APPENDIX G – BEST MANAGEMENT PRACTICES (BMPS)

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Introduction

This appendix documents the selection of site specific Best Management Practices (BMPs). BMPs are designed for the prevention and control of non-point source pollution originating from resource management activities, and to mitigate the effects to the beneficial uses of the watersheds in and adjacent to the Deadman Project Planning Area. This interdisciplinary process included:

A. Selection of specific BMPs based on the general BMPs which are defined in "General Water Quality Best Management Practices" (USDA Forest Service publication, November, 1988);

B. Development of implementation and monitoring plans for each BMP;
C. Analysis of the ability to implement and the effectiveness of each BMP.

The following was documented for each BMP selected:

A. Title of general BMP as defined in "General Water Quality Best Management Practices"
B. Objective of the BMP
C. Explanation of the need for the BMP
D. Implementation and Responsibility - an explanation of how the BMP will be achieved and who will be responsible for implementation of the BMP
E. Ability to Implement rating. The ratings are:

High: Almost certain the BMP can be implemented as planned. These BMPs are usually implemented or enforced using mechanisms such as the Planning Process, Timber Sale Contract Provisions and road-building specifications, Forest Service manual direction, environmental documents, and Forest Plan Standards and Guidelines.

Moderate: Greater than 75% certainty the BMP can be implemented as planned. Implementation of the BMP may be dependent on factors such as funding, or unidentified physical constraints, such as soil or topographic conditions, or extreme weather events, such as a 50- or 100- year flood occurring in the Project Area.

Low: Less than 75% certainty the BMP can be implemented as planned. An example of a low ability to implement might be conflicting regulatory requirements, excessive project restrictions, or lack of funding.

F. Effectiveness rating of the BMP. The ratings are:

High: Practice is highly effective (> 90%) and one or more of the following types of documentation are available:

1. Literature/Research - must be applicable to the area.
2. Administrative studies - local or within similar ecosystem.
3. Experience - judgment of an expert by education and/or experience. During the BMP selection and design process, all BMPs will be reviewed by qualified
4. Fact - obvious by reasoned (logical) response.

Implementation and effectiveness of this practice will be monitored and the practice will be modified if necessary to achieve the objective of the BMP.

Moderate: Documentation shows that the practice is effective less than 90% of the time, but at least 75% of the time.

OR

Logic indicates that this practice is highly effective, but there is little or no documentation to back it up.

Implementation and effectiveness of this practice will be monitored and the practice will be modified if necessary to achieve the objective of the BMP.

Low: Effectiveness unknown or unverified, and there is little or no documentation.

OR

Applied logic is uncertain in this case, or the practice is estimated to be less than 75% effective.

This practice is speculative and needs both effectiveness ad validation monitoring.

G. Monitoring plan for the specific BMP.

Monitoring will be conducted primarily by District personnel with assistance from Forest resource specialists. Each year a sample of units which have had

BMP's applied will be monitored for implementation and effectiveness of those BMP's. Units will be selected using a random sample.

BMPs are used to derive specific mitigation measures to be specified in the Deadman Environmental Impact Statement (EIS). BMPs drawn on to derive specific mitigation measures are referenced to this appendix in the EIS. Other BMPs govern the method of analysis, methods of harvest unit layout, Timber Sale Contract language and contract administration.

Further explanation of Colville National Forest BMP implementation direction is found in the Colville National Forest Land and Resource Management Plan (Forest Plan), pages 4-51 and 4-52 and in the Final Environmental Impact Statement for the Forest Plan, Appendix G.

Compiled for the Deadman Interdisciplinary Team by:

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Micheal E. Porter April 1, 1997

Fire suppression and fuels management

F-1 Fire and Fuel Management Activities

Objective: To reduce potential public and private losses which could result from wildfire and possible, subsequent flooding and erosion by reducing the frequency, intensity and destructiveness of wildfire

Explanation: Timber harvest activities can create additional fuel residues (slash). The harvest units in the Deadman Project Planning Area will be analyzed and evaluated for potential wildfire hazard and associated damage to water quality. If necessary, slash will be treated to reduce the risk of catastrophic fire and subsequent flooding and erosion. Potential fuel treatments will be evaluated on a unit-by-unit basis and will provide for retention of the kind and amount of residues needed for on-site benefit of water resources in the Project Planning Area. Units displaying a minimal resource risk due to wildfire will not be treated for hazard reduction but may be treated for site preparation. The following fire hazard reduction measures will be considered following the completion of timber harvest activities:

a. Broadcast burning
b. Underburning
c. Lopping and scattering of slash
d. Grapple Piling
e. Leaving tops attached during yarding operations, to reduce post-harvest fuel loadings.

Implementation and Responsibility: Fuels Management will be implemented through normal program planning and budgeting and NEPA process, predominantly by the Kettle Falls fire management organization. Other resource specialists may be involved in fuel modification projects that are implemented by Fire Management. The management constraints and multiple resource protection prescriptions are documented in the Brush Disposal appraisal and the individual unit burn plans. Application of constraints and prescriptions are the responsibility of the district Fire Management Officer. The mechanisms for implementing this BMP are the planning process and individual unit burn plans. The Fuels Management Specialist will evaluate the need for interdisciplinary team assistance in developing burn plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation and effectiveness monitoring is done by fuel management and other specialists within the Forest Service fire organization. Also see Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices and Item 26: Riparian Areas.

F-2 Consideration of Water Quality in Formulating Prescribed Fire Prescriptions

Objective: To provide for water quality protection while achieving the management objectives through the use of prescribed fire

Explanation: Fire prescription elements will be developed with specific concerns for the protection of water, soils, and riparian vegetation. Prescription elements will be designed to control fire intensity, rate of spread, residence time, and fuel consumption. Some measures to achieve these objectives will be:

a. Seasonal and weather constraints on burning when soil, duff, and fuel moistures are high enough to reduce consumption (e.g. Spring burning)
b. Excluding fire from specified areas such as RHCA's
c. Developing fire ignition patterns to control fire behavior
d. Developing fire prescription elements for wind speed, air temperature, relative humidity, soil moisture, fuels (e.g. moisture, quantity, and distribution), slope, and aspect

Implementation and Responsibility: Field investigations are conducted as required to identify site-specific conditions which may affect the prescription. Water quality objectives are established prior to preparation of the burn plan. The prescription elements are assessed by an interdisciplinary team, and the fire prescription is prepared by the Fire Management Officer. The fire prescription should be reviewed by the interdisciplinary team and will be approved by the appropriate line officer. The mechanisms for implementing this BMP are the planning process and individual unit burn plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest Service fire organization personnel and watershed specialists monitor implementation and effectiveness of this BMP. Also see Forest Plan Monitoring Guide, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

F-3 Protection of Water Quality During Prescribed Fire Operations

Objective: To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering water bodies

Explanation: Some of the techniques used to prevent water quality degradation in the Deadman Project Planning area will be:

a. Constructing water bars in fire lines
b. Maintaining the integrity of Riparian Habitat Conservation Areas and wetlands
c. Planning prescribed fires with intensities that will not result in soils becoming hydrophobic
d. Retaining or re-establishing ground cover to prevent erosion of the burned site

Implementation and responsibility: Forest Service and/or other crews are used to prepare the units for burning. This includes waterbarring firelines and reducing fuel concentrations. The Interdisciplinary Team will identify riparian areas, wetlands, and soils with high risk of

becoming hydrophobic as part of project planning. The mechanisms for implementing the BMP are the Timber Sale Contract and individual unit burn plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest Service fire organization personnel and watershed specialists monitor implementation and effectiveness of this BMP. Also see Forest Plan Monitoring Guide, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

Road systems

The following Road System Best Management Practices apply only to specified roads unless temporary roads are specifically identified within the text of an individual BMP. Stream categories mentioned below are defined in Infish 1995.

R-1 General Guidelines for the Location and Design of Roads

Objective: To locate and design roads which will have minimum resource damage

Explanation: Road location and design standards will be based on the intended road purpose and protection of aquatic resources. General road location Standards will include the following:

1) New Traffic Service Level (TSL) "D" roads with design speed of 10 mph or less will be located on a predominately non-geometrical horizontal and vertical alignment to minimize the amount of excavated material needed to construct the road.
2) The road grade will be rolling when possible between control points to provide roadbed drainage.
3) Generally roads should be located on flatter side slopes over steeper side slopes to limit soil movement outside of the road clearing limits.
4) Generally roads should be located to utilize existing old road prisms rather than on undisturbed ground to minimize the amount of new slope construction.
5) New road alignments should enter and leave Riparian Habitat Conservation Areas (RHCA) in as short a length as possible given the constraints at the crossing location for relieving roadway drainage and road alignment into and out of the RHCA.
6) Road location should take into account grade runout to facilitate design of sag curves in Category 1,2 and 4 RHCA's.
7) Generally new stream crossings should be located in areas of lower stream gradient over areas of higher stream gradient to limit the amount of scour protection needed at the drainage structure outlet and in Category 1 RHCA's and therefore, to make it easier to provide for upstream fish passage through the drainage structure.
8) Generally limit the location of roads in RHCA's to stream crossings unless specific site analysis determines otherwise. All new road locations will (to the extent feasible) be at least 100’ from the edge of isolated seeps or wet areas to minimize new stock access to these sensitive areas. The road designer will ensure that a debris barrier is included in the road construction specifications wherever stock access is likely given

topography and vegetative cover.

9) Generally try to minimize the number of stream crossings as determined by site specific analysis.

Road design standards will include the following:

1) Road design standards will be the minimum necessary to meet user and resource needs.
2) Culverts in Class 1 through 4 streams will be designed to pass a 100 year flood flow with no damage to the road fill. In lieu of sizing a culvert so that the fill will not be overtopped, the 100 year flood may be accommodated in a high water bypass design. Culverts in Class 3 and 4 streams should also be designed to pass a 25 year flood with a headwater equal to or less than the height of the culvert. Culverts in Class 1 and 2 streams should also be designed with a minimum of 2 feet of freeboard between the top of the culvert and the headwater surface at a 50 year flood flow to accommodate the passage of debris.
3) Culverts in Category 1 RHCA's will be installed to provide for upstream fish passage.
4) On haul roads, all contributing areas will be armored with gravel unless the designer determines that the duration of active use and length of the crossing are short enough that the benefit would be negligible. Native materials may also provide effective armoring of the road surface. Contributing areas may extend further than 200’ from a stream if drainage structures are not functioning to disperse road surface runoff onto forested slopes.
5) Roadway drainage should be designed so that water concentrated by the road prism is dispersed prior to entering stream channels.
6) Roads in Category 1,2 and 4 RHCA's will be designed in such a way that stream flow will not be diverted down the road in the event the crossing is overtopped.
7) In ephemeral draws (swales) the designed drainage should generally be a self-maintaining type such as a drain dip or outslope drain (OSD). Generally use culverts in ephemeral draws where the cost of stabilizing the roadbed and fill slope on drain dips and OSD are greater than for the culvert installation with scour protection.
8) During road construction/reconstruction design, roads in contributing areas that intersect erosive soils will receive special erosion control treatment where slopes are steep and cutslopes are higher than 6’. Alteration of cutslopes to widen roads will be minimized in these areas. Where cutslopes in contributing areas must be altered (as for curve widening), or where soils will be exposed by new road construction, disturbed soils will be seeded and treated with a mulch and tackifier, and/or a bioengineering treatment such as fascines. On erosive soils in contributing areas, special care will be taken during design to ensure that the potential for cutslope slumping is accounted for. They are especially susceptible when uphill drainage structures fail or when old skid trails or temporary roads concentrate and divert water across cutslopes. The designer will conduct an on-the-ground check of slope gradient, cutslope moisture and the stability of upstream crossings and slopes, as appropriate. Special design measures to protect streams from failures on these soils may be needed. These may include drop inlets or cutslope revegetation with deep-rooted shrubs.

Implementation and Responsibility: Road location standards will be implemented by the Project

Transportation Planner. Road design standards will be implemented by the Road Designer.

Ability to Implement: Moderate for location in that site specific analysis may allow deviating from the general guidelines; High for design in that there are set tightly controlled processes for checking design work

Effectiveness: High where the new construction road location can limit the area of cut and fill slopes and the number of stream crossings

Monitoring: Location and design standards will be monitored by the Forest Engineer or his designate in tagline reviews and the engineering road contract review process.

R-2 Erosion Control Plan

Objective: To limit and mitigate erosion and sedimentation through effective planning prior to initiation of road construction activities and through effective contract administration on planned methods during construction

Explanation: Include contract clause CT6.311 to require the Purchaser prior to starting road construction work, to submit a plan of operation for road construction which sets forth general erosion control measures to be used. As a minimum, include in the plans sufficient language to designate Category 1 to 3 Riparian Habitat Conservation Areas (RHCA) as "Sensitive" on new construction and where drainage structure work is required in the RHCA on reconstruction. Category 4 RHCA's may also be designated as "Sensitive" construction areas when called for in the site specific analysis. Require and approve with any needed negotiation the Purchaser's methods for construction in these "Sensitive" areas.

As a minimum, the plan of operation for road construction should include:

1) Interim drainage structure scheduling and spacing on pioneer road construction. Spacing should be based on pioneer road grade.
2) Allowable lengths of pioneer road construction opened up but not built to grade with permanent drainage installed, and the schedule that pioneer road construction will be done on
3) How subsurface water encountered in the earthwork construction will be diverted and treated until the road is cut to grade and the permanent drainage is installed
4) The schedule for pioneer road construction through "Sensitive" areas
5) Erosion control measures for roads not completed prior to seasonal shutdown

As a minimum, the methods for construction through "Sensitive" areas will include:

1) How water is to be diverted from construction area in non-erodible conduits or ditches
2) How diverted water will be filtered if sediment enters the stream
3) How earthwork construction will proceed across the drainage as the drainage structure is installed
4) How sediment will be contained within the clearing limits during construction

Implementation and Responsibility: The Road Designer will be responsible for including language in the plans which designate the category 1 to 3 RHCA's as "Sensitive". The

Engineering Representative (ER) will be responsible for reviewing and approving the road construction operating plan and methods for construction in "Sensitive" areas. The ER will also be responsible for inspecting work for compliance with the operating plan and methods of construction proposed by the Purchaser. If the Purchaser's work is not in conformance with the agreed upon requirements in the road construction operating plan and methods of construction, the ER will be responsible for taking appropriate action under the contract.

Ability to Implement: Moderate given that the ER and Purchaser need to negotiate an agreed upon operating plan with methods of construction

Effectiveness: Moderate depending on the amount of precipitation encountered during construction

Monitoring: The ER will monitor the effectiveness of the operating plan and construction methods in "Sensitive" areas in reducing erosion. The ER will document those findings in the contract daily diary or final inspection report.

R-3 Timing of Construction Activities

Objective: To minimize erosion by conducting road reconstruction and construction operations during minimal runoff periods

Explanation: The Timber Sale Contract will specify a Normal Operating Season. Road construction and reconstruction work will predominately be done within the normal operating season. Work may be accomplished outside this time period subject to the approval of the Engineering Representative (ER). Specification 204 and Special Project Specification (SPS) 204.01F1 will be included in the contract to require the following work scheduling as a minimum:

1) Limit the length of road not built to grade and surfaced to 1000 feet outside the appropriate road construction operating season.
2) Limit the length of road not built with permanent drainage to 1000 feet outside the appropriate road construction operating season.

Limitations 1 and 2 above may be adjusted at the discretion of the ER based on current weather and ground conditions.

3) Limit the work as noted in Category 1 Riparian Habitat Conservation Area (RHCA) to times outside the spawning season for fish present in the RHCA.

Implementation and Responsibility: The Road Designer is responsible for assuring Specification 204 and applicable SPS's are used in the contract, with the appropriate road construction operating season dates identified. The ER is responsible for assuring that the reconstruction or construction is accomplished in conformance with the plans, specifications and contract clauses.

Ability to Implement: Moderate since the ER does not have 100% control over the timely placement of erosion control structures

Effectiveness: High compared to having an uncontrolled amount of road in an incomplete state

outside the normal operating season

Monitoring: The ER will monitor the effectiveness of this BMP and document those findings in the contract daily diary.

R-4 Road Slope and Waste Area Stabilization (Planning)

Objective: To minimize long term soil erosion by locating, designing and constructing road slopes and waste areas in such a fashion to minimize slope failures and soil movement from the clearing limits

Explanation: General road location standards which would affect the stability of constructed cut and fill slopes, and waste areas include the following:

1) As with BMP R-1, generally locate roads and waste areas on flatter side slopes over steeper side slopes to minimize the cut and fill slope area.
2) Avoid where possible, road locations on inner gorge areas with side slopes over 60% to minimize cut and fill slope area and the risk of intercepting subsurface water in or adjacent to a Riparian Habitat Conservation Area
3) Avoid where possible, road locations which would intercept subsurface water on side slopes over approximately 30% to minimize the risk of long term failure in constructed cut slopes.
4) Avoid road locations through land forms which show mass movement where the Forest Geotechnical Engineer estimates there is a high probability of continued mass soil movement.

Road design standards for stable cut and fill slopes, and waste areas include the following:

1) The road designer will design to the steepest slope ratio for a given soil type which is mechanically stable given dry conditions and gives a seed bed which will reliably hold seed on the slope given a seed application method.
2) Revegetate cut and fill slopes, waste areas and ditches as a minimum. Areas that will have cut and fill slopes constructed in highly erodible material should be identified in the preconstruction design walk phase, and special revegetation measures should be designed for these areas. This also applies to existing roads where reconstruction would involve rejuvenation of cut or fillslopes.
3) Seed concentrations and application methods should be sufficient to achieve revegetation of the roadway within 3 years of application.
4) Where roadbed drainage is concentrated on fill slopes, the slope should be armored or filter material placed on it. This standard applies to new road construction. The road designer should evaluate the need for existing fill slope protection when adding drainage structures to existing roads. Special care should be taken to disperse runoff from drainage structures where they outlet onto steep slopes and there is another road located lower on the slope.
5) Cut slopes with subsurface water present may be stabilized by flattening the slope ratio for slopes under 2 feet in height or buttressed for slope heights over 2 feet. Where buttressing is utilized, water coming out of the slope should be filtered to prevent piping of material from the slope into roadway drainage.
6) Generally, waste areas should be located on flatter side slopes over steeper side slopes.

Concentrated sidehill or roadway drainage should not be dumped onto the waste area. Waste area slopes should be graded so as not to concentrate water. Waste area slopes should be constructed no steeper than 3:2. Waste material should be compacted to a layer placed specification as a minimum with special attention given to compacting the fill faces leaving the slope face in a roughened condition.

7) Embankments will generally be placed using side cast and end haul methods. Added compaction requirements may be required by the Forest Geotechnical Engineer for construction of major embankments to assure the mass stability of the embankment. Major embankments are those that are over 8 feet high and 100 feet long.
8) Embankments should not be designed on side slopes over 70% for those materials whose angle of repose is at 5:4.

Construction standards for stable cut and fill slopes include the following:

1) Excavated material should be controlled inside the construction limits as required in Specification 203. Special construction practices should be applied in areas where the ground slope is too steep to construct a stable fill on (generally ground slopes over 70%). The excavated material from these full-bench areas should be end-hauled to a road embankment or waste area as designated in the plans, and not sidecast outside the construction limits unless site specific analysis determines otherwise.
2) Cut slopes should not be undercut at the bottom of the slope to create material for roadbed finishing thereby destabilizing the whole slope.
3) Cut slopes should be left in a roughened condition as cut by a dozer or excavator to give places for erosion control seed to catch and sprout.

Implementation and Responsibility: The Transportation Planner is responsible for locating roads and making the needed contacts with the Forest Geotechnical Engineer to meet the above standards. The Road Designer is responsible for assuring the appropriate field work is completed prior to design and for designing roads to the above standards. The Road Designer is responsible for securing the needed input from the Forest Geotechnical Engineer to determine compaction requirements on major embankments. The Engineering Representative is responsible for administering the plans and specifications which apply the above standards on the ground.

Ability to Implement: Moderate given the variability of subsurface water conditions.

Effectiveness: High

Monitoring: The Forest Hydrologist will monitor the effectiveness of these design standards. The findings will be documented in a Monitoring report.

R-5 Road Slope and Waste Area Stabilization (Preventive)

Objective: To minimize soil erosion from cut slopes, fill slopes, and waste areas

Explanation: All roads, fill slopes and cut slopes in the Deadman Project Planning Area will require vegetative and/or physical restraint measures to provide for adequate surface soil

stability. The level of stabilization effort needed was determined by the interdisciplinary team during the Planning Process. The following measures will apply to the Project Area.

a. Seeding and fertilization of cuts, fills, and roadbeds at the conclusion of construction of all roads
b. All roads will be ditched in areas where runoff control is necessary, as determined by the Road Locator during field reconnaissance.
c. Filter windrows will be constructed at the toe of all fills for 200 feet on each side of perennial streams.
d. Riprap, headwalls, and outfalls will be constructed on any culverts 24 inches in diameter and greater.
e. Compacted fills (layer placement) will be used going into and out of all perennial stream crossings.
f. Drain dips will be installed on all roads at a spaced distance averaging 300 feet. All drain dips which do not contain native rocks will be rocked.

Specific design specifications for these measures can be found in Forest Service Specification for Construction of Roads and Minor Drainage Structures.

Implementation and Responsibility: Initial project location, mitigative measures, and management requirements and needs are developed during the environmental analysis process, using an interdisciplinary approach. These requirements and needs are translated into contract provisions and specifications. The mechanisms for implementing and enforcing this BMP are Forest Service Specifications for Construction of Roads and Minor Drainage Structures, Contract Provision CT6.6 (Erosion Control and Soil Treatment by Purchaser), and the Road Plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest Service work leaders, road inspectors, and their supervisors monitor work accomplishment and effectiveness to ensure that design standards, project plan constraints, and mitigative measures are met. Watershed specialists assist in implementation and effectiveness evaluations. Also see Forest Plan Monitoring Guide, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian.

R-6 Dispersion of Subsurface Drainage Associated with Roads

Objective: To minimize the possibilities of roadbed, cut slope, and fill slope failure and the subsequent production of sediment

Explanation: On existing roads where seasonal subsurface flow occurs in the roadbed and traffic use would produce soil movement outside the clearing limits, traffic management will be the first action taken to limit soil movement. Where traffic management will not have sufficient effect on subsurface flow in the roadbed to limit soil movement to the clearing limits, the road will be reconstructed to achieve this goal. Reconstruction could include constructing a cutoff ditch on the uphill side of the road to lower the water table and intercept subsurface drainage, installing

subsurface blanket or trench drains to achieve the same objective, or leaving the subsurface drainage net as is and stabilizing the roadbed with stabilization fabric and ballast material.

On new construction roads where subsurface flow is evident, it should be avoided by the road location where feasible. If subsurface flow is not feasible to avoid through site specific analysis, similar design solutions may be used as for reconstruction of existing roads. See further direction for cut slope excavation in BMP R-4.

Wherever subsurface water is intercepted and concentrated, this flow will be routed to intact forest ground where it can infiltrate. Flow will be routed to a stream channel only where there is no other feasible design alternative.

Implementation and Responsibility: The Road Locator will be responsible for avoiding areas with evident subsurface flow where feasible. The Road Designer will be responsible for accomplishing sufficient field work to determine where perennial subsurface flow is affecting existing roads and where evident subsurface flow is occurring along new construction alignments as a minimum. The Road Designer is responsible for designing appropriate measures to limit soil movement due to subsurface flow to within the clearing limits. For those cases where subsurface flow is discovered in construction, the Engineering Representative (ER) is responsible for designing the appropriate measures for limiting soil movement to the clearing limits. The ER and Forest Service Representative (FSR) are responsible for managing commercial traffic under the timber sale to minimize roadbed damage where subsurface flow is present.

Ability to Implement: High since these are standard forest practices

Effectiveness: Moderate due to some subsurface drainage problems not being evident until roads are constructed

Monitoring: The effectiveness of design methods will be evaluated and documented by the Forest Hydrologist during BMP monitoring trips. The effectiveness of traffic management will be documented by the ER or FSR in their contract daily diaries.

R-7 Control of Surface Roadway Drainage Associated with Roads

Objective: To 1) minimize the erosive effects of water concentrated by road drainage features, 2) disperse run-off from the road, and 3) minimize soil movement outside the road clearing limits.

Explanation: Runoff from the road template will be directed off the roadway and ditch relief will be provided at short enough intervals (based on soil type) that soil movement will be minimized outside the road clearing limits. Where it is impractical to relieve drainage in short enough intervals, ditches and roadbeds should be armored to achieve a more practical spacing of drainage structures. The old drainage structure handbook chart will be used as a guide to determine spacing of drainage structures based on soil type. Where roadbeds and ditches are armored, concentrated water may still need to be relieved at selected intervals less than those shown on the handbook chart to adequately disperse runoff from the road. Refer to BMP R-4 for slope protection requirements where concentrated water is channeled onto cut and fill slopes.

Road designers will minimize the length of road draining directly to any stream channel as far as feasible. Wherever possible, road runoff will be outlet to forested buffer areas. Water that is concentrated and drains directly into a Riparian Habitat Conservation Area (RHCA) will be filtered to minimize sediment transport outside the clearing limits. Filter windrows or brush blankets are preferred filtration structures. Generally, roadbed and ditch relief drainage structures are located in ephemeral draws where possible, to avoid redirecting concentrated seasonal runoff down a road ditch. This dispersion of road drainage is especially needed on FS Road #9565.800 and its local spurs.

Sustained grades, steeper than 8%, on outwash-derived soils in contributing areas will be armored with surface aggregate unless native materials effectively armor the road surface. All new drain dips will be rocked on maintenance level 2 and higher roads, unless native materials provide effective armoring. On maintenance level 1 roads (closed to use after haul), rock may be required on drainage dips for acceptable sediment mitigation. All drainage dips/fords that convey concentrated flows (i.e. flow from ephemeral draws or seeps) will be rocked unless native materials provide effective armoring. The objective is to harden the structures enough to tolerate some ORV and cattle use.

Revegetate new traffic service level "D" roadbeds and ditches to minimize soil movement in the mid to long term by grass seeding as part of the construction contract. When roads are closed, the roadbed will be seeded at the time of closure.

Implementation and Responsibility: The Road Designer is responsible for determining the soil type for basing drainage structure spacing. The Road Designer is responsible for applying the above guidance in the design and spacing of drainage structures and armoring.

Ability to Implement: High since this is standard forest practice

Effectiveness: Moderate

Monitoring: The Forest Hydrologist will be responsible for monitoring and documenting the effectiveness of these measures.

R-8 Constraints Related to Pioneer Road Construction

Objective: To minimize sediment production and mass wasting problems associated with pioneer road construction

Explanation: To meet the objective of minimizing sediment, the following constraints should be followed when constructing pioneer roads in the Project Planning Area:

a. Construction of pioneer roads will be confined to the final roadway construction limits, unless otherwise approved by the Engineering Representative or Contracting Officer's Representative. Excavation will be conducted so as to prevent undercutting the final cut slope and to minimize depositing materials outside the designated roadway limits.
b. Erosion control work will be completed prior to periods of seasonal precipitation and then

kept up daily as work progresses. The amount of pioneer road open in construction outside the normal operating season will be limited by use of specification 204.

c. No Riparian Habitat Conservation Area (RHCA) will be crossed with a pioneer road without approval of the Purchaser's construction methods as required in BMP R-2. Specification 204 will require that the contractor divert live water in RHCA's into non-erodible channels or conduits and specification 603 will require that the Purchaser install the drainage structure before crossing an RHCA.

Implementation and Responsibility: The ER is responsible for administering the contract to address the above requirements. The Purchaser or contractor will be responsible for implementing mitigation measures. Compliance with plans, specifications, and operating plans is determined with tests, measurements, and observations by the ER. The mechanisms for implementing and enforcing this BMP are: Forest Service Specifications for Construction of Roads and Minor Drainage Structures, Contract Provision B6.6 (Erosion Prevention and Control) Roads), B6.5, (Stream course Protection), and the Road Plans for each timber sale.

Ability to Implement: Moderate since the ER is not on site at all times

Effectiveness: Moderate

Monitoring: The ER is responsible for monitoring the effectiveness of the above requirements. Monitoring will be documented in the contract daily diaries.

R-9 Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects

Objective: To minimize erosion and sedimentation from disturbed ground on incomplete projects

Explanation: Protective measures must be applied to all areas of disturbed, erosion-prone, unprotected ground. When conditions permit operations outside of the dry season, erosion control measures must be kept current with ground disturbance, to the extent that the affected area can be rapidly closed, if weather conditions deteriorate. Areas should not be abandoned for the winter if the remedial measures are incomplete. The following preventive erosion control measures will occur in the Deadman Project Planning area before the onset of the wet season:

a. Removal of temporary culverts, culvert plugs, diversion dams or elevated streamcrossing causeways;
b. Installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipators, dips, sediment basins, berms, debris racks or other facilities needed to control erosion;
c. Removal of debris, obstructions, and spoil material from channels and floodplains

Implementation and Responsibility: Project mitigative measures and location are developed and documented during the environmental analysis process using an interdisciplinary approach. Contracted projects will be implemented by the Contractor or Purchaser. Compliance with project plan criteria, contract specifications, and operating plans is determined with tests,

measurements, and observations by the Contracting Officer's Representative or Engineering Representative. The mechanisms for implementing and enforcing this BMP are Forest Service Specifications for Construction of Roads and Minor Drainage Structures, Contract Provisions BT6.31 (Operating Schedule), BT6.65 (Current Operating Areas), BT6.6 (Erosion Prevention and Control), and CT6.6 (Erosion Control and Soil Treatment by Purchaser).

Ability to Implement: High for location and design; Moderate for construction

Effectiveness: High

Monitoring: The Engineering Representative or Contracting Officer's Representative will review road construction and will document their observations. Also see Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

R-12 Location, Design and Control of Construction in Riparian Habitat Conservation Areas (RHCA)

Objective: To reduce the adverse effects of sedimentation from nearby roads on slope stability, vegetation, and aquatic resources in riparian areas

Explanation: RHCA's are defined and described in BMP T-7.

Road location standards for RHCA's will include the following:

1) Locate waste areas outside of RHCA's.
2) New road locations in RHCA's will be avoided to the maximum possible extent, subject to site evaluations by the road locator.

Road design standards for construction and reconstruction in RHCA's will include the following:

1) Water concentrated by the road prism should be filtered and dispersed prior to entering the stream channel where run-off is not effectively filtered by the forest floor. Brush blankets, filter windrows or fences, riprap blankets or sediment basins are some examples of filtering methods.
2) Minimize the road length draining directly to channels of any class by providing ditch relief or dips that outlet onto buffer strips where sediment can be filtered out.
3) Minimize the amount of concentrated water from ditches and roadbed flowing over fill slopes to reduce the sediment carrying capacity of water flowing into an RHCA over material that is more easily moved than undisturbed soil.
4) Protect cut and fill slopes within the 100 year flood plain from erosion to create a stream crossing which will not fail when subjected to a 100 year flood flow.
5) Protect roadbeds within RHCAs or contributing areas by armoring with aggregate surfacing unless the native material provides adequate protection.
6) The stream bed at culvert outlets should be protected from scour for velocities expected in the 100 year flood flow.
7) Added mid to long term erosion protection and stabilization measures may be required adjacent to streams in RHCA's based on site specific analysis. This could include items

such as planting riparian vegetation or other bio-engineering techniques.

Road construction standards for RHCA's will include the following:

1) See BMP R-2 for minimum construction methods required for construction in sensitive areas.
2) Live water flowing into the construction area will be diverted around the area prior to pioneer road construction across an RHCA. Water will be contained by non-erodable dams or a sump. Water will be diverted by piping or a non-erodable ditch. Where a sump is used to contain water for diversion around the construction site, the water will be filtered prior to diversion back into the stream bed.
3) No sediment producing materials should be left within the 100 year flood plain unless they are designated to be placed there such as road embankment.
4) Temporary bypass roads at creek crossings will be stabilized and revegetated with grass as a minimum.
5) Culverts will be bedded into the streambed sufficiently to avoid piping under the culvert. Even-graded, non-cohesive material is unsuitable and will not be used for bedding and backfill material.

Implementation and Responsibility: The Road Locator will be responsible for applying the above standards for new road location. The Road Designer will be responsible for applying the above design standards in the design of new construction and reconstruction roads. The Engineering Representative (ER) will be responsible for assuring that the road plans, specifications, operating plans and contract clauses are implemented under the contract.

Ability to Implement: High for location and design due to the Forest's review procedures; Moderate for construction since the ER is not present on the construction site at all times

Effectiveness: High for design and location standards, since their emphasis on avoidance will minimize the area affected; Moderate for construction since heavy construction in stream channels cannot avoid sediment introduction to areas accessible to high flows

Monitoring: In signing the road plans for the timber sale, the reviewing engineer attests that they incorporate the standards in this BMP. The ER will monitor the effectiveness of construction standards in their contract daily diaries. The Forest Hydrologist will monitor the mid-term to long-term effectiveness of these standards.

R-15 Disposal of Right-of-Way and Roadside Debris

Objective: 1) To ensure that debris generated during road construction and reconstruction is kept out of streams and to prevent slash and debris from subsequently obstructing channels; 2) to prevent debris dams which obstruct fish passage, or which could result in downstream damage from high water flow surges after dam failure; 3)to avoid removal of woody debris from riparian areas.

Explanation: Construction slash will as a general rule be placed in windrows at the toe of fillslopes or in slash mats mulching the fillslope. Where there is an excess of slash over that needed to protect fillslopes or where slopes are too steep to permit windrow placement, the

excess may be sidecast. This will minimize the need to disrupt additional ground to bury or burn slash.

This procedure is recommended for all areas but is required in Riparian Habitat Conservation Areas. All fillslopes in contributing areas will be protected by windrows or slash mats or both. On reconstructed segments, slash will be used for fillslope protection to the extent it is available.

Implementation and Responsibility: The road designer is responsible for including these specifications in the road plans. The engineering representative who administers the construction contract ensures that windrows or slash mats are properly placed and compacted, and determines which, if any, trees may be removed from riparian areas. The mechanisms for implementing and enforcing this BMP are Forest Service Specifications for Construction of Roads and Minor Drainage Structures, Contract Provision BT6.5 (Streamcourse Protection), and the Road Plans.

Ability to Implement: High

Effectiveness: Moderate to high; Research in Horse Cr, Idaho, showed that filter windrows reduced the amount of sediment eroded off fillslopes even compared to hydromulched fillslopes (Burroughs and King, 1989). Even 20% ground cover is credited with reducing cut and fillslope erosion by 1/3 according to the Washington Forest Practices Board's Standard Methodology for Conducting Watershed Analysis, 1994, p. B-29.

Monitoring: NEPA field review process, plan in hand review, progress review during construction, and road construction review process. Also see Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

R-16 Specifying Riprap Composition

Objective: To minimize sediment production associated with the installation and utilization of riprap material

Explanation: Riprap is commonly used to armor streambanks and drainage ways from the erosive forces of flowing water. Riprap must be sized and installed in such a way that it effectively resists erosive water velocities. On occasion, this may require the use of filter blankets or other methods in conjunction with riprap to prevent the undermining of structures. Stone used for riprap should be free of weakly structured rock, soil, organic material, and materials of insufficient size, all of which are not resistant to streamflow and would only serve as sediment sources. Riprap is commonly used at outlets of drainage facilities in erodible soils for energy dissipation. The Army Corps of Engineers and Federal Highway Administration procedures are available for designing riprap structures.

Implementation and Responsibility: Project location and mitigative measures are developed through the road design process to meet the constraints and requirements of the project plan.

Contracted projects are implemented by the Contractor or Purchaser. Compliance with project criteria and operating plans is determined with tests, measurements, and observations by the

Forest Service Contracting Officer's Representative of Engineering Representative.

Ability to Implement: High

Effectiveness: High

Monitoring: Design review, progress review during construction and road construction review process. Also see Forest Plan monitoring plan.

R-18 Maintenance of Roads

Objective: To maintain roads in a manner which provides for water quality protection by controlling the placement of waste material, keeping drainage facilities open, and by repairing ruts and failures to reduce sedimentation and erosion.

Explanation: Road maintenance will be a required work activity under contract clauses CT5.4, CT5.42 and CT5.43 where applicable on the timber sale. Standard maintenance specifications with specific work requirements will be included in the Timber Sale Contract, as applicable, for roadbed blading, ditch cleaning, culvert cleaning, roadbed clearing and slide removal.

On road segments in or immediately adjacent to RHCA's excess material removed from sloughed cutslopes or ditches, which cannot be worked into the road surface, will be hauled to a disposal site designated by the Engineering Representative (ER) or Sale Administrator (SA).

Implementation and Responsibility: The road designer will be responsible for including the appropriate maintenance specifications as dictated by the applicable road segment features on roads used in the timber sale. The ER or SA is responsible for assuring that the maintenance work is performed according to the specifications in the contract.

Ability to Implement: Moderate since the SA and ER are not present at all times to monitor road conditions and maintenance work

Effectiveness: High

Monitoring: The implementation of road maintenance requirements is monitored by the SA through the life of the sale, and documented in the contract daily diaries.

R-20 Traffic Control During Wet Periods

Objective: To minimize road surface damage and rutting, and lessen sediment washing from road surfaces

Explanation: Under the Timber Sale Contract, the Purchaser's operations would be limited by the operating season clauses in the Timber Sale Contract (BT 6.3, 6.31, 6.6, 6.65, CT 6.3, 6.311, 6.6). Purchaser's operations are limited under these clauses to situations where resource damage will not occur. Resource damage which would limit the Purchaser's operations includes local damage that may occur at a single soft, moist spot where displaced soil would move into a stream channel wetland or pond, even when the majority of a road system is trafficable. These

weak links in contributing areas to RHCA's will be identified and their condition will limit the use of the road by the Purchaser.

Implementation and Responsibility: The Sale Administrator (SA) will be responsible for controlling Purchaser use of forest roads.

Ability to Implement: Variable since SA is not constantly on the project to react to changes in weather and Purchaser's timely response to changes in road stability

Effectiveness: High but dependent on implementation

Monitoring: The SA will monitor the Purchaser's implementation of this BMP and document his findings in the contract daily diaries.

R-21 Snow Removal Controls to Avoid Resource Damage

Objective: To minimize the impact of melt water on road surfaces and embankments and to reduce the probability of sediment production resulting from snow removal operations

Explanation: If roads in the Deadman Project Area are used during the winter for harvest-related activity, the following measures will be employed to meet the objectives of this practice.

a. The Contractor or permittee is responsible for snow removal in a manner which will protect roads and adjacent resources.

b. Snow berms will be removed or breached to avoid accumulation or channelization of melt water on the road and to prevent water concentration on erosive slopes or soils. If the road surface is damaged, the Contractor or permittee shall replace lost surface material with similar quality material and repair structures damaged in blading operations unless otherwise agreed in writing.

c. Where snow is plowed within RHCA's, care will be taken to minimize road surface material displaced with the snow.

Implementation and Responsibility: Contracted projects will be implemented by the Contractor or Purchaser. Compliance with developed criteria and the operating plan will be determined with tests, measurements, and observations by the Contracting Officer's Representative, Engineering Representative or Timber Sale Administrator. The mechanisms for implementing and enforcing this BMP are Contract Provision BT5.4 (Road Maintenance), CT5.4 (General and Special Maintenance Requirements), CT5.42 (Maintenance of Roads for Joint Purchaser and Recreation Use), and CT5.43 (Maintenance of Other Roads).

Ability to Implement: High

Effectiveness: Moderate

Monitoring: Forest road management inspection trips; see implementation section for tracking.

Also see Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices and Item 26: Riparian Areas.

R-22. Water Quality Protection for Pits and Quarries

Objective: To minimize off-site movement of sediment from active and inactive borrow pits. To ensure that concentrated water draining from the pit area is dispersed or properly controlled to protect slopes and streams from erosion.

Explanation: Wherever topsoil depth and topography make salvage feasible, topsoil will be stripped, stockpiled and protected from erosion for purposes of later reclamation before removal of additional rock.

Drainage from borrow pits will not be permitted to enter stream channels or wetlands without filtration through a buffer strip of intact forest ground or grassland. If no buffer strip exists, alternative sediment control measures will be used as necessary to ensure that sediment-laden water does not directly enter streams.

New rock pits will not be located in RHCA's. In existing pits, no new excavation will occur in RHCA's (stream or wetland) without prescription of site-specific measures to avoid damage to riparian and aquatic resources. These measures will be included in the operating/development plan.

After an entry, when a pit will be left inactive for a period of time, drainage and sediment control measures will be inspected to ensure they will function properly during the snowmelt season.

Implementation and Responsibility: Pit operation and development plans are developed by the Forest Geologist, and site specific water quality protections, where needed, are designed after interdisciplinary consultation and review with the forest hydrologist or district resource specialist. The Engineering Representative ensures that excavation and haul are done in accordance with this BMP. The ER is also responsible for checking pit drainage and sediment control adequacy after road acceptance.

Ability to Implement: Moderate since site specific drainage and sediment control plans are not always included in pit operating/development plans; Locations of some existing pits may limit the ability to detain sediment.

Effectiveness: High where full implementation is achieved

Monitoring: Implementation of this BMP will be documented by the ER in the daily diaries.

R-23 Obliteration of Temporary Roads and Landings

Objective: To reduce sediment and restore productivity of the land at the completion of intended use.

Explanation: The National Forest Management Act requires that all temporary roads be returned to resource production within ten years. Temporary roads and landings will be constructed in the

Deadman Project Area. The following measures will be applied to all temporary roads and landings constructed under this project.

a. Culverts and bridges will be removed and natural drainage configuration reestablished and, where necessary, streambanks will be stabilized.
b. Sideslopes will be reshaped if necessary for stabilization.
c. Road effectively drained and blocked.
d. Road returned to resource production through revegetation (grass, browse, or trees). Seedbed preparation, by scarification will be done according to Contract Specifications.

On landings where slash piles will be small enough that no burning will be necessary, the landing will be deep ripped, seeded, and slash will be scattered to act as a mulch and facilitate revegetation.

Implementation and Responsibility: Obliteration of temporary roads to a level that blocks vehicular traffic, removal of culverts and bridges, and roadway stabilization will be required by the Timber Sale Contract. The Pre-sale Forester is responsible for including ripping and slash mulch requirements in the contract for landings where no slash pile burning will be needed. Further revegetation needs will be addressed in Sale Area Improvement Plans to achieve resource production above that required for stabilization of the road bed surface. Temporary road location and stabilization measures will be determined by the Sale Administrator by agreement with the Purchaser. The Sale Administrator may request the advice of a watershed specialist in determining the most appropriate location and stabilization measures required. District Rangers or their representatives are responsible for assuring that the obliteration of such roads is accomplished. The mechanisms for implementing and enforcing this BMP are Contract Provision CT5.1, Option 1 (Temporary Road Construction), and CT6.6 (Erosion Control and Soil Treatment by Purchaser).

Ability to Implement: High

Effectiveness: High

Monitoring: Post-sale reviews by the Sale Administrator. Also see Forest Plan Monitoring Guide, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

Timber management

T-1 Timber Sale Planning Process

Objective: To introduce water quality and hydrologic considerations into the timber sale planning process

Explanation: The timber sale planning process identifies problems and provides for administrative controls, corrective treatments, and preventive measures. This process defines and estimates the potential changes to water quality and instream beneficial uses. An analysis of cumulative watershed effects is also completed. The result is an EA or EIS and a sale plan or analysis files. These documents will describe how to avoid potential damage during and

following the sale layout and subsequent logging operations. Mitigation of damaging effects for those treated areas where damage is unavoidable will be required. The EA or EIS will also preclude treatment of environmentally sensitive areas where damage from proposed treatments cannot be mitigated to conform to Federal, State and Local water quality criteria.

Implementation and responsibility: Input during the project planning process from the Deadman Interdisciplinary Team included: a District Resource Assistant, a District Planning Forester, the Forest Hydrologist, the Forest Fisheries Biologist, and others. All timber sale contracts that are developed from this planning process will include provisions to meet water quality criteria and other resource protection requirements as provided by the EIS.

Ability to Implement: High

Effectiveness: High

Monitoring: During the Interdisciplinary Process by the Team Leader and Team Members. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-2 Timber Harvest Unit Design

Objective: To ensure that timber harvest unit design will secure favorable conditions of water flow, water quality and fish habitat

Explanation: The number, size, and location of timber harvest units and associated harvest activities will all have an effect on the Deadman Creek Watershed, within the Deadman Project Planning Area, and will affect the ability of the watershed to absorb the impacts of the proposed harvest. The proposed timber harvest units were evaluated to estimate the response of the watershed to the proposed harvest treatments. The harvest unit design was then modified or watershed treatment measures were applied to maintain watershed functions and values and to meet Forest Plan Standards and Guidelines.

Implementation and responsibility: The hydrologic survey and evaluation of proposed timber harvest is accomplished through the interdisciplinary process of timber sale planning for the Deadman Project Planning Area. Harvest unit design, including logging systems and unit layout, to assure acceptable watershed conditions is then incorporated into the EIS, sale plan, and analysis files. On-the-ground accomplishment of these measures will be carried out by the Sale Preparation Forester, the Sale Administrator, and the administrator of post-sale slash disposal and cultural activities. Periodic field reviews will help evaluate timber harvest unit design. A follow-up review will be conducted by qualified resource specialists, including hydrologists, fisheries biologists, and soil scientists or geologists.

Ability to Implement: High

Effectiveness: High

Monitoring: See implementation and responsibilities section. Also see Forest Plan Monitoring

Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-3 Use of Erosion Potential Assessment for Timber Harvest Unit Design

Objective: To prevent downstream water quality degradation by identifying areas with high erosion potential and adjusting harvest unit design

Explanation: The potential for erosion and mass wasting for the Deadman Project Planning Area was estimated by evaluating the soil, topography, rock type, drainage pattern, water conditions, and plant community. Forest Plan Standards and Guidelines were used to develop alternatives and mitigation measures to meet water quality standards in the Project Planning Area. Recommended mitigation measures are included in the Deadman EIS.

Implementation and responsibility: The determination of the potential for erosion and mass wasting is accomplished during the project planning process and is evaluated for each timber harvest unit. The Interdisciplinary Team uses this information to help develop the alternatives and mitigation measures included in the EIS.

Ability to Implement: High

Effectiveness: High

Monitoring: Watershed specialists will evaluate the post-harvest condition of selected harvest units. Also, see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-4 Use of Sale Area Maps for Designating Water Quality Protection Needs

Objective: Delineate protection areas and available water sources as a guide for both the Purchaser and the Sale Administrator, to ensure their recognition and proper consideration and protection on the ground during harvest operations.

Explanation: The following features will be designated on the Sale Area Map, which is an integral part of the Timber Sale Contract (TSC).

a. Location of stream courses to be protected. All stream channels within the sale area boundary that have defined bed and banks, whether intermittent (class IV) or perennial, will be designated for protection. Protection of these stream courses would be enforced under the terms of the TSC.
b. Wetlands (meadows, lakes, bogs, etc.), springs, seeps and small seasonally or perennially saturated areas
c. Harvest unit boundaries
d. Yarding method by harvest unit
e. Roads where Purchaser's use is prohibited or restricted
f. Water sources available for Purchaser's use
g. Sources of rock for road work, riprapping, etc
h. Structural improvements

Implementation and responsibility: During sale preparation and layout, the Sale Preparation Forester will verify that all wetland areas and stream locations shown on the Washington Dept. of Natural Resources GIS stream map and on the USFWS National Wetland Inventory Maps are excluded from harvest units. The Pre-sale Forester will also identify and delineate unmapped wetlands and streams within harvest units. These will all be included on the sale area map. The areas are reviewed on-the-ground by the Purchaser and the Sale Administrator prior to harvesting.

Ability to Implement: High - standard FS procedure

Effectiveness: High

Monitoring: The sale area map will be reviewed by the interdisciplinary team during the sale package review before the contract is let.

T-5 Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the Purchaser conducts operations in a timely manner within the time period specified in the Timber Sale Contract

Explanation: The Timber Sale Contract will specify a Normal Operating Season, during which operations may generally proceed without resource damage. During this time, harvest operations will be suspended if ground conditions are such that excessive damage to soil, water, and other resources will result. Operations will be permitted outside the Normal Operating Season only when they can be conducted without damage to soil, water, and other resources. Site conditions will be assessed before deviations from the normal operating season are permitted.

Implementation and Responsibility: Limited operating periods are identified and recommended during the Timber Sale Planning Process by the interdisciplinary team and are followed throughout the life of the timber sale, primarily by the Sale Administrator. The mechanism for implementing this BMP is Contract Provision BT6.6 (Erosion Prevention and Control).

Ability to Implement: High

Effectiveness: High

Monitoring: During implementation of timber sale activities, by the Sale Administrator, Forest Service Representative (FSR), engineers, and watershed specialists. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-7 Riparian Habitat Conservation Area Designation and Protection

Objective: To designate and to protect riparian areas along streams and wetlands

Explanation: This is interim direction established by the Inland Native Fish Strategy (INFISH) which was approved by the Regional Foresters of the Northern, Intermountain, and Pacific

Northwest Regions of the USDA, Forest Service and which became effective August 30, 1995. This direction replaces the interim riparian standards established May 20, 1994 (informally known as the screening process) and amends the Forest Plan for protection of streamside areas and wetlands. Interim Riparian Management Objectives (RMOs) are established for all watersheds that are occupied by inland native fish and where a watershed analysis has not been completed. Interim Riparian Habitat Conservation Areas (RHCA) are established where a watershed analysis has not been completed. Standards and guidelines are established to govern management activities within the entire geographic area of a project.

RHCA's will be identified along all protected stream courses and around all wetlands, seeps, springs and other upland riparian areas, using INFISH interim guidelines. Usually harvest unit boundaries are marked to exclude these areas. No harvest, equipment operation or servicing, machine fireline construction, or other sale-related mechanized activity will be permitted within RHCA's, except for road construction or reconstruction and, if necessary, a minimum number of approved skid trail crossings.

RHCA's will not be subjected to prescribed fire that would remove the soil protection afforded by the duff layer or kill riparian shrubs. Wherever possible, hand fireline construction in riparian areas will be avoided; fire may be allowed to back down into riparian areas if conditions are such that riparian functions and values would not be damaged.

Implementation and responsibility: The Sale Preparation Forester is responsible for mapping RHCA's and stream courses on the Sale Area Map, and for excluding them from harvest units. Stream protections are implemented in the Timber Sale Contract (TSC) by means of standard clause BT6.5. The Sale Administrator (SA) would be responsible for TSC compliance during harvest operations. The Forest Service Representative would also modify unit requirements to achieve the objectives of this BMP if any riparian areas were missed during layout and RHCA's had not been designated.

Ability to Implement: Moderate since some unit layout may occur during the winter when intermittent streams and small wetlands are hidden by snow; Contract modifications to designate additional RHCA's cannot be guaranteed because they are subject to Purchaser agreement.

Effectiveness: Moderate to high; This depends on field personnel's ability to detect and identify small hydrologic features, and on ground slopes in RHCA's bordering non-perennial streams. Where slopes adjacent to intermittent streams are steep, the required 50-foot RHCA may not be adequate to filter incoming sediment.

Monitoring: The Sale Administrator will verify whether all riparian areas requiring protection were identified during sale layout and will document in the contract daily diaries any additional riparian areas discovered during sale operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel.

T-8 Streamcourse and Wetland Protection

Objective: To protect stream integrity and avoid management-induced flow obstructions and sediment introduction; to protect the water storage and conveyance functions of wetlands by minimizing soil displacement, rutting and flow concentration.

Explanation: In most cases, stream protection will be automatically ensured by excluding Riparian Habitat Conservatin Areas (RHCA) from harvest units. In addition, the following management controls and practices will be incorporated into the Timber Sale Contract (TSC):

a) The Sale Administrator must approve in advance and on the ground the location, method, and timing of streamcourse crossings for skid trails, harvester/forwarder trails, and temporary roads.
b) The timber Purchaser is required to repair any unavoidable damage to stream channels and streambanks to the extent practicable.
c) All project debris will be removed from stream channels if it would block or pollute flow. Trees felled over or in protected stream courses (eg. cable corridors, road right-of-ways) that do not block flow will be left unless the Forest Service representative directs otherwise.
d) Equipment operation within RHCA's is not permitted except at approved crossings. Landings and/or fuel storage sites will not be located within RHCA's.
e) Logs will normally be fully suspended in cable harvest units over protected stream courses, and dragging within RHCA's will be minimized to the extent practicable.
f) Temporary roads will not be constructed in RHCA's unless no other feasible alternative exists. If a temporary road must cross an RHCA, the crossing will be constructed to achieve a level of stream or wet area protection that is similar to that achieved in permanent road construction.
g) Where swales or draws must be crossed by temporary roads or skid trails, the location and method of crossing will be controlled such that soil compaction and gouging are minimized. Crossing structures that would remain in place overwinter will provide for uninterrupted throughflow. Care will be required during removal of any crossing structures to minimize soil gouging.
h) Waterbars or other erosion control structures will be located so as to disperse concentrated flows of water and permit trapping and retention of sediment before it reaches a stream channel.

Implementation and Responsibility: The Pre-sale Forester is responsible for inclusion of the relevant clauses in the TSC and for ensuring that unit layout minimizes the number of channel crossings needed for the temporary transportation system. The Sale Administrator is responsible for on-the-ground implementation that achieves the stated objectives.

Ability to Implement: High - standard FS procedure

Effectiveness: High, because of emphasis on avoidance of sensitive areas

Monitoring: Implementation will be documented by the Sale Administrator in the sale inspection diary. Effectiveness of methods used to cross RHCA's or ephemeral streams or draws will be monitored during post-sale reviews by District personnel and watershed specialists.

T-9 Determining Tractor Loggable Ground

Objective: To protect water quality from degradation caused by tractor logging ground disturbance

Explanation: Tractor logging in the Deadman Project Planning Area generally will be restricted to slopes of 35% or less. Tractors may be allowed to operate on slopes exceeding 35% generally over short runs of less than 200 feet where site factors indicate that soil compaction and erosion will not exceed Forest Plan Standards and Guidelines. This is determined by both on-site field visits and prior experience on the District. Other factors considered when selecting tractor operable land were: topography, soil texture, soil drainage, and drainage pattern.

Implementation and responsibility: Land suitable for tractor logging was identified during the timber sale planning process. These determinations will be verified and changed where necessary to reflect better site specific information during sale layout and sale administration. Provisions in the Timber Sale Contract specify the areas and conditions upon which tractors can operate. Requirements governing tractor operations will be incorporated into the Timber Sale Contract. The mechanism for implementing this BMP is the timber sale planning process.

Ability to Implement: High

Effectiveness: High

Monitoring: The Sale Administrator oversees the operation to ensure compliance. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-10 Log Landing Location

Objective: To locate landings in such a way as to minimize creation of hazardous watershed conditions

Explanation: All landings in the Project Planning Area will be approved prior to clearing, or located by the Forest Service, under provisions of the Timber Sale Contract. The following criteria are used in evaluating landings:

a. The cleared or excavated size of both cable and helicopter landings shall not exceed that needed for safe and efficient yarding and loading operations.
b. Helicopter and cable landing locations are selected on the basis of the least amount of excavation and erosion potential, where sidecast will neither enter drainages nor damage other sensitive area.
c. Landings are located outside of Riparian Habitat Conservation Areas so that designated timber can be yarded with minimal disturbance to these areas.

Implementation and Responsibility: The Sale Administrator ensures that the landings are located and constructed according to the terms of the Timber Sale Contract. The mechanism for implementing this BMP is Contract Provision BT6.422 (Landings and Skid Trails).

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Watershed specialists will assist in evaluating the effectiveness of this BMP. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-11 Tractor Skid Trail Location and Design

Objective: To minimize new soil compaction and erosion in harvest units and limit total soil disturbance to 20% of a unit; to minimize trail crossings over streams.

Explanation: In units designated for tractor yarding, skid trails will be spaced a minimum of 130 feet apart, and in second-entry units, existing trails will be used whenever possible. Tractors will be limited to skid trails; if necessary, logs will be winched to the trail.

The skid trail network will be approved in advance on the ground by the Sale Administrator. The skidding pattern will be designed to avoid short steep slopes as much as is feasible, and to avoid the need for excavated skid trails. The degree and extent of existing soil compaction in second-entry units has not been measured, but can be assumed to approach the 20% standard. To the maximum extent possible, old trails will be utilized, and these units will be assessed after the sale for exceedances of the soil disturbance standard.

In units designated for harvester-forwarder yarding (cut-to-length), main forwarder trails will be a minimum of 150 feet apart, with spur trails spaced at least 40 feet apart center to center. To the extent possible depending on the availability of woody material, slash mats, twelve inches in depth, will be constructed on spur and main trails. Old trails crossing wetlands will not be used.

In all units with ground-based yarding systems, the trail network as a whole will be approved in advance on the ground by the Sale Administrator.

Temporary roads on steep phases of hazard 1 and 2 soils will require similar erosion control treatments to specified roads. The Sale Administrator will request assistance from forest specialists if it is necessary to cross one of these soils.

Implementation and Responsibility: The Pre-sale Forester will ensure that unit layout is as compatible as possible with the objectives of minimizing stream channel and wetland crossings and new soil compaction and erosion. The Sale Administrator implements this BMP during operations.

Ability to Implement: High - standard layout and sale administration responsibilities

Effectiveness: Moderate for cut-to-length systems; Variable slash availability will determine the actual slash mat depth, and its effectiveness in limiting compaction will vary depending on soil moisture content. On short steep pitches, the slash mat may be dislocated by the forwarder exposing bare soil. This BMP is expected to reduce soil disturbance over what would occur

without it, but actual results will vary.

Monitoring: Implementation will be documented by the Sale Administrator in the sale inspection diary. Effectiveness monitoring will be conducted by District personnel. The results will be reported or referenced in the Forest Annual Monitoring Report.

T-12 Suspended Log Yarding in Timber Harvesting

Objective: To 1) protect soils from excessive disturbance and 2) maintain the integrity of riparian areas, wetlands, and other sensitive watershed areas

Explanation: Fully suspended log yarding will be required over all streamcourses within cable-yarded units. The Interdisciplinary Team considered alternative yarding methods including but not limited to helicopter, short-span, and long-span methods when they formulated action alternatives.

Implementation and responsibility: Areas which will require suspended yarding are identified during the project planning process. Specific yarding systems which will be used in the timber sale are documented in the Timber Sale Contract and are designated on the Sale Area Map by the Sale Preparation Forester. The Sale Administrator will oversee the project operation using terms established in the Timber Sale Contract. The mechanisms for implementing this BMP are Contract Provisions BT6.42 (Skidding and Yarding) and CT6.42 (Special Yarding/Skidding Methods).

Ability to implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-13 Erosion Prevention and Control Measures During Timber Sale Operations

Objective: To ensure that the Purchaser's operations shall be conducted to minimize soil erosion

Explanation: Equipment shall not be operated on the timber sale when ground conditions are such that excessive damage will result. Adequate erosion control methods will be applied to all disturbed ground that may contribute sediment to the stream system. The kinds and intensity of erosion control work done by the Purchaser will be approved by the Forest Service and shall be adjusted to ground and weather conditions and the need for controlling runoff. Any additional erosion control work and the specific weather and ground conditions during which work can occur will be specified in the Timber Sale Contract. This work includes seeding, fertilizating, mulching, waterbar construction, ditchline cleanout, and keeping culverts unplugged.

Implementation and responsibility: The Sale Administrator and Forest Service Representative oversee implementation by the Purchaser. Specialists will be available for advice as needed.

The mechanisms for implementing this BMP are Standard Contract Provisions BT6.6 (Erosion Control and Soil Treatment by Purchaser) and CT6.6.1 (Wetlands Protection).

Ability to implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-14 Revegetation of Areas Disturbed by Harvest Activities

Objective: To establish a vegetative cover on disturbed sites to prevent erosion and sedimentation

Explanation: Where soil has been severely disturbed by the Purchaser's operations, the Purchaser shall take appropriate measures normally used to establish an adequate cover of grass or other vegetation, including the application of seed, mulch, and fertilizer as necessary, or take other agreed upon stabilization measures. To minimize chronic stock trampling and trailing on disturbed soils (i.e. skid trails and landings), seed mixes for revegetation and erosion control projects will use only vegetative species with low palatability for cattle.

This measure is applied in contracts where it is expected that disturbed soils in parts of the sale area will require vegetative cover for stabilization and the problems will not be mitigated by other contract provisions.

Implementation and responsibility: An estimate of the need is included in the sale plan or sale planning records, and in the Timber Sale Appraisal. Where the establishment of vegetation is needed, appropriate language must be included in the Timber Sale Contract. The Forest Service shall annually designate on the ground the disturbed soils, such as logging areas and temporary roads, that must be treated. The Forest Service, shall provide requirements as to soil preparation and the application of suitable seed mixtures, mulch, and fertilizer, and the timing of such work. It is the responsibility of the Sale Administrator to make sure that revegetation work is done correctly and in a timely manner. The mechanisms for implementing this BMP are Contract Provisions BT6.6 (Erosion Prevention and Control) and CT6.6 (Erosion Control and Soil Treatment by Purchaser).

Ability to implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item

25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-15 Log Landing Erosion Prevention and Control

Objective: To reduce erosion and subsequent sedimentation from log landings.

Explanation: This practice uses administrative, preventive, and corrective controls to meet the objective. Erosion/sediment control practices and drainage structures needed during use are identified by the Sale Administrator. At the time of unit closure, landings will be evaluated to identify any recontouring work that may be needed to ensure the site will not be subject to mass wasting or gullying. The Sale Administrator assesses the need for stabilization, with watershed specialist input as needed.

Implementation and responsibility: Timber Sale Contract requirements provide for erosion prevention and control measures on all landings. Provisions are made in the Timber Sale Contract for landings to have proper drainage. After landings have served the Purchaser's purpose, the Purchaser shall ditch or slope the landings to permit the drainage and dispersion of water. Provisions are also made for revegetation, if necessary. The specific work needed on each landing will depend on the actual ground conditions. It is the responsibility of the Sale Administrator to ensure that this practice is properly implemented on the ground. The mechanisms for implementing this BMP are Contract Provisions BT6.6 (Erosion Prevention and Control), BT6.63 (Landings), and CT6.6 (Erosion Control and Soil Treatment by Purchaser).

Ability to implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-16 Erosion Control on Skid Trails

Objective: To protect water quality by minimizing erosion and sedimentation from skid trails.

Explanation: This practice employs preventive controls to reach the objective. The Timber Sale Contract requires the installation of erosion control measures on skid trails, cable corridors, and temporary roads. Normally, the work involves constructing cross ditches and water spreading ditches. Other methods such as backblading may be agreed to in lieu of cross drains.

Deep decompaction, subsoiling, slash mulching (using intact—not chipped—slash), winter logging, or forwarding over slash mats will be used to avoid excessive concentration of overland flow along the skid trails, landings, and temporary roads in areas where the topography or layout will otherwise promote disruption of near-surface and surface runoff

The forest or district hydrologist will evaluate the potential for flow disruption in high-risk units in conjunction with the pre-sale forester. High-risk units may have highly compactable soils or a

dense skid trail/landing network left from a previous entry. The need for active restoration of infiltration capacity will be assessed in the field during sale layout, and rehabilitation provisions will be included in the sale contract wherever feasible to do so. Grass seeding may also be required in the Timber Sale Contract. These areas are designated on the ground annually as logging and temporary access construction progresses.

At unit closure, minimum required erosion control practices will include scarification adequate to produce a grass seedbed, grass or other seeding, and either debris mulching or waterbar construction or both.

Implementation and responsibility: The mechanisms for implementing this BMP are Contract Provision BT6.64 (Skid Trails and Fire Lines) and CT6.6. (Erosion Control and Soil Treatment by Purchaser).

Ability to Implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-17 Meadow Protection During Timber Harvesting

Objective: To avoid locating roads, landings, and skid trails in meadows

Explanation: In order to protect watershed and wildlife values, roads will not be located in meadows in the Deadman Project Planning Area. Vehicular or skidding equipment will not be used in meadows.

Implementation and responsibility: Purchaser compliance will be the responsibility of the Sale Administrator. The mechanism for implementing this BMP will be Standard Contract Provision BT6.61 (Meadow Protection).

Ability to Implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-18 Erosion Control Structure Maintenance

Objective: To ensure that constructed erosion control structures are stabilized and working

Explanation: Erosion control structures are only effective when they are in good repair and stable condition. Once the erosion control structures are constructed and seeded, there is a possibility that they may not become adequately vegetated or they may become damaged by subsequent harvest activities. It is necessary to provide follow-up inspection and structural maintenance in order to avoid these problems and ensure adequate erosion control.

Implementation and responsibility: The Purchaser shall provide maintenance of soil erosion control structures constructed by the Purchaser for one year but not beyond the period of the Timber Sale Contract. The Sale Administrator oversees the Purchaser's implementation of this BMP. After the Timber Sale Contract closes, erosion control structure maintenance work may be accomplished through watershed restoration practices by the Forest Service. The mechanism for implementing this BMP is Timber Sale Contract Provision BT6.66 (Erosion Control Structure Maintenance).

Ability to Implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Implementation and apparent effectiveness of this BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-19 Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

Objective: To assure the adequacy of required erosion control work on timber sales

Explanation: Erosion prevention work done in previous years will be periodically checked during the life of each timber sale. In addition, this work will be compared to other erosion prevention and control measures done on previous timber sales, as a measure of their effectiveness in meeting water quality objectives.

Implementation and responsibility: Specific requirements for erosion control are included in the Timber Sale Contract. Sale administrators, with assistance as needed from watershed specialists, will ensure erosion control measures conform to the applicable provisions. The mechanisms for implementing this BMP are Contract Provisions BT6.6 (Erosion Prevention and Control), BT6.66 (Erosion Control Structure Maintenance), CT6.6 (Erosion Control and Soil Treatment by Purchaser), and BT6.35 (Acceptance of Work).

Ability to Implement: High

Effectiveness: High

Monitoring: The Timber Sale Administrator will monitor implementation during harvest operations. Ranger District personnel will monitor erosion prevention work done during previous years and on previous timber sales. Implementation and apparent effectiveness of this

BMP will be monitored during post-sale BMP reviews by District personnel. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-20 Reforestation

Objective: To reforest all suitable land harvested within five years after the regeneration cut and to promptly reforest all other suitable areas not harvested but in need of reforestation

Explanation: Regeneration harvest areas are regenerated with trees within five years after cutting. Planting is used to supplement natural regeneration wherever possible. The implementation of this practice affects water quality by helping to stabilize soils, increase ground cover, and provide improved infiltration.

Implementation and responsibility: During the timber sale planning process, the interdisciplinary team assesses the capability of proposed areas to achieve reforestation within the prescribed period. The Silviculturist is responsible for this work and uses information collected by the interdisciplinary team. This information includes soil productivity, soil depth, soil moisture holding capacity, microclimate, plant indicators, slope, aspect, shape of slope, position on slope, percent of course rock fragments, moisture regime, and potential for natural regeneration. This information is used to determine regeneration methods.

Ability to Implement: High

Effectiveness: High

Monitoring: Regeneration and stocking surveys will be done by the Forest Service to verify the success of the reforestation.

T-21 Servicing and Refueling of Equipment

Objective: To prevent pollutants such as fuels, lubricants, bitumens, raw sewage, wash water and other harmful materials from being discharged into or near rivers, streams and impoundments or into natural or human-made channels leading thereto

Explanation: Refueling and servicing areas for all types of mechanized equipment, including helicopters will be located outside of Riparian Habitat Conservation Areas at a distance from streams such that a fuel spill will not enter the stream. In the case of ground-based equipment, servicing and refueling will be done at landing locations where possible, and location of these areas will be agreed upon prior to harvest operations. Helicopter servicing, refueling, and fuel storage areas will be designated. These areas should contain enough suitable material to facilitate construction of berms to contain potential spills. Berms will be large enough to contain the entire amount of fuel that is stored. If the total oil or oil products storage exceed 1320 gallons or if any single container exceeds a capacity of 660 gallons, a Spill Prevention Control and Countermeasures Plan (SPCC Plan), certified by a registered professional engineer, will be required.

Implementation and responsibility: The Timber Sale Administrator will designate the location,

size, and allowable uses of service and refueling areas. The mechanisms for implementing this are Contract Provisions BT6.34 (Sanitation and Servicing), and CT6.341 (Hazardous Materials).

Ability to Implement: High

Effectiveness: High

Monitoring: See Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

T-22 Modification of the Timber Sale Contract

Objective: To modify the Timber Sale Contract if new circumstances or conditions arise and indicate that the timber sale will irreversibly damage soil, water, or watershed values

Explanation: Harvest operations will be conducted as planned in the Timber Sale Contract, once it is sold. However, if it is determined that operations would cause serious environmental damage or if new evidence indicates that unacceptable damage is likely to occur, the Timber Sale Contract will be modified to a degree that will mitigate predicted amount of damage. In addition, the Environmental Impact Statement may be amended depending on the level of modification required by the contract.

Implementation and Responsibility: If the timber sale must be modified to protect the watershed, an agreement will be made with the timber sale Purchaser, or the contract may be terminated by the Chief of the Forest Service if the Purchaser does not agree to the terms of the environmental modification. The mechanisms for implementing this BMP are Contract Provisions BT8.3 (Contract Modification), BT8.32 (Changed Conditions), BT8.33 (Modification for Catastrophe), and CT8.3 (Contract Modification).

Ability to Implement: High

Effectiveness: High

Monitoring: EA (NEPA) review process. Also see Forest Plan Monitoring Guide, Item 1: Compliance with NEPA, Item 2: Standards and Guidelines, Item 25A: Water Quality, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

Vegetation manipulation

VM-1 Slope Limitations for Tractor Operation

Objective: To reduce gully and sheet erosion and associated sediment production by limiting tractor use.

Explanation: This is a preventive measure that limits excessive surface disturbance and prevents surface water from concentrating. The measure limits tractor operation to gentle slopes to prevent disturbance and erosion. Evaluation criteria used to determine slope restrictions are climate, soil condition, soil stability, and mass stability, as determined by field and office

analysis. These determinations made during the environmental analysis.

Implementation and responsibility: The Sale Administrator or Contracting Officer's Representatvite is responsible for ensuring implementation of the contract provisions that apply to tractor operation on steep slopes. Project planners have the responsibility to ensure that appropriate tractor operation provisions are included in the contract. This practice is implemented on vegetative manipulation projects where appropriate. For in-service projects, the project supervisor is responsible for the project and for identifying areas where operations should be limited. The supervisor's direction is taken from the project work plan and project Environmental Impact Statement.

Ability to Implement: Moderate

Effectiveness: High

Monitoring: Implementation monitoring will be done by the Contracting Officer's Representative, Project Supervisor, Sale Administrator, Forest Service Representative, and watershed specialists. Watershed specialists will evaluate post-project soil condition on selected projects to verify the effectiveness of the site-specific project BMPs. Also see Forest Plan monitoring plan.

VM-2 Tractor Operation Excluded from Wetlands and Meadows

Objective: To limit turbidity and sediment production resulting from compaction, rutting, runoff concentration, and subsequent erosion.

Explanation: This practice is a preventive measure designed to keep from concentrating surface water and to keep from compacting soil surfaces which may lead to rill or gully erosion with associated turbidity and sediment production. This measure is intended to prevent or reduce the need for corrective measures to prevent water concentration problems. BMP T-17, Meadow Protection During Timber Harvest, is related to this practice.

Implementation and responsibility: The application is mandatory on all vegetation manipulation projects unless specifically excepted in the environmental analysis (NEPA) process. The Contracting Officer's Representatvite is responsible for identifying wet areas and meadows not previously identified by the project planners. For force account projects, the project supervisor is responsible for identifying wet areas and meadows not previously identified by the project planner. The supervisor is also responsible for following project management requirements pertaining to wet areas and meadows. The project planners are responsible for including appropriate contract specifications and identifying management constraints in the project work plan and the Environmental Impact Statement.

Ability to Implement: High

Effectiveness: High

Monitoring: The Contracting Officer's Representatvite or project supervisor will monitor implementation of this BMP.

VM-3 Revegetation of Surface Disturbed Areas

Objective: To protect water quality by minimizing soil erosion through the stabilizing influence of vegetation.

Explanation: This is a corrective practice to stabilize the soil surface of the disturbed area. The vegetation selected will be a mix best suited to meet the management objective for the area. Fertilization, irrigation, tackifier, netting, jute or other material may be necessary to ensure plant growth.

Grass or browse species may be seeded between recently planted trees where appropriate for aesthetics, erosion prevention or wildlife needs. The factors evaluated are soil fertility, slope, aspect, erosion hazard, soil water holding capacity, climatic and weather variables, and suitable species selection. To minimize chronic stock trampling and trailing on disturbed soils (i.e. roadcuts and fills), seed mixes for revegetation and erosion control projects will use only vegetative species with low palatability for cattle. These are both field determinations and office interpretations made by an interdisciplinary team. Timber BMP T-14, Revegetation of Area Disturbed by Harvest Activities, is related to this BMP.

Implementation and responsibility: The identification of disturbed areas and treatment needs will be determined through an environmental analysis. Projects are subsequently monitored to assess their effectiveness, and need for follow-up action. The responsible line officer assembles an interdisciplinary team when appropriate or assigns specific individuals or work teams to plan and execute the project.

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation monitoring will be done by the Contracting Officer's Representative, Sale Administrator, Forest Service Representative, and watershed specialists. Watershed specialists will evaluate the effectiveness of the treatment measures for selected projects. Also see Forest Plan monitoring plan.

VM-4 Soil Moisture Limitations for Tractor Operation

Objective: The objective of this measure is to prevent compaction, rutting, and gullying and production of sediment and turbidity.

Explanation: This is a preventive measure that reduces surface disturbance during wet soil conditions which would result in compaction, rutting, and gullying. This measure reduces the need to later correct rutting and gullying problems. Soil erodibility, climatic factors, soil/water relationships, and mass stability are constraining factors which are identified by soil scientists, geologists, and hydrologists during the environmental analysis (NEPA) process.

Implementation and responsibility: The Contracting Officer's Representatvite is responsible for determining when the soil surface is unstable and susceptible to damage and is responsible for suspending or terminating operations for contracted projects. For in-service projects, the project

supervisor is responsible for determining when the soil surface is unstable and susceptible to damage, and is then responsible for terminating operations. Project planners are responsible for including appropriate contract provisions and management requirements in project work plans and the Environmental Impact Statement.

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation monitoring is done by either the Contracting Officer's Representatvite or project supervisor, with assistance as needed from watershed specialists. Also see Forest Plan monitoring plan.

Watershed management

W-1 Watershed Restoration

Objective: To repair degraded watershed conditions and improve water quality and soil stability.

Explanation: Watershed restoration is a corrective measure to:

a. Improve ground cover
b. Improve infiltration
c. Prevent overland flow and conserve the soil resource
d. Stabilize stream banks and stream channels
e. Improve soil productivity
f. Reduce flood occurrence and flood damage
g. Enhance economic, social, and/or aesthetic values of the watershed

The following factors shall be considered during development of restoration projects: predicted changes in water quality; downstream values; site productivity; threats to life and property; any direct or indirect economic returns; and social or scenic benefits.

Watershed restoration measures should reflect the state of the art and must be chosen to reflect the unique hydrologic and climatic characteristics of each watershed. Examples of watershed restoration measures are streambank stabilization, landing pullback, and ripping and planting unused temporary roads and landings.

Implementation and Responsibility: This management practice is implemented through the development of a Watershed Improvement Needs (WIN) inventory identification of projects, the approval of restoration plans and related environmental assessments, and the funding and implementing of the restoration actions. The Forest Supervisor shall ensure that a WIN inventory is completed and prioritized.

Planning should be done through an interdisciplinary effort. Multifunctional funding of projects should be pursued where improvement of watershed conditions will benefit multiple resource areas. The actual work may be done by force account or through contract. Effectiveness should be monitored by project proponents.

Ability to Implement: Low to moderate; KV funding is decreasing on the forest, and watershed improvement needs in other locations currently carry higher regional priority than most on the CNF. Staff reductions may affect the availability of field personnel experienced in revegetation work.

Effectiveness: Moderate; revegetation on difficult sites may be slow and only partially successful.

Monitoring: Watershed specialists and Ranger District resource personnel will evaluate the performance and effectiveness of the watershed restoration measures.

W-4 Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Control & Countermeasure (SPCC) Plan

Objective: To prevent contamination of waters from accidental spills

Explanation: A contingency plan is a predetermined organization and action plan to be implemented in the event of a hazardous substance spill. Factors considered for each spill are the specific substance spilled, the quantity, its toxicity, proximity of the spill to waters, and the hazard to life and property. The SPCC Plan is a document which requires appropriate measures (40 CFR 112) to prevent oil products from entering the navigable waters of the United States. An SPCC Plan is needed if the total oil products on site above-ground storage exceeds 1320 gallons or if a single container exceeds a capacity of 660 gallons.

Implementation and Responsibility: The hazardous spill contingency plan identifies coordination responsibilities for various kinds of spills, as well as the names and telephone numbers of agencies to call for spill reporting and cleanup. Most spills are cleaned up by agencies or spill cleanup contractors specially equipped for the job. Disposal methods and sites will be coordinated with EPA, State, and local officials responsible for safe disposal. SPCC Plans are required facilities owned by the Forest Service and special use permittees, as well as by timber sale operators and other contractors who store petroleum products. They must be reviewed and certified by a registered professional engineer.

Ability to Implement: High

Effectiveness: High

Monitoring: The Sale Administrator and Engineering Representative will track the implementation of this BMP throughout the timber sale. In the event of a spill, watershed specialists will monitor the situation and provide advice.

W-5 Cumulative Watershed Effects

Objective: To protect the beneficial uses of water and streams from the cumulative effects of multiple land management activities which may result in adverse (degraded) water quality or stream habitat conditions

Explanation: Cumulative, off-site watershed effects (CWE) include all adverse impacts on

beneficial uses of water occurring away from the sites of actual land management activities, as well those effects which occur after the activity has occurred.

Implementation and Responsibility: To evaluate the extent of additional management activity that can be recommended in a given watershed the following process is employed:

a. The existing watershed condition is determined.
b. The additional effects that proposed management activities would be expected to create are estimated and added to the existing conditions.
c. The cumulative effects and condition is compared to a threshold of concern which considers Basin objectives for the watershed.

If the condition is estimated less than the threshold value, the management activity in question occurs as planned. If the condition approaches or exceeds the threshold of concern, a caution flag is raised for the manager. Prior to implementing the planned activity, the scheduling of activities, type and effectiveness of mitigation measures, and potential for watershed improvement activities are reviewed to determine if changes can be made which would result in the project meeting watershed objectives.

The cumulative watershed impact evaluation process is implemented by specialists working in an interdisciplinary mode. Proposed activities are evaluated in terms of their locations relative to sensitive land types. Proposed activities occurring within or adjacent to sensitive land types are evaluated in terms of types of activities that have been judged to be appropriate for those grounds. As required, the nature and/or location of the activity is modified to insure adequate protection of the sensitive land.

Ability to Implement: High

Effectiveness: High

Monitoring: Specialists evaluate watershed and channel condition for both project and forest planning level analyses. The evaluations compare actual conditions with those estimated in either the Forest Plan or project environmental documents. Also see Forest Plan monitoring plan.

W-6 Control of Activities Under Special Use Permit

Objective: To protect surface and subsurface water quality from physical, chemical, and biological pollutants resulting from activities that are under special use permit

Explanation: Many activities and uses take place on National Forest System lands which are not directly related to Forest Service management activities. Some examples are: electronic sites, highway and railroad rights-of-way, and power transmission lines. There are other uses which are recognized Forest Service land management activities which are achieved through permits to a public or private agency, group, or individual. Examples of these types of uses are; organization camps, recreation residence tracts, and ski areas.

Activities on lands withdrawn under Federal Energy Regulatory Commission (FERC) authority

may be exempt from Forest Service control. When the FERC permit is renewed, the Forest Service makes a complete restudy of water quality and quantity needs and updates the constraints with which the permittee must operate.

Implementation and Responsibility: The special use permit under which these agencies, groups, or individuals operate, details the conditions they must meet to continue operating. The permittees are required to conform to all applicable State and Local regulations governing water quality and sanitation. Failure on the part of the permittee to meet the conditions of the special use permit may result in the permit being revoked.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest or Ranger District resource personnel inspect facilities authorized under special use permit to ensure compliance with the soil and water protection requirements. Specialists assist in evaluating the effectiveness of the water quality related BMPs included in the Permit. Also see Forest Plan monitoring plan.

W-7 Water Quality Monitoring

Objective: To determine effects of land management activities on the beneficial uses of water; to monitor baseline watershed conditions for comparison with State Water Quality standards, Forest Plan standards, and estimation of long-term trends; to ensure the health and safety of water users; to evaluate BMP effectiveness; and to determine the adequacy of data, assumptions, and coefficients in the Forest Plan.

Explanation: The Forest will manage watersheds to produce water of quality and quantity sufficient to maintain beneficial uses and comply with applicable State requirements for protection of waters.

Water quality monitoring is a mechanism which evaluates the effectiveness of a management prescription in protecting water quality. A water quality monitoring plan may be made a part of an EA or EIS, a management plan, a special use permit, or it may be developed in response to other needs.

Implementation and Responsibility: A water quality monitoring plan is written, reviewed, and implemented by qualified Forest personnel.Interpretation of the data and any reporting is also done by qualified personnel. The EPA STORET system should be used for computer storage of most water quality data collected.

Specific monitoring and evaluation plans should include such items as:

a. Monitoring objectives
b. Review of existing data and information
c. Location of monitoring sites
d. Soil or water quality characteristics that are to be monitored and evaluated

e. Type(s) or technique(s) of monitoring
f. Intensity of monitoring (frequency and duration)
g. Responsibilities and roles of monitoring personnel
h. Methodology for analysis and evaluation
i. Estimated cost
j. Report preparation

When changes and effects from management activity are detected, the Forest will evaluate their significance and determine appropriate action. Where project level activities will not meet Forest Plan standards or water quality objectives requirements for the protection of waters of the State, they will be redesigned, rescheduled, or dropped.

Ability to Implement: Low to moderate; Monitoring is poorly funded in current FS budgets.

Effectiveness: High when fully implemented, documented and reported to management

Monitoring: Project environmental documents are reviewed prior to approval to ensure that adequate monitoring is proposed. Water quality monitoring plans are developed or reviewed by Forest watershed personnel and/or Forest NEPA coordinator and/or Forest Watershed Staff Officer. Also see Forest Plan monitoring plan. Results of these monitoring projects will be reported in the Forest Annual Monitoring Report.

W-8 Management by Closure to Use (Seasonal, Temporary, and Permanent)

Objective: To exclude activities that could result in damage to either resources or improvements, such as roads and trails, resulting in impaired water quality

Explanation: A watershed may be in such a sensitive stability condition that any use during a given portion of the year, usually the rainy season, could result in impacts to water quality. In other cases, water quality may already be impaired and improvement not considered to be practical without substantially reducing or eliminating further use. These conditions could have resulted from past land use or from natural disasters. Closure to use may be used when the condition of the watershed must be protected to preclude water quality impacts.

Implementation and Responsibility: The Deadman Interdisciplinary Team and the Forest Hydrologist will recommend appropriate road closures in the Project Planning Area after an evaluation of watershed conditions and alternative protection methods. The mechanism for implementing and enforcing this BMP is 36 CFR 251.50 and PL 95-200.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest and Ranger District resource and watershed personnel evaluate implementation and the effectiveness of closure to use on a case-by-case basis.