Willamette National Forest Pilot Road Analysis

Appendix C

Fisheries Process Paper

October 1998

Background Statement

Aquatic species of interest on the Willamette NF include those currently considered as PETS (proposed, endangered, threatened, or sensitive): bull trout (threatened); spring chinook (proposed threatened); winter steelhead (proposed threatened); and Oregon chub (endangered). Also of interest are native rainbow trout (including the McKenzie "redside" rainbow); native coastal cutthroat trout (including Hacklemann cutthroat); introduced summer steelhead; and introduced brook trout. Several other fish species occur on the forest, but they will not be discussed in this pilot project, including five sculpins, two dace, two lamprey, mountain whitefish; suckers; squawfish; and warmwater fishes that have been introduced into the reservoirs behind Army Corps of Engineer dams.

Roads influence the health and distribution of aquatic species on National Forest System lands by several mechanisms:

a) impacts to riparian areas can lead to: loss of streamside shade; loss of nearstream vegetation which would otherwise provide a pathway for nutrient inputs (e.g. insects, leaves) and large woody material: reduction or loss of a filter which prevents sediment from entering the stream course; compaction or loss of floodplains; destabilization of steep slopes adjacent to streams; channelization of the stream course; allowing access to people that may result in behaviours such as poaching, vandalism, or litter, and localized erosion from vegetation removal/trampling.

b) impacts to stream channels due to inherent/natural characteristics of watersheds where road building on soils with moderate and/or high potentials for fine sediment; unstable soils; or severe erosion, especially on steep slopes, may lead to excessive fines entering stream channels. The fines are likely to settle in relatively low gradient, depositional sections of stream channels that are often favored as spawning sites by salmonid species. Fines interfere with reproductive success by interrupting the ability of eggs to metabolize and/or smothering young fish that have not emerged from the interstitial spaces of spawning gravel areas.

c) increase in risk of impact by roads to stream channels and aquatic species due to events related to management: the age of a road, the surface material, the number of stream crossings and drainage features, the density of roads, together with the percent of a watershed that has been harvested (e.g. hydrologically unrecovered) are all factors which can interact with the inherent characteristics to increase the risk that roads in a given watershed may be impacting beneficial uses such as fish reproduction, distribution, and survival. Such events are most likely to occur through chronic impacts (e.g. sedimentation from road and roadside run-off, fish distribution restrictions and alterations in stream channel morphology due to improperly sized or placed culverts), or to more significant episodic events such as floods or catastrophic fires which may lead to increased runoff and impacts to water quantity and quality.

Process description and documentation

Issues and Key Questions

The two main issues identified which are directly related to fisheries are:

1. ***How and where do roads affect fish populations?***
2. ***How and where do roads affect fish habitat?***

The issue begins with identifying which watersheds and subwatersheds are important for fish or other aquatic organisms of interest. In the Pacific Northwest the focus is salmonid spawning and rearing, and whether or not the population status of a species is known. The methodology for determining sample units and status was similar to that used for the Interior Columbia Basin Ecosystem Management Project (Volume III PNW GTR-405 USDA/USDI 1997). Sixth Field subwatersheds were the sample unit and the status of naturally producing populations was rated with the following criteria:

- **Present – strong:** (no populations are known to meet this criteria which includes: stable or increasing numbers; all major life history forms are present that were historically present; and the population includes 500 adults within the Sixth Field. It is probable that some of our native cutthroat and rainbow trout populations meet this criteria, but we do not have valid information to document this).
- **Present – depressed:** (populations that meet this criteria must have one of the following characteristics: a major life-history component has been eliminated; numbers are declining or less than half of the historical habitat is occupied; or total abundance is less than 500 adults).
- **Absent:** this was modified from the ICBEMP to be defined as Sixth Fields where the species is extinct (primarily due to passage blocking large flood storage dams on the Willamette National Forest) and does not include subwatersheds that were never occupied by the species.
- **Present**: migration corridor (does not support spawning or rearing, but functions as a route or wintering area for migrating fish).

During analysis with other resource areas the criteria listed above were lumped into the categories of :

- "**T&E occupied**" which means that either bull trout, winter steelhead, spring chinook, Oregon chub or a combination of those species occur in the subwatershed and the subwatershed is used primarily for spawning/rearing, or migration.
- "**Historic T&E**" which means that the subwatershed once supported bull trout, winter steelhead, spring chinook, or a combination of those species and was used for spawning/rearing and migration.

Subwatersheds currently occupied by bull trout, winter steelhead, spring chinook or Oregon chub were identified, as were watersheds of historic occupation, which will be important for consideration during species recovery planning under the Endangered Species Act. These

watersheds were compared to other resource "hot spots" to provide a Forest level idea of priority areas for road and transportation system management.

Table 1. Sixth Field subwatersheds important for fish production or migration

Fifth Field/ Sixth Field	Bull Trout	Spring Chinook	Winter Steelhead	Oregon Chub	Native Resident
Little North Santiam					
01-1	absent	present - d			present
01-2		present - d			present
Breitenbush					
02-1	absent	absent	absent		present - d
02-2	absent	absent	absent		present - d
Middle North Santiam					
78-2		absent	absent		present - d
78-4		absent	absent		present - d
78-6	absent	absent	absent		present - d
78-7	absent	absent	absent		present - d
Upper North Santiam					
79-1	absent	absent	absent		present - d
79-2	absent	absent	absent		present - d
79-3	absent	absent	absent		present - d
South Santiam					
06-1	absent	absent	present - d		present - d
06-3		present - d	present - d		present - d
06-9			present - d		present - d
McKenzie					
07-1	present - d	present - d			present - d
07-3	present - d	present - d			present - d
07-4	present - d	absent			present - d
07-5					present - d
07-6	absent	absent			present - d
07-7	present - d	present - d			present - d

Fifth Field/ Sixth Field	Bull Trout	Spring Chinook	Winter Steelhead	Oregon Chub	Native Resident
Calapooia					
09-1		present - d	present - d		present - d
Blue River					
10-1		absent			present - d
10-2					present - d
10-4					present - d
Lower McKenzie					
11-1	absent	present - d			present - d
11-3	present - d	present - d	Summer steelhead		present - d
Quartz Creek					
12-1		present - d	summers		present
South Fork McKenzie					
13-1	migrate	migrate			present - d
13-2	migrate	present - d			present - d
13-3	migrate	present - d			present - d
13-4	present - d	present - d			present - d
13-5	present - d				present - d
13-6	present - d	present - d			present - d
Horse Creek					
14-1	present - d	present - d	summers		present - d
14-2	present - d	present - d	summers		present - d
Fall Creek					
15-1		present - d	present - d		present - d
15-2		present - d	present - d		present - d
15-3		present - d	present - d		present - d
Winberry					
16-1		present - d	present - d		present - d

Fifth Field/ Sixth Field	Bull Trout	Spring Chinook	Winter Steelhead	Oregon Chub	Native Resident
North Fork Middle Fork Willamette					
17-1	absent	absent			present
17-2	absent	absent			present
17-5	absent	absent			present
Salmon Creek					
18-1	absent	absent			present - d
Lookout Reservoir 19		absent		present	present - d
Salt Creek					
20-1	absent	absent		present - d	present - d
20-2	absent	absent			present - d
Middle Fork Willamette					
21-3	migrate	present - d			present - d
21-4	migrate	present - d			present - d
Hills Creek					
22-1	absent	present - d			present - d
Upper Middle Fork Willamette					
23-1	present ?	absent ?			present - d
23-3	present ?	present - d			present
23-4	present - d	present - d			present - d
23-5	present ?	present - d			present - d
23-6	migrate	present - d			present - d
Upper North Fork Willamette					
24-1	absent	absent			present

Documentation will be provided by having a Forest-wide map that illustrates: administrative boundaries, lakes, Class I and II streams, 5th Fields ("watersheds"), 6th Fields ("subwatersheds"), with certain 6th Fields highlighted for importance, especially of spawning, of the various salmonids and the Oregon chub. This map will be produced on a transparent mylar layer so that it can be posed on top of the transportation layer, hydrological and geological information/areas of concern. Recreation, other social, wildlife and other spatially located information can also be compared to aquatic values for further analysis. Spatial

knowledge can be obtained of the areas of high risk to aquatic beneficial uses based on either inherent or managed characteristics. Another result will be a table highlighting 6th Field subwatersheds within 5th Field watersheds that may be a priority for taking further steps and designing a site-specific action or project through later ATM and/or NEPA process.

Findings and Results

Key Questions from the 8/16/98 Appendices - Fisheries/Aquatics response:

AQ(1) ***How does the road system affect fine sediment that enters streams, lakes, or wetlands?***

At the Forest scale a map was produced of quaternary landslide geology, which was presumed to be a high risk source for fine sediments to aquatic systems. We do not take direct measurements of fine sediment in our streams, but have made estimates for embeddedness or substrate size distribution of individual channel habitat units during low flow summer stream inventories. At the scale of analysis done for Pilot Roads there is no definitive answer for this question as it relates to site specific aquatic species habitat or survival. During watershed analysis some riparian roads were noted as affecting fine sediment in aquatic habitat due to chronic maintenance problems.

AQ(2) ***How does the road system affect mass soil movements that affect aquatic or riparian ecosystems?***

A count of ERFO (flood events from major weather systems in 1964, 1986, and 1996) sites was summed for each Sixth Field subwatershed and compared to overall road density in that Sixth Field. There was a slight increase in the trend of ERFO sites as road densities increased, but without further evaluation of the watershed characteristics and the ERFO data this information does not provide any great insight.

AQ(3) ***How does the road system affect sedimentation downstream (aggradation of channels, reservoirs)?***

In the Western Cascades major channel changes, including noticeable aggradation often occur during high flow flood events. The road system, as well as harvest units, were documented as contributing to stream aggradation at specific sites on the Forest after the floods of 1996. The result of the Pilot Road Analysis at the Forest scale points to watersheds with high numbers of stream/road crossings. Further analysis, which would look site specifically at channel reaches that are impacted needs to be done at a smaller scale than the Pilot effort.

There is evidence of aggradation in areas of the large flood control reservoirs, but the contribution of non-road causes (e.g. wind and wave erosion, amounts of previous riparian harvest, and natural sedimentation) cannot be easily separated from the influence of roads.

AQ(4) ***How does the road system modify drainage density which affects water quality and quantity?***

Not addressed by fisheries. Ditto for AQ (5) How does the road system affect movement of groundwater?

AQ(6) ***How does the road system affect invasions of non-native aquatic species?***

As of 1998, the Willamette National Forest has not had a significant problem of accidental or intentional releases of non-native aquatic plants or animals (with the exception of bull frogs and warmwater fishes which were introduced many years ago for the most part). Non-native aquatic plants are beginning to be of concern. Many of these introductions are tied more to the presence of large amounts of reservoir habitat, and less tied to the road system. The road system does allow the State of Oregon to accomplish fish stocking for recreational fishing. They use a combination of native and non-native salmonids, and have used less non-native species/stocks as ecological concerns have increased over native aquatic species.

AQ (7) ***How does the road system affect at-risk aquatic species through changes in public access resulting in increased fishing-related mortality or habitat loss?***

The fact that most of the main rivers and many of the larger fish-bearing tributaries outside of Wilderness have riparian roads has allowed people access for legal and illegal angling. Where we have an at-risk species, such as bull trout, which has been impacted by many factors (State of Oregon eradification efforts in the 1950's and 1960's; habitat impacts due to pre-1990 National Forest management practices; and liberal angling regulations up to the mid-1990's) there is concern about poaching and it does occur. Part of this issue relates to dispersed camping site access to rivers, part to the lack of both state and Forest Service law enforcement capabilities, and part due just to the location of roads next to streams where bull trout migrate, spawn and/or rear. The U.S. Fish and Wildlife Service would like the Forest Service to take a hard look at these roads in the long term, as they relate to bull trout recovery. In some cases the road is an established paved travel route (e.g. scenic byway) and there is limited possibilities to relocating the road. Dispersed access is an issue that can be (and is being) addressed to a certain extent, but not significantly analyzed in this pilot effort.

Habitat loss due to roads located in riparian areas does contribute to loss of shade, loss of floodplain, constriction of channel reaches, and has allowed for easy access to remove large instream or near-stream wood until policies changed for a wider range of ecosystem values in the 1990's. These types of impacts are fairly common on the Willamette National Forest outside of Wilderness and many of these situations were identified in Watershed Analysis. As follow-up to Watershed Analysis some of these site specific impacts will be addressed or are currently being addressed. There are some key stream reaches occupied by at-risk bull trout, winter steelhead, and spring chinook that do not have riparian roads and these areas provide refugia that are likely to remain protected into the future.

Due to time and a limited data set, we did not take a statistical look at fish population status as correlated with road density. In the Columbia Basin assessment the result was documented that there was an increasing absence and decreasing proportion of strong non-anadromous salmonids with increasing road densities at the Sixth Field subwatershed scale. The strongest aquatic populations were associated with the lowest mean road densities.

AQ (8) ***How does the road system affect key interactions between aquatic and terrestrial systems?***

Density of roads within Riparian Reserves was analyzed during this Pilot effort. That analysis helped the team to identify the subwatersheds with the greatest amount of riparian road densities. The legacy of forest management prior to 1990, as discussed above, has left the landscape with many riparian roads and significant riparian areas that were clearcut to the

streambank. Many of the impacts were analyzed during watershed analysis and included looking at stream temperature increases that could only be explained by timber harvest, which involved riparian harvest and sometimes roads and even landings in riparian areas. This in turn has impacted the ability of streams to support native salmonids due to loss of habitat complexity, and in some cases where warmer temperatures occur we have observed the movement upstream of fish species associated with warmer stream temperatures (e.g. redside shiners, squawfish, suckers).

AQ (9) ***How does the road system alter the storage capacity of stream channels for coarse woody debris, sediment, and organic matter?***

Due to the significant road infrastructure on the Willamette, some of it built before fish passage in smaller tributaries was of concern to managers, we know that the road system has altered the capacity of stream channels for large woody material. This is primarily due to culverts which are undersized, easily plugged by woody material, or failing because of their age. It is less clear if sediment and organic matter are prevented from moving downstream due to culverts. Because the road system has allowed for removal of instream and nearstream large woody material prior to 1990, that type of activity has allowed for **increase** in the movement of sediment and organic matter downstream due to the decrease in hydraulic complexity of stream channel reaches (in contradiction to the question which talks about **prevention** from moving downstream). This lack of hydraulic complexity has been studied on the Willamette National Forest at Quartz Creek by Oregon State University, however the role of roads is not explicity examined in the study which covers several years of stream channel and fish data from 1988 to the present (1998).

AQ (10) ***How does the road system affect risks to water quality from chemical spills or roadway-applied chemicals, such as oils, de-icing salts, herbicides, and fertilizers?***

A main railroad follows along areas where the endangered Oregon chub reside. A main highway on the Forest crosses the two primary bull trout spawning streams left in the Western Cascades of Oregon. At this time the biggest impact from winter road treatments on the highway is the tons of cinder rock used to provide traction. These cinders end up in the spawning streams and are of concern to spawning and rearing habitat conditions. Salts are not the primary winter highway treatment, so have been less of a concern. Newer chemicals are being used, but based on the MSDS information they appear to be relatively safe. The biggest risk is most likely from transport of chemicals which could have a major affect on aquatic life if (when) a truck or railroad accident occurs.

AQ (11) ***How does the road system affect channel structure and geometry, and isolation of floodplains from their channels?***

This was not answerable at the Forest scale. We currently have smaller scale efforts ongoing on portions of the Forest which does get at this question: 1) Fall Creek ATM, and 2) Blue River Watershed Road Risk Assessment Study. The Fall Creek ATM effort uses an interdisciplinary risk/value analysis by road segment. The Forest took examples of ATM efforts on the Umpqua NF and carried them into site specific ATM for the Willamette NF's Fall Creek watershed with some modifications. The Blue River effort also works at the road segment scale. Examples of the site specific forms for data collection on Blue River will be

attached to the final report. Watershed analysis also provides some examples of identified important stream reaches that are impacted by the road system due to constriction of the channel.

AQ (12) ***How does the road system affect wetlands?***

From an aquatic biological perspective, the road system has impacted small wetlands through both interception of existing small wetlands and creation of small wet areas by ground water interception. As awareness of the value of wetlands has increased over the last decade the road system has had less impact on existing wetlands of all sizes during road location and construction.

AQ (13) ***What indicators are most useful to define interactions between water, aquatic ecosystems, and roads?***

The following information is being collected in Blue River Watershed (see examples of field forms):

- Adequate information at a road segment scale for type, condition, and number of stream crossings.
- Road segment interaction with a stream's floodplain, where the road is parallel to the stream.
- Road surface type.
- Culvert fill failure risk.
- Sustained steep (>15%) road grades in excess of 500 feet.
- Percent of road with sideslopes >51%.
- Other items of interest for looking at impacts to the aquatic ecosystem:
- Road maintenance records, at a minimum a record of maintenance accomplished (date, type) including knowledge of site specific chronic or severe maintenance sites.
- Documentation of known spawning reaches with review by state and other agency biologists.
- Tracking of temporary road locations, construction, and decommissioning or obliteration, which is vital to endangered species act consultation, but not currently tracked in the Forest road database.

Key questions (in addition to the questions **AQ (1-13)** are:

- ***Where do the inherent and/or the managed characteristics of a watershed, with respect to aquatic values, display a high risk to aquatic beneficial uses?***

We did look at this in a cursory manner and the results are provided in the Pilot report.

- ***Where do streams/rivers have a road (or multiple roads) in the riparian reserve on both sides of the channel?***

There are places on the Forest where a multiplicity of roads appear, and site specific analysis is needed to define the need and proper amount of road. We did not get to this for scale and time reasons.

- ***Where are chronic maintenance problems or trouble spots and can they explain any stream channel or fish population conditions?***

Some of the Watershed Analyses provided very useful information on location of road maintenance problem sites, which is allowing the districts to follow-up at a project scale. This question also relates to the importance of knowing something about fish population status, which takes coordinated interagency and stakeholder cooperation to be most efficient and cost-effective for identifying populations to monitor.

References

US Department of Agriculture and US Department of Interior. 1997. *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basin, Volume III.* PNW-GTR-405. Pacific Northwest Research Station. Portland, Oregon.