Fisheries Biological Assessment
for
Long Prairie Grazing Allotment

Hood River Ranger District, Mt. Hood National Forest

NEPA document: Long Prairie Grazing Allotment Environmental Assessment 2005

Fifth Field Watersheds: Lower Hood River and Middle Columbia-Mill Creek

Seventh Field Subwatersheds: Neal Creek, West Fork Neal Creek, and North Fork Mill Creek

This Biological Assessment Addresses the Following Listed Fish Species:

LISTED SPECIES or HABITAT	ESA STATUS	ESA / EFH DETERMINATION
Lower Columbia River Steelhead Ecologically Significant Unit (ESU)	Threatened	May Affect, Not Likely to Adversely Affect
Middle Columbia River Steelhead Ecologically Significant Unit (ESU)	Threatened	May Affect, Not Likely to Adversely Affect
Lower Columbia River Steelhead Critical Habitat	Proposed	Will Not Adversely Affect
Middle Columbia River Steelhead Critical Habitat	Proposed	Will Not Adversely Affect
Essential Fish Habitat	N/A	No Adverse Affect

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Introduction

This Biological Assessment (BA) has been prepared in compliance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended. Section 7 of the ESA assures that through consultation (or conferencing for proposed species) with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NOAA Fisheries), federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of potential designated habitat.

The purpose of this BA is to describe and evaluate potential impacts of proposed USDA Forest Service actions on any fish species listed as endangered, threatened, proposed, or candidate for listing under the ESA. This document addresses any effects on the following fish species and Evolutionarily Significant Units (ESUs): Lower Columbia River steelhead trout (*Oncorhynchus mykiss*) and Middle Columbia River steelhead trout (*O. mykiss*).

This BA addresses the effects of operation and maintenance of the Long Prairie Cattle Allotment (hereafter referred to as the Allotment) on threatened aquatic species suspected or known to reside in the Neal Creek, West Fork Neal Creek, and North Fork Mill Creek watersheds located in the Hood River and Mill Creek basins within and adjacent to the Mt. Hood National Forest (MHNF), Hood River Ranger District (Figure 1). This BA addresses activities included in an Environmental Assessment (EA) that is scheduled for completion by September 30, 2005 and which analyzes grazing and associated activities in the entire Allotment for the years 2005 - 2012. The current permit was issued before the 2003 grazing season and will expire before the 2012 grazing season. The terms and conditions of the permit will be amended by the EA process. Grazing and associated activities on the Allotment were consulted on previously for the 2002 grazing season, and also for the 2003 and 2004 grazing seasons. The permitee has elected not to graze cattle during the 2005 and 2006 seasons. Thus, this consultation covers grazing seasons from 2007 – 2011 (five years).

The legal description of the project area is T.1S, R.10E, Sections 1,2,3, E. ½ Sec.10,11,12,13,14, E.1/2 Sec. 15, NW ¼ Sec. 23 (Hood River County) and T. 1S, R. 11E, portions of sections 7 and 18 (Wasco County). The allotment is approximately 5,700 acres, and has supported livestock grazing since the inception of the Mt. Hood National Forest in 1906. The analysis area includes portions of streams that lie within the approximately 1,200 acres of land previously managed by the Forest Service exchanged to a private owner in 1992, and were previously within the Allotment boundary. This is located in T. 1N, R. 10E, Sec. 36 and T. 1N, R. 11E, Sec. 31 (Hood River County). This land is now downstream of the National Forest boundary, and may continue to be grazed by the FS permittee under a verbal agreement with the landowner. The grazing

activities within the privately-owned portion of the Allotment are interrelated and interconnected to the activities within the MHNF and will be analyzed in this BA.

The Allotment is located within three fifth field watersheds; Lower Hood River, East Fork Hood River and Middle Columbia-Mill Creek (Figure 2). Neal Creek is a subwatershed of the Hood River, and North-South Forks Mill Creeks is a subwatershed of Mill Creek.

Three tributaries to the East Fork Hood River 5th field watershed are within the allotment boundary at its western edge. None of these tributaries are fish bearing, and cattle do not tend to use this portion of the allotment due to the steep terrain. Because of the low use by cattle, distance to listed fish (at least one mile) and no predicted effects to listed fish or their habitats, East Fork Hood River will not be analyzed in this document. The headwaters of Mosier Creek, on the east side of the Allotment, will also not be analyzed in this document for the same reasons.

The majority of both Neal Creek and North-South Forks Mill Creek watersheds lie on private or Hood River/Wasco County land (see Table 1). The North Fork Mill Creek portion of the Allotment is within the Mill Creek Tier 1 Key Watershed. Tier 1 watersheds have been identified as crucial refugia for at-risk fish species under the Northwest Forest Plan. The Lower Hood River and Middle-Columbia – Mill Creek watersheds supports populations of coho salmon (*O. kisutch*), steelhead trout, coastal cutthroat trout (*O. clarki*), and resident and coastal rainbow trout (*O. mykiss*). Watershed analysis was completed for Neal Creek as part of the Hood River Watershed Assessment (HRWG 1999) and on Mill Creek in 2000 (USFS 2000).

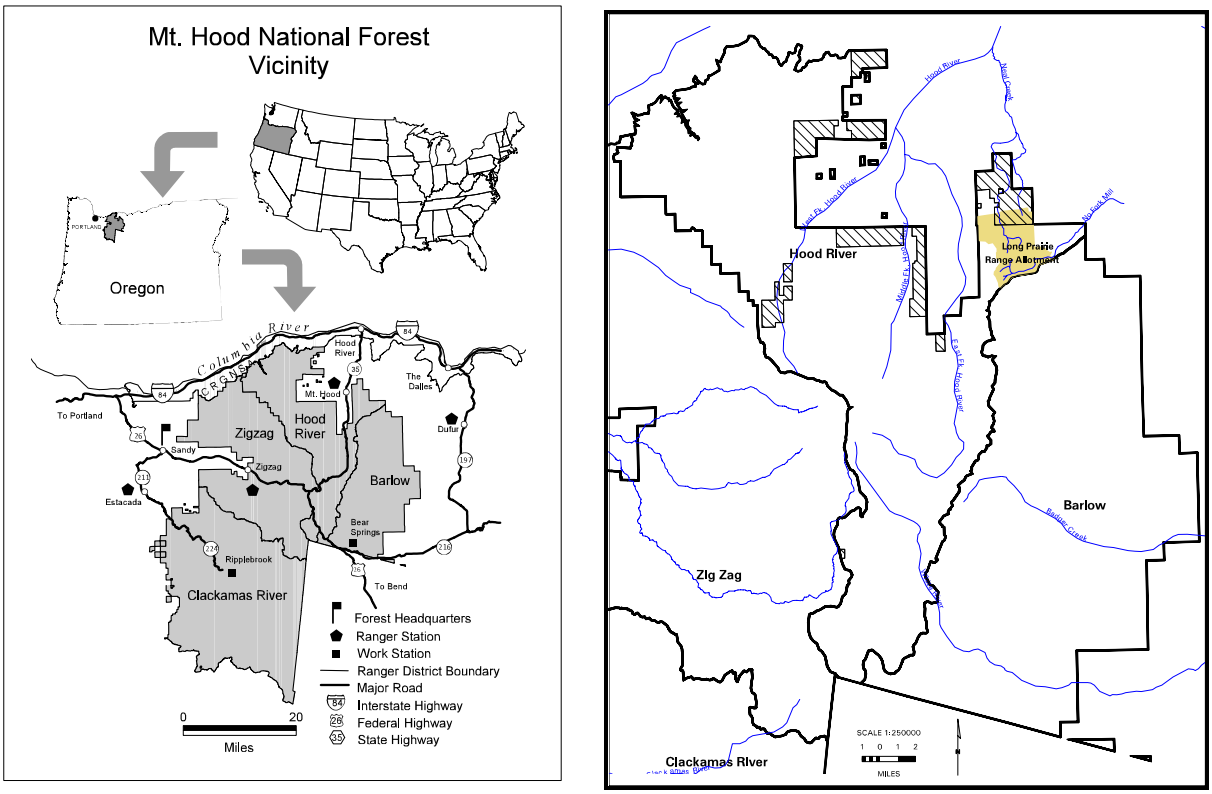

Figure 1. Location of the Mt. Hood National Forest in Oregon (left) and the Long Prairie Cattle Allotment in relation to the entire Mt. Hood National Forest (right). Private land is indicated with diagonal lines in the figure on the right.

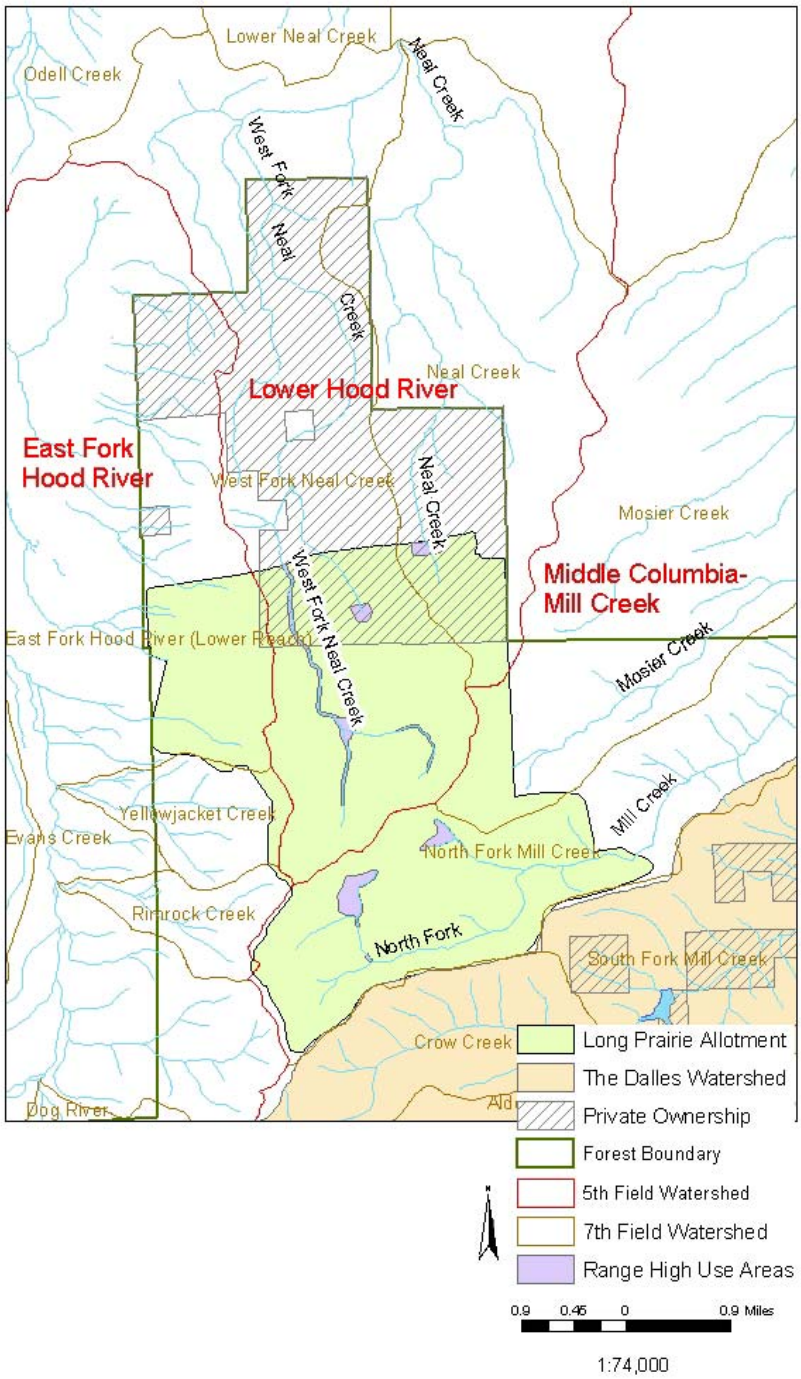

Figure 2. Fifth and seventh field watersheds that lie within the Long Prairie Grazing Allotment boundaries in the Mt. Hood National Forest.

Land use allocations, as outlined in the MHNF Land and Resource Management Plan (LRMP), within the Allotment include: C1, Timber Emphasis, B2, Scenic Viewshed, and B7, Riparian Area. Land allocations within the Allotment as identified in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD) include Late Successional Reserve, Matrix, and Riparian Reserve (Table 1).

Table 1. Northwest Forest Plan land allocations and the area of Federal and non-Federal land within the Lower Hood River (which encompasses the Neal Creek subwatershed) and Middle Columbia - Mill Creek 5th field Watersheds. Riparian Reserve acres overlap other lands allocations; hence acreages below exceed the total amount of Lands Administered by the Forest Service.

	Acreage		***Percent of Federal Lands***	
Land Use Allocation	***Lower Hood***	***Middle Columbia - Mill Cr.***	***Lower Hood***	***Middle Columbia - Mill Cr.***
Congressional Reserve	2		0.07%	
Late Successional Reserve	195	4,317	7%	28%
Riparian Reserve	171	332	6%	2%
Administratively Withdrawn		898		6%
Matrix	2,355	10,084	87%	66%
			Percent of Entire Watershed	
			Lower Hood	***Middle Columbia - Mill Cr.***
Lands Administered by the Forest Service	2,723	15,299	4%	38%
Non-Federal Land	72,338	25,251	96%	62%

Analysis Approach

In conjunction with the recent efforts to clarify language in the 1994 Northwest Forest Plan Record of Decision regarding the Aquatic Conservation Strategy, and in response to concerns raised in previous litigation, NOAA Fisheries has worked with the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Forest Service (FS) to revise the methods for making determinations of effect for land management activities impacting ESA-listed salmonid species in the Northwest Forest Plan geographical area. Currently, this new approach is required only for timber sales that warrant an effects determination of may affect, likely to adversely affect or may affect, not likely to adversely affect listed fish species. Because the proposed action is not

a timber sale, a modification of the new approach was used to assess effects. In this regard, the constituent activities or elements of the proposed action (*e.g.*, number of cow calf pairs or Animal Unit Months (AUMs) turned out, pasture configuration and turn-out/gather locations, and fencing and other range improvements) were analyzed for potential effects on the Lower Columbia River steelhead and Middle Columbia River steelhead ESUs habitat pathways of water quality, habitat elements, channel condition and dynamics, and watershed conditions. Each pathway has several relevant habitat indicators, such as temperature, substrate character, streambank condition, and riparian reserves.

In applying the revised analysis approach, the agencies consider eight factors, derived largely from the joint NOAA Fisheries and Fish and Wildlife Service ESA Section 7 Consultation Handbook, when evaluating the effects of an action on habitat indicators and subsequently the effects on ESA-listed fish. These factors are proximity, probability, magnitude (severity and intensity), nature, distribution, frequency, duration, and timing. It is possible for agencies to complete their action analysis and reach an effect determination using only the first three factors. For example, if the action agency determines the species or habitat is not in proximity to the effects of a project element, then the element has a neutral effect on this indicator and no further analysis is needed. Likewise, if the outcome of assessment of the probability factor is entirely discountable (extremely unlikely to occur), no further factor analysis is required for that element. If the outcome of the probability analysis is not discountable, the element should be assessed for the magnitude factor. Again, should the outcome of the assessment for magnitude result in insignificant effects, no further factor analysis is required for that project element.

The analysis considered the direct and indirect effect of the project's elements on each habitat indicator and then utilized the relevant factors to determine if there was an effect on species and/or habitat and whether it was insignificant, discountable, or beneficial. A summary for each habitat indicator was developed to ascertain whether effects from various elements combine to create adverse effects on any of the indicators. This information was used to make an overall project effect determination.

Watershed Description

Allotment boundaries overlap three 5th field watersheds: Middle Columbia - Mill Creek, East Fork Hood River and the Lower Hood River (Figure 2). The Allotment encompasses the headwaters of two 6th field watersheds: North-South Forks Mill Creek, and Neal Creek. The Forest Service recently redefined 5th and 6th field watershed boundaries. For the purpose of this assessment, West Fork Neal Creek and Neal Creek from its confluence with West Fork Neal Creek upstream to its headwaters were each assessed at the 7th field scale (both creeks are within the Neal Creek 6th field watershed). North Fork Mill Creek was also assessed at the 7th field scale from the eastern allotment boundary

upstream to its headwaters (the creek is within the North-South Forks Mill Creek 6th field watershed).

The headwaters of seven streams, four of which bear fish, are within the boundaries of the Long Prairie grazing allotment. Neal Creek, West Fork Neal Creek, North Fork Mill Creek, and Mosier Creek, all 7th field watersheds, originate from springs within the allotment and are fish-bearing (Figure 2). Of the four, only West Fork Neal Creek and North Fork Mill Creek are fish-bearing (resident rainbow and cutthroat) within the Allotment.

Neal Creek
The headwaters of Neal Creek are located on private land north of the National Forest boundary, but within the Allotment (T1N, R11E, Sec. 31, Figure 2). Neal Creek's headwaters are approximately 2 miles to the northeast of the West Fork Neal Creek headwaters. Neal Creek is a tributary to mainstem Hood River, and is a second-order stream from the mouth to RM 5.1 and a first-order stream from RM 5.1 to its headwaters (RM 10.3). Neal Creek flows for approximately 5 miles in a northerly direction from its headwaters at an elevation of about 3,600 feet to its confluence with West Fork Neal Creek at RM 5.1 at an elevation of 1,000 feet. From the confluence, Neal Creek flows for another 5 miles to its confluence with the mainstem Hood River at RM 4.5 just upstream of Powerdale Dam.

West Fork Neal Creek
West Fork Neal Creek is the largest tributary to Neal Creek and its headwaters originate in a wet meadow/spring complex in the Surveyor's Ridge pasture (T1S, R10E, Sec. 11, Figure 2). West Fork Neal Creek is a second order stream from the mouth to RM 8.1 and a first order stream from RM 8.1 to its headwaters (RM 8.8). The average gradient in West Fork Neal Creek is 5%, but the section between RM 3.0 and RM 4.0 averages 12% gradient with numerous cascading riffles (USFS, 1999). The headwaters have a much lower gradient and the stream flows through several meadow complexes. The valley in the headwaters is broad and U-shaped but further downstream, especially as the stream exits the Allotment, the valley becomes more V-shaped and the stream is more confined.

North Fork Mill Creek
North Fork Mill Creek originates in a wet meadow/spring complex in Gibson Prairie (T1S, R10E, Sec. 14, Figure 2) and is a 1st order stream from RM 12.3 to RM 12.4. It is a second order stream from the MHNF boundary (RM 6.4) to RM 12.3 (USFS, 2000b). North Fork Mill Creek flows northeast beginning in a trough-like valley form at its headwaters and enters a moderately V-shaped valley from RM 12.0 down to the MHNF boundary (USFS, 1992). As in West Fork Neal Creek the headwater portions of stream (above the forks) lie largely within wet meadow complexes. Unlike West Fork Neal Creek, however, the uppermost headwaters of North Fork Mill Creek usually dry up every summer.

Fisheries Description

No fish species listed as threatened or endangered are known to be present in streams within the Allotment boundaries. However, Lower Columbia River steelhead trout (in Neal Creek and West Fork Neal Creek), and Middle Columbia River steelhead trout (in Mill, North Fork Mill, and South Fork Mill Creeks), are both listed as threatened species and are present downstream of the allotment boundary (Figure 3). Detailed descriptions of fish distribution relative to the allotment boundary follow.

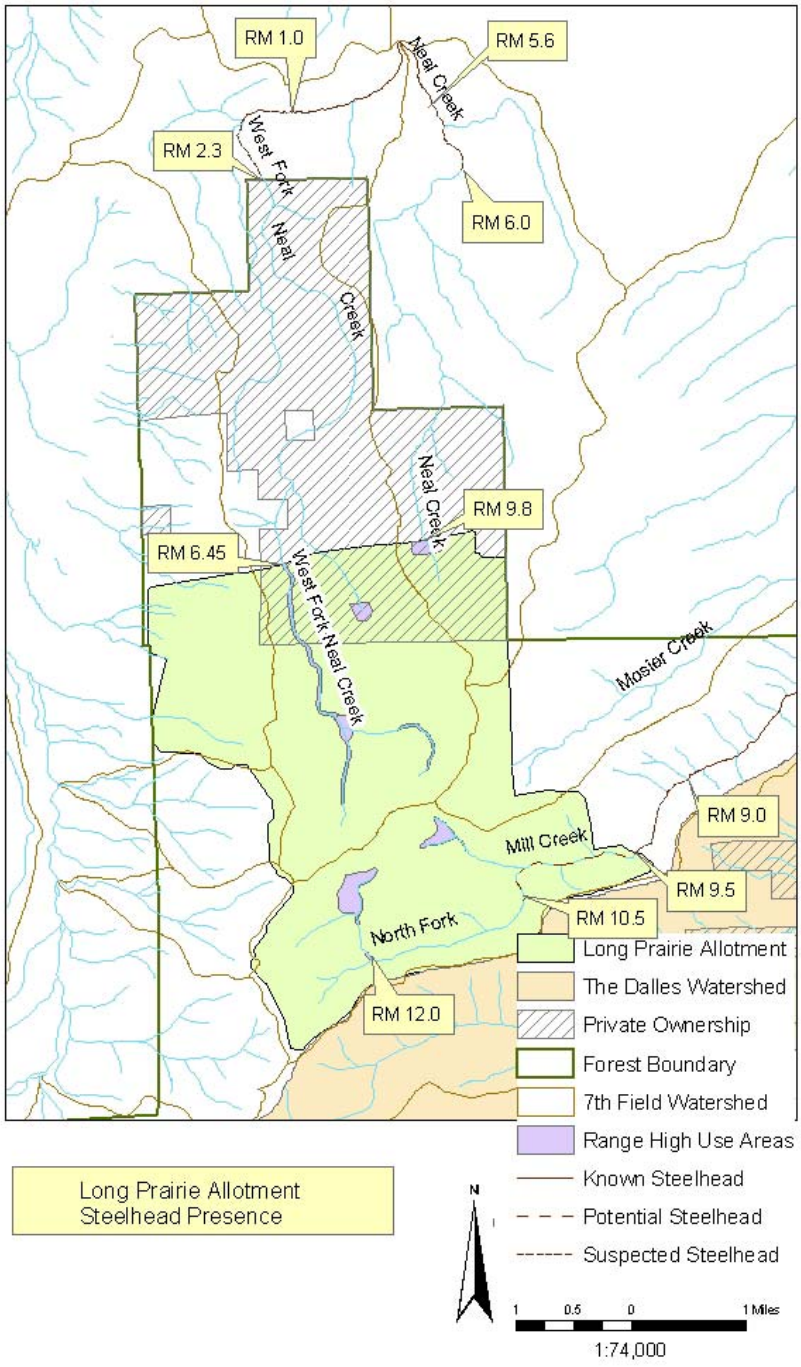

Figure 3. Known, potential, and suspected distribution of steelhead trout within Neal Creek, West Fork Neal Creek, and North Fork Mill Creek in relation to the Long Prairie Grazing Allotment in the Mt. Hood National Forest. Range or livestock high use areas are those areas where cattle tend to congregate based on monitoring data and observations from the Range Conservationist.

Potential TES Aquatic Species not addressed in this Document

Bull Trout

There are no historic or current observations of Columbia River bull trout *Salvelinus confluentus* in Neal Creek or West Fork Neal Creek (Buchanan et al., 1997). Bull trout have never been documented in Mosier Creek or North Fork Mill Creek (Jen Clark, Wasco County Soil and Water Conservation District, personal communication). Water temperatures are likely too high to support bull trout in any of these streams. Also, there is no designated bull trout critical habitat in any of these streams. As such, activities in the Allotment will have no effect on bull trout and they will not be discussed further.

Coho Salmon

Neal Creek

Coho salmon are a proposed species for listing as threatened or endangered and are known to occur in Neal Creek. Coho have never been documented above the confluence with West Fork Neal Creek and are not believed to ascend past the confluence. The indigenous run of coho in the Hood River watershed may be extinct and the coho currently present are considered hatchery strays by ODFW (Hood River Soil & Water Conservation District, 1999).

Mill Creek

Coho salmon are known to occur in Mill Creek but they have never been documented above the confluence of North and South Forks Mill Creek, a distance of approximately 10 RM downstream of the allotment boundary (Jen Clark, Wasco County Soil and Water Conservation District, personal communication).

Threatened Aquatic Species addressed in this Document

Definitions of terms used to describe fish presence

The terms “known,” “potential,” and “suspected” are used to describe steelhead distribution in this document. Known presence describes areas where steelhead have been documented. Areas of known presence could also be defined as occupied habitat. Potential presence describes areas where steelhead have not been documented, but these areas are accessible to steelhead if conditions allow. Suspected presence describes areas where steelhead have not been documented, but fisheries biologists believe they are present.

Neal Creek

Steelhead trout in Neal Creek (and West Fork Neal Creek) are within the Lower Columbia Evolutionary Significant Unit (ESU) and are listed as threatened. Steelhead have been documented in Neal Creek a half mile above its confluence with West Fork Neal Creek, where a culvert that was a probable barrier used to exist (Figure 3). There are no known or suspected barriers to fish passage in Neal Creek above this point, but the steep gradient of the stream may preclude anadromy. Based on a field visit March 17, 2003, it is the professional judgment of Forest Service fish biologists that steelhead are unlikely to ascend the steep,

cascading section of Neal Creek that begins at approximately RM 6.0 (the confluence with West Fork Neal Creek is at RM 5.1). This point appears to be at or near the upper limit of steelhead distribution in Neal Creek. It is believed that steelhead spawn in Neal Creek no higher than one mile upstream of the West Fork Neal Creek mouth (Steve Pribyl, ODFW, personal communication).

ODFW stream survey personnel noted “trout fry (steelhead?)” throughout their survey of Neal Creek from its confluence with West Fork Neal Creek at RM 5.1 to RM 8.8 – the MHNF boundary before the land exchange (ODFW, 1993). These “trout fry” were probably cutthroat trout which are present to at least RM 8.8, where an impassable culvert exists (Steve Pribyl, ODFW, personal communication, Figure 4). Genetic analysis of fish in the main-stem of Neal Creek below the confluence with West Fork Neal Creek indicates coastal rainbow trout only (Kostow, 1994). ODFW personnel found both juvenile and adult “rainbow/steelhead” in Neal Creek at RM 1.5 and at RM 5.0, and found adult cutthroat trout at RM 5.0 as well (Olsen et al., 1995). It appears cutthroat are present primarily in the headwaters of Neal Creek.

Based on the information available, the upper limits of steelhead distribution and suspected habitat are to the steep gradient reach beginning at ~RM 6.0 in Neal Creek (Figure 3).

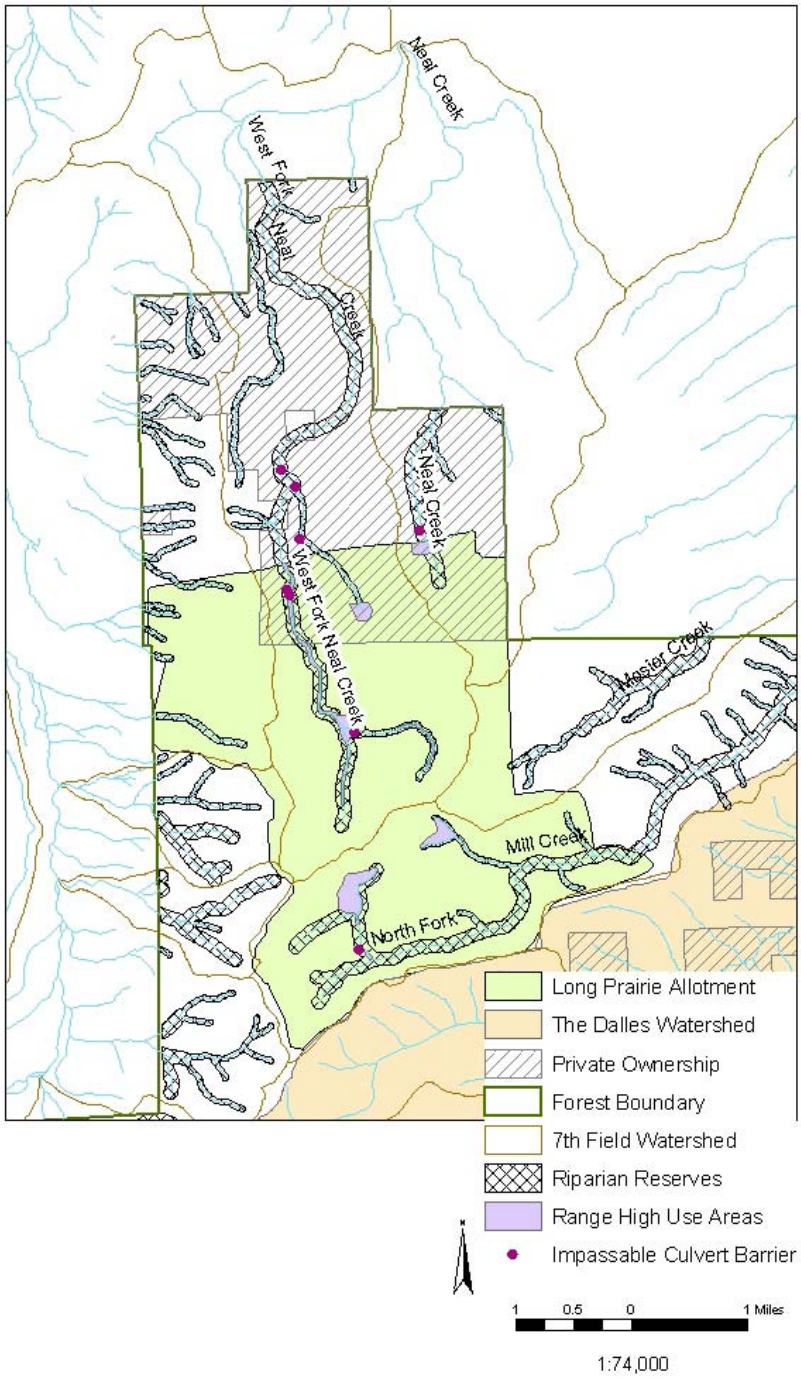

Figure 4. Known culvert barriers and riparian reserves within Neal Creek, West Fork Neal Creek, and North Fork Mill Creek in the Long Prairie Grazing Allotment in the Mt. Hood National Forest. Range or livestock high use areas are those areas where cattle tend to congregate based on monitoring data and observations from the Range Conservationist.

West Fork Neal Creek
Salmonids known to be present in West Fork Neal Creek include resident coastal rainbow, steelhead, cutthroat, and a naturalized population of brook trout (*S. fontinalis)*. Steelhead are known to spawn below the old MHNF boundary within the first mile of West Fork Neal Creek (Holly Coccoli, Hood River Watershed Group, personal communication), but adult steelhead have never been documented within the MHNF (Figure 3). Steelhead are unlikely to ascend as far upstream as the old MHNF boundary (RM 2.3) in West Fork Neal Creek due to natural gradient barriers below the forest boundary, small size, and a lack of suitable spawning habitat (Steve Pribyl, ODFW, personal communication). This distribution of steelhead spawning and rearing habitat is corroborated by StreamNet which lists the upper limit as RM 2.52 (StreamNet, 2005). There are also six culverts that are upstream migration barriers; the lowest located at approximately RM 5.5 (Figure 4) (USFS, 2000).

Based on the information available, the upper limits of steelhead distribution and suspected habitat in West Fork Neal Creek is RM 2.3 (Figure 3).

North Fork Mill Creek
Fish present in North Fork Mill Creek include cutthroat trout, resident rainbow trout, and Middle Columbia River ESU steelhead trout. Middle Columbia River ESU steelhead trout are found in Mill Creek and South Fork Mill Creek and have been documented by MHNF fisheries personnel in North Fork Mill Creek to within 0.5 RM of the allotment boundary, and their presence is suspected up to the eastern boundary of the allotment at approximately RM 9.5 (Figure 3). The culvert at the 1711-630 road (at the eastern boundary of the allotment) was a barrier to fish passage, but was replaced in the summer of 2004 and is now passable. During a walking survey of North Fork Mill Creek in 2004, MHNF fisheries biologists identified the upper limit of potential steelhead presence to be at approximately RM 10.5, based on small channel size and the lack of suitable spawning habitat upstream of this point (Figure 3). Cattle do not use the area downstream of the headwaters forks (RM 12.0) due to steep terrain and heavy timber, thus the closest location of grazing is 3.0 RM from known steelhead presence.

Life History and Ecology of Steelhead in or Near the Allotment
Like other salmonids, steelhead trout require adequate water quality and quantity, cover (provided by large and small wood, boulders, brush, substrate, and/or surface turbulence), invertebrate food, and various sizes and distributions of pool and riffle units. Preferred spawning substrate includes well oxygenated, loose small to medium sized gravels. Spawning occurs in the spring, usually in riffles or the downstream end of pools. Steelhead generally spawn from late winter to early summer, but most spawning is completed prior to June. Fry emergence from the gravel normally occurs by the middle of July but depends on water temperature and time of spawning. Optimum temperature ranges for

steelhead spawning is 3.9 – 9.4°C (Bjornn and Reiser, 1991). Temperatures exceeding 22°C place the fish at risk for mortality.

Rearing habitat is often along stream margins, associated with instream structure provided by boulders, brush and wood. These habitats also provide cover from predation and are used for feeding lanes. Good riparian vegetation provides a critical food source, with “50% or more of the total diet of trout during the summer months of peak feeding comprising invertebrates of terrestrial origin” (Behnke, 1992).

See Table 2 for a summary of pertinent information for fish distribution and stream reaches relative to the Long Prairie Grazing Allotment. Some information in this table is referred to later in the document (in the Effects Analysis section), but is included here to provide a complete spatial description.

Table 2. Summary of pertinent information for fish distribution and stream reaches relative to the Long Prairie Grazing Allotment.

	Neal Creek	**West Fork Neal Creek**	**North Fork Mill Creek**
Reach of stream within Allotment boundary	RM 9.80 – 10.30 (headwaters)	RM 6.45 – 8.80 (headwaters)	RM 9.50 – 12.40 (headwaters)
Reach of stream within privately-owned land	RM 8.80 – 10.30 (headwaters)	RM 2.30 – 7.00	N/A
Location of *old* National Forest boundary	RM 8.80	RM 2.30	RM 6.40
Location of *new* National Forest boundary	N/A: Neal Creek is completely outside of the new National Forest boundary	RM 7.00	N/A: The National Forest Boundary has not changed in this area.
Upper limit of *known* steelhead presence	RM 5.60	RM 1.00	RM 9.00
Upper limit of *suspected* steelhead presence	RM 6.00	RM 2.30	RM 9.50 Note: Upper limit of *potential* steelhead presence is RM 10.50.
Distance from Allotment boundary to *known* steelhead presence or occupied habitat downstream	4.20 miles	5.45 miles	0.50 miles Note: Due to proposed fence, heavy timber, and steep terrain, cattle impacts on stream are 3.0 RM upstream from where steelhead are known to occur.
Distance from Allotment boundary to *suspected* steelhead presence downstream	3.80 miles	4.15 miles	0.0 miles (steelhead presence is *suspected* up to the allotment boundary). Note: *Potential* steelhead presence is to RM 10.5, which is one mile within the allotment boundary and 1.5 RM from grazing activity.
Entry of East Fork Hood River Irrigation Canal (glacial)	N/A: The canal enters West Fork Neal Creek only	RM 1.70	N/A: The canal enters West Fork Neal Creek only

Historic Use Levels and Grazing Management Strategies

Sheep and cattle grazing on the MHNF has been documented as far back as the 1880's. Forest Service records document grazing in the Allotment since 1906. Historically, two permittees have turned their cows out on the Allotment. One permittee has operated a permit here since 1940, and the other permittee's father has held a permit for the Allotment since the early 1920's. The estimated carrying capacity for grazing on the MHNF as a whole was reduced by 60% for sheep (33,990 reduced to 13,500) and 61% for cattle (4,827 reduced to 1,900) between 1923 and 1941 for a variety for reasons including recreation activities, the exclusion of grazing from the City of The Dalles watershed, and overgrazing. In 1942, Forest Service documents state "sheep are kept…away from fishing grounds by herding" (USFS, 1942). Sheep are no longer grazed in the Allotment.

Under the most recent Allotment management plan, in place since 1982, one permittee was allowed to graze 52 cow/calf pairs and the other 53 cow/calf pairs for the annual grazing season from June 15 to September 30. Actual dates of use are determined by range readiness monitoring, which consists of a visual assessment of key plant species development and soil moisture content and firmness.

For the last ten years (1995 – 2004), the permittee currently allowed 53 cow/calf pairs took "non-use" and did not graze during the grazing season, and thus the maximum number of cow/calf pairs turned out onto the Allotment was 52 each year. The non-use permittee is no longer in the livestock business and has waived his permit back to the Forest Service, resulting in one permit issued for the Allotment allowing a maximum of 52 cow/calf pairs. In 2003 and 2004, a maximum of 52 cow/calf pairs was turned out in the Allotment.

The Allotment is divided into three grazing units: Surveyor's Ridge, Long Prairie, and Gibson Prairie (Figure 5). The majority of the Surveyor's Ridge and Long Prairie Units fall into the West Fork Neal Creek and Neal Creek watersheds within the MHNF, and the Gibson Prairie Unit falls mainly into the North Fork Mill Creek Watershed. A portion of the Surveyor's Ridge Unit lies within the East Fork Hood River 5th field watershed and encompasses several small, intermittent, non-fish bearing tributaries to the East Fork.

The most recent past Allotment management plan identified a "three pasture, rest rotation" grazing system. Since 1982, livestock were rotated between the three different units within the Allotment. Two units were grazed each year, the remaining unit was rested, and permittees were required to move their cattle to a new unit before 50% of the current year's forage growth is consumed (or 35% of the current year's forage growth in riparian areas). Permittees were asked to remove their cattle before September 30 if forage utilization levels or drought conditions dictate. Cattle were unloaded in the handling facility at Long Prairie meadow, which is located within a riparian reserve, at the beginning of the

grazing season before they were turned out, and loaded up at this facility at the end of the season when they come off the Allotment (Dan Fissell, Range Conservationist, USFS, personal communication).

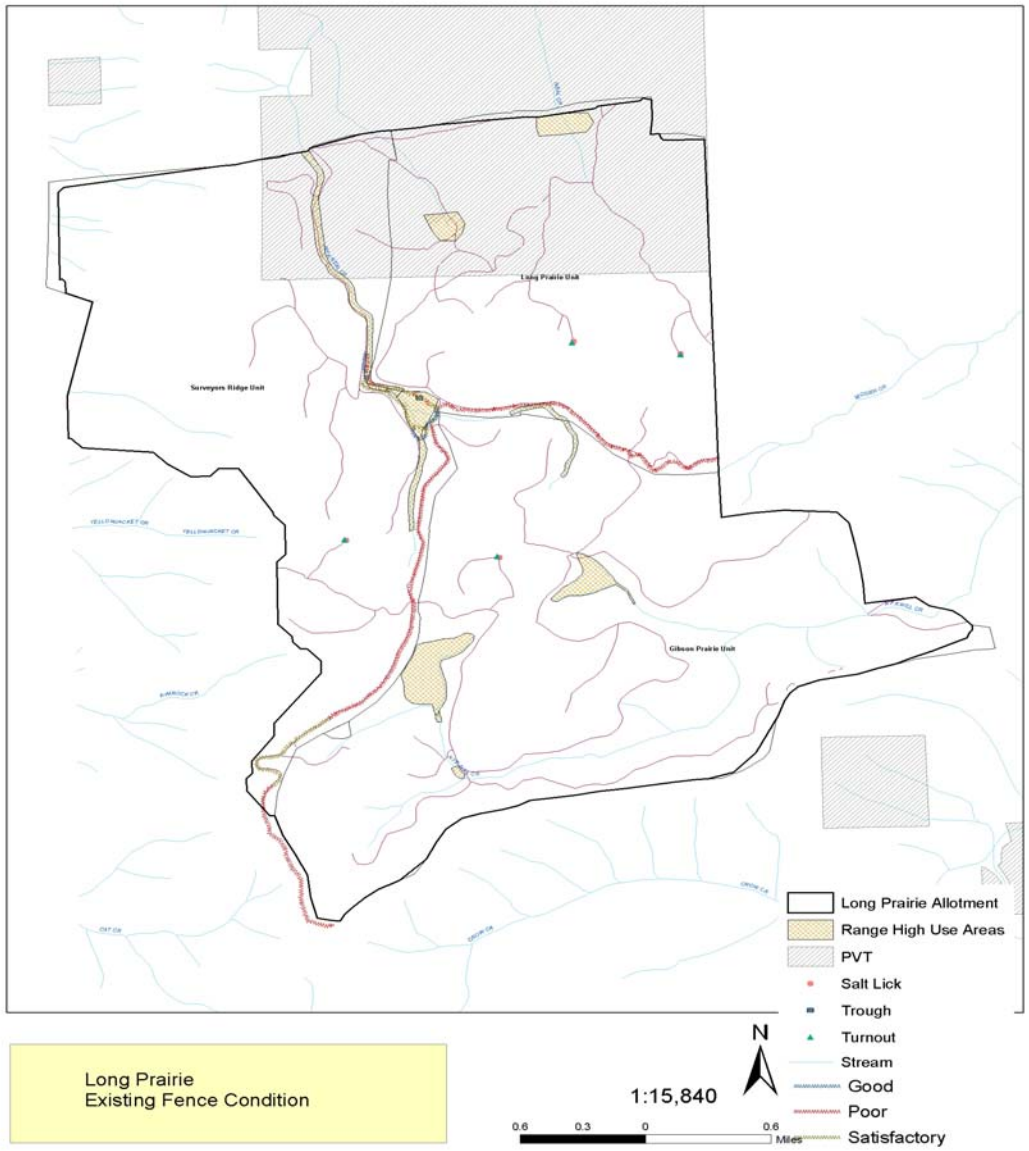

Figure 5. The three grazing units within the Long Prairie Grazing Allotment, including major fence lines. The thin black line shows the boundary between the three units, or pastures, within the Allotment.Portions of some fences were monitored in September, 2004, and their current condition is shown.

Annual Operating Plan
The MHNF issues an Annual Operating Plan for the Allotment that specifies where the cattle will be grazed and general guidelines the permittee must follow in terms of maintaining range improvements and salting locations and schedules. The plan also specifies that the permittee must maintain all existing range improvements.

Aquatic Resource Concerns Regarding Past Management
This BA addresses renewal of an existing permit. As described in the Proposed Action, measures will been taken to reduce impacts to riparian areas. Listed below are findings of monitoring of the previous permit. This information is included to set the context for predicted effects of the renewed permit.

In summer, cattle seek out riparian areas for shade, forage, and water. Within the Allotment, several stream segments and portions of some of the headwater tributaries are used by cattle throughout the summer and affect the resident fish populations and habitat both directly and indirectly. According to Dan Fissell, Range Conservationist, there are several hotspots or high use areas throughout the Allotment where cattle tend to congregate (Figure 4). These areas are all near water but other factors also influence cattle movement including vegetation and terrain (i.e., slope). The cows tend to stay out of steep areas and areas with dense tree stands or large amounts of down wood. The hotspots are generally more “meadow-like” with gentle terrain. The cattle travel into or through other areas in the Allotment but the impacts to streams outside the hotspots are much less. Vegetation utilization monitoring conducted throughout the Allotment bears this out, as the utilization in the hotspots is higher than other areas.

Both West Fork Neal and North Fork Mill Creeks have low channel gradient headwaters and steeper, more confined middle sections. The upper section of West Fork Neal Creek (the area around Long Prairie) is a “C4” Rosgen channel type that is actively downcutting. Rosgen (1996) identified riparian vegetation as having a “very high” controlling influence on the stability of a C4 channel. He also identified this channel type as having a “very high” sensitivity to disturbance from increases in sediment.

During the MHNF stream survey of West Fork Neal Creek in 1999, it was noted that cattle had access to and were affecting the stream from RM 6.45 to 8.8 (from the boundary of the Allotment upstream to the headwaters). Specifically, the surveyors noted trampled dirt banks and cattle feces in the stream. Temperatures taken with handheld thermometers during the survey noted higher water temperatures from RM 6.45 to the headwaters where grazing was occurring, and temperatures as high as 19°and 20°C were recorded at some locations. Cut banks and erosion were also common in this area.

Extensive bank trampling and multiple cattle stream crossing trails at the headwaters of both West Fork Neal and North Fork Mill Creeks were

documented by MHNF fisheries, soil, and hydrology personnel during and at the conclusion of the 2004 grazing season. Numerous areas of bank trampling, fine sediment introduction, channel downcutting and riparian vegetation removal were noted and mapped along a 0.5 mile section of West Fork Neal Creek in the Long Prairie corral area. A total of 27 areas of bank trampling and 23 stream cattle crossings or an average of 1 crossing or trampled bank every 50 feet of stream were identified. This represents approximately 1500 square feet of concentrated disturbance in the 0.5 mile section of stream. This was a high use area for cattle due to the location of the main corral where the cows were turned out and gathered every year.

The Hood River District Fish Biologist who conducted sensitive aquatic mollusk surveys at the West Fork Neal Creek headwaters at Long Prairie on August 7, 1999 noted that there were "very few snails" and that cows were standing in and around the creek. She also noted that the stream banks were disturbed by the cows walking on them, and that there was a large quantity of cow manure in and around the creek.

The upper reaches of North Fork Mill Creek (the area around Gibson Prairie) are of similar channel type and similar general channel condition to those described for West Fork Neal Creek. North Fork Mill Creek is undergoing more severe channel downcutting around Gibson Prairie than West Fork Neal, due in part to the loss of riparian vegetation. The Mill Creek Watershed Analysis noted degradation of Gibson Prairie due to cows keeping "riparian grasses short" and physically altering the streambanks. "The ephemeral streams within the meadow complex are actively downcutting which has resulted in a lowered water table, effectively draining the meadow." This was also verified during the field visits during the summer of 2004.

Other subwatersheds such as Mosier Creek, Neal Creek, and Lower East Fork Hood River have low use or minor influence due to steep topography or very small portions of the allotment are located in the subwatershed.

Literature Review

The effects of grazing on riparian and stream environments have been well studied and documented. Riparian vegetation can be changed, reduced, or eliminated by grazing, and riparian areas can be essentially eliminated through channel widening, channel aggrading, or lowering of the water table. Also, cattle are likely to graze more heavily in riparian areas than in upland zones because of the flatter terrain, water, shade, and more succulent vegetation. Salmonid populations are generally reduced in grazed areas where stream channels often contain more fine sediment, stream banks are more unstable, banks are less undercut, and summer water temperatures are higher than in non-grazed areas (Platts, 1991).

Water quality and quantity available to fish can also be affected by grazing. Soil compaction and the subsequent decrease in infiltration rate, coupled with depletion of soil cover caused by grazing, increases water runoff (Platts, 1981). Even if livestock do not directly affect water quality during the grazing season, total dissolved solids, in particular fecal coliform and fecal streptococci, can dramatically increase in streams once fall rains begin (Kauffman and Krueger, 1984). Several studies found average water temperatures dropped when cattle were excluded from streams, and that daily water temperature fluctuations were smaller when cattle were prevented from grazing in and around streams (Kauffman and Krueger, 1984).

Platts (1991) also noted that the effects of land use practices, such as grazing, may be difficult to detect over the long term because annual degradation may be hard to measure, and because "conditions may be poor for so long that they are accepted as natural." This may be the case for stream habitat and fish populations within the Long Prairie Allotment because the area has been grazed for almost 100 years. Furthermore, Platts concludes that the accumulated effect of multiple small changes to aquatic systems may be the most detrimental to fisheries because our present methods may not detect subtle changes.

In general, researchers have concluded that livestock grazing degrades stream and riparian habitats, and the habitats improve when grazing is prohibited (Platts, 1991). Platts (1991) found this pattern in 20 of 21 grazing studies he reviewed. Three years after being fenced to exclude livestock, Otto Creek in Nebraska had decreased stream widths, the streambanks stabilized, and summer water temperatures decreased by 2-5°C than before livestock exclusion (Armour, 1977). The stream reaches within the Long Prairie Allotment are generally within forested areas, and thus the effects of grazing on fish and fish habitat may not be as detrimental as in open, meadow areas (trees stabilize the banks and provide shade and cover).

Fish populations can rebound dramatically if grazing activity ceases to exist in their habitat. Kimball and Savage (1977) reported a 425% increase in fish populations in a section of Diamond Fork Creek, Utah, after livestock had been kept away for 4 years. The increase in fish populations was also attributed to a 60% reduction in forage utilization once grazing was resumed (Platts, 1981).

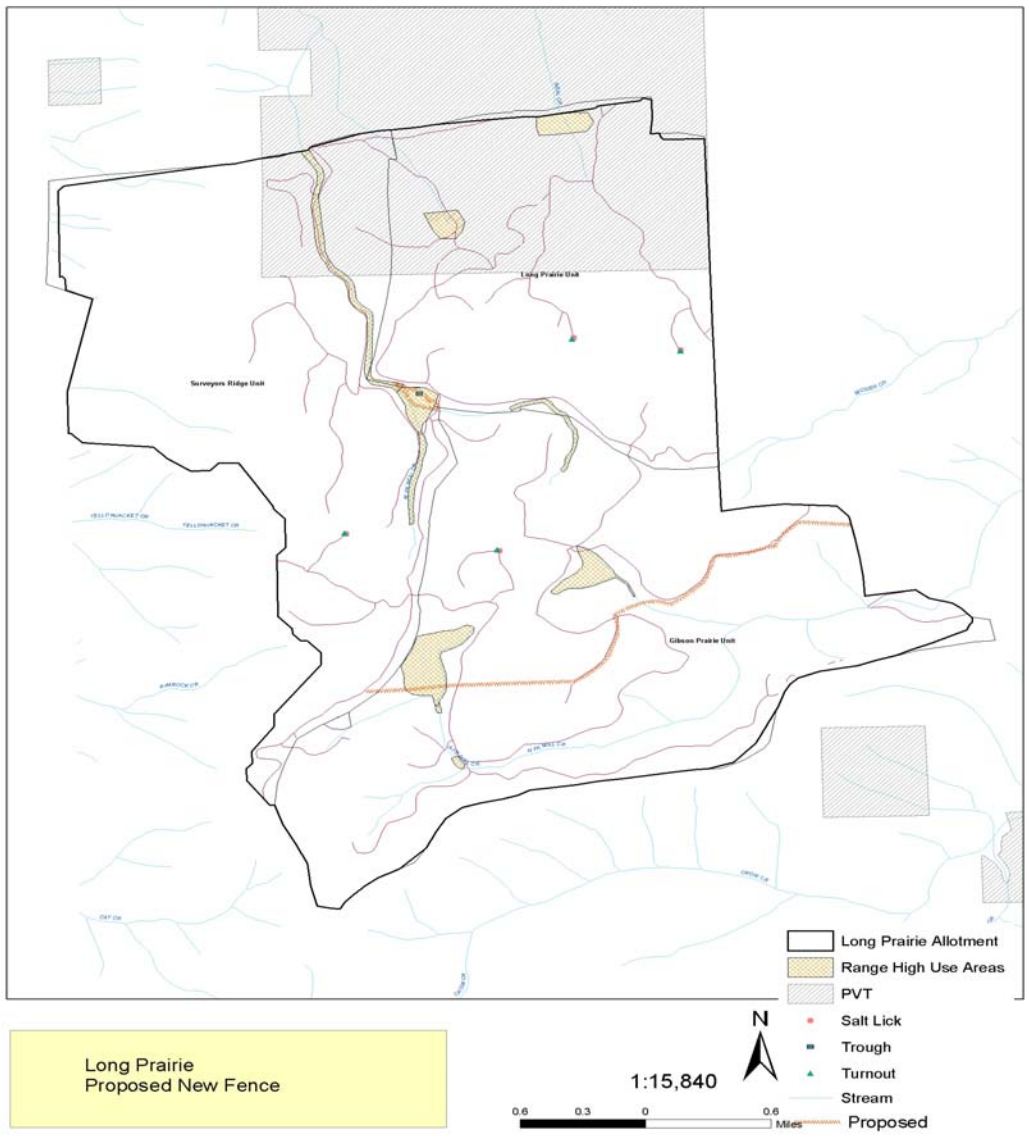

Figure 6. Proposed action for the Long Prairie Grazing Allotment. Proposed salting locations, water sources, turn-out locations, and new fences are shown. The thin black line shows the boundary between the three units, or pastures, within the Allotment.

Proposed Action

The Rescissions Act of 1995 requires each National Forest to establish and adhere to a schedule for the completion of NEPA on all grazing allotments for which NEPA analysis was needed. The last environmental analysis for the Long Prairie Grazing Allotment was completed in 1985. Thus, the Hood River Ranger District is currently completing an EA for the Allotment and a decision is scheduled to be signed by September 30, 2005. The terms and conditions of the grazing permit for the Allotment will be changed as a result of the NEPA process, and are described below.

Under the proposed action a maximum of 105 cow/calf pairs or 368 AUMs could be authorized. However under the adaptive management principle, a course of action is selected as a starting point (182 AUMs, or 52/pair for 3.5 months) that is believed to best meet or move toward the desired objectives. Monitoring will occur over time with evaluation of the results then used by the interdisciplinary team and the line officer to make adjustments to management (timing, frequency, duration and intensity) as needed to ensure adequate progress toward the defined objectives. The maximum numbers under this alternative would be a 3.5 month grazing season with 105 cow/calf pairs or 368 AUMs. Note that AUMs would not be increased above the minimum number of 52 cow/calf pairs unless monitoring occurs and results indicate that stream conditions have improved.

The permittee has opted to not utilize his permit for the 2005 and 2006 grazing seasons. Thus, there would be no impacts associated with grazing on the allotment to fish species or their habitat for those years. Some of the design features listed below as part of the proposed action would be accomplished before cattle are turned out for the 2007-grazing season.

To summarize, there will be no grazing on the Allotment for the 2005 and 2006 grazing seasons. Grazing will recommence in 2007, when 52 pairs will be turned-out. If monitoring indicates that resource conditions allow, additional cow/calf pairs (past the baseline allowed of 52 pair) may be added. These additional pairs can be removed at any time if resource damage occurs. The maximum number of cow/calf pairs that would be allowed on the Allotment is 105.

The proposed action would convert the allotment to a two-pasture, deferred-rotation grazing scheme, utilizing the Long Prairie and Gibson Prairie pastures. Under this two-pasture scheme, both pastures would be used every year, but the timing of the use in each pasture would be switched annually (early or late use). The Surveyor's Ridge pasture was dropped from the proposed action because it would require more fencing to keep the cows within the pasture. Also, cows tend to drift off forest in this pasture, especially late in the season when there is less forage available. Surveyor's Ridge pasture could be used in the future if resource conditions or management considerations warrant: if vegetation and

riparian conditions are not improving within the other two units; if some unforeseen event (like fire) reduces forage in one of the other two units; or if adaptive management allows an increase in cow/calf pairs, management may revert to a three-pasture, rest-rotation system, which would allow for a complete season's rest for one pasture each year, and rotating the rested pasture each year. Also, the Surveyor's Ridge pasture will continue to be considered as part of the Allotment so that if there is cattle drift due to fence failures, the cattle would not be trespassing and their use of the pasture would have been covered by analysis.

Under the proposed action, there would be a normal grazing season of June 15 to September 30 (season may be adjusted to reflect annual variations in range readiness, range condition, and utilization levels). Forage capacity analysis completed by the Range Conservationist found that production on the Allotment is ample enough to easily support 105 cow/calf pairs (the maximum that would be allowed). Even with the proposed improvements in place (exclusion from the riparian areas, Surveyor's Ridge Unit, and the south half of the Gibson Prairie Unit, described in detail below), the remaining area in the Allotment will still provide forage for 105 cow/calf pairs. Also, problems with resource damage within the Allotment are due to the distribution of cattle, not to limited available forage.

Adaptive Management Relative to Number of Cow/Calf Pairs Grazed

The proposed action will focus on end results for ecosystem components present in the Allotment, through adaptive management. "Adaptive management requires knowledge of the current conditions, potential or capability of riparian sites, current management, effects of the management on the resources, and possible management changes that may be made to move the current condition toward the desired condition (Cowley and Burton, 2004)".

The proposed action involves the use of an adaptive management approach where detailed thresholds will be identified and monitored on an appropriate basis. Grazing management could be adjusted through increasing or decreasing livestock numbers, or adjusting the timing, frequency, intensity, or duration of grazing. Incremental increases to permitted livestock numbers would be based on resource recovery. Stream morphology and vegetation conditions would be monitored and stocking levels adjusted accordingly.

Monitoring will follow protocol outlined in the document "Monitoring Streambanks and Riparian Vegetation" by Cowley and Burton (2004). Three indicators will be monitored: modified greenline, modified woody species regeneration, and streambank stability. Monitoring these parameters will document current conditions and trends which will in turn monitor effectiveness of the grazing strategy. The first two parameters deal with vegetation amounts and composition within the riparian area. The third parameter deals with the stability of the

streambanks. Recovery of riparian vegetation, especially the woody species component, will help with stream shading and ultimately water temperature. Monitoring sites will be selected according to the protocol. Physical habitat will be monitored only (as opposed to chemical contamination) because the physical habitat is most impacted by grazing.

Any request to increase animal numbers beyond 182 AUMs will trigger monitoring consistent with the protocol outlined by Cowley and Burton. This monitoring will take place prior to any additional animals being added to the allotment and used as a baseline to determine riparian condition trends from the addition of cattle. At a minimum, forest standards and guidelines would have to be met before an increase in AUMs would be allowed (percent bank erosion and stream shade, for example). Also, if it is not possible to complete baseline monitoring due to funding or other circumstances, an increase in AUMs would not be allowed. Monitoring will take place in year 1 and year 3 after the cows are added. Results from this monitoring will be documented in a summary report prepared by the Range Conservationist. If a degrading trend is detected in the monitoring, the additional cows will be removed from the allotment.

In addition to the monitoring described above, the stream temperature sites on West Fork Neal Creek and North Fork Mill Creek will continue to operate and collect annual temperature data to ensure these streams are meeting state water quality standards.

Design Features Included in the Proposed Action

Fencing and Range Improvements
Fencing that will protect sensitive riparian areas was given top priority within the proposed action.

Long Prairie Corral
The Long Prairie corral will be moved just north of its current location. The corral will be moved for two reasons: to protect an archeological site and to reduce damage to the riparian area. The exact new location of the corral is not yet known, but it will be 100-150' away from West Fork Neal Creek, which is approximately the extent of the functional riparian area. Once the corral is moved, impacts to the creek will not be eliminated, but will be greatly reduced. A 150-yard exclosure fence would be constructed as an east-west fence (just north of the current corrals) in conjunction with a fence on the east bank of West Fork Neal Creek. Together, these fences would form an exclosure of the south end of Long Prairie meadow and West Fork Neal Creek. The trough in Long Prairie meadow would be piped from its current location and into the new enclosed area. The intent of both the exclosure and the trough relocation is to better protect stream trampling in West Fork of Neal Creek at gather time when cattle are kept in the pasture and corral (Figure 6).

Gibson Prairie Meadow/North Fork Mill Creek
An east-west fence would be constructed on the northern side of North Fork Mill Creek to restrict cattle from the headwaters of North Fork Mill Creek (Figure 6).

Areas where evidence of streambank trampling exists near the headwaters of North Fork Mill Creek (in the Gibson Prairie meadow) are of concern and will be protected using either "knee-knockers" (down wood will be placed along the riparian area in the alder patch at the upper extent of the headwaters), and potentially with polywire fence in the approximately 600' of stream that extends downstream of the alder patch to the proposed new fence.

Before cattle are turned back out on the allotment, the fence along the 1711 road (1.5 miles) and 1700 road (2.5 miles) would be reconstructed. These are the fences between the Surveyor's Ridge and Gibson Prairie Units, and between the Long Prairie and Gibson Prairie Units, respectively. These fences are essential to controlling cattle use of the pastures within the two pasture system.

Pasture Configuration and Turnout/Gather Locations
The new corral site at Long Prairie would be used as a gathering facility for animals in the fall before cattle are removed. There may be some incidental use throughout the season to accommodate horses used by the permittees to manage their livestock, or sick animals needing attention.

Cattle would be turned out in the spring at one of four turn-out locations. The turn out location selected each year would be based on pasture in use. The turn out location in the Gibson Prairie pasture would be at the 90-degree bend along the 1700013 road (about half way in on the 1700013). For the Long Prairie pasture the turn out location would be at the end of the 1710643 or the 1710630. If Surveyor's Ridge pasture is utilized, the turn out location would be at the end of the 1700672. Salting locations would occur in the same spots as the turn out locations. In other words, a salt lick would be placed at the ends of roads 1710643, 1710630, 1700672 and at the bend in 1700013. Although Figure 6 does not show road numbers, it does depict turn-out locations.

Other Design Features Proposed but not yet Funded
Fencing and Range Improvements
The following descriptions are for fencing projects that are mainly to prevent cattle from drifting off the Allotment, but are not essential to riparian projection.

An exclosure would be constructed on the headwaters of West Fork Neal Creek within the Surveyor's Ridge Unit. Also, the northern boundary of the Allotment would be fenced. This would include two miles of fence and three cattleguards. The private land north of the allotment boundary would no longer be considered for inclusion in a grazing system with Forest Service lands, as in the past (Figure 8). The existing fence along the eastern allotment boundary (1¼ miles) and the

existing drift fence (3/4 mile) near the eastern boundary would be reconstructed to protect wildlife winter range.

Two guzzlers would be reconstructed: the north (1700-642) and south (1700-641). A new water source would be developed at Horseshoe pond (1710-640) and at the 1710-643. Although Figure 6 does not show road numbers, it does depict water source locations.

Maintenance
Under the proposed alternative, the perimeter fence (1/2 mile) around Long Prairie Meadow would be maintained by the permittee. The Forest Service would be responsible for maintaining the West Fork Neal Creek exclosure. Unless otherwise noted, the permittee would be assigned maintenance of all other fence and water improvements.

Effectiveness of Purposed Fencing and Range Improvements
Although several fences are purposed and several will be in place before cattle are turned out on the Allotment in 2007, there is the very real possibility that, over the course of the permit when cows are on the Allotment (2007 – 2012), some of the fencing will fail and cows will have access to riparian areas. Given funding and staffing levels for range and fisheries personnel, the permittee's past ability to monitor and maintain fences, and amount of fencing associated with the Allotment, there is a high likelihood that fence breaches may go unnoticed for short periods of time during the grazing season and that cows will be present in and around the headwaters of both West Fork Neal and North Fork Mill Creeks.

Endangered Species Act Project Area and Action Area
The action area is defined for ESA purposes as: "All areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CRF § 402.02).

Project Area
For purposes of this assessment, areas within the Allotment boundary where cattle will be allowed to graze are the areas for potential direct effects of the project (Figure 6). There are no predicted direct effects to ESA listed fish and proposed critical habitat within the Project Area because there are no listed fish or proposed critical habitat within the Allotment boundary.

Action Area
For purposes of this assessment, areas where there are potential indirect effects to ESA listed fish and proposed critical habitat of the proposed action define the Action Area. This area includes West Fork Neal Creek and Neal Creek above their confluence up to the Allotment boundary; and North Fork Mill Creek upstream of the eastern Allotment boundary.

Analysis of Effects

Cattle grazing and associated activities on the Allotment will have no direct effects to steelhead that reside either within or downstream from the Allotment boundary. Project design features such as fencing and range improvements, the relocation of the Long Prairie corral, pasture configuration and grazing scheme, turn-out/gather locations, and the proximity of grazing to habitat where ESA listed species occur would prevent any adverse direct impacts to any listed fish species and their habitat. Although steelhead could potentially be present in North Fork Mill Creek within the allotment boundary, cattle due not use the area due to steep terrain and heavy timber. Also, proposed fences would exclude cows from the area where steelhead could potentially be present. However, impacts from grazing in the headwaters of Neal Creek, West Fork Neal Creek, and North Fork Mill Creek within the Allotment boundary could have indirect effects to steelhead that reside downstream. Indirect effects relate primarily to habitat degradation from grazing itself and the potential effects downstream. Habitat components that could be affected include sediment, water temperature, and nutrient enrichment. Some of these impacts could be carried downstream and, in combination with natural and anthropogenic influences, could have an effect. In other words, degraded stream conditions downstream may be exacerbated, though at a low level, by grazing activities within the Allotment. For the purposes of this analysis, the known or occupied distribution of steelhead was used, relative to the farthest extent of grazing that could occur within the Allotment (Figure 3 and Table 2).

The following analysis generally uses habitat indicators from NMFS (1996) to evaluate the potential indirect effects of the proposed action on environmental parameters important to ESA listed fish species. Because analysis was completed using a modification of the new Analytical Process approach, only some indicators were used. Indicators to be analyzed were selected by the hydrologist and fisheries biologist on the EA team. The selection of indicators was based on those perceived to be potentially affected by the proposed action and on those that were found to be degraded by previous analysis of grazing on the Allotment in the years 2002 – 2004.

This analysis evaluates the indirect potential effects of the proposed action on Lower Columbia River steelhead and Middle Columbia River steelhead and their proposed critical habitat. The grazing activities within the privately-owned portion of the Allotment are interrelated and interconnected to the activities within the MHNF and are also analyzed.

Water Temperature

Environmental Baseline: ***At Risk***

Water temperature data has been collected by the Forest Service on West Fork Neal Creek for the past 10 years (Table 3 and Figure 7) and North Fork Mill Creek for the past 6 years (Table 4 and Figure 8). The West Fork Neal Creek

site is at the new MHNF boundary (RM 7.0) and the North Fork Mill Creek site is at the eastern allotment boundary (RM 9.5). Water temperature data was also collected in Neal Creek at the MHNF boundary during 2003 (Figure 9). Hand held thermometer readings were also taken during stream surveys in North Fork Mill Creek and West Fork Neal Creek in 2000 and 1999, respectively.

Table 3. Dates of water temperature recorder deployment, total days deployed, and number of days threshold temperatures were exceeded in West Fork Neal Creek from 1994 – 2004. The recorder was located at the new Mt. Hood National Forest boundary at river mile 7.0.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
START DATE	5/11/1994	5/26/1995	5/8/1996	1/1/1997	5/29/1998	6/17/1999	5/31/2000	5/30/2001	6/6/02	6/12/03	6/4/04
END DATE	11/21/1994	11/8/1995	12/31/1996	10/13/1997	10/20/1998	10/4/1999	10/2/2000	9/30/2001	10/10/02	10/15/03	9/30/04
DATA DAYS	195	167	237	251	145	109	125	125	182	126	120
Temperature Criteria	**Days Exceeded**										
7 Day Avg Max > 17.8 °C	0	0	0	0	0	0	0	0	0	0	0
7 Day Avg Max > 15 °C	0	0	0	0	0	0	0	0	0	0	0
7 Day Avg Max > 13.9 °C	11	6	9	0	18	0	0	0	5	0	0

Table 4. Dates of water temperature recorder deployment, total days deployed, and number of days threshold temperatures were exceeded in North Fork Mill Creek from 1999 – 2004. The recorder was located at the allotment boundary located at river mile 9.5.

	1999	2000	2001	2002	2003	2004
START DATE	6/24/1999	5/31/2000	5/26/2001	6/6/02	8/28/03	6/4/04
END DATE	10/4/1999	10/2/2000	9/30/2001	10/10/02	10/15/03	9/30/04
DATA DAYS	103	125	128	128	49	120
Temperature Criteria			**Days Exceeded**			
7 Day Avg Max > 17.8 °C	0	0	0	0	0	0
7 Day Avg Max > 15 °C	0	0	0	0	0	0
7 Day Avg Max > 13.9 °C	3	6	6	18	0	18

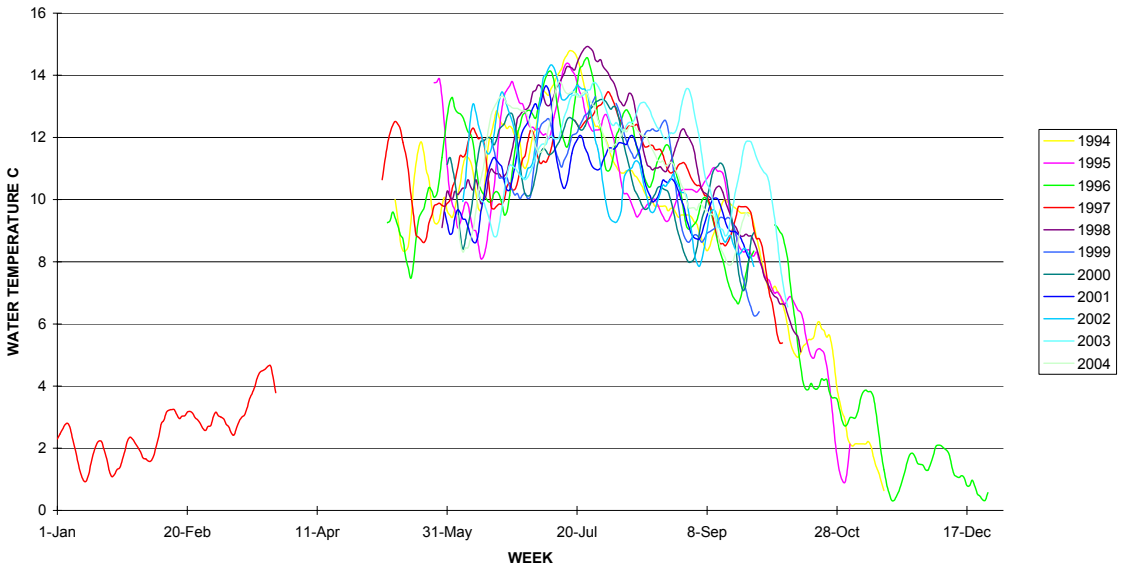

Figure 7. Seven day average maximum water temperatures (ºC) in West Fork Neal Creek from 1994 through 2004. The water temperature recorder was located at the old Mt. Hood National Forest boundary at river mile 7.0.

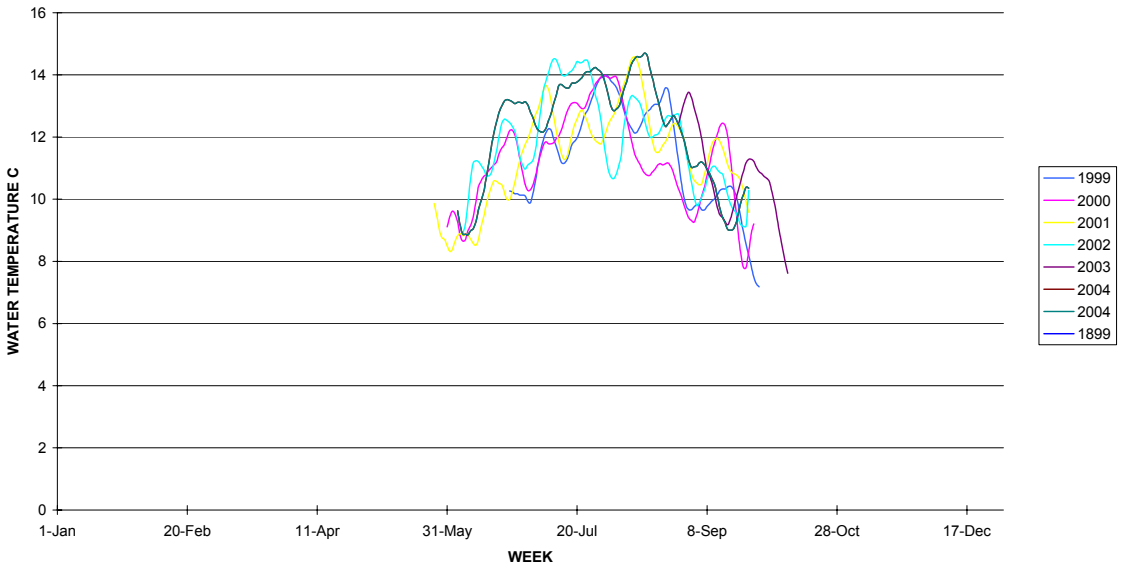

Figure 8. Seven day average maximum water temperatures (ºC) in North Fork Mill Creek from 1999 - 2004. The water temperature recorder was located at the allotment boundary at river mile 9.5.

Figure 9. Seven day average maximum water temperatures (ºC) in Neal Creek in 2003. The water temperature recorder was located at the old Mt. Hood National Forest boundary at river mile 8.8.

Water temperatures in West Fork Neal Creek and North Fork Mill Creek on federal lands are generally quite cool, rarely exceeding NOAA Fisheries steelhead criteria for properly functioning and meeting State of Oregon water quality standards (17.8 °C). Seven-day average maximum temperatures did exceed the properly functioning threshold of 13.9 °C in both creeks, usually in mid-summer, for 3-18 days depending on the creek and year (Tables 3 and 4; Figures 7 and 8). None of the days when this threshold was exceeded occurred during the spawning period, all were within the migration and rearing period. Handheld thermometer readings taken in West Fork Neal Creek in the headwaters during the 1999 stream survey exceeded 20 °C and could be cause for concern (USFS, 1999).

There is limited water temperature data available for Neal Creek above its confluence with West Fork Neal Creek. Data collected in 2003 at the old MHNF boundary indicates Neal Creek temperatures follow a pattern very similar to that seen in West Fork Neal Creek (Figure 9). It is likely this pattern holds true for other years where data was not collected. In 2003 there were only 2 days where temperatures exceeded 13.9 °C. Data collected by the Hood River Watershed Group (HRWG) in 1998 at the confluence of Neal and West Fork Neal Creeks found seven-day average maximum temperatures of 14.8 °C in Neal Creek and 17.0°C in West Fork Neal, indicating a greater heat contribution from the West Fork. This also indicates a general warming trend in a downstream direction – a situation not unexpected and one that likely occurs in North Fork Mill Creek as well. In fact, North Fork Mill Creek is listed on the 2002 State of Oregon 303d list

of impaired water bodies for temperature. The listed segment is from RM 0 – 3.7, well downstream from the allotment boundary.

Potential Effects of Action:
Proximity – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek.

Probability – There is very low probability of an effect to water temperature as the result of grazing and associated activities; however, a slight positive effect is anticipated over time due to mitigation measures.

The proposed action allows continuation of 182 AUMs in the allotment but includes a number of mitigation measures to protect riparian vegetation in West Fork Neal Creek and North Fork Mill Creek. A new corral configuration would be implemented that keeps cattle out of the upper West Fork Neal Creek channel and riparian area. This new corral and water source inside the corral would allow riparian vegetation next to West Fork Neal to recover and, over time, provide additional shading of the creek. A new fence in the southern portion of the allotment would keep cattle out of North Fork Mill Creek, also allowing streamside vegetation to grow and increase stream shading.

In addition to the fences, several measures will be employed to encourage better dispersion of cattle away from riparian areas. These include turn out locations other than the Long Prairie corral, salt licks away from riparian areas and eventual development of 2 additional water sources. Bailey and Welling (1999) showed that cattle spent more time and grazed more forage in pasture areas where off-channel water sources, such as guzzlers or water troughs, were provided than in similar control areas where no supplement was provided. In an Oregon study, Miner et al. (1992) observed that cows spent an average of 25.6 minutes/day in the stream if it was the only source of water. However, if an off stream tank was made available, cows spent only 1.6 minutes/day in the stream. Utilizing these dispersion measures will provide additional benefit to riparian areas within the allotment.

Magnitude - The effect to water temperature in any stream at the 7th field scale will be neutral or slightly positive over time as shading increases in the headwaters due to mitigation measures.

Implementation of the proposed action will allow shade providing riparian vegetation to recover, thus slightly decreasing maximum hourly stream temperatures. It is expected that West Fork Neal Creek and North Fork Mill Creek will continue to meet State Water Quality Standards for stream temperature. The proposed action would allow an incremental increase of cattle up to a maximum of 368 AUMs if resource conditions allow. A discussion of

monitoring to define conditions that may allow additional animals is found in the description of the proposed action. The additional cattle will not be introduced if riparian and channel areas aren't showing a recovery trend. If additional cattle are introduced and the riparian area and channel conditions deteriorate, these cattle will be removed.

Summary - The effect to this indicator at the 7th field scale will be neutral to slightly positive.

Suspended Sediment-Intergravel Dissolved Oxygen / Turbidity
Environmental Baseline: ***At Risk***
Trampled streambanks and areas of riparian vegetation removal are sources of sediment related to grazing within the allotment (see Aquatic Resource Concerns Regarding Past Management above).

Neal Creek
A substrate survey was conducted within each of the reaches of Neal Creek by ODFW during the Aquatic Inventory in 1993. Reach 5 (RM 5.1 to 5.6) was reported to have an average of 20% fines and sands. Reaches 6 and 7 were reported to have 19% and 18%, respectively (Table 5). A gravel road parallels Neal Creek from the West Fork confluence for ~2.3 miles, possibly contributing to the percent of fines found within reach 5 and 6. The high percentage of stream bank erosion in reaches 5 and 6 (see Streambank Condition) is also likely a contributor of silts and fine sands into the watershed. Neal Creek flows through the Long Prairie grazing allotment and across the Bonneville Power Administration (BPA) powerline right-of-way.

Table 5. Stream channel habitat indicators for Neal Creek. Data is from a 1993 Oregon Department of Fish and Wildlife Physical Habitat Survey. Reach 5 through Reach 7 extend from the confluence with West Fork Neal Creek to RM 8.8 (approximately 1.5 RM from the headwaters). The Long Prairie Grazing Allotment boundary is at approximately RM 9.8.

	Reach 5	Reach 6	Reach 7
River Mile	5.1 – 5.6	5.6 – 6.9	6.9 – 8.8
Mean Wetted Width (ft)	9.5	9.5	8.2
Wetted Width/Depth Ratio	9.7	10.4	13.9
Mean Gradient	5.3	9.7	11.8
Dominant Substrate Size	Gravel	Cobble	Cobble
Average Percent Fines (silt/organics) and Sand	20%	19%	18%
Actively Eroding Bank (percent reach length)	31.0%	9.1%	***
Wood Class*	1.2	1.7	1.3
Primary Pools (3'+)/mi	0	0	0
Pools all depths/mi	16.23	13.08	0
Rosgen Channel Type**	A4	A3	A3

* ODFW protocol defines Wood Class 1 as: Woody debris absent or in very low abundance. No habitat complexity or cover created.
** Rosgen channel type classifications are based on *bankfull* width/depth ratios, not on wetted width/depth ratios. Only wetted width measurements were taken during this survey.
*** Data Not Available

West Fork Neal Creek
Pebble count data from the West Fork Neal Creek stream survey (USFS, 1999) indicates that fine sediment ≤ 2mm (USFS protocol is to lump all sediment 2mm and smaller) makes up 19% of the total in the pool tails and/or riffles surveyed (Figure 10). Percentage of sands, silt and organic substrate < 2mm in diameter from the 1994 ODFW survey was 29% from RM 0.0 to 2.0. Note that the ODFW protocol assesses the amount of fine substrate for all habitat types (including pools), not just in potential spawning habitat as in the MHNF protocol. This is the

only quantitative data for substrate composition but MHNF fisheries personnel have also noted relatively high amounts of fine sediment in the headwaters during fish and mollusk presence/absence surveys.

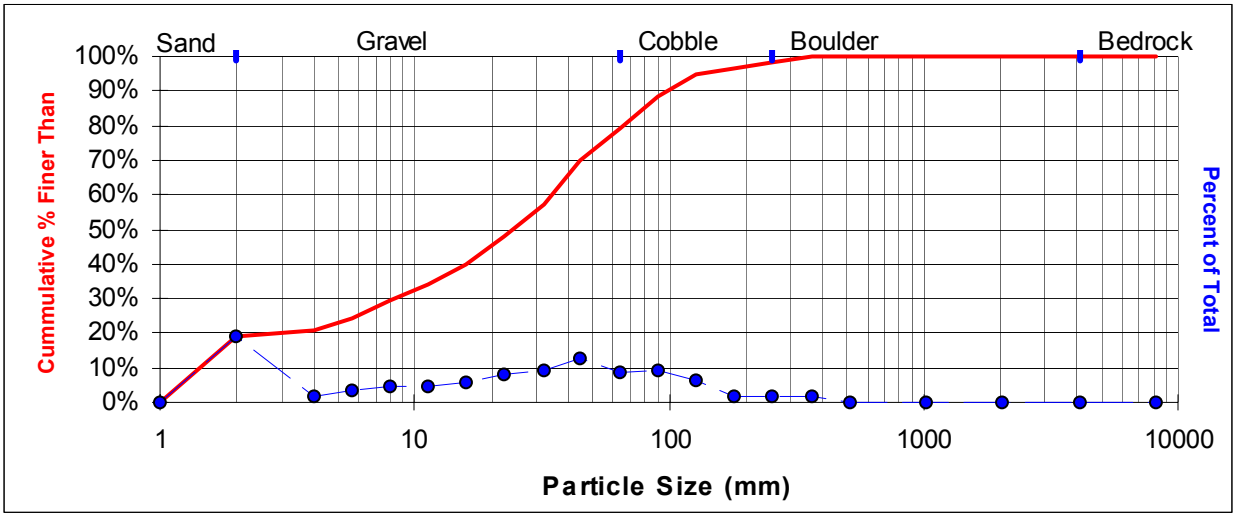

Figure 10. Summary of pebble count information taken during the 1999 West Fork Neal Creek stream survey conducted by MHNF personnel from RM 2.3-8.8. A total of 204 particles were counted.

Hood River Watershed Group volunteers collected turbidity information during 1997-1998 at several locations within the Neal Creek watershed, including two locations in West Fork Neal Creek. At RM 1.7, just above the East Fork Irrigation canal, the turbidity never exceeded 9 NTU's and the median was 4 NTU's. At the mouth of West Fork Neal Creek the median NTU reading was 5 but the high value was 24. The high reading was a result of glacially turbid water that enters the creek via the East Fork Irrigation canal that can contribute up to 85% of the total stream flow (ODFW 1994). The low median reading at the mouth indicates highly turbid water is not always present. Glacially turbid conditions are most prevalent in the fall and the streams/ditch can also run turbid during storm events in winter and spring.

Based on the relatively high amount of fine sediment ≤ 2mm throughout the stream and artificially high turbidity levels in the lower 1.7 miles, at least during periods of glacial runoff, West Fork Neal Creek is considered at risk for sediment.

North Fork Mill Creek

Pebble count data from the North Fork Mill Creek stream survey (USFS, 2000a) indicates that fine sediment ≤ 2mm (USFS protocol is to lump all sediment 2mm and smaller) makes up 18% and 44% in reaches 1 and 2, respectively of the total in the pool tails and/or riffles surveyed (Figure 11). The weighted average for the two reaches, based on reach lengths, is 23% fine sediment ≤ 2mm. The actual amount of fine sediment < 1mm is unknown but likely less than 20% of the total. However, given the high amount of fine sediment in the headwater reach, at least

some of which may be due to cattle grazing, the watershed is considered at risk for this indicator. There is no data for turbidity but typically the water is clear with turbidity levels probably within the range of natural conditions.

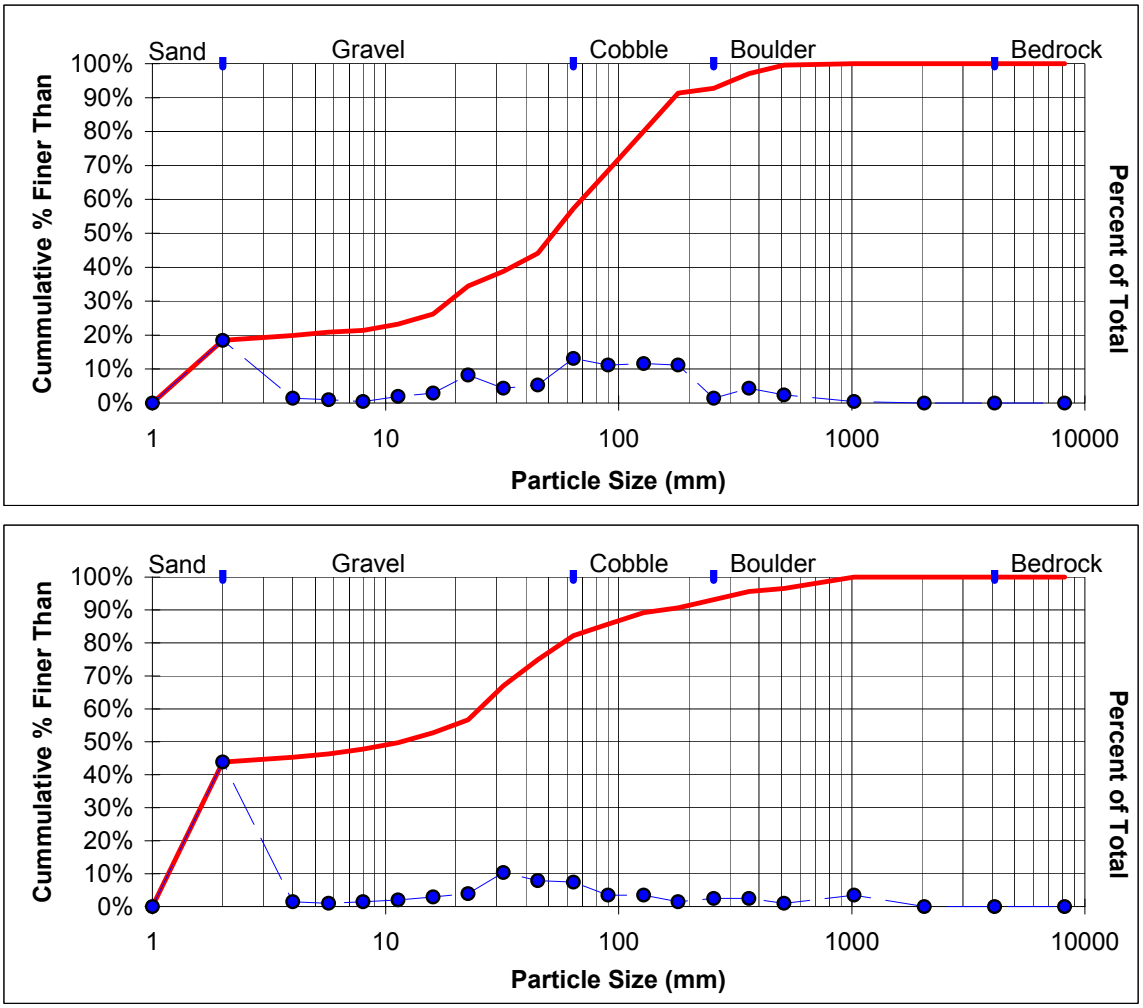

Figure 11. Summary of pebble count data for North Fork Mill Creek that was collected as part of the Level II survey conducted in 2000. The top graph is for reach 1 (RM 6.4-11.2) and the bottom graph is for reach 2 (RM 11.2-12.4).

Potential Effects of Action:
Grazing intensity, use during wet periods and accessibility of animals to streams and adjacent riparian areas are important factors in determining potential sedimentation from cattle grazing. The following table summarizes these three factors in relation to number of cow/calf pairs, or AUMs, grazed.

	182 AUMs	**Up to 368 AUMs**
General Grazing Intensity	Low	Low-Moderate
Use During Wet Periods	Low to None	Low to None
Riparian Area Use	Low to Moderate	Low to Moderate
Overall Trend of Aquatic Resource Related to Sediment under the Proposed Action	Improve Current Conditions ↑	Improve Current Conditions ↑

The major contributor of sediment by grazing activities is the proximity and access of animals to, and the time spent within, water bodies and riparian zones during drinking, feeding and loafing. The proposed action includes additional riparian fencing and measures to encourage animals to use areas other than riparian areas which will result in reduced bank trampling and sediment introduction into West Fork Neal Creek and North Fork Mill Creek. The greatest reduction of sediment will occur in the Long Prairie area of West Fork Neal Creek. With the new corral configuration, access to this section of the creek will be eliminated or greatly reduced. Reduction of sediment will also occur in the headwaters of North Fork Mill Creek in Gibson Prairie, where the construction of the proposed fence and the placement of down wood along the stream channel upstream of the fence will eliminate or reduce bank trampling. Recovery of riparian vegetation in general will provide additional protection to buffer any surface erosion that might occur adjacent to riparian areas. Salting and alternative water sources will attract cattle to areas other than the riparian. It is anticipated that with implementation of additional riparian fencing and measures to encourage cattle use outside riparian areas, sedimentation from grazing activities will be greatly reduced from the current levels.

Also, additional cattle above the base 182 AUM level will not be introduced if riparian and channel areas, including bank erosion, aren't showing a recovery trend. If additional cattle are introduced and the riparian area and channel conditions deteriorate, these cattle will be removed.

Proximity – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM

upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek.

Probability – There is very low probability that steelhead in Neal Creek, West Fork Neal Creek, or North Fork Mill Creek or their habitat will be affected by sedimentation that results from grazing and associated activities. However, over the life of the permit, there may be incremental amounts of increased sedimentation if cows gain access to the headwaters of the streams when fences fail. Bank trampling and reduction of riparian vegetation resulting in potential bank instability is expected if fence failures occur.

Several of the riparian areas where cattle tended to congregate under the previous management plan will be protected. Cattle may have access to some areas, including Neal Creek's headwaters at the northern boundary of the Allotment (on the privately-owned land) and areas within the headwaters forks of both West Fork Neal Creek and North Fork Mill Creek that either won't have fencing or where the fencing may fail. In North Fork Mill Creek, cattle tend to congregate in the headwater meadows (where access to the stream will be protected) and apparently stay out of the riparian areas downstream of the headwaters forks due to steep terrain, thus the vast majority of potential impacts would be in a localized portion of the watershed, and only if fences fail. The headwaters of Neal Creek and the reach of West Fork Neal Creek that lie on the privately-owned portion of the Allotment are not fenced and thus bank trampling by cattle may occur. However, potential cattle access to these areas could be short-term, as a fence is proposed (but not yet funded) along the northern forest boundary to exclude cattle from the private portion, and the Surveyor's Ridge Unit may not be used (that is the unit that contains most of West Fork Neal Creek).

Sediments are introduced into the headwaters areas as soil from damaged banks falls into the streams. Because the summer low-flow in all three creeks is only 1 cfs or less by mid-summer, they have limited ability to transport sediment and fines, so much of the material stays in the headwaters until storm events transport it downstream. Unstable banks resulting from grazing are also more prone to erosion during storm events, increasing the likelihood of sedimentation. However, as one moves further downstream the fine sediment generated in the headwaters is deposited in slack water areas and likely little of it actually reaches areas where steelhead or their habitat is present.

Magnitude – There could be a cumulative increase in fine sediment in all three creeks over the life of the permit. This would be due to short-term periods of bank trampling if and when cows gain access to the headwaters. The amount of unstable bank in is quite small in reach 2 of North Fork Mill Creek (Table 6), and in the upper 6.5 miles of West Fork Neal Creek (Table 7). Also, it is unlikely that the sediments generated in the Allotment influence stream habitat in Neal Creek at the 7th field watershed scale, as only the uppermost 0.5 RM of the stream are

within the Allotment. Because of small channel sizes and their limited ability to transport sediment, the amount of sediment change where steelhead or habitat occur would be immeasurable. The effect to the sediment indicator will not be of sufficient magnitude to affect the overall condition within any of the three 7th field watersheds, and will be of an insignificant magnitude where steelhead or habitat occur.

Table 6. Stream channel habitat indicators for North Fork Mill Creek within the Mt. Hood National Forest. Data is from a draft report of a 2000 Level II riparian survey. North Fork Mill Creek is within the Long Prairie Cattle Allotment from approximately RM 9.5 to 12.4.

	Reach 1	Reach 2
River Mile	6.4 – 11.2	11.2 – 12.4
Mean Wetted Width (ft)	6.3	3.5
Bankfull Width/Depth Ratio	19.6	12.8
Mean Gradient	6%	3%
Dominant Substrate Size	Gravel/cobble	Sand/silt
Fines <2 mm in gravel	18%	44%
Percent Bank Instability	8.5%	0.1%
Large Woody Material/mi	32.6	5.7
Primary Pools (3'+)/mi	0.9	0
Pools all depths/mi	59.8	55.8
Rosgen Channel Type	B4a	B4

Table 7. Stream channel habitat indicators for West Fork Neal Creek from its confluence with Neal Creek to the headwaters (RM 0.0 to 8.8). Data for Reach 1 (RM 0.0-2.0) is from a 1993 Oregon Department of Fish and Wildlife Physical Habitat Survey. Data for Reach 2 (RM 2.3-8.8) is from a 1999 Forest Service Level II riparian survey. No data is available for the reach from RM 2.0 to RM 2.3. Not all of the data between the two reaches is directly comparable due to differences in survey methods.

	Reach 1	Reach 2
River Mile	0.0 – 2.0	2.3 – 8.8
Mean Wetted Width (ft)	11.5	8.3
Width/Depth Ratio	15.7	12.9
Mean Gradient	6.2	5.4
Dominant Substrate Size	Gravel/Cobble	Gravel
Fines <2 mm in gravel	***	19%
Average Percent Fines (silt/organics) and Sand	29%	***
Actively Eroding Bank (percent reach length)	13.3%	***
Percent Bank Instability	***	7.0%
Large Woody Material/mi	134	9.8
Primary Pools (total)	4	2
Pools all depths/mi	12.5	24.4
Rosgen Channel Type	***	B4

*** Data Not Available

Summary – The effect to this indicator would be slightly negative due to cumulative effects for Neal Creek, West Fork Neal Creek, and North Fork Mill Creek due to anticipated short-term cattle access to the headwaters. However, the effect to the sediment indicator will not be of sufficient probability or magnitude to affect the overall condition within the 7th field watersheds. The effect to this indicator at the 7th field scale will be neutral to slightly negative.

Chemical Contaminants / Nutrients

Environmental Baseline:

Neal Creek

No Data

Based on conditions in West Fork Neal Creek, the Neal Creek watershed is probably properly functioning at the 7th field scale.

West Fork Neal Creek

Properly Functioning

At the 7th field scale the watershed is properly functioning for this indicator. Dissolved oxygen, pH, nitrates and phosphorus were all measured several times during the year in West Fork Neal Creek near the mouth in 1987 and/or 1998. Oregon standards for all of the above were met every time measurements were taken. There have been no documented spills into West Fork Neal Creek from agricultural or industrial sources, and the stream is predominantly surrounded by

forest land (county or Forest Service). West Fork Neal Creek is not on the CWA 303(d) list.

North Fork Mill Creek
Properly Functioning
There are no known sources of chemical contamination within the MHNF. There has been some nutrient loading in Gibson Prairie associated with the grazing in Long Prairie Allotment but in the professional judgment of the Zone fisheries biologist for the Hood River and Barlow Ranger Districts North Fork Mill Creek is properly functioning at the watershed scale. North Fork Mill Creek is not on the CWA 303(d) list.

Potential Effects of Action:
Introduction of nutrients and pathogens may occur as a result of transport from animal waste. The potential for effects is a function of timing, total livestock density and livestock access. Although general grazing intensity is a factor, levels of fecal coliform in streams tend to be more closely related to livestock use in or adjacent to surface water and not general stocking rates.

Grazing intensity, timing of grazing and ability for livestock to access surface water in the allotment all influence nutrient input. The following table summarizes those findings which are applicable in determining potential nutrient and pathogen effects.

	182 AUMs	**Up to 368 AUMs**
General Grazing Intensity	Low	Low-Moderate
Use During Wet Periods	Low to None	Low to None
Riparian Area Use	Low to Moderate	Low to Moderate
Overall Trend of Aquatic Resource Related to Nutrients and Pathogens under the Proposed Action	Improve Current Conditions ↑	Improve Current Conditions ↑

The major contributor of nutrients and pathogens by grazing activities is the proximity and access of animals to, and the time spent within, water bodies and riparian zones. It is anticipated that with implementation of additional riparian fencing and measures to encourage use outside riparian areas introduction of these pollutants from grazing activities will be greatly reduced from the current levels.

Proximity – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek.

Probability – There is very low probability that steelhead in Neal Creek, West Fork Neal Creek, or North Fork Mill Creek or their habitat will be affected by nutrient input that results from grazing and associated activities. However, over the life of the permit, there may be short-term periods of increased nutrient input if cows gain access to the headwaters of the streams when fences fail. Nutrients in animal wastes may stimulate algae and aquatic plant growth (Bauer and Burton, 1993). Although at moderate levels the increase in aquatic plants may have little to no affect on water quality, high levels can lead to reduced dissolved oxygen levels. No monitoring of water quality has been conducted within the Allotment although cow manure was found in and around the creek during surveys conducted by MHNF field personnel during 1999 and 2000. Based on the literature, both the instream and riparian feces likely is a source of nutrients and bacteria into the aquatic ecosystem. The reach of Neal Creek that is within the allotment boundary is relatively short, but given the fact that cows prefer to congregate at the stream's headwaters when they are within the privately-owned portion of the Allotment, nutrient input from cattle manure likely impacts the water quality at the site. Still, it is unlikely that nutrient input in this short reach of stream is broadcasted to the watershed as a whole. No monitoring of water quality has been conducted in West Fork Neal Creek within the Allotment although cow manure was found in and around the creek during several surveys conducted by MHNF field personnel during the 1999 and 2004 seasons. The fact that dissolved oxygen levels were relatively high (> 8.0), and nitrate and phosphorus levels were low in West Fork Neal Creek indicates any effects from cattle are not apparent in the lower watershed and are likely site specific at best. It is unlikely that nutrient input in the ~2.3 RM of stream within the Allotment influences habitat further downstream. Likewise, it is unlikely that nutrient input from cows in the headwaters of North Fork Mill Creek within the Allotment influences habitat further downstream.

Magnitude – Whether the amount of nutrients and bacteria introduced into any of the three creeks from cattle manure are detrimental to steelhead in terms of decreasing dissolved oxygen levels during peak respiration times is unknown but unlikely. There could be a short-term spike in nutrients in the streams after storm events or if and when cattle gain access to the headwaters. As a result of the nutrient input, a sag in dissolved oxygen could occur. Based on the professional opinion of the zone fisheries biologist, the small amount of nutrient loading would not cause an oxygen sag that would impact fish or habitat downstream. Any potential oxygen sag would not extend far downstream and oxygen levels would be back up to acceptable levels well upstream of where steelhead and their habitat occur.

MHNF stream surveyors in 1999 in West Fork Neal Creek and in 2000 in North Fork Mill Creek did not mention any large mats of algae or other aquatic vegetation (a sign of increased nutrients) – a detail they would normally note if applicable. Aquatic vegetation is not noticeable in photographs of the stream taken in the respective years when the streams were surveyed. It is assumed that some localized water quality degradation can occur but the available evidence suggests it is not a major problem. The effect to the nutrient indicator will not be of sufficient magnitude to affect the overall condition within any of the three 7th field watersheds, and will be of an insignificant magnitude where steelhead or habitat occur.

Summary – The effect to the nutrient indicator will not be of sufficient probability or magnitude to affect the overall condition within the 7th field watersheds, even if cattle do gain access to headwaters areas. In the professional opinion of the zone fisheries biologist, given the distance from potential nutrient input due to grazing to areas where steelhead or potential habitat occur, each stream has enough dilution and buffering power to dilute potential impacts, such as a reduction in dissolved oxygen. Also, the cold water temperatures in all three streams may mitigate the potential effects of reduced dissolved oxygen due to increased nutrient input. Overtime, an improvement in water quality, though immeasurable, is predicted because cows will have no or reduced access to stream (see Hydrology report for more detail). The effect to this indicator at the 7th field scale will be neutral.

Substrate Character and Embeddedness

Environmental Baseline:

Neal Creek

At Risk

The Neal Creek reaches surveyed in 1994 by ODFW reported gravel (reach 5) and cobble (reaches 6 & 7) as dominant substrate sizes (Table 5). Levels of embeddedness were not measured. However, fine sediments (silt/organics and sand) made up an average of 19% of the substrate in the reach from RM 5.1 – 8.8. From field visits to the lower mile of Neal Creek, and to be conservative when there is no hard data, this watershed rates as at risk.

West Fork Neal Creek

At Risk

Gravel and cobble sized substrate made up 29% and 28% of the total, respectively, in the lower two miles of West Fork Neal Creek (Table 7). However, fine substrate < 6mm and course-sized gravel (32-64mm) made up 25% and 22% of the total substrate in the reach from RM 2.3-8.8 (Table 7). Due to the relatively large amount of fine sediment < 6mm in the upper watershed the watershed is at risk for this indicator. Embeddedness was not measured as part of either survey but likely exceeds 20% in some, but not all, areas based on MHNF personnel observations.

North Fork Mill Creek
Properly Functioning
Gravel and cobble sized substrate made up 26% and 35% of the total in reach 1 of North Fork Mill Creek and 38% and 10% in reach 2. Conditions downstream of the MHNF boundary are unknown. The majority of the stream within the MHNF is properly functioning although the upper mile is not. Embeddedness has not been measured and is probably less than 20% in reach 1, but with the amount of fine sediment greater than 40% in the headwaters embeddedness likely exceeds 20% in places in reach 2.

Potential Effects of Action:
Proximity, Probability, and Magnitude – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. Continued grazing in the Allotment could result in some bank erosion if and when cows gain access to the streams that would contribute fines to the substrate, and it is likely that at some locations in the headwaters the substrate will be dominated by sand and silt. However, this contribution of fines will not have a measurable influence on the reaches of stream below the allotment boundary. Also, given that grazing activity has occurred for the last century, and that grazing intensity will lessen in the next several years due to design features that exclude cattle from streams, it appears substrate conditions will be stable.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Pool Frequency and Quality
Environmental Baseline:
Neal Creek
Not Properly Functioning (Frequency)
Poor pool frequency in Neal Creek was noted in the ODFW Aquatics Inventory (1993). Only 8 pools were noted in reach 5 and 17 pools in reach 6. None of the pools noted were primary pools ($\geq$1m in depth) and no pools were noted in reach 7. The watershed is not properly functioning for this indicator.

Not Properly Functioning (Quality)
The average residual depths for all pool types in Neal Creek were $\leq$ 0.85 meters (2.8 ft), 1993. No primary pools (>1m deep) were found. There is risk of fine sediment (reference Sediment indicator) settling in pools and pools do not tend to provide good cover. With a steep mean gradient within each reach, this watershed is likely not capable of producing many deep pools. The watershed is not properly functioning for this indicator.

West Fork Neal Creek

Not Properly Functioning (Frequency)

Pool frequencies were 12.5 and 24.4 pools/mile in reaches one and two, respectively (Table 7). Neither reach meets the NMFS properly functioning threshold of approximately 96 pools/mile.

At Risk (Quality)

Average residual pool depths in West Fork Neal Creek were 1.6 ft and 1.15 ft in reaches one and two, respectively. There were four primary pools (>1m deep) in reach 1 and 2 in reach two when respective surveys were completed in 1993 and 1999. Given the small size of the stream large numbers of deep pools are not expected in West Fork Neal Creek. However, the average depth of pools has likely been reduced to an unknown degree by fine sediment since much of this finer material would accumulate in pool habitat. This would be more prevalent in the lower gradient headwaters (upper mile) and downstream from the East Fork Irrigation canal due to glacial fines. Thus, the watershed is at risk for this indicator.

North Fork Mill Creek

Not Properly Functioning (Frequency)

Neither stream reach met the NMFS thresholds for properly functioning or at risk (Table 6).

Not Properly Functioning (Quality)

Average residual pool depths in North Fork Mill Creek were 1.2 ft and 1.1 ft in reaches one and two, respectively. There were four primary pools (>1m deep) in reach 1 but none in reach two. Given the small size of the stream large numbers of deep pools are not expected in North Fork Mill Creek. However, the average depth of pools in reach two has likely been reduced to an unknown degree by fine sediment since much of this finer material would accumulate in pool habitat. Thus, the watershed is at risk for this indicator.

Potential Effects of Action:

Proximity, Probability, and Magnitude – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. In the headwaters, which is where cattle could congregate in the Allotment if fencing fails, some pools may be degraded in quality in terms of reduced depth and possibly cover (via reduction in riparian vegetation). The amount of this degradation is unknown but would likely be concentrated at the headwaters in Gibson Prairie (North Fork Mill Creek) near the Long Prairie corral (West Fork Neal Creek), and near the northern boundary of the Allotment in Neal Creek. Although cows could trample streambanks and wallow in some specific locations, grazing activities in the allotment will not significantly change the

number of pools per mile or the quality of the pools there are at the 7th field watershed scale.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Refugia
Environmental Baseline:
Neal Creek
At Risk
The riparian reserve is somewhat buffered in spots, but there are several areas where grazing and timber use have reduced riparian habitat. Refugia that may be present at the headwaters could be affected by cattle that tend to congregate there during the early part of the grazing season, when these areas most likely have the most water in them. The watershed is at risk.

West Fork Neal Creek
At Risk
Riparian reserves are generally intact but there are areas impacted to varying degrees by grazing (the headwaters), timber harvest (there are several clear cuts that border the stream with varying buffer widths), and roads within riparian areas. Some of the more important refugia areas, at least in the headwaters, are several low gradient meadow complexes that are also hotspots where cattle tend to congregate. These meadows are naturally more sensitive to disturbance and much of the degradation discussed for other indicators is centered in these meadows.

North Fork Mill Creek
At Risk
Riparian reserves are generally intact but the headwater meadow areas, especially Gibson Prairie, are impacted to varying degrees by grazing. Timber harvest and roads have encroached within riparian areas in several areas although shading and buffer widths appear adequate except along one clear cut unit. Some of the most important refugia areas are the lower gradient meadow complexes that are also hotspots where cattle tend to congregate. These meadows are naturally more sensitive to disturbance and much of the degradation discussed for other indicators is centered in these meadows

Potential Effects of Action:
Proximity, **Probability, and Magnitude -** Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. Although there are few deeper pools in the headwaters of all three streams, and the pools that do exist are likely refugia for fish attempting to reach cooler water and cover during the heat of the summer, steelhead do not use the

headwaters areas. Refugia downstream from the Allotment is not affected by grazing activities, though refugia within the Allotment could be impacted at the headwaters or other stream reaches when and if cattle gain access to the streams. There will be no effect to refugia at the 7th field watershed scale.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Streambank Condition

Environmental Baseline:

Neal Creek

At Risk

Stream surveys by Oregon Dept. of Fish and Wildlife in 1993 from mouth to the MHNF boundary noted that Lower West Fork Neal and the Neal Creek watershed had a total bank erosion of 10.9%. Bank stability was measured throughout the watershed, by ODFW in 1993. In reaches 5, 6 and 7 (Neal Creek) 31.0%, 9.1% and negligible percentage, respectively, were the reported *actively eroding* measurements for the Bank Stability rating. The survey was in 1993 and personal observations of this creek have noted further erosion after the 1996 flood, so this rates the watershed as at risk.

West Fork Neal Creek

Properly Functioning

ODFW personnel in 1993 reported 13.3% of the survey reach to be actively eroding whereas MHNF personnel reported that 7% of the banks were instable (Table 7). It is not known if the two protocols used are directly comparable but assuming they are relatively close the weighted average bank instability for West Fork Neal Creek is approximately 8.5%. Note that the highest concentration of unstable banks within the MHNF surveyed portions was between RM 2.3 – RM 3.2, not in the headwater hotspot areas. Trampled banks were frequently identified within the allotment however, from RM 6.45 to RM 8.8. Overall the watershed is properly functioning for this indicator although certain reaches have higher levels of bank instability.

North Fork Mill Creek

Properly Functioning

MHNF personnel reported 8.5% bank instability in Reach 1 and very little (0.1%) bank instability in Reach 2 (Table 6).

Potential Effects of Action:

Proximity, **Probability, and Magnitude -** Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. Cattle do not venture into the lower stream reaches where steelhead and their habitat is present. Although banks may be trampled by cattle for short

periods of time when fencing fails, bank stability within the 7th field watersheds will not be changed significantly by bank trampling that occurs within the Allotment. The overall amount of instable banks within the watershed would not be changed as a result of continued grazing.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Floodplain Connectivity
Environmental Baseline:
Neal Creek
At Risk
Neal Creek has reduced linkages to wetlands due to roads within the floodplain. ODFW Aquatic Inventory stream surveyors noted terraced and artificially channelized streambanks throughout the surveyed watershed. Overall the watershed is likely at risk for this indicator.

West Fork Neal Creek
Properly Functioning
The entrenchment ratio for the section of stream from RM 2.3 - 8.8 was 2.69 (USFS, 1999), which is within the moderately to slightly entrenched category according to Rosgen (1996). This entrenchment ratio was the "average" over several miles of stream surveyed and in places the ratio was likely higher (less entrenched) or lower (more entrenched). Roads, primarily Forest road 1700, do impinge upon the floodplain in areas but although the road is relatively close to the stream in areas it is the opinion of the Zone fisheries biologist for the Hood and Barlow Ranger Districts that roads in the upper watershed have little effect on floodplain connectivity. Based on field observations and the available data the channel is not incised to a great degree and in areas with degraded streambanks the stream can still access the floodplain. West Fork Neal Creek is properly functioning for this indicator.

North Fork Mill Creek
At Risk
The entrenchment ratio for stream reaches one and two was 1.6 (USFS, 2000b), which is within the moderately entrenched category according to Rosgen (1996). This entrenchment ratio was the "average" over several miles of stream surveyed and in places the ratio was likely higher (less entrenched) or lower (more entrenched). There are some road crossings and roads do lie within riparian reserves in some areas, however, it is the opinion of the Zone fisheries biologist for the Hood and Barlow Ranger Districts that roads in the upper watershed have little effect on floodplain connectivity. Based on field observations and the available data the channel is not incised to a great degree (with the exception of some intermittent channels in Gibson Prairie) and in areas with degraded streambanks the stream can still access the floodplain. North Fork Mill Creek is properly functioning for this indicator.

Potential Effects of Action:
Proximity, Probability, and Magnitude – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. In Neal Creek, the ability of the wetland area at the headwaters to function appropriately has been compromised in the past by soil compaction and reductions in riparian vegetation that occur as a consequence of grazing activity. The low flow that these areas have normally is reduced further by increases in run-off that occurs when soils are compacted. Areas that would normally be wet into the late summer may dry out earlier due to grazing activity, but this would only affect the floodplain within the allotment, not within the watershed as a whole. In West Fork Neal and North Fork Mill Creeks, although there are site specific impacts to streambanks and riparian vegetation due to past grazing activity, the ability of the stream to access the floodplain still exists. Some of this may be due to the small size and "power" of the stream. Higher flows that could cause greatly accelerated erosion and incision appear to be infrequent and enough vegetation and roughness is present to stabilize the stream during normal high flow events. Since the channel has remained functional in this regard, even after a century of grazing, there is no reason to expect conditions to change in the future. In fact, past impacts to the floodplains will be greatly reduced by the proposed fencing, and the function of the floodplains within the Allotment is expected to improve. Grazing will have no effect on the floodplains in any of the watersheds at the 7th field scale.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Riparian Reserves
Environmental Baseline:
Neal Creek
At Risk
From 1994 surveys off-forest (lower watershed), there were from 6.5 to 25 trees within the riparian reserve per 1000'. There were no trees over 20" in diameter in the 10 miles surveyed. According to 1993 ODFW survey data, 96% of the stream was shaded in the reaches from RM 5.1 – 8.8. The watershed is currently at risk overall, due to low potential for large woody debris recruitment and existing roads that limit riparian vegetation development in parts of the watershed.

West Fork Neal Creek
At Risk
Stream shade from RM 2.3-8.8 averaged 73.4% (USFS, 1999) and 93% of the stream was shaded in the lower two miles (ODFW, 1993). Stream shade in the upper watershed was variable, however, and shade generally decreased in the

uppermost mile surveyed (Figure 12). This decrease is in large part due to natural meadows in the headwaters. Except for these meadows systems the riparian canopy was a mixture of conifers and deciduous trees of varying sizes. Large woody debris recruitment potential was rated "satisfactory" for 35%-40% of the stream length and in no need of treatment (Hood River Soil and Watershed Conservation District, 1999). Agricultural lands (i.e. orchards), urban development and existing infrastructure (roads, etc.) limit riparian vegetation development throughout much of the rest of the watershed. It is for this reason that the watershed is rated at risk. Grazing impacts are primarily of a site specific nature, as described above, and are not a primary cause of riparian degradation throughout the watershed.

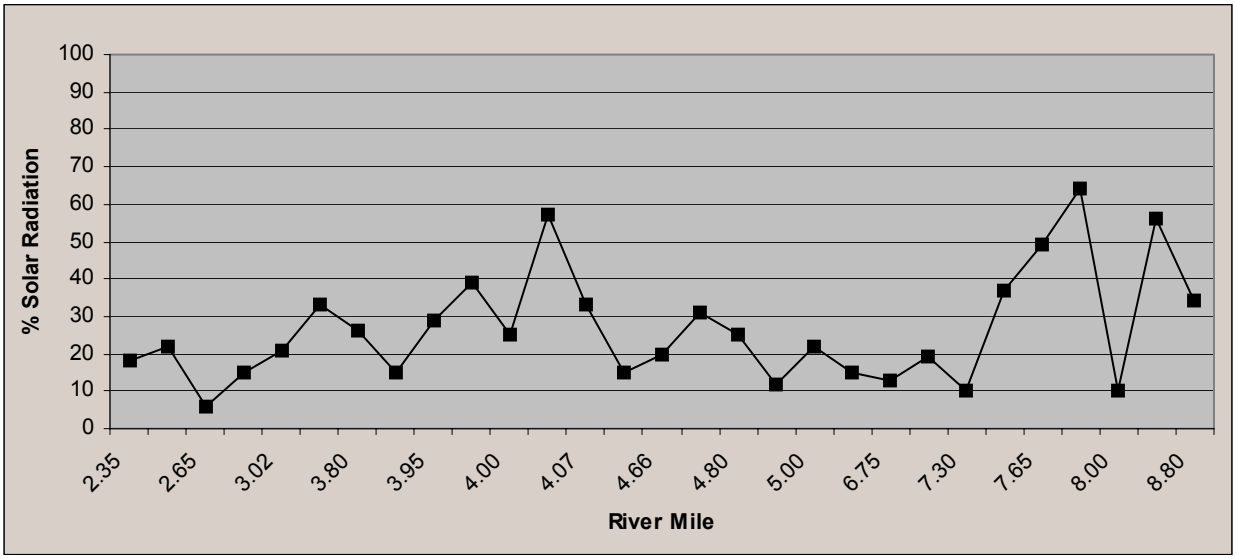

Figure 12. Solar radiation readings taken with a solar pathfinder in West Fork Neal Creek during a 1999 stream survey conducted by MHNF personnel. Stream shade is the inverse of solar radiation.

North Fork Mill Creek

At Risk

Stream shade from RM 6.4-11.2 averaged 71% and from RM 11.2 to 12.4 the average shade was 57%. Stream shade in the upper watershed was less (Figure 13) primarily due to the prevalence of more open, meadow habitat. Except for these meadows systems the riparian canopy was a mixture of conifers and deciduous trees of varying sizes. Large woody debris recruitment potential was not estimated in the Mill Creek watershed analysis (USFS, 2000a) but is likely within the range of natural conditions given the adequate shade, implying a relatively dense stand and amounts of large woody debris that meet NMFS properly functioning thresholds. It is for this reason that the watershed is rated at risk. Grazing impacts are primarily of a site specific nature, as described above, and are not a primary cause of riparian degradation throughout the watershed although shading a some loss of small woody vegetation has occurred in the

headwaters. The watershed within the MHNF is rated at risk due to impacts in Gibson Prairie and meadow refugia area in general.

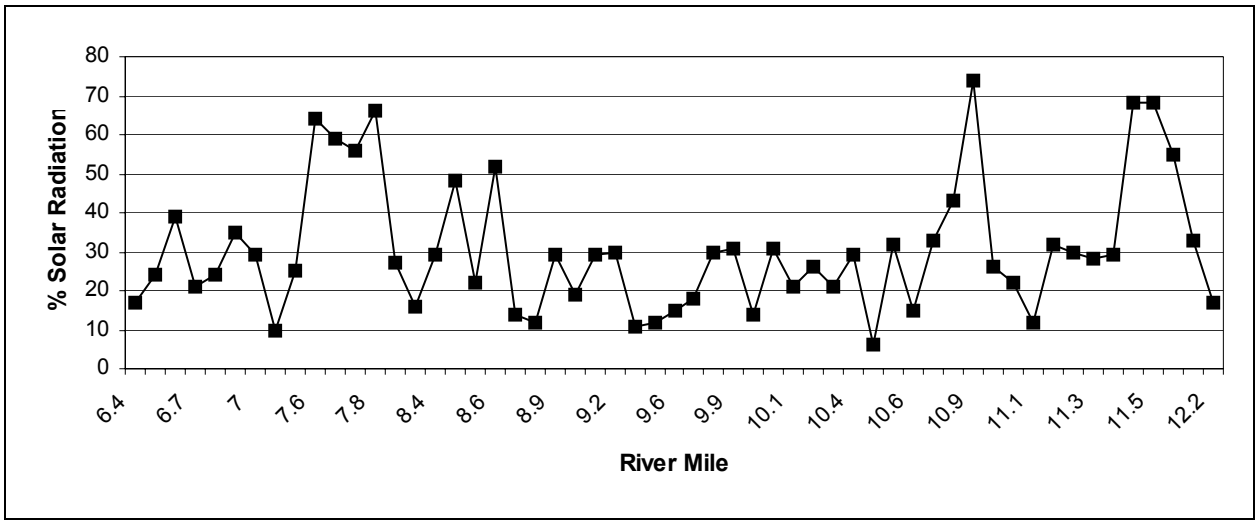

Figure 13. Solar radiation readings, measured with a solar pathfinder, normalized for the month of July that were taken in North Fork Mill Creek as part of a Level II riparian survey in 2000.

Potential Effects of Action:
Proximity, Probability, and Magnitude – Grazing and associated activities are located 3.0 RM upstream from where steelhead are known to occur in North Fork Mill Creek, 5.45 RM upstream from where steelhead are known to occur in West Fork Neal Creek, and 4.20 RM from where steelhead are known to occur in Neal Creek. Cattle grazing in the headwaters areas will continue to alter the composition of vegetation within the riparian reserve. However, the potential composition of the natural community is difficult to assess due to historic practices of seeding the grazing allotment area with non-native grasses. Impacts to the watersheds as a whole as a result of grazing are insignificant, and conditions within the riparian reserves within the Allotment are expected to improve over time as proposed fencing to exclude cattle is implemented.

Summary - The effect to this indicator at the 7th field watershed scale will be discountable.

Aggregate Federal Effects

We are not aware of any proposed federal actions for which a Biological Assessment has been submitted contemporaneously with this BA for ESA consultation, which would affect the ESA action area for this project. All ongoing actions with potential adverse effects (where ESA consultation has been concluded), and effects of completed federal actions, are included in the

environmental baseline for each indicator and have been considered in this analysis.

Effects Determination / Rationale

The effects determination for grazing and associated activities on the Long Prairie Grazing Allotment for the years 2005 – 2012 is **"may affect, but is not likely to adversely affect" (NLAA)** for Lower Columbia River steelhead and Middle Columbia River steelhead.

The analysis of effects determined that the effect of the proposed action on the baseline indicators to be neutral, neutral to slightly negative, neutral to slightly positive, and insignificant or discountable effects to the habitat of Lower Columbia River and Middle Columbia River steelhead that occurs within or downstream of the project area. The analysis of effects also determined that there would be no direct effects to individuals of these species.

The project elements of the proposed action include number of cow calf pairs or Animal Unit Months (AUMs) turned out, pasture configuration and turn-out/gather locations, and fencing and other range improvements. These elements were found to have a discountable effect on the following environmental indicators at the 7th field scale: Substrate character and embeddedness, Pool frequency and quality, Refugia, Streambank condition, Floodplain connectivity, and Riparian reserves.

Project elements were found to have a neutral to slightly positive effect on Temperature. The effect to water temperature in any stream at the 7th field scale will be neutral or slightly positive over time as shading increases in the headwaters, due to project design features including fencing that excludes cows from the headwaters and water and salting sources that will attract cows away from the currently accessible riparian areas. As 7-day maximum stream temperatures are reduced within the project area, they will have a positive impact to waters downstream where steelhead reside. As this project is implemented there could be an overall reduction of temperature-related stress to steelhead compared to current conditions.

Project elements were found to have a neutral to slightly negative effect on Suspended sediment – intergravel dissolved oxygen/turbidity at the 7th field scale. Although over the life of the permit sediment resulting from short periods of bank trampling and sloughing may accumulate over time, the amount will be immeasureable where steelhead and their habitat occur. Fencing and other range improvements designed to exclude cows from riparian areas or to encourage them to use less sensitive areas within the Allotment should reduce the amount of bank trampling that occurred under past management. Still, some trampling may occur when fences fail, and the overall increase in sediment could slightly reduce the quality of spawning gravels and thus spawning success.

Project elements were found to have a neutral effect on Chemical contaminants/nutrients at the 7th field scale. Although spikes of nutrient input may occur in the streams within the Allotment if and when cattle gain access to the streams and after storm events, the potential resulting change in dissolved oxygen levels would not extend downstream to where steelhead and their habitat is present.

All other habitat indicators (those that were not included in this analysis) will not be affected by grazing and associated activities on the Allotment and are expected to maintain their current condition.

Overall, the design features included in the proposed action should improve conditions for steelhead downstream. However, it is not possible to measure the amount of improvement that could occur, and there is the potential of a slight negative, though also immeasurable, effect to sediment where steelhead occur.

Proposed Critical Habitat

NOAA Fisheries proposed critical habitat for Lower Columbia River steelhead and Middle Columbia River steelhead on December 14, 2004. This project is designed to have no effect on ESA listed species or proposed critical habitat. Over the life of the permit however, it is reasonable to conclude there may be failure of fences used to exclude livestock for short periods of time. If this occurs, there could be downstream effects on proposed critical habitat. Analysis of effects to in-stream and other habitat elements address Primary Constituent Elements in proposed steelhead Critical Habitat. As described earlier, there may be minor negative effects, but these effects will likely only effect indicators at the site scale, and effects to steelhead, and habitat occupied by steelhead will be either insignificant or discountable. The only primary constituent element not addressed is forage for juvenile anadromous fish in freshwater habitats. Any effect to forage is expected to be minimal, short-term and discountable.

Therefore, it is determined that the effect of this project to proposed Critical Habitat will not adversely affect proposed Critical Habitat. This analysis finds no adverse affect to any Primary Constituent Elements.

The AP provides a dichotomous key utilized to reach the appropriate ESA effect determination. Utilizing the indicator summaries from the Analysis of Effects section of this document, the key provided an effect determination of **"may affect, but is not likely to adversely affect" (NLAA)**, as shown in Table 8

Table 8. AP Effects Determination Key.

AP Project Effects Determination Key For Species and Designated Critical Habitat	
1) Do any of the indicators summaries have a positive or negative conclusion?	
X	Yes - Go to 2
	No – No Effect
2) Are the indicator summary results only positive?	
	Yes – NLAA
X	No – Go to 3
3) If any of the indicator summary results are negative, are the effects insignificant or discountable?	
X	Yes – NLAA
	No – LAA, fill out Adverse Effects Form

ESA Cumulative Effects

ESA cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR section 402.02].

The private land in Middle Columbia-Mill Creek watershed is located downstream from the action area. The private land in the Lower Hood River watershed is located within the action area. Long Prairie Grazing Allotment effects could combine cumulatively (beneficially or detrimentally) downstream of the federal action area. It is expected that land management activities in privately owned portions of Lower Hood River watershed and Middle Columbia-Mill Creek sub-watershed, such as timber harvest and agricultural practices, will continue in the future. It is also expected that activities on these lands will comply with county, state, and federal laws and regulations.

Future actions that are reasonably certain to occur in the future on the Allotment within the privately-owned portion include timber harvest in the riparian areas along both West Fork Neal and Neal Creeks. The landowner harvested timber in the headwaters of Neal Creek and an unnamed tributary to West Fork Neal immediately after he obtained the land in 1994, and continued harvesting on his land in 2004 (the reach of West Fork Neal Creek that is located on his land extends from RM 2.3 – 7.0, and the reach of Neal Creek on his land is from RM 8.8 – 10.3, the headwaters). Also, it is likely that timber harvest activities will continue on land owned by Hood River County downstream from the privately-owned land. However, the building of new roads near the creek will probably not occur, as most timber within the riparian areas on both the privately-owned and County-owned land was harvested recently and new logging would most likely be accomplished with helicopters.

Impacts to steelhead from continued timber harvest on private and county lands near West Fork Neal and Neal Creek include increased sedimentation which could degrade spawning areas and smother incubating eggs in redds, and increased water temperature. Both impacts would be a result of decreased riparian vegetation.

Since the habitat degradation in West Fork Neal and Neal Creeks is affected by a multitude of influences off-forest, it is difficult to ascertain whether grazing activities within the Allotment contribute to the problem and if so how much. Most of the degraded sites are localized in the hotspot areas and based on the available data it does not appear that conditions downstream are a result of grazing, though it is difficult to tease out grazing impacts from other anthropogenic influences. Thus direct ties between habitat degradation in the reaches where steelhead are known or suspected to be present and activities on the grazing Allotment (and specifically downstream impacts) cannot be conclusively made.

Long Prairie Grazing Allotment includes objectives and design elements to maintain or improve water and aquatic habitat quality within the project area. The Long Prairie Grazing Allotment will not contribute significantly to adverse effects at a level to place endangered species or their habitat at risk.

Determination of Effect – Essential Fish Habitat

When the Magnuson-Stevens Act of 1976 was re-authorized in 1996, it directed Regional Fishery Management Councils to identify Essential Fish Habitat (EFH) for commercial fish species of concern. Effects analysis contained here and in the Biological Assessment address potential effects to EFH for steelhead. The Long Prairie Grazing Project is not expected to adversely affect fish habitat in the Lower Hood River basin or the Mill Creek basin. Three salmonid species are identified under the MSA, Chinook salmon, coho salmon and Puget Sound pink salmon. These species are not present in the project area or action area of the proposed action. The proposed action will have **No Adverse Effect** on Essential Fish Habitat for any of these species as designated under the 1996 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

References

Armour, C.L. 1977. Effect of deteriorated range streams on trout. Bureau of Land Management, Idaho State Office, Boise.

Bauer, S.B. and T.A. Burton. 1993. Monitoring protocols to evaluate water quality effects of grazing management on western rangeland streams. U.S. Environmental Protection Agency, Report No. EPA 910/R-93-017.

Behnke, R.J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.

Bjornn, T.C. and Rieser, D.W. 1991. Habitat requirements of salmonids in streams. American Fisheries Society Special Publication 19: 83-138.

Buchanan, D.V., M.L. Hanson, and R.M. Hooton. 1997. Status of Oregon's bull trout. Oregon Department of Fish and Wildlife, Portland, Oregon.

Cowley and Burton. 2005. Monitoring Streambanks and Riparian Vegetation, Multiple Indicators. Idaho Technical Bulletin No. 2005-02. U.S. Department of the Interior, Bureau of Land Management, Idaho. http://www.id.blm.gov/techbuls/05_02/index.htm.

Currens, K.P., C.B. Schreck, and H.W. Li. 1990. Allozyme and morphological divergence of rainbow trout (Oncorhynchus mykiss) above and below waterfalls in the Deschutes River, Oregon. Copeia 1990(3): 730-746.

Gregg, R. and F. W. Allendorf. 1995. Systematics of Oncorhynchus species in the vicinity of Mt. Hood: preliminary report to Oregon Department of Fish and Wildlife. Division of Biological Sciences, University of Montana, Missoula, Montana.

Hood River Soil and Water Conservation District. 1999. Hood River Watershed Assessment. Hood River, Oregon.

Kauffman, J.B., and Krueger, W.C. 1984. Livestock impacts on riparian ecosystems and streamside management implications…a review. Journal of Range Management 37(5).

Kimball, J. and F. Savage. 1977. Diamond Fork aquatic and range habitat improvements. USDA Forest Service, Ogden, Utah.

Kostow, K. 1994. Annual genetics report. Oregon Department of Fish and Wildlife, Portland, Oregon.

NOAA, 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Long beach, California.

ODFW. 1993. Aquatic inventories project physical habitat survey report. Mid-Columbia District, The Dalles, Oregon.

Olsen, E.A., R.A. French, and A.D. Ritchey. 1995. Hood River and Pelton ladder evaluation studies, annual report 1994. Oregon Department of Fish and Wildlife, Portland, Oregon, and Confederated Tribes of the Warm Springs Reservation, Warm Springs, Oregon.

Platts, W.S. 1981. Influence of forest and rangeland management on anadromous fish habitat in western North America: effects of livestock grazing. USDA Forest Service, GTR PNW-124, Portland, Oregon.

Platts, W.S. 1991. Livestock grazing. American Fisheries Society Special Publication 19: 389-423.

Rosgen, D.L. 1996. *Applied River Morphology.* Minneapolis: Printed Media Companies.

StreamNet. 2005.

USFS. 1990. Land and resource management plan. Mt. Hood National Forest, Sandy, Oregon.

USFS. 2000. Forest-wide culvert survey.

USFS. 2000a. Mill Creek watershed analysis. Mt. Hood National Forest, Sandy, Oregon.

USFS. 2000b. Draft North Fork Mill Creek stream survey completion report. Mt. Hood National Forest, Sandy, Oregon.

USFS. 1942. Range management work plans. Mt. Hood National Forest, Policies and Practices, Parkdale, Oregon.

USFS. 1992. Stream survey report for North Fork Mill Creek. Mt. Hood National Forest, Sandy, Oregon

USFS. 1999. Stream survey report for West Fork Neal Creek. Mt. Hood National Forest, Sandy, Oregon.

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