INTRODUCTION

This report analyzes the effects on the water and soil resources for the Larson Forest Restoration Project (LFRP) area alternatives. This report describes the existing conditions, the desired future conditions, cumulative effects analysis, and the effects that various management alternatives have on these conditions.

AREA OF ANALYSIS

The LFRP is located on the Black Mesa Ranger District on the Apache-Sitgreaves National Forests (ASNF) in Coconino County, Arizona. Physically the project is situated near and on the southern edge of the Colorado Plateau along the Mogillon Rim and is dominated by a series of Permian sedimentary limestone and sandstone flat ridges and steep canyons where water flows north through ephemeral, intermittent and several interrupted perennial and perennial streams.

The southwest project area between Forest Lakes Estates and Chevelon Canyon is underlain by gently northward dipping limestone beds that form a sort of karst plain. Numerous dry sinkholes (e.g. Hidden Lake) dot the landscape along with other karst features. The karst terrain suggests this area of the project is an important groundwater recharge area. Sinkholes in the project area are typically steep sided (>30%) circular depressions that often show signs of connectivity with subsurface features and serve as flow pathways for water.

The project area is contained within Hydrologic Units of varying orders of size as defined by the United States Geological Survey and delineated by Federal agencies including the US Forest Service. These Hydrologic Units have been assigned code numbers ranging from two to twelve digits reflecting the intensity of delineation. A “first” level Hydrologic Unit is the broadest delineation and employs a two digit Hydrologic Unit Code (HUC). First level hydrologic units are progressively subdivided into “second”, “third”, and “fourth levels, etc.” hydrologic units. For more information on hydrologic units, see the following website: http://water.usgs.gov/GIS/huc.html
The LFRP is within two 5th level HUC watersheds (most of it is in one) and five 6th level HUC subwatersheds. The project is approximately 30,041 acres. See Table 1 for a summary of watershed acreage within the LFRP. There are 120.8 acres within this project that are privately owned.

The LFRP ranges in elevation from approximately 7,821 feet in the south along Larson Ridge to approx. 6,500 feet in the North in Wildcat Canyon. Average annual precipitation ranges from approximately 37 inches at the higher elevations to 30 inches at the lowest elevations. Vegetation types range from mixed conifer to ponderosa pine forest.

<table>
<thead>
<tr>
<th>Watershed (HUC 5) and Subwatershed (HUC 6)</th>
<th>Project Acres</th>
<th>HUC 5 Total Acres</th>
<th>% HUC 5th code</th>
<th>HUC 6 Total Acres</th>
<th>% HUC 6th code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Chevelon Canyon</td>
<td>29,052</td>
<td>173,690</td>
<td>16.73%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
<td>15,121</td>
<td></td>
<td></td>
<td>25,468</td>
<td>59.37%</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
<td>3,481</td>
<td></td>
<td></td>
<td>16,692</td>
<td>20.85%</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
<td>1,690</td>
<td></td>
<td></td>
<td>17,069</td>
<td>9.90%</td>
</tr>
<tr>
<td>Long Tom Canyon-Chevelon Canyon</td>
<td>8,760</td>
<td></td>
<td></td>
<td>21,231</td>
<td>41.26%</td>
</tr>
<tr>
<td><strong>Lower Chevelon Canyon</strong>*</td>
<td><strong>3</strong></td>
<td><strong>146,787</strong></td>
<td><strong>0.002%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Potato Wash*</td>
<td>3</td>
<td></td>
<td></td>
<td>12,960</td>
<td>0.02%</td>
</tr>
<tr>
<td><strong>Canyon Creek</strong></td>
<td><strong>986</strong></td>
<td><strong>203,233</strong></td>
<td><strong>0.48%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canyon Creek Headwaters</td>
<td>986</td>
<td></td>
<td></td>
<td>25,798</td>
<td>3.82%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>30,041</strong></td>
<td><strong>523,710</strong></td>
<td><strong>129,572</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Due to small percentages these watersheds will be omitted from further considerations in this report

METHODOLOGY USED FOR DATA COLLECTION AND ANALYSIS

Existing soil and watershed conditions were assessed using the Terrestrial Ecosystem Survey of the Apache-Sitgreaves NFs (TES) (Laing et.al. 1987) in conjunction with field observations taken in 2012 and 2013.

The ASNF has developed spatially defined databases for use in a Geographic Information System (GIS). A majority of the data and information contained in this report were derived from the forest GIS database.

Region 3 Soil Condition Guidelines (FSH 2509.18) indicate when soil impairment begins. These are not standards, but indicators of where management change may need to occur. A qualitative analysis of the effects of implementing ground treatments will affect soil resources using the following guidance (Table 2).

The State of Arizona Department of Environmental Quality issues a biannual report on the status of surface water quality (ADEQ, 2010). This report lists impaired and non-attaining water bodies for the state along with management recommendations for
improvements. This document was used in assessing the potential impacts from proposed activities.

Riparian areas were assessed using Proper Functioning Condition (PFC) surveys (Pritchard et al., 1998). This survey is used throughout the Western United States by the US Forest Service and Bureau of Land Management to assess conditions of riparian areas. The protocol for this survey requires professional judgment by a team of resource specialists on 17 items. The result of this survey is a riparian reach that is either in proper functional condition (PFC), functioning at risk (FAR), or non-functional (NF).

Table 2. Soil Condition Guidelines for Selected indicators of Soil Hydrologic Function*

<table>
<thead>
<tr>
<th>Index</th>
<th>Satisfactory</th>
<th>Impaired</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Density*</td>
<td>Slight Increase (1-5%)</td>
<td>Moderate Increase (5-15%)</td>
<td>Significant Increase (&gt;15%)</td>
</tr>
<tr>
<td>Infiltration*</td>
<td>Slight Decrease (1-10%)</td>
<td>Moderate Decrease (10-50%)</td>
<td>Significant Decrease (&gt;50%)</td>
</tr>
<tr>
<td>Penetration Resistance*</td>
<td>Slight Increase (1-10%)</td>
<td>Moderate Increase (10-50%)</td>
<td>Significant Increase (&gt;50%)</td>
</tr>
<tr>
<td>Aerial Extent</td>
<td>Slight Disturbance (1-5%)</td>
<td>Moderate Disturbance (5-20%)</td>
<td>Significant Disturbance (&gt;20%)</td>
</tr>
</tbody>
</table>

*Excerpt from R3 Supplement FSH 2509.18

Cumulative watershed impacts were analyzed using the “Equivalent Disturbed Area” model described in “Apache/Sitgreaves National Forests Cumulative Watershed Effects Analysis Procedure” (Lovely, 1991, 2004 Draft).

Key regulatory requirements considered in this assessment are displayed in Appendix A.

AFFECTED ENVIRONMENT EXISTING CONDITIONS

1. SOILS

Soil condition is generally satisfactory throughout the LFRP. Soil conditions were determined through field investigations in 2013 and the Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests (TES) (Laing et.al 1987). Soil condition (see below) was estimated using R3 Soil Condition Rating Guide (FSH 2509.18). Observations indicate satisfactory condition over most of the project area and are discussed by mapping unit. Gully erosion and accelerated soil loss is occurring along a few open and closed roads where road drainage structures are not functioning or absent and are a source of sediment to streams, however, ground cover conditions are generally improving within these areas. Table 3 describes characteristics and selected interpretations from the TES by mapping unit.
<table>
<thead>
<tr>
<th>TES Map Unit</th>
<th>Acres by Map Unit</th>
<th>Soil Classification (Family)</th>
<th>Vegetation Taxonomic Unit</th>
<th>MU Slope Class</th>
<th>Soil Condition Rating for MU (see below)</th>
<th>Soil Erosion Hazard for MU</th>
<th>Timber Harvest Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>182</td>
<td>307</td>
<td>Udic Haplustalfs, LSC, 5, 0, fine, mixed, deep, very cobbly sandy loams, h. ppt.</td>
<td>Pipos/Jude2/Quga</td>
<td>0-15%</td>
<td>Satisfactory</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>183</td>
<td>2,494</td>
<td>Udic Haplustalfs, LSC, 5, 0, fine, mixed, deep, very gravelly sandy loams, h. ppt. Lithic Haplustalfs, LSC, 5, 0, clayey, mixed, shallow, gravelly sandy loams, h. ppt</td>
<td>Pipos/Jude2/Quga</td>
<td>0-15%</td>
<td>Satisfactory</td>
<td>Slight</td>
<td>Severe (Low Strength when wet)</td>
</tr>
<tr>
<td>189</td>
<td>663</td>
<td>Typic Hapludalfs, LSC, 6, -1, very cobbly loams Udic Haplustalfs, HSC, 5, -1, very cobbly loams</td>
<td>Pipos/Pidos/Jude2/Quga</td>
<td>40-120%</td>
<td>Unsatisfactory</td>
<td>Severe</td>
<td>Severe (steep slopes, severe erosion hazard)</td>
</tr>
<tr>
<td>192</td>
<td>7,798</td>
<td>Udic Haplustalfs, LSC 5, 0, fine, mixed, very cobbly sandy loam, h. ppt. Udic Haplustalfs, clayey-skeletal, LSC 5, 0, mixed, gravelly sandy loam, h. ppt.</td>
<td>Pipos/Quga</td>
<td>16-40%</td>
<td>Satisfactory</td>
<td>Severe</td>
<td>Severe (low strength when wet, Erosion hazard)</td>
</tr>
<tr>
<td>193</td>
<td>8,350</td>
<td>Udic Haplustalfs, LSC 5, 0, fine, mixed, mod.deep, gravelly loam, h. ppt. Lithic Haplustalfs, LSC 5, 0, clayey, mixed, shallow, gravelly sandy loam, h. ppt.</td>
<td>Pipos/Quga</td>
<td>0-15%</td>
<td>Satisfactory</td>
<td>Slight</td>
<td>Severe (low strength when wet)</td>
</tr>
<tr>
<td>197</td>
<td>6,481</td>
<td>Udic Haplustalfs, LSC 5, 0, clayey-skeletal, mixed, mod.deep, very stony sandy loam, h. ppt. Lithic Haplustalfs, LSC 5, 0, clayey-skeletal, mixed, shallow, very stony sandy loam, h. ppt.</td>
<td>Pipos/Quga</td>
<td>0-15%</td>
<td>Satisfactory</td>
<td>Slight</td>
<td>Moderate</td>
</tr>
<tr>
<td>202</td>
<td>3,206</td>
<td>Typic Glossudalfs, LSC 6, 0, fine, mixed, gravelly loam, h. ppt. Typic Glossudalfs, LSC 6, 0, clayey-skeletal, mixed, gravelly loam, h. ppt.</td>
<td>Abco/Psmeg/Pipos/Pist</td>
<td>16-40%</td>
<td>Satisfactory</td>
<td>Severe</td>
<td>Severe (Low strength when wet, severe erosion hazard)</td>
</tr>
<tr>
<td>206</td>
<td>634</td>
<td>Typic Dystrudepts LSC 6 Udic Haplustepts, LSC 5</td>
<td>Abco/Psmeg/Pipos/Pit/Pipos/Quga</td>
<td>41-120%</td>
<td>Satisfactory</td>
<td>Severe</td>
<td>Severe (steep slopes, severe erosion hazard)</td>
</tr>
</tbody>
</table>
The following is a brief description of the characteristics of the soils within the Larson Analysis Area by TES mapping units:

The soils of map units 183, 193 and 197 are found on nearly level to strongly sloping elevated planes. Soils are shallow to deep (10” to 40” to bedrock and deeper) with gravelly to very gravelly sandy loam or loam surface textures. Subsurface soils have a gravelly to very cobbly sandy loam layer that ranges from 2 to 10 inches thick over gravelly to very stony sandy clay or clay layer. Sandstone bedrock from the Coconino formation is found from 10 to over 40 inches below the surface. Soil condition is rated satisfactory. These soils are subject to soil compaction and displacement when soils are wet. Erosion hazard is slight, however, there has been compaction and displacement found on many user created roads and trails within the project area, reducing overall soil productivity (see road section). The lithic (shallow) component of MU 197 has large amounts of surface rock which may limit mechanical harvest activities. Windthrow hazard is high during periods of saturated soils due to the shallow nature and low strength of the soils of this unit. Saturated soils may occur on these soils in the spring through early May in some years.

TES map units 182, 192 and 202 are found on moderately steep slopes (16-40% slope). The soils are moderately deep to very deep (greater than 20” to bedrock) with surface textures ranging from gravelly to very cobbly sandy loams and loams. Subsurface textures range from cobbly to very cobbly sandy clays, sandy clay loams or clays which commonly occur from 6 to 12 inches below the soil surface. Ephemeral and intermittent streams occur adjacent to this unit in drainage bottoms. The soils are rated as having satisfactory soil conditions as ground cover and bare soil is limited in extent. The soils have been rated moderate to severe for erosion hazard, but are well suited for harvest operations when soil moisture conditions are low or ground is frozen. Erosion hazard is based on whether soil loss tolerance for the soil is exceeded if all protective litter and vegetation is removed. Excessive soil loss is localized usually associated with the many user created non-system roads and motorized trails found in the project area. These soils also are susceptible to compaction and displacement when wet due to low soil strength.

TES map units 208 occurs on alluvial plains of 0-5% slope. These soils are deep, well drained, with sandy loam to loam surface textures. These soils are susceptible to gully erosion and compaction and displacement when wet. This unit contains some of the riparian areas within the project footprint. These units were not rated for soil condition comparing current soil loss to tolerance levels, however, condition is displayed in the Proper Functioning Condition ratings by reach. A map of PFC determinations within the project area can be found in the riparian section (see ASNF PFC Summaries, 2002, 2013) along with detailed descriptions of condition.
TES map units 189 and 206 are characterized as having slopes greater than 40 percent occurring on canyon side slopes. The soils have a severe erosion hazard, primarily due to the steep slopes. The soils of MU 206 are currently in satisfactory soil condition, with almost 100 percent ground cover primarily of litter and duff. Soils of MU 189 are rated as having unsatisfactory soil condition because effective ground cover is less than is necessary to prevent soil loss in excess of soil loss tolerance. MU 189 occurs on the north end of the project and within Wildcat Creek. MU 206 primarily occurs along the mainstem and tributaries of Chevelon Canyon. Both soils have severe timber harvest limitations due to steepness of slope and severe erosion hazard.

R3 Soil Condition:

Soil condition is a descriptive indicator of general soil health. Soil condition is primarily determined by evaluating surface soil properties. This is the critical area where plant and animal organic matter accumulate, begin to decompose and eventually become incorporated into soil. It is also the zone of maximum biological activity and nutrient release. The physical condition of this zone plays a significant role in soil stability, nutrient cycling, water infiltration and energy flows. The presence and distribution of the surface soil is critically important to productivity.

Soil condition is based on an interpretation of factors which affect three primary soil functions. The primary soil functions evaluated are: soil hydrology, soil stability and nutrient cycling, all of which are interrelated.

Soil condition is categorized by four classes: satisfactory, impaired, unsatisfactory and inherently unstable. The following definitions describe each class (R-3 Supplement FSM 2509.18):

- **Satisfactory**: Indicators signify that soil function is being sustained and soil is functioning properly and normally. The ability of the soil to maintain resource values and sustain outputs is high.

- **Impaired**: Indicators signify a reduction in soil function. The ability of the soil to function properly and normally has been reduced and/or there exists an increased vulnerability to degradation. An impaired category indicates there is a need to investigate the ecosystem to determine the cause and degree of decline in soil functions. Changes in land management practices or other preventative measures may be appropriate.

- **Unsatisfactory**: Indicators signify that a loss of soil function has occurred. Degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs or recover from impacts. Unsatisfactory soils are candidates for improved management practices or restoration designed to recover soil functions.

- **Inherently Unstable**: These soils have natural erosion exceeding tolerable limits. Based on the Universal Soil Loss Equation (USLE) these soils are eroding faster than they are renewing themselves but are functioning properly and normally.
2. WATER QUALITY

The State of Arizona Department of Environmental Quality (ADEQ) has recently released the latest integrated 305(b) assessment and 303(d) listing report in conjunction with the EPA. This assessment on streams and lakes is categorized as meeting all designated uses, impaired, inconclusive, or attaining some uses (ADEQ, 2010). Examples of designated uses include Aquatic and Wildlife (cold), full body contact, drinking water standards, etc.

There are no impaired or non-attaining lakes and streams within the LFRP. Willow Springs Creek was found to exceed pH slightly in one sample where it flows into Willow Springs Lake, which does not exceed for those water quality parameters tested including pH. Willow Springs Creek then flows from this reservoir into Chevelon Creek, passing through a small portion of the LFRP. However, it is reasonable to assume that its water quality is the same as the source (Willow Springs Lake) during base flow conditions. Chevelon Creek is the most important water body downstream of the LFRP and was found to exceed State water quality standards for biocriteria above Chevelon Lake and for dissolved oxygen below. Chevelon Creek is not considered to be impaired and the LFRP will not alter these minor and likely naturally occurring exceedances.

3. RIPARIAN/STREAM CONDITION AND WETLANDS

A report written by Hydro Science in 1993 (Haynes, 1993) explored the conditions of Upper Willow Creek and Middle Willow Creek watersheds a few miles west of the LFRP in the adjacent Upper Clear Creek 5th Code Watershed. The area is very similar physically, biologically and was managed much the same historically. This report found the upland conditions to be acceptable but response reaches in the upper and middle portions of the Upper Willow Creek watershed as well as the main stem of Willow Creek to have unacceptable conditions with active gully erosion. Hydro Science attributed the declining riparian area condition to historic overgrazing. They found that timber harvests have done little to degrade riparian areas.

Riparian conditions were inventoried in 2013 within the project area using “Process for Assessing Proper Functioning Condition” (USDI-BLM 1993). A summary of these results by sixth level HUC watershed is displayed in Table 4. Of the 88 miles of stream surveyed, 9 miles were rated as in Proper Functioning Condition, 64 miles were determined to be non-riparian, and the remaining 15 miles were rated as either Functional At Risk (12 miles) or Non-functional (3 miles). Overall, trends for FAR were interpreted as mostly improving.

Peak flows have increased in these watersheds over the last century due to impacts from heavy ungulate grazing and other actions, and have changed the ability to return to satisfactory conditions for a long time (Haynes, 1993). Meadow areas in headwater reaches have lost riparian species and have been invaded by upland species due to incised streams and lowered water tables.
Stream mileage by watershed is given in Table 5. The majority of streams are either intermittent or ephemeral within the project area. Upper Wildcat Canyon (67 miles), Long Tom Canyon-Chevelon Canyon (43 miles), Woods Canyon and Willow Springs Canyon (30 miles) have the most stream miles contained within the project area. These three watersheds therefore have the highest probability of management actions directly affecting stream channels. Four watersheds have no perennial streams within the project area. Both Canyon Creek Headwaters (3 miles) and Upper Chevelon Canyon – Chevelon Canyon Lake (7 miles) have less than 10% of their area within the project area and will not need further analysis but are described here in the affected environment sections for information purposes. There are only three acres of project in the Upper Potato Wash subwatershed and is not significant enough for further considerations.

There are a small number of wetlands in the within the project area as identified in the National Wetlands Inventory (http://www.fws.gov/wetlands/). These occur in the Woods Canyon / Willow Springs Canyon and Long Tom Canyon-Chevelon Canyon subwatersheds with a small pond in found in the later. All of the wetland features occur in areas not proposed for suitable for mechanical treatments and are naturally buffered from timber activities (i.e., in meadows, gravel pits or behind wildlife exclosures). These
features and all wetlands that may be located during field reviews or project implementation will receive appropriate protections as described in the BMP’s.

<table>
<thead>
<tr>
<th>SUBWATERSHEDS (Sixth Level HUC</th>
<th>Watershed Stream Miles</th>
<th>Project Area Stream Miles</th>
<th>Proportional Extent (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canyon Creek Headwaters</td>
<td>91</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>57</td>
<td>2</td>
<td>3.5</td>
</tr>
<tr>
<td>Intermittent</td>
<td>22</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>Perennial</td>
<td>12</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Long Tom Canyon-Chevelon Canyon</td>
<td>150</td>
<td>43</td>
<td>28.7</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>38</td>
<td>19</td>
<td>50.0</td>
</tr>
<tr>
<td>Intermittent</td>
<td>57</td>
<td>24</td>
<td>42.1</td>
</tr>
<tr>
<td>Perennial</td>
<td>55</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
<td>110</td>
<td>7</td>
<td>6.4</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>32</td>
<td>7</td>
<td>21.9</td>
</tr>
<tr>
<td>Intermittent</td>
<td>40</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Perennial</td>
<td>38</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
<td>108</td>
<td>67</td>
<td>62.0</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>47</td>
<td>29</td>
<td>61.7</td>
</tr>
<tr>
<td>Intermittent</td>
<td>61</td>
<td>38</td>
<td>62.3</td>
</tr>
<tr>
<td>Perennial</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
<td>125</td>
<td>30</td>
<td>24.0</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>45</td>
<td>6</td>
<td>13.3</td>
</tr>
<tr>
<td>Intermittent</td>
<td>65</td>
<td>15</td>
<td>23.1</td>
</tr>
<tr>
<td>Perennial</td>
<td>15</td>
<td>9</td>
<td>60.0</td>
</tr>
<tr>
<td>Totals</td>
<td>584</td>
<td>150</td>
<td>124.4</td>
</tr>
</tbody>
</table>

4. ROADS

Road mileage by subwatershed is given in Table 6. Subwatersheds Woods Canyon/Willow Springs (170 miles) and Upper Wildcat Canyon (169 miles) have the most road miles of subwatersheds analyzed. The least road miles amongst subwatersheds are found in Upper Chevelon Canyon - Chevelon Canyon Lake (102 miles) and Canyon Creek Headwaters (115 miles).

Stream density (miles per square mile) is a measure of drainage efficiency of a watershed. A watershed with a higher stream density more effectively drains water and sediment from headwater to higher order streams.

Road density is an indicator of existing watershed effects because it takes into account the size of a watershed when examining road miles. Table 7 displays a comparison of both stream and road density per watershed in the project area.
Table 6. Road mileage by Subwatershed and project area

<table>
<thead>
<tr>
<th>Sixth Level HUC Watershed</th>
<th>Subwatershed Road Miles</th>
<th>Project Area Road Miles</th>
<th>Proportional Extent (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canyon Creek Headwaters</td>
<td>115.04</td>
<td>12.61</td>
<td>2.3</td>
</tr>
<tr>
<td>Long-Tom Canyon-Chevelon Canyon</td>
<td>137.07</td>
<td>78.52</td>
<td>57.3</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
<td>102.15</td>
<td>11.35</td>
<td>11.1</td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
<td>169.24</td>
<td>114</td>
<td>1.5</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
<td>170.44</td>
<td>26.64</td>
<td>15.6</td>
</tr>
<tr>
<td>Totals</td>
<td>693.94</td>
<td>243.12</td>
<td>87.8</td>
</tr>
</tbody>
</table>

Woods Canyon/Willow Springs Canyon and Long Tom Canyon-Chevelon Canyon have the highest stream densities at 4.79 and 4.52 miles/sq. mile, respectively. This suggests an ability to effectively transport sediments to higher order streams during rain and runoff events. Canyon Creek Headwaters Upper Wildcat Canyon have the lowest stream densities at 2.26 and 2.71, respectively.

Table 7. Road and Stream Density (miles per square mile) by Subwatershed and Project Area

<table>
<thead>
<tr>
<th>SUBWATERSHEDS (Sixth Level HUC)</th>
<th>Stream Density</th>
<th>Project Area Stream Density</th>
<th>Road Density</th>
<th>Project Area Road Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canyon Creek Headwaters</td>
<td>2.26</td>
<td>1.95</td>
<td>2.85</td>
<td>0.31*</td>
</tr>
<tr>
<td>Long Tom Canyon-Chevelon Canyon</td>
<td>4.52</td>
<td>3.14</td>
<td>4.13</td>
<td>2.37</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
<td>4.12</td>
<td>2.65</td>
<td>3.83</td>
<td>0.43*</td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
<td>2.71</td>
<td>2.84</td>
<td>4.25</td>
<td>2.87</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
<td>4.79</td>
<td>5.52</td>
<td>6.54</td>
<td>1.02</td>
</tr>
</tbody>
</table>

* Not representative as area within project area is very small.

The subwatersheds with the highest road densities are Woods Canyon/Willow Springs Canyon at 6.54 miles/sq. mile and Upper Wildcat Canyon at 4.25 miles/sq. mile. This means that Woods Canyon/Willow Springs Canyon has more length of road than naturally occurring stream channels. This suggests that the drainage network in this area has been extended as roads essentially act as stream channels, being conduits for sediment and capturing water from both snowmelt runoff and rain events. These roads additionally act as sediment sources in many of these watersheds.

The subwatersheds with the lowest road densities are Upper Chevelon Canyon-Chevelon Canyon Lake (3.83) and Canyon Creek Headwaters (2.85). It should be noted that Long Tom Canyon-Chevelon Canyon, and Upper Chevelon Canyon-Chevelon Canyon Lake are the only watersheds with higher stream than road densities. The high road to stream...
density ratio in most of these watersheds suggests higher runoff rates and induced sediment inputs.

Project area road density for all watersheds is generally less than watershed area road density. This suggests that roads are generally not more concentrated more heavily within the project area boundary than in the remainder of the watersheds. The project area has less roads because it contains proportionally more steep slopes, which restrict road construction. System roads are generally restricted to ridge tops. Open road densities are much lower than total road density in all watersheds and within the project area. At least 0.7 miles of system roads show signs of active gully erosion and are in need of basic maintenance and repair. These include, but are not limited to FR9527 (figure 1) and sections of FR172.

Data for non-system roads (sometimes referred to as “user-created” roads) is available for the project area (Table 8). These are important in that these features add overall to the road densities and therefore impact watershed function. These features often occur in locations where roads would not normally be placed such as perpendicular to steep slopes, over steep streambanks and along/in stream channels (photo2, 3). Often these roads effectively “reopen” old logging roads that had been returned to a more natural state and were not adversely affecting hydrologic processes. Upper Wildcat Canyon and Long Tom Canyon-Chevelon Canyon Lake have most of the roads at 29 and 13.4 miles respectively. The other areas have very few miles due to their smaller project area and/or proximity to Forest Lakes Estates and the highway.

<table>
<thead>
<tr>
<th>Sixth Level HUC Watershed</th>
<th>User Created Roads in Project (Miles)</th>
<th>User Created Road Density (Proj. Mi/ Mi²)</th>
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</thead>
<tbody>
<tr>
<td>Canyon Creek Headwaters</td>
<td>0.27</td>
<td>0.17</td>
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<tr>
<td>Long-Tom Canyon-Chevelon Canyon</td>
<td>13.41</td>
<td>0.98</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
<td>29.07</td>
<td>1.23</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
<td>1.97</td>
<td>0.36</td>
</tr>
<tr>
<td>Totals→</td>
<td>44.72</td>
<td>2.75</td>
</tr>
</tbody>
</table>
Figure 1. Gully erosion along FR9527.
Figure 2. User created road along stream channel in Little Springs Canyon. The road crosses the channel numerous times before exiting the valley bottom via system roads 1.1 miles upstream.
Figure 3. User created roads following the power transmission lines crisscross and climb steeply in and out of Long Tom Canyon causing gully erosion.
5. Equivalent Disturbed Area (EDA) Analysis (Cumulative Watershed Effects)

A cumulative watershed effects analysis is based upon an “Equivalent Disturbed Area” model described in “Apache/Sitgreaves National Forests Cumulative Watershed Effects Analysis Procedure” (Lovely, 1991, 2004). The model used in this analysis calculates the runoff inducement potential of various treatments and indexes them to the runoff potential of open roads. Thus, the EDA figure represents the percent of the watershed area which will have runoff-related disturbance levels equivalent to that of being in a roaded condition. When the cumulative EDA for past, present, proposed, and foreseeable future activities reaches 15% for a 6th code watershed, the situation usually raises a “red flag” that the total ground cover disturbing and runoff inducing activity in the watershed may be reaching levels that could signal potential deleterious impacts to watershed resources, particularly stream channel stability and water quality. The application of this type of analysis has been a standard practice on the Apache-Sitgreaves National Forests since the early 1990’s (Lovely, 1991). The ASNFs model was adapted to fit local conditions of Cumulative Watershed Effects (CWE) models developed in Region 5 of the Forest Service. (See for example the Equivalent Roaded Acres section of Eldorado National Forest, 1998) These types of CWE models are in common use in the western United States although some incorporate data on watershed, soils, and stream channel characteristics to develop threshold of concern values specific to a watershed (See for example Chapter 20 “Cumulative Off-Site Watershed Effects Analysis” in the Region 5 Soil and Water Conservation Handbook.). The level of watershed data collection and analysis needed to perform that type of extension of the model is not yet entirely available on the A-SNFs. However, for the Larson FHP enough current physical data is available on the 6th code subwatersheds to ascertain that the 15% threshold is very conservative.

The Long Tom Canyon-Chevelon Canyon subwatershed has a current EDA rating of 2.89%, the Upper Wildcat Canyon subwatershed is at EDA of 2.49%, and the Woods Canyon and Willow Springs Canyon subwatershed has a current EDA of 2.51%.

6. FRCC (Fire Regime Condition Class)

FRCC data for the project area is from the Larson Fire and Fuels Specialist Report, (Fuels Specialist’s Report, 2014). “FRCC is a metric that quantifies how departed a system is from historical conditions in relation to fire and the role fire historically played in that system (Hann and Bunnell 2001, Hardy et al. 2001, Hann et al. 2004). Ecosystem attributes analyzed to determine FRCC include vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern.

There are three condition classes:

- **Condition Class 1**: Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within their historical range.

- **Condition Class 2**: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies
have departed from historical frequencies by one or more return intervals (either
increased or decreased), resulting in moderate changes to one or more of the
following: fire size, intensity and severity and landscape patterns. Vegetation
attributes have been moderately altered from their historic range.

Condition Class 3: Fire regimes have been significantly altered from their
historical range. The risk of losing key ecosystem components is high. Fire
frequencies have departed from historical frequencies by multiple return intervals.
This results in dramatic changes to one or more of the following: fire size,
intensity, severity, and landscape patterns. Vegetation attributes have been
significantly altered from their historical range.”

FRCC class ‘1’ is the desired vegetation condition for optimum soil and water resources.
It is a condition that allows for desired hydrologic condition and function. FRCC class
‘2’ is a condition that does allow for an upward or improving trend of hydrologic
function. Currently, the entire project area is classified as being in FRCC class ‘3’ due to
the exclusion of wildfire over a long period of time.

**DESired CONDITIONS**

1. **Soil Condition**
   - Infiltration capacity is promoted through minimizing compaction from equipment
     use and providing for high levels of effective ground cover
   - Residual coarse woody debris meets prescribed levels of 7-14 tons/acre in
     ponderosa pine, and 8-16 tons/acre in mixed conifer.
   - Carbon input sources are maintained to retain current levels of soil carbon well
     distributed across the landscape

2. **Water Quality** meets state standards for designated uses. Sediment inputs downstream
do not degrade existing conditions.

3. **Riparian and Stream Conditions**
   Riparian areas and stream channels are functioning properly or show a trend towards
an improving PFC when sufficient native vegetation, landforms, soil condition, and
debris are present to:
   - Dissipate energies associated with wind or water, thereby reducing erosion and
     improving water quality;
   - Filter sediment, capture bedload, and aid floodplain development;
   - Improve flood-water retention and ground water recharge;
   - Develop root masses that stabilize channel banks against cutting action;
   - Develop diverse ponding characteristics to provide habitat and water depth,
duration, and temperature necessary for aquatic/amphibian habitat, waterbird
breeding, and other uses;
   - Soils and soil microbes will continue to provide attributes to sustain healthy,
diverse, and resilient native botanic communities;
   - Support greater biodiversity; and
   - Produce commodities desired by society at a rate commensurate with ecosystem
function.
Only those roads identified as necessary for the management of the forests and to provide for recreation needs are retained. Level 1 roads are “put to bed” and do not contribute sediment to stream channels. User created and unneeded roads have been obliterated or reclaimed.

4. Fire Regime Condition Class is returned to Class 1 where possible, which is an indicator for returning vegetation conditions to resemble historic conditions in ponderosa pine and dry mixed conifer vegetation types. This condition is characterized by more open overstory canopies, more herbaceous understory, and is maintained by a more frequent low intensity fire rather than through mechanical means.

Best Management Practices

This project will incorporate Best Management Practices, both general and site specific, designed to protect water quality and watershed values. These BMPs are presented in Appendix B of this report. A Special Management Zone (SMZ) Buffer Map, a BMP in itself, is provided in Appendix D, and was developed on the best information available and subject to change during field review and project implementation. Appendix E provides the guidelines used to develop the streamside buffer width portion.

Forest Plan Compliance with the Alternatives

The Apache-Sitgreaves National Forest Land and Resource Management Plan (Forest Plan) contains several standards, guidelines and goals that pertain to soils, watersheds and riparian areas. A selection of the most pertinent ones to this project follows:

- Management direction for riparian areas is stated: "Improve vegetation condition in riparian areas. Improvements will be accomplished by reducing, or in some cases, eliminating adverse impacts from grazing, vehicles, and over-use by man" (pg. 15).
- "Maintain, or where needed, enhance soil productivity and watershed condition by 2020. Maintain a high quality sustained water yield for Forest users and others. Identify and protect wetlands and floodplains" (pg. 16).
- "Ensure compliance with Public Law 92-500 "Federal Water Pollution Control Act" and amendments including the Clean Water Act of 1977. Implement best management practices to prevent water quality degradation. Implement improvement action where water quality degradation does occur, except for special cases where temporary or short-term degradation is occurring from road crossing construction or similar situations" (pg. 81).
- "Provide adequate drainage to prevent concentrated flow and sediment laden runoff from entering water courses" (pg. 81).
- "Designate stream courses to receive protection during projects (e.g., timber sales, road work). Those streams shown on 7.5 minute quads as a stream course should be considered for designated stream courses" (pg. 81).
- “Conserve soil and water resources; avoid permanent impairment of site productivity and ensure conservation of soil and water resources. The minimum soil and resource management requirement is to control surface water runoff and erosion at not less than tolerance conditions. (pg. 81).

- "Maintain suitable filter/buffer strips between stream courses and disturbed areas and/or road locations to: … b. maintain water quality standards" (pg. 83).

- "Improvements: Maintain and enhance riparian vegetation along streams to maintain suitable water temperature and other conditions for stream flow" (pg. 83).

- "Erosion control measures will be included in road plans. Construct roads to keep sediment out of riparian and aquatic habitats" (pg. 104).

- Standards and guidelines in Management Area 2 state: "Plan/accomplish erosion reduction projects on areas disturbed by project activities where the site is not expected to stabilize within two years or when water quality degradation will occur" (pg. 153).

- Management emphasis for riparian areas states: “Recognize the importance and distinctive value of riparian areas when implementing management activities. Give preferential consideration to riparian area dependent resources … Manage to maintain or improve riparian areas to satisfactory riparian condition… do not adversely affect riparian dependent resources" (pg. 155).

The Revised Forest Plan (est. ROD fall 2014)

The revised plan is nearing completion. The following plan components from the draft plan are listed that may have specific application to the Larson project. The proposed action appears to comply with plan components; however, specific changes to the project that may be based on revised plan implementation will be documented prior to the decision of the Larson project.

Soils Desired Conditions (DCs)

- Soil condition rating is satisfactory.

- Soils are stable within their natural capability. Vegetation and litter limit accelerated erosion (e.g., rills, gullies, root exposure, topsoil loss) and contribute to soil deposition and development.

- Soils provide for diverse native plant species. Vegetative ground cover (herbaceous vegetation and litter) is distributed evenly across the soil surface to promote nutrient cycling, water infiltration, and to maintain natural fire regimes.

- Biological soil crusts (e.g., mosses, lichens, algae, liverworts) are present and reestablished if potential exists.

- Soil loss rates do not exceed tolerance soil loss rates.

Soils Standards & Guidelines (S&Gs)
Projects with ground-disturbing activities should be designed to minimize long- and short term impacts to soils resources. Where disturbance cannot be avoided, project specific soil and water conservation practices should be developed.

Severely disturbed sites should be revegetated with native plant species when loss of long term soil productivity is evident.

Water Resources Desired Conditions

- Vegetation and litter is sufficient to maintain and improve water infiltration, nutrient cycling, and soil stability.
- Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances.
- Water resources maintain the capability to respond and adjust to disturbances without long term adverse changes.
- Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat from negative effects of precipitation events (e.g. flooding and sediment produced above the level needed for maintenance)
- Stream channels and floodplains are dynamic and resilient to disturbances. The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows.

Water Resources S&Gs

- Projects with ground-disturbing activities should be designed to minimize long- and short term impacts to water resources. Where disturbance cannot be avoided, project specific soil and water conservation practices and BMPs should be developed.
- Streams, streambanks, shorelines, lakes, wetlands, and other bodies of water should be protected from detrimental changes in water temperature and sediment to protect aquatic species and riparian habitat.
- To protect water quality and aquatic species, heavy equipment and vehicles driven into a water body to accomplish work should be completely clean of petroleum residue. Water levels should be below the gear boxes of the equipment in use. Lubricants and fuels should be sealed such that inundation by water should not result in leaks.

All Potential Natural Vegetation Types (PNVTs) DC

- Vegetative ground cover (herbaceous vegetation and litter cover) is optimized to protect and enrich soils and promote water infiltration. There is a diverse mix of cool and warm season grasses and desirable forbs species.
- Organic soil cover and herbaceous vegetation protect soil, facilitate moisture infiltration, and contribute to plant and animal diversity and ecosystem function.
- Grasses, forbs, shrubs, and litter are abundant and continuous to support natural fire regimes.

All PNVT S&Gs
Vegetation treatments shall include measures to reduce the potential for introduction of invasive plants and animals and damage from nonnative insects and diseases.

Project plans should include quantitative and/or qualitative objectives for implementation monitoring and effectiveness monitoring to assist in moving toward or maintaining desired conditions.

**Riparian PNVTs DCs**

- Natural ecological disturbances (e.g., flooding, scouring) promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian-dependent species.

- Riparian-wetland conditions maintain water-related processes (e.g., hydrologic, hydraulic, geomorphic). They also maintain the physical and biological community characteristics, functions, and processes.

- Stream (lotic) riparian-wetland areas have vegetation, landform, and/or large coarse woody debris to dissipate stream energy associated with high waterflow.

- Streams and their adjacent floodplains are capable of filtering, processing, and storing sediment; aiding floodplain development; improving floodwater retention; and increasing groundwater recharge.

- Vegetation and root masses stabilize streambanks, islands, and shoreline features against the cutting action of water.

- Wetland riparian areas are capable of filtering sediment and aiding floodplain development that contribute to water retention and groundwater recharge.

- Soil compaction from forest activities (e.g., vehicle use, recreation, livestock grazing) does not negatively impact riparian areas.

- Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.

- Riparian obligate species within wet meadows, streambanks and active floodplains provide sufficient vegetative ground cover (herbaceous vegetation and litter cover) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize streambanks, and provide for wildlife and plant needs.

- Large coarse woody debris provides stability to riparian areas and stream bottoms lacking geologic control (e.g., bedrock) or geomorphic features (e.g., functioning floodplains, stream sinuosity, width/depth ratio).

**Riparian S&Gs**

- Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.

- Wet meadows and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
Ponderosa pine PNVT –
  - Coarse woody debris, including logs, ranges from 3 to 10 tons per acre. Logs average 3 per acre within the forested area of the landscape.
  - Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.

Dry mixed conifer PNVT –
  - Coarse woody debris, including logs, ranges from 5 to 15 tons per acre. Logs average 3 per acre within the forested area of the landscape
  - Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.

ENVIRONMENTAL CONSEQUENCES

DIRECT AND INDIRECT EFFECTS

Summary of Effects:

The following is a summary chart comparison of Alternative Effects.

<table>
<thead>
<tr>
<th>Table 9: Summary of Soil and Water Effect by Alternative.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upland Soils</strong></td>
</tr>
<tr>
<td>No Change – soil condition satisfactory except in riparian areas</td>
</tr>
<tr>
<td>Coarse woody Debris meets soil quality guidelines</td>
</tr>
<tr>
<td><strong>Riparian Area &amp;</strong></td>
</tr>
<tr>
<td>Stream Channel Condition</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| Water Quality & Quantity | No change from current. Water quality and stream condition on slow upward trend from past activities (grazing, roads) | Creates a greater vegetative grass component than Alt 1 and Alt 3, thereby improving retention, storage, and filtering functions. SMZs and BMPs provide protection from sediment to riparian and stream channels. Opportunity to increase long term water yield | Similar to Alt 2, however vegetative grass component transitions fewer acres and is shorter lived than 2. Opportunity to increase short term water yield. |

| Roads | Potential for reduced road densities and improved road conditions within project area. | Potential for reduced road densities and improved road conditions within project area. |

| Cumulative Effects | No cumulative effects | No significant cumulative effects |

| FRCC and Return to Stable Historic Conditions | Much of the area has low forage production due to high concentrations of conifer needle litter layer. | Decreases in canopy closure & stand densities result in shift to herbaceous understory, maintained on FRCC ‘1’ (54% of project area) | Decreases in canopy closure and stand densities result in shift to herbaceous understory, maintained on FRCC ‘1’ (14% of project area) |
Alternative Descriptions:

**Alternative 1 – No Action**

Under the no action alternative overstocked and dense forest stands within the project area would not be treated. Fire hazard would not be reduced. Wildlife habitat improvements for northern goshawk and Mexican spotted owl would not occur. No road decommissioning or rehabilitation of unauthorized routes would occur, therefore water quality and watershed function would not improve. The project area would not move toward desired conditions, as outlined in the ASNFs Land and Resource Management Plan, as amended (1987).

**Alternative 2 – Proposed Action**

In response to the purpose and need, the Black Mesa Ranger District, Apache-Sitgreaves National Forests, propose the following:

- Selectively cut trees and broadcast burn after treatment on approximately 25,701 acres (see Table 1).
  - Treatments include: group selection (22,710 acres), intermediate thinning (1,143 acres), pre-commercial thin (1,152 acres) and shelterwood/seed cut (696 acres)
- Broadcast burn without selectively cutting trees on approximately 4,180 acres.
- Allocate approximately 20% of acres for old growth characteristics.
- Mechanically treat up to 670 acres of trees within Mexican spotted owl (MSO) protected activity centers (PACs).
- Treat by hand (non-mechanized methods) on up to 700 acres in MSO PACs.
- Mechanically treat up to 25,627 acres in Northern Goshawk (NGO) foraging areas and post-fledgling family areas (PFAs).
- Rehabilitate up to 10 dispersed camping sites along Forest Service Road (FSR) 172.
- Repair two road water crossings along FSR 170B.
- Erect a 9.5 acre fence exclosure around the riparian area in Long Tom Canyon. Plant the enclosed area with native riparian species. The area is currently closed to public use.
- Open approximately 156 miles of existing closed roads to be used for treatment activities. Close and rehabilitate roads when treatments are completed.
- Decommission approximately 7.5 miles of closed (maintenance level one) roads.
- Obliterate and rehabilitate approximately 45 miles of unauthorized routes in the project area.
- Amend the Apache-Sitgreaves forest plan to add clarifying language to: (1) describe desired conditions for the project area managed for northern goshawk; (2) express relative amounts of forest cover, as well as the distribution of that
cover, including the interspaces between tree groups; (3) define the relationship between the interspaces and natural openings, such as meadows; (4) clarify that canopy closure is evaluated at the tree group scale within vegetation structural stages (VSS) 4, 5, and 6; and (5) align the forest plan with the 2012 Mexican Spotted Owl Recovery Plan from U.S. Fish and Wildlife Service.

**Mechanical Treatments**

Mechanical treatments refer to a variety of possible “tools” to meet objectives. Methods include, but are not limited to: the use of chainsaws or feller-bunchers to cut trees and lop slash, skidders to move material to landings along forest service approved skid trails, and bulldozers to pile or rearrange slash for burning or erosion control. Other specialized equipment may be used to cut, chop, break, lop or treat the fuels to meet resource objectives. Landings created for treatments would range in size from ¼ to 1 acre with an average of one landing every 20 acres. Several products could result from treatments such as biomass, fuelwood, and lumber, which could be sold through personal use and commercial wood product contracts.

In all treatment units, old trees (pre-settlement trees) would be retained except for forest health concerns or public safety. Within the treatments units identified for group selection, intermediate thin, and pre-commercial thinning, post-settlement ponderosa pines (in VSS class 5 or 6) may be removed to meet restoration objectives according to criteria presented in the September 13, 2011 Old Growth Protection and Large Tree Retention Strategy (pg 9-24). The creation of interspace and majority of timber harvest would be primarily focused in VSS 3 and 4.

In addition to the exemption categories in the LTRS, ponderosa pine in VSS class 5 or 6 may be removed if:

- The trees infected with mistletoe are in stands where the majority of the understory is free from mistletoe and,
- The infected trees have dwarf mistletoe rating (DMR) of 4 or more. *Mistletoes of North American Conifers*¹ (Geils 2002, pg 69) provides instructions on rating dwarf mistletoe infections.

Where severe dwarf mistletoe infection centers are located the treatment would focus on removal of infected trees to establish new regeneration groups (VSS 1) or to favor existing uninfected regeneration. Where regeneration groups are not established, focus on reduction of severely infected trees within the leave tree group.

In stands with over story trees heavily infected with mistletoe (trees with a DMR rating of 4+), a shelter wood with reserves treatment would be used. This is an even-aged treatment that involves leaving larger trees for regeneration and removing all trees in the understory that are infected with mistletoe. Once regeneration is established a second entry would be needed to remove the remaining infected over story trees originally left

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behind. Therefore, all trees infected with mistletoe would eventually be removed. This type of treatment is planned for approximately 700 acres on the Larson project area and would not adhere to the exemption categories presented in the LTRS.

**Meadow, Riparian, and Aspen Enhancement**

All post settlement ponderosa pine would be treated where they have encroached into existing meadows and riparian areas. Riparian and meadow treatments would occur without the use of mechanized equipment. Trees that provide stream bank stability would be maintained regardless of size. Slash would be removed from the drainage and hand piled or lopped to the ground. Three existing and potential snags would be left around meadows for wildlife. Riparian planting would occur with native species within the stream channel (approximately 5 acres within the project area). Fences may be erected where stands of aspen are located to encourage aspen regeneration and to provide aspen protection from elk and deer browsing. All post-settlement conifers would be removed from areas previously fenced to exclude elk.

**Treatments in Mexican Spotted Owl Protected Area Centers (PACs)**
The Larson project contains portions of five PACs within the project boundary and five adjacent to PACs along or within 0.5 mile of the project boundary. While most of the planned treatments would occur in ponderosa pine stands surrounding MSO PACs, some treatments are also proposed for areas within PACs, outside of the nest cores. The primary focus of the treatments is to abate fire risk to MSO protected habitat, while also enhancing nest/roost and foraging habitat. Broadcast burning would be used after mechanical treatments where necessary. In MSO nest/roost, recovery and foraging habitat key owl habitat elements would be retained and trees larger than 12 inches dbh would be favored, however, trees up to 16 inches dbh may be removed. The project would be consistent with the current MSO recovery plan (2012).

**Treatments in NGO PFAs and foraging areas**

Group selection would be used to regenerate ponderosa pine, white pine, and Douglas-fir in openings 0.1 to 4 acres in size within excess VSS classes and/or in areas heavily infected with dwarf mistletoe. Tree groups would be maintained by VSS class, generally in groups of 4 to 20 trees. Desirable dominant and co-dominant southwestern white pine and ponderosa pine would be left as single trees or groups throughout the area. When possible, regeneration openings would be created in areas with severe dwarf mistletoe infection.

**Prescribed Fire**

Prescribed fire refers to a controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allow the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives. Broadcast, maintenance, and pile burning are all types of prescribed fires which are proposed for the Larson project.

**Broadcast burning and maintenance burns** - Broadcast burning is a prescribed fire within a predetermined area (burn block) and with predetermined burning parameters (prescription) designed to meet the objectives stated in the proposed action. Broadcast burns would be located in areas where fuel loadings (dead fuels and/or live fuels) are
unnaturally high due to exclusion of natural fire and/or an accumulation of activity slash from past treatments. In most cases, prescribed burning would occur following mechanical treatments. Activity slash is created from mechanical treatment activities. It may be removed from the site to landings or be cut and scattered on the ground and may be treated later as part of a broadcast burn. A maintenance burn would follow the initial broadcast burn on a schedule of every 2 to 10 years. Maintenance burns would be located in areas where fuel loadings (dead fuels and live fuels) are close to their natural/historic state (generally less than 10 tons per acre). Burning activities would generally occur from October – December.

If prescribed burning is unable to occur due to environmental or personnel constraints, then additional mechanical entries would occur to meet fuels reduction objectives.

**Road Activities**
No new permanent road construction is planned. The existing road system would be used and maintained with minor reconstruction and maintenance, commensurate with use.

Maintenance level 1 roads currently closed to public use would be opened temporarily and closed after project activities are concluded. Closure may be a physical barrier, gate, or by regulation. Closed roads would be left in a stable hydrologic state and would be periodically maintained. During implementation, general road maintenance would be required prior to using existing system roads to access treatment units. These roads would be maintained as needed for the life of the project. The following work is classified as maintenance: blading and shaping the roadbed, reshaping drain dips or grade sags, reshaping waterbars and cross ditches, spot rockin in the roadbed, brushing and removing danger trees, removing snow, minor realigning of road junctions, cleaning culverts, seeding, removing excess material from the roadbed, and placing fill material in ruts. Road reconstruction includes major improvements such as removing small trees and stumps, constructing new drainage dips, water bars, and outlet ditches.

**Forest Plan Amendment**
See attachment.

**Watershed Restoration**
Up to 7.5 miles of maintenance level 1 roads would be decommissioned and permanently removed from the Forest Service road system. Up to 45 miles of unauthorized motorized trails would be obliterated and returned to their natural state.

Along the FSR 170B two low-water stream crossings would be improved through hardening and bank stabilization. Along FSR 172 up to 10 dispersed camping sites may be rehabilitated. This includes ripping and seeding the ground in order to promote vegetation growth. The campsites would be temporarily closed. In the riparian area surrounding Long Tom Canyon, a 9.5 acre fenced exclosure would be erected in order to protect riparian tree and herbaceous species from elk and deer browsing. This area is already closed to use. Native willows and other riparian species would be planted within the exclosure. Streamside riparian plantings may occur to encourage vegetation growth on up to 5 acres within the project area.
Alternative 3

Alternative 3 was developed in response to public concerns raised about retention of large trees and landscape openness. Within the treatments units, large, post-settlement ponderosa pines in VSS class 5 or 6 may be removed to meet restoration objectives according to criteria presented in the September 13, 2011 Old Growth Protection and Large Tree Retention Strategy (pg 9-24). Mistletoe infection would not be used as a sole basis for removing trees in VSS class 5 or 6. Alternative 3 proposes the same action as alternative 2 for roads, prescribed fire, watersheds improvements, and meadow, riparian, and aspen enhancement. Alternative 3 changes silvicultural prescriptions for MSO habitat and NGO habitat.

Differences between the alternatives include:

- Shelterwood/seed cut would not occur in alternative 3. These stands would only be treated with prescribed fire.
- In alternative 2, trees in VSS class 5 or 6 could be removed due to dwarf mistletoe infection. In alternative 3, trees in VSS class 5 or 6 could only be removed in accordance with the LTRS.

SOILS:

Alternative 1 - No Action

The existing conditions and trends of upland soils described in the Existing Conditions section of this report will continue under this Alternative 1nd scenario. Organic soil carbon will accumulate at potential rates. Soil fertility will slowly improve commensurate with the accumulation of organic carbon. Where ground cover is well developed and intact, infiltration rates will be near potential as surface runoff is minimized. Erosion will remain a concern in those areas recovering from past disturbance, both natural and anthropogenic, but should reduce as ground cover is re-established.

This alternative will not affect soil condition. Alternative 1 will retain the 100 percent of acreage in FRCC ‘3’ land within the project area (Fuels Specialist Report, 2014). A greater extent of area under ponderosa pine and mixed conifer stands would likely experience moderate to high soil burn severity in a wildfire. The loss of canopy cover, ground cover, and organic debris on the soil surface, together with the possible occurrence of hydrophobic soil layers in these areas and instances, would likely lead to dramatic increases in soil erosion and loss of soil organic matter and soil fertility. More erodible soils would likely reach soil erosion rates that result in loss of productivity.

Soils in grasslands would not be affected to the same degree since burn severities would likely be lower. Wildfire in these areas may also tend to stimulate more vigorous growth of grass and forb vegetation leading to overall improvements in ground cover.
Alternative 2 – Proposed Action

This alternative would not have long-term impacts to soil productivity with the implementation and monitoring of BMPs as prescribed in Appendix B. Short-term increases in soil loss are expected, and are not considered important as prescribed BMPs for logging activities have shown to be effective (ASNF 2007, 2010). A recent administrative study of soil disturbances by logging equipment implementing treatments similar to those proposed in Alternative 2 (and C) (Sitko and Hurteau, 2010) was initiated in 2007 to help the forest determine initial soil compaction or soil bulk density and resistance to penetration from fuel reduction treatments near Greer, Arizona. Correlations between Soil Disturbance Classes as described in “Forest Soil Disturbance Monitoring Protocol” (Page-Dumroese, et al. 2009) and change in soil condition (R3 Supplement FSH 2509.18) due to compaction were established in this study. In the study, 81 percent of the area showed no reductions in soil condition class, however, 19 percent were either impaired or unsatisfactory. Based on this initial study, reductions in soil condition were detected in SDC 2 and 3, but no reductions in soil quality were detected in SDC 0 and 1. The following table shows an example of the visual indicators and management activities that may be found with the proposed thinning treatments. For more information, see the Soil Disturbance Monitoring protocol which can be found in the project record.

<table>
<thead>
<tr>
<th>Disturbance Type</th>
<th>Severity Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Past Operation</td>
<td>None</td>
</tr>
<tr>
<td>Wheel Tracks or Depressions</td>
<td>None</td>
</tr>
<tr>
<td>Equipment trails from more than 2 passes</td>
<td>None</td>
</tr>
<tr>
<td>Excavated and bladed trails</td>
<td>None</td>
</tr>
</tbody>
</table>


The Greer study showed that soil condition was impacted in Severity Class 2 and 3. Further monitoring is warranted during this project as the initial study was limited in scope.

Other Western US studies (Page-Dumroese, et al, 2006 and 2009)(ERI, 2003) also describe initial effects of thinning operations and report that once compacted, soil bulk density may take many years to recover to pre-treatment conditions; therefore, utilizing methods to limit initial compaction are most desirable. BMPs prescribed in Appendix B are effective in helping limit the extent and number of trips of the machinery or the compacting force, avoiding the times of year or soil moisture conditions that are more susceptible to compaction, and avoiding the soils most susceptible to damage provide the best defense to loss of soil productivity.
Where mechanical harvesting/thinning is practiced, short-term increases in erosion related to ground cover disturbance cause by the harvest/thinning, transport, and skidding operations are minimized by BMPs (Appendix B) that retain slash and limit disturbance and soil displacement. Subsequent slash disposal activities will extend the time of or temporarily re-initiate ground cover disturbance and its related erosion. Finer textured soils and soils without high rock fragment content will have more potential for compaction. Implementation of BMPs restricting mechanized treatment activities during periods of wet soil conditions will avoid serious compaction issues in most of the upland soils. In areas with extensive development of biotic soil crusts, mechanical harvesting will also cause a short-term increase in erosion as the soil crust is disturbed. This impact can be reduced to some extent by limiting mechanical entry to times when biotic soil crusts are least susceptible to disruption (such as very dry periods).

Long-term positive effects would occur in areas where production of grass cover is stimulated by prescribed burning and by opening of the canopy cover through thinning operations. This effect would be most visible in grassland restoration treatments and in open areas where group selection cuts are made. Increases in ground cover where slash is lopped and scattered will also lead to positive impacts on soil fertility as well as a quick reduction of erosion from harvest activities.

As mentioned earlier, a principal objective of the LFRP project is to reduce the occurrence of hazardous fuels – both standing and on the forest floor. Reducing these categories of hazardous fuels necessarily leads to a lower input of organic soil carbon to the soil layers. However, implementation of Region 3 guideline to leave needed levels of large organic material on the forest floor, both in thinning and prescribed burning operations, should maintain current soil fertility levels in the long term. Prescribed fires can reduce the level of organic debris available for soil fertility maintenance, particularly where they reach moderate to high severity levels. Careful management of prescribed fires can limit the severity of the impact to soil resources but a complete elimination of potential impacts is not possible. Where both treatments occur on the same land, the activities will be coordinated such that the minimum levels of residual coarse woody debris identified in the BMPs will remain (except in areas where risk to human life and property from wildfire is high).

Since the severity of subsequent wildfires would likely be reduced by implementation of the proposed action (Fuels Report, 2011), the amount of area under ponderosa pine and mixed conifer stands would likely experience moderate to high soil burn severity in a wildfire is reduced significantly. As mentioned above, with uncharacteristic wildfire, the loss of canopy cover, ground cover, and organic debris on the soil surface, together with the possible occurrence of hydrophobic soil layers in these areas and instances, would likely lead to dramatic increases in soil erosion and loss of soil organic matter and soil fertility.

This alternative will improve vegetative condition at a greater rate than either Alt 1 or Alt 3. Maintenance of open canopy is consistent with pre-settlement conditions (TNC 2006). The monitoring protocol for soil conditions is included in the Best Management Practices Evaluation Procedure (BMPEP), and can be found in the project record.
As described above, no long term effects to soil productivity are expected with the implementation of this alternative with the implementation of soil and water conservation practices (or BMPs).

**Alternative 3**

The effects of implementation for upland soils described above in Alternative 2 are similar to the effects of implementation in Alt 3. However, as reported in both the fuels and silviculture specialist reports, Alt 3 creates less acres in FRCC ‘1’ than the Proposed Action, and more acres in FRCC ‘1’ than Alt 1. Due to the small size of created openings and the current spacing of trees greater than 16 inches dbh, most treated areas under alternative 3 would quickly develop interlocking or nearly interlocking crowns within a relatively short time span following this treatment (15 years), based on resulting density and average growth rates (Ronco et al. 1985)(Fuels Specialist Report, 2014, Silviculturist Specialist Reports 2014). Based on the inverse relationship between overstory cover and herbaceous production, herbaceous groundcover would eventually be replaced by conifer needles due to light and moisture competition with conifers. Herbaceous productivity would revert to pre-treatment levels.

**Riparian and Stream Conditions**

**Alternative 1 – No Action**

Under this Alternative 1nd considering the absence of wildfire, current trends in condition of riparian areas within the Rim Lakes project area would be expected to continue. Tree density and canopy closure within the riparian areas would increase. Current levels of large woody debris would be available to the stream channel both from the riparian and adjacent upland zones. Areas where deciduous woody riparian vegetation is being shaded out by invading conifers would remain in that condition.

Little changes to stream water temperatures would occur. Sedimentation from uplands would be expected to be lowest under Alternative 1 as ground cover remains high and infiltration rates would remain unaltered. Most level 1 roads are currently stable and not contributing sediment. Channel and streambank conditions functioning at risk would be expected to remain in a slowly improving upward trend (ASNF PFC Summaries 2013).

This alternative will allow riparian condition improvement at a slower rate than Alt B and Alt C as there would be no direct reduction to conifer overstory to allow riparian vegetation to increase and improve riparian functions.

**Alternative 2 – Proposed Action**

Under the proposed action alternative, thinning and burning operations would occur both on adjacent side slopes and within riparian/streamside zones. Site-specific streamside management zones (SMZs) have been delineated for stream channels in the project area. The SMZs will also be managed under guidelines described in BMPs in Appendix B. The width of the SMZs, types of treatments allowed, and guidelines for the implementation of those treatments vary depending on the aquatic resource values to be
protected and the potential risks for deleterious impacts related to soil erosion (see ASNF 2006a for description of SMZ guidelines). Treatments within the SMZs will be regulated both in space and time to achieve multiple resource management objectives. Treatments within SMZ’s, in combination with those on surrounding upland areas, should reduce the risk of significant damage to riparian communities and stream channel integrity due to the occurrence of any future wildfires in the project area. The treatments will have beneficial impacts on riparian area vegetation composition and structure. These treatments are specifically designed to reduce the conifer canopy cover in those riparian zones to stimulate the development of the underlying deciduous woody riparian vegetation (e.g., aspens, willows and cottonwoods). This desired change in riparian vegetation would likely have a positive impact on stream channel stability and improve unsatisfactory riparian condition to properly functioning condition more quickly than Alternative 1.

Harvest/thinning operations that occur within the Streamside Management Zones would slightly reduce the canopy cover in riparian areas and could cause a potential short-term warming effect on stream temperatures where thinning would be more aggressive. However, as most stream channels within the project area are ephemeral and/or dry during May, June, and much of July, stream temperatures would not be influenced significantly by overstory thinning. Prescribed fire treatments in the SMZs will likely have little potential to reduce canopy cover in riparian areas and would not result in further loss of shade. Proposed treatments across the entire project area will have the potential to cause a long-term reduction in the amount of large woody debris available for future input to the stream channels. Since the majority of woody debris in the affected streams is generated within the streamside riparian zones, BMPs designed to provide for future large woody debris and other BMPs should limit the extent and severity of this potential impact and prevent loss of channel stability or structural diversity related to large wood. Strict application of BMPs designed to maintain ground cover and large woody materials on the soil surface within the riparian buffer zones will reduce the amount of sediment reaching the channels from harvested and burned upland slopes and prevent excessive levels of sedimentation in stream reaches.

This alternative will improve riparian condition at a faster rate than Alt 1 and Alt 3. This alternative will decrease FRCC ‘3’ moving towards and maintaining FRCC ‘1’ or historic conditions. Reductions in upland tree density and the long-term maintenance of open stands and forest openings should respond with increased stream flow and water yield (Brewer, 2008), which in turn would provide longer periods of intermittent stream flow. These increases are more prevalent in the project area as they are in some of the highest precipitation zones found for ponderosa pine and dry mixed conifer on the forests, a result of the orographic lifting effect of the Mogollon Rim.

**Alternative 3**

To the extent possible, the Larson project area would be managed to promote the spatial distribution of vegetation structural stages and canopy fuel heterogeneity while being restricted to not cutting any tree in VSS class 5 or 6. Aspen and hard wood species would be promoted as much as possible. Activity slash and burning would be managed as in Alternative 2.
Effects of treatments in Alternative 3 are similar to Alternative 2, however, it is likely there would be less opportunity for created openings and less long term improvement in additional water yield to enhance streamflow and riparian conditions due to a more rapid canopy closure predicted (Silviculture Specialist Report, 2014).

III. WATER QUALITY AND QUANTITY:

**Alternative 1 - No Action**

This alternative is not anticipated to produce any changes to existing water quality trends in the streams, springs and surface water bodies in or downstream of the project area. Open roads and any “closed” roads still being used for motorized travel will continue to discharge runoff and sediment to project area streams, especially where the roads are poorly located in stream bottoms, have inadequate drainage structure, and are hydrologically connected to the stream network.

This alternative would not provide for reduced vegetative conditions that are more resistant to uncharacteristic wildfire. The effects to water quality and quantity in the case of fires resulting in high soil burn severity are well documented, and result in heavy sediment and ash inputs to streams, as well as increased risk of damaging flows to streams, riparian areas and downstream structures. It is likely that under any conditions, a wildfire entering these untreated watersheds under Alt 1 would have considerably greater impacts to water quality and channel stability than wildfire occurring after implementation of Alternatives 2 or 3.

This alternative will not improve, or improve slowly, water quality. Water quantity will continue to decline as less water would be available for stream flows due to the closing of the overstory (Silviculture Specialist Report, 2014).

**Alternative 2 – Proposed Action**

Principal water quality impacts of the actions proposed in this alternative would include increased short-term inputs of ash and sediment to stream channels and impoundments in the project area and, to a lesser extent, downstream of the area. The increase in ash would occur in response to prescribed burning in the project area. Implementation of BMPs to retain the filtering capacity of streamside buffer zones and implementation of burn prescriptions to moderate the extent and severity of burns have shown keep the input of ash to non-significant levels.

The principal source of increased sediment to the streams will likely be re-opened or improved roads in the project area. Level 1 roads that are re-opened will be closed again after the project objectives have been completed in the area. Thus the sediment generated on their surfaces would likely decrease over time. In addition, approximately 10 dispersed campsites, 7.5 miles of level 1 roads, and 45 miles of unauthorized ATV trails will be decommissioned and obliterated, further reducing sediment loss over time. However, it is likely that chronic sediment inputs to area streams will increase since it may be necessary to upgrade roads and increase the size and number of landings to
accommodate chip vans or other equipment used for treatments. (No new road construction is planned as part of this alternative.)

A second source of increased sediment input to streams will be from areas where ground cover has been reduced or eliminated due to harvest, thinning and prescribed fire activities. Skid trail locations are not generally designated prior to harvest, and have the potential to compact and expose bare mineral soils to erosive agents. The mechanical harvesting techniques envisioned for some areas of this project, such as the use of feller-bunchers, can reduce the degree of soil gouging with positive benefits to preventing soil erosion. However, they still tend to disturb existing ground cover and expose bare mineral soils and do so over higher percentages of the treatment area than conventional logging activities. BMPs will be implemented to maintain the sediment filtering capacity of streamside buffer strips. It is particularly important that the filtering capacity of the strips be maintained during the periods when adjacent side slopes are in a disturbed situation (i.e., ground cover reduced by management activity). Specific BMPs for streamside management zones are included in Appendix B. Implementation of BMP’s designed to protect water quality is effective in preventing long term deterioration of water quality from sediment.

Fuel reduction treatments in forested watersheds will probably have long-term detectable increase in water yields either on-site or downstream (Brewer, 2008; Bosch and Hewlet 1982; Hornbeck and others 1997; Troendle and others 2003, 2007). Prescriptions that cover most of the project area are likely to remove greater than 20 percent of basal area that is needed to generate a detectable change in flow. Less than 5% of the treatments prescribed in Alternative 2 are regeneration cuts with very small patches and groups, which allow more snow collection in openings, resulting in more potential on-site water storage and yield. The hydrologic effect would be that the area would provide longer periods of flow in intermittent streams within and downstream of the project area.

Bosch and Hewlet (1982) concluded and subsequent data (Hornbeck and others 1997) and modeling (Troendle and others 2003, 2007) support that removing less than 20 percent of the basal area may also result in a change in flow, but this change will not be detectable. In cases where there is a detectable hydrologic response to fuel management treatments, the observed response will be greatest in wet years and smallest or non-detectable in dry years. Prescribed fires, when designed and used as a fuel reduction tool alone, are probably less likely to influence water yield than mechanical treatments or burning with mechanical treatments because of the smaller reduction in basal area and lack of ground disturbance by heavy machinery.

Measures taken to reduce the potential impact of increased peak flows and runoff are described in the following section on Cumulative Watershed Effects.

Alternative 2 would have the highest herbaceous understory response and greatest understory plant diversity. “Native grasses, forbs and shrubs would improve in number and vigor with reduced forest canopy in stands which fall below 35% Maximum SDI. Openings in the canopy would produce approximately 800 to 1000 lbs of forage on approximately 20-40% of the mechanically treated area. In the remaining 60-80% of the treated areas, forage may range from 200 to 400 pounds per acre. Current production is less than 50 pounds per acre in some closed stands. Production would peak
approximately 6 years after treatment but would be longer in duration than alternative 3 due to the larger number of openings and gaps in the canopy” (Silviculture Specialist Report, 2014). This increase in a vegetative grass component will improve the ability of watershed to intercept and retain water inputs (precipitation and snow melt).

**Alternative 3**

The conditions and trends for water quality and quantity described under the Existing Conditions section of this report will continue under this alternative. Both Alternative 2 and Alternative 3 reduce canopy coverage and disturbed soil to a roughly equivalent level. This alternative, however, is not expected to maintain open canopy cover conditions as long as alternative 2. The effects of mechanical treatments will provide increases to water yield similar to alternative 2, however, they would be much shorter lived, as forest canopies are expected to close much faster (Silviculture Specialist Report, 2014), as soon as 15 years, and at least 10% and up to 20% of the area is expected to return to historic open conditions where periodic fire can maintain the open conditions. Regeneration cuts with small patches are not prescribed in Alternative 3 and would probably result in less water yield increase as well.

Expected increases in forage production and basal area ground cover will diminish quickly over time. Alternative 3 would have a less understory plant diversity than alternative 2 but greater than alternative 1. “The diameter limit leaves more trees in the upper canopy resulting in a slightly lower production of herbaceous understory than alternative 2 (Abella 2006). Openings in the canopy would produce approximately 800 to 1000 lbs of forage on approximately 10% of the mechanically treated ground. In the remaining 90% of the treated area forage may range from 200 to 400 lbs per acre (Clary 1975). Extra trees left in the upper canopy due to the diameter cap would result in a lower understory production and diversity than alternative 2. Production would peak approximately 6 years after treatment (Clary 1975). Understory production would be of short duration as the canopy would close in within 10 to 15 years.” (Silviculture Specialist Report, 2014).

**ROADS**

No new system roads are proposed for any alternative. Alternative 2 and 3 require re-opening and minor maintenance of about 156 miles of maintenance level 1 (ML1) roads. No temporary roads are to be constructed. All ML1 and temporary roads will be closed when the mechanical fuel treatment is completed, and approximately 10 dispersed campsites, 7.5 miles of level 1 roads, and 45 miles of unauthorized ATV trails will be decommissioned and obliterated, reducing sediment loss over time. The short term impact to water quality from sediment from roads opened during harvest operations are mitigated by BMPs. BMP monitoring across the ASNFs show that BMPs are effective in preventing sediment from reaching streams when strictly followed. No significant impact to water quality is expected with implementation of Alternative 2 or 3 from road impacts. There is an opportunity to provide long term sediment reduction over existing road conditions through implementation of BMPs on roads that will be used by the project. Sediment production from roads diminishes over time after proper closure and non-use (Beschta, 1978).
CUMULATIVE WATERSHED EFFECTS:

Alternative 1 - No Action

No cumulative effects occur under this alternative.

Alternative 2 and 3

Land and water management activities, development activities, and natural events can all have impacts on various aspects of a properly functioning watershed. Some activities will have a very short term effect on watershed functions while others will have effects that last for decades or more. Some activities will have differing effects depending on the time scale viewed. For example, a short term negative effect may be balanced by a long term positive impact. The individual impacts of activities and events can also result in an incremental and additive effect over time or over an aerial extent that negatively or positively affect watershed functions. Therefore it is desirable to look at present, past and foreseeable future actions and events to be able to assess the cumulative impacts occurring in an area. Water resource and soils related impacts are usually assessed on a watershed basis. The size of the watershed over which a cumulative effects analysis is performed will depend on the nature of the activities and of the anticipated impacts.

Watershed functions of concern in this area of the Southwest include surface runoff, water yield, peak flows, erosion and sedimentation, channel and streambank stability, riparian health, and water quality and quantity. The management activities envisioned as elements of the Larson Forest Health Project (FHP) include temporary opening and reconditioning of closed roads; upgrading of limited sections of road for hauling of forest products and for promotion of public safety; construction of landings; harvest, skidding and decking of logs, timber stand thinning by hand and mechanical means; on-site chipping and transport of tree boles and slash; various types of slash treatment; prescribed burns and creation of fire breaks for fuel hazard reduction; grassland and riparian restoration treatments; and management of existing road closures for protection of wildlife habitat. These activities can have short term and/or long term direct effects on watershed functions by the exposure of bare mineral soil, compaction of soil, changing the permeability of soils, removal or disturbance of ground cover, interception of lateral flows at cut banks, concentration of overland flows, reduction of canopy interception of precipitation, reduction of transpiration, changes in distribution of snow pack, changing filtering capacity of riparian vegetation, reducing streambank vegetation and other factors maintaining stream bank stability, reducing large wood available for channel maintenance, changing the input of allochthonous organic materials to streams, increasing the input of ash and fire related compounds, and various other direct effects. Consequent indirect effects can then occur to the watershed functions mentioned above. Positive watershed impacts can also result from project activities including increases in grass and ground cover, stimulation of woody riparian vegetation communities, and prevention of large scale intense wildfires which can produce dramatic impacts to watershed health and functioning. Still other actions proposed, such as rehabbing user created trails, decommissioning some system ML 1 roads, improving existing roads, will have an immediate positive effect on watershed function.
Watersheds Within Project Area

The watersheds involved in the Larson FHP, as described in the Existing Conditions section of the Watershed Specialist report for this project, are listed in Table 1. (See the Existing Conditions section for an explanation of the different levels of Hydrologic Unit designations.)

<table>
<thead>
<tr>
<th>Table 11. Fifth and Sixth Level HUC Watershed Acreage in the Larson FHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed (HUC 5) and Subwatershed (HUC 6)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Upper Chevelon Canyon</td>
</tr>
<tr>
<td>Upper Wildcat Canyon</td>
</tr>
<tr>
<td>Woods Canyon and Willow Springs Canyon</td>
</tr>
<tr>
<td>Upper Chevelon Canyon-Chevelon Canyon Lake</td>
</tr>
<tr>
<td>Long Tom Canyon-Chevelon Canyon</td>
</tr>
<tr>
<td>Lower Chevelon Canyon*</td>
</tr>
<tr>
<td>Upper Potato Wash*</td>
</tr>
<tr>
<td>Canyon Creek</td>
</tr>
<tr>
<td>Canyon Creek Headwaters</td>
</tr>
<tr>
<td>Totals</td>
</tr>
</tbody>
</table>

* Due to small percentages these watersheds will be omitted from further considerations in this report

The most appropriate level of watershed size for this analysis is the 6th code level. These subdivisions of the 5th code watersheds generally range from about 10,000 to 20,000 acres. The 6th code watersheds involved in this project are listed in Table 1. The Larson projects occupy portions of six 6th code subwatersheds. However, over 91% of the project area is located in the three 6th code watersheds of Upper Wildcat Canyon, Long Tom Canyon-Chevelon Canyon, and Woods Canyon / Willow Springs Canyon. The remaining 7.9% of the project area is divided among three 6th code subwatersheds in which the project acres never constitute more than 9.9% of the subwatershed area. The contributions of EDA in these watersheds will be inconsequential in relation to that in the remainder of the watersheds. Consequently, detailed analysis of EDA relationships will not be attempted in them. These non-analyzed watersheds include Upper Potato Wash, Canyon Creek Headwaters, and Upper Chevelon Canyon-Chevelon Canyon Lake.

Methodology

This analysis is based upon an “Equivalent Disturbed Area” model described in “Apache/Sitgreaves National Forests Cumulative Watershed Effects Analysis Procedure” (Lovely, 1991, 2004 Draft). This model estimates the amount of runoff induced over time by various management activities and wildfire. Induced runoff is considered a primary effect since many impacts such as erosion, sedimentation, and channel stability are runoff induced. The levels of expected runoff are indexed by a Disturbance Factor with respect to that occurring from an open road surface. This Disturbance Factor is set to 1.00 for open roads. Other activities or events are assigned Disturbance Factors
proportional to the rating of 1.00. Some activities such as open roads or residential development are assumed to have a constant disturbance factor over time. The impacts of other activities such as fire or timber harvest will have an initial impact that declines to pre-disturbance conditions over time. The time for recovery will differ depending on the activity. The model assigns the Disturbance Factor and recovery period for an activity to the acres of that activity, calculates the recovery based upon the year being modeled, and then calculates the resulting “Equivalent Disturbed Area” (EDA) for the activity in that year. The model aggregates the sum of all disturbances by 6th code subwatersheds. For this analysis, we calculated the EDA for past activities (including timber sales, other timber management treatments, fires) and existing disturbances (including roads, trails, major power lines, and residential development). These disturbances are reported for the initial year of implementation for this project (assumed to be 2015). This figure represents the existing condition EDA for that year. The model then considers known future activities that will occur within the 6th code subwatersheds. The model is used to calculate the associated total EDA for the year 2015 under the assumption that all treatments proposed within in the project area watersheds will occur in this first year of implementation of the Larson project. This represents a severely compressed time schedule since the projects will actually be implemented over a period of years. In effect, the resulting EDA from this analysis represents a type of “worst case” analysis which will serve as a “course filter” pointing toward those watersheds that will have the greatest concentration of impacts. The total EDA is compared with an indicator for additional cumulative effects analysis at 15% of the watershed area to warn if the level of activity under the compressed time scale would cause significant cumulative effects or not. This can be accomplished in a number of ways including actions at the planning level for the project such as reduction of the level of activity in an affected watershed, or distribution of activities over time. It should also involve a field inspection of the watershed by watershed specialists and treatment managers to better characterize existing conditions of the watershed, determine the nature of any specific watershed hazards, obtain a detailed understanding of proposed activities as they occur on the landscape, and to identify opportunities to mitigate site specific watershed consequences of the proposed action.

The calculation of percent of watershed in EDA should not be considered an absolute indication that a watershed will or will not be negatively impacted by a proposed action. The resulting EDA figures require professional judgment for adequate interpretation. They are meant to assess the hazard of the scale and the duration dimensions of disturbance in a watershed. As such they indicate where changes in scale, duration or timing of project activities may require adjustment. They do not address the site specific hazards of activities on various watershed functions. Addressing these hazards will require strict adherence to BMPs developed for the project and, in some cases such as treatments in riparian zones, further on-site development of treatment prescriptions and mitigating measures by resource specialists before and during project implementation.

Tables 2a and 2b present the ranges of Disturbance Factors and projected recovery periods for various types of activities, events and conditions that are used in this model. (In cases where multiple activities have or are programmed to occur on the same acre of land, the Disturbance Factor was modified to reflect the specific mix of activities for that acre.)
**Table 12: Disturbance Factors and Recovery Periods Used in EDA Model**

<table>
<thead>
<tr>
<th>Type of Disturbance or Activity For Past, Existing and Foreseeable Projects</th>
<th>Disturbance Factor</th>
<th>Recovery Period Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads and Trails and Landings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open or Seasonally Closed</td>
<td>1.00</td>
<td>None</td>
</tr>
<tr>
<td>Closed or Abandoned w/o Treatment</td>
<td>0.50</td>
<td>None</td>
</tr>
<tr>
<td>Obliterated</td>
<td>0.10</td>
<td>25</td>
</tr>
<tr>
<td>Extended Clearing on Highway 260 Below the Rim</td>
<td>0.40</td>
<td>None</td>
</tr>
<tr>
<td>Wildfire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crown or High Intensity</td>
<td>0.50</td>
<td>25</td>
</tr>
<tr>
<td>Moderate Intensity</td>
<td>0.10</td>
<td>10</td>
</tr>
<tr>
<td>Low Intensity</td>
<td>0.05</td>
<td>5</td>
</tr>
<tr>
<td>Private Land Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Density</td>
<td>0.70</td>
<td>None</td>
</tr>
<tr>
<td>Moderate Density</td>
<td>0.40</td>
<td>None</td>
</tr>
<tr>
<td>Low Density</td>
<td>0.20</td>
<td>None</td>
</tr>
<tr>
<td>Note: Based on aerial photo interpretation, more specific DFs may be estimated using the above index values</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Past and Foreseeable Timber Harvest/Thinning/Slash Treatment Methods*

| Tractor Clearcut/Patch Logging | 0.40 | 25 |
| Tractor Partial Cut/ Commercial Thinning** | 0.15 to 0.29 | 25 |
| Precommercial Thinning – Mechanical | 0.15 | 25 |
| + Precommercial Thinning – Hand (no ground disturbance) | 0.05 | 10 |
| + Broadcast Burn | 0.08 | 10 |
| + Light Intensity Broadcast Burn | 0.05 | 2 |
| + Hand Pile and Burn | 0.05 | 5 |
| + Mechanical Pile and Burn | 0.15 | 10 |
| + Mechanical Site Prep (Disking) | 0.15 | 10 |
| + Lop and Scatter | -0.10 | 10 |

* Foreseeable treatments are modeled as if all treatments take place in the year 2015. Therefore there is no reduction from the initial DF when calculating for the year 2015.

** Examples Removal Cut (overstory or partial) and Commercial Thinning – 0.23, Shelterwood Cut – 0.25, Shelterwood Removal Cut - 0.30.
Table 12a: Disturbance Factors and Recovery Periods Used in EDA Model

<table>
<thead>
<tr>
<th>Type of Disturbance or Activity For the Larson Proposed Projects (Includes Rim Lakes FHP where they occur)</th>
<th>Disturbance Factor</th>
<th>Recovery Period Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen Treatment</td>
<td>0.25</td>
<td>25*</td>
</tr>
<tr>
<td>Shelterwood Cut</td>
<td>0.25</td>
<td>25*</td>
</tr>
<tr>
<td>Group Selection / Intermediate Thin Foraging - Harvest***</td>
<td>0.22</td>
<td>25*</td>
</tr>
<tr>
<td>MSO Restricted - Harvest &lt; 24***</td>
<td>0.22</td>
<td>25*</td>
</tr>
<tr>
<td>MSO Target Threshold - Harvest &lt; 24***</td>
<td>0.22</td>
<td>25*</td>
</tr>
<tr>
<td>PFA/Nest - Harvest***</td>
<td>0.22</td>
<td>25*</td>
</tr>
<tr>
<td>Intermediate Thin</td>
<td>0.20</td>
<td>25*</td>
</tr>
<tr>
<td>Pre-Commercial Thinning – Hand Meadow Enhancement***</td>
<td>0.05</td>
<td>10*</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
<td>10*</td>
</tr>
<tr>
<td>Meadow &amp; Riparian Enhancement (Planting)</td>
<td>-0.10</td>
<td>0*</td>
</tr>
</tbody>
</table>

*** Rim Lakes FHP proposed actions within 6th codes.

A Geographic Information System (GIS) approach was used to implement the model and to assign EDA values to the 6th code watersheds involved.

Input Data

1. Forest and regional office data bases used in the model were
   1. watersheds boundaries
      - updated 5th and 6th code watershed coverages for Apache-Sitgreaves NFs
   2. roads
      - within Larson projects boundary: updated road route coverage
   3. trails
      - Forest level trail route coverages for Apache-Sitgreaves NFs
      - User created roads and trails mapped by FS personnel using GPS during the summer of 2013.
   4. fires
      - Forest level fire history coverages for Apache-Sitgreaves supplemented by severity information from FS personnel and evaluation of burn areas in Google Earth.
      - burn severity coverages from the Rodeo-Chedeski Fire
   5. past timber sales
      - FACTS timber inventory activity database linked to the existing vegetation timber stand GIS layers for the Apache-Sitgreaves NFs
   6. foreseeable future timber treatments
      - FACTS timber inventory activity database linked to the existing vegetation timber stand GIS layers for the Apache-Sitgreaves NFs
   7. private land development levels
      - evaluation of Google Earth coverage of project area
   8. major power transmission line clearing
      - Forest GIS layer
   9. project treatments
GIS layers for treatments developed for project

**Additional Assumptions**

**Adjustment for new entry timber activities**
The proposed project includes treatment of many areas that had been entered for timber treatments in previous years. In some cases, these previous entered areas have not totally recovered to pre-disturbance condition. The Disturbance Factor for the proposed treatments assumes that treatments are applied to stands that are in a fully recovered hydrologic condition. Where that assumption does not hold, the application of the full Disturbance Factor for the proposed treatment on top of the remaining EDA for the previous treatment would result in an overestimate of the resulting EDA for those acres. An adjustment is made to essentially reset the pre-existing harvest related EDA for those acres to zero and then apply the full Disturbance factor that reflects the expected endpoint conditions from the proposed treatment.

**Opening of closed roads in project area**
For the purposes of this analysis, it is assumed that only those closed roads identified as required for the Larson Forest Health Project within the project boundary will be opened and will return to full Disturbance Factor index of 1.00. This assumption is a likely overestimate of the actual level of road use that will be needed for this project.

The effects of landings are assumed to be part of the treatment.

**Analysis Results**

EDA analyses were completed for the Existing Condition, No Action Alternative, and Proposed Action Alternatives with the output year being 2015. The No Action Alternative differs from the Existing Condition in that foreseeable future activities are included in the No Action Alternative. No attempt was made in this analysis to portray the resulting EDA in the project area watersheds of a future wildfire event with and without project treatments. Spatially based projections of the fire related parameters necessary to run the EDA model for such scenarios were not available at the time of analysis. However, an evaluation of watershed consequences of these scenarios can be found in the Watershed Specialists Report.

The Existing Conditions and No Action Alternative EDA analyses are summarized in Tables 3 and 4, respectively. The results indicate that three of the three analyzed watersheds currently have low existing levels of EDA. With the exception of roads, past vegetation management activities account for most of the existing EDA, overshadowing most other contributing factors. Roads are the 2nd highest contributor toward EDA in these three watersheds. Private land development is a significant contributor in both Long Tom Canyon - Chevelon Canyon and Upper Wildcat Canyon subwatersheds.

The resulting EDAs considering Proposed and Foreseeable actions under a deliberately compressed schedule of implementing all actions in the year 2015 are displayed in Table 5. This “worst case analysis” indicates that EDA levels ranged from a low of 12.3% of watershed in the Upper Wildcat 6th code watershed to a high of 19.9% of watershed in the Woods Canyon and Willow Springs Canyon watershed. In only one of the three studied
watersheds, existing condition EDA levels were above the indicator for additional analysis value of 15% used by the Apache-Sitgreaves NFs. Much of the increase in EDA related to the Larson projects is contributed by the Larson Forest Health Project and in Woods Canyon and Willow Springs Canyon watershed is attributed to the additional Rim Lakes activity planned in the watershed.

There is no significant differences exist between the watersheds as to the dominant sources of disturbance. The Larson FHP increase EDA significantly, however, as is the case with Upper Wildcat Canyon and Long Tom Canyon, even if all proposed treatments were implemented in the year 2015, they would still result in a EDA level considered to be low risk. Woods Canyon and Willow Springs Canyon subwatershed Treatments compressed to the year 2015 result in an EDA in excess of the 15% threshold level. In the Woods Canyon and Willow Springs Canyon subwatershed, the disturbance associated with the scale and extent of the proposed Rim Lakes Forest Health Project, is the dominant contributor to the estimated EDA levels.

These results indicated the need to complete additional analysis related to the cumulative effects of treatments proposed for the Larson Forest Health Project. For the Woods Canyon and Willow Springs Canyon subwatershed more detailed EDA analysis was required.

As shown in Table 5, Upper Wildcat and Long Tom Canyon – Chevelon Canyon watersheds both remain below the 15% indicator level.

In all, 16,191 acres of treatment are proposed in this project for this 16,692 acre watershed. That amounts to all but the steepest portions of the subwatershed. The disturbance involved in the proposed treatments result in an EDA value of 19.9% of watershed. However, both the Rim Lakes and Larson treatments are expected to take many years to complete.

Given the physical characteristics of this particular subwatershed, no long-term negative effects are expected and project activities will greatly improve subwatershed conditions in the long-term by reducing the risk of catastrophic wildfire.

Woods Canyon and Willow Springs Canyon subwatershed is not a sensitive watershed. The following basin characteristics was computed using USGS Arizona Stream Stats. The mean basin slope as computed using USGS Arizona Stream Stats in the Woods Canyon and Willow Springs Canyon subwatershed is about 6.87% and there are a number of extensive (30-60 acre) relative flat areas. The mean basin elevation is 7,600 ft. and relative relief in feet is 867. It is undeveloped. The 50 year and 100 year 24 hour precipitation are 6.12 and 6.86 inches respectively. The highest Precipitation occurs in August with a mean of 4.59 inches. There are about 65.9 miles of stream channel. There are two reservoirs within the subwatershed that capture flows and sediment from a majority of the subwatershed. There are no active or inactive landslides or deposits present. The karst terrain provides sinkholes and other closed basin features that capture runoff. Soils with the watershed are not highly erodible except in canyons too steep for mechanical treatment. There are no municipal water supplies downstream for a great distance. Overall, the Woods Canyon and Willow Springs Canyon subwatershed is not sensitive to treatment.
Fire Regime Condition Class and Return to Sustainable Forests (Watersheds)

Due to the degree of departure from historical conditions and the proportion of Ponderosa Pine and Dry Mixed Conifer forest types on and off-forests, the ASNFs provide a significant contribution to the sustainability of both vegetation types. Early- to mid-aged forests with closed canopies are over represented. There is an ecological need to restore composition and structure (reduce tree density and increase number of large trees) and sustain ecological processes (restoration of natural fire and other disturbance regimes) in these forested vegetation types (White 2009). Along with modification of natural processes, there has been a change in ecological potential, which has made these communities more susceptible to drought stress, insect, and disease infestations, and uncharacteristic wildfire. Hydrologic conditions are tied to these altered conditions as well. As depicted in the Silviculture Specialist Report (2014), significant gains in herbaceous understory are predicted by opening tree canopies and maintaining these openings. Water yield improves with more open canopies (Brewer 2006). More open overstory conditions are less likely to burn uncharacteristically in both intensity and extent, reducing potential effects to watershed or stream resources (Fuel Specialist’s Report 2014).

**Alternative 1 – No Action**

Alternative 1 provides no change in the near 100 percent departure from sustainable ecosystems.

**Alternative 2 – Proposed Action**

Alternative 2 provides for significant improvement in restoring and maintaining ecological and hydrological conditions and risk to those resources over existing conditions. The improvement and maintenance of open conditions provide long term improvement of hydrologic function of watersheds.

**Alternative 3**

Alternative 3 decreases canopy closure and stand densities resulting in shift to herbaceous understory. Further overstory treatments would be necessary to improve conditions as to be sustained by ecological processes (fire adapted) over the long term.

**Forest Plan Consistency Comparison for all Alternatives**

Management direction for riparian areas is stated: "Improve vegetation condition in riparian areas. Improvements will be accomplished by reducing, or in some cases, eliminating adverse impacts from grazing, vehicles, and over-use by man" (pg. 15).

- Alternative 1 does not address this direction.
- Alternative 2 and 3 will remove competing overstory vegetation in selected riparian areas, while protecting riparian areas through BMPs.
"Maintain, or where needed, enhance soil productivity and watershed condition by 2020. Maintain a high quality sustained water yield for Forest users and others. Identify and protect wetlands and floodplains" (pg. 16).

- Alternative 1 does not address this direction.
- Alternative 2 and 3 provide for improved riparian condition, increasing and sustaining projected water yields over current conditions, Wetlands and floodplains are protected by BMPs

"Ensure compliance with Public Law 92-500 "Federal Water Pollution Control Act" and amendments including the Clean Water Act of 1977. Implement best management practices to prevent water quality degradation. Implement improvement action where water quality degradation does occur, except for special cases where temporary or short-term degradation is occurring from road crossing construction or similar situations" (pg. 81).

- Alternative 1 does not actively improve areas of current water quality impairment
- Alternative 2 and 3 will improve watershed conditions in areas currently unsatisfactory through active road management and implementation of site specific BMPs

"Provide adequate drainage to prevent concentrated flow and sediment laden runoff from entering water courses" (pg. 81).

- Alternative 1 does not address current degraded road and riparian conditions.
- Alternative 2 and 3 actively manage roads and improve some riparian areas through treatment. Activity generated sediment is mitigated through BMP implementation as well as the use of Streamside Management Areas.

"Designate stream courses to receive protection during projects (e.g., timber sales, road work). Those streams shown on 7.5 minute quads as a stream course should be considered for designated stream courses" (pg. 81).

- Alternative 1 - N/A
- Alternative 2 and 3 have designated streamside management areas as directed in ASNF Streamside Management guidelines (ASNF, 2006a).

“Conserve soil and water resources; avoid permanent impairment of site productivity and ensure conservation of soil and water resources. The minimum soil and resource management requirement is to control surface water runoff and erosion at not less than tolerance conditions. (pg. 81).

- Alternative 1 – N/A
- Alternative 2 and 3 implements site-specific BMPs and Soil Disturbance Monitoring Protocol to protect soil and water resources.

"Maintain suitable filter/buffer strips between stream courses and disturbed areas and/or road locations to: … b. maintain water quality standards" (pg. 83).

- Alternative 1– N/A
Alternative 2 and 3 implements streamside management zones and implements and monitors BMPs to protect stream systems from excessive sediment.

- "Improvements: Maintain and enhance riparian vegetation along streams to maintain suitable water temperature and other conditions for stream flow" (pg. 83).
  - Alternative 1 – N/A
  - Alternative 2 and 3 will improve riparian vegetation in the long term and provide stream cover to provide stream shading. Reductions and maintenance of reduced canopy cover in uplands to historic or pre-settlement conditions will reduce evapo-transpiration and provide long term improvement in streamflow conditions. Alternative 2 maintains more area in improved as more area is allowed to be maintained by periodic low intensity fire.

- "Erosion control measures will be included in road plans. Construct roads to keep sediment out of riparian and aquatic habitats" (pg. 104).
  - Alternative 1 – N/A
  - Alternative 2 and 3 utilize numerous BMPs for road maintenance and post project closure mitigation.

- Standards and guidelines in Management Area 2 state: "Plan/accomplish erosion reduction projects on areas disturbed by project activities where the site is not expected to stabilize within two years or when water quality degradation will occur" (pg. 153).
  - Alternative 1 – N/A
  - Alternative 2 and 3 has BMP stipulations regarding treatment of disturbed soils. Monitoring of project areas provides for further rehabilitation if necessary, and provides improved guidance for future projects.

- Management emphasis for riparian areas states: “Recognize the importance and distinctive value of riparian areas when implementing management activities. Give preferential consideration to riparian area dependent resources … Manage to maintain or improve riparian areas to satisfactory riparian condition… do not adversely affect riparian dependent resources” (pg. 155).
  - Alternative 1 provides no active riparian improvement of unsatisfactory conditions.
  - Alternative 2 and 3 provide for improved riparian conditions through overstory treatment and protection from project activities through implementation and monitoring of BMPs and implementation of streamside management guidelines.
LITERATURE CITED


Arizona Department of Environmental Quality. 2009. 2006/2008 Status of Ambient Surface Water Quality in Arizona – Arizona’s Integrated 305(b) Assessment and 303(d) Listing Report. ADEQ, Phoenix, Arizona


Page-Dumroese, Deborah S., Martin Jurgensen, and Thomas Terry. 2010. “Maintaining Soil Productivity during Forest or Biomass-to-Energy Thinning Harvests in the Western United States”. West. J. Appl. For. 25(1)


Appendix A. Regulatory Requirements

The Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4), also known as the Federal Clean Water Act (CWA): Provides the structure for regulating pollutant discharges to waters of the United States. The Act's objective is "...to restore and maintain the chemical, physical, and biological integrity of the Nation's waters," and is aimed at controlling point and non-point sources of pollution. The U.S. Environmental Protection Agency (EPA) administers the Act, but most permitting, administrative, and enforcement functions are delegated to State governments, which is the Department of Environmental Quality in Arizona (ADEQ).

Pertinent sections of the Clean Water Act:

- CWA Sections 208 and 319: recognize the need for control strategies for non-point source pollution.
- CWA Section 303(d): requires waterbodies with water quality determined to be either impaired (not fully meeting water quality standards) or threatened (likely to violate standards in the near future), to be compiled by ADEQ in a separate list which must be submitted to EPA biannually. These waters are targeted and scheduled for development of water quality improvement strategies on a priority basis.
- CWA Section 305(b): require that states assess the condition of their waters and produce a biannual report summarizing the findings.

Pertinent Executive Orders:

- Executive Order 11988 – Floodplain Management: Floodplains come under special considerations under Executive Order 11988. The purpose of the Order is "...to avoid to the extent possible the long and short term impacts associated with the occupancy and modification of floodplains..." Section 1 further states: "...to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains..."
- Executive Order 11990 - The Protection of Wetlands: Wetlands are protected under this order and directs federal agencies to "...minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands..." Section 5 also states: "In carrying out the activities described in Section 1 of this Order, each agency shall consider factors relevant to a proposal's effect on the survival and quality of the wetlands. Among these factors are: (a) public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion..."

Forest Service Manual Requirements:

- Forest Service Manual (FSM) guidelines describe the objectives and policies relevant to protection (and, where needed, improvement) of water quality on National Forest System lands so that designated beneficial uses are protected (FSM 2532.02 and 2532.03). Guidelines for data collection activities (inventory and monitoring) are described.
FSM 2554: The National Forest Management Act requires that lands be managed to ensure the maintenance and long-term soil productivity, soil hydrologic function, and ecosystem health. Soil quality is maintained when erosion, compaction, displacement, rutting, burning, and loss of organic matter are maintained within defined soil quality standards.

Apache-Sitgreaves National Forest Land and Resource Management Plan:

Management direction for riparian areas is stated: "Improve vegetation condition in riparian areas. Improvements will be accomplished by reducing, or in some cases, eliminating adverse impacts from grazing, vehicles, and over-use by man"(pg. 15).

"Maintain, or where needed, enhance soil productivity and watershed condition by 2020. Maintain a high quality sustained water yield for Forest users and others. Identify and protect wetlands and floodplains"(pg. 16).

Standards and guidelines state: "Ensure compliance with Public Law 92-500 "Federal Water Pollution Control Act" and amendments including the Clean Water Act of 1977. Implement Best Management Practices (BMPs) to prevent water quality degradation. Implement improvement action where water quality degradation does occur, except for special cases where temporary or short-term degradation is occurring from road crossing construction or similar situations" (pg. 81).

"Provide adequate drainage to prevent concentrated flow and sediment laden runoff from entering water courses" (pg. 81).

"Designate stream courses to receive protection during projects (e.g. timber sales, road work). Those streams shown on 7.5 minute quads as a stream course should be considered for designated stream courses" (pg. 81).

“Conserve soil and water resources; avoid permanent impairment of site productivity and ensure conservation of soil and water resources. The minimum soil and resource management requirement is to control surface water runoff and erosion at not less than tolerance conditions.” 36 CFR 218.23 and 27 (pg. 81).

"Maintain suitable filter/buffer strips between stream courses and disturbed areas and/or road locations to maintain water quality standards" (pg. 83).

"Improvements: Maintain and enhance riparian vegetation along streams to maintain suitable water temperature and other conditions for stream flow" (pg. 83).

"Erosion control measures will be included in road plans. Construct roads to keep sediment out of riparian and aquatic habitats" (pg. 104).

Management emphasis for riparian areas states: “Recognize the importance and distinctive value of riparian areas when implementing management activities. Give preferential consideration to riparian area dependent resources … Manage to maintain or improve riparian areas to satisfactory riparian condition… do not adversely affect riparian dependent resources" (pg. 155).

36 CFR 212.5 (b) Road System:

“...the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands”....“The minimum system is the road system determined to be needed to
meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR part 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.”

➢ Identification of unneeded roads. “Responsible officials must review the road system on each National Forest and Grassland and identify the roads on lands under Forest Service jurisdiction that are no longer needed to meet forest resource management objectives and that, therefore, should be decommissioned or considered for other uses, such as for trails...”
APPENDIX B

Hydrology and Soils

Stream Channels

- Stream channels to be protected will be shown on the project contract maps along with their associated Streamside Management Zones (SMZs), if applicable.
- SMZs shall be designated along intermittent and perennial stream channels and selected ephemeral channels as determined by an FS hydrologist prior to project implementation.
- Stream channels shall be crossed at designated crossings only and shall be pre-approved by the authorized Forest Service (FS) Officer in consultation with a Hydrologist.
- There shall be no skidding longitudinally within stream channels.
- There shall be no decking and machine piling of slash material within stream channels.
- Lead-out ditches or water-bars shall not be constructed in such a manner as to divert run-off into stream channels.
- Unless designated by the authorized FS Officer, debris generated from treatment activities will be removed from stream channels.
- Trees designated for removal shall be felled away the stream channel.
- Trees, in or on the banks of stream courses that are providing bank and stream channel stability shall not be removed. The authorized FS Officer will identify exceptions where restoration or additional thinning is needed for resource concerns.
- The authorized FS Officer will use their authority for skid trail and log landing location to protect stream courses that were not designated on the project contract map.
- Riparian areas and meadows designated for protection will also be delineated on the project area and contract maps. A smaller map of buffers is located in Appendix D. A GIS ArcMap of the buffers (Special_Management_Zones.mxd) can be found in the project record.

Streamside Management Zone (SMZ) Designation

SMZ width is based on the nature of resource values at risk (such as the presence of aquatic ESA species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative groundcover conditions, stream bank and riparian conditions, natural geologic features, and flow regime. SMZ widths shall be designated using the matrix in Appendix F as a guide:

For SMZs along perennial and intermittent streams;
- Directional falling of trees shall be away from the stream channel.
- Ground skidding, decking of logs and machine piling are permitted only on existing roadbeds that are located within SMZs.
- Road construction and burning of concentrated slash are prohibited within the SMZ.
- Stream channels to be protected within SMZs will be identified on watershed and project area contract maps.
- Stand prescriptions shall include a sketch of the SMZ location and width.
- Ground based harvest operations may be conducted in SMZs if at least 6 inches of snow cover over a minimum of 3 inches of frozen ground are present.
• Harvest operations will be suspended if these conditions are not met due to warm temperatures.

Special or Streamside management zone map is within the project record and in Appendix D and also includes buffers on wetlands and significant karst feature such as sinkholes.

**Drainage Bottoms** - The following are recommended BMPs for harvesting activities around ephemeral drainages, *whether designated on a map or not.*

a) No skidding will be allowed up or down ephemeral channels or in low points or swales.
b) No road construction will be allowed in or immediately adjacent to ephemeral streams except at designated crossings.
c) All skid trails crossing drainages will be designated and approved by the authorized FS officer prior to activity, and will be at right angles to stream banks.
d) Minimize the number of skid trail and road crossings across these channels.
e) Maintain an undisturbed filter strip of vegetation and litter between skid trails/log decks/roads and the channel wide enough to prevent sediment from entering the channel.
f) Construct water control features (waterbars, leadout ditches etc.) on these skid trails and roads.
g) Minimize the amount of logging debris deposited in ephemeral channels and remove excess debris by hand or end lining with one end suspension except where coarse woody debris is needed for stream health as identified by fisheries or watershed specialists.
h) Do not cut trees where the root system is important in maintaining the integrity of the bank, including but not limited to cutbanks and headcuts.
i) No log decks will be located within or immediately adjacent to the ephemeral streams or depressions.
j) The preferred method for extracting biomass using feller-buncher or grapple skidder equipment near ephemeral drainages (within 75 feet) will be to approach the material to be extracted on the contour as much as possible to the ephemeral drainage, cut or grapple biomass, then back equipment out as much as possible. This action will reduce ground disturbance by limiting the turning of equipment in or near the stream channels, and will retain as much of the filtering effect of undisturbed ground cover as possible. Slash can be placed to drive equipment over to reduce rutting and soil disturbance.
k) Outslope roads/skid trails to minimize concentration of water/sediment into streams closer than 50 feet to channel.
l) Place water control features so there is adequate filter distance between structure outlets and stream channel (minimum of 50 feet and width can increase as slope steepness increases).

**Upland Soil**

**Wetlands, Springs, Seeps, and Meadows**

• Wetlands, springs, seeps, and meadows will be protected from treatment activities and include a 50 ft. limited access buffer that excludes mechanized equipment. Treatments
may occur within these areas if specific restoration objectives are identified and approved by the FS Officer.

- Ground based harvest operations may only be conducted within 50 feet of wetlands, springs, and meadows if at least 6 inches of snow cover over a minimum of 3 inches of frozen ground are present.

**Limit the Operating Season**
- Ground disturbing activities (tractor skidding, decking and machine piling, etc.) shall be limited to dry or solidly frozen soil conditions.

**Log Landing Erosion Prevention and Control**
- Immediately after use, landings will be scarified to bare mineral soil to eliminate compaction.
  - Once scarified, log landings are to be reseeded with an erosion control seed mix consisting of certified weed free native species. Slash or chips will be scattered on landings to further retard formation of rills and gullies.
  - Slash or impound drainage outlets of landings to prevent direct deposition of sediment to waterways.

**Skid Trails**
- To minimize soil disturbance by equipment use, trees are to be felled to the lead and the authorized FS officer shall locate skid trails as far apart as possible to reduce the number of skid trails needed to harvest the unit.
  - Use existing skid trails where properly located.
  - Designate new skid trails throughout the project area to prevent long, straight skid trails from running up and down slopes.
  - Skidding or forwarding of logs will be with at least one end of the log suspended above the ground surface.
  - Skid trails will be water-barred, scarified and seeded with primarily native species as needed.
  - All berms and depressions such as ruts will be filled in or removed, restoring skid trails to the natural grade of the slope to the greatest extent possible.
  - Slash generated from the project may be spread in addition to water barring where conditions allow.

**Soil Productivity/Coarse Woody Debris**
- To maintain or improve soil productivity, manage towards having a minimum of:
  - 5-10 tons/acre of coarse woody debris (the 3” + size class) in pine-oak vegetation types
  - 7-14 tons/acre in pine vegetation types
  - 8-16 tons/acre in mixed conifer types.

**Machine Piling of Slash**
- Where slash is machine piled, minimize disturbance to existing ground cover, surface soil and rock material and any existing surface organic material (i.e. surface litter and duff and old semi-decomposed branches and logs).
  - Rough piling will also reduce impacts from equipment. Rough piling involves piling only large concentrations of slash, leaving areas of low concentration undisturbed.
• Machine pile when soils are dry or solidly frozen.

Prescribed Burning

• For the retention of long term soil productivity, to maintain the sediment filtering capacity of streamside management zones, and to reduce erosion, burning is allowed at low to moderate burn intensities.
• Machine constructed (i.e. dozer) control lines shall not be constructed on slopes greater than 40% or within SMZ's. Exceptions will be identified by the authorized FS Officer and specific mitigations will be determined at that time.

Roads

Maintenance of Roads

• Existing and newly constructed roads are maintained throughout the life of the project to insure that drainage structures (culverts, rock crossings, rolling dips, etc.) are functioning correctly, and that concentrated surface run-off does not occur.
• Drainage control structures will receive maintenance prior to winter shutdown of project operations.

Long Term Road Closures

• Closed roads (ML 1) will be disguised or blocked reseed with an erosion control seed mix of primarily native species and lightly scarified.
• Road berms located lateral to the roadbed will be removed and ruts will be filled in.
• Water-bars of enough size to either remove the water from the road or with enough storage to prevent run-off from returning to the road will be installed.
• All connected disturbed areas (CDA): high runoff areas like roads, skid trails, mines, burns, or highly compacted soils that drain directly into the stream system will be disconnected from stream systems.
• Where necessary, scarify, reseed and camouflage the road entrance with rocks and slash to improve the road closure.
• Wing fence construction may be necessary in some cases to effectively prevent new resource damage from vehicles attempting to drive around closures.

Karst Features

Karst processes - that is, the process by which water dissolving away soluble rock such as limestone - create karst topography, an area typified by sinkholes, underground streams, caves, and springs. Local and regional hydrological systems resulting from karst processes can be directly influenced by surface and sub-surface land use practices. Karst terrain is an important feature of groundwater movement and recharge. Karst terrain will be managed to assure that water quality, spring flow, drainage patterns and caves are not significantly altered.

• Karst features such as prominent sinkholes and entrances to significant caves (as defined by the Federal Cave Resource Protection Act of 1988) have been given site-specific
SMZ’s and may have limited access buffered zones within the LFRP of up to 75 feet that excludes mechanical entry/treatment.
Appendix C. Soil and Water Monitoring Plan for Larson


Conduct Implementation and Effectiveness Monitoring for Best Management Practices. The Contract Administrators Representative will use the BMP implementation form provided by Watershed Staff to monitoring BMP implementation. These forms will be reviewed annually to verify BMP implementation. Implementation review and selection of effectiveness monitoring sites will be accomplished as a part of either the annual TSO review of Contracting Officers Representative, Sale Administrators or during a District Activity Review. Utilize forms provided for BMP Implementation and Effectiveness Monitoring. See "Best Management Practices Effectiveness Program Procedures" for site selection and detailed monitoring procedures. Results of BMP monitoring will be forwarded to ADEQ in the Annual Assessment of Water Quality Accomplishment Report to be completed by the Supervisor's Office due in September of each year.

The desired result of BMP monitoring is to document forest practices and BMPs that appear effective in reducing sediment and moderating flow regimes in forest streams. BMPs that are found to be ineffective in protecting identified resource, aquatic and water quality goals will be adjusted. Poor performance in BMP implementation will be documented and forwarded to District for corrective action.

B. Soil Disturbance Monitoring

Conduct Soil Disturbance Monitoring on selected cutting units (Forest sampling strategy is To Be Determined). Soil bulk density information will also be collected and compared to disturbance classes to add to forests’ knowledge of the correlation of soil disturbance class and soil condition. Soil Disturbance Classes and sampling protocols are described in “Forest Soil Disturbance Monitoring Protocol” (Page-Dumroese, et.al. 2009). Soil condition classes are described in FSH 2509.18 R3 Supplement.

The desired result of Soil Disturbance Monitoring is to determine if forest practices may be reducing long term soil productivity through modification of soil function through compaction, displacement or loss of soils.
Appendix D. Working SMZ Buffer Map for Larson
Appendix F. Streamside Management Zone Guidelines Used in Developing Special Management Zone Buffer Map for Larson

i. Stream Reach Classification

Class I Stream Reaches
a) Upstream of municipal water supply intakes from surface waters or springs which might be contaminated by runoff from treatment areas.
b) Containing occupied habitat, critical habitat or habitat specified in recovery plans for species recovery for listed aquatic ESA species.
c) Identified in the most recent ADEQ 305(b) report as a “Unique Water”
d) Identified in the most recent ADEQ 303(d) List of Impaired Waters (where the parameter of impairment may be associated with land management activities)

Class II Stream Reaches
a) perennial and intermittent tributaries to Class I reaches
b) containing fish species other than ESA listed species

Class III Stream Reaches
All other reaches

Stream reach classification will be determined in a consistent manner across the Forest on a watershed wide basis by watershed and fisheries personnel. Timing of classification will depend initially on the scheduling of projects requiring implementation of streamside management zone BMPs and will likely be accomplished through the project planning process. Unless changes occur in State water quality designations or in identification of ESA species habitat, these classifications will be used in guiding BMP applications in Streamside Management Zones for future projects in the watershed.

RATIONAL

This classification scheme developed by the Forest is intended to achieve water quality conditions needed to meet land and natural resource management objectives in the A-SNF Forest Plan. The classification scheme is also designed to meet the requirements of the State of Arizona’s Antidegradation Rule found at A.A.C. 18-11-107 and federal antidegradation policy fount at 40 CFR 131.12., and application described in the Antidegradation Implementation Procedures (ADEQ 2004). Under the Clean Water Act and Arizona’s surface water quality standards rules, existing uses are recognized and designated uses are assigned to surface waters. Federal and state law requires that surface waters be protected from discharges that might degrade water quality. To implement this requirement, the State of Arizona has identified an antidegradation protection level, or tier, appropriate for each surface water.

All “unique” streams require tier 3 anti-degradation protection (“prohibits lowering of water quality”) and are contained within the Class I category. Some other Class I streams could potentially qualify for tier 3 anti-degradation protection because of the presence of or planned use for recovery of threatened or endangered aquatic species, (a criteria used to establish unique
waters). Other Class I streams would qualify for tier 1 ("prohibits further degradation") when water quality does not currently meet appropriate state standards. These impairments are related to parameters that could be influenced by land and resource management activities on the National Forest.

Class II streams in the Forest classification have the potential to directly impact streams provided tier 3 anti-degradation protection or have designated (or potentially designated) uses (fisheries) requiring an elevated measure of water quality protection. Class III streams generally have designated uses requiring a lower measure of water quality protection and would fall into either a State designated tier 1 or tier 2 protection levels depending on their flow regimes.

The following are excerpts from the Antidegradation Implementation Procedures (ADEQ 2004).

"The tiered protection levels are applied as follows:

**Tier 1** – Applies to all surface waters as a minimum level of protection, and requires that the level of water quality necessary to protect existing uses be maintained and protected. ADEQ interprets Tier 1 as requiring that water quality standards be achieved; Tier 1 prohibits further degradation of existing water quality where parameters of concern do not meet applicable water quality standards. Tier 1 applies as the default protection level for intermittent waters, ephemeral waters, effluent dependent waters, canals, and impaired waters on the §303(d) list for the parameters that resulted in the surface water being listed on the §303(d) list.

**Tier 2** – Applies to high quality, perennial surface waters, i.e., where existing water quality is better than applicable water quality standards. Tier 2 requires that existing high water quality be maintained, but allows limited degradation. Tier 2 prohibits significant degradation unless a review of reasonable alternatives and social and economic considerations justifies a lowering of water quality. Tier 2 is the default protection level for all perennial waters.

**Tier 3** – Applies to unique waters as identified under R18-11-112. Tier 3 prohibits any lowering of water quality in a unique water unless it is short-term, as determined by ADEQ on a case-by-case basis.

Where a perennial surface water is listed on the state’s §303(d) impaired waters list for one or more parameters, and where existing water quality for other parameters is better than water quality standards, the surface water will be afforded Tier 1 and Tier 2 protection on a parameter-by-parameter basis. That is, Tier 1 protection for the parameters not meeting water quality standards and Tier 2 protection for parameters that are equal to or better than water quality standards. Tier 3 protection will be afforded to all parameters on a unique water. Where a perennial waterbody has not been listed as an impaired water or as a unique water, the presumed antidegradation protection level is Tier 2 for all parameters of concern.
DEFINITIONS:

Antidegradation: A statutory policy and implementation procedure adopted by regulatory authorities to protect existing waterbody uses and prevent water quality from deteriorating unless some defined public benefit is realized from lowering water quality and a minimum level of waterbody protection is maintained.

Designated Use: A use of a surface water specified by ADEQ, including those categories specified in R18-11-104. Designated uses include domestic water source, full-body contact recreation, partial body contact recreation, fish consumption, aquatic and wildlife (cold water), aquatic and wildlife (warm water), aquatic and wildlife (ephemeral), aquatic and wildlife (effluent dependent waters), agricultural irrigation, and agricultural livestock watering. Designated uses are accompanied by established water quality criteria that describe numeric or narrative benchmarks designed to ensure that the designated uses are achievable. Designated uses are adopted or removed by rule, and are subject to numeric and narrative water quality standards prescribed by the rule. If a surface water has more than one designated use, the most stringent water quality criterion applies.

Ephemeral Water: A surface water that has a channel that is at all times above the water table and that flows only in direct response to precipitation.

Intermittent Surface Water: Surface water, which, at times of the year, receives water from a spring or from another source such as melting snow.

Perennial Surface Water: A surface water that flows continuously throughout the year.

Significant Degradation: The consumption of 10 percent or more of a waterbody’s available assimilative capacity for any pollutant or parameter.

Temporary Degradation: Degradation that is six months or less in duration, i.e., water quality returns to baseline water quality within six months after the project commences; short-term degradation.

Unique Water: A surface water that is classified as an outstanding state resource water by ADEQ under R18-11-112.

NONPOINT SOURCE COVERAGE

Nonpoint source discharges (NPS) are not exempt from antidegradation requirements. 40 CFR §131.12(a)(2) clearly requires imposition of appropriate NPS controls to maintain and protect existing water quality for Tier 2 protection. Also, degradation of a Tier 2 surface water is conditioned upon an ADEQ determination that allowing lower water quality is necessary to accommodate important economic or social development in the area.
In March 1994, US EPA transmitted guidance regarding nonpoint sources and the antidegradation provisions of the Water Quality Standards, with clarifying remarks for antidegradation implementation. US EPA’s regulatory interpretation of 40 CFR §131.12(a)(2) is that it does not require ADEQ to establish best management practices (BMPs) for nonpoint sources where regulatory programs requiring BMPs do not exist. The Clean Water Act leaves it to the states to determine what, if any, controls on nonpoint sources are needed to provide for attainment of state water quality standards. States may adopt enforceable requirements or voluntary programs to address nonpoint sources of pollution. 40 CFR §131.12(a)(2) does not require that states adopt or implement best management practices for nonpoint sources prior to allowing point source degradation of high quality water. However, where a state has adopted nonpoint source controls, the state must assure that such controls are properly implemented before authorization is granted to allow degradation of water quality. US EPA also interprets 40 CFR §131.12(a) as prohibiting degradation as unnecessary to accommodate important economic and social development if it could be partially, or completely, prevented through implementation of existing state-required BMPs.

Pursuant to this guidance, nonpoint sources of water pollution are addressed by the Arizona antidegradation policy and implementation procedures, particularly where those sources are subject to permitting or otherwise regulated. To ensure compliance, nonpoint source discharges must demonstrate that cost-effective and reasonable BMPs have been appropriately selected, installed, and maintained.

Generally, if nonpoint source activities comply with the conditions or BMPs noted in their respective individual or general permit, they are presumed to meet antidegradation requirements and no detailed antidegradation review is required. For example, if a county requires erosion and sediment controls for construction sites of less than one acre, activities regulated by this policy will be deemed to be in compliance with antidegradation provisions if prescribed erosion and sediment controls are implemented and maintained. The level of antidegradation review required will depend upon the uses of the water segment that would be affected, the level of protection (i.e., tier) assigned to the applicable water segment and/or parameter of concern, the nature of the activity, and the extent to which water quality would be degraded.

COORDINATION WITH 305(B) ASSESSMENT AND 303(D) LISTING

§305(b) of the Clean Water Act requires each state to prepare and submit to U.S. Environmental Protection Agency (US EPA) a biennial report describing water quality of all surface waters in the state. Each state must monitor water quality and review available data to determine if water quality standards are being met. From the § 305(b) report, the §303(d) list is created which identifies surface waters that do not meet water quality standards. These waters are known as water quality limited waters or impaired waters. Identification of a surface water as impaired may be based on an exceedance of a numeric or narrative water quality standard.
UNIQUE WATERS RULE:

A.A.C. R18-11-112 prescribes the process for classifying unique waters. Any person may nominate a surface water to be afforded Tier 3 level of protection by filing a nomination with ADEQ. ADEQ considers nominations during the triennial review of surface water quality standards. The nominating party has the burden of establishing the basis for classifying the waterbody as unique water. The nomination shall include a map and description of the surface water; a statement in support of the nomination, including specific reference to the applicable criteria for unique water classification; supporting evidence that the applicable criteria are met; and available, relevant water quality data for establishing baseline water quality. ADEQ may classify a surface water as a unique water based on the following criteria: The surface water is a perennial water and is in a free-flowing condition; The surface water has good water quality. For the purposes of this regulation, “good water quality” means that the surface water has water quality that meets or exceeds applicable water quality standards; and The surface water meets one or both of the following conditions: (a) is of exceptional recreational or ecological significance because of its unique attributes; (b) threatened or endangered species are known to be associated with the surface water or the surface water provides critical habitat for a threatened or endangered species.”

ii. Guidance to Application of Streamside Management Zone BMP

1. Apply the following direction if SMZ is within ½ mile of private land boundary of designated WUI.

Treatment measures necessary to reduce the risk of wildfire encroachment on adjacent private lands will take priority over other considerations in these SMZs. Entry and treatments in these reaches will be considered on a case by case basis by ID teams to assure that the fire management objectives and water quality objectives for these reaches are appropriately balanced. Where fire management objectives can be met within the recommendations contained in the matrix for SMZ BMP applications, those recommendations shall be followed. Otherwise, restrictions shall be modified to allow for activities necessary to reduce the risk of loss of life and damage to private property. Particularly in Class I SMZs, all measures identified to protect water quality and stream bank and channel integrity that do not preclude the attainment of fire risk management objectives shall be employed.

Activities described in this guidance are permitted within the language of the State of Arizona Antidegradation rule. Approval of the Arizona Department of Environmental Quality is necessary when activities occur within 303(d) listed impaired or State designated “Unique” waters.

iii. Ephemeral Drainages Best Management Practices

See Appendix B.
D. Stream (Aquatic) Management Zones - Class I, II and III

<table>
<thead>
<tr>
<th>Class I Stream</th>
<th>Steep 40+</th>
<th>Moderate 16-40%</th>
<th>Slight 0-15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Upstream of municipal water supply intakes; 2. Containing occupied habitat, critical habitat or habitat specified in recovery plans for listed aquatic ESA species; 3. Identified in the most recent ADEQ 305(b) report as an “Outstanding Arizona Water”; 4. Identified in the most recent ADEQ 303(d) List of Impaired Waters</td>
<td>Severe Erosion Hazard</td>
<td>Moderate and Severe Erosion Hazard</td>
<td>Slight Erosion Hazard</td>
</tr>
<tr>
<td>Perennial/Intermittant</td>
<td>300' no mechanical access filter strip on both sides of stream <em>; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire after recovery of treatment area above filter</em>*, 5% of filter with high severity burn allowed</td>
<td>200' no mechanical access filter strip on both sides of stream <em>; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire after recovery of treatment area above filter</em>*, 5% of filter with high severity burn allowed</td>
<td>100' no mechanical access filter strip on both sides of stream <em>; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire after recovery of treatment area above filter</em>*, 5% of filter with high severity burn allowed</td>
</tr>
<tr>
<td>Ephemeral drainages directly tributary to above reaches</td>
<td>100' no mechanical access filter strip on both sides of channel; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire with no more than 10% of filter with high severity burn allowed</td>
<td>75’ no mechanical access filter strip on both sides of channel; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire with no more than 10% of filter with high severity burn allowed</td>
<td>75’ no mechanical access filter strip on both sides of channel; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire with no more than 10% of filter with high severity burn allowed</td>
</tr>
</tbody>
</table>

* If riparian vegetation extends beyond the filter strip, an ID team will evaluate the nature of practices to be applied to the riparian area beyond the filter strip needed to protect the riparian ecosystem
** Ground cover objectives will be met in areas upslope of SMZ prior to low soil burn severity fire within the SMZ
## CLASS II REACHES

### Steep 40+ (Severe Erosion Hazard)

1. perennial and intermittent tributaries to Class I reaches; 2. containing fish species other than ESA listed species

- Highly Erodible Soils (primarily Datil soils) (TEU Units 130, 131, 140,141,570,536)

### Moderate 16-40% (Moderate to Severe Erosion Hazard)

- Moderate 16-40% (Moderate to Severe Erosion Hazard) No Highly Erodible Soils

### Slight 0-15% (Slight Erosion Hazard)

- Slight 0-15% (Slight Erosion Hazard)

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<table>
<thead>
<tr>
<th>Perennial/Intermittant</th>
<th>150’ no mechanical access filter strip on both sides of stream <strong>; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire after recovery of treatment area above filter</strong>, 5% of filter with high severity burn allowed</th>
<th>150’ filter strip on both sides of stream <strong>; apply Limited Mechanical Access concept beyond 75’ from stream, within 75’ of stream no mechanical access; hand felling, hand piling, and hand slash treatment allowed; 150’ setback of machine piles and new roads; low intensity prescribed fire after recovery of treatment area above filter</strong>, 10% of filter with high severity burn allowed</th>
<th>75’ no mechanical access filter strip on both sides of stream <strong>; hand felling, hand piling, and hand slash treatment allowed; 100’ setback of machine piles; low intensity prescribed fire after recovery of treatment area above filter</strong>, 10% of filter with high severity burn allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephemeral drainages directly tributary to above reaches</td>
<td>75’ filter strip on both sides of channel, apply Limited Mechanical Access concept if feasible</td>
<td>Utilize Ephemeral BMP within 75’ of channel</td>
<td>Utilize Ephemeral BMP within 75’ of channel</td>
</tr>
</tbody>
</table>

* If riparian vegetation extends beyond the filter strip, an ID team will evaluate the nature of practises to be applied to the riparian area beyond the filter strip needed to protect the riparian ecosystem
<table>
<thead>
<tr>
<th>CLASS III REACHES</th>
<th>Steep 40+ (Severe Erosion Hazard)</th>
<th>Moderate 16-40% (Moderate to Severe Erosion Hazard)</th>
<th>Slight 0-15% (Slight Erosion Hazard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. perennial and intermittent tributaries to Class I reaches;</td>
<td>Highly Erodible Soils (primarily Datil soils) (TEU Units 130, 131, 140,141,570,536)</td>
<td>Moderate 16-40% (Moderate to Severe Erosion Hazard) No Highly Erodible Soils</td>
<td>Slight 0-15% (Slight Erosion Hazard)</td>
</tr>
<tr>
<td>2. containing fish species other than ESA listed species</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perennial/Intermittant</td>
<td>75' no mechanical access filter strip on both sides of stream <em>; hand felling, hand piling, and hand slash treatment allowed; low intensity prescribed fire after recovery of treatment area above filter</em>*, 5% of filter with high severity burn allowed</td>
<td>75' filter strip on both sides of stream *; apply Limited Mechanical Access concept</td>
<td>75' filter strip on both sides of stream *, apply Limited Mechanical Access concept</td>
</tr>
<tr>
<td>Ephemeral drainages directly tributary to above reaches</td>
<td>Utilize Ephemeral BMP within 50' of channel</td>
<td>Utilize Ephemeral BMP within 50' of channel</td>
<td>Utilize Ephemeral BMP within 25' of channel</td>
</tr>
</tbody>
</table>

* If riparian vegetation extends beyond the filter strip, an ID team will evaluate the nature of practises to be applied to the riparian area beyond the filter strip needed to protect the riparian ecosystem.