SILVICULTURE
BEST MANAGEMENT PRACTICES

WYOMING
NONPOINT SOURCE MANAGEMENT PLAN

2004
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PURPOSE

This "Best Management Practices" document is being updated to reflect new information acquired through audits of the program and implementation of new technology. This series of conservation practices when selected and applied properly to most silvicultural activities, will result in maintaining the existing designated uses of water resources, and reducing adverse effects and water quality degradation.

It is also being prepared as part of the "Wyoming Nonpoint Source Management Plan" as required by section 319 (b) of the Clean Water Act.

It can be viewed as a companion document to Chapter I of the Wyoming Water Quality Rules and Regulations and used as a guide to land management agencies and private individuals and industries who are conducting silvicultural activities. If used properly, these practices can effectively minimize water quality degradation and prevent violations of the State water quality standards.
INTRODUCTION

This set of Best Management Practices is based in part on the USDA Forest Service "Soil and Water Conservation Practices Handbook" (FSH 2509.22) used in Forest Service Regions 1 and 4, the USDA Forest Service “Watershed Conservation Practices Handbook” (FSH 2509.25) used in Region 2 and USDA Natural Resources Conservation Service District Practice Standards (Silviculture BMPs, 1997), and the earlier version of the Silviculture Best Management Practices of Wyoming (1997).

The practices contained herein are not an exact duplication of the above references. Many practices have been omitted because they deal with topics other than silviculture, such as recreation, range, or minerals. Others have been left out or changed significantly because they apply to Forest Service policy and/or administrative procedures and are not relative to the purpose of the document.

The contents of the original document finalized in March, 1997 has been modified to reflect recommendations suggested in the audit report conducted in 2000 and 2001 by a grant to the Wyoming Timber Industry Association from the Wyoming Department of Environmental Quality. Those recommendations can be found in the Wyoming Forestry Best Management Practices Forest Stewardship guidelines for Water Quality 2000/2001 Field Audit Report, (2002)

The format used in this document differs from the handbooks described above. The general format used is as follows:

PRACTICE: Includes the sequential number of the practice and a descriptive title. The ordering of the practices is arbitrary and has no intended significance.

OBJECTIVE: Describes the desired results of the practice as it relates to soil and water resource protection and beneficial uses.

CONDITIONS WHERE PRACTICE APPLIES: Describes where or when the practice applies. Often it is a very general statement, and it is up to the operator to decide if implementation is appropriate.

EXPLANATION: Further defines the brief title and expresses how the practice is applied. Describes criteria or standards where applicable.

CONCERNS: Contains comments on the implementation of the practice.

TECHNICAL SUPPORT: Directs the reader to agencies and organizations who can offer information and expertise on the implementation of the practice.

REFERENCES: Lists manuals or texts where further information on the practice can be found.
Section 319 of the Clean Water Act requires that each of the practices developed must address impacts to surface and groundwater. The majority of the BMPs are designed to reduce impacts upon surface water. Many of the practices, by their nature, do not have any effect on groundwater. If there is a definite association to groundwater quality, there will be a brief explanation of that concern. As information on the use of these practices accumulates, the groundwater concerns will be amended appropriately.

The practices have been divided into five sections for ease of presentation and selection. The sections are: (I) Planning, (II) Harvesting, Thinning, Slash Treatment, and Revegetation, (III) Roads, (IV) Pesticides, Herbicides, Fertilizers, and Chemicals, and (V) Fire Management. The "planning" section contains practices that should be implemented before the actual work starts. The other four sections apply to on-site procedures. Some of the practices in the "Roads" section are planning functions in nature, but since they apply specifically to road construction, maintenance or closure it seems more appropriate to put them there.

Many of the practices are technical in nature and should be implemented by knowledgeable and experienced staffs.

In Wyoming, approximately 79% of the forested land is managed by a federal or state agency. An even larger percentage of the state's marketable saw timber is on these lands. The land management agencies, to a large extent, either have the appropriate technical staffs necessary for the proper selection and implementation of these practices, or have access to them. A private individual, however, who wishes to manage the timber on his land, may be at a loss to understand and use these practices. It is incumbent upon this individual to seek advice from the various state and federal conservation or regulatory agencies before proceeding with a silvicultural operation. Even though BMP practices are voluntary the land owner is ultimately liable for compliance with the state water and air quality standards.
DEFINITIONS

Baseline Data/Inventories. Resource data from the area that identifies and quantifies all resources. The area to be inventoried may include lands beyond the point of impact, i.e., resources that may be affected downwind or downstream by the planned action.

Best Management Practice (BMP). Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. Best management practices (BMPs) include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, or after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

BMPs adopted through the Wyoming continuing planning process (CPP) after problem assessment, examination of alternative practices and appropriate public participation are to be the most practically effective (including technological, economic and institutional considerations) means of achieving surface water quality standards and preventing or reducing the quantity or concentration of wastes discharged to surface waters of the state.

BMPs are contained within a state certified water quality management plan adopted under section 319 of the federal act in accordance with the state's CPP. In certain instances, certified state water quality management plans will not contain specific BMPs but will outline a process to be followed in developing BMPs for individual activities.

Buffer Zone. An area of land and/or water where certain activities may be limited or excluded. The area and nature of a buffer zone is determined by inventory, planning, public law, etc. The limits of a buffer zone may be expressed as time, space, or actions, either separately or in combination.

Carrying Capacity. (Recreation): the amount of recreation use an area can sustain without deterioration of site quality; (Wildlife): the maximum number of animals an area can support during a given period of the year; (Range): the maximum stocking rate possible without damaging the vegetation or related resources. Carrying capacity may vary from year to year on the same area due to fluctuating forage production.

Chapter 1. Wyoming surface water quality standards and classifications.

Chapter 2. Discharges/permit regulations for Wyoming.

Chapter 3. Regulations for permits to construct, install, or modify public water supplies, wastewater facilities and other facilities capable of causing or contributing to pollution.

Chapter 4. Releases of oil and hazardous substances.

Cold Water Game Fish. Grayling (Thymallus arcticus), Northern Pike (Esox lucius), Salmon (Oncorhynchus), Sauger (Stizostedion canadense), Tiger Muskie (Esox), Trout (Salmo and Salvelinis), Walleye (Stizostedion vitreum), and Whitefish (Prospium williamsoni).

Cross Drain/Ditch. A man-made ditch or channel constructed to intercept surface water runoff and divert it before the runoff concentrates to erosive volumes and velocities.

Crowning. Forming a convex road surface which allows runoff to drain from the running surface to both sides of the road prism.

Cumulative Effect. The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other action (40 CFR 1508.7).

Degraded Watershed. A basin which has suffered environmental damage, resulting in accelerated soil or vegetative loss or chemical contamination to the quantifiable detriment of other beneficial uses.

Designated Streams. A stream or portion of a stream identified as warranting special consideration in management decisions and project activities. See also Stream or Steamcourse.

Designated Use. Actual or potential use that may be made of the waters of the state, including but not necessarily limited to domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; preservation and enhancement of fish, wildlife and other aquatic resources.

Floodplain. The lowland and relatively flat areas adjoining inland waters that are covered by its waters during flooding.

Hazardous Substances. Materials which by their nature are potentially toxic or dangerous to handle or dispose of, or which can contribute to environmental degradation. Examples may be but are not limited to radioactive materials, petroleum products, pesticides, chemicals, and biological wastes.

Log Landing. An area where logs are skidded or yarded prior to loading and transportation to a mill.

Mitigate. To avoid, offset or lessen real or potential impacts or effects through the application of additional controls or actions. Counter measures are employed to reduce or eliminate undesirable or unwanted results.

Monitoring. The periodic evaluation of resources or activities on a representative sample basis to establish long-term trends, assess the impacts of land management activities, determine how well objectives have been met, and check compliance with established standards.
**Natural Water Quality.** That quality of water which would exist without measurable effects or measurable influence of man's activities.

**NEPA Process.** All measures necessary for compliance with the requirements of section 2 Title I of the National Environmental Policy Act (NEPA).

**Nephelometric Turbidity Unit (NTU).** The standard unit used to measure the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through water, as measured by a nephelometer

**Nonpoint Source Pollution (silviculture).** Diffuse sources of water pollution that originate from any indefinable sources and normally includes agricultural and urban runoff, runoff from construction activities, etc. In practical terms, nonpoint sources do not discharge at a specific, single location (such as a single pipe). Nonpoint source pollutants are generally carried over or through the soil and ground cover via stormflow processes. Unlike point sources of pollution (such as industrial and municipal effluent discharge pipes), nonpoint sources are diffuse and can come from any land area. The following silvicultural activities are considered to be nonpoint sources of pollution: nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvest operations, surface drainage, and road construction and maintenance from which there is natural runoff (40 CFR 122.27).

**Normal Operating Season.** A portion of a year when normal timber harvesting operations are expected to take place uninterrupted by adverse weather conditions.

**Outsloping.** Shaping a road to cause drainage to flow toward the outside shoulder (generally the fillslope), as opposed to insloping which encourages drainage to flow to the inside shoulder (generally the cut slope). Emphasis is on avoiding concentrated water flow.

**Pesticide.** A general term applied to a variety of chemical materials including insecticides, herbicides, fungicides, and rodenticides.

**Point Source.** Originating from a discrete identifiable source or conveyance. Silvicultural point sources of pollution include the following: Rock crushing, gravel washing, discharging sedimentation ponds, and log sorting and storage facilities where water is applied intentionally to the logs (40 CFR 122.27).

**Reclamation.** Restabilization of land denuded by land management activities.

**Reforestation.** The renewal of forest cover by seeding, planting, or natural means.

**Revegetation.** The replacement of vegetative cover which has been harvested or lost due to natural occurrences. Accomplished either through planting of nursery stock or seeding, or through natural processes.
**Riparian Areas.** Geographically delineable areas along a stream course with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.

**Riparian Ecosystem.** A transition between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

**Rip Rapping.** The use of clean large rock, boulders, concrete chunks or similar non-erosive, heavy objects as an armoring device. Materials such as broken asphalt, car bodies, waste construction debris, scrap metal and other forms of solid waste are not acceptable for use as rip rap.

**Road Maintenance Plan.** A documented schedule and program for upkeep of roads to provide a level of service for the use and protection of resource. For example, the USDA Forest Service uses five levels of maintenance: Level I being the least intensive and Level V being the most intensive.

**Rocking.** The application of aggregate to a roadbed to provide strength and a more stable erosion and resistant surface.

**Sale Area Map.** A map of suitable scale and detail to be legible which is part of a timber sale contract. The map identifies sale area boundaries and contract requirements specific to the sale.

**Significant Disturbance.** Disturbance of surface resources, including soil, water and vegetation, which has the potential to measurably impact water quality.

**Site Preparation.** A general term for removing unwanted vegetation, slash, and even roots and stones from a site before reforestation. It is generally accomplished by either mechanical, chemical, or biological means, or controlled fire.

**Site Specific.** Pertains to a discernible, definable area or point on the ground where a project or activity will (or is proposed) to occur.

**Soil and Water Conservation Practices (SWCP).** The set of practices which, when applied during implementation of a project, ensures that soil productivity is maintained, soil loss and water quality impacts are minimized, and water-related beneficial uses are protected. These practices can take several forms. Some are defined by state regulation or memoranda of understanding between the Forest Service and the States and thus are recognized as Best Management Practices (BMPs). Others are defined by the Forest interdisciplinary teams or described in Forest Service Manuals and Handbooks. Both kinds of SWCPs are included in the Forest Plans as forest wide standards or are referenced in the plans. A third kind of SWCP is identified by the interdisciplinary team for application to specific management areas. These are included as Management Area Standards in the appropriate management areas in the Forest Plan. A fourth kind, site specific SWCPs, are based on project level evaluation and represent the most effective and practical means of accomplishing the soil and water resource goals and protecting the beneficial uses of a specific area. These site specific conservation practices supplement the
Forest Plan for specific projects. In Wyoming, these site specific SWCPs are recognized as specialized Best Management Practices in the state's nonpoint source management plan. This handbook will aid in the development of the fourth kind of SWCP.

**Soil Productivity.** The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture, nutrients, texture, structure, organic matter, and length of growing season.

**Stream or Stream course.** A natural channel with defined bed and banks. It may be perennial, intermittent, or ephemeral.

**Surface Waters of the State.** All permanent and intermittent defined drainages and lakes and reservoirs which are not man-made retention ponds used for the treatment of municipal, agricultural or industrial waste; and all other bodies of surface water, either public or private which are wholly or partially within the boundaries of the State. Nothing in this definition is intended to expand the scope of the Environmental Quality Act, as limited in W.S. 35-11-1104.

**Toxic Materials.** Those materials or combinations of materials including disease causing agents, which, after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the administrator of the Environmental Protection Agency, cause death, disease, behavioral abnormalities, cancer, genetic malfunctions (including malfunctions in reproduction) or physical deformations in such organisms or their offspring.

**Warm Water Game Fish.** Bass (Micropterus), Catfish (Ictalurus punctatus), Crappie (Pomoxis), Ling (Lota lota), Perch (Perca flavescens), Sunfish (Lepomis), and White Bass (Morone)

**Water bar.** A depression dug into a road surface to divert water from the road unto a filter strip at the edge of the road. There are many designs and shapes that are functional. Generally the depression is never aligned more than 30 degrees from a line that runs perpendicular across the road and never at more than a 2 % grade.

**Wetlands.** Those areas in Wyoming having all three (3) essential characteristics: (1) Hydrophytic Vegetation; (2) Hydric Soils; and (3) Wetland Hydrology.

**Windrowing.** To pile slash or debris in a row along the contour of the slope.

**404 Permit.** Permit issued by the Army Corps of Engineers which regulates the placement of dredged or fill material into waters of the United States. This permit requires state certification that the project will not adversely affect water quality.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
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<tr>
<td>BMP</td>
<td>Best Management Practice</td>
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<tr>
<td>COE</td>
<td>Army Corps of Engineers</td>
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<tr>
<td>DEQ/AQD</td>
<td>Department of Environmental Quality/Air Quality Division</td>
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<tr>
<td>DEQ/LQD</td>
<td>Department of Environmental Quality/Land Quality Division</td>
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<tr>
<td>DEQ/SWP</td>
<td>Department of Environmental Quality/Solid Waste Program</td>
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<tr>
<td>DEQ/WQD</td>
<td>Department of Environmental Quality/Water Quality Division</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FSH</td>
<td>Forest Service Handbook</td>
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<tr>
<td>FSM</td>
<td>Forest Service Manual</td>
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<tr>
<td>G&amp;F</td>
<td>Wyoming Game &amp; Fish Department</td>
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<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>NTU</td>
<td>Nephelometric Turbidity Unit</td>
</tr>
<tr>
<td>R-1</td>
<td>Region 1 of the USDA Forest Service</td>
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<tr>
<td>R-2</td>
<td>Region 2 of the USDA Forest Service</td>
</tr>
<tr>
<td>R-4</td>
<td>Region 4 of the USDA Forest Service</td>
</tr>
<tr>
<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
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<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
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<tr>
<td>WACD</td>
<td>Wyoming Association of Conservation Districts</td>
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<tr>
<td>WDA</td>
<td>Wyoming Department of Agriculture</td>
</tr>
<tr>
<td>WGS</td>
<td>Wyoming Geological Survey</td>
</tr>
<tr>
<td>WHD</td>
<td>Wyoming Highway Department</td>
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</table>
TIMBER SALE PLANNING

Timber harvesting and reforestation are activities that require advanced planning before proceeding with the activity. For federal agencies the timber sale planning is accomplished through the NEPA process. For state and private entities the development of a timber sale plan can be anywhere from an analysis similar to the NEPA process to just a verbal declaration of the expectations from the harvest. It is recommended that a timber sale plan be written and agreed to for all timber sale operations regardless of ownership.

The analysis should evaluate the potential for impacts to and the cumulative effects on the soil and water resources. If a significant potential impact exists, the analysis should: (1) consider how to minimize potential effects during and following the sale layout and subsequent logging operations; (2) include mitigation of effects for those treated areas where impacts are unavoidable; and (3) identify environmentally sensitive areas where impacts from proposed treatments cannot be mitigated to conform with standards.

The planning document should incorporate the BMPs listed in this document whenever the planned activity impacts an area that could be mitigated by employing one or more of the BMPs.
PRACTICE #: 1 Soil and Water Resource Monitoring and Evaluation

OBJECTIVE: To determine the effects of land management activities on soil productivity and designated water uses; to monitor baseline watershed conditions for comparison with state standards; to ensure the health and safety of water users; and to evaluate the effectiveness of applied BMP's.

CONDITIONS WHERE PRACTICE APPLIES: All silvicultural management activities.

EXPLANATION: This practice is meant to ensure compliance with the standards in order to avoid the irreversible or long term effects on the soil resource and to produce water of quality and quantity sufficient to maintain designated uses in compliance with state water quality standards. Monitoring and evaluation are meant as feedback mechanisms to compare the results of management activities and BMP's on soil and water resources with the previous conditions, desired end products, and state standards. To accomplish this, a comparison will be made on a representative sample basis, of effects on soil and water over time. Monitoring and evaluation may include for example:

a. Bulk density, soil disturbance, and/or tree growth to evaluate soil productivity.

b. Pathogens and pH to monitor swimming sites.

c. Sediment, turbidity, and water temperature to evaluate domestic water supplies.

d. Sediment, dissolved oxygen, water temperature, air temperature, pH, cobble embeddedness, insect habitat evaluation, percent fines in the substrate, and channel cross sections to monitor effects on aquatic life.

It is not the intent of this practice to require a specific approach to monitoring, however, standard protocols must be followed. Consideration of the size and type of operation, amount of road building required, and types of waterbodies at risk should be taken into account when deciding on a monitoring regime. In many instances, for example, surface water turbidity may be the only monitoring concern. A specific monitoring and evaluation plan should include the following:

- Monitoring objectives
- Review of existing data and information
- Parameters to be monitored
- Types, techniques, and frequency of monitoring
- Data analysis and evaluation
- Reporting
- Cost

When monitoring indicates waterbody degradation, or that a violation of water quality standards is occurring, action should be taken immediately to remedy the situation. This may involve rescheduling, redesigning, mitigation for damage, or dropping the operation. It is the
responsibility of the person owning the land being harvested to make sure that monitoring is carried out.

**CONCERNS:** Technical support in a variety of disciplines (water quality, wildlife, engineering, soil science etc.) is essential for this practice to have any real value.

**TECHNICAL SUPPORT:** DEQ/WQD, G&F, State Forester, NRCS, USGS

**REFERENCES:** Water Quality Rules & Regulations - Chapter 1
PRACTICE #: 2    Wetlands Analysis and Evaluation

OBJECTIVE: To maintain wetland functions and avoid adverse soil and water resource impacts associated with the destruction or modification of wetlands.

CONDITIONS WHERE PRACTICE APPLIES: Whenever wetlands occur within the boundaries of a proposed silvicultural management operation.

EXPLANATION: The Clean Water Act regulates activities and new construction in all waters of the U.S. including wetlands. Evaluation of proposed actions in wetlands should consider factors relevant to the proposal's effect on the survival and quality of the wetlands. Section 404 permits may be required from the Army Corps of Engineers (COE) before any work begins which involves the placement of dredged or fill material into any wetland. Some activities, including the construction of temporary roads for timber harvesting, are exempt from 404 permitting requirements. There are conditions, however, that apply to this exemption and the final determination of whether any specific activity is exempt is made by the Corps of Engineers. This practice requires that the COE be contacted whenever an operation involves work in a wetland. Prior notification to the COE will result in a determination of whether the activity is already authorized by regulation, exempt from regulation, or requires a permit. The permitting process, if applicable should result in adequate protection from the activity. A buffer zone similar to that suggested in PRACTICE #: 3 should be provided.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: COE, DEQ, G&F, NRCS, WACD, FWS

REFERENCES: Definition of Wetlands
PRACTICE #: 3  Riparian Area Designation

OBJECTIVE: To minimize the effects of road building and harvesting activities on Riparian Areas.

CONDITIONS WHERE PRACTICE APPLIES: All silvicultural activities.

EXPLANATION: The riparian area is not a zone of exclusion, but an area of closely managed activity. It acts as (1) an effective filter and absorptive zone for sediment; (2) provides shade; (3) protects aquatic and terrestrial riparian habitats; (4) protects channel and streambanks; and (5) promotes floodplain stability. As a preventative measure, ground disturbance from silvicultural activities will be minimized, but timber harvesting may be used to achieve the riparian area objectives. On-the-ground evaluation will determine the need for designation of a buffer zone, the subsequent width necessary to meet management objectives, and the extent to which timber harvest activities may be restricted. Factors such as unstable slopes, soils, stream classification, channel stability, resources dependent on these areas, and fisheries habitat condition should all be considered when determining the proper width of a buffer zone. The following table can be used as a general rule:

<table>
<thead>
<tr>
<th>Slope %</th>
<th>Buffer Width (ft)(^\diamond)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 35</td>
<td>50 (or equal to the height of mature trees)</td>
</tr>
<tr>
<td>greater than 35*</td>
<td>100</td>
</tr>
</tbody>
</table>

CONCERNS: Effective identification of riparian values and subsequent protection of these areas is one of the most basic and useful practices for reducing sedimentation. Neglect of these areas will multiply any adverse effects from upland activities.

* Operations on slopes greater than 35% need to be given special technical consideration and should be coordinated with the appropriate technical agencies.

\(^\diamond\) Actual width is this width or a width equivalent to the mean height of mature dominant late-seral vegetation whichever is greater.

TECHNICAL SUPPORT: DEQ/WQD, State Forester, G&F, NRCS, WACD

PRACTICE #: 4 Oil and Hazardous Substance Spill Contingency

OBJECTIVE: To minimize potential contamination of waters from accidental spills by prior planning and development of Spill Prevention Plans.

CONDITIONS WHERE PRACTICE APPLIES: Whenever an activity requires the above ground storage of hazardous substances or petroleum products.

EXPLANATION: A Spill Prevention Control and Countermeasure plan (SPCC) is required by Federal regulation when more than 1320 gallons of petroleum products are stored. State regulation requires that all spills in excess of 25 gallons of gasoline or 10 barrels of crude oil are reported to the DEQ Water Quality Division. Virtually all spills of hazardous substances (including pesticides) should be reported. An unofficial plan should still be developed even if the volume of material is less than the 1320 gallon regulatory baseline, or the substances are pesticides or fertilizers instead of petroleum products.

A spill contingency is an immediate reporting and action plan that contains a predetermined system of responses 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, property, and the environment. All petroleum products, lubricants, solvents, and other substances capable of polluting surface or groundwater should be stored within a diked area large enough to contain the largest theoretical spill (110%). Sufficient containment and cleanup materials should be stockpiled in the immediate vicinity of the storage area to absorb any spills that occur. The storage area should also serve as the equipment servicing and fueling area and should be located on level ground at least 150 feet away from riparian areas.

CONCERNS: Failure to adequately plan for hazardous substance spills may result in severe surface water and/or groundwater contamination. Costs of cleanup may be extremely expensive.

TECHNICAL SUPPORT: DEQ/WQD, EPA

REFERENCES: Wyoming Water Quality Rules and Regulations: Chapter 1, Chapter 4, CERCLA. Wyoming Forestry BMPs.
PRACTICE #: 5  Sanitary Guidelines for the Construction of Camps

OBJECTIVE: To protect surface and subsurface soil and water resources from nutrients, bacteria and chemicals associated with solid waste and sewage disposal.

CONDITIONS WHERE PRACTICE APPLIES: Whenever temporary labor, spike, logging, and fire camps are necessary for the conduction of a silvicultural operation.

EXPLANATION: Environmental and health impacts associated with these camps can be adverse if care is not taken to properly plan, locate and design wastewater facilities. In establishing site locations, sewage disposal consideration should not be overlooked. Despite the sometimes urgent development of a site, wastewater design should be a primary consideration. This should result in adequate sewage disposal facilities, and little or no health and water pollution threats.

The same applies to the urgent establishment of fire camps. Sufficient care should always be given to the potential impacts associated with human waste and wastewater disposal. Disposal facilities at existing stations or work centers can be overloaded by fire crews. If this occurs, septic tanks may be overloaded, solids may overflow and plug and damage drain fields. Surfacing effluent becomes a potential pollution and health hazard and constitutes an illegal discharge.

Consideration should also be given to the sanitary handling of garbage and other solid waste. Animal-proof receptacles should be used on site, and the waste materials should ultimately be disposed of at a properly designed, operated and permitted landfill. Regulation of solid waste is by DEQ, Solid Waste Section.

CONCERNS: Improper handling of waste constitutes a health hazard and a risk to surface and groundwater from biological and chemical contamination. All construction of permanent or temporary sanitary facilities requires a Permit to Construct from DEQ/WQD. In some counties permitting authority has been delegated to the County Health Department.

TECHNICAL SUPPORT: DEQ/WQD, DEQ/SWP

PRACTICE #: 6  Timber Sale Design

OBJECTIVE: To insure that timber harvest unit design will maintain or improve hydrographic characteristics by increasing runoff quantity and/or extending the runoff period, maintain water quality and soil productivity, and reduce soil erosion and sedimentation.

CONDITIONS WHERE PRACTICE APPLIES: All proposed timber sales, especially those in the vicinity of sensitive watersheds as identified in the Wyoming Water Quality Assessment Report (305b) and/or Wyoming Game & Fish classifications.

EXPLANATION: This is an administrative and preventive practice. The proposed timber harvest units are evaluated to estimate the response on the affected watersheds. This involves field examination, evaluation of existing data, analysis of potential watershed response (e.g. water yield and sediment yield analysis), and professional judgment. The first decision to be made is whether or not an area is "suitable" for timber harvesting. Determining suitability can involve consideration of many variables including but not limited to economics, geology, climate, regeneration potential and civil and legal liabilities.

Once suitability has been established, characteristics to be evaluated can include: (1) the recovery from past harvests; (2) the allowable area that can be harvested; (3) the protection of stream channels; (4) the erosion potential of the area; (5) landform characteristics; (6) the number, size, shape and location of the harvest units; (7) estimated location and size of roads and skid trails; (8) logging system design; (9) the number and type of stream crossings; (10) the potential natural recovery rate of the watershed; (11) time of year that the timber harvest will occur; and (12) the quality and timing of runoff that might result from a particular harvest. Where adverse water quality or soil productivity impacts may result, the harvest unit design should be modified, individual units deleted, and/or natural recovery rate accelerated by using watershed improvement measures.

CONCERNS: This practice cannot be implemented by a layman. Technical assistance must be provided by a professional forester with input from the associated disciplines (wildlife biology, engineering, hydrology, soil science).

TECHNICAL SUPPORT: DEQ, Game & Fish, State Forester, Professional Forester, NRCS

PRACTICE #: 7  Skidding Design

OBJECTIVE: To minimize erosion and sedimentation and protect soil productivity by designing skidding patterns that best fit the terrain.

CONDITIONS WHERE PRACTICE APPLIES: Whenever skid trails are required to remove forest products.

EXPLANATION: This is a preventative practice. The watershed factors that are considered include slope, aspect, soil stability, vegetative cover, riparian areas, and other factors that may affect the flood and sediment yield potential of the land. The careful control of skidding patterns serves to avoid on-site and downstream channel impacts, the buildup of destructive runoff flows, erosion in sensitive runoff areas such as meadows and riparian areas, and a reduction in soil productivity.

Two complementary methods of protecting soil and water resources by skid trail design are:

a. End-Lining. This method involves winching logs directly out of the sensitive areas (meadows and riparian areas) with a cable operated outside of the sensitive areas. In this manner, logs can be removed from the sensitive areas while avoiding encroachment by heavy equipment and associated site damage.

b. Felling to the Lead. This method involves felling trees toward a predetermined skid pattern. This procedure facilitates an uncomplicated approach of the tractor operating between the log and the skid trail. Soil disturbance and compaction are consequently lessened and residual stand and site impacts are lessened.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: State Forester, WACD, NRCS, Professional Forester

PRACTICE #: 8  Suspended Log Yarding

OBJECTIVE: To identify those areas where suspended log yarding is appropriate to protect soil from excessive disturbance and accelerated erosion and to maintain the integrity of the riparian area and other sensitive watershed areas.

CONDITIONS WHERE PRACTICE APPLIES: On steep slopes and riparian areas where tractors cannot operate.

EXPLANATION: Suspended log yarding includes all yarding systems which suspend logs either partially or wholly off the ground. These systems include highlead, skyline, helicopter, and balloon yarders. All of the systems result in less soil disturbance since heavy machinery is not used over the sale area. In some cases, these systems require fewer roads because of longer skidding distances.

CONCERNS: This option may make timber harvesting possible in areas which should more appropriately be removed from consideration because of unstable soils, thereby greatly increasing the risk of slumping or sliding.

TECHNICAL SUPPORT: Decision to use this practice should be made by a professional forester.

PRACTICE #: 9  Water Source Development Consistent with Water Quality Protection

OBJECTIVE: To supply water for road construction and maintenance and fire protection while maintaining water quality.

CONDITIONS WHERE PRACTICE APPLIES: Whenever a large water supply is needed for silvicultural activities.

EXPLANATION: Water source development is normally needed to supply water for road construction, dust control, mixing surface compaction, and for fire control requirements. Water source development should aim toward the construction of durable long-term sources rather than the construction of hasty, expedient developments. Permanently designed sources, such as tanks, should result in the lowest long-term impact on the affected streams.

Other considerations in the development of water sources should be:

a. Downstream flow should not be reduced so as to detrimentally affect aquatic resources, fish passage, sensitive species or other uses. The Wyoming G&F should be contacted to coordinate the timing of any operation to assure that fish migration and/or spawning is not compromised.

b. Temporary cofferdams should be constructed of sandbags containing sand or clean gravel, or other materials and means which will not induce sediment into the stream.

c. Overflow should go directly back into the stream.

d. All temporary facilities for gathering water will be removed prior to causing any resource damage.

CONCERNS: State engineer should be contacted before developing any water storage facility or diversion. Placement of fill material in any surface water may require a 404 permit from the Army Corps of Engineers.

TECHNICAL SUPPORT: State Engineer, COE, DEQ/WQD, NRCS

REFERENCES: USFS R-4 Technical Guide - Erosion Prevention and Control on Timber Sale Areas

NRCS Standards: 349 Dam, Multiple Purpose
356 Dike
362 Diversion
342 Critical Area Planting
378 Pond
410 Grade Stabilization Structure
423 Hillside Ditch
HARVESTING,
THINNING,
SLASH TREATMENT
AND REVEGETATION
PRACTICE #: 10    Equipment Limitations in Wetlands, Bogs, and Wet Meadows

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

CONDITIONS WHERE PRACTICE APPLIES: Application of this practice is recommended wherever the above-mentioned areas occur.

EXPLANATION: This practice is designed to prevent soil puddling, compaction and displacement, and the concentration of surface water and soil erosion, which may lead to rill or gully erosion and subsequent water quality degradation. Tractor operations in these areas may be limited to specialized equipment and/or entering the area during favorable conditions (e.g. dry, frozen soil etc.) This measure is intended to prevent or reduce the need for corrective measures to solve water concentration problems due to tractor use.

CONCERNS: It must be noted that wetlands often do not contain surface water year round. Equipment operation in wetlands needs to be carefully managed even if the area is in a dry state during silvicultural operations.

TECHNICAL SUPPORT: G&F, NRCS

REFERENCES: Definition of Wetlands, Practice #7 - “Skidding Design”. Wyoming Forestry BMPs.
PRACTICE #: 11 Log Landing Location and Design

OBJECTIVE: To locate landings in such a way as to avoid soil erosion and water quality degradation.

CONDITIONS WHERE PRACTICE APPLIES: All timber harvesting activities.

EXPLANATION: This practice is both administrative and preventive. The following criteria are used in evaluating landings:

a. The cleared or excavated size of landings should not exceed that needed for safe and efficient skidding, decking and loading operations. Every landing must meet the safety requirements of the Occupational Safety and Health Administration.

b. Where a choice exists, landing locations are selected which involve the least amount of excavation and the least erosion potential. They should be located to utilize existing terrain that does not exceed 10% slope. Additional evaluation is necessary when there is no alternative to landing construction on slopes greater than 10%.

c. Where possible, landings are located near the points of ridges so that felled timber lying between drainages can be skidded to the landing without crossing channels or impacting riparian areas.

d. Landings are located where the least number of skid roads are required and sidecast will neither enter drainages nor damage other sensitive areas.

e. If possible, landings are positioned such that skid road approach will be nearly level.

f. Locate landings to minimize the number of tractor roads entering a given landing.

g. Some landings are designed and constructed as part of specified roads.

h. Landings are shaped to drain in a planned direction and manner to minimize erosion and sediment delivery to stream courses.

i. Landings generally will not be located in riparian or buffer areas.

CONCERNS: Selection of sites, and landing design and oversight should be done by a professional forester. Improper location of landings will contribute greatly to erosion and subsequent sedimentation.

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester

PRACTICE #: 12  Log Landing Erosion Protection and Control

OBJECTIVE: To reduce the impacts of erosion and subsequent sedimentation from log landings through the use of mitigating measures.

CONDITIONS WHERE PRACTICE APPLIES: On all log landings.

EXPLANATION: This practice employs administrative, preventive and corrective controls to meet the objective. All landings should be designed to have proper drainage. After landings have served their purpose, they should be ditched or sloped to permit the drainage and dispersion of water. Other measures may include scarifying, smoothing and sloping construction of drainage ditches, prevention of water draining off roads from reaching a landing, spreading slash, covering with wood chips, or applying straw mulch. Cut and fill banks around landings should be sloped to remove overhangs and otherwise minimize erosion. The specific work needed on each landing will depend on the actual ground conditions. Re-seed if necessary after sale is closed (see Practice #: 3).

CONCERNS: Landings will generally require some sort of post treatment to reduce surface compaction and enhance infiltration and revegetation.

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester

PRACTICE #: 13  Revegetation of Areas Disturbed by Harvest Activities

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

CONDITIONS WHERE PRACTICE APPLIES: Where soil has been disturbed by a silvicultural operation and it is not expected that natural revegetation can occur or will occur soon enough to minimize erosion.

EXPLANATION: Seeding or planting may be necessary along roads and skid trails, landings, in some clearcuts and following controlled burns. Advice should be sought from a professional forester, conservation district, or agricultural office concerning soil preparation, appropriate seed mixtures and the application of mulch and fertilizer, and the timing of such work to improve the chances of success. (Some suggested seeding species, amounts, and applicable areas and listed below)

CONCERNS: It is not unusual that an adequate vegetative cover does not result after a single seeding or planting effort. These areas should be inspected occasionally, preferably during a runoff event, to evaluate the level of success and determine if further action is required. If fertilizers are used to aid in revegetation, care must be taken to protect surface water and groundwater (see practice # 38)

TECHNICAL SUPPORT: WACD, State Forester, Agricultural Extension Office, NRCS, Professional Forester


NRCS Standards: 342 Critical area planting
                 484 Mulching
                 460 Land Clearing
                 500 Obstruction Removal
                 650 Woodland Direct Seeding
                 490 Woodland Site Preparation
                 666 Woodland Improvement

Seeding Recommendations:

When developing a seed mix for application on a disturbed area the goal is to have approximately 40 pure live seeds per square foot. A seed mix should be made up of three to four species of plants. One of the species should be an annual wheat, rye or oats (at least 10% of any seed mix). The annual species will provide quick cover but will persist for only one to two years. The other species should be a native plant if possible or a domestic species that has been grown and harvested as close to the area as possible. They should also be compatible with the elevation, aspect, and moisture regime you are seeding. Any local NRCS office can be contacted if there is doubt of what to sow.
Seeding should be accomplished within one week of disturbance to take advantage of the moisture in the turned over soil. If that is not possible then seed during a period when afternoon showers begin to provide adequate moisture for germination and growth. It is possible to sow seed on six to twelve inches of snow. This can be done either in the early winter for germination in the spring or in the spring during snow melt.
### Species and Varieties of Grasses, Forbs, Shrubs for Revegetation of Disturbed Areas

#### Site Adaptation Zones

**Zone 1**  Dry Douglas-fir, limber pine, lodgepole, Rocky Mountain Juniper, and ponderosa pine habitat types; with a significant bunchgrass component in the understory.

**Zone 2**  Mesic Douglas-fir, moist ponderosa pine habitat types.

**Zone 3**  Moist Douglas-fir with blue huckleberry in the understory: habitat types occurring on well-drained soils.

**Zone 4**  Subalpine fir: Engelmann spruce habitat types on well-rained soils.

**Zone 5**  High, cold environments-timberline habitat types.

**Zone 6**  Wet sites-imperfectly to poorly drained soils-commonly in the Engelmann spruce and subalpine fir climax forest overstory.

<table>
<thead>
<tr>
<th>Recommended Varieties</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>Zone 5</th>
<th>Zone 6</th>
<th>Seeding Rate: #Pls/ac @ 40 Seeds/ft²</th>
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<tr>
<td>Herbaceous: (grasses, forbs)</td>
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<td>Bannock or Critana thickspike wheatgrass</td>
<td>C¹</td>
<td>C</td>
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<td>--</td>
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<td>Ephriam or Fairway crested wheatgrass</td>
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<td>Manska or Luna pubescent wheatgrass</td>
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<td>Bromar mountain brome</td>
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<td>Garrison creeping foxtail</td>
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<td>Climax timothy</td>
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<td>Alsike clover</td>
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<tr>
<td>Tretana birdsfoot trefoil</td>
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<tr>
<td>Tufted hairgrass³</td>
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<td>--</td>
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<td>C</td>
<td>C</td>
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</tbody>
</table>

Annual Wheat, Rye, or Oats should make up at least 10% of any seed mix.
### SPECIES AND VARIETIES OF GRASSES, FORBS, SHRUBS FOR REVEGETATION OF DISTURBED AREAS (Cont.)

<table>
<thead>
<tr>
<th>recommended varieties</th>
<th>site adaptation zone</th>
<th>Generally planted as seedling not Sown by seed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>shrubs: (all native)</td>
<td></td>
<td></td>
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<tr>
<td>Antelope bitterbrush</td>
<td>C</td>
<td>N</td>
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<tr>
<td>Mountain snowberry</td>
<td>C</td>
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<tr>
<td>Western snowberry</td>
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<td>--</td>
</tr>
<tr>
<td>Common snowberry</td>
<td>--</td>
<td>C</td>
</tr>
<tr>
<td>Skunkbush sumac</td>
<td>C</td>
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</tr>
<tr>
<td>Willow spp</td>
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<tr>
<td>Redosier dogwood</td>
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</tr>
<tr>
<td>Alder</td>
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</tr>
<tr>
<td>Saskatoon serviceberry</td>
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<td>N</td>
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<tr>
<td>Rocky Mountain Maple</td>
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</tr>
<tr>
<td>Golden currant</td>
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<tr>
<td>Common chokecherry</td>
<td>--</td>
<td>C</td>
</tr>
<tr>
<td>Silver Buffaloberry</td>
<td>--</td>
<td>C</td>
</tr>
<tr>
<td>Blue huckleberry</td>
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</tr>
<tr>
<td>Woods Rose</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Native Plum</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

1 C = Use on critical areas where establishment of vegetation is difficult such as road cuts, landings, harvest trails, and other areas of compacted or subsoil material. Double the rates specified.

2 N = Use on non-critical areas where establishment of vegetation is relatively easy. Broadcast adapted seed at the rate of 40 pure live seeds per square foot.

3 = Native plant

*note: This is the rate of pure live seed (pls) for non-critical areas broadcasted. For critical areas, double the rates specified.

reference: Seeding Rate Statistics for Native and Introduced Species, August 1996, USDI-National Park Service and USDA-Natural Resources Conservation Service. NRCS Plants database
PRACTICE #: 14  Erosion Control on Skid Trails

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

CONDITIONS WHERE PRACTICE APPLIES: Wherever skid trails are constructed.

EXPLANATION: This practice normally requires constructing cross ditches and water spreading ditches. Other methods such as backblading or slash placement may be appropriate in lieu of cross drains. Grass seeding may also be appropriate depending on actual conditions. Areas in need of erosion control measures need to be designated on the ground as logging and trail construction progresses.

The USFS Timber Sale Administration Handbook (FSH 2409.15) contains guidelines for spacing cross drains, construction techniques and cross drain heights.

CONCERNS:

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester


NRCS Standards: 560 Access Roads
342 Critical Area Planting
561 Heavy Use Area Protection
423 Hillside Ditch
350 Sediment Basin
410 Grade Stabilization Structure
PRACTICE #: 15  Stream Channel Protection

OBJECTIVE: To protect the natural flow of streams; to provide unobstructed passage of stormflows; to provide unobstructed fish passage; to maintain shading and ambient stream temperatures; to reduce sediment and other pollutants from entering streams; and to restore the natural course of any stream as soon as practicable if the stream is diverted as a result of timber management activities.

CONDITIONS WHERE PRACTICE APPLIES: Whenever streams occur within the vicinity of a silvicultural activity.

EXPLANATION: The following points are fundamental to protecting stream channels:

a. The location and method of stream crossings will be decided in the project planning phase prior to commencement of the operation.

b. The channel and streambanks should be returned to their original condition and stability or as close as practicable upon the completion of any construction activity.

c. Operations should be conducted in such a way that debris does not enter the stream course. Any material which inadvertently or accidentally enters a stream course in an amount which adversely affects the natural flow, water quality, or fishery resource, should be removed immediately in a manner which causes the least disturbance.

d. Wheeled or track laying equipment should not operate within the stream channel except for the purpose of constructing or maintaining bank protection devices or stream crossings. When ground skidding systems are employed, logs should be end-lined out of the stream side areas.

e. Water bars and other erosion control structures on roads and skid trails should be located to prevent water and sediment from being channeled into stream courses, and to dissipate concentrated flows.

f. Material removed from stream courses as a result of necessary construction will be moved to an upland area where it will not be washed back to the stream during runoff.

g. Some construction activities involving the temporary placement of fill material below the normal high water mark may require a permit from the Army Corps of Engineers. The Corps should always be contacted before an activity of this type begins.

h. Harvest units should be designed to minimize construction along stream courses and riparian areas. See practice # 3.
i. Winter crossing of small streams and stream side zones when the ground is covered with at least 6 inches of snow or frozen is desirable if possible. Snow bridges are alternative, temporary crossing possibilities. However, any debris deposited in the channel will need to be removed before spring runoff.

CONCERNS: Stream diversions should be avoided unless performed under the recommendation and guidance of a professional hydrologist or engineer. The State Engineer's office must be contacted preceding any diversion. In all of these instances, avoidance is much preferred to mitigation. Experience has shown that "correction" of these impacts seldom results in conditions that approximate pre-project conditions.

TECHNICAL SUPPORT: COE, DEQ, G&F, State Forester, State Engineer, NRCS


NRCS Standards: 560 Access Roads
342 Critical Area Planting
362 Diversion
393 Filter Strip
395 Fish Stream Improvement
350 Sediment Basin
580 Streambank and Shoreline Protection
584 Stream Channel Stabilization
410 Grade Stabilization Structure
326 Clearing and Snagging
PRACTICE #: 16   Erosion Control and Structure Maintenance

OBJECTIVE: To insure that erosion-control structures are stabilized and working effectively.

CONDITIONS WHERE PRACTICE APPLIES: On all drainage structures, culverts, stream crossings, water bars, ditches, water spreaders and dissipators etc., whether previously in place or newly constructed for the operation.

EXPLANATION: Erosion control structures are only effective when they are in good repair and stable condition. Once the structures are constructed they may become damaged during subsequent harvest activities. Those erosion control measures that require vegetative cover may not become adequately stocked. It is necessary to provide follow-up inspection and structural maintenance or reseeding in order to avoid these problems and insure that they are serving their intended purpose. This practice should continue for at least one year after the harvest operation is complete, and up to the time that all disturbed areas have been sufficiently reclaimed.

CONCERNS: If fertilizers or other chemicals are used to encourage revegetation, care must be taken to avoid contamination of surface water or groundwater (see practice # 38).

TECHNICAL SUPPORT: State Forester, NRCS

REFERENCES: Office of Surface Mining has literature on land reclamation. Wyoming Forestry BMPs.

NRCS Standards: 342 Critical Area Planting
                356 Dike
                362 Diversion
                410 Grade Stabilization Structure
                580 Streambank and Shoreline Protection
                584 Stream Channel Stabilization
PRACTICE #: 17  Slash and Cull Wood Treatment in Sensitive Areas

OBJECTIVE: To protect water quality by protecting sensitive areas from degradation which would result from using mechanized equipment for slash or cull wood disposal.

CONDITIONS WHERE PRACTICE APPLIES: Whenever slash treatment is necessary within meadows, wetlands, riparian areas or landslide areas. The burning of slash may involve compliance with Wyoming DEQ Air Quality Division Smoke Management Regulations (Chapter 10, Section 4 of the Air Quality rules and Regulations). The forester should contact the Air Quality Division to determine the applicability of those rules and Regulations.

EXPLANATION: Hand piling or removal of slash from the above mentioned areas may be necessary to eliminate degradation which would occur from heavy equipment use. These areas should be identified and designated as special treatment units in the planning stages of the operation.

CONCERNS: Accumulation of slash in stream channels can obstruct fish passage.

TECHNICAL SUPPORT: State Forester, Professional Forester

ROADS
PRACTICE #: 18 General Guidelines for the Location and Design of Roads and Trails

OBJECTIVE: To locate and design roads and trails with minimal soil and water resource impact while considering all design criteria.

CONDITIONS WHERE PRACTICE APPLIES: Whenever new construction of roads is necessary.

EXPLANATION: There are several considerations which should be incorporated into the design and location of roads and trails. These factors directly affect protection of water quality, soil and other resource values.

a. Location, design, construction, and reconstruction activities should utilize appropriate technical resource staffs to evaluate effects of transportation needs and operation, and recommend mitigating measures to minimize adverse impacts.

b. Roads and trails should be designed based on traffic and safety requirements of anticipated use. The design should incorporate features to prevent or minimize soil movement and sedimentation as well as undue disruption of water flow.

c. Stream crossing structures should be designed to provide the most efficient drainage facility consistent with resource protection. The design should involve a hydrologic analysis to determine runoff rates and volumes, flood conditions, velocities, scour, open channel shapes, approach topography, materials foundation conditions, and fish passage as required.

d. Locate and design roads and trails to drain naturally by appropriate use of outsloping or insloping with cross drainage and grade changes, where possible. Relief culverts and roadside ditches should be designed whenever reliance upon natural drainage would not protect the running surface, excavation or embankment. Road and trail drainage should be designed to maximize sediment deposition prior to entry to live water.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: State Forester, G&F, NRCS, Professional Forester


NRCS Standards: 560 Access Roads
                 561 Heavy Use Area Protection
OBJECTIVE: To prevent, limit and mitigate erosion, sedimentation and resulting water quality degradation prior to the initiation of construction and maintenance activities through effective administration and timely implementation of erosion control practices.

CONDITIONS WHERE PRACTICE APPLIES: Whenever road construction is necessary.

EXPLANATION: Land disturbing activities may result in at least short term erosion. Poorly designed, located, constructed and maintained roads are usually responsible for the majority of stream sedimentation problems associated with forest management practices. By effectively planning for erosion control, sedimentation can be minimized.

Roads and trails require a variety of erosion control measures. Many erosion control practices will not only protect water quality but also maintain road prism integrity, reduce maintenance costs and improve trafficability. The location of the road or trail with respect to streams, beneficial uses of that water, soil, and geologic information govern the degree of stabilization required. Stabilization usually includes a variety of practices that promotes the reestablishment of vegetation on exposed slopes, provides physical protection to exposed surfaces, prevents downslope movement of soil, or controls road drainage.

Since a newly constructed road is most susceptible to erosion from seasonal precipitation, the timing of erosion control practices is of primary concern. Those practices that can be accomplished concurrent with road construction should be favored as a means of immediate protection of the water resource.

The following items may be considered erosion control measures when constructed in a timely manner. To maximize effectiveness, erosion control measures should be in place and functional prior to seasonal precipitation and runoff:

a. Measures to reestablish vegetation on exposed soils. This is usually accomplished by seeding suitable grass and legume species in conjunction with possible mulching and fertilization. In some situations, treatments may include tree seedling planting or sprigging of other woody species. (See practice # 13)

b. Measures which physically protect the soil surface from detachment or modify the topography to minimize erosion. These treatments may include the use of chemical additives to the road travelway and ditches and the use of mulches, riprap, erosion mats, and terracing on cuts, fills and ditches. Temporary waterbars in areas of uncompleted roads and trails can be effectively utilized to reduce sedimentation.

c. Measures which physically inhibit the downslope movement of sediment to streams. These may include the use of slash filter windrows on or below the fill slopes, catch basins at culvert inlets, anchored straw bales in drains and other water spreading devices.
d. Measures that reduce the amount of soil disturbance in or near streams. These measures may include dewatering culvert installation or other construction, and immediate placement of permanent culverts during road pioneering. Temporary pipes should not be used unless positive control of sedimentation can be accomplished during installation, use and removal.

e. Measures that control the concentration and flow of surface and subsurface water. These may include insloping, outsloping, ditches, cross drains, under drains, trenches, water spreading devices, energy dissipators etc.

CONCERNS: Practice should be implemented by appropriate technical staffs. Fertilizer use and the application of chemicals to road surfaces have the potential to affect groundwater if not handled and applied properly. Waste oil is not appropriate as a surface treatment for forest roads. The application of chemicals to road surfaces and the construction of sedimentation ponds may require permits from DEQ. Streambank stabilization and road crossing construction likewise may require 404 permits from the Corps of Engineers. The respective agencies should be contacted during the planning stages.

TECHNICAL SUPPORT: DEQ, COE, State Forester, NRCS, G&F, Professional Forester

REFERENCES: USFS R-4 Technical Guide

NRCS Standards: 560 Access Roads
561 Heavy Use Area Protection
342 Critical Area Planting
PRACTICE #: 20  Timing of Construction Activities

OBJECTIVE: To minimize erosion by restricting operations during excessive moisture periods and to avoid impacts to fish migration and spawning.

CONDITIONS WHERE PRACTICE APPLIES: Whenever road construction is necessary.

EXPLANATION: Erosion and sedimentation are directly related to runoff. Scheduling operations during periods when the probabilities for rain and runoff are low is an essential element of effective erosion control. Equipment should not be operated when ground conditions are such that severe rutting and other excessive impacts will result.

In addition, it is important to keep permanent erosion control work as current as practicable with ongoing operations. Construction of drainage facilities and performance of other work which will contribute to the control of erosion and sedimentation should be carried out concurrent with the earthwork operations or as soon thereafter as practicable. Limitation of the amount of area being graded at a site at any one time, and minimization of the time that any one area is laid bare should be a consideration when scheduling the work. Erosion control should be kept current when road construction occurs outside of the normal operating season.

CONCERNS: Fish migration occurs at different times for depending on the species and stream segment. Sedimentation during these periods can have a severe adverse impact on the fishery resource, therefore, the Game & Fish Dept. should be contacted to coordinate scheduling of operations.

TECHNICAL SUPPORT: State Forester, G&F, NRCS, Professional Forester

REFERENCES: Wyoming Forest BMPs
PRACTICE #: 21  Slope Stabilization and Prevention of Mass Failures

OBJECTIVE: To reduce sedimentation by reducing the chances for road related mass failures, including landslides and embankment slumps.

CONDITIONS WHERE PRACTICE APPLIES: Wherever cut and fill is required for road construction.

EXPLANATION: Road construction in mountainous terrain requires cutting and loading natural slopes which may lead to landslides and/or embankment failures depending on soil strength, geology, vegetation, aspect, and groundwater regime. Landslides are costly to repair and generate large quantities of erosion and sedimentation.

Roadways may drastically change the subsurface drainage characteristics of a slope. Since the angle and height of cut and fill slopes increase the risk of instability, it is often necessary to provide subsurface drainage to avoid moisture saturation and subsequent slope failure. Where it is necessary, horizontal drains, drainage trenches, or drainage blankets may be used to lower the subsurface water levels and to prevent groundwater from entering embankments.

In areas with high landslide potential, the composition and characteristics of embankments may be controlled since they are essentially engineered structures. Care should be taken to prevent the incorporation of construction slash or other organic material, and the embankment material should be placed by one of the following methods:

   a. Layer placement  
   b. Controlled compaction  
   c. Controlled compaction using density controlled strips

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: State Forester, NRCS, WHD, WGS, Professional Forester

PRACTICE #: 22  Stabilization of Slopes

OBJECTIVE: To minimize soil erosion from road cut slopes, fill slopes and travelway.

CONDITIONS WHERE PRACTICE APPLIES: Whenever road construction is necessary.

EXPLANATION: Road construction exposes fresh, loose soil to the erosive force of wind, water and traffic. Surface erosion from roads is greatest during the first year following construction. It is desirable to minimize erosion and thereby reduce the adverse impacts on water quality, vehicle maintenance, road maintenance, and safety. Erosion can occur on cut slopes, fill slopes and/or travelway. Each of the three surfaces has erosion considerations which are outlined below:

<table>
<thead>
<tr>
<th>Surface</th>
<th>General Characteristics</th>
<th>Stabilization Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutslope</td>
<td>Steeper, undisturbed, and more sterile soil</td>
<td>Vegetative and mechanical stabilization</td>
</tr>
<tr>
<td>Fillslope</td>
<td>Flatter, loose, and more fertile soil</td>
<td>Vegetative and mechanical stabilization</td>
</tr>
<tr>
<td>Travelway</td>
<td>Flattest, compact</td>
<td>Surface Stabilization</td>
</tr>
</tbody>
</table>

Vegetative measures include seeding herbaceous species (grass, legumes or browse species) or planting brush or trees. Fertilization, mulching, and/or erosion netting and fabrics may be required to insure success. (See Practice #: 13)

Mechanical measures include construction of slash windrows, straw bale dams, erosion netting and fabrics, terraces, or benching, riprapping, tackifiers, and gunnite.

Surface stabilization includes watering, dust pallatives, aggregate layer, bituminous surface treatment or asphalt paving, depending on traffic, soils, and climatic factors.

An integrated system of collection control, and dispersion of concentrated surface water is very important in order to prevent erosion on fillslopes, travelways, and natural slopes below cross drains and culverts.

CONCERNS: Application of chemicals, and/or fertilizers to the road surface or drainage may result in groundwater contamination if done improperly.

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester

REFERENCES: USFS R-4 Technical Guide - Erosion Prevention and Control on Timber Sale Areas. Additional information may be available from the WHD.
PRACTICE #: 23 Permanent Road Drainage

OBJECTIVE: To minimize the erosive effects of concentrated water and the degradation of water quality by proper design and construction of road drainage systems and drainage control structures.

CONDITIONS WHERE PRACTICE APPLIES: Whenever road construction is necessary.

EXPLANATION: Degradation of water quality by sediment and the erosive effects of surface runoff can be minimized by stabilizing the road prism and adjacent disturbed areas from erosion. Velocities in the road drainage system can be dissipated before entry into the natural system by design and construction of control structures.

A number of measures can be used alone or in combination to control the detrimental effects of road drainage. Methods used to control water and reduce erosion may include: properly spaced culverts, cross drains, water bars, rolling dips, energy dissipators, aprons, gabions and armoring of ditches and drain inlets and outlets. Dispersal of runoff can also be accomplished by rolling the grade, insloping, outsloping, crowning, contour trenching, installation of water spreading ditches, etc.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester


NRCS Standards: 560 Access Roads
362 Diversion
561 Hillside Ditch
606 Subsurface Drain
608 Surface Drainage Main or Lateral
**PRACTICE #: 24 Pioneer Road Construction**

**OBJECTIVE:** To minimize sediment production and mass wasting associated with pioneer road construction.

**CONDITIONS WHERE PRACTICE APPLIES:** Whenever the construction of pioneer roads is necessary.

**EXPLANATION:** Pioneer roads are built to allow equipment access for construction of planned roadways. Pioneering should be done within the corridor of the planned road. To meet the objective of minimizing sediment, the following constraints should be followed:

a. Construction of pioneer roads should be confined to the roadway construction limits.

b. Pioneering should be conducted so as to prevent undercutting of the final cut slope, prevent avoidable deposition of materials outside the designated roadway limits, and accommodate drainage with culverts or log crossings.

c. Erosion control work should be completed concurrent with construction activity.

**CONCERNS:** Practice should be implemented by appropriate technical staffs.

**TECHNICAL SUPPORT:** State Forester, G&F, NRCS, Professional Forester

**REFERENCES:** USFS R-4 Technical Guide - Erosion Prevention and Control on Timber Sale Areas.

NRCS Standards: 560 Access Roads
342 Critical Area Planting
561 Heavy Use Area Protection
PRACTICE #: 25  Timely Erosion Control Measures on Incomplete Roads

OBJECTIVE: To minimize erosion of and sedimentation from disturbed ground on incomplete projects.

CONDITIONS WHERE PRACTICE APPLIES: Whenever road building cannot be completed within the current construction season.

EXPLANATION: The best drainage design and erosion control measure can be useless if projects are incomplete at the end of the normal operating season. Affected areas can include roads, fills, tractor trails, skid trails, landings, stream crossings, bridge excavations, and firelines. Preventive measures include:

a. The 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;

b. The removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossing causeways;

c. The removal of debris, obstructions, and spoil material from channels and floodplains;

d. Grass seeding, planting deep rooted vegetation and/or mulching.

Protective measures should be applied to all areas of disturbed, erosion prone, unprotected ground that is not to be reclaimed in the present year. When conditions permit operations outside the normal operating season, erosion control measures should be kept current with ground disturbance to the extent that the area can be rapidly "closed" if weather conditions deteriorate. Area should not be abandoned for the winter with remedial measures incomplete.

CONCERNS: Practice should be implemented by appropriate technical staffs. Groundwater may be at risk if fertilizers are used improperly.

TECHNICAL SUPPORT: State Forester, Professional Forester

PRACTICE #: 26   Control of Road Construction Excavation and Sidecast Material

OBJECTIVE: To reduce sedimentation from unconsolidated excavated and sidecast material caused by road construction, reconstruction or maintenance.

CONDITIONS WHERE PRACTICE APPLIES: Whenever sidecast or other excess material is produced by a roadwork operation.

EXPLANATION: Unconsolidated material from road construction is frequently exposed on cut and fill slopes, can be difficult to stabilize, and represents a major sediment source. The area of exposed material can often be reduced by strict adherence to the lines, grades and dimensions detailed in the road design. In some cases, layer placement and/or benching may be necessary for stabilization and to obtain the proper dimensions and fillslope ratios. End hauling and retaining structures may be necessary to prevent thin layers of unconsolidated material from being sidecast on steep slopes where compaction is impractical. Prior to commencing construction, reconstruction or maintenance activities, waste areas should be located where excess material can be deposited and stabilized. Waste areas cannot be located in stream channels, flood plains, wetlands, or riparian areas. If waste areas are located on steep slopes, excess materials should be consolidated and stabilized.

Normal erosion control such as seeding should be supplemented with special mitigation measures such as jute netting, erosion cloth, mulching, slash windrows, sediment ponds, hay bale dams and rock gabions when such measures are determined necessary for local conditions.

CONCERNS: The construction of sedimentation ponds may require a permit from DEQ/WQD. Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: DEQ/WQD, State Forester, COE, NRCS, Professional Forester.

REFERENCES: Wyoming Forestry BMPs
PRACTICE #: 27  Controlling In-Channel Excavation

OBJECTIVE: To minimize stream channel disturbance and related sediment production, and to maintain natural stream course integrity and flow conditions.

CONDITIONS WHERE PRACTICE APPLIES: At all necessary stream crossings.

EXPLANATION: During the construction of roads and the installation of stream crossing structures, it may be necessary for construction equipment to cross, operate in, or operate near stream courses. However, this will only be allowed at predetermined crossings for the necessary construction or removal of culverts or bridges, or for the construction of streambank protection devices. Close coordination with the DEQ, COE, and Wyoming Game & Fish Dept is needed to minimize damage to the stream and aquatic resources.

Excavation during the installation of stream-side structures should be accomplished in the following manner in order to protect water quality.

a. Except for operations where no violations of water quality standards will occur, no excavation should be made outside of caissons, cribs, or cofferdams or sheet piling, and the natural streambed adjacent to the structure should not be disturbed.

b. If any excavation or dredging is made at the site of the structure before caissons, cribs or cofferdams are sunk in place, all such excavations should be restored to the original ground surface or the streambed should be protected with suitable stable material.

c. Excess material excavated from the stream channel must be removed to a suitable upland disposal site where it can be stabilized and prevented from reentering the channel during runoff.

d. If the channel is damaged during construction, it should be restored as nearly as possible to its original configuration and stability without causing additional damage to the channel.

e. As much as is practicable, all in-channel work should be scheduled during periods of low flow. This must be balanced with the necessity to complete work before winter so that erosion control structures and stream crossings are in place and stable before spring flooding. The timing of construction activities should also be coordinated with the Wyoming Game and Fish Dept. to ensure that the operation does not interfere with fish migration and spawning.

CONCERNS: In some instances, in-channel work will require a 404 permit from the Army Corps of Engineers. The COE should be contacted during the planning stages or at least 90 days prior to construction to be assured of securing any necessary permits. Practice should be implemented by appropriate technical staffs. (See Practice #: 2 for 404 permit explanation.)
TECHNICAL SUPPORT: COE, DEQ/WQD, G&F, State Forester, EPA, NRCS, Professional Forester

PRACTICE #: 28   Diversions of Flows Around Construction Sites

OBJECTIVE: To minimize downstream sedimentation by insuring that all stream diversions are carefully planned.

CONDITIONS WHERE PRACTICE APPLIES: Whenever a stream diversion is determined to be necessary for an in-channel operation.

EXPLANATION: Flow must sometimes be guided or piped around project sites. Typical examples are bridge and dam construction. Such a diverted flow should be restored to the natural stream course as soon as practicable and, in any event, prior to the major storm season or fish migration season. Stream channels impacted by construction activity should be restored to their natural grade, condition, stability and alignment as soon as possible. The State Engineer must be notified on all stream diversions.

CONCERNS: In some instances, in-channel work will require a 404 permit from the Army Corps of Engineers. The COE should be contacted during the planning stages or at least 90 days prior to construction to be assured of securing any necessary permits. Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: COE, DEQ/WQD, Game & Fish Dept., State Forester, State Engineer, NRCS

REFERENCES:

NRCS Standards:  342 Critical Area Planting
                350 Sediment Basin
                356 Dike
                362 Diversion
                410 Grade Stabilization Structure
                423 Hillside Ditch
                582 Open Channel
                608 Surface Drain
PRACTICE #: 29 Stream Crossings on Temporary Roads

OBJECTIVE: To keep temporary roads from unduly damaging streams, disturbing channels, or obstructing fish passage.

CONDITIONS WHERE PRACTICE APPLIES: All temporary road systems.

EXPLANATION: Culverts, temporary bridges, low water crossings or fords will be required on temporary roads at all locations where it is necessary to cross stream courses. Such facilities should be designed and installed to provide unobstructed stream flow and fish passage, and to minimize damage to stream courses.

The number of crossings should be kept to the minimum needed for access. Channel crossings should be as perpendicular to stream courses as possible. Streambank excavation should be kept to the minimum needed for the use of the crossings.

Crossing facilities shall be removed when the facility has served its purpose and is no longer needed. Fills associated with these facilities shall also be removed to an upland disposal site. The stream channel and banks should also be returned to the original configuration, condition and stability.

CONCERNS: Practice should be implemented by appropriate technical staffs. (See Practice #: 2 for 404 permit explanation.)

TECHNICAL SUPPORT: COE, DEQ/WQD, Game & Fish Dept., State Forester, NRCS


NRCS Standards: 356 Dike
362 Diversion
342 Critical Area Planting
423 Hillside Ditch
582 Open Channel
608 Surface Drain
410 Grade Stabilization Structure
350 Sediment Basin
PRACTICE #: 30  Bridge and Culvert Installation (Disposition of Surplus Material and Protection of Fisheries)

OBJECTIVE: To minimize sedimentation and turbidity resulting from excavation for in-channel structures.

CONDITIONS WHERE PRACTICE APPLIES: Wherever bridges or culverts are required.

EXPLANATION: Excavation in or near stream courses is a common requirement for the installation of bridges, culverts and other stream-side structures such as weirs, check dams, riprapping, or fish passage structures. Surplus material should not obstruct the stream course including the floodplain nor the efficiency of the associated structure. Preventive measures include:

a. Consideration should be given to the size, type and length of culverts to avoid constructing a barrier to fish migration. Culverts improperly sized or placed can decrease water depth and/or increase velocities to the point where the structure is an effective barrier to fish migration. Bottomless culverts are always preferred and the slope and length should be such that water velocities do not exceed 4 feet/second. The Wyoming Game & Fish Dept. can supply site specific criteria on the subject and should be contacted, preferably in the planning stages, before stream crossings are constructed in live water.

b. Diverting stream flow around construction sites during construction in order to minimize erosion and downstream sedimentation.

c. Easily erodible material should not be deposited into live streams.

d. Any material stockpiled on floodplains should be removed before rising waters reach the stockpiled material.

e. During excavation in or near the stream course, it may be necessary to use suitable cofferdams, caissons, cribs or sheet piling. This will usually be the case where groundwater is contributing a significant amount of water to the immediate excavation area. If any of the aforementioned devices are used, they should be practically watertight and no excavation should be made immediately outside of them. If water from the subsurface strata is not significant, pumping may be used, provided sediment from the pumped water can be disposed of where it will not reenter the stream during high flows.

f. Water pumped from foundation excavation should not be discharged directly into live streams, but should be pumped into settling ponds. Construction of these ponds will require a permit from DEQ/WQD. Likewise, an NPDES permit will also be required if the sediment ponds are designed to have a discharge point.
g. When needed, bypass roads should be located to have minimal disturbance on the stream course.

h. The construction activity in or adjacent to the stream should be limited to specific times to protect beneficial water uses (e.g. fisheries).

i. Operation of mechanical equipment in live streams should be kept to the amount necessary to avoid impacts to the aquatic resources.

**CONCERNS:** Practice should be implemented by appropriate technical staffs. Because of the substantial risk to fisheries, the Game & Fish Dept. should always be coordinated with as early as possible. (See Practice #: 2 for 404 permit explanation.)

**TECHNICAL SUPPORT:** DEQ/WQD, COE, Game & Fish, State Engineer, State Forester

**REFERENCES:** NRCS Standards: 410 Grade Stabilization Structure
587 Water Control Structure
**PRACTICE #: 31  Regulation of Borrow Pits, Gravel Sources and Quarries**

**OBJECTIVE:** To minimize sediment production from borrow pits, gravel sources, and quarries, and limit channel disturbance in those gravel sources suitable for development in floodplains.

**CONDITIONS WHERE PRACTICE APPLIES:** Whenever gravel sources must be developed for use in the construction of forest roads.

**EXPLANATION:** Borrow pits, gravel sources, and quarries are often susceptible to erosion due to steep side slopes, lack of vegetation, and/or their proximity to water courses. Whenever possible, the topsoil should be removed and stockpiled for use as surface dressing during the reclamation phases, prior to excavation of the site.

Drainage design for the excavation should consider temporary erosion control measures during the life of the material source and permanent drainage control measures after the site has been rehabilitated. When excavation of the site has been completed on all or part of the area, and the site will not be used again, the sides should be sloped, graded, or scaled and the general pit area smoothed and stabilized. Oversize material, if planned for use as riprap or derrick rock, should be stockpiled. If not it should be scattered or buried. Finer material, if available, should be spread over the bottom of the pit prior to spreading stockpiled or imported topsoil. Seeding, mulching and/or planting should be carried out. If the site will be used again, the above requirements can be limited to those essential to resource protection between uses. Access roads to the site should also have temporary or permanent drainage design for erosion control depending on the life of the pit or the roads should be ripped, drained, blocked to traffic, and seeded, mulched and/or planted unless other uses are planned.

Borrow pits and gravel sources located in floodplains require special attention. Material deposited in floodplains or along channel sections during storm runoff often provide excellent and inexpensive sand and gravel. Because of easy access, these deposits are often in demand. With careful planning and design, these deposits can often be removed with minimal impact on water resources. Under some circumstances, sand and gravel removal may alter stream flow characteristics and consequently affect stream-channel stability and create a new sediment source. Excavation of these deposits within stream channels should be limited to those above the normal high waterline.* If the borrow area is subject to periodic flooding, leveling, shaping or other special drainage features and/or erosion controls should be provided.

DEQ, Land Quality Division regulates gravel mining and dredging operations and must be contacted before operations begin. Likewise, if a crushing and washing facility is used, an NPDES permit will be required from the Water Quality Division for any water discharged to the surface. For operations within the normal high water marks of stream channels, a 404 permit from the Army Corps of Engineers may be required.

**CONCERNS:** Practice should be implemented by appropriate technical staffs. Groundwater may be impacted by excavations below the normal water table.
* There are isolated instances, usually in stream channels, heavily overloaded with sediment where removal of material from below the high water mark is acceptable. Where this is appropriate, however, needs to be determined by conference and coordination with DEQ/WQD, COE, and G&F.

**TECHNICAL SUPPORT:** DEQ/WQD, DEQ/LQD, COE, NRCS

**REFERENCES:** Wyoming Water Quality Rules and Regulations: Chapters 1, 2, 3
PRACTICE #: 32  Disposal of Right-of-Way and Roadside Debris

OBJECTIVE: To insure that debris generated during road construction is kept out of streams and to prevent slash and debris from subsequently obstructing channels.

CONDITIONS WHERE PRACTICE APPLIES: On all road construction projects.

EXPLANATION: As a preventative measure, construction debris and other newly generated slash developed along roads near streams should be disposed of by the following means as applicable:

a. On Site
   1. Windrowing
   2. Scattering
   3. Burying
   4. Chipping
   5. Disposal in cutting units
   6. Piling and burning

b. Removal to landfills or proper disposal sites

c. A combination of the above.

d. Large limbs and cull logs may be bucked into manageable lengths and piled along the roadside for fuel wood.

CONCERNS:

TECHNICAL SUPPORT: State Forester, Professional Forester

REFERENCES: Wyoming Forestry BMPs.

NRCS Standards: 500 Obstruction Removal
                560 Access Road
                460 Land Clearing
OBJECTIVE: To minimize sediment production from streambanks and structural abutments in natural waterways.

CONDITIONS WHERE PRACTICE APPLIES: Wherever streambanks have been disturbed by road construction.

EXPLANATION: The stabilization of stream embankments disturbed by the construction of a water crossing or a roadway fill parallel to a stream course, is necessary to prevent erosion of the material during natural stream flow. To reduce sediment and channel bank degradation, it is necessary to incorporate "armoring" into the design of a structure to allow the water course to stabilize after construction. Riprap, gabion structures and other measures are commonly used to armor stream banks and drainage ways from the erosive forces of flowing water. These measures must be sized and installed in such a way that effectively resist erosive water velocities. Stone used for riprap should be free from weakly structured rock, soil, organic materials, and materials of insufficient size, all of which are not resistant to stream flow and would only serve as sediment sources. Materials excavated from the stream channel are not suitable for riprap. Outlets for drainage facilities in erodible soils require riprap for energy dissipation.

CONCERNS: Many materials cannot be used for streambank protection. Examples of prohibited materials are broken asphalt, car bodies, scrap metals and any variety of material which can be considered solid waste. An entire section of streambank protection practices is being developed for inclusion into the nonpoint source management plan. DEQ/WQD and/or COE must be contacted before any material other than clean rock or concrete is used as rip rap.

TECHNICAL SUPPORT: DEQ, COE, Game & Fish Dept., NRCS, EPA


NRCS Standards: 350 Sediment Basin
362 Diversion
580 Streambank & Shoreline Protection
584 Stream Channel Stabilization
342 Critical Area Planting.
PRACTICE #: 34    Treatment of Temporary Roads

OBJECTIVE: To reduce sediment generated from temporary roads by obliterating them at the completion of their intended use.

CONDITIONS WHERE PRACTICE APPLIES: On all temporary roads.

EXPLANATION: Temporary roads are constructed for a specific short-term purpose. In order to prevent low level casual use, such roads are either closed or obliterated at the completion of their intended use. Closure means to effectively drain, stabilize and reclaim the road while leaving the road prism in place for possible use at a future date. Obliteration means to completely restore the area to its previous condition or to an improved condition. The road prism is removed and the area is permanently stabilized and returned to resource production. Roads that are "closed" rather than "obliterated" may require occasional monitoring and maintenance to ensure functioning drainage and stability. Temporary roads that are allowed to remain in use beyond their prescribed time are subject to continued, uncorrected damage, and they become chronic sediment sources.

Effective treatment is generally achieved through a combination of the following measures:

   a.   Road effectively drained and blocked

   b.   Temporary culverts and bridges removed and natural drainage configuration re-established.

   c.   Road returned to resource production through revegetation.

   d.   Side slopes reshaped and stabilized.

CONCERNS: If fertilizers are used to encourage revegetation, care must be taken to protect surface water and groundwater (see practice # 38).

TECHNICAL SUPPORT: State Forester, NRCS, Professional Forester.

REFERENCES: Wyoming Forestry BMPs.
PESTICIDES, HERBICIDES, FERTILIZERS AND CHEMICALS
PRACTICE #: 35  Proper Application and Use of Pesticides

OBJECTIVE: To reduce or eliminate possible adverse effects on water quality by the proper handling and application of pesticides and herbicides.

CONDITIONS WHERE PRACTICE APPLIES: Where it has been determined that the use of Federally and State registered products are necessary and appropriate for the control of undesirable vegetation or insect pests. It must be noted that this practice is intended to apply to the kind of pesticide use normally associated with silvicultural activities. It is not intended to address the much broader pest management techniques associated with crop production, range management or aquatic pest management.

EXPLANATION: Depending on the characteristics of the specific site and circumstances, the use of pesticides may be necessary. All pesticides shall be handled, transported and applied by a licensed applicator as specified by the product label to achieve control of the pest organism. Besides reducing the risk to water quality, this practice also amounts to an economic benefit to the user by getting the most efficient use of the associated chemical.

Application near surface water requires an adequate vegetative buffer zone to insure that the chemicals are not sprayed into, or drained into any surface water either directly or carried by sediment particles. Generally, a buffer area at least 150 feet wide is recommended for most applications.

When working with a problem that will require aerial application of a pesticide, check the pesticide label for restrictions on aerial applications.

A spill contingency plan to handle accidental spills should be developed (see PRACTICE # 4, "Oil and Hazardous Spill Contingency).

Records should be kept documenting the type and mixture of chemical used, area of application, amount applied, rate of application, method and time of application and the name of the person doing the application.

CONCERNS: Advice should be sought from appropriate technical staffs concerning the type, amount, and system of application of any pesticide or herbicide. Improper storage, transportation or application can adversely affect groundwater as well as surface water. Consideration should be given to the proximity of public water supplies and intakes, private domestic wells and water supplies, and aquatic communities. Consideration should also be given to the protection of fisheries and riparian vegetation. Many chemicals are highly toxic to fish and other aquatic organisms. Loss of riparian vegetation and wetlands results in eventual habitat loss by removing woody vegetation which in turn allows livestock to more heavily graze stream banks and cause bank erosion.

TECHNICAL SUPPORT: WACD, NRCS, Agricultural Extension Offices, State Forester, EPA, WDA, Appropriate Industry Representatives.

REFERENCES: Methods of Application, Product Selection and Monitoring (WDA), 680 Nutrient Management (NRCS), 595 Pest Management (NRCS), Appropriate Industry Publications.
PRACTICE #: 36  Proper Application and Use of Fertilizers

OBJECTIVE: To reduce or eliminate possible adverse effects on water quality by the proper handling and application of fertilizers.

CONDITIONS WHERE PRACTICE APPLIES: Where soil testing has confirmed that naturally occurring nutrients are insufficient to provide adequate ground cover or adequate grazing for wildlife or livestock.

EXPLANATION: Use of this practice will depend upon the characteristics of the particular site and circumstances under consideration. Appropriate application of fertilizer should not only assist in the growth of ground cover but offer economic benefits by insuring that only the amount of product necessary is used. A buffer area between where the product is being used and surface water is necessary to filter out undesirable pollutants. The width of this buffer area is determined by slope, vegetation and soil conditions (see PRACTICE # 3, Riparian Area Designation).

Records should be kept documenting the type of fertilizer used, area of application, amount applied, method and time of application.

CONCERNS: Advice should be sought from appropriate technical staffs concerning the type, amount, and system of application of fertilizers. Improper storage, transportation or application can adversely affect groundwater as well as surface water. Consideration should be given to the proximity of public water supplies and intakes, private domestic wells and water supplies, and aquatic communities.

TECHNICAL SUPPORT: WACD, NRCS, Agricultural Extension Offices, State Forester, WDA

REFERENCES: Methods of Application, Product Selection and Monitoring (WDA)

NRCS Standards: 680 Nutrient Management (NRCS).
PRACTICE #: 37  Cleaning and Disposal of Pesticide Containers and Equipment

OBJECTIVE: To prevent water contamination and risk to humans and aquatic life from cleaning and disposal of pesticide containers.

CONDITIONS WHERE PRACTICE APPLIES: Whenever pesticide use is appropriate

EXPLANATION: The cleaning and disposal of pesticide containers and equipment must be done in accordance with Federal, State, and local laws, regulations and directives. Containers are rinsed three times or in a manner to insure that all residual pesticide has been flushed from the container. The rinse water should be applied to the project area, and the containers taken to an approved disposal site. Application equipment is also rinsed and the rinse water applied to the project site before the equipment is moved from the project area.

Records should be kept that document how and where containers are disposed.

CONCERNS: Improper cleaning and disposal of pesticide containers can adversely affect groundwater as well as surface water and is in direct violation of the pesticide label. Consideration should be given to the proximity of public water supplies and intakes, private domestic wells and water supplies, and aquatic communities.

TECHNICAL SUPPORT: WACD, NRCS, Agricultural Extension Offices, State Forester, WDA

REFERENCES:  Methods of Application, Product Selection and Monitoring (WDA)

NRCS Standards:  595 Pest Management
PRACTICE #: 38  Pesticide Application, Monitoring and Evaluation

OBJECTIVE: To determine and document that pesticides have been applied safely and to provide an early warning for any contamination of water or non target areas or resources.

CONDITIONS WHERE PRACTICE APPLIES: Whenever pesticide use is appropriate.

EXPLANATION: This practice provides feedback on the placement, accuracy, application amount, and any water contamination that might occur from pesticide use so as to minimize or eliminate hazards to non-target areas or resources. Monitoring and evaluation methods include spray cards, dye tracing, and direct measuring of pesticides in or near water. Type of pesticide, equipment, application difficulty, public concern, beneficial uses, monitoring difficulty, availability of competent laboratory analysis and applicable Federal, State, and local laws and regulations are factors considered when determining the monitoring and evaluation needs.

In addition to the application monitoring described above, records should be kept documenting the type and mixture of chemical used, area of application, amount applied, rate of application, method and time of application and the name of the person doing the application.

CONCERNS: Practice should be implemented by the applicator. In some instances a state pesticide applicator's license is required.

TECHNICAL SUPPORT: WACD, NRCS, Agricultural Extension Offices, State Forester, WDA, County Weed & Pest

REFERENCES:  Methods of Application, Product Selection and Monitoring (WDA), NRCS Standards: 595 Pest Management (NRCS)
PRACTICE #: 39  Servicing and Refueling of Equipment

OBJECTIVE: To prevent contamination of waters from accidental spills of fuels, lubricants and other harmful materials.

CONDITIONS WHERE PRACTICE APPLIES: Whenever any of the above substances are used in a silvicultural operation.

EXPLANATION: During servicing or refueling, pollutants from logging, road construction or revegetation efforts may enter a watercourse. This threat is minimized by selecting service and refueling areas at least 150 feet away from wetlands, riparian areas and stream channels and by using berms around such sites to contain spills (see PRACTICE # 4, Oil and Hazardous Spill Contingency).

In the case of a spill, immediate action must be taken to contain, remove and properly dispose of the spilled material. All spills must be reported to DEQ/WQD as mandated in Wyoming Water Quality Rules and Regulations, Chapter 4. Applying mitigating measures immediately following a spill will invariably reduce adverse impact and cleanup costs.

CONCERNS: Accidental spills have the potential to cause severe damage to aquatic systems and groundwater.

TECHNICAL SUPPORT: DEQ/WQD, WACD, NRCS, Agricultural Extension, WDA

REFERENCES: Chapter 4, Wyoming Water Quality Rules and Regulations
FIRE MANAGEMENT
PRACTICE #: 40 Protection of Soil and Water from Prescribed Burning Effects

OBJECTIVE: To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients and debris from entering surface water.

CONDITIONS WHERE PRACTICE APPLIES: On all prescribed burns.

EXPLANATION: Some of the techniques used to prevent soil erosion and water quality degradation are:

a. Construct water bars in fire lines.

b. Avoid intense fires which may promote water repellency, nutrient leaching and erosion.

c. Retain or plan for sufficient ground cover to prevent erosion of the burned sites.

d. Remove debris added to stream channels as a result of prescribed burning when determined to be detrimental to aquatic life.

e. Surface scarification or other soil preparation may be necessary in areas of intense burns.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: State Forester, G&F, NRCS, Professional Forester

REFERENCES: NRCS Standards: 338 Prescribed Burning
PRACTICE #: 41  Stabilization of Fire Suppression Related Watershed Damage

OBJECTIVE: To stabilize all areas that have had their erosion potential significantly increased, or their drainage pattern altered by suppression related activities.

CONDITIONS WHERE PRACTICE APPLIES: On all burns as applicable.

EXPLANATION: Treatments for fire suppression damages include, but are not limited to:

  a. Installing water bars and other drainage diversions in fire roads, fire lines and other cleared areas.

  b. Seeding, planting and fertilizing to provide vegetative cover.

  c. Spreading slash or mulch to protect bare soil.

  d. Repairing damaged road drainage facilities.

  e. Clearing stream channels of debris deposited by suppression activities when determined to be detrimental to aquatic life.

  f. Scarification may be necessary to encourage percolation on excessively burned soils.

CONCERNS: Practice should be implemented by appropriate technical staffs. Groundwater will only be impacted by the improper use of fertilizers.

TECHNICAL SUPPORT: State forester, WACD, NRCS, Agricultural Extension Office, G&F, Professional Forester

REFERENCES: Wyoming Forestry BMPs
PRACTICE #: 42   Emergency Rehabilitation of Watersheds Following Wildfires

OBJECTIVE: To minimize the loss of soil and on-site productivity, the deterioration of water quality, and threats to life and property, both on-site and off-site.

CONDITIONS WHERE PRACTICE APPLIES: Whenever wildfires burn to such an extent that water quality degradation can be expected.

EXPLANATION: Emergency rehabilitation is a corrective measure that involves a variety of treatments. Treatments may include:

   a. Seeding grasses or other vegetation to provide a protective cover as soon as possible.

   b. Fertilizing.

   c. Fencing to protect new vegetation.

   d. Clearing debris from stream channels.

   e. Constructing channel-stabilization structures and debris-retention structures.

Treatments are selected on the basis of on-site values, downstream values, probability of successful implementation, social and environmental considerations, federal, state, and local laws, and cost as compared to benefits.

CONCERNS: Practice should be implemented by appropriate technical staffs.

TECHNICAL SUPPORT: DEQ/WQD, State Forester, WACD, NRCS, Professional Forester

REFERENCES: NRCS Standards: 342 Critical Area Planting
652 Woodland Direct Seeding
490 Woodland Site Preparation