

3.13 WATER QUALITY AND WATERSHED HEALTH

3.13.1 Summary

All action alternatives have the potential to directly benefit water quality and watershed health within the Project Area through road decommissioning and stream crossing removals. Alternative 4 would have more potential overall to benefit water quality and watershed health.

3.13.2 Introduction

Three indicators (miles of new road construction, number of stream crossings, and proportion of upland open and upland young forest within each watershed) related to water quality and watershed health will be addressed in the analysis of effects of four alternatives associated with the Echo Trail Area Forest Management Project. These indicators measure the potential direct, indirect, and cumulative effects to water quality and watershed health at both the site specific and watershed-scale.

Miles of New (including New Temporary and New Temporary Winter) Road Construction

New road construction, including new temporary and new temporary winter roads, may affect water quality and watershed health within the Echo Trail Area Forest Management Project unless properly designed and mitigated during project implementation. Potential effects of new road construction include soil and vegetation disturbances, increased erosion, surface runoff, and sedimentation. New road construction adjacent to both flowing and non-flowing streams, wetlands, and lakes may also affect riparian function, aquatic habitat, as well as migration and movement of aquatic organisms. Potential effects to hydrologic processes, aquatic habitat, and soil displacement from roads and trails are discussed thoroughly in the Superior National Forest Land and Resource Management Plan FEIS pages 3.6-11-12 (USDA Forest Service 2004d). Because of these potential effects, this indicator is very useful for evaluating effects to water quality and watershed health within the Echo Trail Area Forest Management Project.

Number of Stream Crossings in the Project Area

Road and stream interactions, including stream crossings and associated culvert and bridge structures may affect water quality and watershed health within the Echo Trail Area Forest Management Project if not properly designed, constructed, or decommissioned properly. Potential effects of stream interactions to water quality include increased point source erosion, increased sedimentation, and disturbance and/or removal of riparian vegetation. Potential effects to watershed and stream flow conditions include unnaturally confined stream channels with increased flows, reduced stream flood flow capacity, and reduced floodplain function during high flow events. Potential effects to aquatic organisms include reduced egg and juvenile survival resulting from point source sedimentation, degraded instream and riparian habitat, fish migration barriers, and loss of stream connectivity. A thorough review of potential effects from roads, trails, and stream crossings is contained in the Superior National Forest Land and Resource Management Plan FEIS pages 3.6.11-12 (USDA Forest Service 2004d). Because of these potential effects, the number of stream crossings associated with each alternative is a useful indicator for evaluating potential effects to water quality and watershed health within the Echo Trail Area Forest Management Project.

Proportion of Upland Open and Upland Young Forest Within Each Watershed

Indicator 3 is a cumulative effects indicator that represents the proportion of each sixth level watershed within the Project Area that is composed of upland open and upland young forest condition. The proportion

of upland open and upland young forest in each 6-level (12 digit) hydrologic unit code (HUC) watershed has been shown to influence peak stream flows which can potentially reshape stream channels, increase erosion, and decrease biological integrity (Verry 2000). This indicator is useful for evaluating cumulative effects because it reflects past, existing, and proposed vegetative management activities that have or could potentially increase the proportion of upland open and/or upland young forest in watersheds within or intersecting the Echo Trail Area Forest Management Project.

Results from a review and analysis of both existing watershed forest conditions as well as those conditions that would result from implementing the action alternatives indicated that there were no watersheds that currently exceed or would exceed the 60 percent upland open and upland young threshold value. This further indicates that existing as well as potential watershed forest conditions resulting from implementing any of the action alternatives would not contribute to peak stream flows that could potentially reshape stream channels, increase erosion, and decrease biological integrity as suggested by Verry (2000). A more detailed discussion of this cumulative effects analysis indicator is located in the Cumulative Effects Section.

3.13.3 Analysis Methods

Each indicator is used to evaluate existing conditions as well as those conditions that would result from implementing the action alternatives. Indicator 1 relates to the total miles of new (including new temporary and new temporary winter road construction within the Project Area). Indicator 2 relates to the total number of stream crossings within the Project Area. A more detailed discussion of the analysis for Indicator 3 is included in the Cumulative Effects Section.

Indicator 1: Miles of new (including new temporary and new temporary winter) road construction

Indicator 1 assesses the miles of new road construction, including both new temporary and new temporary winter roads that are proposed within the Project Area for each alternative. This indicator does a good job of highlighting the differences among alternatives because it is reflective of potential soil disturbances, erosion, point source sediment input into local streams as well as a measure of potential change to watershed, riparian, stream, and wetland hydrologic functions.

Indicator 2: Number of stream crossings

Indicator 2 assesses the total number of stream crossings resulting from either decommissioning and/or new temporary road construction that are proposed within the Project Area for each alternative. This indicator does a good job of highlighting differences among alternatives because it represents the potential effects to instream and riparian habitats, potential erosion and point source sediment input at stream crossing sites, as well as potential effects to stream flow, flood flow capacity, and sediment transport. Additionally, this indicator is very useful for determining potential effects to aquatic organism passage and stream connectivity.

3.13.4 Analysis Area

The analysis area for Indicator 1 (miles of new (including new temporary and new temporary winter) road construction) and Indicator 2 (number of stream crossings) includes all route types within the Project Area including classified roads, temporary roads, non-jurisdictional roads, unclassified roads, unauthorized motorized trails, decommissioned roads, and special use authorizations.

The analysis area for cumulative effects indicator 3 (proportion of upland open and upland young forest within each watershed) includes all 6th level watersheds that occur within or intersect the Echo Trail Area Forest Management Project. This analysis includes all ownerships within the Project Area.

The indicator was chosen for the analysis because potential effects associated with each alternative should be evident at the watershed scale. This indicator and current condition information was also used during the 2004 Forest Plan revision and analysis process (USDA Forest Service 2004d, USDA Forest Service 2004b). Existing condition information used for both analyses is currently the most reliable information available.

The above analysis area will be used for direct, indirect, and cumulative effects for each relevant indicator. The timescale selected for all indicators is 25 years because effects from road construction, stream crossings, and vegetative management may be observable for many years following the initial impact of a particular activity.

3.13.5 Affected Environment

Indicator 1

There are currently 416 miles of existing classified roads, temporary roads, non-jurisdictional roads, unclassified roads, and special use roads within the Echo Trail Area Forest Management Project (Table 3.13-1). Existing roads and routes have been and are currently maintained at various levels for different uses and transportation needs as a result of historical or more recent road management decisions. Unauthorized use of existing roads and routes as well as associated negative impacts to soils, water, and wildlife has also increased recently within the Project Area as well as throughout the Forest.

Indicator 2

There are currently 233 stream crossings within the Echo Trail Area Forest Management Project (Table 3.13-2 and Table 3.13-3). Most stream crossings occur on classified all season, seasonal, and winter roads, non-jurisdictional drivable roads, and system trails.

The existing condition of stream crossings is variable throughout the Echo Trail Area Forest Management Project. Recent stream crossing inventories on the Superior National Forest indicate that it will be necessary to continue inventorying and improving the existing road transportation system and associated stream crossings for several years. Some stream crossings continue to contribute point source sediment into local streams. These same crossings and others are unnaturally confining stream channels, reducing stream flood flow capacity, and inhibiting sediment transport. Some crossings may also be restricting aquatic organism passage as a result of increased flows and/or perched culvert outlets. It is anticipated that future stream crossing inventories will continue to identify stream crossing concerns and assist with prioritizing stream crossing habitat improvement and restoration projects.

Table 3.13-1. Miles of Existing and Proposed Roads¹				
Road/Route Type	Alt. 1	Alt. 2	Alt. 3 Mod	Alt. 4
Classified Roads				
Classified State, County, Twp (public roads)	62	62	62	62
Classified Seasonal State Forest Roads	4	4	4	4
Classified All Season OML 5 (NFS)	0.04	0.04	0.04	0.04
Classified All Season OML 4 (NFS)	24	24	24	24
Classified All Season OML 3 (NFS)	24	24	24	24
Classified Seasonal OML 2 (NFS)	65	56	56	56
Classified Seasonal OML 1 (NFS)	42	46	46	46
Classified Winter OML 1 (NFS)	99	94	94	94
Total Miles	321	310	310	310
Temporary Roads				
Temporary on Existing Road	0	2	2	2
Temporary New Road	0	17	17	15
Temporary Winter on Existing Road	0	15	14	14
Temporary New Winter Road	0	56	41	36
Total Miles	0	90	74	67
Non-Jurisdictional Roads				
Non-Jurisdictional Drivable Roads	22	23	23	23
Non-Jurisdictional Motorized Trails	18	17	17	17
Total Miles	40	40	40	40
Unclassified Roads				
	39	13	13	13
Total Miles	39	13	13	13
Decommissioned Roads				
Roads Removed from system, no work required		11	11	11
Miles of Road for Decommissioning	0	23	24	23
Total Miles	0	34	35	34
Special Use (SU) Authorizations				
Special Use Long-Term Trail Authorization	9	8	8	8
Special Use Long-Term Road Authorization	7	7	7	7
Special Use Short-Term Road Authorization	0.4	3	3	3
New Const. Special Use Road Authorization	0	3	3	3
Total Miles	16	21	21	21
Total Miles new SU Road Auth. Short Term (Temporary Roads)	0	6	6	6

¹ The existing condition of the transportation system is displayed under Alternative 1. If Alternative 1 is chosen for implementation, no changes to the transportation system would occur. Alternatives 2, 3 Modified, and 4 propose changes to the transportation system.

² "Miles of Road Proposed for Decommissioning" includes system and unclassified roads as well as user developed ATV trails (Dan Hernesmaa, per. Comm.. Feb 3, 2006).

Road/Route Type	Alt. 1	Alt. 2	Alt. 3 Mod	Alt. 4
Permanent and Seasonal Crossings				
Classified All Season Roads	61	61	61	61
Classified Seasonal Roads	45	42	42	42
Classified Winter Roads	48	48	48	48
Non-Jurisdictional Drivable	13	15	15	15
Special Use Road (Long Term)	2	2	2	2
Special Use Non-Federal Rd. Portion (Long Term)	5	5	5	5
Special Use Trail Authorization	5	5	5	5
System Trails ¹	44	44	44	44
Unclassified Roads with ATV Use	10	7	7	7
Total	233	229	229	229
Short Term Special Uses				
Special Use Seasonal Road	0	2	2	2
Special Use Seasonal Road Decommissioned	0	2	2	2
Special Use Winter Road	0	1	1	1
Special Use Winter Road Non-Federal Road Portion	0	5	5	5
Permanent Stream Crossings				
Seasonal System Road Crossings Decommissioned	0	0	0	0
Unclassified Road Crossings Decommissioned	0	2	2	2
Federal Temporary Road Stream Crossing				
New Temporary Seasonal Road Crossings Constructed	0	3	4	3
New Temp Seasonal Road Crossings Decommissioned	0	3	4	3
Temporary Winter Roads	0	40	35	25

¹ Includes motorized and non-motorized trails and portages.

Road/Route Type	Alt. 1	Alt. 2	Alt. 3 Mod	Alt. 4
Special Use Seasonal Roads	0	2	2	2
Special Use Winter Roads	0	1	1	1
Unclassified Roads	0	2	2	2
New Temporary Seasonal Roads	0	3	4	3
Temporary Winter Roads	0	40	35	25
Total	0	48	45	33

¹ Includes the following under the control of the Forest Service- winter and seasonal temporary and special use temporary, unclassified, and permanent seasonal and winter roads.

3.13.6 Environmental Consequences

3.13.6.1 Direct and Indirect Effects

This section evaluates the potential impacts of Alternatives 1-4 to water quality and watershed health within the Echo Trail Area Forest Management Project. Direct and indirect effects would vary among alternatives depending upon: 1) the total miles of proposed new temporary and new temporary winter roads constructed, and 2) the number of permanent and temporary stream crossings decommissioned or constructed.

All alternatives would follow applicable Minnesota Forest Resources Council (MFRC) Voluntary Site-Level Forest Management Guidelines (MFRC 2005) as well as required design features and mitigation measures contained in this EIS (Appendix A). All Forest-wide desired conditions, objectives, standards and guidelines contained in the Superior National Forest Land and Resource Management Plan (USDA Forest Service 2004b) would also be followed during project implementation. Relevant Forest Plan desired conditions, objectives, standards and guidelines include, but are not limited to those established for: 1) Watershed Health, Riparian Areas, and Soil Resources, 2) Terrestrial and Aquatic Wildlife; and 3) Transportation System (USDA Forest Service 2004b).

Alternative 1 (No-action)

Indicator 1

Alternative 1 would maintain the existing road transportation system within the Echo Trail Area Forest Management Project. No new temporary or new temporary winter roads would be constructed. No road decommissioning would occur. As a result, there would be no potential improvements to existing water quality and watershed conditions from road decommissioning activities. Continued use of unclassified roads by off-road vehicles, including ATVs and OHVs, would continue to potentially contribute sediment into local streams and impact both instream and riparian habitat conditions. Overall, Alternative 1 has a higher potential to negatively affect water quality and watershed conditions than the other alternatives because it does not decrease total road miles within the Project Area and does not improve water quality and watershed conditions as a result of road decommissioning.

Indicator 2

Alternative 1 would maintain all existing stream crossings within the Echo Trail Area Forest Management Project. No temporary road stream crossings would be constructed. As a result, there would be no increased potential for sediment input at new stream crossing sites or a potential reduction in aquatic organism passage. Poorly designed, inadequate or unnecessary stream crossings would not be removed or decommissioned under Alternative 1. Stream crossings associated with user developed ATV trails, non-jurisdictional roads, and unclassified roads would not be closed or removed through administrative decisions and/or road/trail decommissioning. As a result, improvement of watershed conditions and reduction in sediment sources at existing stream crossing sites would not occur. There would also be no potential improvement to aquatic organism passage resulting from stream crossing removal or restoration projects. Continued use of unauthorized stream and wetland crossings on user developed ATV trails, non-jurisdictional roads, and unclassified roads by off-road vehicles, including ATVs and OHVs, would continue to potentially contribute sediment into local streams and impact both instream and riparian habitat conditions. Overall, Alternative 1 has the greatest potential to negatively affect water quality and watershed conditions because it does not reduce the total number of road stream crossings in the Project Area through decommissioning unclassified roads.

Direct and Indirect Effects Common to All Action Alternatives (Alternatives 2, 3 Modified, and 4)

Alternatives 2, 3 Modified, and 4 propose various levels of new temporary and new temporary winter road construction, temporary road stream crossing construction and decommissioning, as well as removal of permanent road stream crossings. The effects below will vary by alternative depending upon the proposed activities.

Indicator 1

Alternatives 2, 3 Modified and 4 each propose increasing the number of new temporary and new temporary winter road miles within the project area. Depending upon the alternative and miles of new temporary road, the construction and use of these roads has the potential to increase short-term soil disturbances, soil erosion, and point source sediment inputs into local streams. Under all alternatives, newly constructed temporary roads would be decommissioned after all use is completed (USDA Forest Service 2004b; Dan Hernesmaa per. comm. Feb 3, 2006).

There are few, if any anticipated negative effects from proposed new temporary winter roads provided that they are designed, constructed, and used following appropriate design criteria and mitigation measures. Typically, these roads are specifically designed to reduce impacts to soils, streams, and wetlands by providing over-the-snow or ice travel for logging equipment during the winter. There may be some short-term disturbances to riparian vegetation that is not protected by snow. Negative impacts to water quality and watershed conditions are not anticipated provided that use is restricted to “frozen” conditions.

Alternatives 2, 3 Modified, and 4 also include decommissioning existing system, unclassified, and temporary use roads. Road decommissioning will render each road unusable by motorized vehicles, remove stream crossings and fill from flood prone and wetland areas, and require revegetating exposed soil surfaces (USDA Forest Service 2004b). Depending upon the alternative and number of system road miles decommissioned, this activity has the potential to improve existing water quality and watershed conditions by reducing total road surface area, potential surface erosion and run-off, as well as sediment input into local streams, lakes, and wetlands. Benefits of stream crossing removal associated with road decommissioning will be discussed below.

Indicator 2

Alternatives 2, 3 Modified, and 4 each propose to construct stream crossings associated with special use, new temporary, and new temporary winter roads within the Project Area. Under all alternatives, newly constructed temporary roads and associated stream crossings would be decommissioned after all use is completed (USDA Forest Service 2004b; Dan Hernesmaa per. comm. Feb 3, 2006). Although temporary road stream crossings will be decommissioned after all use is completed, there may be some short-term negative effects resulting from point source erosion, sediment input, and stream flow manipulation if these structures are not designed and constructed properly.

There are few, if any anticipated negative effects from proposed new temporary winter road stream crossings provided that they are designed, constructed, and used following appropriate design criteria and mitigation measures. Typically, these roads and stream crossings are specifically designed to reduce impacts to soils, streams, and wetlands by providing over-the-snow or ice travel for logging equipment during the winter. There may be some short-term disturbances to riparian vegetation that is not protected by snow. Negative impacts to water quality and watershed conditions are not anticipated provided that use is restricted to “frozen” conditions.

Alternatives 2, 3 Modified, and 4 also propose to reduce the total number of unclassified road stream crossings within the Project Area as a result of road decommissioning. This activity has the potential to improve water quality and watershed conditions as well as improve aquatic organism passage. Potential water quality improvements include reduced point source erosion and sediment input at existing stream crossing sites. Improvements to watershed conditions include improving natural stream flow conditions, flood flow capacity, and floodplain function as well as sediment and large woody debris transport. Benefits to aquatic organisms include improved egg and juvenile survival, aquatic organism passage, and stream connectivity.

Alternative 2

Indicators 1 and 2

Alternative 2 includes constructing 17 miles of new temporary road and decommissioning 34 miles of system and unclassified roads (Table 3.13-1). When compared to other action alternatives, Alternative 2 would construct the same number of new temporary road miles as Alternative 3 Modified and two more miles than Alternative 4. Alternative 2 would decommission one less road mile than Alternative 3 Modified and the same number of road miles as Alternative 4. Alternative 2 includes reusing or constructing 2 special use seasonal road crossings, decommissioning 2 special use seasonal road stream crossings, and utilizing 6 special use winter road crossings (Table 3.13-2 and Table 3.13-3). Alternative 2 would also decommission 2 unclassified road stream crossings. In addition to special use and permanent road stream crossings, Alternative 2 would construct and ultimately decommission 3 new temporary seasonal road stream crossings and utilize 40 new temporary winter road stream crossings (Table 3.13-2 and Table 3.13-3). A big difference among the action alternatives is the use of temporary winter road stream crossings, a practice which is considered to have little or no negative effects to water quality and watershed health. When compared to the other action alternatives, Alternative 2 proposes to utilize the greatest number of temporary winter road stream crossings.

Alternative 3 Modified

Indicators 1 and 2

Alternative 3 Modified includes constructing 17 miles of new temporary road and decommissioning 35 miles of system and unclassified roads (Table 3.13-1). When compared to the other alternatives, Alternative 3 Modified would construct the same number of new temporary road miles as Alternative 2 and 2 more miles than Alternative 4. Alternative 3 Modified proposes to decommission the greatest number of road miles among all alternatives. Alternative 3 Modified includes reusing or constructing 2 special use seasonal road crossings (includes the use of one existing crossing and the construction of one new stream crossing), decommissioning 2 special use seasonal road stream crossings, and utilizing 6 special use winter road crossings (Table 3.13-2 and Table 3.13-3). Alternative 3 Modified would also decommission 2 unclassified road stream crossings. In addition to special use and permanent road stream crossings, Alternative 3 Modified would construct and ultimately decommission 4 new temporary seasonal road stream crossings and utilize 35 new temporary winter road stream crossings. A big difference among the alternatives is the use of use of temporary winter road stream crossings, a practice which is considered to have little or no negative effects to water quality and watershed health. When compared to the other action alternatives, Alternative 3 Modified proposes to utilize fewer temporary winter road stream crossings than Alternative 2 but more than Alternative 4.

Alternative 4

Indicators 1 and 2

Alternative 4 includes constructing 15 miles of new temporary road and decommissioning 34 miles of system and unclassified roads (Table 3.13-1). When compared to other alternatives, Alternative 4 would result in constructing fewer new temporary road miles than both Alternatives 2 and 3 Modified. Alternative 4 would decommission the same number of road miles as Alternative 2 and one less road mile than Alternative 3. Alternative 4 includes reusing or constructing 2 special use seasonal road crossings (includes the use of one existing crossing and the construction of one new stream crossing), decommissioning 2 special use seasonal road stream crossings, and utilizing 6 special use winter road crossings (Table 3.13-2 and Table 3.13-3). Alternative 4 would also decommission 2 unclassified road stream crossings. In addition to special use and permanent road stream crossings, Alternative 4 would also construct and ultimately decommission 3 new temporary seasonal road stream crossings and utilize 25 new temporary winter road stream crossings. A big difference among the action alternatives is the use of temporary winter road stream crossings, a practice which is considered to have little or no negative effects to water quality and watershed health. When compared to the other action alternatives, Alternative 4 proposes to utilize the fewest number of temporary winter road stream crossings.

Conclusion – Direct and Indirect Effects

There are some anticipated direct or indirect negative effects to water quality and watershed health within the Echo Trail Area Forest Management Project as a result of implementing any of the action alternatives. These effects are expected to be minimal provided that all required project design features and mitigation measures referred to and/or described previously are followed during project implementation. Potential short term negative affects associated with new temporary roads and stream crossings including point source erosion, run off, and stream flow and flood plain manipulation are expected to be minimal. Forest Plan standards and objectives require that road and trail crossings of streams, wetlands, and riparian areas adjacent to lakes and streams be minimized, that hydrologic and riparian functions be maintained or improved when roads or trails are constructed across wetlands, that temporary roads and stream crossings be stabilized and effectively closed to motorized traffic following all use, and that vegetation is established on these roads within 10 years after termination of all contracts, leases, or permits (USDA Forest Service 2004b).

All action alternatives have the potential to directly benefit water quality and watershed health within the Echo Trail Area Forest Management Project through road decommissioning and stream crossing removals. Based upon the above analysis and the benefits associated with minimizing the total miles of new temporary and new temporary winter roads as well as utilizing the fewest number of new temporary winter road stream crossings, Alternative 4 has more potential overall to benefit water quality and watershed health.

3.13.6.2 Cumulative Effects

Indicators 1 and 2

The analysis area for Indicator 1 (miles of new road construction, including new temporary and new temporary winter roads) and Indicator 2 (number of stream crossings) includes all route types within the Project Area including classified roads, temporary roads, non-jurisdictional roads, unclassified roads, unauthorized motorized trails, decommissioned roads, and special use authorizations. Because effects from road construction and stream crossings may be evident for a long period, 25 years was selected as the appropriate time-scale to evaluate cumulative effects.

It is not likely that construction of new temporary roads and stream crossings associated with the Echo Trail Area Project action alternatives will contribute to long-term negative cumulative effects to water quality and watershed health within the Project Area provided that required Forest Plan standards and guidelines are followed during project implementation and construction activities (USDA Forest Service 2004b). Potential short-term negative cumulative effects include point source erosion, surface run-off, and sediment input into local streams, lakes, and wetlands. Other negative cumulative effects include reduced flood flow capacity and floodplain function as well as sediment transport, movement of large woody debris, and restricted aquatic organism passage. Many of these potential short-term negative cumulative effects will not likely occur or continue as a result of decommissioning new temporary roads and associated stream crossings that are associated with each of the action alternatives.

In addition to Voluntary Site-Level Forest Management Guidelines (MFRC 2005), State of Minnesota best management practices, Shoreland Rules (Minnesota Department of Natural Resources (MNDNR) 1989), as well as other Minnesota Public Water Works rules and State wetland regulations should also contribute to minimizing negative cumulative effects from State, county, and private landowners within the Project Area. Past, present, and reasonably foreseeable future actions of other land owners that could potentially contribute to negative cumulative effects associated with new road construction and stream crossings include State, county, and private road construction projects associated with timber harvest, private development, and special use permits, as well as routine road maintenance activities. The Superior National Forest will continue to improve the existing road transportation system and associated stream crossings on the Forest. It is also very likely that road transportation systems and associated stream crossings managed by other State, county, local, and private entities have similar improvement needs. Assuming that the inventory, maintenance, and improvement of road transportation systems on both non-Forest and Forest Service lands will generally occur at the same rate, it is very likely that cumulative effects will be further minimized and/or mitigated in the future. The USFS and State of Minnesota have also made significant improvements in the design and correct placement of stream crossings that maintain fish passage and sediment transport. Provided that the above standards and guidelines, best management practices, and State of Minnesota requirements are adopted by all respective land owners and managers, the activities associated with Alternatives 2, 3 Modified, and 4 are not expected to contribute to long-term cumulative effects to water quality and watershed health with respect to present and reasonably foreseeable future actions.

Indicator 3

The analysis area for the cumulative effects Indicator 3 (proportion of upland open and upland young forest within each watershed) includes all 6th level watersheds that occur within or intersect the Echo Trail Area Forest Management Project. This analysis includes all ownerships within the Project Area. The indicator was chosen for the analysis because potential effects associated with each alternative should be evident at the watershed scale. This indicator and current condition information was also used during the 2004 Forest Plan revision and analysis process (USDA Forest Service 2004d, USDA Forest Service 2004b). Existing condition information used for both analyses is currently the most reliable information available. The timescale selected for the cumulative effects Indicator 3 was 25 years because effects from vegetative management may be observable for many years following the initial impact of a particular activity.

Based on a review and analysis of existing conditions, which reflects all past vegetative management activities within the project area, as well as those conditions that would result from full implementation of alternatives 2, 3 Modified, and 4, there are no watersheds within or intersecting the Echo Trail Area

Forest Management Project that currently or would potentially exceed the 60 percent threshold as a result of implementing alternatives 2, 3 Modified, or 4. Although upland open and upland young values for individual watersheds differ slightly among alternatives, no value was found to exceed the 60 percent threshold. Based on other watershed characteristics including the portion of each watershed in wetland, lowland, and water, portion of each watershed within the BWCAW, where no activities are proposed, and the portion of each watershed within and outside the project area, it is also not likely that proposed vegetative management associated with alternatives 2, 3 Modified, and 4 would result in an upland open and upland young value exceeding 60 percent for any watershed.

There are 30 6th level watersheds occurring within or intersecting the Echo Trail Area Forest Management Project. These watersheds range in size from 9,910 to 37,159 acres and are composed of between 19 and 59 percent wetland, lowland, and water. Nine of these watersheds occur almost entirely or partly within the BWCAW where no management activities occur. Six of the 30 watersheds have more than 50 percent of their area inside the Echo Trail Area Project boundary. Most watersheds have less than 40 percent of their surface acres within the Project Area.

Eight of the 30 watersheds were excluded from further review and analysis for Indicator 3 based on the proportion of each watershed that was composed of wetland, lowland, and water and the proportion of the watersheds that occur in the BWCAW, where no activities would occur. Five of the watersheds are composed of over 40 percent wetland, lowland, and water. This condition would therefore make it impossible for vegetative management activities to result in an upland open and upland young value that could potentially exceed the 60 percent threshold. Additionally, 5 of the Project Area watersheds have more than 40 percent of their surface area within the BWCAW where vegetative management activities do not occur. Provided that there are no future large natural events such as wind storms or wildfire, it is unlikely that the proportion of these watersheds in upland open and upland young forest condition could ever exceed the 60 percent threshold.

There are some limitations associated with only looking at the portion of each watershed within the Echo Trail Area Forest Management Project. Results from the analysis of effects for 6th level watersheds that occur predominantly within the Project Area may be more reliable than those results for watersheds that occur predominantly outside of the Project Area. Regardless of how much area of each watershed occurs within the Project Area, current condition and data analysis completed during the 2004 Forest Plan Revision should be adequate to measure effects to water quality and watershed health (USDA Forest Service 2004d).

Vegetation management activities for all alternatives will follow required design features and mitigation measures contained in this EIS (Appendix A), standards and guidelines in the 2004 Forest Plan (USDA Forest Service 2004b), and applicable MFRC Voluntary Site-Level Forest Management Guidelines (MFRC 2005). Design features and mitigation measures as well as Forest Plan standards and guidelines have been developed to maintain or restore riparian ecological function within near-bank and remainder riparian zones. Under these design criteria, no harvest of trees would occur within 100 feet of flowing streams except for the purpose of maintaining or restoring riparian ecological function. Remainder riparian management zones would also be established adjacent to near-bank zones depending upon floodplain and shoreline slope conditions where vegetative management would favor extended rotation of site appropriate tree species. These criteria will together serve to protect and enhance both riparian and within stream channel habitat conditions as well as water quality and watershed health. The above design criteria and mitigation measures, Forest Plan standards and guidelines, and applicable MFRC guidelines have been effective in the past and will continue to protect water quality and watershed health in the future.

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