practicable to maintain stream shading.

Impacts to water quality would be short-term and would result from potential runoff from leaks and spills associated with construction equipment. No long-term impacts to water quality are expected because there would be no new point sources of pollution under Alternative 2. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized. Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

A potential increase in low flow and 2-year peak flows could occur as a result of forest clearing proposed under Alternative 2. As discussed in Section 3.3 – Watershed Resources, forest clearing and creation of new impervious surfaces can increase surface and shallow subsurface flows, ultimately altering the flow regime of a watershed (Dunne, T. and L. B. Leopold 1978; Naiman, R.J. and R. E. Bilby 1998). Proposed forest clearing within the White Pass Study Area would only have the potential to affect surface flows because research indicates that forest clearing predominantly affects soil moisture, surface runoff, and shallow subsurface flow in the soil profile (Naiman and Bilby 1998; Keppeler 1998; Harr et al. 1975). As

described in Section 3.3 – Watershed Resources, the flow model analysis area does not account for the flows at the mouth of each 5th field watershed area. Instead, the flow model watershed area has been modified to include the entire drainage area of the White Pass Study Area, which is located in the headwaters of the 5th field. The flow model area within the Upper Tieton drainage is approximately 535 acres with the flow measured at the inlet to Leech Lake. The flow model area within the Upper Clear Fork Cowlitz drainage is approximately 1,460 acres and all flows are measured at the confluence with Millridge Creek. Under Alternative 2, the low flow in the modified Upper Tieton River watershed would not increase, whereas in the modified Upper Clear Fork Cowlitz River watershed, low flows would increase by approximately 1.4 percent over existing conditions (refer to FEIS Table 3.3-18). Due to the lack of gauging stations within each watershed, the percent increase cannot be applied to actual low flow values. As modeled, the increase in low flow does not take into consideration the groundwater fed component of the flow model area within the Upper Clear Fork Cowlitz drainage. Groundwater discharges below the cliff band are the main component of low flows of the drainage from the proposed expansion area. Therefore, the increase in low flow associated with forest removal in the expansion area is likely overstated and actual increase in low flow would not be measurable at downstream gauging locations.

Peak flows within the White Pass Study Area typically occur during the fall, early season rain-on-snow-events, and during spring snow melt when the ground surface becomes saturated. Surface and shallow subsurface flow associated with rain events and snow melt is the main contribution to peak flows within the White Pass Study Area (refer to Section 3.3 –Watershed Resources). The peak flow response to forest clearing proposed under Alternative 2 would not increase in the Upper Tieton River and would increase in the Clear Fork Cowlitz River by approximately 0.3 percent over existing conditions. The small increase in peak flow in not expected to be measurable at downstream gauging locations.

Modified Alternative 4

Under Modified Alternative 4, White Pass would expand the existing ski area SUP boundary into the Hogback Basin and development would take place within the existing ski area, including a 7-acre parking lot. No direct impacts to fish habitat would occur because there is no habitat present within the White Pass Study Area. Indirect impacts to fish habitat under Modified Alternative 4 would be the most of any Action Alternative due to the amount of full clearing proposed. Potential downstream impacts to fish habitat would be slightly more than as described under Alternative 2 due to the additional construction associated with the parking lot and ticket booth.

Approximately 25.8 acres of clearing and grading would occur within Riparian Reserves under Modified Alternative 4 (refer to Table 3.3-14 in Section 3.3 – Watershed Resources). Increased sedimentation and decreased water quality could potentially impact downstream fish habitat in Leech Lake, Clear Creek, and Millridge Creek. Impacts to fish habitat would be as described, but slightly more than under Alternative 2 due to the construction of Trails 4-16 and 4-17, and the parking lot. The implementation of Management

Requirement MR1 would require the development of a SWPPP and Mitigation Measure MM2 and Other Management Practice OMP5 would require appropriate erosion control Best Management Practices (i.e., silt fencing) and the revegetation of exposed soils to reduce potential erosion and sediment yield to streams. Therefore, the potential for increased sediment loading would not be measurable.

A Conceptual Stormwater Management Plan (CSMP) for the proposed parking area was created to help attain water quality, sediment regime and in-stream flow Aquatic Conservation Strategy Objectives (ACSOs). The objective of the CSMP is to maintain and restore water quality to support healthy riparian, aquatic, and wetland ecosystems; maintain and restore the sediment regime under which aquatic ecosystems evolved, including timing, volume, rate and character of sediment input, storage, and transport; maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing; and to protect the timing, magnitude, duration, and spatial distribution of peak, high and low flows. The CSMP would achieve these objectives through collection, detention and routing of surface runoff, improvement of water quality/sediment retention, and treatment for petroleum hydrocarbon contaminants (refer to FEIS Appendix M – Conceptual Stormwater Management Plan).

Increased sedimentation could potentially impact downstream fish habitat in Leech Lake, Knuppenberg Lake, Clear Creek, and Millridge Creek. The potential for increased sediment loading within the Upper Clear Fork Cowlitz watershed would be as described, but slightly more than under Alternative 2 due to the construction of the emergency egress trail. Impacts to the Upper Tieton watershed would be more than under Alternative 2 due to construction of the parking lot and ticket booth (refer to Section 3.3 – Watershed Resources).

Under Modified Alternative 4, impact to stream shading would be similar to, but slightly more than as described under Alternative 2. Clearing and grading associated with the construction of the 7-acre parking lot and ticket booth would occur in the Upper Tieton watershed. Stream shading would be reduced by less approximately 1.5 percent. Since streams are fed primarily by groundwater below the cliff band, no impact to stream temperatures are expected. In the Upper Clear Fork Cowlitz watershed, stream shading would be reduced by 5.6 percent, slightly more than as described under Alternative 2(refer to Table 3.3-15).

Potential impacts to water quality would be as described under Alternative 2, except the construction of the parking lot and ticket booth would have the potential to impact water quality in the Upper Tieton watershed through increased runoff during construction. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized. Implementation of the CSMP for the proposed parking lot would help to maintain and restore water quality, sediment regime, and in-stream flows (refer to

Appendix M – Conceptual Stormwater Management Plan). Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

The potential for increased low and peak flows within the White Pass Study Area would be similar to, but slightly more than as described under Alternative 2. Within the modified Upper Tieton River watershed, low flows would increase by approximately 2.1 percent and peak flows by approximately 0.5 percent over existing conditions. The small increase in flow is not expected to be measurable at downstream gauging locations.

Alternative 6

Under Alternative 6, White Pass would expand the existing ski area SUP boundary into Pigtail Basin. No direct impacts to fish habitat would occur because there is no habitat present within the White Pass Study Area. Potential downstream impacts to fish habitat would be lowest of any Action Alternative due to the reduced amount of development proposed.

Approximately 12.6 acres of clearing and grading would occur within Riparian Reserves under Alternative 6 (refer to Table 3.3-14 in Section 3.3 – Watershed Resources). Increased sedimentation and decreased water quality could potentially impact downstream fish habitat in Leech Lake, Clear Creek, and Millridge Creek. Implementation of Mitigation Measures MM7 and OMP5 would require appropriate erosion control Best Management Practices (i.e., silt fencing) and the revegetation of exposed soils to reduce potential erosion and sediment yield to streams.

Increased sedimentation and decreased water quality could potentially impact downstream fish habitat in Leech Lake, Knuppenberg Lake, Clear Creek, and Millridge Creek. The potential for increased sediment loading would be as described, but slightly less than under Alternative 2 due to the reduced development in the Hogback Basin. Potential impacts to fish habitat from increased sediment loading to the Upper Tieton watershed would be slightly more than under Alternative 2 due to construction of the parking lot and ticket booth (refer to Section 3.3 – Watershed Resources).

Potential impacts to water quality would be similar to, but slightly less than as described under Alternative 2 due to the reduced development in the Hogback Basin. The construction of the parking lot and ticket booth would have the potential to impact water quality in the Upper Tieton watershed through increased runoff. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized. Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

A Conceptual Stormwater Management Plan (CSMP) for the proposed parking area was created to help attain water quality, sediment regime and in-stream flow Aquatic Conservation Strategy Objectives (ACSOs). The objective of the CSMP is to maintain and restore water quality to support healthy riparian,

aquatic, and wetland ecosystems; maintain and restore the sediment regime under which aquatic ecosystems evolved, including timing, volume, rate and character of sediment input, storage, and transport; maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing; and to protect the timing, magnitude, duration, and spatial distribution of peak, high and low flows. The CSMP would achieve these objectives through collection, detention and routing of surface runoff, improvement of water quality/sediment retention, and treatment for petroleum hydrocarbon contaminants (refer to FEIS Appendix M – Conceptual Stormwater Management Plan).

The potential for increased low and peak flows within the White Pass Study Area would be similar to, but slightly more than as described under Alternative 2. Within the flow model analysis area for the Upper Tieton River watershed, low flows would increase by approximately 0.7 percent and peak flows by approximately 0.2 percent over existing conditions. The small increase in flow is not expected to be measurable at downstream gauging locations.

Alternative 9

Under Alternative 9, White Pass would construct new lifts and trails within the existing ski area SUP boundary. There would be no direct impacts to fish habitat because no habitat is present within the White Pass Study Area. Potential downstream impacts to fish habitat could occur in the Upper Clear Fork Cowlitz River and Upper Tieton River watersheds through changes in flow, changes in water quality (i.e., temperature), and increased sediment loading.

Approximately 24.4 acres of clearing and grading would occur within Riparian Reserves along perennial streams and in mature, closed-canopy forest structure under Alternative 9 (refer to Table 3.3-14 in Section 3.3 – Watershed Resources). Increased sedimentation and decreased water quality could potentially impact downstream fish habitat in Leech Lake, Clear Creek, and Millridge Creek. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measure MM2 and Other Management Practice OMP5 would require appropriate erosion control Best Management Practices (i.e., silt fencing) and the revegetation of exposed soils to reduce potential erosion and sediment yield to streams. Therefore, the potential for increased sediment loading would not be measurable.

The potential for increased sediment loading would be similar to, but slightly more than Alternative 2 due to the increased development in the Upper Tieton and Upper Clear Fork Cowlitz watersheds. Approximately 1.2 acres of grading would occur on high erosion potential soils and approximately 10.7 acres on moderate and low erosion potential areas would occur due to construction of the lifts, trails, parking lot, and ticket booth (refer to Table 3.2-4). Due to the reduced trail development in Alternative 9, this potential impact would be substantially less than would occur in the other Action Alternatives. The implementation of Management Requirement MR1 would require the development of a SWPPP and

Mitigation Measure MM2 and Other Management Practice OMP5 would require appropriate erosion control Best Management Practices (i.e., silt fencing) and the revegetation of exposed soils to reduce potential erosion and sediment yield to streams. Therefore, the potential for increased sediment loading would not be measurable.

Under Alternative 9, impact to stream shading would be similar to, but slightly more than as described under Alternative 2. Approximately 20.3 acres of clearing and grading would occur in the Upper Tieton watershed associated with the construction of the lift, trails, parking lot, and ticket booth. Stream shading would be reduced by approximately 8.6 percent on perennial and intermittent stream channels (refer to Section 3.3 – Watershed Resources for more information on stream shading). Since streams are fed primarily by groundwater below the cliff band, no impact to stream temperature is expected. In the Upper Clear Fork Cowlitz watershed, impacts to stream shading would result from approximately 4.1 acres (1.0 percent) of clearing associated with trail construction. Similar to the Upper Tieton watershed, streams are primarily fed by groundwater below the cliff band. The implementation of Mitigation Measures MM3 and MM10 would retain riparian understory vegetation to the greatest extent practicable to maintain stream shading. Therefore, no measurable impacts to stream temperatures within the Upper Clear Fork Cowlitz watershed are expected under Alternative 9.

Potential impacts to water quality would be similar to, but slightly less than as described under Alternative 2 from the trail construction within the existing ski area. The construction of a new lift, trails, parking lot, and ticket booth would have the potential to impact water quality in the Upper Tieton watershed through increased runoff during construction. The implementation of Management Requirement MR1 would require the development of a SWPPP and Mitigation Measures MM2, MM4, and MM7 would require associated water quality monitoring to ensure that potential impacts to downstream water quality are minimized. Implementation of the CSMP for the proposed parking lot would help to maintain and restore water quality, sediment regime, and in-stream flows (refer to Appendix M – Conceptual Stormwater Management Plan). Potential indirect impacts to downstream fish presence are therefore not expected to be measurable.

The potential for increased low and peak flows within the flow model area would be similar to, but slightly more within the Upper Tieton River drainage than as described under Alternative 2 because of the increased forest clearing (specifically full clearing in mature, closed-canopy forest, as opposed to the tree island removal in parkland proposed in the other Action Alternatives) within the existing ski area. Low flows would increase by approximately 4.6 percent and peak flows by approximately 1.1 percent over existing conditions. The increase in flow is not expected to be measurable at downstream gauging locations.

Within the Clear Fork Cowlitz River flow model area, the increase in flows would be slightly less than as described under Alternative 2 due to the reduced amount of tree removal proposed. Low flows would

increase by approximately 0.7 percent over existing conditions, whereas peak flows would increase by approximately 0.2 percent. Therefore, increased flows in the Upper Clear Fork Cowlitz watershed are not expected to be measurable at downstream gauging locations.

6.0 EFFECTS DETERMINATION

The effect determination for the Proposed Action and all Action Alternatives on listed fish species occurring with the Upper Tieton River watershed is listed below in Table 7. Table 8 lists the effect determination for each listed species occurring within the Upper Clear Fork Cowlitz River watershed.

Table 7:
Determination of Effects to Special Status Species Occurring in the Upper Tieton River Watershed

Species	Alternative 2	Modified Alternative 4	Alternative 6	Alternative 9
Middle Columbia River Steelhead (*Oncorhynchus mykiss*)	No Effect			
Bull Trout (*Salvelinus confluentus*)	No Effect			
Redband Trout (*Oncorhynchus mykiss sp.*)	No Effect			

Table 8:
Determination of Effects to Special Status Species Occurring in the Upper Clear Fork Cowlitz Watershed

Species	Alternative 2	Modified Alternative 4	Alternative 6	Alternative 9
Lower Columbia River Chinook (*Oncorhynchus tschawytscha*)	No Effect			
Lower Columbia River Steelhead (*Oncorhynchus mykiss*)	No Effect			
Lower Columbia River/Southwest Washington Coho (*Oncorhynchus kistuch*)	No Effect			

7.0 CONCLUSION

7.1 UPPER TIETON RIVER WATERSHED

Special Status Species and Other Resident Fish Populations

The determination for this project relative to bull trout is **No Effect** under all Action Alternatives. The project **will not jeopardize the continued existence** of redband/inland rainbow trout, and if it was listed the determination for this project would be **No Effect** under all Action Alternatives. The permanent clearing of Riparian Reserves will potentially increase some localized sediment movement downstream as

discussed in the Subpopulation Size section. This potential effect will be buffered by Leech Lake, so downstream fish populations will not be adversely affected.

Steelhead and Essential Fish Habitat for Chinook and Coho salmon

The determination for Middle Columbia River steelhead and Essential Fish Habitat relative to all projects occurring in the Upper Tieton watershed is **No Effect** under all Action Alternatives, because steelhead passage to the Upper Tieton watershed is blocked by Rimrock dam. Predicted effects to water quality or fish habitat above the dam would have no effect downstream due to the buffering affects of the dam.

7.2 UPPER CLEAR FORK COWLITZ RIVER WATERSHED

Special Status Species, Essential Fish Habitat and Other Resident Fish Populations

The effects determination for this project relative to Lower Columbia River steelhead and Chinook and coho salmon is **No Effect** under all Action Alternatives. Similarly this project will have **No Effect** on Essential Fish Habitat for Chinook and coho salmon under all Action Alternatives. Habitat occupied by anadromous fish is over 8 miles downstream of the project area. The permanent clearing of Riparian Reserves (on intermittent stream channels) will potentially increase some localized sediment movement downstream as discussed in the Sediment section. This potential effect would be buffered by Knuppenberg Lake, so downstream resident fish populations in Millridge Creek and the Clear Fork Cowlitz River would not be adversely affected.

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