APPENDIX B

ISSUES ADDRESSED THROUGH BEST MANAGEMENT PRACTICES OR PROJECT DESIGN CRITERIA

Soil Productivity
The potential effects of the proposed activities on *soil productivity* are compaction, puddling, displacement, and erosion. Timber harvest, fuels treatment and site preparation can result in soil damage and loss of site productivity. Soil compaction inhibits root elongation, reduces the infiltration and storage of water and decreases the gaseous exchange between roots and the atmosphere. This can inhibit seedling establishment and can reduce the growth of trees. Reductions in future timber volume are proportional to the degree and extent of compacted soil.

Puddling affects *soil productivity* in much the same way as compaction. Displacement of topsoil can remove soil nutrients from the root zone of desired vegetation and expose the soil to the forces of erosion. Soil erosion can result in nutrient-rich topsoil moving down slope, away from the root zone of desired vegetation. If eroded soil reaches a stream, it can reduce water quality. Exposed mineral soil may promote the invasion of a site by undesirable vegetation.

Based on the best information available, the Standards and Guidelines are believed to be adequate to protect the soil resource. The extent and distribution of detrimental soil impacts such as compaction, displacement, and severe burning, measured in percent of each activity area, are used to analyze the effects of management activities on long-term soil productivity.

This issue is addressed with Soils mitigations shown in Appendix A.

Soil Organisms
Logging and site preparation can affect the numbers of species and abundance of soil organisms. Some of these organisms, called Mycorrhizae, have been shown to profoundly affect forest growth and productivity. Mycorrhizal fungi assist trees in absorbing water, nutrients and provide protection from pathogen attack. Soil compaction, loss of soil organic matter, and changes in vegetation can affect soil organisms.

Efforts to minimize soil disturbance, maintain organic matter, and encourage rapid growth of native vegetation would help to conserve soil organisms, facilitate re-colonization, and maintain forest productivity.

This issue is addressed with the soils mitigations in Appendix A, and with the slash treatment described in the Proposed Action.

Slope Stability
Road construction and timber harvest can increase the rate of mass failures, and the size and number of these events. Changes in hydrologic processes and root deterioration can contribute to these effects (Sidle, R. C. 1985). Soil compaction, soil displacement, and vegetation removal can cause changes in hydrologic process. Factors in soil stability not related to management activities include soil type, geology (rock composition and slope shape), and earthquakes.

This issue is addressed through identification of unstable and potentially unstable slopes, and consideration of these areas in placement of temporary roads.

Potential Effects Associated with the Haul Routes.
The haul route for Units 16 and 17 of the Canyon Thinning Timber Sale, utilizing Forest Roads 4205 and 42, would be going through the East Fork Lewis River watershed. Road improvements and haul route usage during the Canyon Timber Sale may have potential impacts to a federally-listed anadromous fish species in this watershed, the Lower Columbia River Steelhead (*Oncorhynchus mykiss)*, in particular the Upper East Fork Lewis River Steelhead Evolutionary Significant Unit (ESU). This Steelhead ESU was federally-listed as threatened under the Endangered Species Act on May 18th, 1998, and has the highest priority for habitat restoration in the State of Washington's Lower Columbia Steelhead Conservation Initiative (Biological Assessment, USDA Forest Service Programmatic Activities, Gifford Pinchot National Forest and Columbia River Gorge National Scenic Area, Washington, 2004). Increased sediment and turbidity, as well as other related habitat alterations (i.e. stream temperature, width-to-depth ratio, water quality, substrate character and embeddedness, bank stability) may result from haul route repairs and usage, and this may cause a decline in federally listed fish populations and fishing opportunities.

This issue is addressed with Hydrology/Fisheries project design features/mitigations described in Appendix A.

Sediment/Turbidity.
Reconstructing the existing Forest Roads 5300-572, 601, 604, and 605 to access Units 8, 9, 10, and 11, and then decommissioning them following harvest, may increase sediment and turbidity in Canyon Creek and Big Rock Creek. Reconstructing temporary roads in Units 3 (3,168 feet), 12 (4,224 feet), and 6 (800 feet) and 16 (1,056 feet) may increase sediment in Siouxon Creek, Canyon Creek, and Big Rock Creek, respectively. Riparian treatments in Unit 12 and Unit 17 may increase sediment and turbidity in Canyon Creek and Fly Creek, respectively. If it occurred, this increased sediment and turbidity may cause a decline in fish populations and fishing opportunities.

This issue is addressed with Hydrology/Fisheries project design features/mitigations described in Appendix A

Increased Peak Flow.
Road construction, reconstruction, decommissioning, and haul route usage may increase peak flow in Canyon, Fly, Siouxon, and Big Rock Creeks, as well as in the East Fork Lewis River. Riparian treatments in Units 12 and 17 may increase peak flows in Canyon Creek and Fly Creek. These peak flow increases may cause a decline in fish populations and fishing opportunities in the Canyon, Siouxon, and East Fork Lewis watersheds.

This issue is addressed by the silvicultural prescriptions that maintain an average of 40 percent canopy closure in the treatment units.

Large Woody Debris (LWD) Recruitment Potential.
Thinning in the Riparian Reserves in Units 12 and 17 may decrease LWD recruitment into the Canyon Creek and Fly Creek by limiting source material in riparian areas, thereby causing a decline in fish populations and fishing opportunities.

This issue is addressed with mitigation to protect existing down wood, create down wood in the treatment units, and with the no-cut buffers along the streams.

Stream Temperature.
Thinning in Riparian Reserves in Units 12 and 17 may increase stream temperature in Canyon Creek and Fly Creek. Road construction, reconstruction, decommissioning, and haul route usage may increase stream temperature in Canyon, Fly, Siouxon, and Big Rock Creeks, as well as in the East Fork Lewis River. Elevated stream temperatures may cause a decline in fish populations and fishing opportunities.

This issue is addressed with the no-cut buffers along the streams.

Aquatic Habitat Fragmentation/Physical Barriers.
Reconstructed, constructed, and improved roads, along with their culverts (culvert replacements needed on FR 5300 and 5700) may cause aquatic habitat fragmentation by creating physical barriers for fish movement in Canyon Creek and Fly Creek. Aquatic habitat fragmentation may cause a decline in fish populations and fishing opportunities.

This issue is addressed in that no new permanent or temporary roads would be constructed on fish-bearing streams. Forest Road 4205522 would be decommissioned, removing a large culvert that fragments the stream corridor.

Substrate Character and Embeddedness.
Riparian Reserve treatments in Units 12 and 17 may impair substrate character and embeddedness in Canyon Creek and Fly Creek. Road construction, reconstruction, decommissioning, and haul route usage may impair stream substrate character and embeddedness in Canyon, Fly, Siouxon, and Big Rock Creeks, as well as in the East Fork Lewis River. Impairment of substrate character and embeddedness may cause a decline in fish populations and fishing opportunities.

This issue is addressed with the no-cut buffers and with Hydrology/Fisheries project design features/mitigations described in Appendix A

Width-to-Depth Ratio.
Treatments in Riparian Reserves in Units 12 and 17 may alter the width-to-depth ratios in Canyon Creek and Fly Creek. Road construction, reconstruction, decommissioning, and haul route usage may alter the width-to-depth ratio in Canyon, Fly, Siouxon, and Big Rock Creeks, as well as in the East Fork Lewis River. Altered width-to-depth ratios may cause a decline in fish populations and fishing opportunities.

This issue is addressed with the no-cut buffers and with Hydrology/Fisheries project design features/mitigations described in Appendix A

Bank Stability.
Riparian Reserve treatments in Units 12 and 17, as well as road construction, reconstruction, decommissioning, and haul route usage may increase the risk of management-induced mass failure by impairing bank stability. Decreased bank stability might lead to blocked fish passage, thereby causing a decline in fish populations and fishing opportunities.

This issue is addressed with the no-cut buffers and with Hydrology/Fisheries project design features/mitigations described in Appendix A

Genetically-distinct Populations of Rainbow Trout in Canyon Creek and Siouxon Creek Subwatersheds.
Treatments in the Riparian Reserves of Unit 12, as well as road reconstruction and decommissioning in Units 3 and 12, may impair the instream aquatic habitat of Canyon Creek and Siouxon Creek. This may lead to a decline in the genetically-distinct rainbow trout (*Oncorhynchus mykiss*) populations found in

Canyon Creek and Siouxon Creek. This may, in turn, lead to a decline in popular fishing opportunities in these two creeks.

This issue is addressed with the no-cut buffers and with Hydrology/Fisheries project design features/mitigations described in Appendix A

Potential Introduction and Spread of Noxious Weeds.
In general, timber sales can result in a substantial amount of ground disturbance, and opening of the canopy during the course of timber harvest activities. Ground disturbance exposes available habitat for noxious weeds, while timber harvest exposes newly created disturbed areas to increased solar radiation, ideal conditions for early seral, weedy species. Areas experiencing ground disturbance within the timber sale would, therefore, be highly susceptible to noxious weed and invasive plant colonization, particularly, in this case, since there are already invasive species growing along access roads to the units.

This issue is addressed with the noxious weed project design features/mitigations found in Appendix A.

Noise Disturbance Adjacent to Unsurveyed Spotted Owl Habitat.
Timber harvest in Units 8, 10, 11, 12, and 20 which are adjacent to suitable spotted owl habitat would create noise disturbance that may affect the ability of spotted owls to forage or nest in these stands, causing a potential decline in nest productivity.

This issue is addressed with a Limited Operations Period mitigation described in Appendix A.

Potential Effects to Known Survey and Manage Mollusk Sites.
Survey and Manage mollusk sites have been documented in Units 9 (2), 10 (1), 12 (3), 14 (1), 16 (2), 17 (2), and 20 (1). Thinning trees at these sites would likely directly affect these animals through mechanical disturbance and indirectly affect them by increase warming and drying at the site. These effects may result in loss of viability of these sites and reduce the distribution of these animals in the watershed.

This issue is addressed with no-cut buffers as described in Appendix A.

Potential Effects to Sensitive Salamander Species.
Several of the small streams adjacent and within Units 12 and 17 may be suitable for Sensitive salamander species. Timber harvest in proximity to these streams could cause direct mechanical effects, and indirect effects through microclimate changes and increased sediment in the streams. These effects could reduce the distribution of these species in the watershed.

This issue is addressed with no-cut buffers along streams, and project design features/mitigations that protect water quality.