

Recommended Forestry Best Management Practices for Louisiana

CONTENTS

■ ABOUT THE MANUAL	lvii
■ USING THE MANUAL	lviii
■ INTRODUCTION	1
■ PLANNING FOR FOREST OPERATIONS	3
■ FOREST ROADS	5
Overview	5
Permanent Roads	5
Temporary Roads	10
■ TIMBER HARVESTING	13
Pre-harvest Planning	13
Streamside Management Zones	14
Felling & Skidding Techniques	19
Landings, Log Decks & Sets	20
Revegetation	21
Equipment Maintenance & Litter	21
■ SITE PREPARATION / REFORESTATION	23
General Methods	23
■ SILVICULTURAL CHEMICALS	25
Fertilization & Pesticides	25
■ FIRE MANAGEMENT	27
Prescribed Burning	27
Fire line Construction & Maintenance	28
Wildfire	29

■ FOREST WETLANDS	30
Benefits And Functions Of Wetlands	30
Overview	30
Normal Silvicultural Activities	31
Established Silvicultural Operations	31
Legal Definition of Wetlands	33
Planning in Wetlands	34
Access Systems	36
Mandatory Road BMPs	36
Permanent Roads	37
Temporary Roads and Skid Trails (change to & here and in subhead)	38
Road Maintenance	38
Harvest Operations in Wetlands	39
Rutting	39
Site Preparation in Wetlands	40
Reforestation in Wetlands	43
Forest Chemicals in Wetlands	43
■ LOUISIANA’S NATURAL & SCENIC RIVERS	45
Overview	45
Notification of Commercial Harvesting	49
■ GLOSSARY	50
■ APPENDIX I: ROAD SPECIFICATIONS	55
Recommendations for Forest Roads	55
Wing Ditches	56
Stream Crossings	58
Culverts For Roads	61
Broad-Based Dips	63
Rolling Dips	64
Waterbars	66
■ APPENDIX II: PLANNING TOOLS	69
Evaluating Slope	69
Evaluation of Aerial Photos	70
Evaluation of Soil Maps	72
Evaluation of Topographic Maps	74
Evaluation of Drainage Area	76
■ APPENDIX III: ROAD SURFACE AREA	79
Determining Road Surface Area	79
Determining Road Surface Material	80
■ APPENDIX IV: REVEGETATION	81
Revegetating Disturbed Areas	81

About the Manual

THIS MANUAL IS PART OF A BROAD UNDERTAKING to educate the forestry community in effective management techniques to safeguard our land and waters and to wisely use the resources found in this state.

A private-public partnership of the Louisiana Forestry Association (LFA), the Louisiana Department of Environment Quality, and the Louisiana Department of Agriculture and Forestry has formulated this guidebook on the state's non-regulatory Best Management Practices (BMPs). It is hoped that such education will help reduce forest soil movement toward the waters of the state.

This revised manual is only a small part of this campaign. Significant progress has already been made in the protection of Louisiana's water quality through increased use of BMPs. From 1989 to 1997, the use of BMPs has increased eightfold. The latest survey by the Louisiana Office of Forestry found that 83 percent of survey sites in 1997 used

BMPs. Our goal is to achieve 90 percent compliance on the year 2000 survey.

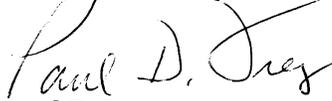
The LAF and The Louisiana Logging Council have also implemented a five-step training curriculum that involves loggers, foresters and landowners. A Master Logger designation recognizes loggers completing 30 hours of training in various aspects of forest management, including BMPs. Master Loggers will complete six hours of continuing education annually to retain that title.

Over the last four years, 2,634 people have attended one or more of these classes and 500 loggers have attained Master Logger designation.

These accomplishments have been a great educational undertaking and a great success. We are proud of the progress and look forward to a bright future for Louisiana's forest environment and the forest professionals who provide the resources we grow and use.



Bob Odom, Commissioner
Louisiana Department of
Agriculture and Forestry



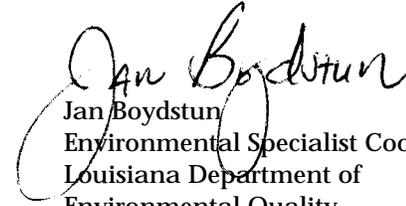
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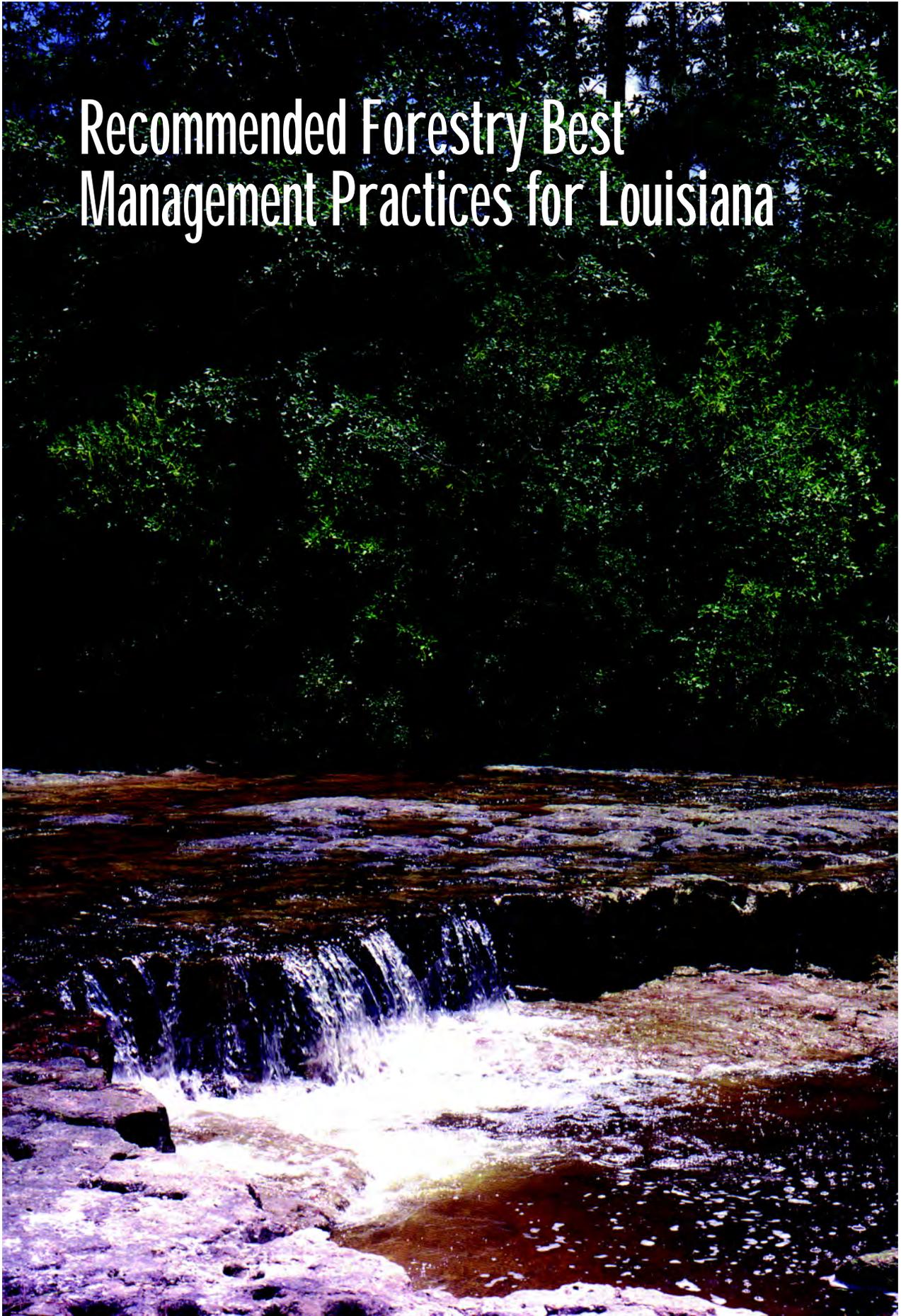
Using the Manual

THIS MANUAL IS WRITTEN TO BE A PRACTICAL FIELD GUIDE for forest landowners, logging contractors and forest industry, to ensure water quality during forestry operations. It sets forth the voluntary guidelines and procedures to be followed for each operation and describes the federally mandated Best Management Practices (BMPs) for forestry operations in wetlands. Each chapter is written as a stand-alone guide. BMPs common to several operations will appear with each.

In using this manual the information it provides can be divided into four basic parts:

- **Voluntary guidelines, pages 3–29:** Each forestry activity is described and the BMPs associated with that activity are stated.
- **Mandated guidelines, pages 30–49:** Discusses the issue of forest wetlands and sets forth the federally mandated BMPs applicable to forest operations in wetlands. Forest operations in the Louisiana Natural and Scenic Rivers System are also discussed.
- **Glossary, pages 50–54:** Definition of terms used to describe the activities presented in this manual.
- **Recommended examples & tools, pages 55–83:** Detailed examples and tools for implementing the BMPs previously described.

Recommended Forestry Best Management Practices for Louisiana



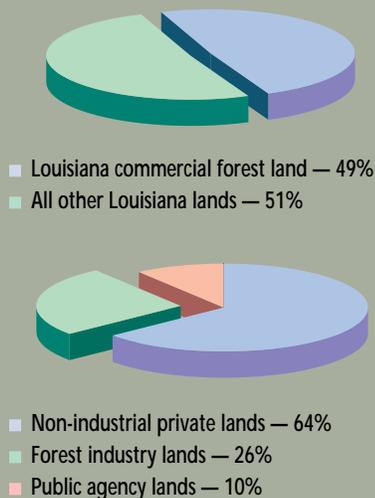
Introduction



COMMERCIAL FORESTS OCCUPY more than 49 percent, or 13.8 million acres, of the land in Louisiana.

Forest ownership here is similar to other southern states. At 64 percent, a majority of the forest land is in nonindustrial private ownership; 26 percent owned by forest industry and the remaining 10 percent held by public agencies.

Status of Louisiana Forests & Lands



Forestry annually contributes more than \$5 billion to the state's economy. If Louisiana is to thrive economically, our forests' ability to produce goods and services must be sustained.

Forest management programs should incorporate adequate measures to provide for proper soil and water conservation. Most streams originating in or flowing

through our timberlands are sources for water supplies, recreation, and other uses.

Section 404 Silvicultural Exemption

*In forested wetlands, the Law provides an exemption from permitting under Section 404 for normal ongoing silvicultural operations, provided that the 15 federally mandated **best management practices**, hereinafter referred to as **BMPS**, are followed.*

The Clean Water Act of 1972 (Public Law 92-500) and its amendments mandate water quality sufficient to provide "fishable" and "swimmable" waters. It requires that all **waters of the United States** will be protected from degradation. This includes, but is not limited to headwater creeks, rich bottomland hardwoods, and permanently flooded cypress-tupelo areas.

The scope of legal jurisdiction was expanded in 1977 by amendments redefining protection to include the **waters of the United States** and their **adjacent wetlands**. This protection, under Section 404, specifies that anyone engaging in activities impacting waters and wetlands is required to secure a permit before proceeding, unless exempted.

Amendments to the Clean Water Act in 1987 required the Louisiana Department of Environmental Quality to assess the quality of water in the state and report its findings to Congress every two years. Under Section 319 of the amended act, the state was also charged with addressing pollution carried to water bodies by rain-



Private landowners, who own most of Louisiana's forest lands, should recognize that Best Management Practices begin with careful planning.

fall runoff. This type of pollution is called *nonpoint source pollution*. It differs from point source pollution that originates from identifiable locations such as end-of-pipe discharges from an industrial facility or city sewage treatment plant.

Most of the early efforts to clean up water pollution were directed toward point sources. Thus, most of what is left to work on is pollution caused by nonpoint sources. LDEQ's nonpoint section uses a cooperative, non-regulatory approach to address forestry nonpoint pollution statewide; primarily through the use of voluntary forestry practices described in this manual.

With support from the U.S. Environmental Protection Agency, and in partnership with the Louisiana Department of Agriculture & Forestry and the Louisiana Department of Environmental Qual-

ity, the Louisiana Forestry Association developed this manual. It is a guide for forest landowners, logging contractors, and forest industry. It sets forth voluntary guidelines and procedures to ensure water quality protection during forestry operations. The goal in meeting state and federal water quality standards is necessary to provide clean water for present and future generations. The forestry community's compliance with this guide is essential for continued freedom and flexibility to practice forestry without further government regulation.

Planning for Forest Operations

PLANNING FOR FOREST operations is complex. It involves several inter-related processes carried out over an extended period of time on areas with varying topography, soil conditions, and other characteristics. Each process may take from days to months to complete. Persons involved in forest operations must comply with numerous laws and regulations. *Best management practices* (BMPs) are recommended operational guidelines to minimize environmental impacts and maintain water quality. Planning is required to incorporate BMPs into a forest operation. The plan should maximize efficiency, minimize traffic, preserve soil integrity, and protect water quality.

There are two stages of planning — preliminary planning and on-the-ground application. A *preliminary plan* is commonly prepared by an appropriate resource professional prior to conducting any operation. This plan includes recommendations for meeting plan objectives with consideration for special areas such as fragile soils on steep slopes that may require special treatment during forest operations.

On-the-ground application can be complex and detailed. It is prepared prior to beginning the operation and should include recommendations on roads, traffic routes, streamside management zones, stream crossings, and the schedule of activities. Finally, each person should be aware of the plan and understand their part in carrying it out.

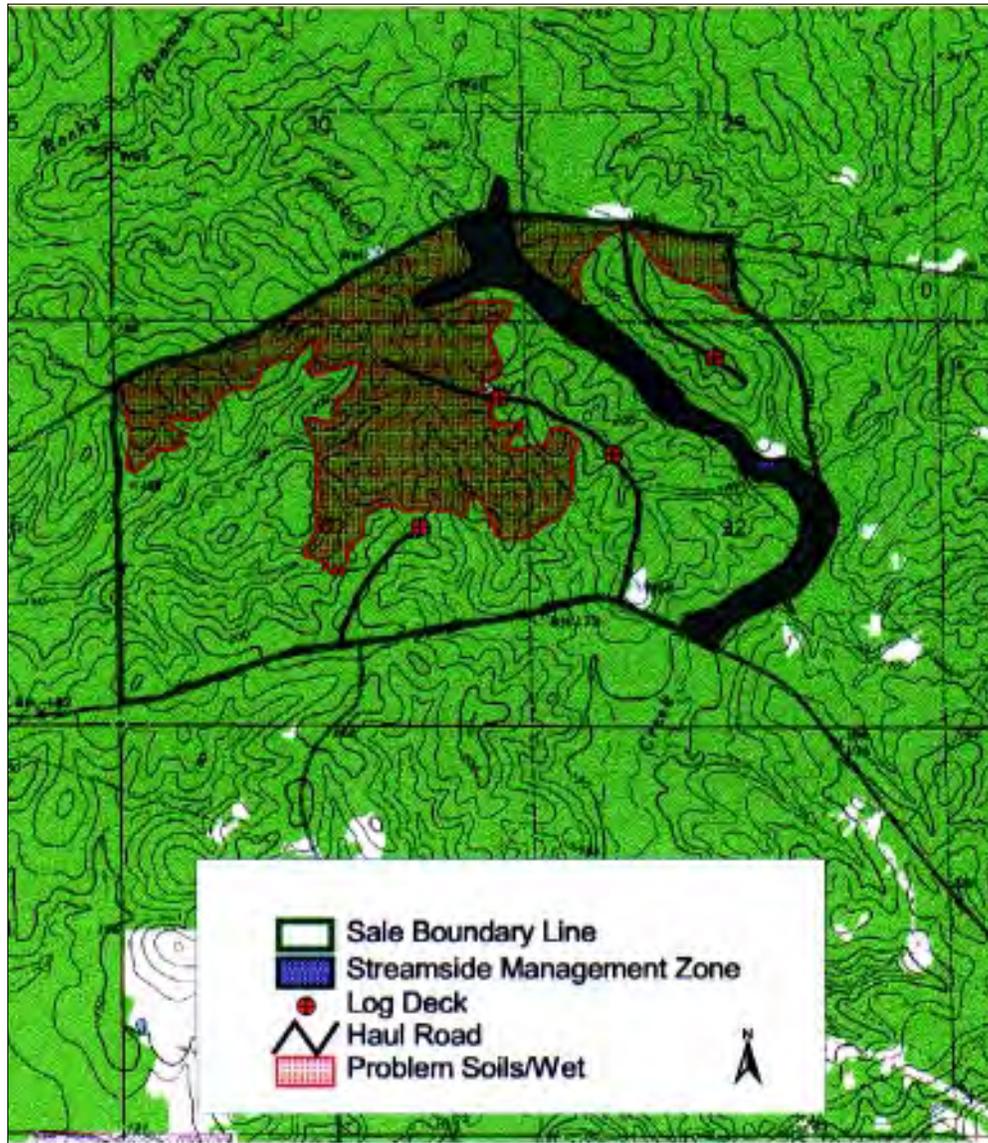
Requirements may differ from tract to tract. For example, does the tract have a stream that requires a streamside management zone? Is there a steep sandy hill on the tract that favors choosing chemical site preparation with hand planting instead of mechanical site preparation followed by machine planting?

Thinking about the following four topics will help select the correct way to accomplish needed forest operations. The planning process should consider these points to protect water quality:

- *The tract topography* — Will topography affect traffic flow for the operation?
- *The tract soil conditions* — Will soil type affect roads and traffic? Will soil type affect equipment decisions and scheduling of activities?
- *The tract hydrology* — How will stream runoff after a major rain affect stream crossing structures?
- *The applicable laws and regulations affecting logging* — How will these laws and regulations affect each part of the forest operation?

Several tools are available to the harvest planner. Some of these are explained in Appendix II.

Forest Hill, Louisiana



1:24,000

Planning for any forest operation should include a map indicating important features.

Forest Roads

OVERVIEW

A

FOREST ROAD SYSTEM is made up of permanent and temporary roads that connect the forest land to existing public roads. They provide forest access for such activities as land management, fire protection, recreation and timber harvesting. Forest roads that are improperly located, poorly constructed and / or not maintained are the largest contributor of nonpoint source pollution from forest activities. Roads on steep slopes, erodible soils or stream crossings hold the greatest potential for degrading water quality. In wetlands, forest roads must comply with 15 mandatory **BMPs**. See page 36.

PERMANENT ROADS

BMPs for Location & Planning

- Use of tools such as soil surveys, topographic maps, and aerial photographs can help achieve the most practical road construction results.
- Design a permanent road system to meet long-range objectives rather than simply to access individual sites. Numerous separate road projects have more environmental impact than one well-designed road system.
- Stabilize or reconstruct existing roads where significant erosion problems exist. Abandon and retire roads where repair is impractical.
- Safety should always be considered with road design and location of intersections, and access points to public roads.
- Minimize the number of stream crossings.
- Cross streams on straight segments and as close to a right angle as possible (see illustration on page 7).
- Locate roads on the best available sites, avoiding excessive slope.
- All suitable excavated material should be used for the construction of the road, when possible. This may include soil removed from ditches during construction or maintenance.

Note: Additional planning assistance may be obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS).

AVOID

- Using streamside management zone (SMZ) for road locations or traffic areas.
- Locating roads adjacent to SMZs.
- Locating roads where water tends to collect.



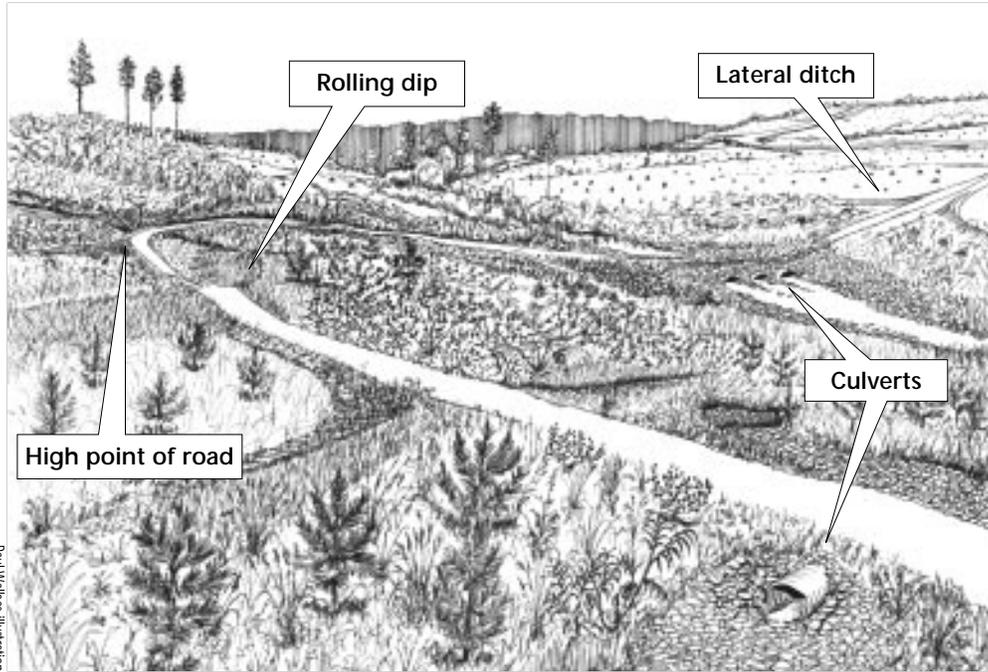
BMPs for Construction

- Salvage merchantable timber prior to clearing the right-of-way.
- Stumps, logs, slash and other organic debris should not be covered with fill material and incorporated into road beds unless the corduroy road construction technique is used.
- Minimize the amount of soil on the road banks or roadsides that is exposed to soil erosion. To minimize problems, revegetate or otherwise stabilize these areas as they are created.
- Functional water diversion structures should be installed at the same time roads are constructed. Drainage water should be dispersed onto the undisturbed forest floor when possible. Soil from parallel and lateral ditches may be incorporated as material for the road bed and drainage structure.
- Road bank slopes should be a 2:1 ratio. Seeding, mulching, or other stabilizing means should be used to reduce the potential for erosion.
- Plan for periods of heavy rain during road construction by including temporary waterbars, turnouts, or other structures to slow water runoff.

BMPs for Drainage

- Ditches, culverts, dips, and wing (lateral) ditches should be installed at the time of construction of the roadway. Ditches should be adequately sized and sloped to prevent silting-up and to allow for maintenance equipment access.
- Roads should be designed to drain at all times by using crowning, ditching, culverts, and water bars.
- Ensure that culverts, water turnouts, and broad-based dips empty road runoff onto the undisturbed forest floor.
- All culverts, permanent or temporary, should be of adequate size to carry the water flow anticipated during heavy rains. (See CULVERT SIZE CHART, Page 61).





Several types of drainage structures are used in this forest access road.



Alabama Forestry Commission photo

A permanent culvert of adequate size has been installed on this forest access road.

BMPs for Water Crossings

- Stream crossings should be constructed to minimize the disturbance to stream banks and existing stream channels.
- Use of equipment in the stream bed should be kept to an absolute minimum.
- Crossing streams at fords should take place when stream flow is down and threat of sedimentation is low.
- Fills and earth embankments used as bridge approaches should be stabilized to minimize potential erosion by using headwalls, wing walls, rip-rap, and other suitable material.
- Excess material and woody debris from road construction should be cleared from streams and drainage ways.
- Bridges and culverts should not constrict clearly defined stream channels.

Note: Some of the most common mistakes in road construction and maintenance are shown below.

AVOID

- Improperly sized culverts (too small).
- Poor location (wet spot, loose soil).
- Insufficient number of wing ditches.
- Steep hills (more than 10 percent grade).
- Use of fill material taken from smz to cover culvert.
- Improperly maintained road crown.
- Plugged culverts.
- Leaving erodible soils unstabilized.
- Leaving ditches clogged with logging debris.
- Inadequate soil compaction or "set-up" time before heavy use.

Note: Proper maintenance of permanent access roads is of vital importance to logging and land management activities. Road systems should be kept in serviceable condition to minimize erosion by rainfall runoff and vehicle use.

BMPs for Road Maintenance

- The road surface should be crowned or outsloped to dissipate surface runoff and minimize erosion of the roadbed.
- Ditches, wing ditches, and culverts should be kept free of logging debris or other obstructions to allow unrestricted passage of water. Siltation should be removed from ditches and wing ditches through periodic maintenance.
- Exposed soil subject to excessive erosion should be revegetated or otherwise stabilized if natural revegetation will not suffice.
- Trees adjacent to permanent roads should be trimmed or cut back to allow maximum sunlight on the road surface.
- Closed roads should be periodically inspected to ensure their integrity.
- Anticipate weak spots in road bed and repair with support materials. Do not excavate the road surface and create a channel.

Exemption for Roads in Wetlands

Road construction for silvicultural purposes in jurisdictional wetlands does not require a permit because of this silvicultural exemption. However, to qualify for silvicultural exemption, the road construction must comply with 15 mandatory BMPs for forested wetlands, (from Clean Water Act, Section 404 Program Definition and Permit Exemption, Part 232.3). See FOREST WETLANDS, Page 30.

Forest Roads

TEMPORARY ROADS

Temporary roads often incorporate the same principles as permanent installations, but not the same degree of refinement and permanence. For example, the need exists to disperse water from temporary roads when conditions are wet, just as with permanent roads.

BMPs for Construction

- Roads should be built on the contour and at a sufficient distance to minimize disturbances to streams. Existing ridge lines should be used where possible.
- Crossings should be designed to prevent restrictions of high water flows during harvest operation.
- Temporary roads may include the use of mats, portable bridges, culverts, lateral ditches, etc.
- Temporary roads may require installation of underlayment to operate trucks across soft or unstable areas.
- Cross streams as close to right angles as is practical.
- Temporary roads should be closed and the soil stabilized after use. Stabilize stream banks, ditches, and roads as needed. Remove temporary crossings.
- Maintaining or closing temporary roads as the operation progresses prevents erosion and minimizes downtime.

AVOID

- Roads located directly up or down steep slopes.
- Turning water onto erodible soils unless additional protection from erosion is used.
- Creating channels by cutting deeper and deeper in an attempt to remove soft spots.



Alabama Forestry Commission photo

Installation of one of the types of temporary bridges that can be used.



Alabama Forestry Commission photo

Another type of temporary logging bridge, completed and ready to use.

TEMPORARY ROADS



WESTVACO photo

Temporary roads should be closed and stabilized after use.

Timber Harvesting

PRE-HARVEST PLANNING



HARVESTING OPERATIONS cause a temporary disturbance in the forest. Pre-harvest planning is critical to ensure that operations are conducted in a manner which minimizes impact to water quality.

Note: During harvest design, careful planning and the use of BMPs will minimize soil disturbance and maintain water quality.

BMPs for Planning

- Identification and delineation of sensitive areas such as smzs, ephemeral streams, bogs, fragile soils, and steep slopes.
- Use of aerial photographs, timber stand maps, topographic maps, and soil surveys to aid in locating log decks or "sets," skid trails, and access roads.
- The timing and type of harvest depends on soil moisture (hydrology), topography, soil type and soil conditions.
- The application of stabilizing or surfacing materials to roads; for example, stone or board run mats applied to potential trouble spots before the operation begins.



Timber Harvesting

STREAMSIDE MANAGEMENT ZONES

A streamside management zone (SMZ) serves as a natural filter of vegetation adjacent to a natural or manmade water body. These zones, also called *riparian* zones, reduce erosion by both slowing the flow of surface water runoff and increasing water filtration. These water bodies may include streams, rivers, bayous, and lakes. To protect water quality, extra precautions may be necessary in carrying out some forest practices.

The key objective of SMZs is to protect and maintain the quality of water on forest lands by the following:

- Maintaining a vegetative filtration strip on ephemeral areas.
- Providing an adequate canopy of forest cover along all perennial streams to maintain normal water and shade conditions.
- Minimizing forest soil erosion by maintaining the appropriate amount of residual ground cover or forest cover under various soil and slope conditions.

When timber is harvested within the SMZ, care should be taken not to compromise the objective of the SMZ.

SMZs should be provided on perennial and intermittent streams and other water bodies. This includes springheads, oxbows, upland flats, and drains bordered by steep or erodible slopes. Any existing drainage structures that over time have come to resemble natural drains are also included.

A *perennial* stream is one that has a well-defined channel and flows year-round except during periods of extreme drought,

when they retain pools of water. *Intermittent* streams have seasonal flow and a continuous well-defined channel. *Ephemeral* streams flow during and for a few hours or days after periods of heavy rain and the stream channel is less recognizable than either perennial or intermittent streams.

Streams designated as scenic rivers will be managed in accordance with state law. See *LOUISIANA'S NATURAL AND SCENIC RIVER SYSTEM*, page 45.

SMZ width is dependent on watershed characteristics and the risk of erosion in the SMZ and adjacent area. The risk is increased by sandy soil, steep grade, large watershed size or increasing stream width. Estimated normal flow width is the distance in feet between the water's edge on one side to the water's edge on the other. This width will be estimated at a time when the stream is at its normal (low) flow. Normal flow width will be an average for the stream, taking into consideration the stream will widen as it flows farther from its source.

Note: SMZ widths are measured from the top of each bank and established on each side of the stream. Determination of SMZ width should be site-specific and should be made by foresters or other qualified professionals. Soil type, slope gradient, vegetation cover, volume flow, and stream classification should be taken into consideration when designing each SMZ.

BMPs for Streamside Management

Along perennial streams, timber can be harvested carefully within an smz provided that the filtering effects of the smz are not compromised.

- Take precautions to protect the remaining timber stands within the smz.
- **Do not remove trees** from banks, beds or steep slopes if removal will destabilize soil and degrade water.
- Permanent residual tree cover is not required along intermittent and ephemeral streams if vegetation and organic debris are left to protect the forest floor during regeneration.
- Flag or mark smzs adjacent to all perennial and intermittent streams and lakes before harvesting.
- Plan harvests to minimize stream crossings.
- Locate stream crossings where stream impacts are likely to be minimal.
- Locate roads, skid trails, fire lanes, and logging sets outside the smz.
- To minimize damage, limit harvesting on smzs and sensitive forested wetlands during abnormally wet periods.
- Consider using wide-tire skidders, forwarders, cable skidders, and tracked equipment to minimize soil disturbance in an smz.
- Construct stream crossings to minimize stream bank and channel disturbance.
- Cross streams at right angles when practical.
- Consider using portable bridges for temporary stream crossings.
- Promptly remove all temporary crossings and restore the site after harvesting is completed.

AVOID

- Skidding across perennial or large intermittent streams, except over an adequately designed crossing.
- Excessive skidding within an smz.

Suggested SMZ Widths

Stream Type	SMZ Width (each side)
Intermittent	35 Feet
Perennial	
less than 20 feet wide	50 feet
more than 20 feet wide	100 feet



Boise Cascade Corporation photo

Timber harvesting is allowed in the SMZ, providing the objectives of the SMZ are not compromised.



WESTVACO photo

SMZs provide a water filtration strip of ground cover on ephemeral areas.



WESTVACO photo

An effective SMZ provides adequate canopy of forest cover along all perennial streams to maintain normal water and shade conditions.



Boise Cascade Corporation photo

An effective SMZ minimizes forest soil erosion by maintaining the appropriate amount of residual ground or forest cover under various soil and slope conditions.

STREAMSIDE MANAGEMENT ZONES

Timber Harvesting



Hancock Timber Resources Group photo

Modern harvesting equipment is used to control the direction of felling.

Timber Harvesting

FELLING & SKIDDING TECHNIQUES

BMPs for Skidding

- Use soil surveys, aerial photographs, and topographic maps to help locate skid trails.
- Use the smallest number, width and length of skid trails needed to log the area effectively.
- Use waterbars, wing ditches, or other appropriate practices to slow and disperse water runoff. Construct water bars to divert water rather than block it.
- Keep stream crossings to a minimum.
- Cross streams at right angles and in straight sections of the stream, when practical.
- Skid logs uphill at an angle.
- Scatter logging slash on wetter areas of skid trails to prevent rutting.
- Keep skidder loads light in sensitive areas to reduce rutting and protect drainage integrity.
- Stabilize skid trails to prevent erosion by using waterbars, logging slash, or other appropriate water diversions.
- Establish vegetative cover after smoothing and shaping of bare ground subject to erosion.
- When crossings streams, temporary fills should be removed in their entirety after completion of harvesting operations.
- Restore stream crossings to natural grade and shape.

AVOID

- Sensitive areas and problem soils.
- Skidding straight up or down steep slopes.
- Long, steep skids. Lay out skid trails on slopes at an angle to break up the grade.
- Water draining down skid trails.
- Skidding in a stream channel even when temporarily dry.
- Skidding across perennial streams or large intermittent streams unless it is done with a properly constructed temporary crossing.
- Excessive damage to remaining timber and other vegetation within smzs.
- Using existing skid trails if further use will cause excessive soil disturbance.

BMPs for Felling

- When possible, trees should be directionally felled away from water bodies.
- Remove only tops and limbs which have fallen into any water body during harvesting.
- Inspect all stream courses to be sure they are free from excessive logging debris.

Timber Harvesting

LANDINGS, LOG DECKS & SETS

Landings, log decks and sets are temporary locations where logs are assembled for temporary storage, loading and transportation.

BMPs for Landings

- Use no more sets than are necessary.
- Make sets no larger than necessary.
- Locate sets on firm, well-drained ground away from streams.
- Locate log sets on a slight slope (less than 5%) for drainage whenever possible.
- Locate sets so skidding will have a minimal impact on the natural drainage pattern.
- Locate sets where skidding will avoid road ditches, sensitive sites, and excessive slopes.
- Reshape disturbed areas to minimize soil erosion.
- Seed and fertilize bare areas that would erode before natural vegetation is re-established.

AVOID

- Locating log decks in smzs or other sensitive areas.
- Locating log decks where they might result in skidding through sensitive areas.

Timber Harvesting

REVEGETATION

BMPs for Revegetation

- Reestablish vegetation on temporary roads, drainage systems, side slopes, back slopes, skid trails or landings following significant soil disturbances when natural revegetation will not prevent erosion. See Revegetation Of Disturbed Areas in Appendix IV, Page 81.

EQUIPMENT MAINTENANCE & LITTER

BMPs for Equipment Maintenance & Litter

- Perform all maintenance away from riparian areas.
- Capture all coolants, oils, fuels, etc. and dispose of waste properly.
- Repair leaks immediately.
- Properly dispose of all trash associated with harvesting. *DO NOT burn or bury.*



LOGGING TRASH



SEEDED TEMPORARY ROAD

Site Preparation & Reforestation

GENERAL METHODS



RAPID REGENERATION OF FOREST LAND following final harvest or natural disaster is both economically and environmentally important. Any increase in erosion, water yield, and storm flow coming from a logged site diminishes rapidly as the site revegetates.

Root systems remain in place many years after trees are cut and provide soil stability which reduces the risk of erosion. Trees also intercept water and impede storm water runoff. Many sites require some type of treatment to accomplish quick and effective regeneration of desirable tree species, or to reduce some undesired effects of harvesting.

BMPs for Site Preparation & Reforestation

- Clearly define boundaries of all smzs before beginning site preparation activities.
- Ripping, shearing, windrowing, and mechanical planting should follow the contours of the land to reduce potential erosion hazard.
- On steep slopes or highly erosive soils avoid intensive site preparation. Use herbicides, hand tools, and / or prescribed fire, but be aware that extremely hot fires may significantly increase erosion potential.
- Hand plant steep, erodable sites as soon as possible after final harvesting and site preparation.
- Where accelerated erosion is likely, use methods which leave logging debris and other natural forest litter scattered over the site.
- Minimize moving soil into windrows and piles.
- The smz along streams should be protected by planning the use of equipment so as to minimize disturbance of these areas. Stream crossing construction should minimize disturbance of the area in which the crossing is being constructed. Such crossings should be restored promptly.
- Equipment operators should be trained and appropriate planning done so that soil disturbance, compaction, and displacement is minimized.
- In order to minimize erosion, firebreaks should have water control structures properly installed and maintained.
- Site preparation activities should not enter smzs and cross stream channels.
- Provide water outlets on bedded or furrowed areas at locations that will minimize movement of soil. Discharge water onto a vegetative surface.

AVOID

- Damage to existing water control devices (i.e. culverts, wing ditches). Site preparation and planting equipment should avoid crossing or turning around in roads, road ditches, and wing ditches. Damages should be repaired immediately.
- Intensive mechanical site preparation on steep slopes or on sites that have high potential for erosion.
- Constructing windrows which will funnel surface runoff into perennial, intermittent, or ephemeral streams.
- Blocking any drainage with beds, windrows, or similar structures.

Two major problems associated with site preparation include soil erosion and potential sedimentation from runoff. Primary factors contributing to accelerated erosion from runoff are percent of the area with exposed soil, type of soil, degree of slope, and ground cover.

Techniques used for site preparation should be based on soils, slope, condition of the site, natural vegetation, crop tree species, and cost. Soils with a shallow surface layer generally have limited capacity to absorb water and are more likely to erode. Steeper slopes provide more rain-water runoff velocity, and thus energy, to erode soils. Ground cover helps hold soil in place and dissipates some of the energy of rainfall.



Ripping, shearing, windrowing and mechanical planting should follow the contours of the land to reduce potential erosion hazard.

Silvicultural Chemicals

FERTILIZATION & PESTICIDES

PESTICIDES, INCLUDING BOTH HERBICIDES AND INSECTICIDES, are valuable tools in maintaining a healthy forest. The use of herbicides, rather than mechanical site preparation methods is recommended on erodable sites to protect water quality. Insecticides can be used to control certain insect infestations where outbreaks are localized provided care is taken to minimize use in SMZs.

Fertilization, may be used to enhance tree growth. Fertilizers can be applied safely with ground and air equipment, provided that care is taken and application is in accordance with label instructions and applicable state and federal laws.

Proper planning, training and conscientious execution of the plan are keys to safe use of silvicultural chemicals.

Note: These guidelines are intended to complement state or local regulations relating to the sale, transportation and use of chemicals.

BMPs for Silvicultural Chemicals

- Follow label directions and applicable state and federal laws in the storage, transportation, handling, and application of all chemicals. All worker protection standards should be strictly followed. *All restricted-use pesticides shall be applied under the supervision of a certified pesticide applicator.*
- Know each chemical's characteristics. Know also topography, soils, drainage, weather, and other potential site hazards that might be important for preventing water pollution during application.
- No leakage of chemicals should be permitted from equipment used for transporting, storing, mixing, or applying chemicals.
- Water for mixing with chemicals should be carried to the field in water-only tanks. The danger of getting a chemical into a ground or surface water supply must be avoided. An anti-siphon device is essential in the water intake to prevent back flow. Chemical mixing should only be done at the application site.
- Mix chemicals and clean tanks only where possible spills will not enter streams, lakes, or ponds. Do not mix chemicals or clean / flush tanks near wellheads. *CONTINUED, NEXT PAGE*

...more Chemical BMPs

- Carefully plan ground and aerial application to avoid direct and indirect entry of chemicals into streams and impoundments. Special care should be taken when chemicals are used in the smz. Realize that significant portions of the smz will probably be left untreated. Leave well-marked buffer zones between target area and surface water.
- Chemicals must not be applied when stream pollution is likely to occur through aerial drift.
- Use spray equipment that is capable of immediate shut-off.
- Where feasible, utilize injection or stump treatment herbicide methods in areas immediately adjacent to open water.
- If a spill should occur, construct a containment dike around it. Use absorbent material such as kitty litter, sawdust, or soil to soak up fluid. Keep the spill from flowing into streams or bodies of water. *Some spills will require notifying appropriate authorities.*
- All empty pesticide containers must be triple-rinsed and disposed of in accordance with label requirements.
- *The rinse water should be used in the pesticide mix and sprayed on the treatment area.*
- Clean equipment in a location where chemicals will not enter any stream, lake, pond.

Chemicals should not be applied if water pollution is likely to occur through aerial drift.

AVOID

- Applying pesticides and fertilizers directly to water bodies such as streams, lakes, or swamps unless specifically prescribed and approved for aquatic management.
- Broadcast application of pesticides within smzs.
- Applying any herbicide adjacent to the smz that would damage trees in the smz or enter a stream.
- Aerial chemical application during turns and over open water.
- Exceeding intended or allowable dosages of chemicals.
- Applying chemicals to vegetation protecting eroded slopes, gullies, drainages, and other fragile areas subject to erosion.



Weyerhaeuser photo

Fire Management

PRESCRIBED BURNING

PRESCRIBED FIRE IS AN IMPORTANT AND USEFUL SILVICULTURAL TOOL. It can be used to prepare a site for planting by reducing logging debris or to prepare a seedbed for seed fall. Prescribed fire can also be used in established stands for silvicultural purposes, wildlife habitat improvement, and hazard reduction. A major concern of forest management is the effect of prescribed fire on surface runoff and soil erosion.

Studies have shown that properly planned and conducted prescribed burning has a minimal impact on water quality in the South. Most problems associated with

prescribed burning can be eliminated with proper planning, awareness of changing weather conditions, and compliance with Louisiana's Voluntary Smoke Management Guidelines (*copies can be obtained from the Louisiana Office of Forestry*). For most flat, sandy soils there is little danger of soil erosion; however, in steeper topography there is a greater chance for soil movement. When a prescribed fire becomes too hot, the entire surface layer (humus) can be consumed, exposing the underlying mineral soil to erosion and increasing surface runoff.

BMPs for Prescribed Burning

- Site prep burns on steep slopes or highly erodible soils should only be conducted when they are absolutely necessary and should be of low intensity. Time prescribed fires so that the moisture level of the forest floor prevents the entire humus layer from being burned.
- A significant amount of soil movement can occur when preparing for prescribed burns; for example, along firebreaks. Firebreaks should have water control structures in order to minimize erosion. Locate firebreaks on contours as much as possible. Water bars should be constructed in firebreaks at frequent intervals to slow surface runoff in areas subject to accelerated erosion, such as steep grades or highly erodible sloping firebreaks.
- Site prep burning creates the potential for soil movement. All efforts should be made to keep high intensity site prep burns out of SMZs.
- Use hand tools when necessary to connect firebreak lines into stream channels.

AVOID

- Burning when conditions will cause a fire to burn too hot and expose mineral soil to erosion.
- Allowing high intensity fire to enter filter strips or SMZs.
- Burning on severely eroded forest soils where the average litter duff is less than one-half inch.

Fire Management

FIRELINE CONSTRUCTION & MAINTENANCE

Fireline construction and maintenance is an essential part of forest management. It deals with site preparation burning, prescribed burning, and wildfire suppression. A number of control practices can be implemented during fireline construction to prevent unnecessary erosion. Periodic inspection and proper maintenance can prevent potential erosion on established firelanes.

BMPs for Firelines

- Firelines should be constructed on the perimeter of the burn area and along the boundary of the smz. The purpose of protecting the smz from fire is to safeguard the filtering effects of the litter and organic matter.
- Firelines should follow the guidelines established for logging trails and skid trails with respect to waterbars and wing ditches, and should be only as wide and as deep as needed to permit safe site preparation burns.
- Firelines that approach a drainage should be turned parallel to the stream or include the construction of a wing ditch or other structure that allows runoff in the line to be dispersed rather than channeled directly into the stream.
- Firelines on highly erodible sites or other problem areas should be inspected periodically to correct erosion problems by installing dips, wing ditches, waterbars, etc. and / or by seeding. See vegetation specifications in Appendix IV , Page 81.

AVOID

- Disturbing existing gullies where possible.
- Disturbing more soil surface than necessary.
- Connecting firelanes directly into stream channels.
- Plowing against the contour where possible.

Fireline construction and maintenance is an essential part of forest management.



Alabama Forestry Commission photo

Fire Management

WILDFIRE

The first and foremost concern in wildfire control is to prevent damage to people and property. During wildfire suppression, fireline BMPs that slow containment efforts must take a lower priority than fire suppression. Potential problems should be corrected later.

BMPs for Wildfire

- Actively eroding gullies should be stabilized when possible.
- Stabilize and revegetate fire lines on steep grades, areas subject to accelerated erosion, or known sensitive areas.
- Ensure all road surfaces are left stabilized and protected.



Alabama Forestry Commission photo

During wildfire suppression, fireline BMPs that slow containment efforts must take a lower priority than the suppression itself.

Forest Wetlands

BENEFITS AND FUNCTIONS OF WETLANDS



FOREST WETLANDS ARE ENVIRONMENTALLY SENSITIVE AREAS. Special attention to the proper use of BMPs is essential if water quality is to be protected. Forest road construction has the potential to disrupt normal drainage patterns and produce sediment that may reach streams. Tree tops or other logging debris left in streams can obstruct water flow, increase erosion of stream banks, and decrease dissolved oxygen in the water. Normal wetland drainage patterns can be altered by severe rutting or by improperly constructed windrows. Excessive soil compaction caused by careless logging can reduce water infiltration, reduce soil moisture available to tree roots, and decrease site quality. **NOTE: The section on wetlands herein is taken from *Handbook on Forested Wetlands*, Forested Wetlands Workshop, August 8, 1996, Alexandria, Louisiana.**

OVERVIEW

Louisiana's bottomland hardwood forests, including wetlands, are productive ecosystems with multiple functions and ecological values that can be managed for commercial timber production without compromising this valuable resource. This section deals with the management of these sites in order that they may continue to provide this ecological value. The reader should keep in mind that many sites classified as bottomlands may be wetland-like, but are not necessarily "wetlands" in the strictest legal or jurisdictional sense. Jurisdictional wetlands are found throughout the state and are not limited to obscure flooded or remote marsh areas.

Maintaining ecological productivity for wetland and wetland-like sites often call for the same management techniques. These wetland BMPs address sustained timber production as one of the landowner's objectives. Timber production is recognized as a land use that is compatible with wetland protection.

Although wetlands are federally regulated, normal forestry operations in wetlands — including but not limited to soil bedding, site

preparation, harvesting, and minor drainage (see note on next page) — are exempt from permit requirements under Section 404 of the Clean Water Act Amendments of 1977, as long as the activity:

- Qualifies as "normal silviculture."
- Is part of an "established" silvicultural operation.
- Does not support the purpose of converting a water of the United States to a use to which it was not previously subject.
- Follows the 15 mandatory BMPs for road construction (see *Access Systems*), and the six mandatory BMPs for site preparation (see *Site Preparation in Wetlands*).
- Contains no toxic pollutant listed under Section 307 of the Clean Water Act in discharge of dredge or fill materials into waters of the United States.

A forestry activity will require a Section 404 permit if it results in the conversion of a wetland to a non-wetland. Landowners who wish to change land use, who feel an activity may change land use, or who are uncertain about the permit exemption

status of a forestry activity should contact the U.S. Army Corps of Engineers (USCOE). If the activity is on a farmed wetland or on

agricultural land, the Natural Resources Conservation Service (NRCS) is the appropriate initial contact.

NOTE: *Minor drainage* refers to installation of ditches or other water control facilities for temporary dewatering of an area. Minor drainage is considered a normal silvicultural activity in wetlands to temporarily lower the water level and minimize adverse impacts on a wetland site during road construction, timber harvesting and reforestation activities. Minor drainage does not include construction of a canal, dike or any other structure which continuously drains or significantly modifies a wetland or other aquatic area.

Minor drainage is exempt from needing an individual 404 permit if it is part of an ongoing silvicultural operation and does not result in the immediate or gradual conversion of a wetland to an upland or other uses. Artificial drainage must be managed. Once silvicultural activity has been completed, the hydrology that existed prior to the activity should be restored by closing drainage channels.

NORMAL SILVICULTURAL ACTIVITIES

Normal silvicultural activities conducted as part of “established, ongoing” silvicultural operations are exempt from Section 404 Corps of Engineers permit requirements as long as the appropriate measures are implemented. Normal activities include but are not limited to road construction, timber harvesting, mechanical or chemical site preparation, reforestation, timber stand improvement and minor drainage. These measures in-

clude 15 federal mandatory BMPs for road construction and the six BMPs for silvicultural site preparation activities in forested wetlands. *Recommended Forestry Best Management Practices for Louisiana* are not required for exemption from Section 404 Corps of Engineers permit requirements; but they are **strongly** recommended to minimize nonpoint source pollution of waters of the state and / or waters of the United States.

ESTABLISHED SILVICULTURAL OPERATIONS

Established or ongoing silvicultural operations are included in a management system (not necessarily written) which is planned over conventional rotation cycles for a property or introduced as part of an established operation. An activity need not itself have been ongoing as long as it is introduced as part of an ongoing operation.

Evidence of use of the property may be used to determine whether an operation is ongoing. Examples of such evidence may include, but not be limited to:

- A history of harvesting with either natural or artificial regeneration.
- A history of fire, insect and disease control to protect the maturing timber.
- The presence of stumps, logging roads, landing or other indications of established silvicultural operations that will continue on the site.
- Explicit treatment of the land as commercial timberlands by government agencies under zoning, tax, subsidy, and regulatory programs.
- Certification under the National Tree

Farm System or Stewardship Program

- Ownership and management by a timber company or individual whose purpose is timber production.

While past management may have been relatively non-intensive, intensification of management involving artificial regeneration and other practices can occur as part of a conventional rotation and be considered an established operation.

Although wetland regulations do not require a written forest management plan, it is in a landowner's best interest to document that operations are established, that BMPs are implemented and effective, and that activities are consistent with other Section 404 exemption criteria.

A change in ownership has no bearing on whether a forestry operation is part of an established, ongoing activity. Continuation or strict adherence to a management plan written for the previous owner is not required by Section 404 silvicultural exemptions.

Note: Forestry activities or operations require a 404 permit from the Corps of Engineers under the conditions listed in the adjacent panel.

A 404 Permit is required when:

- The activity results in the immediate or gradual conversion of a wetland to an upland as a consequence of altering the flow and circulation or reducing the reach of waters of the United States.

Changes in flow, circulation or reach of waters can be affected by permanent major drainage such as channelization or by placement of fill materials. A discharge which changes the bottom elevation of waters of the United States without converting it to dry land, does not reduce the reach of waters but may alter flow or circulation and therefore may be subject to permitting requirements.

The criteria that are used to determine if a wetland has been converted include a change in hydrology, soils and vegetation to such an extent that the area no longer qualifies as a jurisdictional wetland according to the *Federal Manual for Delineating Jurisdictional Wetlands (1987)*.

- A new activity results in a change from the past, historical use of the wetland into a different use to which it was not previously subject where the flow of circulation of waters is impaired or the reach of the waters is reduced. Such a change does not meet the established, ongoing requirement and causes the activity or operation to lose its exemption.

Examples of this situation are areas where tree harvesting has been the established use and the landowner wishes to convert the site for use as pasture, green tree reservoir, agriculture, real estate or aquaculture. In such cases, the landowner must first obtain a 404 permit before proceeding with the change.

- Roads and stream crossings are constructed in wetlands without following the mandatory federal BMPs.
- The area has lain idle for so long that hydrologic modifications are necessary to resume operations. This does not refer to temporary water management techniques such as minor drainage, plowing, bedding and seeding which are exempt, normal silvicultural activities as long as they don't result in the conversion of wetlands to uplands. However, it does apply to reopening ditches which were once established as permanent wetland drainage structures but have lost their effectiveness for this purpose as they filled in with soil and vegetation.

Note: *Streamside management zones* or *smzs* should be established and managed around the perimeter of all major drainages and open bodies of water contained within wetlands; for example, mainstream courses or oxbow lakes.

Forest Wetlands

LEGAL DEFINITION OF WETLANDS

The U. S. Army Corps of Engineers (*Federal Register*, 1982) and the Environmental Protection Agency (*Federal Register*, 1980) jointly define wetlands as:

“Those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support and, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.”

Criteria for Delineating Wetlands

Established by the
U.S. Army Corps of Engineers (USCOE)

- **Hydrophytic vegetation** — plants that have the ability to grow, effectively compete, reproduce, and / or persist in anaerobic soil conditions.
- **Hydric soils** — soils that are saturated, flooded, or ponded long enough during the growing season for anaerobic conditions to develop.
- **Wetland hydrology** — inundated by water sufficient to support hydrophytic vegetation and develop hydric soils.

All three must be present under normal circumstances for an area to be identified as a jurisdictional wetland.

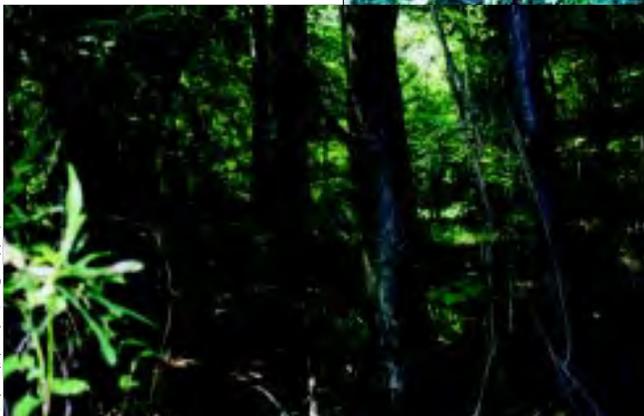
Forest Wetlands

PLANNING IN WETLANDS

Planning for timber harvesting is an often overlooked step in silvicultural activities. When working in wetlands or wetland-like areas, planning is essential. To facilitate planning, identify and mark the location of waterbodies and other sensitive areas using aerial photographs, topographic maps or soil surveys. (See Appendix II, Page 69).



WESTVACO photo



Louisiana Forestry Association photo

The photos on these two pages illustrate examples of four typical Louisiana wetlands.



WESTVACO photo



Louisiana Forestry Association photo

PLANNING IN WETLANDS

Forest Wetlands

ACCESS SYSTEMS

Roads provide access for timber removal, fire protection, hunting, routine forest management activities, and other multiple use objectives. When properly constructed and maintained, roads will have minimal impact on water quality, hydrology, and other wetland functions.

MANDATORY ROAD BMPs

As mandated by Amendments to the Clean Water Act, forest roads in jurisdictional wetlands including “waters of the United States” must be constructed and maintained in accordance with the following mandatory Best Management Practices to retain Section 404 exemption status:

15 Federally Mandated BMPs for Roads

1. Permanent roads, temporary access roads, and skid trails in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific silvicultural operations and local topographic and climatic conditions.
2. All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except portions of such roads that must cross water bodies) to minimize discharge of dredged or fill material into waters of the U.S.
3. The road fill shall be bridged, culverted or otherwise designed to prevent the restriction of expected flood flows.
4. The fill shall be properly stabilized and maintained to prevent erosion during and following construction.
5. Discharges of dredged or fill material into waters of the U.S. to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the U.S. (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself.
6. In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum.
7. The design, construction, and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body.
8. Borrow material shall be taken from upland sources whenever feasible.
9. The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species.
10. Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist.
11. The discharge shall not be located in the proximity of a public water supply intake.
12. The discharge shall not occur in areas of concentrated shellfish population.
13. The discharge shall not occur in a component of the National Wild and Scenic River System.
14. The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts.
15. All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Forest Wetlands

PERMANENT ROADS

Permanent roads are constructed to provide all or nearly all-season access for silvicultural activities, and are maintained regularly. Construction of permanent roads in wetlands and wetland like areas should be minimized.

BMPs for Permanent Roads

- Construct and maintain permanent roads in forested wetlands according to the 15 mandatory BMPs listed opposite.
- Plan the access system prior to construction. Whenever possible, avoid crossing streams, sloughs, sensitive areas, etc.
- Consider relocating poorly designed or constructed section(s) of an established road system that may lead to water quality pollution during and after the management activity.
- If applicable, construct roads well before the management activity to allow roads to stabilize.
- Construct fill roads only when necessary. Road fills should be as low as possible to natural ground level and should include adequate cross-drains for surface water flow.
- Borrow pits should be located outside smzs and jurisdictional wetlands.
- Stabilize soils around bridges, culverts, low water crossings, etc. When natural stabilization will not occur quickly, fill material should be stabilized with grass, rip-rap, etc.
- Construct fill roads parallel to water flow, where possible.
- Use of a geo-textile or a geo-grid fabric can increase soil bearing capacity and reduce rutting.
- Use board-road or wooden mats where needed to minimize rutting. Stream crossings should be made at right angles to the channel, when possible, and should not impede stream flow.
- Minimize sediment production when installing stream crossings.
- Use gates or otherwise restrict unnecessary traffic on wet roads.
- Road ditches should not feed directly into stream channels.

Forest Wetlands

TEMPORARY ROADS AND SKID TRAILS

Roads provide access for timber removal, fire protection, hunting, routine forest management activities, and other multiple use objectives. When properly constructed and maintained, roads will have minimal impact on water quality, hydrology, and other wetland functions.

BMPs for Temporary Roads and Skid Trails

- Construct and maintain temporary roads in forested wetlands according to the 15 mandatory BMPs.
- Favor temporary roads over permanent roads when possible. When properly constructed, temporary roads will have less impact on the hydrology of forested wetlands than permanent roads.
- Temporary road fill should be removed and the area restored to its original elevation upon completion of operations.

ROAD MAINTENANCE

As mandated by Amendments to the Clean Water Act, forest roads in jurisdictional wetlands including “waters of the United States” must be constructed and maintained in accordance with the following Best Management Practices to retain Section 404 exemption status.

BMPs for Road Maintenance

- All drainage structures should be inspected and maintained, especially following unusually heavy rains.
- Ditches, culverts, and other water flow structures should be kept free of debris.

Forest Wetlands

HARVEST OPERATIONS IN WETLANDS

Harvesting should be done with consideration to season, stand composition, soil type, soil moisture, and the type of equipment that is used. When done correctly, harvesting can benefit site productivity for future forests, improve regeneration, and benefit the overall hydrologic function of a wetland site.

BMPs for Wetland Harvest Operations

- Harvest during dry periods if possible to minimize rutting.
- Use low pressure / high flotation tires or wide tracks where possible, so that excessive damage to residual stand will not occur.
- Keep skidder loads light when rutting is evident.
- Fell trees away from watercourses if possible.
- During harvesting, remove any obstructions in channels resulting from harvesting operations.
- Limit operations on sensitive sites and in smzs during periods of wet weather.



RUTTING

Ruts should not be present to the extent that they impede, restrict, or change natural water flows and drainages. The determination of excessive rutting is highly subjective and must be made

only by a forester or other qualified individual who evaluates rutting extent, depth, soil type, direction and position, and other local factors.

Forest Wetlands

SITE PREPARATION IN WETLANDS

Site preparation activities in forested wetlands for the establishment of pine plantations¹ in Louisiana may or may not require a Clean Water Act Section 404 permit.

NO PERMIT REQUIRED

The following are circumstances where mechanical site preparation activities do not require a permit:

- Mechanical silvicultural site preparation² is a non-permitted activity in wetlands that are:

Seasonally flooded — Characterized by surface water that is present for extended periods, especially early in growing season and is absent by the end of the season in most years but water table is often near the surface.

Intermittently flooded — Characterized by substrate that is usually exposed, but where surface water is present for variable periods without detectable season periodicity.

Temporarily flooded or saturated — Characterized by surface water that is present for brief periods during the growing season, but also by a water table that usually lies well below the soil surface for most of the season.

Historically 25% or more pine — Conducted in pine plantations and other silvicultural sites that originally or historically contained more than 25% pine in the canopy (except as listed under “permit required,” next page — circumstances which *do* require a permit). Examples typical of these wetlands include pine flatwoods, pond pine flatwoods and wet flats, such as certain pine-hardwood forests.

- The site preparation activity is conducted in a manner designed to minimize impacts to the aquatic ecosystem and are conducted according to the six BMPs³ listed below:

Minimize soil disturbance—Position shear blades or rakes at or near the soil surface and windrow, pile, and otherwise move logs and logging debris by methods that minimize dragging or pushing through the soil to minimize soil disturbance associated with shearing, raking, and moving trees, stumps, brush, and other unwanted vegetation.

Avoid soil compaction — Conduct activities in such a manner as to avoid excessive soil compaction and maintain soil tilth.

¹ These guidelines were developed for the establishment of pine plantations and does not apply to, restrict, or require a permit for mechanical site preparation for the establishment of hardwood plantations.

² Mechanical silvicultural site preparation activities include shearing, raking, ripping, chopping, windrowing, piling and other similar methods used to cut, break apart, or move logging and other debris following harvesting for the establishment of pine plantations.

³ These BMPs firmly establish that forestry site preparation activities including shearing, raking, moving logging slash, windrowing, piling, etc. are part of normal silviculture; therefore, implementation of the mechanical site preparations BMPs does not constitute “land clearing” or other non-exempt activities.

Limit erosion and runoff — Arrange windrows in such a manner as to limit erosion, overland flow, and runoff.

Keep logging debris out of SMZs — Prevent disposal or storage of logs or logging debris in stream-side management zones (defined areas adjacent to streams, lakes, and other waterbodies) to protect water quality.

Maintain natural contour and drainage— Maintain the natural contour of the site and ensure that activities do not immediately or gradually convert the wetland to a non-wetland.

Exercise water management — Conduct activities with appropriate water management mechanisms to minimize off-site water quality impacts.

PERMIT REQUIRED

The following are circumstances where mechanical site preparation activities require a permit:

- A permit will be required in the following areas unless they have been so altered through past practices (including the installation and continuous maintenance of water management structures) as to no longer exhibit the distinguishing characteristics described below (see “circumstances where mechanical silvicultural site preparation activities do not require a permit” above).

Permanently flooded, intermittently exposed, and semi-permanent flooded wetlands

Permanently flooded wetlands— characterized by water that covers land surface throughout the year in all years.

Intermittently exposed wetlands — characterized by surface water throughout the year except in years of extreme drought.

Semi-permanently flooded wetlands— characterized by surface water throughout the growing season in most years and when absent, the water table is usually at or near the land surface. Examples of these three types include cypress gum swamps, muck and peat swamps and cypress strands / domes.

Riverine bottomland hardwood wetlands

Seasonally flooded floodplains— characterized by seasonally flooded or wetter river floodplain sites where overbank flooding has resulted in alluvial features such as well-defined floodplains, bottom / terraces, natural levees, and backswamps. Surface water present for extended periods, especially early in growing season, but absent by end of the season in most years, but water table often near land surface. Field indicators include water-stained leaves, drift lines and water marks on trees.

Hardwoods dominant — hardwoods dominate the canopy but do not include sites where more than 25% of canopy is pine.

Poorly drained soils — soil characteristics include listed hydric soils that are poorly drained or very poorly drained.

Non-riverine forest wetlands — Are rare, high-quality, wet forests with mature vegetation; located on the southeastern coastal plains, with hydrology dominated by high water tables representing two forest community types.

Non-riverine wet hardwood forests — poorly drained mineral soil interstream flats (comprising 10 or more contiguous acres), typically on the margins of larger peatland areas, seasonally flooded or saturated by high water tables, with vegetation dominated (greater than 50% of basal area per acre) by swamp chestnut oak, cherrybark oak, or laurel oak alone or in combination.

Non-riverine swamp forests — very poorly drained flats (comprising 5 or more contiguous acres), with organic soils or mineral soils with high organic content, seasonally to frequently flooded or saturated by high water tables, with vegetation dominated by bald cypress,

pond cypress, swamp tupelo, water tupelo, or Atlantic white cedar alone or in combination.

The term “high quality” refers to generally undisturbed forest stands, whose character is not significantly affected by human activities such as forest management. Non-riverine forest wetlands dominated by red maple, sweetgum, or loblolly pine alone or in combination are not considered to be of high quality, and do not require a permit.

Tidal freshwater marshes — *Wetlands regularly or irregularly flooded by freshwater with dense herbaceous vegetation, on the margins of estuaries or drowned rivers or creeks.*

Maritime grasslands, shrub swamps and swamp forests — *Barrier island wetlands in dune swales and flats; underlain by wet, murky or sandy soils, vegetated by wetland herbs, shrubs and trees.*

Four other wetland types in addition to the five above — white cedar swamps, Carolina bay wetlands, low pocosin wetlands and wet marl forests — require a permit for mechanical silvicultural site preparation, but are not normally found in Louisiana.

Note: Pine plantations that have already been established in the nine wetland types are grandfathered and not subject to the above prohibition. Thus, if a pine plantation already exists in the wetland types, no permit will be required for mechanical site preparation in order to continue pine plantation management on that site. Further, it is important to note that the above prohibition against mechanical site preparation in the above wetlands does not preclude pine management all together. Pine management can occur as long as the pine trees can be established consistent with the other clearly exempt activities including, harvesting, minor drainage, seeding, plowing and cultivating.

BMPs for Pine Wetlands

- Site preparation in forested wetlands, as outlined under *Permanently flooded wetlands* above, should be conducted according to the six BMPs listed under Riverine bottomland hardwood wetlands on page 41.



AVOID

- Permanently flooded, intermittently exposed and semi-permanent flooded wetlands.
- Riverine bottomland hardwood wetlands.
- Non-riverine forest wetlands.
- Tidal freshwater marshes.
- Maritime grasslands, shrub swamps and swamp forests.



Forest Wetlands

REFORESTATION IN WETLANDS

Reforestation in wetlands is not much different from regenerating uplands, with regard to water quality; the main factors to consider are the sites' potential for erosion and sedimentation, and for hydrology.

FOREST CHEMICALS IN WETLANDS

Use of chemical treatment should be limited within an SMZ because of their pollution potential. Application of pesticides, including herbicides, should be made by injection or directly. Forest fertilizer should be applied in such a manner (such as rate, time, or frequency of application) to prevent soil or water pollution. If state and federal laws

regarding the proper use of silvicultural chemicals are adhered to and manufacturers label directions followed, the judicious use of chemicals should not jeopardize an SMZ or the water it protects. Care should also be taken in areas adjacent to an SMZ to prevent the drift, spill, seepage, or wash of chemicals into the SMZ or watercourse.

BMPs for Chemicals in Wetlands

- Follow all label instructions to the letter. Be aware that some chemicals are labeled for use in wetlands and some are not.
- Conduct applications by skilled and, if required, licensed applicants.
- Identify and establish buffer areas for moving surface waters, especially for aerial applications.

AVOID

- Do not allow spray or rinse water to enter smzs.



Weyerhaeuser photo

A variety of plants are found along the upland-bottomland interface.

Louisiana's Natural & Scenic Rivers

OVERVIEW

THE LOUISIANA NATURAL AND SCENIC RIVERS SYSTEM is one of the nation's largest, oldest, most diverse and unique state river protection initiatives. It currently includes 52 streams, rivers, bayous, stream complexes and segments thereof, totaling over 1,700 miles in length. Additions or deletions to the Scenic River System are made by the Louisiana Legislature.

The system was proposed in the late 1960s and adopted in the early 1970s with the Louisiana Natural and Scenic River Act, which outlined requirements for a river to be included. It also established a regulatory program and empowered the Secretary of the Louisiana Department of Wildlife and Fisheries (LDWF) to administer the system through regulation and permits.

In 1978, the Legislature created a scenic river task force, mandated to update the Act, set policy and establish regulations for full implementation, and oversee planning for system management by the LDWF.

SENSITIVE ACTIVITIES

The following activities are prohibited, require a permit, or are exempted adjacent to or within 100 feet of the low-water mark of a state scenic stream:

Prohibited activities — Certain activities which drastically alter the natural and scenic qualities of streams in the system are *prohibited* by the State of Louisiana.

- Channelization
- Channel realignment
- Clearing and snagging
- Impoundments
- Commercial clearcutting within 100 feet of the low-water mark

Scenic River Permit Requirements

Activities requiring permit — Any other activity that may have a direct, significant ecological impact on the river must be permitted by the Louisiana Department of Wildlife and Fisheries. In addition, four other agencies — the Department of Environmental Quality, Department of Agriculture and Forestry, Department of Culture, Recreation and Tourism, and the Office of State Planning — review permit applications. **Activities which must be permitted**, for example, include, but are not limited to:

- Bridge, pipeline and powerline crossings
- Bulkheads, piers, docks and ramps
- Waste water discharges
- Land development adjacent to the river
- Aerial application of pesticides and fertilizers to fields adjacent to scenic streams.
- Water withdrawals

Contact the Louisiana Department of Wildlife & Fisheries for permitting information under the Louisiana Natural & Scenic Rivers System.

Activities exempted from regulation by the act — While clearcutting of trees for commercial purposes within 100 feet of the low water mark is prohibited, removal of a portion of the trees is allowed as follows:

- *Selective harvesting* — The selective harvesting of trees for commercial purposes is exempt under the following definition: the removal of trees, either as single scat-

tered individuals or in small groups at relatively short intervals, resulting in openings generally less in width than twice the height of the dominant trees. Repeated indefinitely, selective harvesting ensures the continuous establishment of reproduction, and an uneven aged stand adequate to encourage and maintain stream shading and stream bank integrity.”

- The cutting of trees for the control of disease or insects
- The harvesting of timber for personal use by the person who owns or leases the property

BMPs for Natural & Scenic Rivers

ACTIVITIES REQUIRING PERMIT

- Bridge, pipeline and powerline crossings
- Bulkheads, piers, docks and ramps
- Waste water discharges
- Land development adjacent to the river
- Aerial application of pesticides and fertilizers to fields adjacent to scenic streams.

ACTIVITIES REQUIRING NOTIFICATION OF THE LOUISIANA OFFICE OF FORESTRY

- Selective harvest in 100 foot buffer
- Cutting trees for insect and / or disease control
- Harvesting trees for personal use

Permits are not required for harvesting trees adjacent to natural and scenic rivers, as outlined above, provided that *prior notification* is given to the Louisiana Office of Forestry.

Disposal of trees or tree tops into a Scenic River is a violation of both the State Water Pollution Control Act and the Scenic Rivers Act. The riparian landowner is liable for a violation of this nature regardless of who actually placed the trees or tops into the stream.

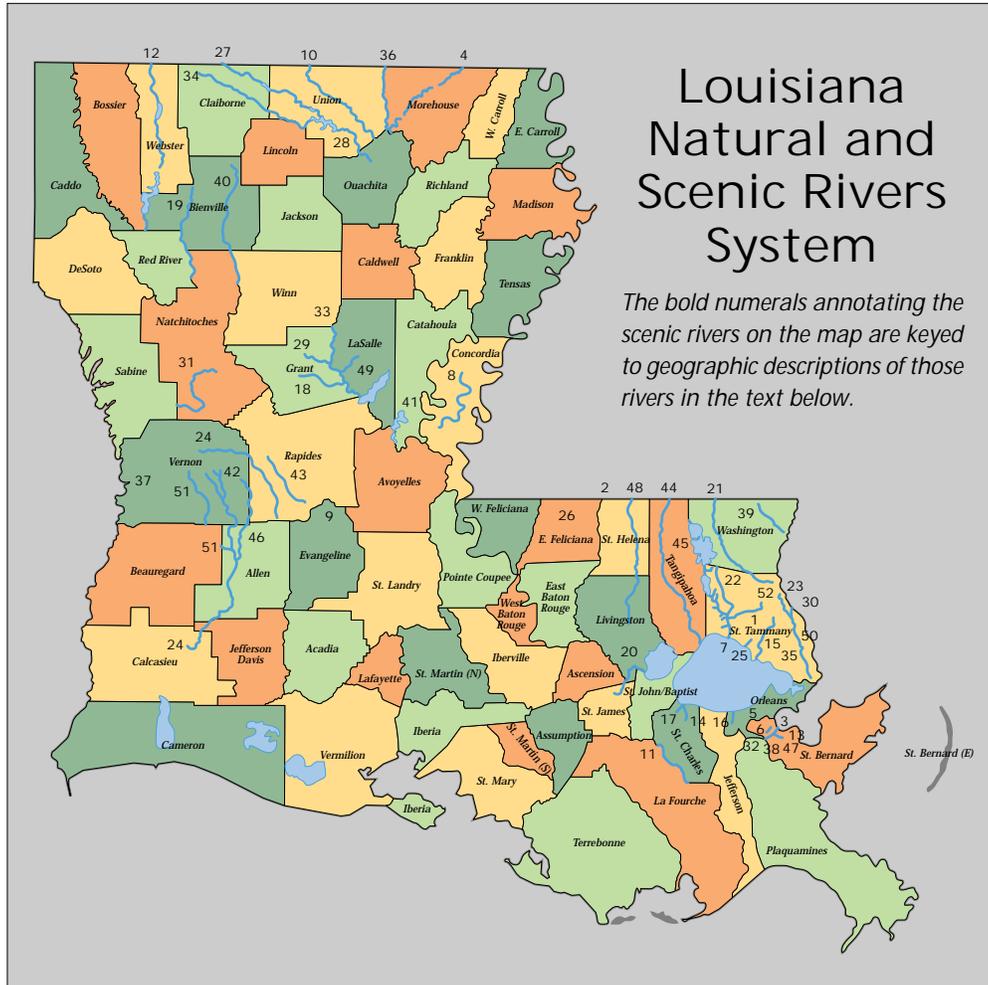
AVOID

PROHIBITED BY THE STATE OF LOUISIANA

- Channelization
- Channel realignment
- Clearing and snagging
- Impoundments
- Commercial clearcutting of timber within 100 feet of the low-water mark

Louisiana Natural and Scenic Rivers System

The bold numerals annotating the scenic rivers on the map are keyed to geographic descriptions of those rivers in the text below.



- 1. Abita River, St. Tammany** — From its headwaters to its entrance into the Bogue Falaya River.
- 2. Amite River, East Feliciana** — From the Mississippi state line to Louisiana Highway 37.
- 3. Bashman Bayou, St. Bernard** — From its origin to Bayou Dupre.
- 4. Bayou Bartholomew, Morehouse** — From the Louisiana-Arkansas state line to Dead Bayou.
- 5. Bayou Bienvenue, St. Bernard** — From Bayou Villere to Lake Borgne.
- 6. Bayou Chaperon, St. Bernard** — From its point of origin to its end.
- 7. Bayou Chinchuba, St. Tammany** — From the West Causeway approach south to Lake Pontchartrain.
- 8. Bayou Cocodrie, Concordia** — From Wild Cow Bayou to Little Cross Bayou.
- 9. Bayou Cocodrie, Rapides, Evangeline** — From U.S. Highway 167 to the Bayou Boeuf-Cocodrie Diversion Canal.
- 10. Bayou D'Outre, Ouachita, Union** — From the Louisiana-Arkansas state line to its entrance into the Ouachita River.
- 11. Bayou Des Allemands, LaFourche, St. Charles** — From Lac Des Allemands to Lake Salvador.
- 12. Bayou Dorcheat, Webster** — From the Arkansas state line to its entrance into Lake Bistineau.
- 13. Bayou Dupre, St. Bernard** — From the Lake Borgne Canal to Terre Beau Bayou.
- 14. Bayou La Branche, St. Charles** — From its source to where it drains into Lake Pontchartrain.
- 15. Bayou La Combe, St. Tammany** — From its headwaters to Lake Pontchartrain.
- 16. Bayou St. John, Orleans** — From its point of origin to its entrance into Lake Pontchartrain.
- 17. Bayou Trepagnier, St. Charles** — From Norco to where it joins Bayou La Branche.
- 18. Big Creek, Grant** — From Highway 167 in Grant Parish to its entrance into Little River.

19. **Black Lake Bayou**, *Red River, Winn, Bienville* — From the Webster-Bienville Parish line to Black Lake in Natchitoches Parish.
20. **Blind River**, *St. James, Ascension, Livingston, St. John* — From its origin in St. James Parish to its entrance into Lake Maurepas.
21. **Bogue Chitto River**, *Washington, St. Tammany* — From the Louisiana-Mississippi state line to its entrance into the Pearl River Navigation Canal.
22. **Bogue Falaya River**, *St. Tammany* — The river from its headwaters to Louisiana Highway 437 in St. Tammany Parish.
23. **Bradley Slough (Bayou)**, *St. Tammany* — all of that portion of the slough lying within the boundaries of St. Tammany Parish.
24. **Calcasieu River**, *Vernon, Rapides* — From Louisiana Highway 8 east through Vernon Parish and all of that portion of said river lying within the boundaries of Rapides Parish.
Allen, Jefferson Davis, Calcasieu — From the mouth of the Whiskey Chitto River in Allen Parish, south through Jefferson Davis Parish, and to its intersection with the Ward Eight Park in Calcasieu Parish.
25. **Cane Bayou**, *St. Tammany* — From its headwaters to Lake Pontchartrain.
26. **Comite River**, *East Feliciana, East Baton Rouge* — From the Wilson-Clinton Highway in East Feliciana Parish to the entrance of White Bayou in East Baton Rouge Parish.
27. **Corney Bayou**, *Claiborne, Union* — From the Louisiana-Arkansas state line to Corney Lake and Corney Lake Dam to Lake D'Arbonne.
28. **D'Arbonne Bayou**, *Union, Ouachita* — From the Lake D'Arbonne Dam to its entrance into the Ouachita River.
29. **Fish Creek**, *Grant* — From its origin near Williana to its entrance into Little River.
30. **Holmes Bayou**, *St. Tammany* — All of that portion of the bayou lying within the boundaries of St. Tammany Parish.
31. **Kisatchie Bayou**, *Natchitoches* — From its entrance into Kisatchie National Forest to its entrance into Old River.
32. **Lake Borgne Canal (Violet Canal)**, *St. Bernard* — From the Forty Arpent Canal to Bayou Dupre.
33. **Little River**, *Rapides, Grant, Catahoula, LaSalle* — From the juncture of Dugdemona and Castor Creek to its entrance into Catahoula Lake.
34. **Middle Fork of Bayou D'Arbonne**, *Claiborne, Union* — From its origin near Louisiana Highway 2 Alternate to Lake D'Arbonne.
35. **Morgan River**, *St. Tammany* — From its juncture with the Porters River to its re-entry into the West Pearl River.
36. **Ouachita River**, *Morehouse, Union* — From the north bank of Bayou Bartholomew at its intersection with the Ouachita River to the Arkansas state line.
37. **Pearl Creek**, *Vernon* — From Louisiana Highway 111 to its entrance into Sabine River.
38. **Pirogue Bayou**, *St. Bernard* — From Bayou Dupre to New Canal.
39. **Pushpatapa Creek**, *Washington* — From East Fork and West Fork join near state line to where it breaks up prior to its entrance into the Pearl River.
40. **Saline Bayou**, *Bienville, Winn, Natchitoches* — From its origin near Arcadia Louisiana to Highway 156 in Winn Parish.
41. **Saline Bayou**, *Catahoula, LaSalle* — From Saline Lake to Larto Lake.
42. **Six Mile Creek**, *Allen, Vernon* — Includes the East & West Forks and beginning at the boundary of Fort Polk Military Reservation (Lookout Road) and extending south through Vernon and Allen Parishes to its entrance into Whiskey Chitto Creek.
43. **Spring Creek**, *Rapides* — From Otis to Cocodrie Lake in Rapides Parish.
44. **Tangipahoa River**, *Tangipahoa* — From the Mississippi-Louisiana state line to the I-12 crossing.
45. **Tchefuncte River and its Tributaries**, *Washington, Tangipahoa, St. Tammany* — From origin in Tangipahoa Parish to its juncture with the Bogue Falaya River, and from the Bogue Falaya River to Louisiana Highway 22, excluding any tributaries thereto from the Bogue Falaya south to Louisiana Highway 22.
46. **Ten Mile Creek**, *Rapides, Allen, Vernon* — From the boundary of Fort Polk Military Reservation (Lookout Road) through Vernon Parish and all of that portion of said creek lying within the boundaries of Rapides and Allen Parishes.
47. **Terre Beau Bayou**, *St. Bernard* — From Bayou Dupre to the New Canal.
48. **Tickfaw River**, *St. Helena* — From the Louisiana-Mississippi state line to Louisiana Highway 42.
49. **Trout Creek**, *LaSalle* — From its origin near Highway 8 to its entrance into Little River.
50. **West Pearl River**, *St. Tammany* — From the confluence of Wilson and Bradley Sloughs to its entrance into Lake Borgne.
51. **Whiskey Chitto Creek**, *Vernon* — From the boundary of Fort Polk Military Reservation (Lookout Road) to the Vernon-Beauregard Parish line. *Allen* — From the Beauregard Parish line to its entrance into the Calcasieu River.
52. **Wilson Slough (Bayou)**, *St. Tammany* — All of that portion of the slough lying within the boundaries of St. Tammany Parish.

Louisiana's Natural & Scenic Rivers

NOTIFICATION OF COMMERCIAL HARVESTING

**LOUISIANA OFFICE OF FORESTRY (LOF)
NOTIFICATION OF COMMERCIAL HARVESTING
ADJACENT TO NATURAL AND SCENIC RIVERS**

A. Date LOF notified _____

B. Name of designated natural or scenic river _____

C. Landowner _____

D. Location:

Parish _____ Section _____

Township _____ Range _____

E. Estimated date operation will begin _____

F. Estimated date operation will end _____

G. Person notifying LOF: 1. Name _____

2. Phone No. _____

H. LOF person receiving notice _____

I. Inspecting forester _____

J. Date inspected _____

K. Retain this form in district office files and send copy to:

Scenic River Coordinator
Department of Wildlife & Fisheries
P. O. Box 98000
Baton Rouge, LA 70898-9000

Chief, Forest Management
LA Office of Forestry
P. O. Box 1628
Baton Rouge, LA 70821-1628

Glossary

TERMS OF FOREST MANAGEMENT

Access road— A temporary or permanent access route for vehicular traffic.

Barriers— An obstruction, intended to restrict pedestrian, horse, or vehicular traffic to a specific location.

Bedding— A site preparation technique, usually in wet areas, whereby a small ridge of soil is formed as an elevated planting or seedbed.

Best management practices (BMPs)— Forest management practices, developed to minimize or prevent non-point source water pollution.

BMPs, 15 Mandatory— See page 36.

Borrow pit— An area that has been excavated for earthen material.

Broad-based dip— A surface drainage structure specifically designed to drain water from an access road while allowing vehicles to maintain normal travel speeds.

Buffer strip— A relatively undisturbed section of forest adjacent to an area requiring special attention or protection such as a stream or lake.

Channel— A natural stream which conveys surface runoff water within well-defined banks.

Chemical site preparation— The use of herbicides to control plant competition to prepare an area for the establishment of a future forest either by artificial or natural means.

Chopping— The flattening of vegetation remaining after harvest in order to concentrate it near the ground.

Clearcutting— The total removal of a merchantable tree crop from an area.

Contour— An imaginary line on the surface of the earth connecting points of the same elevation.

Contour line— A line drawn on a map connecting points of the same elevation.

Corduroy— Placing small poles side by side, perpendicular to the roadway, usually over a mat of woody vegetation.

Culvert— Pipe made of metal, plastic, or other suitable material; installed under roads to transmit water from the roadway or side ditches, storm runoff, seeps and drains.

Cut and fill— Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or road fill areas.

Disking— Tilling soil to enhance site preparation.

Diversion ditch— A drainage depression or ditch built across a slope to divert surface water from that slope.

Ephemeral stream— A water course generally without a well-defined channel that flows only in response to rainfall. These streams flow less than 20% of the year during normal rainfall conditions.

Erosion— The detachment and transportation of soil particles.

Filter strip— A vegetated area of land separating a water body from forest management activities.

Firebreak (fire lane)— Naturally occurring or man-made barriers to the spread of fire.

Fireline— A barrier used to stop the spread of fire, constructed by removing fuel or rendering fuel inflammable using water or fire retardant.

Ford — A natural or paved stream crossing suitable for shallow streams with stable bottoms.

Forest practices — An activity related to the growing, protecting, harvesting, and processing of forest tree species.

Forestry — The science, the art and the practice of managing and using for human benefit the natural resources that occur on and in association with forest lands.

Grade — The slope of a road, usually expressed as a percent.

Gully — An eroded channel at least 12 inches deep.

Harvesting — The removal of merchantable tree crops from an area.

Herbicide — Any chemical or mixture of chemicals intended to prevent the growth of or promote the removal of targeted trees, bushes, and/or herbaceous vegetation.

High-flotation equipment — Machinery that exerts low ground pressure.

Humus layer — The top layer of the soil formed by the decay of organic matter.

Intermittent stream — A watercourse that flows in a well-defined channel for 20–90% of the year during normal rainfall conditions.

Jurisdictional wetlands — Areas subject to the regulations of the Clean Water Act of 1987; generally, concave or low-lying topographic forms that collect, store, or flow water frequently enough to favor a majority of plants that are adapted to saturated soil conditions.

Lateral ditch — A water turnout to move water from the roadway or road side ditches. It is the same as a wing ditch or diversion ditch.

Log deck — A place where logs are assembled for temporary storage, loading and transportation.

Logging — The felling and transportation of wood products from the forest to a delivery location.

Logging debris — The unutilized and generally unmarketable accumulation of woody material, such as limbs, tops, and stumps, that remains after timber removal.

Low-water bridge — A stream crossing structure built with the expectation that, during periods of high water or flood, water will flow over the structure.

Mineral soil — The layer of earth composed of sand, silt, and clay, in varying amounts, with less than 20% organic matter in the surface layer.

Mulching — Covering an area loosely with some material to hold soil in place and facilitate revegetation. Straw, bark, hay, or wood fibers are common mulches.

Natural channel — A water course created by the erosive forces of water moving over land.

Natural regeneration — The planned regeneration of a forest that either uses existing trees as a source of seed or encourages sprouting from stumps or roots.

Non-point source pollution — Pollution which is 1) induced by natural processes, including precipitation, seepage, percolation, and runoff; 2) not traceable to any discrete or identifiable facility; 3) controllable through the utilization of best management practices.

Nutrients — Mineral elements in the forest ecosystem such as nitrogen, phosphorus, and potassium, usually insoluble compounds that are present naturally or they may be added to the forest environment as forest chemicals, such as fertilizer.

Organics — Particles of vegetative material in the water, which can degrade water quality by decreasing dissolved oxygen and by releasing organic solutes during leaching.

Outfall protection — A rip-rap or aggregate placed at the outlet of a culvert or water-control device to protect that area from erosion damage due to the force or velocity of the outlet of water.

Outslope road — A road along a hill constructed so that the water will flow across the road toward its downhill side.

Perennial stream— A watercourse that flows continuously (at least 90% of the year) in a well-defined channel.

Pesticides— Any chemical substance that is used to control undesirable insects, diseases, vegetation, animals, or other forms of life.

Point source pollution— Sources of water pollution which can be traced to a specific place or location.

Pollution— The presence in a body of water (or soil or air) of substances of such character and in such quantities that the natural quality of the environment is impaired or rendered harmful to health and life or offensive to the senses.

Prescribed burning— The controlled application of fire to wild land fuels under such conditions of weather, fuel moisture, etc. which allows the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread needed to further certain planned objectives (of silviculture, wildlife habitat management, grazing, fire hazard reduction, etc.).

Permanent road— A high specification permanent road which is maintained periodically and serves as a main artery in a network of roads.

Parallel ditch— A drainage ditch alongside and parallel to a road.

Regeneration— The young tree crop replacing older trees removed by harvest or disaster; the process of replacing old trees with young.

Residual trees— Live trees left standing after the completion of harvesting.

Rill erosion— An erosion process in which numerous small channels only several inches deep are formed. Occurs mainly on disturbed and exposed soils.

Riparian— The land adjacent to and pertaining to the banks of streams, rivers, or other water bodies.

Rip-rap— Aggregate placed on erodible sites to reduce the impact of rain or surface runoff on these areas.

Rutting— Tracks in the soil resulting from the passage of heavy vehicles.

Rolling dip— Cross between a water bar and a broad-based dip; it has a reverse grade, but is shorter than a broad-based dip.

Salvage cut— Removal of trees that are dead or imminently threatened with death in order to utilize their wood before it is ruined by natural decay agents.

Scarify— To break up the forest floor and topsoil preparatory to natural or direct seeding (or the planting of seedlings).

Secondary road— A road constructed for a particular use or single operation and normally abandoned upon completion of the operation.

Sediment— Soil material suspended in air or water which is being transported or moved from its original site; the material which is deposited.

Seedbed— The soil prepared by natural or artificial means to promote the germination of seed and the growth of seedlings. (also see log deck)

Set— A place where logs are assembled for temporary storage, loading, and subsequent transportation.

Shearing— A site preparation method that involves cutting brush, trees, and other vegetation at the ground level using tractors equipped with angled or v-shaped cutting blades.

Sheet erosion— The removal of a fairly uniform layer of soil from the soil surface by water runoff.

Side ditch— A drainage ditch alongside and parallel to a road.

Silvicultural activities— All forest management activities, including intermediate cutting, harvest, log transportation, and forest road construction (EPA interpretation).

Silviculture — Generally, the science and art of cultivating (growing and managing) forest crops, based on a knowledge of silvics; and more particularly, the theory and practice of controlling the establishment, composition, constitution and growth of forests. (Society of American Foresters)

Site preparation — A general term for removing unwanted vegetation and other material — if necessary — and soil preparation carried out before reforestation.

Skid trail — A route over which logs are moved from the location where the trees were felled to a landing or road.

Soil productivity — The output or productive capability of a forest soil to grow timber crops.

Slope — Steepness of the land expressed as the amount (in percent) of vertical fall per 100 ft. of horizontal distance.

Soil — The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil conservation — Using the soil within the limits of its physical characteristics and protecting it from unalterable limitations of climate and topography.

Stream — A well-defined natural channel that has a flow anywhere below its headwaters greater than 5 cubic feet per second at least 50% of the time (EPA—US Army Corps of Engineers). A permanently or intermittently flowing body of water that follows a defined course.

Ephemeral stream flows during precipitation events and for a short period thereafter along a course that may or may not have a well-defined channel.

Intermittent stream flows only during wet periods (20–90% of the year), in a continuous, well-defined channel.

Perennial stream flows most of the time (more than 90% of the year) and flows in a well-defined channel.

Streambanks — The boundaries of a stream which contain normal flows.

Streamside management zone (SMZ) — Also known as riparian zones, these are sensitive areas adjacent to lakes, streams, and water courses where extra precautions in carrying out forest practices are necessary to protect water quality.

Temporary road — A minimal road of short-term use, which links timberland parcels to a permanent road.

Turnout — Drainage ditch which drains water away from roads. (see wing ditch)

Waterbar — A diversion dam constructed across a road or a trail to remove and disperse surface runoff in a manner which adequately protects the soil resource and limits sediment transportation.

Water body — An area of standing water with relatively little or slow movement (pond, lake, bay, slough).

Water course — A definite channel with bed and banks within which concentrated water flows continuously or intermittently.

Water pollution — Contamination or other alteration of the physical, chemical or biological properties of any natural waters of the state, or other such discharge of any liquid, gaseous or solid substance into any waters of the state, as well, or is likely to create a nuisance or render such waters harmful or detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life. (EPA definition)

Water quality — A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Watershed area — All land and water within the confines of a drainage divide.

Wetlands — Geographic area characteristically supporting hydrophytes, hydric soils, and some saturation or flooding during the growing season.

Windrow — Slash, residue, and debris pushed and / or raked into rows.

Wing ditch — A water turnout or diversion ditch constructed to move and disperse water away from the road and side ditches into adjacent undisturbed areas so that the volume and velocity of water is reduced on slopes. It is the same as a lateral or diversion ditch.

Appendix I: Road Specifications

RECOMMENDATIONS FOR FOREST ROADS

The following is a simple list of recommended specifications for forest roads.

- Roads should follow ridges as much as possible with road grades between 2% to 10%. Grades steeper than 10% should not exceed 500 feet in length and slopes greater than 15% should not exceed 200 feet in length. By breaking or changing grade frequently fewer erosion problems will result than by using long, straight, continuous grades.
- On highly erodible soils, grades should be 8% or less, but grades exceeding 12% for 150 feet may be acceptable as long as measures are taken to prevent erosion. Graveling the road surface can help maintain stability.
- Intermittent or perennial streams should be crossed using bridges, culverts, or rock fords. Cross as close to a right angle to the stream as possible. Structures should be sized so as not to impede fish passage or stream flow (see pipe culvert recommended specifications, page 66; and size chart, page 62).
- Install water turnouts prior to a stream crossing to direct road runoff water into undisturbed areas of the streamside management zone (SMZ). Road gradients approaching water crossings should be changed to disperse surface water at least 50 feet from the stream. With the exception of stream crossings, roads should be located a minimum distance of 50 feet from any flowing or identifiable stream. Distance is measured from the bank to the edge of soil disturbance, or in case of fills, from the bottom of the fill slope.
- Outslope the entire width of a road where road gradient and soil type will permit. Usually inslope the road toward the bank as a safety precaution on sharp turns, steep road gradients, or slippery soils. Use cross drainage on inslope or crowned roads to limit travel distance of runoff water.
- Where roads are insloped or crowned, and gradients begin to exceed 2% for more than 200 feet, broad-based dips or rolling dips should be placed within the first 25 feet of the beginning of the incline.
- Haul roads that intersect highways should use gravel, mats or other means to keep mud off the highway.
- At culverts and dips, install rip-rap or other devices at the outlets to absorb and spread water, if needed.
- Use brush barriers or check dams as needed along roads and sensitive areas to filter sediment.
- Control the flow of water on road surfaces by keeping drainage systems open and intact during logging operations.
- Inspect roads at regular intervals to detect and correct potential maintenance problems.

Appendix I: Road Specifications

WING DITCHES

Definition: A water turnout, or diversion ditch constructed to move and disperse water away from the road and side ditches into adjacent undisturbed areas so that the volume and velocity of water is reduced on slopes.

Purpose: To collect and direct road surface runoff from one or both sides of the road away from the roadway and into undisturbed areas.

Conditions where practice applies: Any road or trail section where water could accumulate or accelerate. The water should be diverted onto undisturbed areas so the volume and velocity is reduced.

RECOMMENDED SPECIFICATIONS

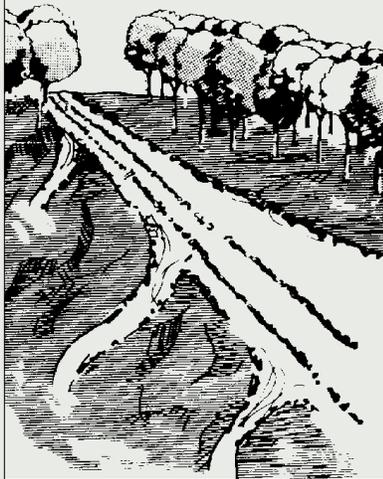
- The wing ditch should intersect the roadside ditch line at the same depth and be outsloped to a maximum grade of 2%.
- On sloping roads, the wing ditch should leave the road ditch line at a 30 to 45 degree angle to the roadbed and be downsloped less than 2% of the natural contour.
- Wing ditches may often be needed to provide stable outlets for other water control devices such as water bars and dips, but additional turnouts may also be needed along stretches of road where water is expected to collect. The spacing of wing ditches will be determined by the topography and relief of the area. Soil texture should also be considered for wing ditch spacing. On highly erodible or sandy soils wing ditches / turnouts should be spaced closer together than on clay soils.
- Wing ditches should not feed directly into adjacent drainages, gullies or channels.
- Wing ditches should be installed or cut solidly into the soil and wide enough to allow maintenance with logging equipment, such as skidders.

Recommended Wing Ditch Spacing

Slope Range		Maximum Distance Between Wing Ditches/ Turnouts (Feet)
Flat	2%	250
	3%	220
	4%	190
	5%	160
Moderate	6%	144
	7%	128
	8%	112
	9%	96
Steep	10%	80
	11%	60

Basic Specifications for Water Turnout Installation

Typical Wing Ditch Bar



Water Dispersal Area
Turns Downslope

Purposes— To safely divert water from a side ditch and disperse it onto a stable outlet.

Construction guidelines— Constructing wing ditches or water turnouts with as flat a bottom as possible:

- Begin the ditch with its bottom at the same depth as the road ditch
- Angle the turnout away from the road to direct all the water from the road ditch
- The curve the wing ditch across the hill to flatten out the grade in the ditch — however, be careful not to turn it back uphill
- Blend or feather the end onto a stable outlet to spread the water as much as possible
- avoid building turnouts that release water directly into streams

Distance guidelines— Water turnouts or wing ditches may often be needed to provide stable outlets for other water control devices such as water bars and dips, but additional turnouts may also be needed along stretches of road where water is expected to collect.

Appendix I: Road Specifications

STREAM CROSSINGS

Definition: Culverts, bridges, or rock fords that allow equipment to cross intermittent or perennial streams, or drains and drainage ditches, and insure minimal negative impact to the stream.

Purpose: To cross intermittent or perennial streams with minimal increase in stream sedimentation.

Conditions where practice applies: Used for ongoing operations where streams or drainages must be crossed by logging, site preparation, road maintenance, and fire suppression equipment.

RECOMMENDED SPECIFICATIONS

General

- Aggregate or other suitable material should be laid on approaches to fords, bridges, and culvert crossings to ensure a stable roadbed approach and minimize sediment in the stream.
- When necessary, stabilize road surfaces and cut and fill slopes using effective erosion control and water control methods (seeding, commercial erosion control material, rip-rap, etc.)
- Stream crossings will require frequent inspections during operations to determine their functional and safe condition. When needed, corrective measures should be taken immediately to restore to full functioning.

- Remove culverts and bridges from temporary stream crossings upon completion of operations and return the crossing as closely as possible to its original condition.

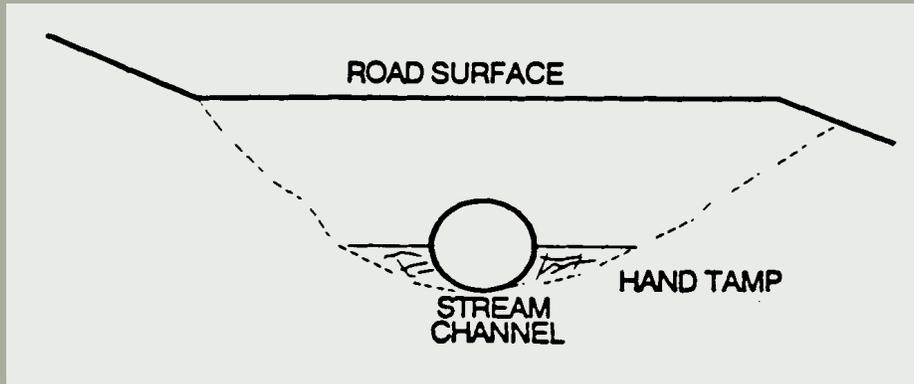
Bridges

- Bridges should be constructed with minimum disturbance to the stream bank, channel and adjacent SMZ.
- When it is necessary to protect approaches and roadbed fills near bridges, adequate erosion protection should be provided by head walls, wing walls, rip rap, etc.
- The use of temporary bridges may be necessary to minimize stream bank disturbances and provide a means of temporary access to critical areas when permanent structures are not warranted or needed.

Fords

- Rock fords may be used if no practical alternative exists. Approaches, stream banks, and stream bottoms must be hard enough or sufficiently stabilized to minimize stream bottom and bank disturbance.

Basic Specifications for Culvert Design and Installation



Definitions

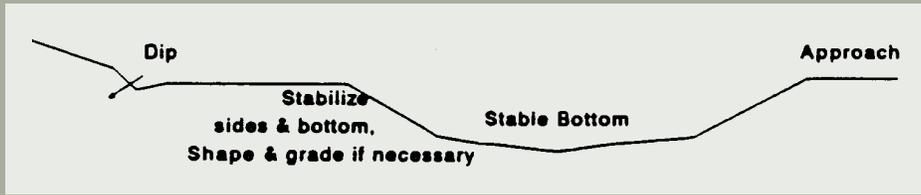
Peak runoff is the accumulated amount, in cubic feet per second, of a storm's runoff from an entire drainage area. Factors that affect runoff include vegetative cover, slopes and soils. The design guidelines included in this section are calculated on a 5-inch, 24-hour storm occurrence.

Head is the vertical column of water that is temporarily stacked over the culvert's entrance. Head provides the energy needed to force water through the culvert. The greater the head, the more water that can be forced through the pipe.

Construction guidelines

- Culverts should be placed in straight sections of stream channels
- The stream should have as straight an entrance and outlet as possible
- The inlet should be placed on the stream bed, not above it
- The approach to the stream crossing should be at right angles to the stream
- Seat the culvert on firm ground, not fill, and compact the earth at least halfway up the side of the culvert
- 18" of compacted fill over culverts is recommended

Basic Specifications for Installation of Fords



If fords (low-water crossings) are used

- Look for stream crossings that have low banks and solid stream beds
- Look for stream sections that can accommodate approaches of about 50 feet on both sides, and that are reasonably level
- Stabilize immediately, and if necessary use heavy applications of gravel
- Make crossings at right angles to the stream and only in straight sections, never in bends
- Install wing ditches, waterbars or dips before the crossing; this will drain water off the side of the road rather than into the stream
- Use other stream crossing methods such as culverts or bridges if water quality is important for domestic use, livestock water, fishponds, etc.
- Never use during high water periods

Appendix I: Road Specifications

Definition: Pipe made of metal, plastic, or other suitable material installed under haul roads to transmit water from the road side ditch, storm runoff, seeps and drains.

Purpose: To collect and transmit water safely from side ditches, seeps or natural drains under haul roads and skid trails without eroding the drainage system or road surface.

Conditions where practice applies: Culverts can be used for any size operation where cross drainage of water is needed. In some cases, a culvert is necessary for temporary drainage crossings. Permanent installation should be periodically inspected for obstructions.

RECOMMENDED SPECIFICATIONS

- Pipe length should be long enough so both ends extend at least one foot beyond the side slope of fill material.
- The culvert should be placed 1% to 2% downgrade to prevent clogging and laid so the bottom of the culvert is as close as possible to the natural grade of the ground or drain.

CULVERTS FOR ROADS

- The culvert should be angled 30 to 45 degrees to the direction of water flow.
- Erosion protection should be provided for outflows of culverts to minimize erosion downslope or downstream of the outfall; it may also be needed on the upstream end of culverts on flowing streams. This protection can be in the form of headwalls, rip rap, geotextile filter cloth, large stone, or pre-fabricated outflow and inflow devices.
- Culverts should be firmly seated and earth compacted at least halfway up the side of the pipe. Cover, equal to a minimum of half the culvert diameter (preferably 1 foot fill per 1 foot culvert diameter), should be placed above the culvert — but never use less than one foot of cover. The distance between pipes in a multiple culvert application should be a minimum of half the pipe diameter.

Culvert Size Chart									
Acres Drained	Light Soils (SANDS)			Medium Soils (LOAMS)			Heavy Soils (CLAYS)		
	Flat (%)	Mod (%)	Steep (%)	Flat (%)	Mod (%)	Steep (%)	Flat (%)	Mod (%)	Steep (%)
	0-5	5-15	15+	0-5	5-15	15+	0-5	5-15	15+
	Culvert Diameter in Inches								
5	18	18	18	18	18	21	21	21	24
10	18	18	18	21	24	27	27	27	36
20	18	18	18	24	27	36	36	36	42
30	18	18	18	27	30	36	36	42	48
40	18	18	18	27	36	42	42	48	
50	18	18	18	30	36	48	48	48	
75	18	21	21	36	42				
100	21	21	24	36	48				
150	21	24	24	42					
200	24	30	30	48					
250	27	30	30						
300	30	36	36						
350	30	36	42						
400	36	36	42						

Appendix I: Road Specifications

Definition: A surface drainage structure specifically designed to drain water from an access road, while allowing all vehicles to maintain normal travel speeds.

Purpose: To gather surface water and direct it off the road to prevent buildup of surface runoff and subsequent erosion, while allowing passage of traffic.

Conditions where practice applies: Used on truck haul roads and heavily used skid trails having a gradient of 8% or less. Should not be used for stream crossings.

Recommended Broad-based Dip Spacing		
Slope (%)	Distance Between Broad-based Dips (Feet)	
Flat	2%	300
	3%	233
	4%	200
	5%	180
Moderate	6%	166
	7%	157
	8%	150

BROAD-BASED DIPS

RECOMMENDED SPECIFICATIONS

- Installation should take place following basic clearing and grading for roadbed construction.
- A 20-foot long, 3% reverse grade is constructed into the existing roadbed by cutting from upgrade of the dip location.
- The cross drain outslope will be 2% to 3% maximum.
- An energy absorber such as rip rap and, in some cases, a level area where the water can spread, should be installed at the outfall of the dip to reduce water velocity thus minimizing erosion.
- On some soils the dip and reverse grade section may require bedding with three inches of crushed stone to avoid rutting the road surface.
- Broad-based dips are very effective in gathering surface water and directing it safely off the road. Dips should be placed across the road in the direction of water flow.
- Approximate recommended spacing table for broad-based dips.

Appendix I: Road Specifications

ROLLING DIPS

Definition: Rolling dips are a cross between water bars and broad-based dips. Like broad-based dips they have a reverse grade (except its shorter) and they direct water off the road. Like water bars they may rely on a mound of soil at the downhill side. Rolling dips should be used on roads with a steeper grade than where a broad-based dip is used.

Purpose: To gather water and direct it safely off the road to prevent buildup of surface runoff and subsequent erosion, while allowing passage of traffic.

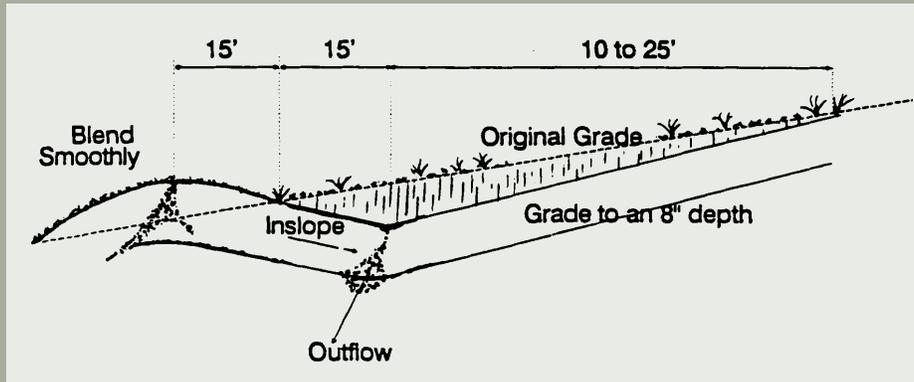
Conditions where practice applies: Used on truck haul roads and heavily used skid trails having a gradient of 15% or less. Should not be used for crossing streams, springs, and seeps.

RECOMMENDED SPECIFICATIONS

- Installation following basic clearing and grading for roadbed construction or on skid trails after logging is completed.
- A 10 to 15-foot long, 3% to 8% reverse grade is constructed into the roadbed by cutting from upgrade to the dip location and then using cut material to build the mound for the reverse grade.
- In hills, rolling dips are located to fit the terrain as much as possible. They should be spaced according to the slope of the planned roadbed.
- Spacing rolling dips can be determined from the adjacent table.

Recommended Rolling Dip Spacing		
Slope (%)	Distance Between Broad-based Dips (Feet)	
Flat	2%	300
	3%	233
	4%	200
	5%	180
Moderate	6%	167
	8%	150
Steep	9%	144
	11%	136
	13%	131
	15%	127

Basic Specifications for Rolling Dip Installation



Definition — Rolling dips are a cross between water bars and broad-based dips. Like broad-based dips, they have a grade (a shorter one) and they direct water from the roadway. Like water bars, they may also rely on a mound of soil at the down-hill side.

Purposes

- To gather water and direct it safely off the roadway
- To provide cross-drainage of inside ditches

Where suitable

- Not for handling live (constantly running) water

- On roads that will be used
- Can be employed on steeper grades than broad-based dips

Construction guidelines

- Place across the road in the direction of flow
- Outslope the dip only, not the road
- Mound excavated material from the dip on the down-hill side
- Blend the mound to as gentle a slope as possible, to make traveling over it easier

Appendix I: Road Specifications

WATERBARS

Definition: A diversion dam constructed across a road or trail to remove and disperse surface runoff in a manner which adequately protects the soil resource and limits sediment transportation.

Purpose: To gather and shed surface water off a road, firebreak, trail, etc. ; To prevent excessive erosion until natural or artificial revegetation can be established; To divert water from an inside (uphill) ditch.

Conditions where practice applies: This is a practice that can be utilized on limited use roads, trails and firebreaks and abandoned or retired roads and trails where surface water runoff may cause erosion of exposed soil.

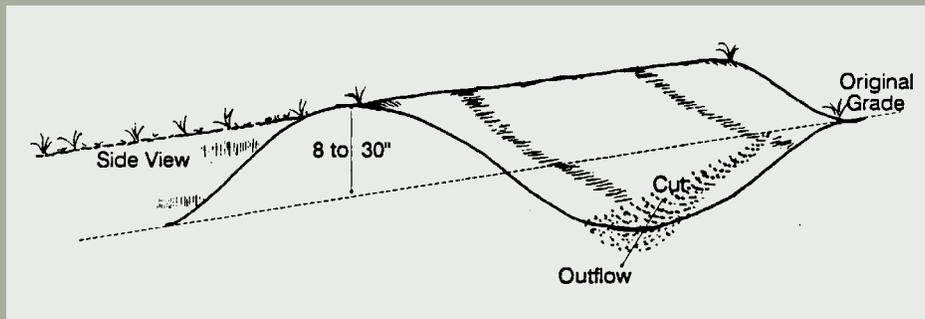
RECOMMENDED SPECIFICATIONS

- Waterbars should be placed at an angle of 30 to 45 degrees to the road, firebreak or trail. Waterbars are not dams. Waterbars intercept and / or divert surface water runoff.
- Recommended proper spacing between waterbars can be determined from the table, below left.
- The outflow end of the waterbar should be fully open and extend far enough beyond the edge of the road or trail to safely disperse runoff water onto the undisturbed forest floor. The outlet should fall no more than 2%.
- Specifications for waterbar construction on forest roads, trails and firebreaks must be site specific and should be adapted to existing soil and slope conditions.

Recommended Waterbar Spacing

Grade of Road		Distance Between Waterbars (Feet)
Flat	2%	250
	3%	220
	4%	190
	5%	160
Moderate	6%	144
	7%	128
	8%	112
	9%	96
Steep	10%	80
	11%	60

Basic Specifications for Waterbar Installation



Purposes

- To gather and shed surface water off a road, trail, firebreak, etc.
- To divert water from an inside ditch
- To prevent excessive erosion until revegetation can be established

Where suitable

- Roads and trails that will have no or very limited traffic
- Abandoned or retired roads and trails
- Firebreaks

Construction guidelines

- Angle across the road in the down-grade direction
- Tie the upper end into the inside ditch's bank, when present
- Empty onto stable outlets
- Can be constructed mechanically or by hand

Note: See the waterbar spacing guidelines displayed in the small table on the opposite page. In addition to distance between waterbars, consider taking advantage of factors such as slope changes, curves and presence of stable outlets.



Smurfit-Stone Container Corp. photo

Tree farmers practice sustainable forestry. That means they share a unique commitment to produce wood for America's needs while protecting our soil, water, and wildlife resources and providing recreation from our woodlands.

Appendix II: Planning Tools

EVALUATING SLOPE

Definition: Slope is the steepness of the land expressed as the amount (in percent) of vertical fall per 100 feet of horizontal distance. For example, a 3% slope means a three foot change in elevation per 100 feet of horizontal distance.

Importance of slope: Slope along with soil texture (sand, loam, clay) and ground cover determines how fast water will drain from an area. Water drains quickly from steep slopes, however erosion may be a problem. Flat surfaces may result in saturated soils. Slope can be managed during road design and layout.

Estimating slope: Slope can be divided into three broad categories: *flat*, *moderate*, and *steep*. Standing downhill, and facing uphill, try to look level back into the hill. To help keep your line of sight level, face uphill with your arm stretched out in front of you with a pencil (or a rolled up dollar bill) pointing up out of your fist. Looking over the tip of the pencil will keep your sight level. Estimate the horizontal, level distance between you and where your line of sight hits the ground. Divide the height distance by horizontal distance to determine the percent of slope. Instruments can be obtained to increase accuracy: an Abney level for \$100+, a clinometer for \$100, or a slope gauge for \$40.

Other sources of slope information:

- USGS topographic maps
- Soil surveys
- Soils maps

Appendix II: Planning Tools

EVALUATION OF AERIAL PHOTOS

Definition: Aerial photographs or “maps” are high altitude photos taken in a very concise and systematic manner. Although maps can be made in color and even infrared, the most commonly used aerial photos are black and white. The top of the map is usually north.

Information provided:

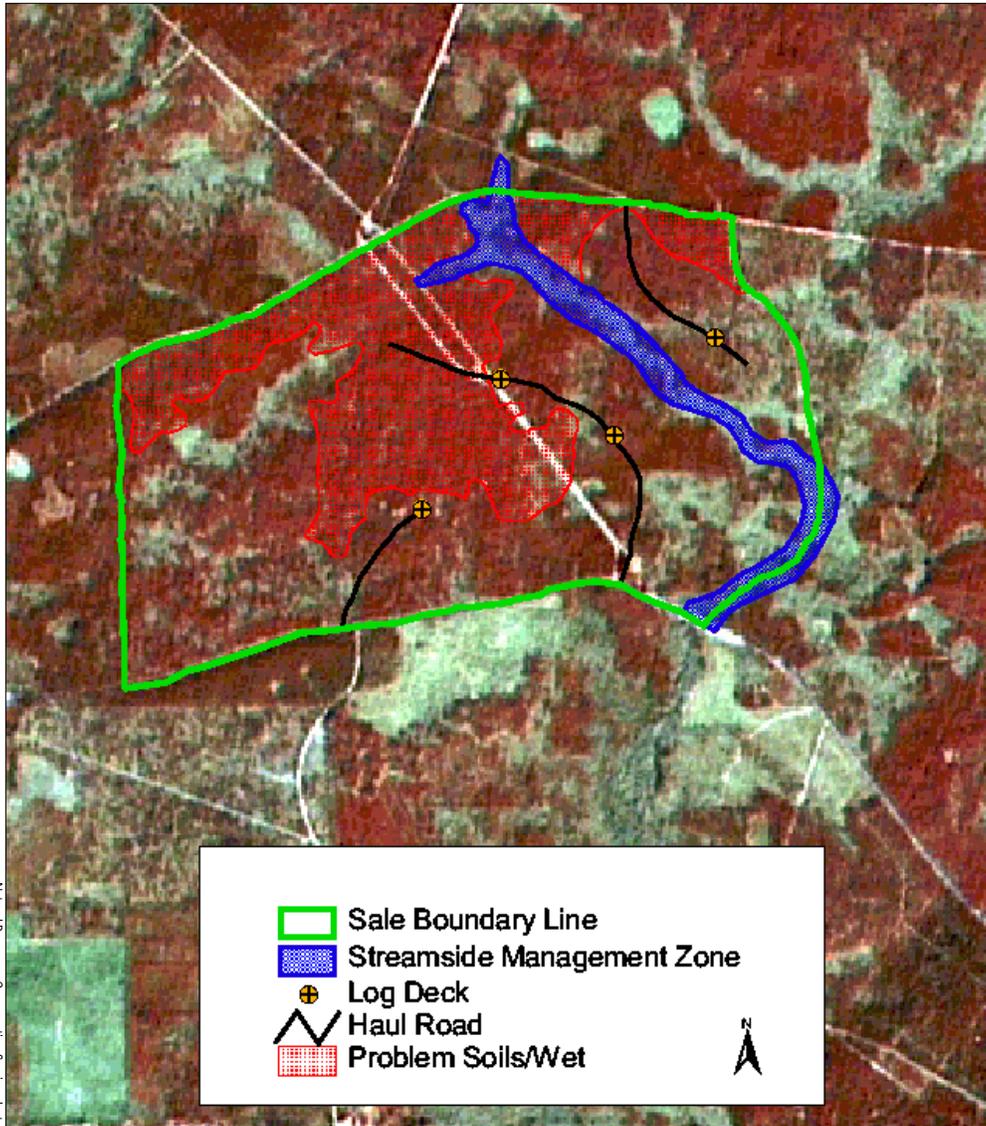
- Boundaries and timber types (for example, on aerial photos, pines appear darker than hardwoods)
- Drainage patterns
- Roads, buildings, etc.

Scale: Aerial photos come in many scales such as 1” = 660’, 1320’, etc. It is important to know the photo scale before using.

Sources for aerial photo information:

- Natural Resources Conservation Service
- Farm Services Agency
- Louisiana Department of Agriculture and Forestry
- Private vendors

Forest Hill, Louisiana



1:24,000

Aerial photographs are valuable planning tools.

Appendix II: Planning Tools

EVALUATION OF SOIL MAPS

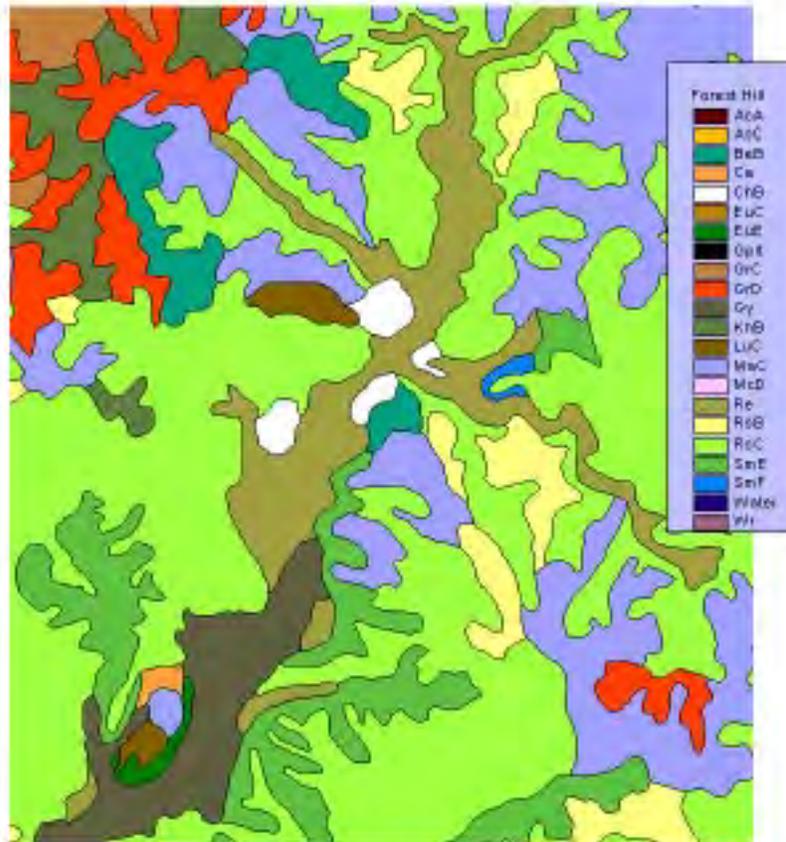
Definition: Soils maps are aerial photographs on which the types are delineated. Soils are classified, mapped, and published by the Natural Resources Conservation Service into a book called a Soil Survey. A Soil Survey can be obtained at your local NRCS office.

Use for soil maps:

- Plan routes
- Avoid problem areas such as wet areas
- Plan where and how to cross streams
- Estimate slopes that may be encountered
- Determine drainage patterns

Soil surveys and soils maps are important planning tools, but an on-site check of the exact soil type and slope is essential.

Forest Hill, Louisiana



Natural Resources Conservation Service map

EVALUATION OF SOIL MAPS

Soil maps are available in each Louisiana parish. They are available to the public at the local (USDA) Natural Resources Conservation office.

Appendix II: Planning Tools

EVALUATION OF TOPOGRAPHIC MAPS

Definition: Topographic maps or “quad sheets” are printed maps that portray the relief of the landscape. In addition, they also display physical features such as roads, buildings, rivers, and creeks.

Scale: The most common used topographic map is the 7.5 minute map which has a scale of 1:24,000 or 1 inch = 2,000 feet. In any case, scale is displayed at the bottom of the map.

Relief: Changes in elevation are shown by a series of contour interval lines. These lines represent a point’s elevation above sea level. Any point along a line is the same elevation as any other point on the same line. The closer the contour lines are to each other, the steeper the slope. The elevation distance between the lines is usually 5 or 10 feet. This information is given at the bottom center of the map. The elevation is frequently printed along several of the contour lines.

Determining slope: Determine the elevation change between two points from the contour lines, being sure to use the proper contour interval. Divide this change by the distance between the two points, using the scale at the bottom of the map. Multiply by 100 to get the percent slope.

Forest Hill, Louisiana



1:24000

Contour Interval 10 Feet

Base Image:
USGS 7.5' Quad, UTM Ellipsoid-Clarke85

Natural Resources Conservation Service map

EVALUATION OF TOPOGRAPHIC MAPS

Topographic maps are available from most forestry and engineering suppliers.

Appendix II: Planning Tools

EVALUATION OF DRAINAGE AREA

Definition: Drainage area, or watershed, is the total number of acres which drain to a common point, such as a culvert, creek crossing, or bridge. Determining the acreage in the watershed is important in sizing culverts, locating stream crossings, or locating bridges.

Using topographic maps: Topographic maps show changes in elevation by a series of contour lines. These lines can be used to determine which slopes drain through an area. To determine the watershed, it is helpful to remember two things:

- On hilltops, contour lines will form a small, roughly circular shape.
- On contour lines with fingerlike projections, the fingers point uphill.

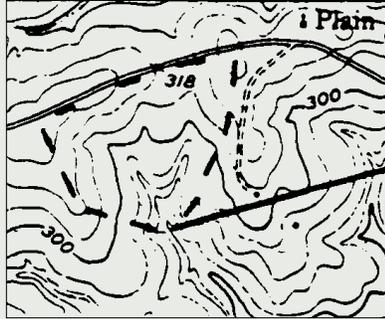
The watershed can be defined by drawing arrows in the direction of drainage to the common point.

Determining areas: After the watershed is drawn, the number of acres in the area can be estimated. For a topographic map with a scale of 1:24,000 (a 7.5 minute map) the table below can be used as a quick guide.

Guide for Area Estimation on 7.5-Minute Topographic Maps	
Facsimile / Shape	Acres
Head of pencil eraser	5
Dime	40
Nickel	50
Quarter	70
1" X 1" square	90

Estimating Storm Runoff for Culvert Sizing

Sample Topographic Map



Estimation guidelines

- Using appropriate maps (like topo map, left), estimate the drainage area for the stream crossing site.
- Using either a soils map or testing the texture by feel, determine if the drainage is predominantly sandy, loamy or clayey.
- Determine the average slope class (flat, moderate or steep) of the drainage area. Although most drainage areas will be either flat or moderate, do not consider the crossing site only, but the whole drainage area.
- Using the table below, determine the runoff for a 5-inch, 24-hour storm for the appropriate drainage area, soil type and slope class.

Peak Runoff from A 5-Inch Storm, in Cubic Feet per Second

Acres	Flat Slopes			Moderate Slopes			Steep Slopes		
	Sand	Loam	Clay	Sand	Loam	Clay	Sand	Loam	Clay
5	4	9	15	6	12	19	8	14	20
10	7	14	24	11	21	35	15	27	40
15	9	19	32	14	29	47	21	39	57
20	11	23	40	17	35	60	26	50	75
25	12	26	47	20	42	70	30	60	92
30	14	30	52	23	47	80	35	70	110
35	15	32	60	25	52	90	40	77	125
40	17	35	65	27	57	100	43	85	140
45	18	37	70	30	62	120	47	95	150
50	19	40	75	32	67	140	50	100	165
75	25	52	100	42	87	160	67	130	230
100	30	65	120	50	110	190	80	170	290



Jim Finley photo

An example of rolling dips on a permanent road.

Appendix III: Road Surface Area

DETERMINING ROAD SURFACE AREA

The following is intended as an aid to determining the surface area of roads.

- Determine the road acreage for each segment of the road system from the Road Surface Area table given below.
- Combine the acreage of each road segment to determine the total acreage of the entire road system.
- Multiply the total acreage of the road system by the recommended application/acre of the appropriate revegetating material (e.g., fertilizer, seed mix, mulch, etc.) to determine the total amount of materials needed.

Guide for Determining Road Surface Area

Road Length (FEET)	Road Width (FEET)						
	8	10	12	14	16	18	20
	A C R E S						
50	0.010	0.010	0.010	0.020	0.020	0.020	0.020
100	0.022	0.020	0.030	0.030	0.040	0.040	0.050
250	0.050	0.060	0.070	0.080	0.090	0.100	0.110
500	0.090	0.120	0.140	0.160	0.180	0.210	0.230
750	0.144	0.170	0.210	0.240	0.270	0.310	0.340
1,000	0.180	0.240	0.280	0.320	0.370	0.410	0.460
1,500	0.280	0.340	0.410	0.480	0.550	0.620	0.690
2,000	0.360	0.480	0.560	0.640	0.730	0.830	0.920
5,000	0.920	1.150	1.380	1.610	1.800	2.070	2.300
5,280	0.970	1.210	1.450	1.700	1.940	2.180	2.430

Wider road widths can be calculated by using multiples from the above table

Appendix III: Road Surface Area

DETERMINING ROAD SURFACE MATERIAL

The following is intended as an aid to determining the surface area of other disturbed forest sites.

- Determine the acreage of each disturbed forest site using the following formula:

average length X average width = total square feet

total square feet / 43,560 = acreage

- Combine the acreage of each site to determine the total acreage of all disturbed sites.

- Multiply the total acreage of the disturbed sites by the recommended application / acre of the appropriate revegetating material, such as fertilizer, seed mix, and mulch, to determine the total amount of materials needed.

Surface Material Determination for Roads

CUBIC YARDS OF SURFACING MATERIAL PER 100 FEET OF ROAD LENGTH

Road Width, feet	Surfacing Material Thickness, inches		
	2	4	6
8	5	10	15
10	6	12	19
12	7	15	22
14	9	17	26
16	10	20	30
18	11	22	33
20	12	25	37
22	14	27	41
24	15	30	44

Appendix IV: Revegetation

REVEGETATING DISTURBED AREAS

Definition: The establishment of vegetation on disturbed soil areas not expected to naturally revegetate in time to prevent erosion.

Purpose: To stabilize the soil and minimize the chance of erosion.

Conditions where practice applies: On areas where activities expose mineral soil and where natural vegetation will not suffice; thus operations may accelerate erosion and contribute sediment to drainages. Other areas to consider are those with highly erodible soils or those severely eroded or gullied.

RECOMMENDED SPECIFICATIONS

Site & Seedbed Preparations

- All disturbed areas with a grade of 5 percent or greater and/or which are subject to excessive erosion should be seeded within the first 15 days of next seeding season after construction as weather permits. These steep grades and any other area with a high erosion potential (such as sets, skid trails, and haul roads) should be identified as soon as the operation is completed. See the tables on the following pages.
- Water control measures and / or shaping of the land should be completed as the operation is finished to guarantee the stability of the site until a ground cover becomes established.

Seeding

- Selected seed mixture may be broadcast or drilled. Seeding is usually more successful in the spring and fall. Broadcast seed can be covered by dragging a chain, brush, disk, or harrow or firming with a roller or cultipacker, or by drilling to ensure seed contact with the soil (0.5–1 inch deep). Permanent grasses may be seeded or sprigged into dead cover provided by temporary cover plants. A long-term perennial, fine-rooted seed mixture should be used for most effective erosion control.
- The objective of seeding is to quickly establish a ground cover that will hold the soil together under most conditions. Seed selection should consider the season, the soil type, the availability of sunlight to the area to be seeded, and the cost of the seed. To get the desired results, a combination of seeds may be required.
- Adapted plants — See the table, on the following pages, *Seed for Revegetation in Louisiana*, for a list of plants and their adaptation by soil types.
- Planting rates and dates — See the table on the following pages, *Revegetation – Planting Information*.
- When temporary cover plants such as annual, cool season crops are used, a follow-up to determine the need for permanent vegetation is needed.

- Legumes should always be used in mixes with grasses.
- Sprigging Methods — Sprigged plants such as Bermuda grass can be planted by sprigging either by hand or machine, or broadcasting the sprigs and then disking and firming with a roller.
- Fertilizing — Apply 600 to 650 lbs. of 13-13-13 (or its equivalent) per acre (these

rates are double normal rates) and either mix into the top 2–3” during seedbed preparation or at the time of planting. Care should be taken to insure that the fertilizer does not enter a stream. To avoid stream contamination, it is recommended that fertilizer not be applied within the streamside management zone. On small areas, fertilizer may be broadcast manually with a spreader prior to or at the time of seeding.

Seed for Revegetation in Louisiana				
Revegetation Type	Species	Sands	Loams	Clays
Annual Grass / crops	Millet			
	Brown top	X	X	X
	Foxtail	X	X	X
	Pearl	X	X	X
	Ryegrass		X	X
	Oats	X ¹	X	X
	Elbon rye	X	X	X
	Wheat	X ¹	X	X
Perennial Grasses	Bahia ²		X	X
	Bermuda			
	Alecia	X	X	X
	Coastal	X	X	X
	Selection 3	X	X	X
	Sheffield	X	X	X
	Common ²		X	X
	NK-37		X	X
	Tall fescue ²		X	X
	Lovegrass ²			
	Weeping	X	X	X
	Wilman	X	X	X
Alamo switchgrass		X	X	
Legumes	Singletary peas		X	X
	Hairy vetch	X	X	X
	Arrowleaf clover		X	X
	Subterranean clover	X	X	X

¹ Not adapted to very deep sands. ² Most shade tolerant. ³ Used as a temporary cover, in mixes, or for wildlife.

Revegetation — Planting Information

Revegetation Type and Season	Species Name	Season of Growth	Planting Dates	Planting Rate / Acre
Annual				
Grass / crops	Millet			
	Brown top	warm	4/15-8/1	40 lbs.
	Foxtail	warm	4/15-8/1	30 lbs.
	Pearl	warm	5/15-8/1	40 lbs.
	Ryegrass	cool	9/1-11/30	24 lbs.
	Oats	cool	9/1-11/30	128 lbs.
	Elbon rye	cool	9/1-11/30	112 lbs.
	Wheat	cool	9/1-11/30	120 lbs.
Perennial				
Grasses	Bahia ²	warm	year-round ²	30 lbs. ¹
	Bermuda			
	Alecia	warm	1/15-6/1	48 bu.
	Coastal	warm	1/15-6/1	48 bu.
	Selection 3	warm	1/15-6/1	48 bu.
	Sheffield	warm	1/15-6/1	48 bu.
	Common ²	warm	3/15-5/15	4 lbs. ¹
	NK-37	warm	3/15-5/15	4 lbs. ¹
	Tall fescue ²	cool	9/15-11/15	20 lbs. ¹
	Lovegrass ²			
	Weeping	warm	3/15-5/1	4 lbs. ¹
	Wilman	warm	3/15-5/1	4 lbs. ¹
	Alamo switchgrass	warm	3/15-5/1	7 lbs. ¹
Legumes³	Singleary peas	cool	9/15-11/30	70 lbs. ¹
	Hairy vetch	cool	9/15-11/30	40 lbs.
	Arrowleaf clover	cool	9/15-11/30	20 lbs.
	Subterranean clover	cool	9/15-11/30	20 lbs.
¹ Pure live seed (% germination x % purity = pure live seed. ² Bahia can be planted year-round if planted with an appropriate cover. ³ Inoculate legumes before planting. Note: Sowing rates are double normal rates to ensure maximum cover.				

REVEGETATING DISTURBED AREAS

