Introduction

Over the past few decades, the availability and capability of Off-Highway Vehicles (OHV's) has increased tremendously, as has the intensity of OHV use on National Forest System (NFS) lands. While these vehicles have provided new recreational opportunities and access to many otherwise remote locations. field surveys have shown **that some** OHV activities **have potential to negatively affect** sensitive resources and water quality.

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This increase in OHV use can affect water resources. OHV use near water bodies, particularly at stream crossings, has the potential to cause the following impacts:

- Delivery of sediment and turbid water to streams and water bodies, particularly during storm events
- Vertical and lateral erosion of stream channels at stream crossings
- Destruction or weakening of riparian vegetation, which can compromise stream-bank stability and increase water temperature
- Water pollution by petroleum and chemical products and other organic and inorganic waste, including human pathogens

The purpose of this set of Best Management Practices (BMP's) is to control nonpoint source pollution that may occur because of OHV recreation activities on NFS lands. Activities that indirectly or directly affect OHV and could potentially impact water quality include travel route planning, trail location and design, construction, operations, maintenance, reconstruction, and restoration of OHV-damaged areas.

The term off-highway vehicle (OHV) means any vehicle used for access or recreation on roads, trails and areas other than those built and maintained for highway-licensed vehicles. It can include standard and high-clearance four-wheel drive (4WD) vehicles, off-road motorcycles (MCs), all-terrain vehicles (ATVs), dune buggies, Side-by Sides (Utility Terrain Vehicles - UTV's, Recreational Utility Vehicle - RTV's) and snowmobiles.

Sediment is by far the primary pollutant associated with OHV activity, although human waste and petroleum products can also be significant pollutants locally. Discharges of sediment into California's waters that are associated with OHV activity are caused by accelerated soil erosion. OHV traffic accelerates erosion by disturbing and exposing soils.

Trails are linear features that concentrate runoff. When runoff is concentrated on a trail and flows directly to a watercourse or water body, the trail becomes part of the drainage network, and creates hydrologic connectivity. Watercourse crossings, and OHV trails located near watercourses and water bodies, have a high potential for hydrologic connectivity. Consequently, watercourse crossings, and the OHV routes near them, have the greatest risk for sediment delivery from OHV activity.

OHV trails can also alter natural drainage patterns by intercepting, diverting, blocking, and concentrating surface and subsurface flows. Where OHV trails/routes run directly up or down slopes, there is high potential for routes to discharge sediment into receiving waters. Proper OHV management, trail location, design, construction, and maintenance can reduce the impact to natural hydrologic functions and water resources.

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Road drainage treatments—for example, out-sloping, inside ditches, and crowned prisms—are not effective on OHV routes. OHV routes typically occur in native soil material that easily erodes. In contrast, to roads which are constructed from deeper sub-soil or regolith. Roads

are also wider, have larger cuts and fill, are more compacted, and generally have gradients that are less steep than OHV trails.

There are situations where implementation of these BMPs may need to be more rigorous and where additional practices may be needed. Such situations include a water body listed pursuant to Clean Water Act section 303(d) as being impaired by sediment, siltation, or turbidity; and key watersheds in the areas covered by the Northwest Forest Plan and the Sierra Nevada Framework.

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Comment: Implementation should always be rigorous. This statement suggests otherwise.

Authorities

The Travel Management Rule (36 CFR, Parts 212, 251, and 261) adopted in 2005 provides the framework for managing OHV use on National Forest System lands. It mandates the USFS to designate routes for motor vehicle use by vehicle type, and if applicable by time of year, and to identify the route designations and seasonal restrictions on a motor vehicle use map (MVUM). With some exceptions, it prohibits motor vehicle use that is not in accordance with those designations.

Both the Northwest Forest Plan and the Sierra Nevada Framework incorporate Aquatic Conservation Strategies that encourage identification of key watersheds on national forest lands where protection of aquatic and riparian resources is a priority.

The Off-Highway Motor Vehicle Recreation (OHMVR) Division of the California State Parks has promulgated Soil Conservation Standards and Guidelines for all projects that it conducts and for which it provides funding. The Forest Service receives grant funding from the OHMVR Division for managing and developing OHV use on National Forest System lands. The Soil Conservation Standard specifically requires management of OHV activities to avoid impacts to both on-site and off-site resources, including water quality. The challenge is for individual forests to ensure that such requirements are effectively implemented through management actions that allow for measurement, monitoring, and assessment.

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This Water Quality Management Plan (WQMP) provides specific practices that are intended to protect and restore water quality while providing opportunities for OHV recreation.

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OHV-1 Planning

Reference: FSM 7710, FSH 7709.55 and FSH 7709.59 Chapter 10

Objective: To use the travel management planning processes, including travel analysis, to develop measures to avoid, minimize, and mitigate adverse impacts to water, aquatic, and riparian resources during OHV management activities, and to identify for restoration OHV-damaged areas and routes not designated for use.

Explanation: Determination of the amount, type and location of OHV trails made through various planning processes (this is an incomplete sentence without a clear meaning). OHV trail management planning includes travel analyses as well as trail management at the project level. Planning occurs at scales that can range from Forest-wide assessments and plans, to watershed scale analyses, to project-level trail activities. Effects on water, and on aquatic and riparian resources, are assessed during planning and are balanced with the need to provide OHV recreation opportunities. Protection and mitigation measures are considered when adverse impacts to water, aquatic, and riparian resources are anticipated.

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Comment: The CWA and P/C prohibit the polluting of the State's waters. They do not include provision for "balancing" clean water with providing OHV opportunity Protection should be required when adverse impacts to water or riparian resources are anticipated, not "considerd!

Trail Management Objectives (TMOs) are developed to document the type of recreational experience each trail will provide, and to provide direction for management of the trail. In addition to considering trail management at the site scale, TMOs also document Forest-wide trail maintenance needs and consider the potential for environmental effects and conflicts with other resources.

The risk from OHV trail management activities is intended to be reduced by using appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

1. Conduct Travel Analysis to determine the appropriate trail system for the recreational objective.
2. In instances where new routes are considered for approval, plan routes to:
   - Minimize the number of stream crossings and the hydrologic connectivity[1] of OHV trails and watercourses.
   - Avoid locations near wetlands (e.g., seeps, springs, marshes and wet meadows).
   - Use existing routes instead of new construction where less damage to water quality will result.
   - Designate existing routes that do not require reconstruction where slopes are between 50% and 65% and erosion hazard is moderate. This bullet point should be completely removed. It should not be a BMP to designate existing routes, nor should routes be approved where slopes are 50-65% and erosion hazard is moderate.
3. To the degree feasible, locate new routes on natural benches, flatter slopes, and on stable soils.
4. Avoid locating new routes on
   - Areas prone to landsliding;
   - Slopes steeper than 65%;
   - Slopes steeper than 50% where the erosion potential is high or extreme; or
   - Slopes over 50%, which lead without flattening sufficiently to dissipate concentrated runoff and trap sediment before it discharges into a water body.
5. Where existing routes pose potential risk, identify trail segments causing adverse impacts to water resources and prioritize mitigation measures such as:
   - closure, decommissioning, or relocation of existing routes or segments that are in high-risk locations, including the SMZ, riparian areas, and meadows to restore surface and subsurface hydrologic properties.
   - Reconstruction to improve, modify, or restore effective drainage.
   - Upgrade of stream crossings.
6. Develop or update Trail Management Objectives (TMO) for each trail.

[1] When trails concentrate runoff that flows directly to a watercourse or water body, they become part of the drainage network and are said to be hydrologically connected. The amount of sediment or turbid water that can be transported to a water body from an OHV route depends on the hydraulic power and capacity of the flow leaving the route. The hydraulic power and capacity of the flow are influenced by the degree to which runoff has been concentrated in the trail.

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Comment: The term "minimize" must be defined. The vagueness of this term in existing regulations has allowed OHV impacts to go unaddressed.

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Comment: These are steep slopes, and OHV use on moderately erodible soils can result in severe rilling and rutting. BMPs should address route gradient as well.

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Karen Schambach 10/3/10 6:07 PM
Comment: Delete "To the extent practicable." CWA and P/C don't allow damage just because preventing it would interfere with OHV recreation. These are "weasel words" that could result in the continuation of on-going damage.

- Define the recreation experience and level of difficulty the trail is designed to provide.
- Determine whether existing trail design standards are adequate to support the defined recreational experience, and whether impacts to water, aquatic, and riparian resources are likely to result from not following TMOs.
- Identify current and future needs and uses of each authorized route in the TMO.
- Identify trails that are being managed differently and/or are serving purposes other than those identified in TMOs.
- Operate the trail as intended by TMOs until the TMOs are revised and/or the trail is reconstructed to accommodate different uses.

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Comment: How does this relate to water quality?

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OHV-2 Location and Design

Reference: FSM 7720 and FSH 7709.56

Objective: To prevent or minimize sediment or turbid water originating from designated OHV routes and to prevent sediment from OHV areas from entering watercourses and water bodies by locating OHV routes to minimize hydrologic connectivity, and by incorporating drainage structures into trail design to effectively disperse concentrated runoff.

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Comment: "Minimize" is too vague. Either define or use word "prevent"

Explanation:

Proper on-site location and design of OHV routes is essential, particularly at stream crossings (See OHV-3).

When trails concentrate runoff that flows directly to a watercourse or water body, they become part of the drainage network and are said to be hydrologically connected. The amount of sediment or turbid water that can be transported to a water body from an OHV route depends on the hydraulic power and capacity of the flow leaving the route. This is influenced by the degree to which runoff has been concentrated in the trail. Sheet and rill runoff typically cannot penetrate a buffer strip, but concentrated runoff often can.

The potential to deliver sediment or turbid water originating from OHV routes and OHV areas to watercourses and water bodies following OHV use is a function of

- The number, location, and design of watercourse crossings
- The volume and energy of concentrated flow leaving the area or route
- The buffering capability (ability to absorb or disperse concentrated flow) of the intervening terrain, including slope gradient and surface cover
- The distance between the route and the receiving water body
- The inherent erodability of the disturbed and exposed soil

The first four of these factors determine the hydrologic connectivity between the route and the watercourse or water body. Watercourses are so important in managing the effects of OHV use on water quality that they have a BMP of their own. (OHV-3)

The techniques included in this BMP are intended to improve drainage and reduce or eliminate the hydrologic connectivity of trails and watercourses. The risk from OHV use can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

Location

1. Where new routes are being considered for addition to the system, locate OHV routes to avoid sensitive areas such as riparian areas, wetlands, meadows, bogs, fens, inner gorges, overly steep slopes, and unstable landforms to the extent practicable.
2. For both existing and new OHV routes, limit hydrologically connected areas to necessary watercourse crossings.
3. Locate trails to minimize the capture, diversion, and/or concentration of runoff from adjacent slopes.
4. Limit the length of hydrologically connected trail segments as much as practicable.
5. Locate drainage structures near watercourses to maximize the filter distance between the drainage outlet and the water resource.
6. Locate steep routes only on well-armored locations than can sustain traffic without accelerated erosion.
7. Limit the length of steep stretches to less than 100 feet on highly erodible soils. Delete # 7. as incompatible with resource objectives. No BMP should allow for steep stretches of any length to be allowed on highly erodible soils.

Design

While the vast majority of OHV routes in the Region are existing routes which had no engineering design analysis nor planning of the trail location because the routes were user-created, new OHV routes may be added to the system where Forests find new routes to be appropriate through appropriate engineering design. When new routes are added:

1. Design and space rolling dips, critical dips, reverse grades, and over-side drains to remove storm runoff from the trail surface before it concentrates enough to initiate rilling or surface erosion.
2. Design trail surfaces to dissipate intercepted water by rolling the grade.
3. Where trails cannot be effectively drained by rolling the grade or using reverse grades, provide trail drainage using OHV rolling dips as specified in *Rolling Dips for Drainage of OHV Trails*, USDA-Forest Service, Pacific SW Region, January, 2006.
4. Wherever possible, incorporate sediment basins at the outlet for rolling dip outlets instead of lead off ditches.
5. Install energy dissipaters at rolling dip outlets if sediment basins will not work.
6. Extend drainage outlets beyond the toe of fill or side-cast.
7. Install aggregate, paver blocks, or other surfacing treatment on tread segments that are steep, erosive, or heavily traveled.
8. Design routes to be no wider than necessary to provide the recreation experience for which they designed as identified in the TMO.
9. Incorporate design elements that discourage off-route use (e.g., taking shortcuts, cutting new lines).

OHV-3 Watercourse Crossings

Reference: FSM 7722 and FSH 7709.56b

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Comment: Define "as much as practicable."

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Comment: Delete the words "Locate drainage structures near water courses to"; just say "Maximize the filter distance…"

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Karen Schambach 10/3/10 6:19 PM
Comment: Sediment basins require regular maintenance. Why not use lead off ditches, properly placed?

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Karen Schambach 10/3/10 6:21 PM
Comment: If trails are hardened, there must be some method used to keep users on the hardened portion. Failure to do so results in the trail becoming wider, as users ride around the treated surface.

Karen Schambach 10/3/10 6:22 PM
Comment: Identify these design ... [1]

Objective: To prevent or minimize the discharge of sediment or turbid water into water bodies when locating, designing, constructing, reconstructing, and maintaining watercourse crossings.

Explanation: The importance of watercourse crossings in managing the effects of OHV use on water quality cannot be overemphasized. Of the pollutants generated by OHV use, sediment has by far the greatest volume and the greatest potential for sediment delivery at and near watercourse crossings where the potential for hydrologic connectivity is high. The approaches to watercourse crossings are typically constructed in native soils that can erode and deliver sediment to channels.

Typical OHV watercourse crossings include low water crossings, fords, bridges, arched pipes, culverts, and permeable fills. Crossing materials and construction vary based on the type of trail and kind of use. To minimize impacts to water quality, design crossings of new routes or relocated routes to provide for the unimpeded flow of water, bed-load and large woody debris, and aquatic organisms. Watercourse crossings must be constructed with minimal disturbance to the streambed and to surface and shallow groundwater resources.

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Fill-slopes and the approaches to watercourse crossings are especially important. All sediment resulting from erosion on these surfaces is delivered directly into the watercourse.

Construction, reconstruction, and maintenance of watercourse crossings often require equipment to be in and near streams, lakes and other aquatic habitats. Such disturbance can increase the potential for accelerated erosion and sedimentation by destabilizing stream-banks or shorelines, removing vegetation and ground cover, and exposing and compacting the soil. Permits may be required for in-stream work associated with stream crossing construction and maintenance projects.

The risk of sediment delivery at watercourse crossings can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions. Location, construction, and maintenance of watercourse crossings, and assessment of watercourse crossing condition, may require consultation with qualified personnel.

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Implementation Techniques:

Crossing Location

1. Locate OHV trails to limit the number of watercourse and surface-water crossings necessary to meet planned activity objectives. (See also OHV-1)
2. Avoid long, steep trail segments on OHV routes that approach crossings.
3. Orient the stream crossing perpendicular to the channel in straight and resilient stream reaches.
4. Disturb as little area as possible when crossing a standing water body.

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Karen Schambach 10/3/10 6:26 PM
Comment: Vague. Also, planned activity objectives should not override water quality protection goals.

5. Where existing OHV trails cross watercourses so that resource damage or water quality is being negatively affected to any substantial degree, Forests should either correct the problem, relocate the route, or close the route to use.

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6. To assist in determining whether or not specific watercourse crossings are causing substantial resource damage or water quality degradation, each year individual national forests shall identify a minimum of the 10 highest risk OHV route watercourse crossings in that forest to evaluate and assess OHV route impacts to water quality and riparian/aquatic resources. Such assessments shall be based on the individual national forest's interdisciplinary team knowledge of areas with high OHV use, erodible soils, steepness of trail crossings, and any other information that

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can assist with such an assessment. Each year individual forests shall report to the Regional Office the exact number of OHV route watercourse crossings visited, evaluated, and either approved for continued use or closed/decommissioned to halt water quality impacts. The Region shall provide the State Water Board with a copy of those reports from individual forests and summarize how many of each forest's 10 high-risk crossings remain in use or had closure/decommissioning.

New Construction or OHV Reconstruction of Trail Approaches to Watercourse Crossings[2]

1. Install cross drainage (cut-off waterbreaks) at crossings to prevent water and sediment from being channeled directly into watercourses or surface waters.
2. Locate cut-off waterbreaks as close to the crossing as possible without being hydrologically connected.
3. To the extent possible, make crossing approaches short and level, or reverse the grade.
4. Armor steep crossing approaches with stable aggregate or trail hardening materials.
5. Where possible, such as at bridges or arch culverts, reverse the grade of the crossing approaches so runoff drains away from the watercourse.

New Construction or OHV Route Reconstruction Design of Watercourse Crossings

1. Design crossing approaches and nearby drainage structures to minimize hydrologic connectivity.
2. Instead of pipe culverts, use bridges, bottomless arches or buried pipe-arches for watercourses with identifiable floodplains and elevated trail prisms.
3. Design watercourse crossings to allow for unobstructed flow including bed-load and organic debris, and to provide for passage of desired aquatic and terrestrial organisms. [Add reference to manuals for sizing & AOP]
4. Place stable materials below the outlets of cut-off waterbreaks to dissipate energy.
5. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces.
6. Construct watercourse crossings to sustain bankfull dimensions of width, depth and slope, and to maintain streambed and bank resiliency.
7. Harden fords with gravel or cobble of sufficient size and depth to prevent movement during wet weather traffic.
8. Stabilize crossing approaches as needed to minimize soil displacement by traffic during the rainy season.
9. Use USFS design specifications for bridges [Add reference].
10. Cross meadows or areas which have naturally high water tables with culvert arrays, perched culverts, and/or permeable fills to maintain meadow function. This item #10 should be completely removed or replaced by the sentence: "Meadows or areas with naturally high water tables will not have OHV routes allowed. Where existing routes currently cut through such features, individual forests will either identify routes for reconstruction around the features or close/decommission the routes".

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Comment: The Sierra Nevada Forest Plan Ammendment prohibits OHV routes in meadows.

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[2] The watercourse *crossing approach* is the segment of trail from the last point where all runoff is diverted from the trail to the edge of the stream channel. This last drainage structure is referred to as a "cut-off waterbreak."

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1. Conduct construction operations during the least critical periods for water and aquatic resources (usually during low water conditions and non-spawning/breeding seasons).
2. Minimize excavation of stream banks and riparian areas during construction.
3. Stabilize adjacent areas disturbed during construction.
4. Keep excavated materials out of channels, floodplains, wetlands, and lakes.

OHV-4 Construction, Reconstruction

Reference: FSH 7709.57

Objective: To prevent or minimize the discharge of sediment or turbid water into water bodies during construction and reconstruction of OHV routes and trails.

Explanation: Vegetation and ground cover is removed during trail construction and reconstruction, exposing the surface and subsurface soil to erosion. Temporary and long-term erosion control measures are necessary to minimize erosion and sediment delivery. The risk from trail construction and reconstruction activities can be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

1. Windrow slash and surface duff and litter at the base of fill slopes to trap sediment.
2. When constructing trails near Streamside Management Zones (SMZ), do not permit side-casting of soil into the SMZ.
3. Do not operate equipment when ground conditions could result in excessive rutting, or runoff that could deliver sediments directly to watercourses or water bodies.
4. Construct OHV-rolling dips[3] when soil moisture is sufficient to allow adequate compaction of OHV rolling dip drainage structures.
5. Close newly constructed trails for one season to allow consolidation of soils in treads and drainage structures so treads and structures can better withstand OHV traffic.
6. Develop and implement an erosion and control sediment plan that describes:
    - Amount of vegetative clearing and amount of soil material to be moved
    - Proposed erosion control measures to retain sediment on the site
    - Proposed sediment control measures to capture mobilized sediment
    - Proposed sequence of implementation for erosion and sediment control treatments
7. Maintain erosion control measures to function effectively throughout the project area during trail construction and reconstruction.
8. Keep erosion control measures sufficiently effective during ground disturbance to allow rapid closure if weather conditions deteriorate.
9. Complete all necessary stabilization measures prior to predicted precipitation that could result in surface runoff.
10. Complete erosion and sediment control treatments before leaving project areas for the winter or rainy season.

[3] *Rolling Dips for Drainage of OHV Trails*, USDA-Forest Service, Pacific SW Region, January 2006.

OHV-5 Monitoring

Reference:

Objective: To minimize sediment delivery to water, aquatic, and riparian resources by identifying OHV routes and trail segments in need of maintenance, by setting priorities for maintenance, and by identifying OHV areas and routes in need of restoration, closure, or decommissioning.

Explanation: The Forest Service will monitor OHV activities and effects to detect existing and probable impacts to water quality, aquatic and riparian resources. The Forest Service will regularly inspect OHV routes and areas through a systematic scheduling of monitoring that will be spelled out to both the State Water Board and the interested public prior to any finalization of the State Water Board waiver process. If adverse water quality effects are occurring due to OHV activity or there is a potential for substantial water quality impacts to occur, the Forest Service will take immediate corrective action. Corrective actions may include, but are not limited to

- Permanent or temporary erosion and sediment control treatments
- Barriers and signing to redistribute use
- Reduction in the amount or type of OHV use or season of use
- Partial or total closure of routes or areas and decommissioning where appropriate

Implementation Techniques:

1. Conduct G-Y-R Trail Condition Monitoring as described in *Revised OHV Trail Monitoring Form (GYR Form) and Training Guide*, USDA-Forest Service, Pacific SW Region, July 30, 2004, to identify routes in need of maintenance and to prioritize maintenance activities.
2. Schedule GYR Trail Condition Monitoring so high-risk and high-maintenance routes are monitored annually; schedule the monitoring of stable routes less frequently, but not less than every three years.
3. Conduct on-the-ground resource specialist inspections of OHV routes at least once every three years to identify and assess newly created unauthorized OHV use, resource impacts, and threats to water quality. Where such resource threats or water quality impacts are identified, temporarily restrict any continued OHV use, schedule restoration treatments, and only re-open the route to OHV use once restoration treatments are effectively completed.
4. Permanently close or decommission any or all routes that pose significant threats to water quality due to sediment discharge or other resource degradation. At a minimum, sign such routes as closed and install temporary erosion and sediment controls prior to the winter season.
5. Permanently close or relocate routes that cannot sustain OHV use without causing adverse effects to the beneficial uses of water. Restore permanently closed routes or portions of routes where active decommissioning and restoration is determined to be necessary.

6. To ensure that BMP's effectively minimize sediment discharge into receiving waters downslope from OHV routes/trails, each national forest shall identify three (3) high-sediment-risk watercourse stream crossings in that national forest and actively monitor in the following manner for each of the five (5) years of the State Water Board waiver: As prescribed through protocols that will be developed by the Regional hydrologist in conjunction with input from State Water Board staff, each

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national forest shall monitor the three high-sediment-risk watercourse stream crossings or other high-sediment-risk OHV sites on at least two dates with no apparent or obvious recent OHV use. Water quality and turbidity levels from those no-apparent-use dates shall be compared with two samples taken on days where OHV use is observed to be at moderate to high use levels. The annual results from each national forest shall be reported to the Region, and the Region shall summarize the information and provide a summary report to the State Water Board. Where sites are shown to produce turbidity higher than acceptable levels, each national forest shall describe adaptive management steps taken to reduce sediment discharge at the site with high turbidity. Where high levels of turbidity are identified and adaptive management actions are implemented, at least one additional turbidity sample shall be taken on a subsequent day when OHV use is observed to be at moderate to high use (to assess the effectiveness of the action). The result shall be communicated as part of the report provided by each national forest to the Region (and by the Region to the State Water Board).

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OHV-6 Maintenance and Operations

Reference: FSM 7732, FSH 7709.58 and FSH 7709.59 Chapter 60

Objective: To prevent or minimize discharges of sediment or turbid water into watercourses and water bodies by maintaining OHV routes and associated drainage structures and by regulating OHV use.

Explanation: OHV trails are linear features constructed in native soil that have a potential to concentrate runoff. Except for occasional hardened segments, trails are not typically surfaced with aggregate. In addition, normal OHV traffic tends to create an outside berm along the tread. Due to the presence of this berm, and gradients typically steeper than roads, runoff from trails cannot be readily drained by crowning or out-sloping as it can for roads. Drainage and erosion control facilities cease to function if they are worn down by continued traffic. These factors make periodic maintenance and field inspection of routes critically important in minimizing the impacts of OHV use on water quality.

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Trail drainage systems may further increase hydrologic connectivity if they deteriorate because of use, weather, or inadequate maintenance. Trail drainage facilities may become inadequate after wildfires or extreme precipitation events due to increased surface runoff, loss of vegetative cover, and stream bulking. New groundwater springs and seeps saturate trails occasionally after the occurrence of a wildfire or following unusually wet periods. Timely maintenance can correct these conditions.

Trail maintenance with mechanized equipment such as SWECO-type trail tractors and mini-excavators can disturb soil, making it susceptible to erosion. Less aggressive maintenance is often necessary to minimize disturbance of stable sites.

The construction of OHV rolling dips is from native soil material. For these structures to hold up under traffic they need to be well compacted. This requires moist soils and the scheduling of maintenance task to exploit the narrow window of time when soil moisture is optimal for compaction.

Obstructions to traffic such as fallen logs and potholes can lead to trail braiding, puddles and off-trail traffic. Prior to opening trails for use, or periodically for trails open year-round, clearing trails of obstructions can reduce the need for repair and restoration.

Trail management objectives (TMO) define the designed use, type of recreation experience, and the level of difficulty that a trail is designed to provide. It is important to maintain trails to the defined maintenance rotation, designed use and level of difficulty. The deterioration of trails to a more challenging difficulty level due to a lack of maintenance can affect water resources. More challenging trails often produce more sediment.

The effects of trail maintenance activities on water quality is intended to be managed by using the appropriate techniques from the following list, adapted as needed to local site conditions.

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Implementation Techniques:

Maintenance Planning

1. Develop and implement annual maintenance plans that are based on the results of trail condition surveys (USFS - TRACS) and monitoring (G-Y-R) and periodic inspections. (See OHV-5) Each national forest shall develop maintenance plans that will ensure that every OHV route will have resource specialists assess the condition of that specific route no less than once every three years.
2. Schedule maintenance to maximize the time-period when soils are at optimal moisture levels for soil compaction.

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Inspection

1. As described above under Maintenance Planning, each national forest shall ensure that resource specialists inspect, monitor and assess each OHV trail at least once every three years to assess its condition and to assist in setting maintenance priorities. (See OHV-5)
2. Identify the need for additional drainage structures, spot rocking, or trail hardening to protect and maintain water, aquatic, and riparian resources.
3. After major storm events, to the extent staffing is realistically available, attempt to inspect potential problem trails, drainage structures and runoff patterns and, as needed
   - Clean out, repair or reconstruct drainage structures that are not functioning
   - Clear the tread of obstructions to traffic that could lead to trail braiding or off-site impacts

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Maintenance Activities

1. As per Regional Forester's direction dated 11-8-2002, follow the maintenance standards and guidelines in *A Field Evaluation of the Use of Small Trail Tractors to Maintain and Construct OHV Trails on National Forests in California*, USDA-Forest Service Pacific SW Region, August 22, 2001. These standards and guidelines include the following:
   - Lift the blade and walk equipment across sections of trail that do not need maintenance.
   - Recycle soil collected in rolling dip outlets into rolling dip structures or back into the trail tread.
   - Do not blade the outside berm off the trail as side-cast; work the berm back into the trail tread.

- Blade soil sloughed from cut-banks, or from side-slopes above trails, only as needed to maintain a safe trail; do not undercut or blade into cut-banks.
- Move the smallest amount of soil necessary to meet the maintenance objective.
- Where soil is too dry or too wet for compaction, defer maintenance on drainage structures, or carry out maintenance by hand.

2. Maintain trail surfaces to dissipate intercepted water in a uniform manner along the trail by the use of OHV rolling dips. (See OHV-2 for design specifications)

3. Groom trails as needed with a rock rake to keep drainage outlets open.

Operations

1. Restrict OHV travel to designated routes or designated motor vehicle use areas rather than allowing cross-country travel.
2. At the time of each OHV route's once-every-three-years inspection by the individual forest's resource specialists, determine the need for clearing obstructions to traffic to avoid braiding. Where clearing is needed, either implement the necessary clearing within one year of inspection or close the route until work is completed.
3. As the single highest priority management practice to ensure that water quality is protected as intended on national forest lands, each national forest shall be responsible for closing routes or restricting OHV use when the potential for sediment delivery is high or during periods when such use would likely damage the tread or drainage features. This management direction shall be made a priority on each national forest to reduce sedimentation into receiving waters and to reduce other resource degradation. (Also see OHV-7)

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OHV-7 Wet Weather Management

Reference:

Objective: To prevent or minimize the discharge of sediment or turbid water into water bodies by closing OHV trails to traffic when soil strength is low and trail treads and drainage structures are susceptible to damage.

Explanation: Soil strength decreases as moisture increases. When soil strength is low, OHV traffic can lead to tread failure and damage to OHV rolling dips. Damage to trail drainage increases the risk of sediment delivery to watercourses and water bodies. Soil displaces and transports easily when soil strength is low and OHV traffic near watercourses and on crossing approaches can result in direct delivery of sediment or turbid water.

The susceptibility of OHV routes to damage when soil strength is low varies with soil type, amount of traffic, and type of vehicle. Each OHV area has a unique combination of soil types and precipitation patterns that determine the appropriate implementation techniques to minimize impacts to water resources during wet weather.

Implementation Techniques: To manage sediment or turbidity discharges from OHV use when soils are wet, the Forest Service will use its authority under 36 CFR Section 261 to close designated OHV routes and areas to vehicular travel. This may be done seasonally by a given date, or be based on local conditions such as precipitation or measurements of soil trafficability. Use the following techniques, as appropriate, using local conditions for wet weather management of OHV trail systems:

1. Develop a wet-weather management plan to respond to storm events in each individual national forest when storms saturate soils during seasons when OHV use is occurring on approved OHV routes.
2. Close OHV routes seasonally for the months when soil moisture is typically high **if OHV routes either are located in areas with moderate to high erosion soils, if soils are expected to be saturated for more than a few days, or if routes run up and down slopes in a manner that has potential to channel water. Where individual national forests presently allow for year-round or winter season OHV use, the Region shall require individual forests to either close routes for the winter rainy season or to document that routes are not located in soils with moderate to high erosion potential, are not located where soils will be saturated for more than a few days, or do not contain route segments that run up and down hillsides above receiving waters.**
3. Close routes for a core period when soil moisture is expected to be high, and extend the closure period as needed, based on precipitation or soil trafficability. (Delete this #3 since #2 above covers this +, makes it redundant)
4. Determine the levels of soil strength and moisture at which OHV trail damage begins to occur for typical traffic, and close routes when measurements of soil strength indicate there is a high risk of damage to drainage structures and trail treads. **To ensure that each national forest applies this management direction in a fashion that reduces risk to water quality, each national forest within three years of any State Water Board waiver approval shall provide the Region with a plan showing at a minimum the ranking of OHV trails in that national forest for potential risk based on soil type, steepness of route segments, and amount of OHV use. The Region shall report a summary of those individual forest reports to the State Water Board with accurate information showing whether or not each identified OHV route on each national forest had the evaluation completed and how the forest determined when to close vulnerable routes to wet season use.**
5. Identify benchmark locations where measurements of precipitation or soil trafficability will be taken to determine when trails will be closed.
6. Identify routes, or loops of routes, with similar conditions that can be selectively closed.
7. Identify and, where economically feasible, reroute or reconstruct trail segments that cause entire routes or trail systems to be closed because they retain moisture longer than is typical for the route.

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OHV-8 Restoration of OHV-Damaged Areas

Reference: FSM 7734

Objective: To prevent or minimize the discharge of sediment or turbid water into watercourses and water bodies by permanently restoring OHV-damaged areas, watercourse crossings, and OHV routes no longer designated for use.

Explanation: Loss of surface duff, litter, and vegetation leaves soils exposed and easily eroded. Ruts and tracks created by OHV traffic are unnatural channels that concentrate surface runoff and increase its erosive power. OHV traffic can also compact soils, causing increased surface runoff.

OHV traffic in wet meadows and marshes damages the root network that stabilizes sensitive soils. This can cause stream incision, which lowers the water table and results in a loss of meadow and riparian vegetation.

OHV-damaged areas, and OHV routes no longer available for use, are identified during the route designation process at the Forest and watershed level and during trail condition surveys and monitoring (see OHV-5). Identify additional trail segments for restoration when rerouting trails.

Restoration of OHV-damaged areas and closed trails includes activities that stabilize and restore the landscape to a more natural state. Treatments can range from simply scattering slash or raking in duff and litter, to watercourse or meadow restoration, to using heavy equipment to break up compaction, fill in incised trails, reshape the area to its natural contour, and install drainage structures. Planting native vegetation helps stabilize slopes, intercepts, and defuses rainfall. Effective closure from OHV traffic is essential to allow restored sites to recover.

Accomplish restoration of OHV-damaged landscapes by using the appropriate techniques from the following list, as applicable and adapt as needed to local site conditions.

Implementation Techniques:

Restoration of Routes and OHV-damaged Areas

When planning the restoration of OHV-damaged routes and areas consider the following steps taken from *Restoration of OHV-damaged Areas – A Ten-Step Checklist*, USDA-Forest Service, Pacific SW Region, May 31, 2006:

1. Identify the source of the problem
2. Effectively close the area to OHV traffic
3. Reshape the land surface to its original contour
4. Disperse concentrated runoff
5. Prepare the seedbed
6. Planting or seeding
7. Stabilize the surface
8. Signing
9. Enforcement and monitoring
10. Remove signs and barriers

More information on each step is included in the report. Additional information on restoring OHV-damaged areas can be found in *Restoration of Off-Highway Degraded Landscapes* (in press) USDA-Forest Service, San Dimas Technology and Development Center, 2010.

Restoration of Watercourse Crossings

With the possible exception of ephemeral watercourses (those that lack a well-defined, scoured channel), restoration of watercourse crossings should be done under the direction of—or after

consulting—a qualified watershed specialist. A permit may be required if in-channel work is necessary.

When restoring OHV watercourse crossings, follow these guidelines as appropriate:

1. Remove any trail hardening materials and restore the channel bottom to its natural gradient and width.
2. If necessary, replace hardening material with cobble similar in size to the native bed-load.
3. Restore crossing approaches to insure that surface runoff does not reach the watercourse.
4. If necessary to divert runoff, install cutoff water-breaks as close to the crossing as feasible.
5. To the extent possible, reshape the stream-banks to their former natural contour.
6. Stabilize and re-vegetate the stream-banks.

OHV-9 Concentrated Use Area Management

Reference: FSM 2160 and FSH 7109.19 Chapter 40

Objective: To prevent or minimize the discharge into water bodies—or contamination of groundwater by infiltration through soils—of turbid water, sediment, petroleum and chemical products or human waste by planning, constructing, installing and maintaining drainage and runoff treatments at OHV staging areas, and by managing the risk of pollution at high-use and high-risk OHV areas.

Explanation: Petroleum products and chemicals from spills during refueling, leaking, damaged or overturned vehicles and from improper disposal, practices can be a source of water contamination. Small amounts can be absorbed by the soil and broken down, but the risk of water contamination is often high in concentrated use areas located near watercourses and water bodies.

Where sanitation facilities are not available or are inadequate, fecal matter and pathogens can enter water bodies. The risk of contamination from fecal matter and pathogens is highest in areas near water bodies with concentrated use. OHV staging areas sometimes constitute large areas with little or no infiltration capacity. Runoff from these areas is high and can transport sediment, nutrients, petroleum products, microbial bacteria, and other pollutants to any nearby watercourses or surface waters.

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OHV staging areas are sometimes used for winter recreation. Snow removal from these facilities may adversely affect water, aquatic, and riparian resources. Plowing can physically displace native or engineered surfaces, damage drainage structures, or alter drainage patterns. Snow plowing may also remove protective soil cover such as vegetation and mulch. These changes can result in concentrated flow, increased erosion, and a risk of sediment delivery.

The risk of delivering sediment, petroleum and chemical products, and human pathogens to water bodies at concentrated use areas can be reduced by using the appropriate techniques from the following list, adapted as needed to local site conditions.

Implementation Techniques:

Staging Areas

1. Where new staging areas are being considered for approval, locate OHV staging areas away from water bodies and watercourses to reduce the potential for hydrologic connectivity.
2. Design new OHV staging areas to accommodate the amount of use expected.
3. To determine necessary drainage, calculate the expected runoff using the appropriate design storm. Include run-on from adjacent areas.
4. Armor both new and existing high-use OHV staging areas with protective materials appropriate for the site.
5. For the limited number of staging areas where groundwater contamination risk from petroleum products is high, armor with permeable pavements and/or integrate vegetative islands to trap and filter runoff.
6. Infiltrate as much of the runoff as possible in areas where the risk of groundwater contamination is low.
7. Where staging areas are located near watercourses or water bodies, and the potential for hydrologic connectivity is high, install a contour berm and trenches around the perimeter to contain sediment and potential spills.
8. To the extent feasible given funding availability, provide permanent or temporary sanitation facilities as appropriate for the level of recreation use expected.
9. Adopt and implement a Spill Prevention, Containment, and Counter Measures plan.
10. Report hazardous spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations.

High Risk Areas and Events

1. Develop and implement a fuel and chemical management plan (e.g. SPCC, spill response plan, emergency response plan) for special events and at locations where the risk of overturned vehicles is high. For example, extreme (highly technical) 4x4 trails and rock crawling areas.
2. Clean up and dispose of spilled materials according to specified requirements in the appropriate guiding document.
3. Report hazardous spills and initiate appropriate clean-up action in accordance with applicable state and federal laws, rules and regulations.
4. Provide temporary or permanent sanitation facilities as appropriate for the use level.

Camping Areas

1. Provide permanent or temporary sanitation facilities at high use areas, especially at campsites and day-use areas near water bodies, watercourses, and riparian areas and meadows.
2. As necessary and feasible, provide sanitation facilities at commonly used camping and resting sites and at other areas of concentrated use.
3. Provide education and training on the principles of backcountry sanitation, pack-it-in and pack-it-out.

Snow Removal

1. Develop a snow removal plan for OHV staging areas plowed for winter recreation (if sites are not restricted from wet season OHV use due to limitations tied to saturated soil conditions discussed in OHV 7 (Wet Weather Management).
2. Move snow in a manner that will prevent disturbance of road surfaces and drainage structures while protecting adjacent water, aquatic, and riparian resources.

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What happens if spills persist? What is the next action to be taken?

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3. Store snow in pre-approved areas where snowmelt will not cause erosion or deposit snow, road de-icers, or traction-enhancing materials directly into surface waters.

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[4] These references include information on OHV management, including trail location, design, construction, and maintenance, all of which affect OHV trail drainage, and therefore ultimately sediment delivery and potential impacts on water quality.