Travel Management Project

Water Resources Report

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Introduction

Travel Management Project

The purpose of this project is to designate an initial system of roads and trails available for public motor vehicle use on the Chequamegon-Nicolet National Forest (CNNF) consistent with the goals and objectives outlined in the 2004 CNNF Land and Resource Management Plan (LRMP or 2004 Forest Plan). The project will comply with the 2005 Travel Management Rule (TMR) that requires a designated system of roads and trails for motor vehicle use by vehicle class and, if appropriate, by time of year. These designated roads and trails will be identified on a Motor Vehicle Use Map (MVUM) that will be published and made available to the public in 2009.

Although this project will be consistent with the goals and objectives in the 2004 Forest Plan and will move toward the desired conditions specified in the Plan, it will not fully accomplish those goals, objectives and desired conditions. This project is an initial effort to designate roads and trails and create a MVUM. Future iterations of the MVUM will continue to move the Forest toward the desired condition of the Forest Plan.

Water Resources, Roads and Trails

Roads and trails are necessary to manage the forest and provide public access recreational activities. Unfortunately, roads and trails that are not properly designed, constructed and maintained or that experience heavy use can have adverse effects on water resources. The most common of these potential effects include restricting the movement of fish at stream crossings, impacting water quality, changing stream channels above and below crossings, and altering wetlands.

Roads and trails can affect the passage of fish and other aquatic species at stream crossings. These effects typically occur at culverts that prevent or at times limit the upstream movement of species. Young fish and weak swimming adult fish are affected most often, but all species can be affected if conditions are too severe at the culvert. Three basic problems can occur that can restrict fish movement at stream crossings: a drop at the culvert outlet, water velocity that is higher than the swimming ability of the fish, and water that is too shallow for fish to swim through.

Drops occur at culverts when the downstream end is set too high or the channel down-cuts. Strong swimming and jumping species such as salmon and steelhead can negotiate some of these jumps if the jump is not too high and there is a resting pool. However, the upstream movement of most other fish can be completely blocked by a drop at the outlet of a culvert. High water velocity generally occurs when the slope of the culvert is too steep or the channel is constricted too much. Whether a species can swim through a culvert depends on the species swimming ability, the velocity of the water (which depends on the slope and roughness of the pipe), pipe length and whether there are good resting pools at the inlet and outlet. It is easy to design a culvert that will allow fish to pass when stream slopes are less than 0.3 percent; it becomes much more difficult when stream slopes exceed 1-2 percent. Water that is too shallow to pass fish typically occurs during low flow periods in culverts that are wide and set too high or at too steep of a slope.

Aquatic passage problems can usually be avoided through careful design and installation of culverts. Culverts need to be adequately sized and set below the streambed. On low gradient streams (i.e., less than 0.3 percent) culverts can be set flat and sufficiently low that the tail-water

creates water depths and velocities that will pass all fish and other aquatic organisms through out the year. On higher gradient streams (i.e., typically more than 1.0 percent), culverts need to be sized to bankfull width and have a natural channel constructed through the culvert that will allow all aquatic organisms to freely move through the culvert. Otherwise rock or other structures such as baffles must be placed in an oversized culvert to create resting areas for fish as they move up through the culvert.

Roads and trails can affect water quality primarily through the processes of erosion and sedimentation. These occur when rainfall or snowmelt detaches soil particles (erosion) and runoff carries these particles and deposits them in streams (sedimentation). Sediment is recognized as the most important water pollutant in the United States in terms of total quantity, miles of stream affected and adverse effects on aquatic communities (Waters 1995). Fine sediment (i.e., sand, silt and clay) is a particular water quality problem in streams because it can reduce available habitat by filling pools; reduce survival of fish eggs and fry; and reduce survival, composition and abundance of aquatic invertebrates.

Roads and trails that are poorly designed, located and maintained or that receive heavy use can be significant sources of sediment to streams. Sediment can originate from road surfaces, ditches, cut slopes and fills. This sediment can be delivered to streams or lakes where runoff from road surfaces and ditches flows directly into the water body. These road or trail segments are referred to as being "hydrologically connected" to the water body. Roads with heavy use, native surface material, inadequate gravel surface, poorly vegetated slopes or ditches and inadequate drainage are the largest sources of sediment. Erosion and sedimentation also increase as the slope of the road or trail increases. Roads that are paved or have at least 6 inches of crushed gravel and are regularly graded to maintain a crowned surface; have ditches and slopes that are protected by good vegetative ground cover; good cross-drainage and low hydrologic connection can be minimal sources of sediment.

Roads and trails can also affect the shape or morphology of stream channels both above and below crossings. These effects occur when culverts are set too high or constrict the channel too much, when culverts wash out regularly or when there is heavy sedimentation from the road.

Culverts that are set too high at the inlet or that constrict the stream too much can cause sediment to deposit in the upstream channel. In low gradient streams, these deposits consist of sand, silt and muck. On steep streams that move gravel bedload at high flows, these deposits consist of gravel and cobble. On these streams, the width of the culvert or bridge should be about as wide as the bankfull width of the channel to maintain natural bedload transport in the stream.

Some stream crossings have undersized culverts that wash out frequently. When this happens is causes the downstream channel to fill with sediment. In low gradient streams this can back water upstream, causing the channel to accumulate sand, silt and muck just like a culvert that is set too high.

Heavy sediment loads from frequent washouts or road surfaces can also affect the downstream channel by causing it to become wider and shallower. Wide, shallow channels with a predominantly sand bed tend to provide poor habitat for fish and aquatic invertebrates.

Most of these effects can be minimized by properly sizing culverts (usually to pass the 100-year flood), minimizing sedimentation from roads and matching the culvert width to the bankfull width, particularly on streams with a mobile gravel bed.

Roads and trails can have two primary effects on wetlands: direct loss of wetland from the road or trail fill itself, and alteration of drainage patterns which can affect wetland hydrology and plant communities. The direct loss of wetland depends on the length and width of road or trail in wetland and whether mineral fill is placed to create the road or trail. The effect on wetland hydrology and plant communities depends on the volume and direction of flow through the wetland, the location of the road in relation to flow direction, the amount of fill associated with the road and whether the road or trail has adequate cross-drainage. The size of the watershed area draining to the wetland is an important determinant of the amount of flow through the wetland.

Avoiding wetland crossings is the best way to minimize affects to wetlands but this is not always possible in northern Wisconsin because of the abundance of wetlands. Where wetland crossings cannot be avoided, they should be located to minimize effects on flow whenever possible (i.e., at or near drainage divides in wetlands, parallel to flow direction, at the upstream or headwaters portion of a wetland, etc.). When this is not possible, adequate cross-drainage must be provided. Most wetlands in northern Wisconsin contain organic soils. In these wetlands the vast majority of water is transmitted through the porous, upper 12-inch layer of organic material. In these situations, 24-inch diameter culverts should be installed with the lower half in the porous organic layer to carry baseflows and the upper half and the upper half available to carry stormflows (Welsch et al. 1995). Porous fill placed on geotextile is another option for maintaining adequate cross-drainage.

Methodology for Analysis

The potential direct and indirect effects of the alternatives on water resources were analyzed using three indicators of potential impact. These included road-stream crossings, roads in riparian management zones (RMZs) and roads in wetland. Road-stream crossings were determined from a geographic information system (GIS) intersect of digital road and stream layers. The road layer was the same layer that was used for all other TMR analyses. The stream layer was derived from the WI hydrography layer developed at a scale of 1:24,000 and having identical line work as the national hydrography layer. These intersects provide an index of potential impacts to stream water quality, channel morphology and aquatic species movement.

Roads in RMZs were determined from the TMR road layer and GIS buffers created around all perennial and intermittent water bodies according to WI's Forestry Best Management Practices (BMPs) for Water Quality (WDNR 2003). A 100-ft GIS buffer was created around all perennial water bodies and a 35-ft zone around intermittent water bodies. These were intersected with the road layer to determine total road length in RMZs. These intersects provide an index of potential impacts to stream water quality and channel morphology from sedimentation. Any erosion from road and trail surfaces in RMZs has the potential for delivery to the water body because of the close proximity. In this sense, they can be considered an estimate or approximation of the hydrologically connected road and trail segments.

Roads in wetlands were determined from a GIS intersect of the TMR road layer and the Wisconsin wetland layer. These intersects provide an index of potential impacts to wetlands since roads can obstruct drainage and impact water quality.

The potential cumulative effects of the alternatives on water resources were analyzed by considering past, present and reasonably foreseeable activities that might affect water resources. Emphasis was placed on potential impacts to water quality (sediment), fish passage and channel morphology. The scope of the analyses was limited to the 171 6th level watersheds that contain

National Forest land but was primarily a qualitative analysis. Activities considered included turn-of-century logging and log drives, road and trail development, timber harvest, recent road and trail improvements to reduce impacts to water resources, the alternatives and future road decommissioning or watershed improvement work.

Existing Condition

The Chequamegon-Nicolet National Forest has abundance of water resources including lakes, streams and wetlands. The Forest contains 609 lakes greater than 10 acres and approximately 2,580 miles of stream. About 85 percent of the stream length is perennial and 15 percent intermittent. There are about 421,000 acres of wetland within the National Forest boundary which cover approximately 21 percent of the area. The most common wetland types include coniferous swamp, coniferous bog, lowland hardwood swamp, shrub swamp, open bog, sedge meadow, shallow marsh, deep marsh and shallow open water.

The current transportation network on the Chequamegon-Nicolet National Forest includes over 11,000 miles of roads and trails. About 25 percent are maintenance level (ML) 1, 44 percent ML 2, four percent ML 3, 13 percent ML 4, eight percent ML 5 and six percent trails or other types of travel ways. There are approximately 2,650 miles of gas tax roads that are managed cooperatively with local townships, counties or the state. The gas tax and ML 1 roads are outside the scope of this project.

Key locations where roads and trails are most likely to affect water resources are at stream crossings, RMZs and wetlands. These serve as indicators of potential impacts to the water resource. Within the Chequamegon-Nicolet National Forest boundary there are approximately 1,850 road and trail stream crossings (as determined from GIS intersects of the road and trail and stream layers), 160 miles of road and trail in RMZs and 500 miles of road and trail in wetlands (Table 1).

Table 1. Transportation System Influence on Water Resources in the National Forest.

Maintenance Level	# of Stream Crossings	Miles in RMZ	Miles in Wetland
1	301	25	97
2	452	39	148
3	112	11	25
4	487	34	109
5	326	29	67
Trail/Other	170	22	52
Total	1,848	160	498

Since 1998 the Forest has placed emphasis on reducing road and trail impacts to water resources. Over this time period, 138 stream crossings were replaced to reduce sedimentation, restore channel morphology and improve fish passage (Chequamegon-Nicolet NF 2007). In addition, 13 road and eight trail segments were reconstructed and four stream crossing removed. This work took place primarily on ML 3, ML 4 and ML 5 roads. After 2003 when the Forest Plan Environmental Impact Statement was prepared, 45 stream crossings were replaced and one road and four trail segments were reconstructed. These activities have reduced impacts to water resources throughout the Forest.

Desired Condition

The Chequamegon-Nicolet National Forest Land and Resource Management Plan (LRMP) contains the following desired conditions for aquatic resources that are applicable to the Travel Management Project (USDA Forest Service 2004a):

> Page 3-59: Healthy watersheds result in high infiltration rates; a minimum of natural or human induced erosion; and the filtering of sediment before it reaches lakes, streams and wetlands.
>
> Page 3-59: The diversity and abundance of wetlands are maintained or restored over time.
>
> Page 3-60: The composition and productivity of biological communities in streams and lakes are not limited by reduction in water quality, including sediment.
>
> Page 3-60: Streams are maintained or restored to provide for natural functions and processes such as the transport of water and sediment within the normal ranges of variability for the watershed.
>
> Page 3-60: Fish passage occurs at all road and trail stream crossings with a few exceptions.

In addition to the above listed desired conditions, the LRMP contains the following objectives and standards that are applicable to the Travel Management Project:

> Page 1-3: Objective 1.3a – Reduce the number of road and trail stream crossings. Reduce sedimentation and improve fish passage in existing road and trail stream crossings.
>
> Page 1-3: Objective 1.3b – Reduce and strive to eliminate off-road and off-trail motorized vehicle use within wetlands, meadows and riparian areas.
>
> Page 1-3: Objective 1.3d – Relocate some existing roads and trails out of riparian management zones.
>
> Page 2-2: Standard – Design and maintain roads and trails in riparian areas or other locations that could affect water quality in accordance with Wisconsin's Forestry BMPs. Road and trail surfaces within these areas will be stabilized with aggregate or other suitable material when being used during non-frozen conditions.
>
> Page 2-2: Guideline – Utilize WI's Forestry BMPs to delineate riparian management zones.
>
> Page 2-2: Guideline – Relocate existing roads and trails out of riparian areas and eliminate stream crossings where practicable.
>
> Page 2-3: Standard – Protect hydrologic function and maintain natural hydrologic regimes in wetlands.
>
> Page 2-3: Guideline – Minimize fill and maintain cross road drainage when wetland road and trail crossings cannot be avoided.

Overview of the Forest Proposal

The purpose of this project is to designate an initial system of roads and trails available for public motor vehicle use on the CNNF consistent with the goals and objectives outlined in the 2004 CNNF LRMP. The project will comply with the 2005 Travel Management Rule that requires a designated system of roads and trails for motor vehicle use by vehicle class and, if appropriate, by time of year. These designated roads and trails will be identified on a MVUM that will be published and made available to the public in 2009.

The forest proposal (Alternative 2) would allow motor vehicle use to continue on 2,080 miles of road (1,621 miles open to highway legal vehicles and 450 miles open to both highway legal vehicles and ATVs, 9 miles of road for ATV use only) and 318 miles of trail (open to ATV use). The vast majority of these roads are at ML2.

Mitigation Applicable to All Alternatives

The travel management project will designate an initial system of roads and trails available for public motor vehicle use on the CNNF consistent with the goals and objectives outlined in the 2004 Forest Plan. The project will comply with the 2005 TMR that requires a designated system of roads and trails for motor vehicle use by vehicle class and, if appropriate, by time of year. These designated roads and trails will be identified on a Motor Vehicle Use Map. Roads and trails that remain open for public motor vehicle use will be the current condition (No Action) or a smaller subset of the current condition (Alternatives 2 and 3).

No on-the-ground activities will occur as a result of this project. Therefore, no water resource mitigation measures are required for this project.

As implementation of this project and the Forest Plan proceed, there are two key Forest Plan standards and guidelines related to roads, trails and water resources that will be implemented over time. These include the standard requiring that road and trail surfaces within RMZs be stabilized with aggregate or other suitable material when being used during non-frozen conditions and the guideline requiring that cross drainage be maintained when wetland road and trail crossings cannot be avoided. Road and trails that remain open for motor vehicle use will need to be inventoried to determine if hydrologically connected segments are adequately surfaced and if segments in wetlands have adequate cross-drainage. Where they are not, surfacing, installation of cross-drains or other maintenance work may be required.

Monitoring

The LRMP prescribes the following monitoring questions for aquatic ecosystem resources (page 4-7). Monitoring is conducted to provide information for these questions which are then answered in monitoring reports at about five year intervals. There are no additional monitoring requirements proposed for this project. The current Forest Plan monitoring questions for water resources include:

What is the current number of road and trail stream crossings? How many of these have been eliminated? How many fish passages have been improved? How many sediment reduction projects have been completed? Is off-road or off-trail motorized vehicle use within wetlands, meadows, and riparian areas decreasing? How many miles of road and trails are currently in Riparian Management Zones? How many miles of these roads and trails have been relocated or reconstructed?

Environmental Consequences

Alternative 1 - No Action

Direct and Indirect Effects

The potential effects of Alternative 1 (No Action) on water resources were evaluated using three primary indices: (1) road-stream crossings, (2) roads in RMZs and (3) roads in wetland. Alternative 1 (No Action) would allow motor vehicle use to continue on 4,657 miles of road (4,169 miles open to highway legal vehicles, 486 miles open to both types of vehicles, 2 miles of road open to ATV use only) and 318 miles of trail (open to ATV use). The vast majority of these roads are at ML 2.

Under Alternative 1 (No Action), there would be 413 stream crossings on roads that remain open to motor vehicle use. While the condition and actual effect of each one of these crossings is not known at this time, inventory from a subset of crossings on the Forest indicates that many of these crossings are likely have some affect on channel morphology, water quality and passage of aquatic organisms (USDA Forest Service 2004b; Table 3-7, page 3-23). While much of the available inventory data for road-streams crossings is for ML 3, 4 and 5 roads, if the effects are proportionally similar, then about 14 percent of these crossings (about 60 sites) could have aquatic passage effects. However, about 50 percent of the crossings open for motor vehicle use under Alternative 1 (No Action) are on intermittent streams and aquatic organism passage may not be required at many of these sites. Thus, it is likely that less then 10 percent (about 40 sites) of all these crossings are affecting aquatic organism passage. Impacts to water quality and channel morphology would be major at approximately 8 percent (about 30 sites), moderate at 20 percent (about 80 sites) and minor at 33 percent (about 140 sites) of all these crossings assuming conditions similar to inventoried sites. Any existing impacts would continue until these road-stream crossings are inventoried and the identified problems are corrected primarily through installation of larger culverts set at the proper elevation. These improvements would occur gradually over time as funding would allow.

Under Alternative 1 (No Action), 37 miles of road located in RMZs would remain open to motor vehicle use. This amounts to 0.8 percent of the 4,657 miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). The condition of the 37 miles of road open to motor vehicle use in RMZs and the actual effect on water resources is not known at this time. While the entire length of road has some potential to affect water quality because vehicle use can cause erosion and there is a strong opportunity for a hydrologic connection to adjacent water bodies, the effects would be highly variable and dependant on road surface conditions, slope and degree of use. Any existing impacts would continue until these road segments are inventoried and the identified problems are corrected through surfacing, drainage and other techniques. These improvements would occur gradually over time as funding would allow.

Under Alternative 1 (No Action), 130 miles of road located in wetland would remain open to motor vehicle use. This amounts to 2.8 percent of the 4,657 miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). These roads can have two primary effects: direct loss of wetland from the road fill, and alteration of drainage patterns which can affect wetland hydrology and plant communities. Assuming an average road width of 16 feet for ML2 roads, 130 miles of road would amount to 252 acres or 0.06 percent of the approximately 421,000 acres of wetland within the National Forest boundary. Thus while the effect on direct loss of wetland habitat could be substantial for a specific wetland, the overall Forest-wide impact

is very small. The effect on wetland hydrology and plant communities would be highly variable depending on volume and direction of flow through the wetland, the location of the road in relation to flow direction, the amount of fill associated with the road and whether the road has adequate cross-drainage. Any impacts to wetland hydrology and plant communities from these roads would continue until these road segments are inventoried and the identified problems are corrected through road relocation or installation of adequate cross-drainage. These improvements would occur gradually over time as funding would allow.

Alternative 2 – Forest Proposal

Direct and Indirect Effects

Alternative 2 (forest proposal) allows motor vehicle use to continue on 2,080 miles of road (1,621 miles open to highway legal vehicles, 452 miles open to both highway legal vehicles and ATVs, 9 miles of road open to ATV use only) and 318 miles of trail (open to ATV use). The vast majority of these roads are at ML 2.

Under the Alternative 2 (Proposed Action), there would be 183 stream crossings on roads that remain open to motor vehicle use. While the condition and actual effect of each one of these crossings is not known at this time, inventory from a subset of crossings on the Forest indicates that many likely have some affect on channel morphology, water quality and passage of aquatic organisms (USDA Forest Service 2004b; Table 3-7, page 3-23). While much of the available inventory data for road-streams crossings is for ML 3, 4 and 5 roads, if the effects are proportionally similar, then about 14 percent of these crossings (about 25 sites) could have aquatic passage effects. However, about 43 percent of the crossings open for motor vehicle use under the Alternative 2 (forest proposal) are on intermittent streams and aquatic organism passage may not be required at many of these sites. Thus, it is likely that less then 10 percent (about 15 sites) of all these crossings are affecting aquatic organism passage. Impacts to water quality and channel morphology would be major at approximately 8 percent (about 18 sites), moderate at 20 percent (about 35 sites) and minor at 33 percent (about 60 sites) of all these crossings assuming conditions similar to inventoried sites. Any existing impacts would continue until these road-stream crossings are inventoried and the identified problems are corrected primarily through installation of larger culverts set at the proper elevation. These improvements would occur gradually over time as funding would allow.

Under Alternative 2 (forest proposal), 15.7 miles of road located in RMZs would remain open to motor vehicle use. This amounts to 0.8 percent of the 2,080 miles of road that would remain open to motor vehicle use under Alternative 2 (Proposed Action) and 0.3 percent of the 4,657 miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). The condition of the 16 miles of road open to motor vehicle use in RMZs and actual effect on water resources is not known at this time. While this entire length of road has some potential to affect water quality because vehicle use can cause erosion and there is a strong opportunity for a hydrologic connection to adjacent water bodies, the effects would be highly variable and dependant on road surface conditions, slope and degree of use. Any existing impacts would continue until these road segments are inventoried and the identified problems are corrected through surfacing, drainage and other techniques. These improvements would occur gradually over time as funding would allow.

Under Alternative 2 (forest proposal), 60 miles of road located in wetland would remain open to motor vehicle use. This amounts to 2.9 percent of the 2,080 miles of road that would remain open to motor vehicle use under Alternative 2 (Proposed Action) and 1.3 percent of the 4,657

miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). These roads can have two primary effects: direct loss of wetland from the road fill, and alteration of drainage patterns which can affect wetland hydrology and plant communities. Assuming an average road width of 16 feet for ML 2 roads, 60 miles of road would amount to 116 acres or 0.028 percent of the approximately 421,000 acres of wetland within the National Forest boundary. Thus while the effect on direct loss of wetland habitat could be substantial for a specific wetland, the overall impact is very small. The effect on wetland hydrology and plant communities would be highly variable depending on volume and direction of flow through the wetland, the location of the road in relation to flow direction, the amount of fill associated with the road and whether the road has adequate cross-drainage. Any impacts to wetland hydrology and plant communities from these roads would continue until these road segments are inventoried and the identified are corrected through road relocation or installation of adequate cross-drainage. These improvements would occur gradually over time as funding would allow.

Roads open for motorized vehicle use in Alternative 2 (forest proposal) represent a 56 percent reduction in stream crossings, a 57 percent reduction in RMZs and a 54 percent reduction in wetlands when compared to Alternative 1 (No Action) and the existing condition. Reducing road-stream crossings open to motorized use would likely reduce erosion and sediment impacts because the road surface would become stabilized from vegetation and erosion would be minimal. However, eliminating motor vehicle use might not reduce aquatic organism passage or channel morphology impacts caused by improper culverts without some type of restoration work. This alternative would provide the opportunity to decommission up to 2,577 miles of unauthorized roads including the removal of up to 230 stream crossings, 21 miles of road from RMZs and 70 miles of road from wetland. This would likely occur gradually over time resulting in a direct positive effect on water resources.

Alternative 3 – Not Enough Motorized Access

Direct and Indirect Effects

Alternative 3 allows motor vehicle use to continue on 2,158 miles of road (1,664 miles open to highway legal vehicles, 474 miles open to both highway legal vehicles and ATVs, 20 miles open to ATV use only), 318 miles of trail (open to ATV use), 42 miles of road during fall only, 22 miles of ATV use on East side of the Forest and 19 miles of road for ATV use only. The vast majority of these roads are at ML 2.

Under Alternative 3, there would be 188 stream crossings on roads that remain open to motorized vehicle use. While the condition and actual effect of every one of these crossings is not known at this time, inventory from a subset of crossings on the Forest indicates that many likely have some affect on channel morphology, water quality and passage of aquatic organisms (USDA Forest Service 2004b; Table 3-7, page 3-23). While much of the available inventory data for road-streams crossings is for ML 3, 4 and 5 roads, if the effects are proportionally similar, then about 14 percent of these crossings (about 25 sites) could have aquatic passage effects. However, about 43 percent of the crossings open for motor vehicle use under the Alternative 3 are on intermittent streams and aquatic organism passage may not be required at many of these sites. Thus, it is likely that less then 10 percent (about 18 sites) of all these crossings are affecting aquatic organism passage. Impacts to water quality and channel morphology would be major at approximately 8 percent (about 15 sites), moderate at 20 percent (about 35 sites) and minor at 33 percent (about 60 sites) of all these crossings assuming conditions similar to inventoried sites.

Under Alternative 3, 16.1 miles of road located in RMZs would remain open to motor vehicle use. This amounts to 0.7 percent of the 2,158 miles of road that would remain open to motor vehicle use under Alternative 3 and 0.3 percent of the 4,657 miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). The condition of the 16.1 miles of road open to motor vehicle use in RMZs and actual effect on water resources is not known at this time. While this entire length of road has some potential to affect water quality because vehicle use can cause erosion and there is a strong opportunity for a hydrologic connection to adjacent water bodies, the effects would be highly variable and dependant on road surface conditions, slope and degree of use. Any existing impacts would continue until these road segments are inventoried and the identified problems are corrected through surfacing, drainage and other techniques. These improvements would occur gradually over time as funding would allow.

Under Alternative 3, 62 miles of road located in wetland would remain open to motor vehicle use. This amounts to 2.9 percent of the 2,158 miles of road that would remain open to motor vehicle use under Alternative 3 and 1.3 percent of the 4,657 miles of road that would remain open to motor vehicle use under Alternative 1 (No Action). These roads can have two primary effects: direct loss of wetland from the road fill, and alteration of drainage patterns which can affect wetland hydrology and plant communities. Assuming an average road width of 16 feet for ML 2 roads, this distance would amount to 120 acres or 0.029 percent of the approximately 421,000 acres of wetland within the National Forest boundary. Thus while the effect on direct loss of wetland habitat could be substantial for a specific wetland, the overall impact is very small. The effect on wetland hydrology and plant communities would be highly variable depending on volume and direction of flow through the wetland, the location of the road in relation to flow direction, the amount of fill associated with the road and whether the road has adequate cross-drainage. Any impacts to wetland hydrology and plant communities from these roads would continue until these road segments are inventoried and the identified are corrected through road relocation or installation of adequate cross-drainage. These improvements would occur gradually over time as funding would allow.

Roads open for motorized vehicle use in Alternative 3 represent a 54 percent reduction in stream crossings, a 56 percent reduction in RMZs and a 52 percent reduction in wetlands when compared to Alternative 1 (No Action) and the existing condition. Reducing road-stream crossings open to motorized use would likely reduce erosion and sediment impacts because the road surface would become stabilized from vegetation and erosion would be minimal. However, eliminating motor vehicle use might not reduce aquatic organism passage or channel morphology impacts caused by improper culverts without some type of restoration work. This alternative would provide the opportunity to decommission up to 2,499 miles of unauthorized roads including the removal of up to 225 stream crossings, 20 miles of road from RMZs and 68 miles of road from wetland. This would likely occur gradually over time resulting in a direct positive effect on water resources.

Cumulative Effects for all Alternatives

Scope

The analysis of cumulative effects on water resources focused primarily on the potential impacts to water quality (i.e., sedimentation), fish passage and channel morphology. Activities that impact fish passage typically occur within the channel itself and include primarily culverts at road or trail crossings or dams. Impacts to channel morphology have been caused primarily by road and trail crossings, dams, historical log drives or heavy sedimentation. Water quality impacts from sediment are caused mostly from roads and trails that are hydrologically connected and streambank erosion.

The scope for the cumulative effects analysis includes both spatial and temporal boundaries. The spatial boundaries for cumulative effects to water resources include the 171 6th level watersheds that contain portions of the National Forest. There watershed are the appropriate size to evaluate the cumulative effects of national forest activities on water resources. They average 22,000 acres in size with a range from 4,200 to 51,600 acres. The temporal period for cumulative effects to water resources could extend from the mid-1800s until 2013. This time period includes the impacts form historic logging and log drives which had a significant effect on streams and rivers in northern Wisconsin, the development era of the 1900's when most roads and trails with the Forest were constructed, present activities and future activities the might reasonably occur over the next five years.

Past Activities

Past activities which have affected water quality, fish passage and channel morphology include historic logging and log drives, construction of dams and the existing road and trail system. Historic logging and log drives had a dramatic effect on sedimentation and channel morphology on most rivers and streams. The process of log driving had several negative effects on streams. Rivers and streams were cleared of wood, trees and rocks to facilitate log drives, banks were cleared of trees from logging and at log rollway sites which were mostly located on high outside bends which initiated streambank erosion and dams were constructed which released flood flows that were higher and occurred for a much longer period than the bankfull-channel forming discharge. In addition, logging dam failures which created large floods were also common. These activities all caused bank erosion and channel scour that led to wider, shallower channels. Roads and trails constructed through out the 20th century included many stream crossings and miles in RMZ and wetlands. Some of the roads and trails caused impacts to water quality from erosion and sedimentation, to fish passage from improperly placed culverts and to channel morphology from culverts set to high or from heavy sedimentation.

Timber harvesting activity can affect water quality primarily by causing erosion and sedimentation from haul roads and skid trails or from soil disturbance from heavy equipment near water bodies. Forest Plans established for the Chequamegon and Nicolet National Forests in 1987 contained standards and guidelines to minimize the potential impact of timber harvesting on water quality. In 1995, Wisconsin established forestry BMPs to protect water quality. These have been adopted by the Forest Service and most other forest managers in Wisconsin. State-wide monitoring indicates the BMPs have been implemented and effective in protecting water quality (Shy and Wagner 2007). Thus impacts to water quality from forestry activities within the 6th level watershed containing National Forest have been minimal in recent years.

A number or road and trail stream crossings have been improved from 1998-2007 resulting in reduced impacts to water resources across the 6th level watershed containing National Forest. These are described under the existing condition. In 2006 and 2007 the Forest implemented five wetland restoration projects that removed fill associated with roads, trails and a dam that restored 55 acres of wetland. All of these activities had a beneficial effect on water resources.

Present Activities

Present activities include those associated with the alternatives, road-stream crossing improvements planned for 2008 and watershed restoration work planned for 2008. The potential effects of the alternatives are described under the direct and indirect effects in this report. The Forest is planning to improve 16 road-streams crossings in 2008 and will cooperate with the Wisconsin Department of Transportation to improve fish passage at two highway culverts. The

Forest will also conduct about 0.5 miles of channel restoration work on the South Fork Flambeau River. Impacts to water quality from timber harvesting would be minimal as described under past activities.

Future Activities

Reasonably foreseeable future activities that could affect water quality (sediment), fish passage and channel morphology over the next five years include improvement of problem road and trail stream crossings, trail relocation, road decommissioning and stream restoration. It is highly likely the Forest will continue to improve road and trail stream crossings at about the same rate as the past ten years. Depending on funding, this would result in improved water quality, fish passage and channel morphology at about 50-100 crossings over the next five years. The state and counties are also likely to improve some crossing over the next five years. The Forest is planning to relocate and improve portions of the Deadhorse Run motorized trail which will reduce wetland impacts. It is also likely the Forest will decommission a number of roads over the next five years and this would include removal of some stream crossings and wetland fills. The amount of decommissioning would be greatest under Alternative 2 (forest proposal), slightly less under Alternative 3 and the least under Alternative 1 (No Action). Impacts to water quality from timber harvesting would be minimal as described under past activities.

Conclusion

Since all alternatives maintain or reduce the length of road open to public motor vehicle use and there has been a general trend of reducing impacts to water quality (sediment), fish passage and channel morphology across all 6^{th} level watersheds, the alternatives would not cause any significant, adverse cumulative effects to water resources. Alternative 2 (forest proposal) would have the most beneficial cumulative effect on water resources, followed closely by Alternative 3. Alternative 1 (No Action) would not have adverse or beneficial cumulative effects on water resources.

Compliance with the Forest Plan and Other Regulatory Direction

All alternatives comply with Forest Plan and Regulatory direction. Alternative 2 (forest proposal) most closely meets the direction by reducing the most roadss open to motor vehicle use in areas sensitive for water resources. It has the lowest number of stream crossings, miles in RMZ and miles in wetland when compared to the other alternatives (Figures 1-3). Alternative 3 also makes substantial progress toward Forest Plan direction but contains slightly more routes in sensitive areas. Alternative 1 (No Action) would leave nearly double the mileage of routes open to public motor vehicle use than the other alternatives. Alternative 1 (No Action) has the highest number of stream crossings, miles in RMZ and miles in wetland of all alternatives and would not help achieve the Forest Plan aquatic desired conditions as well as Alternatives 2 and 3.

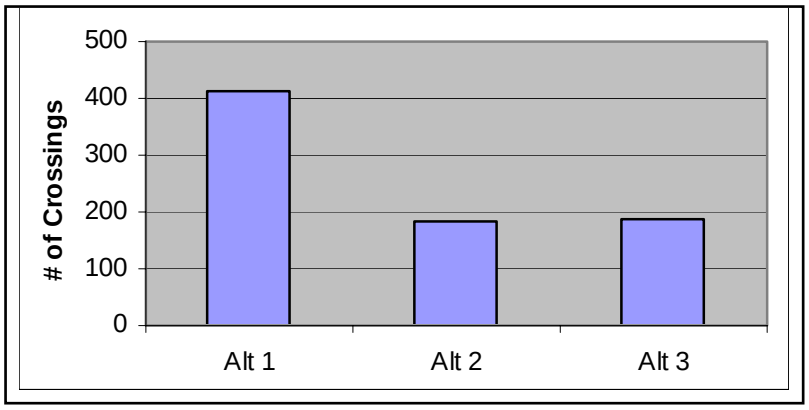

Figure 1. Number of Stream Crossings by Alternative

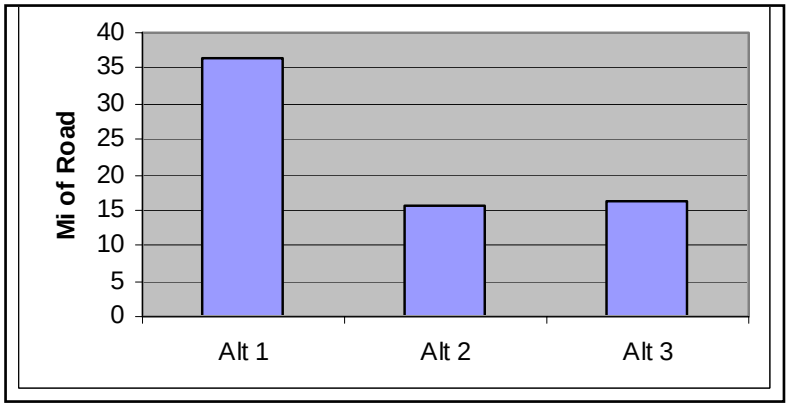

Figure 2. Miles of Road in RMZ by Alternative

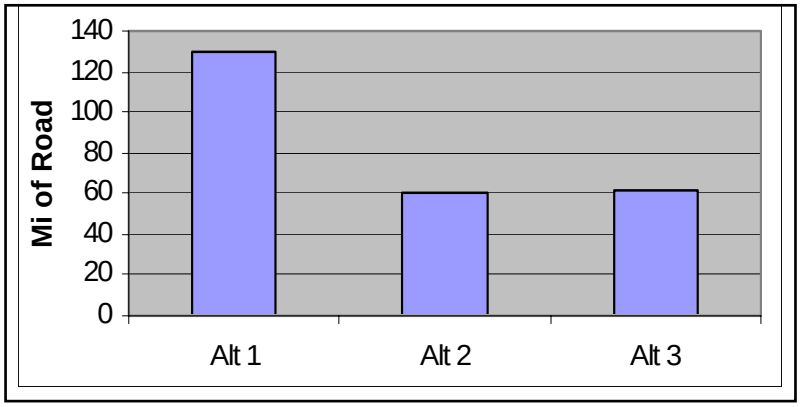

Figure 3. Miles of Road in Wetland by Alternative

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