3J: Wetlands Forest Management

Management Measure for Wetlands Forest Management

Plan, operate, and manage normal, ongoing forestry activities (including harvesting; road design, construction, and maintenance; site preparation and regeneration; and chemical management) to adequately protect the aquatic functions of forested wetlands.

Management Measure Description

Forested wetlands provide many beneficial functions that need to be protected. Among these are floodflow alteration, sediment trapping, nutrient retention and removal, provision of important habitat for fish and wildlife, and provision of timber products. The extent of wetlands (including forested wetlands) in the continental United States has declined greatly in the past 40 years because of conversion to other land uses. There are currently approximately 100 million acres of wetlands in the 48 contiguous states, or about one-half of their extent at the time of European settlement. Although the rate of wetlands loss has slowed in recent years, the United States continues to sustain a net loss of approximately 58,000 acres per year. Forestry activities are the third leading cause of wetlands loss–behind urban development and agriculture–and accounted for 23 percent of wetland losses from 1986 to 1997 (Dahl, 2000). Given the historic and ongoing losses, it is critical that additional effects to wetlands be avoided and minimized to the maximum extent possible.

Potential effects of forestry operations in wetlands include the following:

- Loss and/or degradation due to discharges of dredged or fill material.
- Sediment production from road construction and use and equipment operation resulting in wetlands filling.
- Drainage alteration as a result of improper road construction and ditching. An excellent discussion of the relationship between forest roads and drainage is contained in the U.S. Forest Service document Water/Road Interaction Technology Series (USDA-FS, 1998b).
- Stream obstruction caused by failure to remove logging debris.
- Soil compaction caused by operation of logging vehicles during flooding periods or wet weather. Skid trails, haul roads, and log landings are areas where compaction is most severe.
- Contamination from improper application or use of pesticides.
- Loss of integrity of whole wetland landscapes (and the functions they serve) as a cumulative effect of incremental losses of small wetland tracts.

Potential adverse effects associated with road construction and maintenance in forested wetlands are alteration of drainage and flow patterns, increased erosion and sedimentation, habitat loss and degradation, and damage to existing timber stands. In an effort to prevent these potential adverse effects, section 404 of the Clean Water Act requires the use of appropriate BMPs for road construction and maintenance in wetlands so that flow and circulation patterns and chemical and biological characteristics are not impaired (see text below).

Harvest planning and selection of the right harvest system are essential in achieving the management objectives of timber production, ensuring stand establishment, and avoiding adverse effects on water quality and wetland functions and values. The potential effects of reproduction methods and cutting practices on wetlands include changes in water quality, water quantity, temperature, nutrient cycling, and aquatic habitat. Streams can also become blocked with logging debris if SMAs are not properly maintained or if appropriate practices are not employed in SMAs.

Site preparation includes but is not limited to the use of prescribed fire, chemicals, and/or mechanical site preparation. Extensive site preparation on bottoms where frequent flooding occurs can cause excessive erosion and stream sedimentation. The degree of acceptable site preparation is governed by the amount and frequency of flooding, soil type, and species suitability and is dependent on the regeneration method used.

Forestry in Wetlands: Section 404

Section 404 establishes a program that regulates the discharge of dredged or fill material into waters of the United States, including wetlands. The Corps and EPA jointly administer the program. The Corps administers the day-to-day program, including permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. EPA develops and interprets environmental criteria used in evaluating permit applications; determines the scope of geographic jurisdiction; and approves and oversees state assumption. EPA also identifies activities that are exempt, enforces Section 404 provisions, and has the authority to elevate and/or veto Corps permit decisions. In addition, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and state resource agencies have important advisory roles.

Section 404(f) exempts normal forestry activities (for example, bedding, seeding, harvesting, and minor drainage) that are part of an established, ongoing forestry operation. A forest operation ceases to be "established" when the area in which it was conducted has been converted to another use or has lain idle so long that modifications to the hydrological regime are necessary to resume operations (40 CFR Part 232.3(c)(1)(ii)(B)). This exemption does not apply to activities that represent a new use of the wetland and that would result in a reduction in reach or impairment of flow or circulation of waters of the United States, including wetlands. In addition, Section 404(f) provides an exemption of discharges of dredged or fill material for the purpose of constructing or maintaining forest roads, where such roads are constructed or maintained in accordance with BMPs to assure that the flow and circulation patterns and chemical and biological characteristics of the navigable waters are not impaired, that the reach of the navigable waters is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. Following are the section 404(f) regulations pertaining to forestry activities, including the BMPs for forest road construction or maintenance.

Code of Federal Regulations, Title 40, section 232.3: Activities Not Requiring a Section 404 Permit

Except as specified in paragraphs (a) and (b) of this section, any discharge of dredged or fill material that may result from any of the activities described in paragraph (c) of this section is not prohibited by or otherwise subject to regulation under this part.

(a) If any discharge of dredged or fill material resulting from the activities listed in paragraph (c) of this section contains any toxic pollutant listed under section 307 of the Act, such discharge shall be subject to any applicable toxic effluent standard or prohibition, and shall require a section 404 permit.

(b) Any discharge of dredged or fill material into waters of the United States incidental to any of the activities identified in paragraph (c) of this section must have a permit if it is part of an activity whose purpose is to convert an area of the waters of the United States into a use to which it was not previously subject, where the flow or circulation of waters of the United States may be impaired or the reach of such waters reduced. Where the proposed discharge will result in significant discernible alterations to flow or circulation, the presumption is that flow or circulation may be impaired by such alteration.

Note: For example, a permit will be required for the conversion of a cypress swamp to some other use or the conversion of a wetland from silvicultural to agricultural use when there is a discharge of dredged or fill material into waters of the United States in conjunction with construction of dikes, drainage ditches or other works or structures used to effect such conversion. A conversion of section 404 wetland to a non-wetland is a change in use of an area of waters of the U.S. A discharge which elevates the bottom of waters of the United States without converting it to dry land does not thereby reduce the reach of, but may alter the flow or circulation of, waters of the United States.

(c) The following activities are exempt from section 404 permit requirements, except as specified in paragraphs (a) and (b) of this section:

* * *

(6) Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment, where such roads are constructed and maintained in accordance with best management practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. The BMPs which must be applied to satisfy this provision include the following baseline provisions:

(i) Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the United States shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the United States;

(iii) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv) The fill shall be properly stabilized and maintained to prevent erosion during and following construction;

(v) Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within the waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(vi) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the United States shall be kept to a minimum;

(vii) 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;

(viii) Borrow material shall be taken from upland sources whenever feasible;

(ix) 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;

(x) Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi) The discharge shall not be located in the proximity of a public water supply intake;

(xii) The discharge shall not occur in areas of concentrated shellfish production;

(xiii) The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv) All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Best Management Practices

Wetland Harvesting Practices

◆ *Conduct forest harvesting according to preharvest planning designs and locations.*

Planning and close supervision of harvesting operations are needed to protect site integrity and enhance regeneration. Harvesting without regard to season, soil type, or type of equipment can damage the site productivity; retard regeneration; cause excessive rutting, churning, and puddling of saturated soils; and increase erosion and sedimentation of streams. Harvesting without regard to other activities occurring in the watershed can cause unacceptable cumulative effects.

◆ *Establish a streamside management area (SMA) adjacent to natural perennial streams, lakes, ponds, and other standing water in the forested wetland following the components of the SMA management measure.*

◆ *Select the harvesting method to minimize soil disturbance and hydrologic effects on the wetland.*

In seasonally flooded wetlands, a guideline is to use conventional skidder logging that employs equipment with low-ground-pressure tires, cable logging, or aerial logging. Comparisons of cable logging and helicopter logging have concluded that helicopter operations cause less site disturbance, are more economical, and provide greater yield. Table 3-40 presents one set of harvesting system recommendations by type of forested wetland (Florida Division of Forestry, 1988). Another alternative is to conduct harvesting during winter months when the ground is frozen (see below).

◆ *Use ultrawide, high-flotation tires on logging trucks and skidders to reduce soil compaction and erosion.*

Using dual-tired skidders and high-floatation tires for log hauling reduces soil damage, soil compaction, surface runoff, and sedimentation (Aust et al., 1994).

◆ *When ground skidding, use low-ground-pressure tires or tracked machines and confine skidding to a few primary skid trails to minimize site disturbance, soil compaction, and rutting. Adjust tire pressure on skidders during wet weather or when conducting forested wetland harvesting (Aust, Virginia Polytechnic Institute and State University, personal communication, 1999).*

Table 3-40. Recommended Harvesting Systems by Forested Wetland Site[a] (Florida Department of Agriculture and Consumer Services, 1988)

Site Type	Conventional	Conventional with Controlled Access[b]	Cable or Aerial	Barge or High Flotation Boom
Flowing Water				
Mineral Soil				
Alluvial River Bottom	B	A	C	C
Organic Soil				
Black River Bottom	B	A	C	C
Branch Bottom	A[c]	B	C	C
Cypress Strand	B	A	A	A
Muck Swamp	C	A	A	A
Nonflowing Water				
Mineral Soil				
Wet Hammock	B	A	C	C
Organic Soil				
Cypress Dome	B	A	A	A
Peat Swamp	C	A	A	A

Note: A = recommended; B = recommended when dry; C = not recommended.
[a] Recommendations include cost considerations
[b] Preplanned and designated skid trails and access roads.
[c] Log from the hill (high ground).

Research conducted by Randy Foltz of the Intermountain Research Station in the Lowell Ranger District of the Willamette National Forest, Oregon (1994), addressed the use of variable tire pressure as a BMP for forest roads. His study showed that by reducing the tire pressure on logging trucks from their highway inflation of 90 psi to between 30 and 70 psi, sediment runoff was reduced on average by 67 percent. The percentage reduction in sediment runoff was directly correlated with the rainfall quantity and traffic volume.

- *When soils become saturated, suspend ground skidding harvesting operations. Use of ground skidding equipment during excessively wet periods can result in unnecessary site disturbance and equipment damage.*

Wetland Road Design and Construction Practices

- *Locate, design, and construct forest roads according to preharvest planning.*

Forestry activities in wetlands are often subject to municipal, county, state, and federal regulations. Therefore, sufficient time should be set aside to obtain all necessary permits.

Improperly located, designed, or constructed forest roads can cause changes in hydrology, accelerate erosion, reduce or degrade fisheries habitat, and destroy or damage existing stands of timber.

- *Use temporary roads in forested wetlands.*

A temporary road in a wetland needs to provide adequate cross-road drainage at all natural drainageways. Temporary drainage structures include culverts, bridges, and porous material such as corduroy or chunkwood.

Construct permanent roads only to serve large and frequently used areas, as approaches to watercourse crossings, or to provide access for long-term fire protection. Use the minimum design standard necessary for reasonable safety and the anticipated traffic volume. Various temporary wetland crossing options are compared in Table 3-41.

Blade the surface of a wetland to be as flat as possible prior to constructing a temporary road (Hislop and Moll, 1996, cited in Blinn et al., 1998). Do not disturb the root mat in any wetland that has grass mounds or other uneven vegetation. Any temporary wetland crossing is enhanced by using a root or slash mat to provide additional support to the equipment.

- *Construct fill roads only when absolutely necessary for access since fill roads have the potential to restrict natural flow patterns.*

Where construction of fill roads is necessary, use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill. The use of pervious materials helps maintain the natural flow regimes of subsurface water. Figure 3-46 demonstrates the different effects of impervious and pervious road fills on wetland hydrology. Permeable fill material is not a substitute for using bridges where needed or for installing adequately spaced culverts at all natural drainageways. Use this practice in conjunction with cross drainage structures to ensure that natural wetland flows are maintained (i.e., so that fill does not become clogged by sediment and obstruct flows).

- *Provide adequate cross drainage to maintain the natural surface and subsurface flow of the wetland.*

Table 3-41. Temporary Wetland Crossing Options (Blinn, 1996)

Crossing Option	Description	Application	Cost
Wood Mats	Individual cants that are strung together using two 3/16-inch galvanized steel cables to make a single-layer crossing.	Wet mineral or sandy soils or existing road beds. Wood mats are not recommended for undisturbed peat or very weak clay soils. They require a relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope.	Approximately $170 to initially construct a 10' x 12' mat
Wood Planks/ Panels	Wood planks or panels are constructed using lumber planking to create a two-layer crossing. Parallel runners are laid down on each side where the vehicle's tires will pass and then lumber is nailed perpendicular to these runners.	Most wetland soils, if sized properly. The surface width needed depends on the soil strength. Wood plank crossings require a relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope.	Approximately $150 to initially construct an 8' x 12' wood plank
Wood Pallets	Wood-pallet crossing mats are sturdy, commercially available, multilayered variation of a three-layer wood pallet (used for shipping or storage) that has been designed specifically for traffic.	Most wetland soils, if sized appropriately. The require a relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope. Most appropriate for hauling or forwarding operations.	Approximately $350 for a commercial 8' x 16' pallet
Bridge Decking	The decking of a timber bridge can be used to cross a small wetland area.	Most wetland soils, if sized properly. Easy to install and remove. Require a relatively level ground surface.	Approximately $6,000 for a 30' x 12' bridge
Expanded Metal Grating	Metal grating is relatively light and the surface is rough enough to provide some traction. Built by hand-placing the grating sections in the wheel paths.	Most shallow wetland soils, sandy soils, or on an existing road. It is not recommended for undisturbed peat or very weak clay soils. Performance is enhanced where there is an adequate root or slash mat to provide additional support.	Approximately $100 for a 4' x 8' grate
PVC or HDPE Pipe and Plastic Road	A PVC and HDPE pipe mat is constructed using 4-inch diameter PVC or HDPE pipes that are tightly connected using galvanized steel cables. Plastic roads are similar to pipe mats except that they are not built to ease the transition of tires between the firm soil and the road.	Most wetland soils, if sized properly. Mat width needed depends on soil strength. Require a relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope.	Approximately $200 for a 4' x 12' pipe mat. Plastic road that is 8' x 40' costs approximately $2,000

Table 3-41. (continued)

Crossing Option	Description	Application	Cost
Tire Mats	A tire mat or panel of tires created by interconnecting tire sidewalls with corrosion-resistant fasteners. Tire threads are also used in some designs. Mats of varying length and width can be created.	Most wet mineral soils with different designs for distinct soils and situations. Tire mats require a relatively level surface with grades up to 5 percent, a fairly straight alignment, and no cross slope.	Approximately $300 for a 5' x 10' mat
Corduroy	Corduroy is a crossing made of brush, small logs cut from low-value and noncommercial trees on-site, or mill slabs that are laid perpendicular or parallel to the direction of travel.	Most wetland soils. Corduroy crossings require a relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope.	Low
Pole Rails	When attempting to support skidding or forwarding machinery equipped with high flotation or dual tires, one or more straight hardwood poles cut from on-site trees can be laid parallel to the direction of travel below each wheel.	Skidding and felling machinery equipped with wide, high-flotation tires and used across small mineral soil wetlands. Should only be used on relatively level surface with grades up to 4 percent, a fairly straight alignment, and no cross slope.	Low
Wood Aggregate	Wood particles ranging in size from chips to chunks can provide cohesion and support on soft soils. Wood aggregate is used in the same way as gravel, except that it is lighter and temporary due to natural deterioration.	The traffic capability of most wet soils can be improved substantially with the application of wood aggregate. Can be used on a variety of grades, alignments, and cross slopes.	Competitive with local sources of gravel fill.
Equipment with Wide Tires, Duals, Bodies, or Tire Tracks	These mobility options provide a method for increasing the contact area between the equipment and the soil so that the machine's weight is spread over a larger surface area.	Many wetland soils. Performance is enhanced in areas where there is adequate root or slash mat to provide additional support to the equipment.	Wide tires may cost more than $4,000 each, tire tracks may cost approximately $7,000 for a set of two tracks.
Central Tire Inflation (CTI)	CTI is a low-ground-pressure option currently for use on hauling vehicles only, but will likely be available on other equipment in the future.	Many wetland soils. The reduced tire pressure, when used with radial ply tires, results in a larger tire "footprint," which reduces the vehicle pressure applied to the ground.	Cost depends on the number of axles retrofitted. 18 axles = $16,000

This can be accomplished through adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow. Designed and constructed according to these considerations helps ensure that bridges, culverts, and other structures do not perceptibly diminish or increase the duration, direction, or magnitude of the minimum, peak, or mean flow of water on either side of the structure.

◆ *Construct roads at natural ground level to minimize the potential to restrict flowing water.*

Float the access road fill on the natural root mat. If the consequences of the natural root mats' failing are serious, use reinforcement materials such as geotextile fabric, geo-grid mats, or log corduroy. Figure 3-47 depicts a cross section of the practice of floating the road. Protect the root mat beneath the roadway from equipment damage by diverting through traffic to the edge of the right-of-way, shear-blading stumps instead of grubbing, and using special wide-pad equipment. Also, protect the root mat from damage or puncture by using fill material that does not contain large rocks or boulders.

◆ *Discharges of dredged or fill material into wetlands or other waters of the United States must comply with CWA section 404 (see text above).*

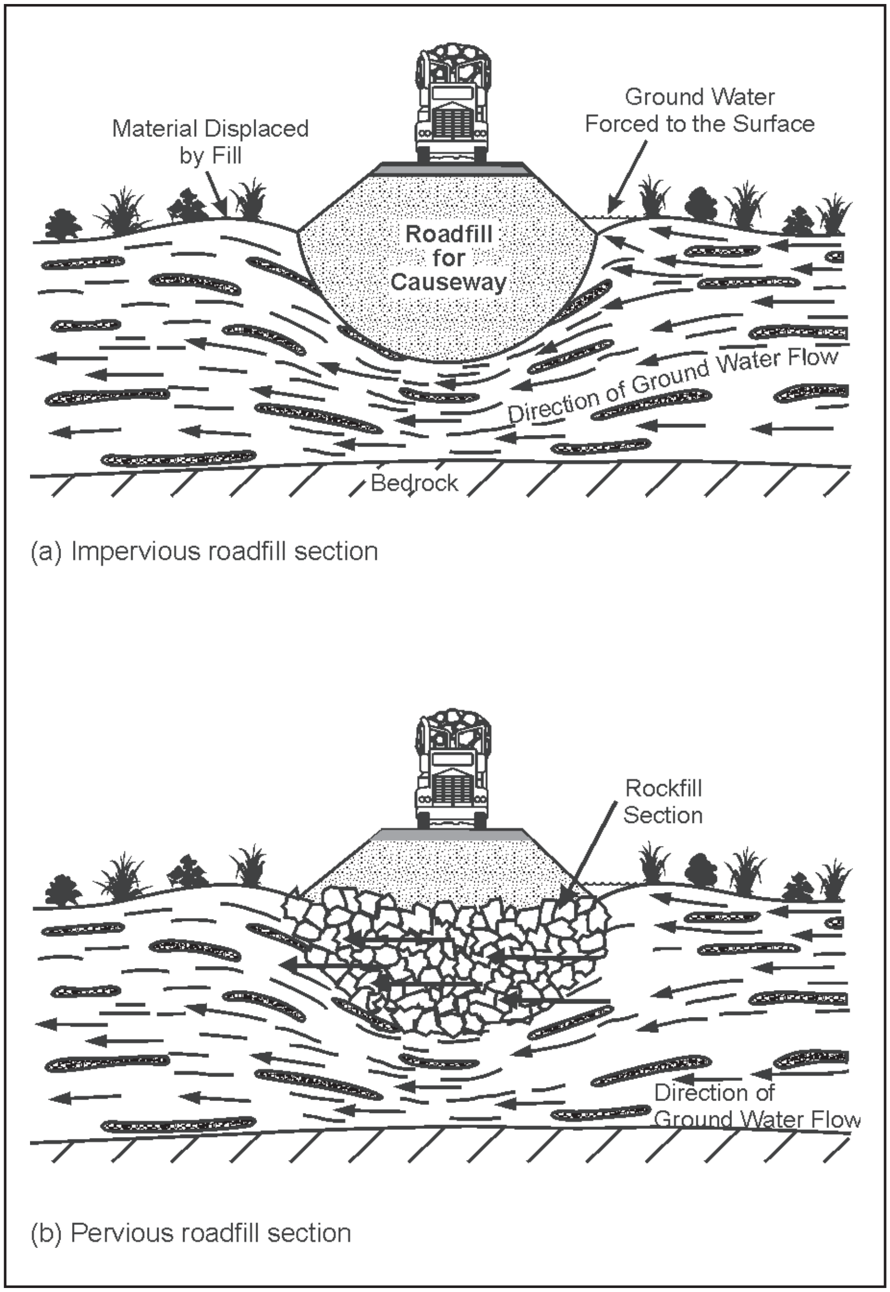

Figure 3-46. Comparison of impervious (a) and pervious (b) roadfill sections. Impervious roadfill consolidates natural material and restricts groundwater flow. Pervious roadfill allows movement of groundwater through it and minimizes flow changes (adapted from Thronson, 1979).

Practices for Crossing Wetlands in Winter

Winter provides an opportunity to cross wetlands with little effect. Roads are often constructed across wetlands in winter to take advantage of frozen ground.

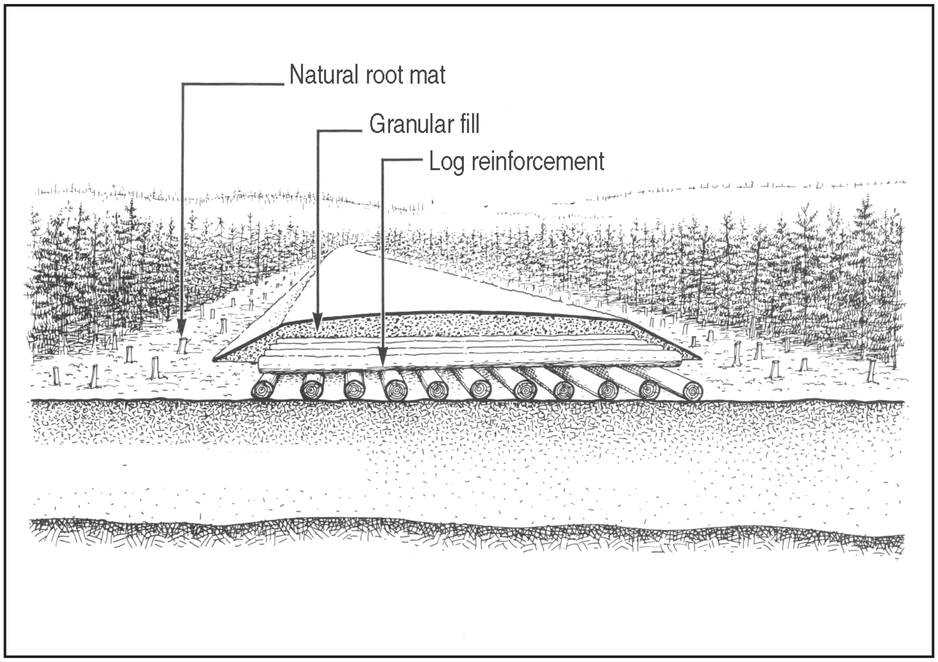

Figure 3-47. Elements of a road crossing through a swamp wetland, cross section (Ontario MNR, 1990).

◆ *The following are recommendations for crossing wetlands in winter, for all wetland types (Minnesota Division of Forestry, 1995):*

- If permanent structures are to be used, follow BMP installation guidelines for permanent roads.
- Select the shortest practical route to minimize potential problems with drifting snow and crossing of open water.
- Avoid crossing open water or active springs. If crossing is unavoidable, temporary crossings are preferred over permanent crossings. These can be ice bridges, temporarily installed bridges, or timber mats.
- Avoid using soil fill.
- Install structures that block water flow so that they can be easily removed prior to the spring thaw. Remove these structures during a winter thaw.
- Use planking, timber mats, or other support alternatives to improve the capability of the road to support heavy traffic. If removal would cause more damage than leaving them in place, these structures can be left as permanent sections on frozen roads. Avoid clearing practices that result in berms of soil or organic material, which can disrupt normal water flow in wetlands.
- Do not operate machinery during a winter thaw. Resume operations only when conditions are adequate to support equipment.
- Remove temporary fills and structures to the extent practical when no longer needed.
- Install buffer strips near open water.
- Anchor temporary structures at one end only to allow them to move aside during high-water flows.

◆ *To avoid excessive damage, equipment operations are best avoided on any portion of a road where ruts are deeper than 6 inches below the water surface for a continuous distance of more than 100 yards (Wiest, 1998).*

Wetland Site Preparation and Regeneration Practices

◆ *Select a regeneration method that meets the site characteristics and management objectives.*

Choice of regeneration method has a major influence on the stand composition and structure and on the forestry practices to be applied over the life of the stand. Natural regeneration may be achieved by clear-cutting the existing stand and relying on regeneration from seed from adjacent stands, the cut trees, or stumps and from root sprouts (coppice). Successful regeneration depends on recognizing the site type and its characteristics, evaluating the stocking and species composition in relation to stand age and site capability, planning regeneration options, and using sound harvesting methods. Schedule harvest during the dormant season to take advantage of seed sources and to favor coppice regeneration. Harvest trees at a stump height of 12 inches or less when practical to encourage vigorous coppice regeneration. Artificial regeneration may be accomplished by planting of seedlings or direct seeding. Table 3-42 presents an example of regeneration system recommendations (Georgia Forestry Association, 1990).

- *Conduct mechanized site preparation and planting of sloping areas on the contour.*
- *To reduce disturbance, conduct bedding operations in high-water-table areas during dry periods of the year.*

The degree of acceptable site preparation depends on the amount and frequency of flooding, the soil type, and the species suitability.

- *Minimize soil degradation by limiting operations on saturated soils.*

Wetland Fire Management Practices

Site preparation burns in wetlands are often the most severe (hottest) and have the most potential to increase surface runoff and soil erosion.

Table 3-42. Recommended Regeneration Systems by Forested Wetland Type (Georgia Forestry Association, 1990)

	Natural Regeneration				Artificial Regeneration		
Type	Clear-cut	Group Selection	Shelter Wood	Seed[a] Tree	Mechanical Site Prep.[b]	Plant	Direct Seed
Flood Plains, Terraces, Bottomland							
Black River	A	B	B	C	D	C	C
Red River	A	B	B	C	D	B	B
Branch Bottoms	A	B	B	C	D	C	C
Piedmont Bottoms	A	B	B	C	D	B	B
Muck Swamps	A	C	C	C	D	C	C
Wet Flats							
Pine Hammocks & Savannahs	A	B	B	B	A	A	B
Pocosins or Bays	A	C	B	B	B	B	B
Cypress Strands	A	C	C	C	D	C	C
Cypress Domes: Peat Swamps							
Peat Swamps	A	C	C	C	C	C	C
Cypress Domes	A	C	C	C	D	C	C
Gulfs, Coves, Lower Slopes	A	B	B	C	C	B	C

Note: A = highly effective; B = effective; C = less effective; D = not recommended.
[a] Seed tree cuts are not recommended on first terraces of floodplains, terraces, and bottomland.
[b] Mechanical site preparation to convert wetlands to pine plantation is regulated by Section 404 of the Clean Water Act and a permit may be required for site preparation to convert some of the wetlands identified in the table, i.e., floodplains, bottomlands, pocosins, bays, cypress stands, peat swamps, cypress domes.

- ◆ *Conduct site preparation burns in a manner such that they do not completely remove the organic layer from the forest floor.*
- ◆ *Do not construct firelines for site preparation that will drain wetlands.*

Chemical Management Practices

- ◆ *Where feasible and applicable, apply herbicides by injection to individual stems.*
- ◆ *For chemical and aerial fertilizer applications, maintain and mark a buffer area around all surface water to avoid drift or accidental direct application.*

Avoid application of pesticides with toxicity to aquatic life, especially aerial applications. Aerial applications generally require a buffer from water, agricultural lands, and homes. Motorized ground applications require a buffer from water. The first pass of each application is be made parallel to the buffer zone. A buffer is not necessary for hand applications; however, hand-applied forest chemicals have to be applied to specific targets, and chemicals need to be prevented from entering the water. Before any application of a chemical, consult state laws and regulations for chemical application for proper buffer establishment. Have a person licensed in chemical application perform all work (Washington State DNR, 1997).

- ◆ *Apply slow-release fertilizers when possible.*

This practice reduces the potential of the nutrients leaching to groundwater, and it increases the availability of nutrients for plant uptake.

- ◆ *Apply fertilizers when leaching will be minimized.*
- ◆ *Base fertilizer type and application rate on soil and/or foliar analysis.*

To determine fertilizer formulations, it is best to compare available nitrogen, phosphorus, potassium, and sulphur in the soils to be treated with the requirements of the species to be sown.

EPA and Corps of Engineers Memorandum to the Field

Mechanical Site Preparation Activities and CWA Section 404

Under certain circumstances, a CWA section 404 permit is required for mechanical silvicultural site preparation activities in wetlands. In 1995, EPA and the U.S. Army Corps of Engineers issued a memorandum to clarify the applicability of section 404 to mechanical silvicultural site preparation activities in the Southeast.

The memorandum (particularly the descriptions of wetlands, activities, and BMPs in the memorandum) focuses on the southeastern United States. However, the guidance in the memorandum is generally applicable when addressing mechanical silvicultural site preparation activities in wetlands elsewhere in the country.

The memorandum clarifies the applicability of forested wetlands BMPs to silvicultural site preparation activities for the establishment of pine plantations in the Southeast. Mechanical silvicultural site preparation activities conducted in accordance with the

BMPs discussed below, which are designed to minimize effects to the aquatic ecosystem, will not require a Clean Water Act section 404 permit. These BMPs further recognize that certain wetlands should not be subject to unpermitted mechanical silvicultural site preparation activities because of the adverse nature of potential effects associated with these activities on these sites.

EPA and the Corps will continue to work closely with state forestry agencies to promote the implementation of consistent and effective BMPs that facilitate sound silvicultural practices. In those states where no BMPs specific to mechanical silvicultural site preparation activities in forested wetlands are currently in place, EPA and the Corps will coordinate with those states to develop BMPs. In the interim, mechanical silvicultural site preparation activities conducted in accordance with the memorandum will not require a section 404 permit.

Circumstances in Which Mechanical Site Preparation Activities Require a Section 404 Permit

Mechanical silvicultural site preparation activities can have measurable and significant effects on aquatic ecosystems when conducted in wetlands that are permanently flooded, intermittently exposed, or semipermanently flooded, and in certain additional wetland communities that exhibit aquatic functions and values that are more susceptible to effects from these activities. For the wetland types identified below, mechanical silvicultural site preparation activities require a permit so that individual proposals can be evaluated on a case-by-case basis for site preparation and potential associated environmental effects.

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 in which Mechanical Silvicultural Site Preparation Activities Do Not Require a Permit* below). Of course, discharges incidental to activities in any wetlands that convert waters of the United States to non-waters always require authorization under Clean Water Act section 404.

Permanently flooded wetlands, intermittently exposed wetlands, and semipermanently flooded wetlands. Permanently flooded wetland systems are characterized by water that covers the land surface throughout the year in all years. Intermittently exposed wetlands are characterized by surface water that is present throughout the year except in years of extreme drought. Semipermanently flooded wetlands are characterized by surface water that persists throughout the growing season in most years and, even when surface water is absent, a water table usually at or very near the land surface. Examples of these wetlands include cypress-gum swamps, muck and peat swamps, and cypress strands/domes.

Riverine bottomland hardwood wetlands. These are seasonally flooded (or wetter) bottomland hardwood wetlands within the first or second bottoms of the floodplains of river systems. Site-specific characteristics of hydrology, soils, and vegetation and the presence of the alluvial features mentioned in the memorandum determine the boundary of riverine bottomland hardwood wetlands. National Wetlands Inventory maps provide a useful reference for the general location of these wetlands on the landscape.

White cedar swamps. These wetlands are greater than 1 acre in headwaters and greater than 5 acres elsewhere. They are underlain by peat of greater than 1 meter and vegetated by natural white cedar representing more than 50 percent of the basal area, where the total basal area for all tree species is 60 square feet or greater.

Carolina bay wetlands. These are oriented, elliptical depressions with a sand rim that are either underlain by clay-based soils and vegetated by cypress or underlain by peat of greater than 0.5 meter and typically vegetated with an overstory of red, sweet, and loblolly bays.

Nonriverine forest wetlands. The wetlands in this group are rare, high-quality wet forests, with mature vegetation, located on the Southeastern Coastal Plain. Their hydrology is dominated by high water tables. Two forest community types fall into this group: (1) nonriverine wet hardwood forests, poorly drained mineral soil interstream flats (comprising 10 or more contiguous acres), typically on the margins of large peatland areas, seasonally flooded or saturated by high water tables, with vegetation dominated (greater than 50 percent of basal area per acre) by swamp chestnut oak, cherrybark oak, or laurel oak alone or in combination, and (2) nonriverine 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.

Low pocosin wetlands. These are the central, deepest parts of domed peatlands on poorly drained interstream flats, underlain by peat soils greater than 1 meter, typically vegetated by a dense layer of short shrubs.

Wet marl forests. These are hardwood forest wetlands underlain with poorly drained, marl-derived, high-pH soils.

Tidal freshwater marshes. These wetlands are regularly or irregularly flooded by fresh water. They have dense herbaceous vegetation and occur on the margins of estuaries or drowned rivers or creeks.

Maritime grasslands, shrub swamps, and swamp forests. These are barrier island wetlands in dune swales and flats, underlain by wet mucky or sandy soils. They are vegetated by wetland herbs, shrubs, and trees.

Circumstances in Which Mechanical Site Preparation Activities Do Not Require a Section 404 Permit

Mechanical silvicultural site preparation activities in wetlands that are seasonally flooded, intermittently flooded, temporarily flooded, or saturated or are in existing pine plantations and other silvicultural sites (except as listed above) do not require a permit if conducted according to the BMPs listed below in *Best Management Practices*. Of course, silvicultural practices conducted in uplands never require a Clean Water Act section 404 permit (see *Code of Federal Regulations* text above).

Seasonally flooded wetlands are characterized by surface water that is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. (When surface water is absent, the water table is often near the surface.) Intermittently flooded wetland systems are characterized by substrate that is usually exposed and the presence of surface water for variable periods without detectable seasonable periodicity. Temporarily flooded wetlands are 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. Saturated wetlands are characterized by substrate that is saturated to the surface for extended periods during the growing season, but also by the absence of surface water most of the time. Examples typical of these wetlands include pine flatwoods, pond pine woodlands, and wet flats (e.g., certain pine/hardwood forests).

Best Management Practices

The BMPs below are from a joint EPA and Corps of Engineers *Memorandum to the Field* (see below) on the application of BMPs to mechanical silvicultural site preparation activities for the establishment of pine plantations in the Southeast. The guidance is, however, generally applicable to mechanical silvicultural site preparation activities in wetlands elsewhere in the country. Every state in the Southeast has developed BMPs for forestry to protect water quality, and most have also developed specific BMPs for forested wetlands.

The BMPs listed here are the minimum to be applied for mechanical silvicultural site preparation activities in forested wetlands where these activities do not require a permit (see *Memorandum to the Field* below). In circumstances where a permit is required, BMPs specifically required for the individual operation will be detailed in the permit.

The BMPs below were developed because silvicultural practices have the potential to result in effects on an aquatic ecosystem. Mechanical silvicultural site preparation activities have the potential to cause effects such as soil compaction, turbidity, erosion, and hydrologic modifications if the activities are not effectively controlled by BMPs.

- *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.*
- *Conduct activities in such a manner as to avoid excessive soil compaction and maintain soil tilth.*
- *Arrange windrows in such a manner as to limit erosion, overland flow, and runoff.*
- *Prevent disposal or storage of logs or logging debris in SMAs.*
- *Maintain the natural contour of the site and ensure that activities do not immediately or gradually convert the wetland to a non-wetland.*
- *Conduct activities with appropriate water management mechanisms to minimize off-site water quality effects.*

The full text of the memorandum is available on the Internet at <http://www.epa.gov/owow/wetlands/guidance/silv2.html>.