North Carolina Forestry BMP Field Guide

NC DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES – FOUNDED 1877

NORTH CAROLINA FOREST SERVICE NC

2022 Edition

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This 2022 Edition replaces the "North Carolina Forestry Best Management Practices Quick Reference Field Guide" that was originally published in 2007 and reprinted in 2016.

Part 1: Introduction and Agency Contacts

Planning Ahead Pays!

Effective and low cost practices to protect water quality can also save time.

Practice	Upfront Time or Cost	Water Quality Payoff
Avoid stream crossings	$	💧💧💧💧💧💧
Preharvest planning	$	💧💧💧💧💧
Effective SMZ (stream buffer)	$$	💧💧💧💧
Prompt erosion & sediment control	$$$	💧💧💧💧
Reusing bridgemats on crossings	$$$$	💧💧💧💧
Returning to a site to fix a problem afterwards	$$$$$$	💧💧

Remember:

Slow it down… ***(get rain to soak into the soil)***

Spread it out… ***(install water diversions)***

Cover it quick… ***(promptly apply groundcover)***

What this Field Guide is and is not

This Field Guide:

✓ …replaces the previous BMP Quick Reference Field Guide that was produced in 2007 and reprinted in 2016.

✓ …is written for loggers, technicians, foresters and others who already have a basic understanding of forest operations. Therefore, for the sake of brevity, industry recognized abbreviations may not be spelled out, and technical terms are not explained.

✓ …illustrates good examples of BMP usage and poor examples of sites where BMPs could have minimized impacts to water quality.

This Field Guide:

⊗ ***…is not the full version of North Carolina's Forestry BMP Manual (revised 2021).***

⊗ ***… is not a full, complete or comprehensive description of all possible BMP options. The selection and intensity of BMP use should be tailored to the activity, a site's conditions, expected rainfall and landowner's needs. Other practices may be suitable if they achieve the same or better results in protecting water quality.***

⊗ ***… is not a complete citation of all rules, regulations, laws or regulatory guidance related to water quality and forestry operations.***

How to Use This Guide

Symbol	What It Means
	Examples of good BMP work that should function properly if maintained. **You want to achieve the results shown by these photos.**
	A bad situation that needs improvement to protect or maintain water quality or conserve soil. **You want to avoid this type of condition.**
	Watch out! Some level of effort was done, but more work is needed to make sure the BMP remains intact and functional. **Maintenance is needed**.

The Linkage Between FPGs and BMPs

Land disturbing forestry activities in North Carolina must comply with the requirements of the statewide rules titled the "**Forest Practices Guidelines Related to Water Quality**" (abbreviated as **FPGs**). These are the required minimum standards. See Part 12 for the FPG rules. The N.C. Forest Service (NCFS) inspects for FPG compliance.

Forestry BMPs are recommendations for conserving soil and protecting water quality. Widespread and effective use of BMPs often makes compliance with the FPGs more attainable. The NCFS may offer BMP suggestions that can help you meet the FPG standards.

County	NCFS	Soil & Water Conservation
Alamance	336-376-3596	336-290-0380
Alexander	828-632-5810	828-632-0638
Alleghany	336-372-8142	336-372-7777
Anson	704-848-4705	704-694-3516
Ashe	336-982-2471	336-246-8875 ext. 3
Avery	828-766-8043	828-733-2291
Beaufort	252-946-3944	252-946-4989
Bertie	252-794-3725	252-794-5305
Bladen	910-588-4861	910-247-3457
Brunswick	910-755-7772	910-253-2830
Buncombe	828-686-5885	828-250-4785
Burke	828-438-6269	828-439-9727
Cabarrus	980-335-0009	704-920-3300
Caldwell	828-757-5612	828-758-1111
Camden	252-336-4332	252-338-1919 ext. 262
Carteret	252-728-3793	252-222-6360
Caswell	336-694-6131	336-694-4162 ext. 3
Catawba	828-465-8443	828-465-8950
Chatham	919-545-2720	919-542-8240

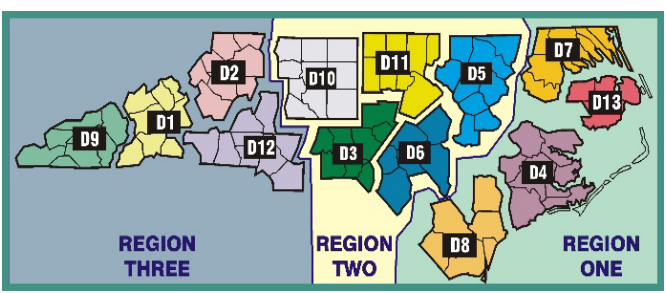
County	NCFS	Soil & Water Conservation
Cherokee	828-837-5426	828-837-6417
Chowan	252-482-4554	252-482-4127
Clay	828-389-4190	828-389-9764
Cleveland	704-487-4954	704-471-0235
Columbus	910-654-4739	910-642-2196
Craven	252-244-0295	252-633-0397
Cumberland	910-483-1535	910-484-8479
Currituck	252-232-0983	252-232-3360
Dare	252-473-2531	252-475-5853
Davidson	336-859-9171	336-242-2075
Davie	336-751-5319	336-751-5011
Duplin	910-289-2735	910-335-3124
Durham	919-560-0562	919-560-0558
Edgecombe	252-823-8346	252-823-8187 ext. 3
Forsyth	336-767-7269	336-703-2840
Franklin	919-496-3665	919-496-3137
Gaston	704-922-0719	704-922-4181
Gates	252-357-0123	252-357-0290 ext. 3
Graham	828-479-6341	828-479-9268
Granville	919-693-3154	919-693-4603

County	NCFS	Soil & Water Conservation
Greene	252-747-3879	252-747-2968
Guilford	336-641-2406	336-641-2440
Halifax	252-826-3219	252-583-3481
Harnett	910-893-4391	910-893-7584
Haywood	828-627-6551	828-452-2741 ext. 3
Henderson	828-891-3957	828-697-4949
Hertford	252-358-3761	252-358-7846
Hoke	910-875-2808	910-848-8032
Hyde	252-926-9201	252-926-4195
Iredell	704-878-4216	704-873-6761 ext. 3
Jackson	828-631-9316	828-586-5465
Johnston	919-989-1925	919-934-7156 ext. 3
Jones	252-448-5531	252-448-2341
Lee	919-775-5214	919-776-2633
Lenoir	252-520-2400	252-526-9799 ext. 3
Lincoln	704-922-0719	704-736-8501
Macon	828-369-8677	828-524-3311
Madison	828-649-3821	828-649-9099 ext. 3
Martin	252-792-3183	252-792-4350
McDowell	828-652-2636	828-652-4434

County	NCFS	Soil & Water Conservation
Mecklenburg	980-335-0009	704-336-2455
Mitchell	828-688-9405	828-765-5049 ext. 3
Montgomery	910-576-5481	910-572-2700
Moore	910-235-0216	910-947-5183
Nash	252-459-7338	252-459-4116 ext. 3
New Hanover	910-251-5750	910-798-7130
Northampton	252-534-4741	252-534-2591 ext. 3
Onslow	910-324-3633	910-937-1306
Orange	919-732-8152	919-245-2750
Pamlico	252-745-3775	252-745-5064 ext. 3
Pasquotank	252-426-5551	252-338-6353 ext. 3
Pender	910-259-7251	910-259-9123
Perquimans	252-426-5551	252-426-5545
Person	336-599-5111	336-599-0284 ext. 3
Pitt	252-355-9079	252-902-1746
Polk	828-859-5149	828-894-8550
Randolph	336-879-1773	336-318-6490
Richmond	910-582-7029	910-895-3950
Robeson	910-618-5540	910-739-5478
Rockingham	336-634-3021	336-342-8260

County	NCFS	Soil & Water Conservation
Rowan	704-216-8993	704-216-8999
Rutherford	828-286-9201	828-287-4220
Sampson	910-592-4515	910-592-7963 ext. 3
Scotland	910-276-0455	910-277-2433
Stanly	704-982-5317	704-986-3059
Stokes	336-593-8154	336-593-2490
Surry	336-356-8177	336-386-8751 ext. 3
Swain	828-488-1003	828-488-2684 ext. 3
Transylvania	828-884-3212	828-884-3230
Tyrrell	252-796-5841	252-796-3891 ext. 3
Union	704-233-1437	704-324-9228
Vance	919-693-3154	252-438-5727 ext. 3
Wake	919-841-4046	919-250-1050
Warren	252-257-5960	252-257-3836 ext. 3
Washington	252-797-4722	252-791-0108 ext. 3
Watauga	828-265-5375	828-264-3850
Wayne	919-731-2010	919-734-5281 ext. 3
Wilkes	336-973-4104	336-838-3622 ext. 3
Wilson	252-237-0914	252-237-5147 ext. 3
Yadkin	336-679-8941	336-849-7583
Yancey	828-682-6788	828-682-3410

N.C. Forest Service District Offices	
D1-Asheville	828-667-5211
D2-Lenoir	828-757-5611
D3-Rockingham	910-997-9220
D4-New Bern	252-649-6770
D5-Rocky Mount	252-442-1626
D6-Fayetteville	910-437-2620
D7-Elizabeth City	252-331-4781
D8-Whiteville	910-642-5093
D9-Sylva	828-586-4007
D10-Lexington	336-956-2111
D11-Hillsborough	919-732-8105
D12-Mount Holly	704-827-7576
D13-Fairfield	252-926-3041



N.C. Department of Environment Quality (DEQ) Regional Offices

This includes DEMLR/Land Quality and DWR/Water Resources	
Asheville	**Washington**
828-296-4500	**252-946-6481**
2090 US Highway 70	943 Washington Sq. Mall
Swannanoa, NC 28778	Washington, NC 27889

Fayetteville	**Wilmington**
910-433-3300	**910-796-7215**
225 Green St., Suite 714	127 Cardinal Dr. Extension
Fayetteville, NC 28301	Wilmington, NC 28405

Mooresville	**Winston-Salem**
704-663-1699	**336-776-9800**
610 E. Center Ave., Ste.301	450 W. Hanes Mill Rd., Ste.300
Mooresville, NC 28115	Winston-Salem, NC 27105

Raleigh 919-791-4200	
Mailing Address:	Office Location Address:
1628 Mail Service Center	3800 Barrett Drive
Raleigh NC 27699-1628	Raleigh NC 27609

U.S. Army Corps of Engineers Field Offices

Asheville: 828-271-7980
Raleigh: 919-554-4884
Washington: 910-251-4610
Wilmington: 910-251-4811

U.S. Fish and Wildlife Service Field Offices

Asheville: 828-258-3939
Raleigh: 919-856-4520
Sandhills Area Sub-Office, Southern Pines: 910-695-3323
Coastal Area Sub-Office, Manteo: 252-473-1131

24-Hour Emergency Oil Spill Hotline:

(N.C. Division of Emergency Management)
1-800-858-0368

Erosion and Sediment Control Complaints:

(N.C. DEQ Div. of Energy, Mineral and Land Resources)
1-866-STOPMUD (786-7683)

N.C. Poison Control Hotline: 1-800-222-1222

SFI Inconsistent Forestry Practices Hotline:

1-877-271-6531

Part 2: Planning

BMP planning helps to:

- ✓ Evaluate the soil's potential for erosion risk.
- ✓ Locate streams and waterbodies to protect.
- ✓ Establish and mark SMZs (stream buffers).
- ✓ Determine road access needs.
- ✓ Assess stream crossing options (including avoidance).
- ✓ Lay out skid trail and deck locations.
- ✓ Anticipate site rehab needs.

Planning can help minimize water quality impacts and promote efficiency of all forestry operations, not just logging.

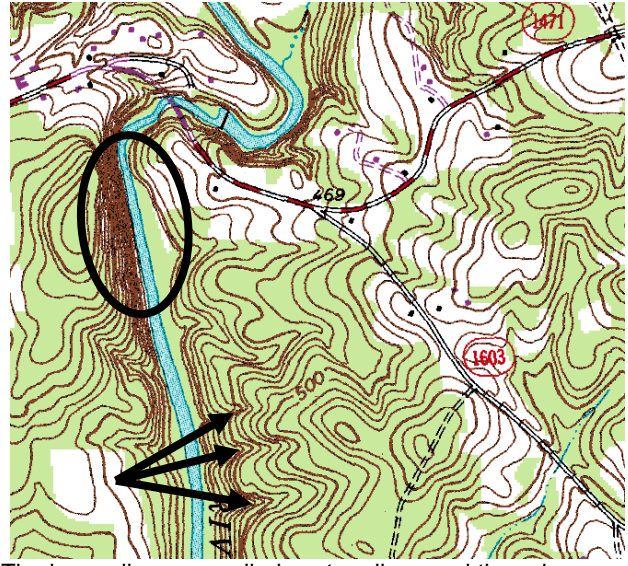
Use these planning tools:

1. On-site visit with maps
2. Topographic maps ("topo" maps)
3. Soil survey maps
4. Aerial photos or satellite images

The NCFS provides a free online Forest Preharvest Planning Tool (QR code) that summarizes multiple data sources to help plan a timber harvest and create custom tract maps. Icons can be placed on the map to show where BMPs should be installed.

Here are five map examples showing the same location.

Example 2A: Topographic (topo) Map



The brown lines are called contour lines and they show similar elevation on the landscape.

-- As contour lines get closer together, this indicates steeper slopes (circled area).

-- Contour lines shaped like a "V" indicate the likely location of a stream, gully or other drainage (three arrows).

-- Dashed or solid blue lines estimate rivers and larger streams. Topo maps do not show all streams.

Visit the site to verify stream location!

Example 2B: Soil Survey Manuscript Map

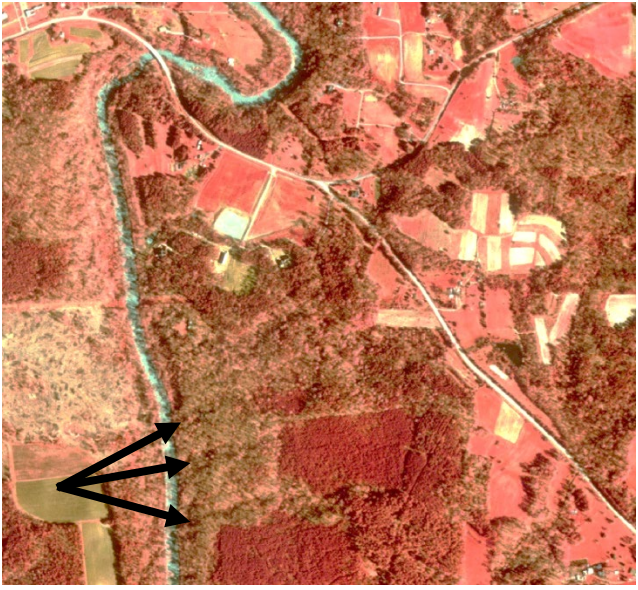
The solid black lines separate different soil types.
The alphabetic codes refer to the estimated soil series.

-- Streams are estimated with dashed lines (three arrows).

-- Soil maps often show more streams than on topo maps, but you should still visit the site to verify stream location.

-- The soil survey has tables of information describing the ability of each soil type to handle heavy equipment and support tree growth.

Example 2C: Aerial Photo



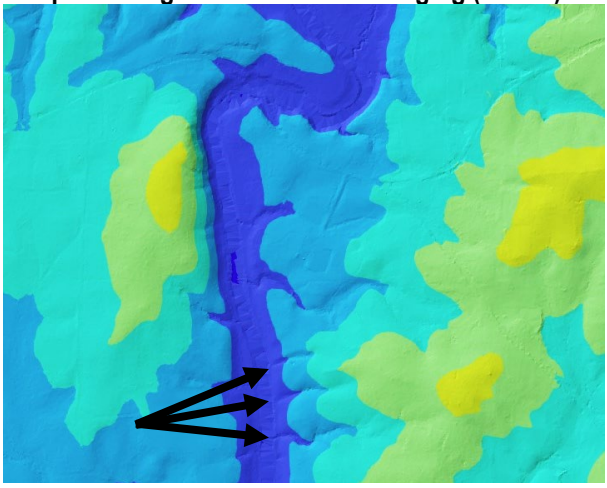
Satellite images and aerial photos may come in black and white, true color or infrared color.

-- Small streams can be hard to see on photos.

-- Compare this with the streams shown on the soils map (three arrows).

-- Changes in shadows or timber types (pine vs. hardwood) can be a clue that a stream corridor exists.

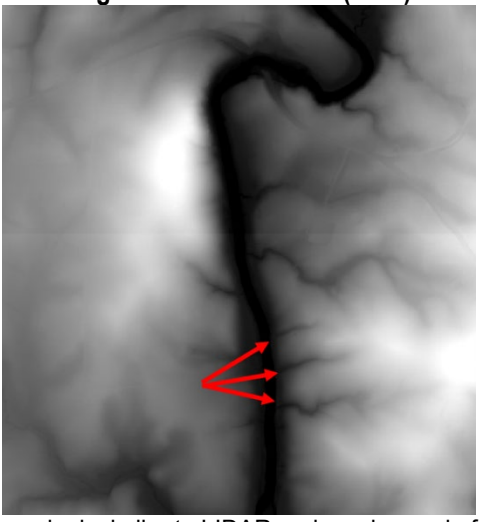
Example 2D: Light Detection and Ranging (LIDAR)



LIDAR is a remote sensing method that uses a pulsed laser to measure the distance from the aircraft sensors to the earth's surface.

-- Quick transitions between colors indicate a steep slope.
-- Darker or indented areas are often streams. It is best to compare with other maps if possible and ground truth.
-- Using LIDAR data ground points is typically best for the purposes of identifying streams as compared with using non-ground points, which are used to detect vegetation.

Example 2E: Digital Elevation Model (DEM)



DEM maps look similar to LIDAR and can be made from LIDAR point clouds. The DEM is a digital representation of ground topography, excluding vegetation and other surface features. The DEM is stored as an image (raster) and is continuous data rather than individual points like LIDAR.

-- DEMs can be viewed in black and white or in color, similar to the LIDAR map.
-- Like LIDAR, the DEM can help identify stream valleys and topography on steep ground (called shaded relief).
-- DEMs can be useful when performing more complex analyses in geospatial software.

Steps for Preharvest Planning

Step 1 - Know the Rules that Apply to Water Quality

- North Carolina FPGs
- State river basin and watershed riparian buffer rules.
- Federal and state wetland rules and requirements.
- Threatened & Endangered (T&E) species rules.
- Other: petroleum spills, pesticides, waste, etc.

Step 2 - Establish and Understand Forest Management and Landowner Objectives

- Understand what outcomes are needed in terms of property access. For example, will the roads/skid trails/stream crossings be temporary or permanent? More BMP work and maintenance will be needed if permanent access is desired afterwards.

Step 3 - Review Maps and Photos

- Examine the site using office tools. Download and/or print topo and soil maps, aerial photos, tax maps, etc.
- Identify parcel and harvest boundaries, along with any r/o/w or easements.
- Identify potential access to the property.
- Mark features on the maps; utility/gas lines, potential skid trail routes, soil prone to erosion or rutting, steep slopes, etc. More BMP work will be needed on steep ground and upon highly erodible soils.

Step 4 - Visit and Assess the Site

Tract Layout

- Take the maps and notes to the tract and walk the site.
- Verify access to the property.
- Ensure that timber sale boundaries and/or ownership boundaries are well marked and visible.

Streams, Waterbodies and Hydrology

- Recognize how water moves through the site. If water is coming onto the site from elsewhere, more runoff control measures may be needed.
- Locate streams and waterbodies that need to be protected.
- Establish and mark SMZs and/or buffer rule zones. Verify the operators recognize the markings.

Stream Crossings

- Avoid crossing streams whenever possible.
- Minimize the number of crossings.
- Evaluate the entire stream reach to determine the best practical crossing location and method.
- Deploy BMPs during installation, use and removal.

Access Roads and Entrances

- Minimize overall road length, width and footprint.
- If a new road must be built, establish the control points and right of way through the tract to lay out the road before construction occurs.
- Construct the road in advance so the soil can firm up.
- Establish access to the public road.
- Prepare to use measures that minimize mud and debris from being dragged onto public roads.
- Provide a suitable sight distance at the public road entrance point for safety. Place warning signs along public roads to warn oncoming traffic.

Skid Trails and Decks

- Minimize overall length, width and footprint on site.
- Locate skid trails and decks as far from waterbodies as practical given the site layout and conditions.
- Prepare to use measures that minimize soil disturbance and erosion along skid trails and decks.
- Different types of logging systems may require different types and/or sizes of skid trails and decks.

  For example, an in woods chipper needs a wide, flat area for the chip vans. More BMPs may be needed due to more exposed soil.

Step 5 - Finalize and Communicate the Preharvest Plan

- Develop a plan to install, evaluate and repair BMPs during and after the operation so that FPG standards are met. Specify a heavy precipitation event threshold to evaluate and repair BMPs.
- Update the site map based on observations during the tract visit. Be sure to include expected BMPs and notes for important features.
- Determine which portion of a site will be harvested first and have a backup plan if site, or soil conditions get too soft.
- Identify who is responsible for stabilizing the different areas of the site.
- Explain how BMPs will be monitored and maintained so they continue to function effectively.
- Communicate your plan! Make sure workers on the job understand what the site looks like and what to expect when it comes to BMPs, rules and water quality protection. This is especially valuable for heavy equipment operators.

The NCFS has BMP training videos on bridgemats, stream crossings, skid trails and installing erosion control devices. Scan this QR code to get links to each video:

Part 3: Erosion and Runoff Control

Keys to Controlling Erosion, Sedimentation and Runoff

Slow It Down

- ✓ Surface runoff can have tremendous erosion force.
- ✓ Slowing the runoff allows sediment to settle out.
- ✓ Use groundcover to allow rain to soak into the soil.
- ✓ Retain effective SMZs to capture sediment in runoff.

Spread It Out

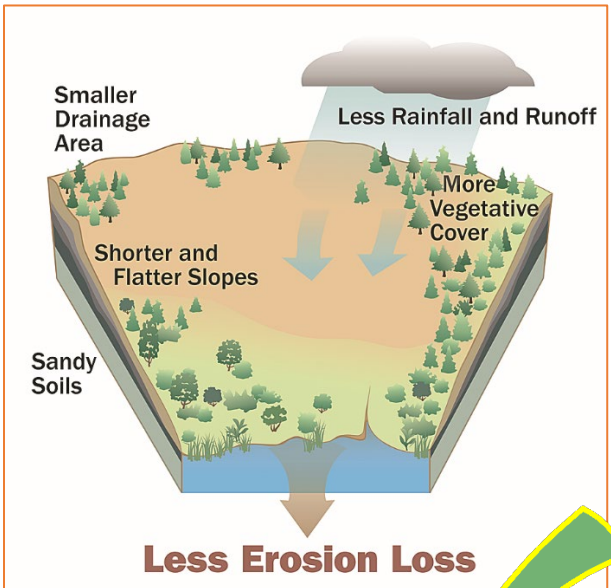
- ✓ Prevent runoff from concentrating or funneling.
- ✓ Install water diversions to control runoff.

Cover It Quick

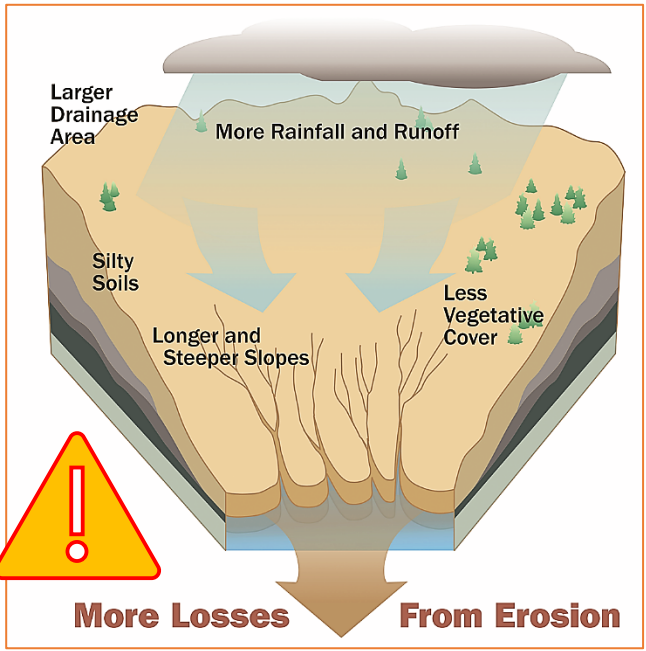
- ✓ Retain groundcover. Quickly replace it if disturbed.
- ✓ Applying and packing in logging debris on skid trails and log decks can be very effective, low cost and easy.

Above the dashed line, groundcover was retained. Below the line, bare soil was exposed. That thin layer of groundcover protected the soil from accelerated erosion.

Fundamental Concepts of Erosion Control



Artwork developed by TetraTech, Inc.,
in cooperation with the Kentucky Division of Water.



Artwork developed by TetraTech, Inc.,
in cooperation with the Kentucky Division of Water.

Overall Goals related to controlling Erosion, Sedimentation and Runoff

- ✓ Minimize soil disturbance and exposing bare soil.
- ✓ Maintain groundcover vegetation where possible and promptly cover disturbed soil.
- ✓ Break the grade on sloping roads, skid trails, firelines, or ditchlines and avoid long, continuous stretches. Divide slopes into shorter lengths that are easily managed, similar to short stair steps, instead of a long slide.
- ✓ Install control structures when soil is dry if possible.
- ✓ When a drainage outlet is needed for a water diversion, place the outlet on stable soil.
- ✓ Monitor the BMPs, especially after a heavy rainfall. Repair, improve or enhance the BMPs as needed to maintain their function.
- ✓ If there is a lot of sediment building up in your BMP structures (ex: sediment pit, check dam, waterbar, etc.), look upslope and find the erosion source. Then, take action to restrain the sediment from moving downhill.

⊗ ***Avoid diverting runoff into streams or gullies.***

Recommended design specifications for all BMPs are outlined in the North Carolina Forestry BMP Manual. This field guide does not provide that same level of detail.

Structures to control Erosion and Runoff

You should use these structures as pairs, picking one from each column and using them together.

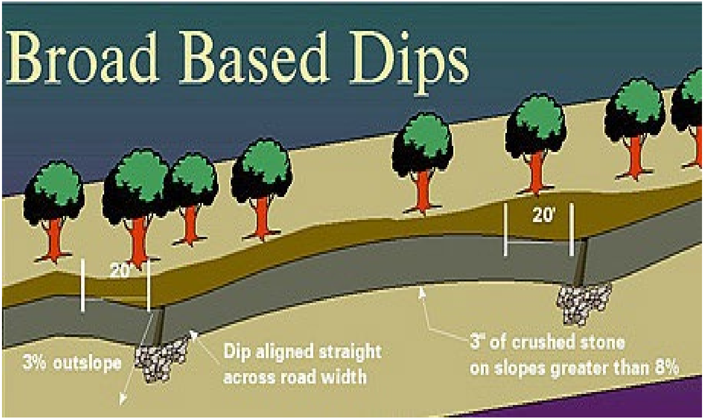
Controlling Runoff	Capturing Sediment
Broad-Based Dip	Brush Barrier
Check Dam	Sediment Pit
Cross Drain	Silt Fence
Fiber Wattles (Coir Logs)	Straw Bales
Inside Ditchline	
Rolling Dip	
Turnout (Wing Ditch)	
Waterbar	

Recommended Spacing of Water Diversion Structures

As slopes get steeper, install more diversions closer together. Spacing in the table below is measured in feet.

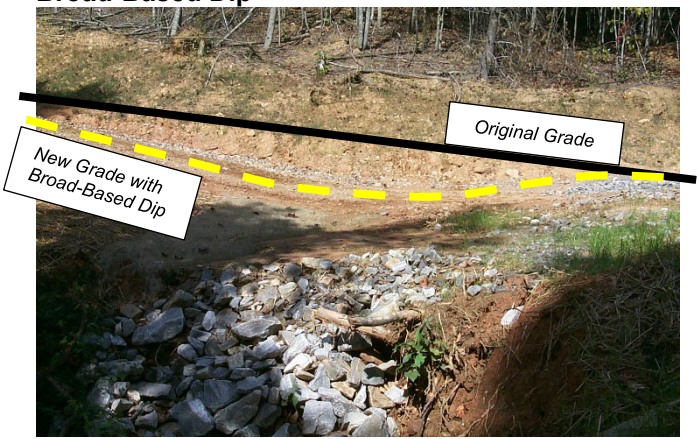
Grade (%)	Waterbar*	Rolling Dip	Turnout or Cross Drain
20+	40 to 30	100	60 to 40
16 to 20	60 to 40	120	100 to 60
11 to 15	80 to 60	135	140 to 100
6 to 10	100 to 80	150	180 to 140
0 to 5	120+ to 100	180	250+ to 180

*For waterbars, see the ‘eye level’ method on pg. 3-24.
For broad-based dip spacing, see next page.
For silt fence spacing, see page 3-17.



Grade	Broad-Based Dip Distance
8% to 12%	150 to 135 feet
4% to 7%	200 to 155 feet
0% to 3%	300 to 235 feet

Broad-Based Dip



- A gentle, shallow dip excavated into the roadway as a permanent feature of the road.
- Dip is installed completely across the full width of the road surface.
- The bottom of the base is tilted slightly outward (downhill), so runoff drains in a controlled manner.
- Installed at 90 degrees across the road surface.
- The reverse grade hump is packed down firmly.
- Outlet is stabilized and in this photo, stone is used.
- The base should be reinforced with gravel.

The broad-based dip is under the rear wheels of the truck.

Note how multiple BMPs are used together as a system:

- Road is constructed along the contour.
- Broad-based dip installed.
- Road surface is stabilized with gravel.
- Roadside edge is stabilized with grass/vegetation.
- Silt fence catches sediment runoff from the outlet of the broad-based dip.

Brush Barrier

Brush is piled along the crest of the roadbed to capture sediment. Brush piles should tightly conform to the ground surface for maximum sediment catching function.

Check Dam

Check dams can be installed using riprap, wood chunks or fiber logs. Fiber matting was installed first to cover exposed soil. Multiple dams are usually needed and frequent clean-out is often required to remove built-up sediment.

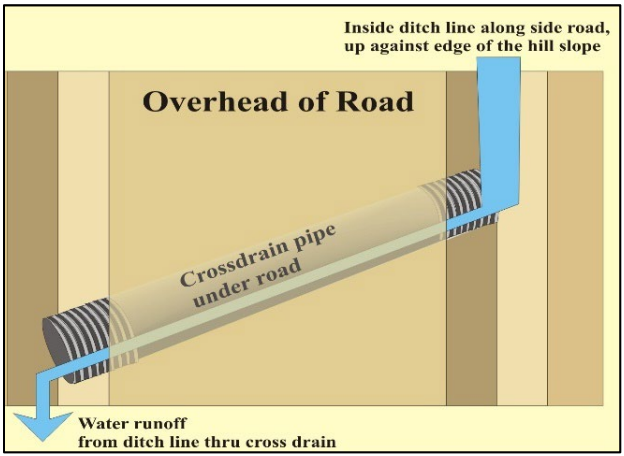
Cross Drain

Culvert is properly angled diagonally through the roadbed.

The diameter appears large enough to minimize blockages by debris.

The culvert headwall is protected, and road is stabilized.

As an alternative, an outsloped road with broad-based dips may not require cross drains or inside ditchlines.



- Install cross drains diagonally with a slight downslope tilt through the roadbed to promote drainage.
- Protect the inlet and outlet from scouring or eroding.
- Extend the pipe ends beyond the road travel surface.
- Stabilize the outlet.

Cross drains can require frequent maintenance to remove blockages and prevent erosion.

Avoid using open top drains or box trenches.

Fiber Wattles (Coir Logs)

These are an example of a rolled erosion control product (RECP). Wattles can be used for check dams or sometimes in place of silt fence. Once installed, they should be left in place and can be seeded over to establish groundcover.

- Install multiple wattles/logs, do not rely on just one.
- Tightly conform the wattle/log to the ground surface.
- Use wire staples to attach the RECP to the soil.
- Stake down the wattle/log and do not puncture it if possible. Install wood stakes along the edges.
- Do not drive over the wattle/log.

Avoid using RECPs with plastic mesh near streams or wetlands. They can entrap wildlife.

Temporary logging road is covered with straw.
Stream crossing is removed and stabilized.
Straw bales are installed to catch and divert runoff.

Straw bales catch sediment from the road at this ford crossing.

Inside Ditchline

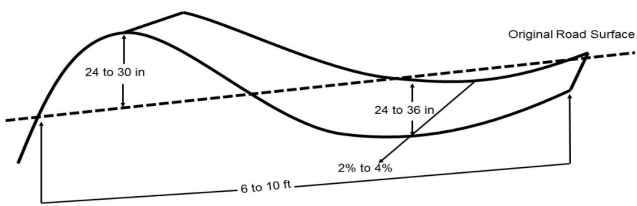
Inside ditchline appears to be stable and not eroding. Groundcover should be applied to the road bank slope.

Ditchline and road are eroding. Action is needed to prevent this ditchline from becoming a deep erosion gully. The road needs grading, water diversions and groundcover.

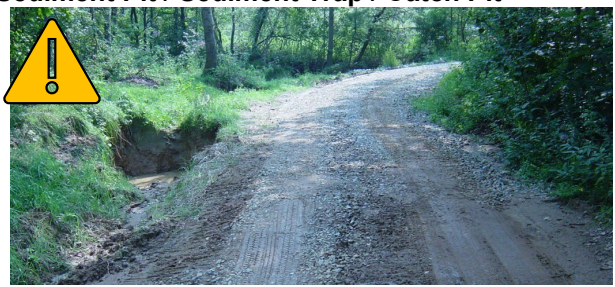
Rolling Dip

Rolling dips are suitable for roads or skid trails.
They are a permanent feature of the travel path.

- Mound and pack the soil to create a firm, gradual hump.
- Install at a slight angle across the road or trail, just enough to allow runoff to slowly drain off.



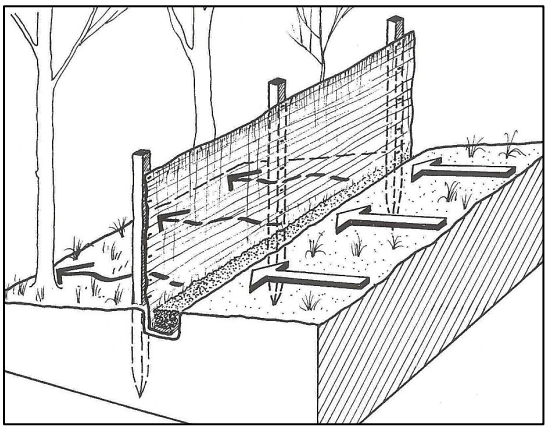
Sediment Pit / Sediment Trap / Catch Pit



This pit collects runoff from a dip in the road. Vegetation stabilizes the soil around the pit, but the pit walls may need to be sloped back to prevent cave in.

This shallow pit allows sediment to settle. A series of pits may work well along a road, skid trail or log deck.

Silt Fence

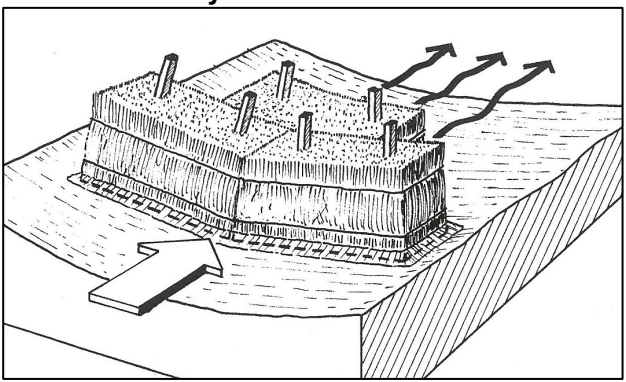


Artwork courtesy of Maine Forest Service.

- At minimum, bury the bottom 6 to 8 inches of silt fence along the uphill face.
- Stake the downhill side of the fence to keep it upright and tightly stretched.
- Avoid sharp angle turns when laying out the silt fence.
- Silt fence is a temporary BMP. Remove the silt fence once the site has permanently stabilized.

Slope (%)…	…Between Fence Rows	Acres
0 to 2	100 feet	0.23
2 to 5	75	0.17
5 to 10	50	0.11
10 to 20	25	0.06
20+	15	0.03

Straw Bales / Hay Bales



Artwork courtesy of Maine Forest Service.

- Set bales so their bottom tightly conforms to the ground.
- Stake bales to the ground to prevent slippage and do not puncture them if possible. Stake around them.
- On multiple rows, stagger the joints like bricks.
- Leave the bales in place whenever possible.

Bales and silt fence were used to install a sediment pit.
The built-up sediment needs to be cleaned out.
The source of the sediment should be addressed.

Turnout (Wing Ditch)

A rolling dip on the road diverts runoff into this wing ditch.

This waterbar ties into a turnout to divert runoff from this closed out skid trail.

This turnout on an active logging road has grass cover.

A rolling dip mound at the crest of the road slope diverts runoff into the turnout. Groundcover stabilization is needed.

Turnouts are suitable on roads, skid trails and firelines.

Waterbars

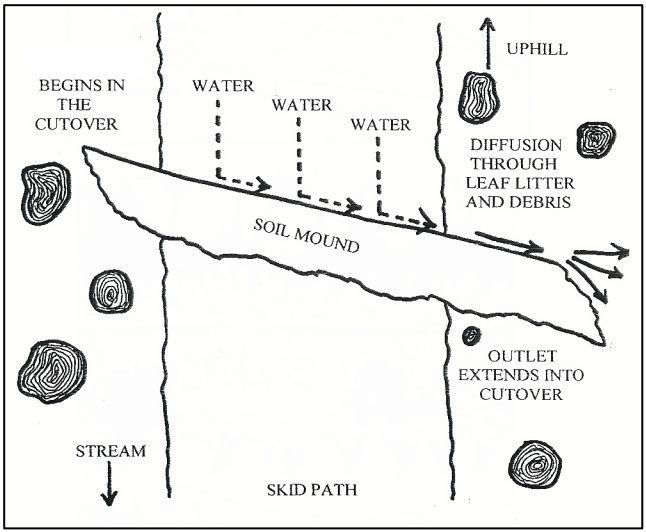
A waterbar is like an angled speed bump that is installed diagonally across closed roads, skid trails or firelines.

Waterbars require careful attention to correctly install and they should not be the only BMP for controlling runoff and erosion. Waterbars are most effective when combined with the establishment of groundcover.

A waterbar should not act like a dam. Instead, it should divert runoff into a collection area or stabilized filter area.

- Construct the waterbar from the upslope side.
- Angle the watebar diagonally 15 to 30 degrees downslope, towards the outfall edge of the road or trail.
- Excavate a shallow trench along the base of the upslope face side of the waterbar to help catch runoff.
- Extend the waterbar fully across the entire width of the road, skid trail or fireline.
- Tie in the uphill end of the waterbar with the slope bank if there is one.

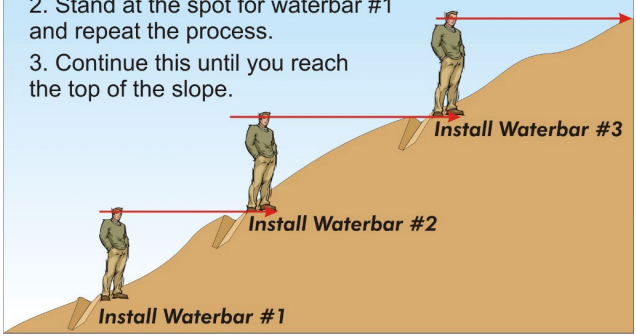
Do not drive over the waterbar once installed.
If vehicle access is required afterwards, consider instead installing rolling dips or broad-based dips.



The outlet should be pushed out so that water has a clear exit. The water should flow out into the cutover, not pond at the end of the waterbar or come back around into the skid trail path.

Locating Waterbars using the "eye level" method:

1. Stand at the bottom of the slope, look straight ahead and locate a waterbar where your sight-line meets the slope.
2. Stand at the spot for waterbar #1 and repeat the process.
3. Continue this until you reach the top of the slope.



Start working from the uphill side, mounding the waterbar.

Create an outlet for runoff to drain away.

Waterbar is mounded and extends the full width across.

Waterbar is angled to divert runoff in a controlled manner.

Waterbar is tied in with the cut bank slope.

Waterbars are not tied in allowing runoff to bypass around.

Runoff can easily bypass around both ends.

Waterbars should not collect water and an outlet is needed.

This waterbar is not tall but it can be effective if multiple waterbars are installed, and there is low surface runoff. Note how the uphill end is tied in with the cutover.
It appears the outlet is blocked and a sediment pit, or straw bale catch basin may be good options. Seeding would help.

This fireline waterbar could be angled better to drain runoff into the woods. Note the turnout where the hardhat is, acting as the outlet for this waterbar.

Logging slash, laps and limbs can provide groundcover throughout the logging job.

Part 4: Roads

Roads may be a long-term sedimentation concern if not properly designed, constructed or maintained.

<u>Note:</u> There are several rules and guidance requirements that limit where roads can be constructed, especially near streams or in wetlands.

Proper road design and layout are key. Consult with an experienced road builder or civil engineer. References are listed below:

- ✓ *A Guide for Forest Access Road Construction and Maintenance in the Southern Appalachian Mountains.*
- ✓ *Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads.* (USFS Pub.No. 1177-1802)
- ✓ *Low-Volume Roads Engineering BMP Field Guide.*
- ✓ *USDA-NRCS Conservation Practice #560, Access Road*.

When possible, avoid constructing new roads. Consider alternative access routes or harvest methods.

The NRCS soil surveys have ratings for each soil series in the county of its suitability as road fill material.

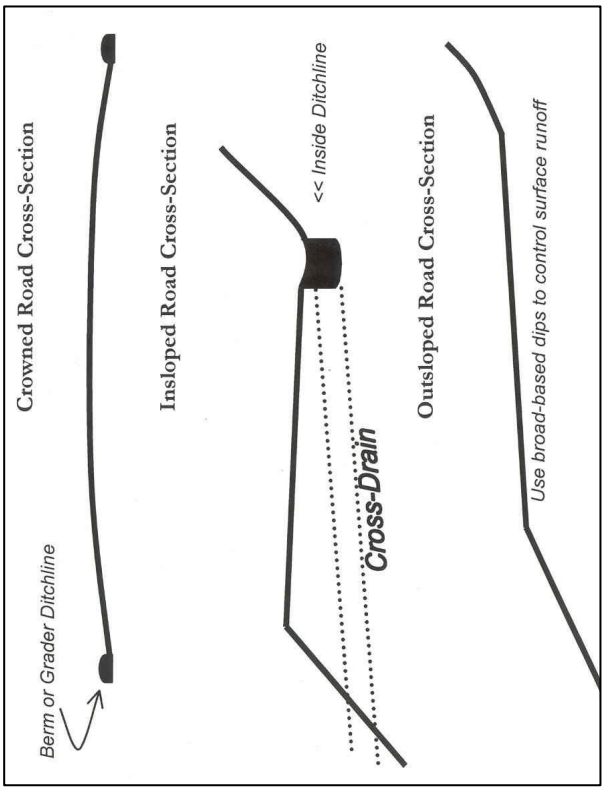
Using geotextiles can reduce the amount of fill material needed and improve the all-weather trafficability of the road. Their upfront cost is often much less than the extra backfill or machine time that would otherwise be needed.

- Minimize the overall footprint of soil disturbance when constructing a new road or rebuilding an old road, including cut banks and fill slopes.
- When possible, construct the road during dry soil conditions and complete work well in advance of the forestry operation. Give time for the new road to settle, firm up, establish groundcover vegetation and assess the function of erosion and runoff controls.
- Incorporate runoff control structures such as broad-based dips, rolling dips, turnouts, sediment pits, crowning, ditchlines and cross drains.
- Promptly stabilize the travel surface, roadside edge and cut bank/fill slope with gravel and/or vegetation.
- Trim back overhanging tree limbs along the road corridor so sunlight can can dry the road after precipitation.
- Establish an access point to the public road in a way that minimizes sedimentation and provides for safety.
- In steep terrain: Place the road along the contour of the land and avoid steep grades up and down the slope. Grades of 10 percent or less are recommended.
- In wetlands: Comply with the 15 required federal BMPs and the 2004 guidance document from the U.S. Army Corps of Engineers.

Avoid placing roads in ephemerals if possible.

Do not build roads in coastal marsh.

Cross-Section Sketches of Road Profile Options



Geotextile keeps gravel from sinking into soft soil. Curving the road reduces the grade and gives room to install water diversions. Groundcover is needed on bare soil.

An ample layer of stone promotes surface drainage, good control of runoff and improved trafficability.

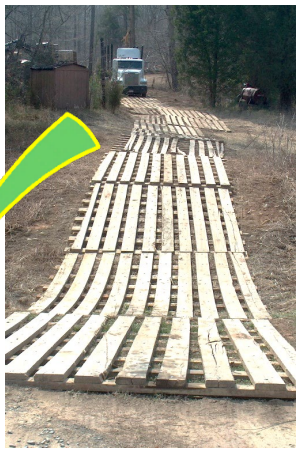
Little effort went into installing water diversions. Too much soil was exposed all at once with no groundcover. Construction was during a wet period and it was used too soon, with no time for it to firm up.

Broad-based dips are built in the road (arrows). There is ample gravel and the road edge is stabilized with grass.

An erosion gully is carving away the road because it lacks water diversions and surface stabilization.

LEFT: No diversions or groundcover, resulting in accelerated erosion and gullying of the road.

RIGHT: This long sloping road has multiple diversions to break the grade and ample vegetation.



LEFT: Entrance stabilized with ample gravel.
RIGHT: Road pallet mats used for an access entrance.

Bridgemats, logs and road mats were used on this logging road access entrance.

This wetland road is low profile, has gravel and uses a cross-drain pipe to allow water to equalize on both sides.

This road was blown out because of inadequate cross drainage to handle storm runoff from neighboring land.

This road is too close to a large river.
The narrow strip of weeds is the only thing keeping sediment out of the water.

This road is sloppy and has lost its structural integrity. Sedimentation into streams is very likely and extra wear and tear on equipment is possible.

Low standard roads like this often need more work to maintain surface drainage and erosion control structures.

Excellent use of gravel on a logging road.

Soft soil has been repeatedly scraped off this road, creating side berms of soil that trap rainfall runoff. Significant regrading is needed to reshape this road.

Good road using gravel, diversions, grass and bridgemats. Work is needed to level off the ruts and prevent sedimentation runoff into the stream.

Part 5: Skid Trails and Log Decks

BMPs for Skid Trails

There are two general types of skid trails:
--Bladed: terrain is excavated, similar to building a road.
--Overland: trail is directly upon the ground surface.

When possible, overland skid trails should be favored because little to no soil excavation is needed. Controlling runoff, erosion and sedimentation is usually easier on overland skid trails.

Research has shown that frequently applying and crushing in leftover logging debris (slash, laps, etc.) upon the skid trail is very effective at controlling runoff, protecting soil from erosion and reducing soil compaction/rutting.

- Stay out of the SMZ wherever possible.
- Minimize soil gouges or trenches from skidding logs.
- Concentrate skidding on as few skid trails as possible by avoiding widespread and random skidding.
- Where possible, limit primary skid trails to 10 percent of the total working area.
- Minimize placement and use of skid trails in ephemerals.
- Minimize skid trail width and avoid two lane skid trails.
- On sloping terrain, follow the land contour.
- Keep skid trails to less than 25 percent grade if possible.

Drop, spread and pack in logging slash on exposed soil.

This overland skid trail uses slash to control the runoff and erosion on the approach way to the stream crossing.

This overland skid trail needs BMPs to control runoff and minimize sedimentation into the stream.

Bladed skid trails with no diversions or groundcover.

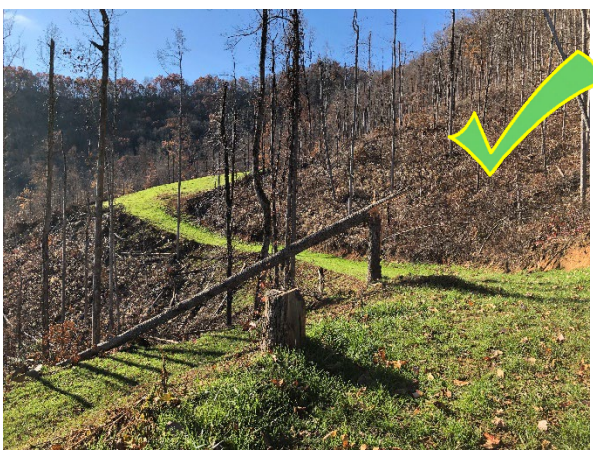
Overland skid trail. Logging slash would help provide soil groundcover.

Shovel logging skid trails in swamps reduce soil impacts.

This rutted, soupy skid trail is a risk to water quality and will likely degrade the soil's condition afterwards.

Above and Below: Two skid trail stream crossing approach ways with slash. Each crossing used bridgemats. At close out, the skid trail was already stabilized so no extra work was needed.

Do not excavate skid trails into the earth!



Set skid trails along the contour on steep ground.

Above and Below: Excellent use of logging slash to cover skid trails and the approach way to a stream crossing.

BMPs for Log Decks

- Keep out of the SMZ. Stay at least 10 feet from stream edge if the deck must be placed in the SMZ.
- Where possible, locate decks out of ephemerals.
- Minimize the number, size and footprint of log decks.
- Minimize soil disturbance.
- Frequently apply and pack down logging debris or woodchips to cover exposed soil.
- Control runoff and capture sediment that flows across or off the deck.

This log deck is on a recently completed job. It is on flat, stable soil. Road pallet mats provided a firm base for log trucks and minimized sedimentation onto the roadway.

Many products are available for access road entrances. This reusable plastic mat is intended to reduce track-out of soil onto the road.

Soil is eroding from this old log deck/truck turnaround. Regrading and stabilization groundcover are needed.

Part 6: SMZ (Stream Buffers)

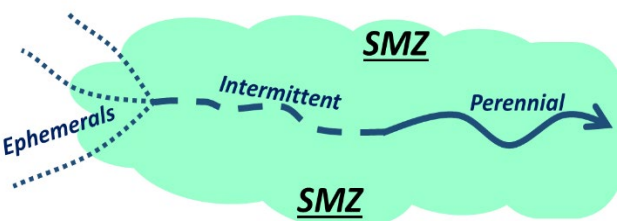
Rule Requirement #1: The FPGs require a SMZ alongside any intermittent stream, any perennial stream, and along the margins of any perennial waterbody.

Rule Requirement #2: Certain watersheds and river basins have additional Riparian Buffer Rules that are in addition to the SMZ requirements. Those areas are:

--Catawba River, and mainstem lakes
--Goose Creek watershed
--Jordan Lake watershed
--Neuse River basin
--Tar-Pamlico River basin
--Randleman Lake watershed

Review the NCFS "WQ" *Forestry Leaflets* that describe the Forest Harvest Requirements of those Buffer Rules.

The SMZ should wrap around the head of the stream to include the ephemeral transition area illustrated below.



The general recommended SMZ width is 50 feet.

SMZs wider than 50 feet may be appropriate when:

- Very steep slopes lead down to the SMZ.
- Multiple ephemerals converge close to and drain towards the SMZ.
- The ephemeral stream leading into the SMZ has evidence of recent channel scouring.
- Exposed, erodible, or disturbed soils are nearby, including old erosion gullies.
- Lack of abundant groundcover or vegetation in the SMZ.
- Streambanks are slumping, undercutting or eroding.
- SMZ is along a special designated sensitive waterway.
- There is a local history of, concern for, or enhanced risk of timber windthrow or blow down in the SMZ (such as tall trees with large crowns, trees on saturated soil, shallow rooted trees and/or site is on the coastal fringe).

SMZs narrower than 50 feet may be acceptable when:

- SMZ is mostly flat ground, and flat terrain extends outward from it for a long distance.
- Soil in the SMZ is dry, stable, undisturbed and has abundant groundcover vegetation.
- SMZ has mostly small trees that can handle strong wind.
- Adjacent stand of timber on both sides of the SMZ has a relatively high density of tree spacing (ex: an uncut stand, plantation thinning, selective harvest, etc.)

BMPs for All SMZs

- **SMZ width is recommended to be 50 feet (each side) and should be no less than 20 feet.**
  -- Measuring the SMZ width immediately atop the ground surface is acceptable, starting at the edge of channel bank.

- Mark the SMZ in the woods so operators can see it.

- Consider leaving the SMZ undisturbed (no cutting) if that aligns with the landowner's objectives.

- Minimize soil disturbance in the SMZ (gouging, scraping, compacting, rutting).

- Promptly re-establish groundcover vegetation that has been removed or lost.

- Keep roads, skid trails, log decks and firelines out of the SMZ. If they must be in the SMZ, keep heavy equipment at least 10 feet from the waterway's edge.

- Conduct equipment refueling and routine servicing outside of SMZs.

- Mix, load, and unload pesticide, fertilizer and other chemicals outside of the SMZ.

If Harvesting Timber from the SMZ

- Remove no more than 50 percent of the SMZ basal area.

  -- Exceptions: Harvesting more than 50 percent basal area may occur in any of these three scenarios:

  (1) Salvaging damaged timber from the SMZ.

  (2) Controlling or removing exotic/invasive/non-native plants in the SMZ.

  (3) Removing planted pines from the SMZ to allow regeneration of other more suitable riparian tree species, thus enhancing plant diversity in the SMZ.

  In each scenario, measures are needed to promote infiltration of runoff into the soil, and along perennial streams, retain enough shade producing canopy cover to avoid full sun exposure.

- If the site is prone to windstorms, consider alternative harvesting prescriptions to minimize the potential of trees blowing over and obstructing the waterway, while still providing adequate shade over perennial streams.

- Fell timber away from the SMZ and stream if possible.

- Avoid creating gaps wider than 1 tree length in the SMZ. Ideally, remaining trees would be evenly spaced apart.

- Stabilize bare soil and repair soil gouges in the SMZ created by the felling and removal of trees.

Do not use the SMZ as a delimbing gate.

For Burning, Site Prep or TSI around SMZs:

- When doing prescribed burns, consider using the stream as a natural firebreak to avoid installing a plowed or bladed fireline. If a fireline is needed in the SMZ, install with hand tools

Do not mechanically site prep, remove stumps, or push soil / debris within the SMZ.

Avoid applying pesticide or fertilizer directly upon the water or into the stream channel.

Mark the SMZ so operators can see it in the woods.

Working around Hydrologically-Connected Ditches

- Minimize nonpoint source pollution produced by forestry operations from being transported by these ditches into intermittent streams, perennial streams or perennial waterbodies.
- Maintain structural integrity of the ditch bank.
- Maintain vegetation along the ditch banks to manage erosion and sedimentation.

Avoid obstructing water flow within the ditch.

Do not service or refuel equipment next to the ditch where possible.

Do not mix/load/unload pesticide, fertilizer or other chemicals next to the ditch where possible.

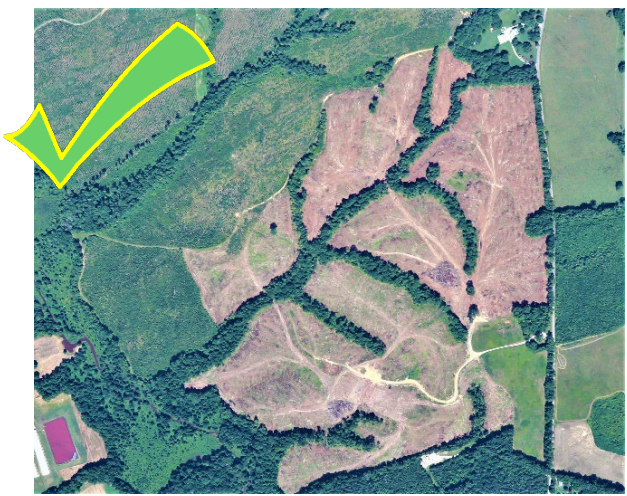
Working around Ephemeral Streams

- Minimize nonpoint source pollution produced by forestry operations from being transported by ephemerals into intermittent streams, perennial streams, or perennial waterbodies.
- When establishing a SMZ on intermittent or perennial streams, the SMZ should wrap around the origin/head of that stream, where the ephemeral transitions into the stream's channel. See illustration on page 6-1.
- Minimize disturbance to the soil and groundcover within the ephemeral area. This includes roads, skid trails, log decks, portable mills and firelines.

- Maintain surface groundcover and woody debris accumulations within the ephemeral if material already exists in place as long as water will not backup onto another person's property.

Do not service or refuel equipment within or next to the ephemeral stream where possible.

Do not mix/load/unload pesticide, fertilizer or other chemicals in or next to ephemerals where possible.



Aerial view of SMZs retained on a timber harvest. Note how the SMZ width varies in some sections.

Excellent SMZ with very little, if any, disturbance or cutting.

Nearly all trees were cut from this SMZ.

Good SMZs that include the ephemeral transition area.

View from inside good SMZs with very little, if any, cutting.

SMZ on this perennial stream was clearcut, which is a violation of the FPGs.

Above and Below: Good SMZs with little disturbance.

Both ditch banks are well vegetated, providing erosion and sedimentation control. The ditch corridor is open with no timber to allow maintenance access.
This open corridor also reduces disturbance during logging since no trees need to be cut off the ditch bank.

Trees were cut from this very narrow section of SMZ along a major river (at left). One tree fell into the river. The muddy logging road bypass on the left is less than 25 feet from the riverbank, and only a thin strip of weeds is there to restrain sediment. Consider public viewpoints along major waterways that host recreational traffic. The SMZ can also be a visual screen and windbreak, if properly designed and protected. (Photo from Aug. 2021.)

Part 7: Stream Crossings

Rule Requirements: The FPGs require protection of water quality when installing a crossing of an intermittent or perennial stream.

BMPs for All Stream Crossings

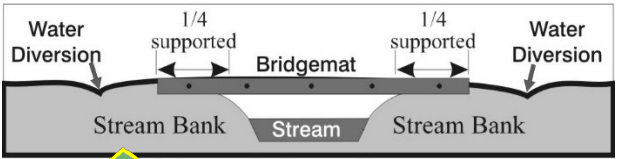
- Avoid having stream crossings whenever possible.
- Minimize the number of crossings.
- Cross where the stream is relatively straight and narrow.
- Keep approach ways to the stream relatively flat.
- Install at a right angle (90°) to the stream channel.
- Maintain as close to normal (pre-construction) streamflow by maintaining depth, width, gradient and capacity of the stream channel at the crossing.
- Conduct construction, installation, and removal work during low water flow if circumstances allow.
- Stabilize the approach ways and/or stream crossing locations so sediment is not transported into the stream.

A list of bridgemat and road mat vendors is available on the NCFS website, scan this QR code:

Brush filled crossings are not acceptable on intermittent or perennial streams, or flowing ditches.

Bridgemats

- Cross where channel banks are firm and stable to provide solid footing to support the bridgemats.
- Maintain a quarter (1/4) of the total bridgemat length on each channel bank footing.
- Create a solid surface platform crossing. Minimize soil and debris from falling down into the channel.
- Lay down curb logs alongside the bridgemat crossing to catch debris and soil from falling over the edges.
- Retain standing bumper trees (goal posts) on either side of the approach way, onto the bridgemats to help funnel the drag of trees across the crossing platform.
- Keep equipment out of the channel when installing and removing bridgemats when at all possible.
- Control runoff and sedimentation.

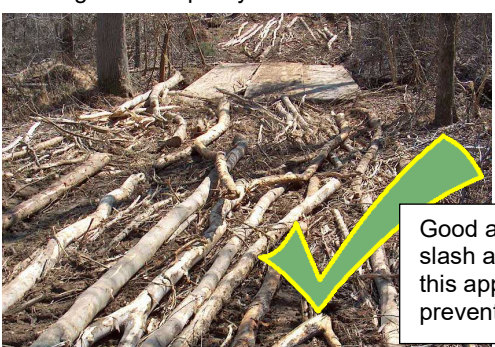


Panels are slipping, soil is entering the stream.

Note the curb logs and panels butted tightly together.

Bumper trees (goal posts) help to funnel the drag of trees across. Panels are butted tightly together.

This crossing is unacceptable. Poor site selection and lack of sufficient logging slash caused soil rutting impacts, creating a water quality risk of sedimentation.



Logging debris is obstructing this stream at the bridgemat crossing. Some curb logs may have helped catch some material from slopping over the sides.

Rule Requirements Related to Obstructions:

- The FPGs require preventing obstructions in intermittent streams or perennial streams.
- State law requires that flow cannot be impeded within natural or man-made waterways which drain the land.
- Consult the NCFS for guidance. Stream and ditch obstructions are evaluated on a case-by-case basis.
- There is no automatic FPG compliance when using bridgemats. The required standards must still be met.

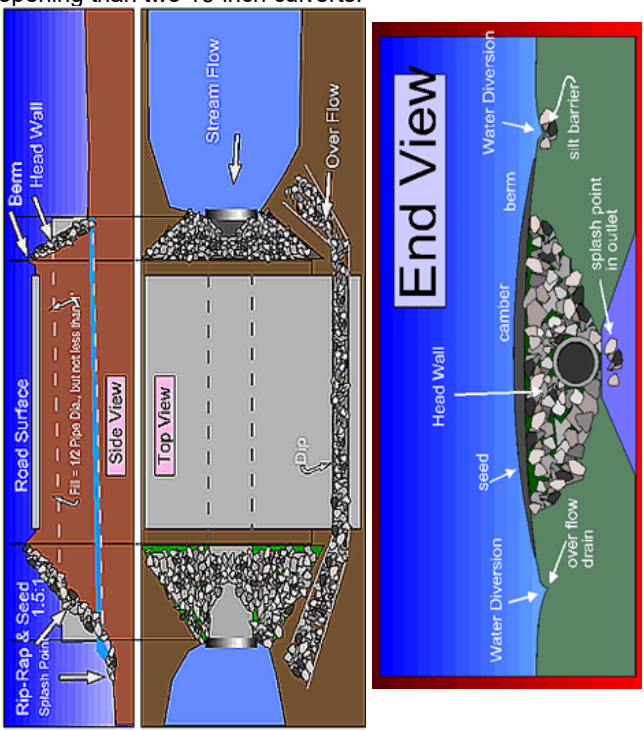
Culverts

- Properly size the culvert diameter based on upstream watershed drainage area, soils, vegetation land cover, slope, size of stream and potential storm runoff.
- Pipe diameter should be no less than 18 inches.
- Extend the pipe ends at least 12 inches beyond the edge of the fill slope.
- Align the culvert to maximize the amount of water that can flow through and allow for aquatic animals to pass.
  -- For temporary: Set culvert immediately upon the stream bottom.
  -- For permanent: Embed 10 to 20 percent of the culvert diameter into the stream bottom.
- Protect and reinforce the inlet and outlet headwalls.
- Set the culvert with a slight downslope grade.
- Backfill with at least 12 inches of material, or one-half of the culvert diameter, whichever is more. Culverts larger than 30 inches in diameter should have backfill thickness that is at least one-third of the culvert diameter.
- Pack down backfill material. Prevent seepage around or underneath the culvert.
- Apply gravel/stone on the installed crossing if needed.
- Install bypass dips on either side of the crossing so floodwater can flow around and reduce the chance of blowing out the pipe.

Avoid perching or elevating the culvert inlet or outlet.

Avoid using material that has asphalt or live cement.

Remember: You cannot simply add the diameters of two smaller culverts together to get the same opening as a larger pipe. A single 30-inch culvert creates a larger opening than two 15-inch culverts.



Both pipes are too small.

Neither has enough groundcover for erosion and sedimentation control.

Headwall is not stabilized (two arrows).

- ✓ Culvert base is buried.
- ✓ Headwall is reinforced.
- ✓ Grass and gravel stabilize the surface.

Culvert base is buried. Headwall has stone for reinforcement and stabilization. Roadway has gravel. There is ample backfill on the culvert.
NOTE: This culvert's diameter may not be large enough when looking at the stream's width.

Culvert is too small, it is off center from the stream channel flow and has no stabilization of the headwall.

Culvert base is not buried enough.

The headwall and crossing surface are not stabilized with groundcover.

Temporary Culvert Sizing

These recommendations should only be used:

- For temporary access.
- During dry periods.
- On sites with relatively dry soils.
- When no rain has fallen or forecast to fall while the crossing is needed.

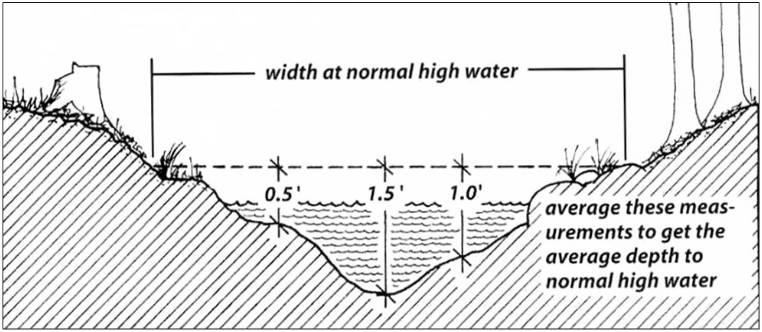
Average Channel Width (inches)	Average Channel Depth (inches)						
	6	12	18	24	30	36	42
12	18	18	18	24	24	30	36
18	18	18	24	24	30	30	36
24	18	24	30	30	36	36	48
30	18	24	30	30	36	48	48
36	18	24	30	36	48	48	48
48	24	30	36	48	48	48	60

North Carolina Forestry BMP Field Guide
STREAM CROSSINGS

Measuring a Stream Channel for Temporary Culvert Sizing

WIDTH: Average channel width at normal high water mark.
Do not simply measure how wide the water is.

DEPTH: Average channel height from the normal high water mark, down to the channel's bottom.
Do not simply measure how deep the water is.



Sketch courtesy of Maine Forest Service, 2004.

Permanent Round Culvert Sizing

These round culvert pipe diameters should account for rainfall rates of 2.5” per hour based on Talbot’s formula. For watersheds larger than 100 acres, consult Table 6-2 in the N.C. Forestry BMP Manual or the online culvert sizing calculator.

	Impervious 100% runoff	Steep slopes, heavy soils, moderate cover		Moderate slopes, heavy to light soils, dense cover		Gentle slopes, agricultural-type soils and cover		Flatland pervious soils
	The letter ‘C ‘ indicates the amount of runoff to expect. High value C means more runoff and heavier streamflow volume Low value C means less runoff and lighter streamflow volume							
Acres	*C = 1.00 Bare Soil*	*C = .80 Higher Runoff*	*C = .70 Lower Runoff*	*C = .60 Higher Runoff*	*C = .50 Lower Runoff*	*C = .40 Higher Runoff*	*C = .30 Lower Runoff*	*C = .20 Normal runoff*
2	18	18	18	18	18	18	18	18
4	18	18	18	18	18	18	18	18
6	24	18	18	18	18	18	18	18
8	24	24	18	18	18	18	18	18
10	30	24	24	24	18	18	18	18
20	36	30	30	30	24	18	18	18
30	42	36	36	30	30	24	18	18
40	48	42	36	36	30	30	24	24
50	48	42	42	36	36	30	24	24
60	36+36	48	42	42	36	36	30	24
70	30+30+30	48	48	42	42	36	30	24
80	36+36+24	30+30+30	48	48	42	36	30	30
90	48+48	36+36	48	48	42	42	36	30
100	48+48	36+36+24	30+30+30	48	48	42	36	30

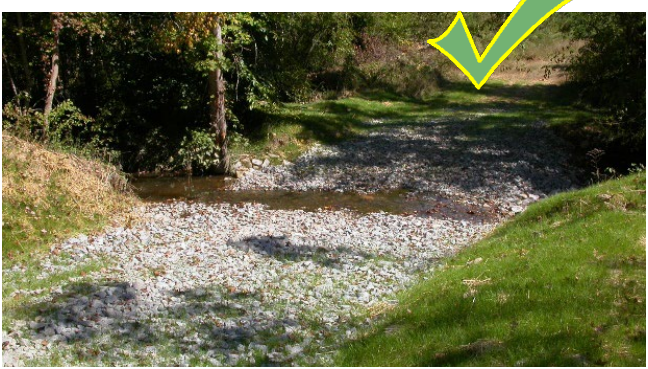
Fords

Appropriate places for a ford crossing may include:

- ✓ A stream that has an existing rocky bottom surface.
- ✓ A crossing that will only see occasional use.
- ✓ Streams too wide for bridgemats or multiple culverts.
- ✓ A low flow stream that often dries up during the year.
- ✓ Areas prone to beaver activity that could dam up a culvert pipe.

⊗ ***Fords are not for skidding logs.***

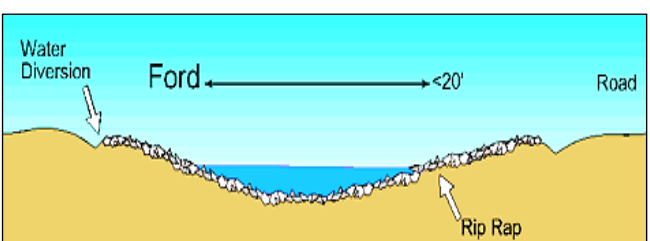
When installing a ford, select sites that have:
(1) low streambanks
(2) solid and level stream bottom
(3) straight section of stream channel



- Minimize the grade of the approach ways.
- Control runoff and sedimentation.
- If the stream bottom is soft and unstable, consider laying down geotextiles as underlayment for the added rock or hardening material.
- Use clean stone or other suitable hardening materials to create a firm surface for vehicle traffic.
- Spread the stone evenly across the stream bottom to avoid dips or humps that could alter streamflow.
- Leave a shallow trough in the center of the channel so stream water can pass during low flow or dry periods.
- Apply clean gravel along the first 100 feet of the approach way. Provide at least 80 percent coverage.
- If the soil is soft, install geotextile underlayment before dumping the clean gravel.

Do not use asphalt or live concrete.

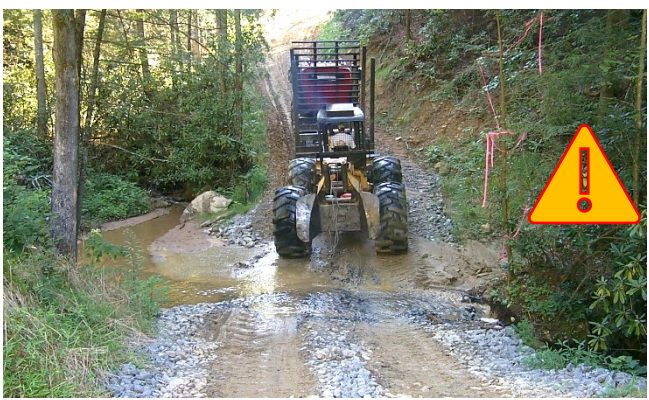
Do not block streamflow.



BEFORE: Bare soil and no hardening of the crossing.

AFTER: Ample gravel applied on the approach ways. Road was widened a little to improve daylighting.

Do not drive within the channel. Cross at right angles.



Don’t let his happen to you! Reconsider your options if you must push or pull trucks through the crossing.

A ford can be a good option for crossing a wide stream. Install ample stone and groundcover on approach ways.

More stone is needed on the road approach ways to keep mud from dragging into the stream crossing.
A good effort was made, but more work is needed.
Apply gravel/stone at least 100 feet back from the channel.

Newly installed shallow ford with plenty of gravel applied.

Pole/Log Crossings

Pole/Log crossings are only for temporary use.

Pole crossings are not suitable for an intermittent stream that has water, or for any perennial stream.

Brush filled crossings are not acceptable on intermittent or perennial streams, or flowing ditches.

Do not deposit soil atop of the pole crossing.

- Allow water to pass through the crossing location.
- Protect the channel bank integrity during use.
- Use only topped and delimbed logs that are free of soil and excess debris.
- Use logs of a large enough diameter so they do not pack too tightly together; usually 10 to 12 inches or larger.
- Pack down limbs, slash, or other woody debris on skid trail approach ways, not in the channel.
- Promptly remove the pole logs after the crossing is no longer needed, or when rain is forecast.
- Stabilize the crossing location during and after use to prevent accelerated erosion or sediment transport. Recontour the channel banks to preexisting condition.

Pole crossing in a dry ditch for haul road access.

Brush-filled crossings are not acceptable for an intermittent or perennial stream, or flowing ditch.

Stream Crossing Rehab

Rehab work is usually needed for every stream and ditch crossing, not just where there is a FPG violation.

- Deposit, crush and pack down leftover slash (limbs, tops, laps, etc.) on the approach ways of skid trail crossings during and after the logging.
- Install erosion and sedimentation control measures. Examples include waterbars, rolling dips, turnouts or sediment traps.
- Remove temporary crossings promptly when no longer needed.
- Stabilize bare soil on the channel banks.
- Remove excessive debris and soil that was deposited into the channel during the forestry operation, to prevent obstructing waterway flow.
- Recontour the channel bank and approach ways if needed to stabilize them. Do not make the channel wider or deeper than it was originally.
- Check the site after heavy rains to make sure the BMPs are still functioning until the site is stabilized. Make repairs promptly if needed.

This skid trail stream crossing needs rehab work. Too much exposed, compacted soil can wash sediment into the stream. There is no groundcover. Note the clipboard in the photo for size scale reference.

This skid trail stream crossing is well done with lots of logging slash on the approach ways that completely covers the ground and prevents soil erosion.

This well-done skid trail stream crossing had grass seed and mulch blankets installed. Debris piles were placed on the slope to help catch runoff before it enters the stream.

Part 8: Wetlands

DISCLAIMER: This section is intended as a quick reference refresher for forestry operators who already have a functional knowledge of the requirements for operating in wetlands. This field guide does not contain all of the laws, rules or guidance for conducting silvicultural activities in wetlands. For more details, reference Chapter 8 of the desktop version of the N.C. Forestry BMP Manual (2021 edition) and its Appendix 10.

Section 404 Permit Exemption

Section 404(f)(1) of the federal Clean Water Act lists activities which are exempt from permitting to dredge material from or discharge into a waters of the U.S. These exemptions include normal farming, silviculture, and ranching activities such as plowing, seeding, cultivating, minor drainage and harvesting for the production of food, fiber, and forest products; and the construction or maintenance of farm roads or forest roads.

To retain the silvicultural exemption in Section 404, forestry activities in wetlands:

- ✓ Must not convert an area of the waters of the U.S. into a use to which it was not previously subject.
- ✓ Must not result in the immediate or gradual conversion of a jurisdictional wetland to a non-wetland.
- ✓ Must not discharge toxic materials.
- ✓ Must not impair the flow or circulation or reduce the reach of waters of the U.S.

[continued on next page]

- ✓ Must comply with the 15 federally required BMPs for roads and skid trails; and follow the 2004 guidance issued by the Corps of Engineers related to forest road construction.
- ✓ Must comply with the six federally required BMPs for mechanical site prep if establishing a pine plantation.

Care must be taken to avoid and minimize wetland disturbance. To qualify for the silvicultural exemptions under Section 404, the activity must be related to the establishment, growth, and harvest of timber and forest products. Owners and operators should avoid undertaking activities that are questionable in relation to silviculture.

Below are some examples of activities in wetlands that likely would require permitting:

- × **Installing a waterfowl impoundment, dike, berm, pond, building, dock, blind, or other structure.**
- × **Constructing a road or stream crossing that is primarily for a non-silvicultural purpose.**
- × **Removing or piling topsoil or stumps in a wetland.**
- × **Ditching, filling, or draining a wetland.**
- × **Installing firebreaks in a wetland for controlled burning that is primarily for wildlife management purposes.**
- × **Clearing wetlands to plant wildlife food plots.**
- × **Altering a stream (damming or channelizing).**
- × **Converting from native forest tree species to non-native species or a different vegetation type.**

BMPs for Timber Harvesting in Wetlands

- Mark sensitive areas where equipment should avoid.
- Avoid using heavy equipment on saturated soil or near waterbodies. Suspend work during flooding.
- Concentrate skidding to the primary skid trails and decks. Avoid randomly dispersed traffic on the site.
- Consider ceasing operations or choosing a better harvest method if a single pass of heavy equipment produces ruts deeper than 12 inches across a significant area of the site beyond the primary skid trails and decks.

BMPs for Shovel Logging

- Minimize the number, width, length, and overall footprint of the shovel skid trails. Keep the skid trail to 1-skidder-width wide. If needed for skidders to pass, install a short, wide section of trail.
- Orient the shovel trails to prevent restriction of expected flood flows that may occur across the harvest area. Install temporary cross drains where needed.
- If the trail must cross a stream, use temporary bridgemats or log stringers. If the trail must go across a coastal marsh, first seek guidance from appropriate agency representatives.
- Build up the shovel trail so heavy equipment travels above the average soil surface. Minimize operation of rubber tired machines off shovel trails.

- Add more trees or logs if the shovel trail begins to sag, sink or break apart.

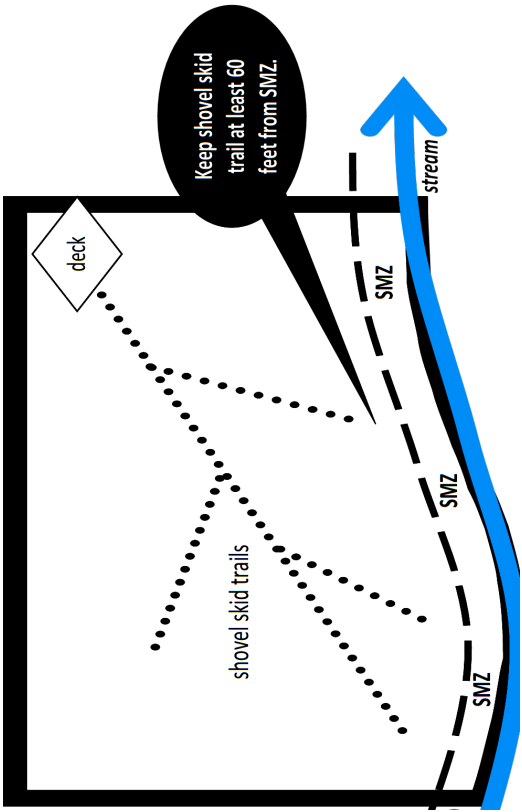
  -- The intent is to avoid 'pumping' action of the soil from each pass of the skidder, which may increase sedimentation and/or turbidity.

- Promptly remove the shovel trail when not needed.
  -- The removed logs/trees should be merchandized; or if not usable, scatter the woody material across the site, away from the SMZ.
- Keep the shovel trail at least 60 feet from the SMZ.
- Limit harvesting trees from the SMZ.
  -- Full retention of trees in the SMZ can maximize its ability to restrain visible sediment and moderate stream temperature.

  -- A fully retained SMZ can also provide a long-term seed source, a wildlife habitat corridor, minimize wind throw potential, and serve as a visual aesthetics screen along the waterway.

- If logging must stop before finishing the harvest, and you wish to keep the shovel trail intact to complete the harvest later, then create gaps in the skid trails if there are identifiable flow-ways, so floodwater can pass through.

Do not excavate new ditches.
Do not obstruct streams, ponds or lakes.
Do not deposit soil atop the shovel skid trail.
Do not excavate stumps or soil.


Keep shovel skid trail at least 60 feet from SMZ.
stream
deck
SMZ
SMZ
SMZ
shovel skid trails

A shovel skid trail for a wetland forest timber harvest.

Side view of a skidder running atop of a shovel skid trail.

Supplemental
Forest Management Considerations
for Logging in Bottomland Swamps

- Retain some permanent seed source trees distributed across the harvest or small clumps/patches of seed source trees. Favor retention of cypress, tupelo, gum, oak or Atlantic white cedar (juniper).
- To promote stump sprouting (known as coppice), cut the stumps at, or slightly above the normal high water mark. This mark is often seen as a permanent water stain or moss line around the base of the trunk. If the stump is submerged underwater, coppice sprouting may be limited.
- Retain snags (if it is safe) and fallen rotten logs to support recruitment of seedlings on hummocks, and to offer wildlife habitat.
- Work with landowners upstream and downstream to promote natural, seasonal stream flows. Take action to prevent water from impounding upon the harvested area while the site regenerates (Examples: beaver dams, man-made berms or clogged culverts).

Much of this backwater slough was clearcut. Be aware that a "slough", "run" or "gut" should be treated like a stream if it
(1) is directly connected to a sound, river or other stream;
(2) flows at least 30 percent of the year; and
(3) has a well-defined channel.
In those cases, a SMZ is required. If the slough has perennial water, then adequate shade must be retained.

Forest Roads in Wetlands

Temporary and permanent roads constructed in wetlands for forestry purposes are exempt from Section 404 permitting if they are constructed in accordance with the mandatory 15 BMPs prescribed in the federal regulations.

In North Carolina, forestry roads in wetlands must also:

- ✓ Adhere to the specifications outlined in a 2004 guidance document from the U.S. Army Corps of Engineers.
- ✓ Comply with the FPGs.
- ✓ Meet the permitting exemption eligibility requirements of the state's CAMA rules, and Dredge & Fill Law (if located in a coastal zone county).

15 Federal Mandatory BMPs for Roads and Skid Trails in Wetlands

Construction of roads, skid trails and stream crossings in a wetlands, or waters of the U.S. for the production of forest products does not require a Clean Water Act Section 404 permit if the 15 federal baseline provisions (mandatory BMPs) listed below are followed:

1. 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 U.S. 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.

2. 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 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 during and following construction to prevent erosion.
5. 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 waters of the United States (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 production.
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.

2004 Guidance for Constructing Exempt Forest Roads in Wetlands of NC

That document contains guidance for road planning and generally accepted road design specifications. It may be presumed that maintaining the Section 404 exemption is contingent upon adhering to this guidance document. It is available in Appendix 10 of the BMP Manual, here:

A Note on Borrow Ditches: If a borrow ditch is dug to build a wetland forest road, then that ditch must not directly or indirectly connect to a stream or ditch outlet. The borrow ditch's un-excavated dead end may need to be as much as 150 feet away (or more) from a stream or another ditch, depending on the soil's drainage capacity.

A well done wetland forest road with its overall footprint kept to a minimum. No ditches were dug.

This is not an acceptable wetland forest road. Water is backing up (on right) and the road is not wide enough to support logging trucks. There is not enough groundcover stabilization to minimize soil erosion.

This culvert crossing in a swamp needs stabilization of the newly applied backfill.

Frequent monitoring is needed to remove debris blockages.

This wetland road is in unacceptable condition after logging. Debris must be removed. The road needs reshaping to allow water to pass and groundcover to stabilize the soil.

This rock ford on a wetland road allows water to pass.

Mechanical Site Prep in Wetlands

Mechanical site prep in most pine wetland forests is exempted from Section 404 permitting, as long as federally required BMPs are followed (next page).

However, a Corps of Engineers permit may be needed for site prep in any of these 9 wetland types:

1. Permanently flooded, intermittently exposed, and semi-permanently flooded wetlands.
2. Riverine bottomland hardwood wetlands.
3. Atlantic white cedar swamps.
4. Carolina Bay wetlands.
5. Non-riverine forest wetlands.
6. Low pocosin wetlands.
7. Wet marl forests.
8. Tidal freshwater marshes.
9. Maritime grasslands, shrub swamps, and swamp forests.

For more details, see Appendix 10 of the BMP Manual.

NOTE: The removal of stumps from a wetland (either fresh stumps or old fat lightered pine rosin stumps) may not be an exempt activity under Section 404. You should consult with the Corps of Engineers if you intend to remove stumps in a forested wetland when not associated with construction of a road or log deck.

Six Federal Mandatory BMPs for Mechanical Site Prep in Wetlands

1. 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.

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

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

4. Prevent disposal or storage of logs or logging debris in SMZs, to protect water quality.

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

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

Minor Drainage

There are many factors to assess when evaluating the applicability, need, benefit or effect of installing minor drainage ditches. Carefully review the federal rules, guidance, and N.C. Forestry BMP Manual, and consider discussing your objectives with the U.S. Army Corps of Engineers before starting.

Consider alternative silvicultural prescriptions that do not require minor drainage. Examples include establishing native wetland tree species or using alternative methods for harvesting timber (shovel logging) or site prep (bedding).

The BMPs included here focus on controlling erosion and sedimentation to help comply with the state FPGs.

In addition to these BMPs, review the guidance memo issued by the EPA and Corps of Engineers in July 2020 (see Appendix 10 of the N.C. Forestry BMP Manual and this QR code). That memo includes information about maintaining eligibility for the Section 404 exemptions while maintaining ditches.

BMPs for Installing Minor Drainage

- Conduct excavation and maintenance during periods of relatively dry soil. If the new minor drainage feature is expected to be deeper than 12 inches, or will directly connect to an outlet, then you should first seek advice from the Corps of Engineers.
- Minimize removal of tree stumps. Cut the tree/stump at ground level and retain the stump/rootwad intact to provide anchoring for the channel and to limit soil disturbance.
- When installing new minor drainage, start excavation near the discharge end while leaving a plug of soil in place to serve as a temporary dam in the newly excavated ditch. This soil plug allows sediment to settle out before connecting the new ditch with an existing drainage outlet.
- Deposit excavated material/spoil within 20 feet of its origin **(Note: This is a state of North Carolina rule requirement).**
- Keep spoil piles small with frequent gaps between them to minimize blockage of floodwaters.
- Stabilize the spoil for erosion and sedimentation control.
- After completing new excavation, stabilize exposed soil in the ditch channel and along the ditchbanks for a distance of 50 feet from the outlet, if there is one. Examples include seed and straw, erosion control matting, excelsior/straw wattles, coconut/coir logs, straw/hay bales, hydroseeding and/or check dams.

BMPs for Ditch Maintenance

- Conduct maintenance during periods of relatively dry soil.
- Minimize the excavation or pushing of trees. Cut the tree/stump at ground level and retain the stump/rootwad intact to provide anchoring for the channel and to limit soil disturbance.
- Install temporary check dams in the ditch to allow visible sediment to settle before the ditch outlet, if there is one.
- Only remove accumulated material down to the ditch's original dimension (depth, width, length).
- Deposit excavated spoil material atop existing adjacent roads or on top of old spoil. **(Note: North Carolina rules require that spoil be placed within 20 feet of its origin).**
- Keep spoil piles small with frequent gaps between them to minimize blockage of floodwaters.
- Stabilize the spoil for erosion and sedimentation control.
- After completing maintenance, stabilize exposed soil in the ditch channel and along the ditchbanks for a distance of 50 feet from the outlet. Examples include seed and straw, erosion control matting, excelsior/straw wattles, coconut/coir logs, straw/hay bales, hydroseeding and/or check dams.

Questions about the Section 404 silvicultural exemptions or guidance should be directed to the U.S. Army Corps of Engineers' Wilmington District Office: 910-251-4811.

Part 9: Site Preparation, Chemicals and Fire

BMPs for Mechanical Site Prep

- Operate heavy equipment when soil is relatively dry.
- Minimize exposure of bare soil, especially on areas with high erosion risk or near waterbodies.
- The site prep should not significantly reduce the infiltration capacity of the soil.
- Minimize overall site disturbance within ephemeral drainages.
- Maintain the natural topography of the land; avoid filling in or leveling off areas.
- Minimize the number of heavy equipment passes across the site.
- Service equipment away from waterbodies and the SMZ.

Avoid working saturated soil.

Stay out of the SMZ.

Avoid uprooting of stumps and trees where possible.

Avoid gouging the soil in a manner that could funnel runoff and deliver sediment into waterbodies.

Additional BMPs for Shearing/Raking/Piling:

- Minimize displacement of topsoil. A toothed rake often works better than a dozer blade.
- Arrange windrows along the contours across the slope, not up and down the slope.
- Leave opening in windrows to avoid impounding surface water runoff. Stagger the openings in windrows.

Avoid pushing debris into the SMZ.

Additional BMPs for Bedding/Tilling/Disking:

- Operate along the land contour across the slope, not up and down the slope.
- Do not aim bed rows or tillage strips downslope towards a stream.
- Retain undisturbed groundcover between bed rows and tillage strips.
- When leaving gap openings within bed rows, stagger the openings from one bed row to the next, minimizing the funneling of surface runoff but still allowing overland sheet flow to pass. This is especially important in low-lying flood-prone areas.

Do not tie in beds or tillage strips with intermittent or perennial streams, ditches or perennial waterbodies.

Forestry Chemicals

Rule Requirements:
If aerial application of pesticide over wetlands or waters of the U.S. will exceed certain annual thresholds of acres or linear feet of waterway treated, then a Certificate of Coverage is needed to comply with the state NPDES Pesticide General Permit. Contact NC DEQ to learn more.

- Follow the product label(s) and/or SDS.
- Apply at least 50 feet from an intermittent or perennial stream or perennial waterbody, unless the targeted area falls within this distance range. Take precautions to protect water quality if applied closer than this.
- Avoid broadcast application in, or over SMZs and water unless the chemical is labeled for aquatic use.
- Apply fertilizer sparingly in ephemeral drainages.
- Avoid chemical application if rainfall is forecast within 24 hours unless needed for product activation.
- Properly store, mix, and load chemicals away from SMZs, ditches and waterbodies.
- Properly dispose chemical containers according to product label recommendations and laws.
- Park equipment used for application outside of the SMZ or away from water.
- Plan for the containment and cleanup of spills or leaks by having suitable tools or materials on-site.

Fire Management

Fire is a natural element of North Carolina's forests. Its careful application in a prescribed manner can sustain forest health, reduce wildfire risk and enhance diversity.

The biggest water quality risk is usually not the actual fire itself, but instead is from erosion and sedimentation that comes from firelines.

Consider allowing the fire to back out from the stream and burn through the SMZ or wetland, thereby avoiding the need to install a fireline along the stream, waterbody or wetland.

A fireline in the transitional ecotone between uplands and the riparian area can block movement of amphibians and other wildlife.

This bladed fireline only scraped off the top layer of vegetation.

Most firelines do not need to be deeply excavated.

BMPs for Firelines on Prescribed Burns

- Install the fireline only as deep and/or wide as necessary to contain the prescribed fire.
- Minimize erosion and prevent runoff from directly entering waterbodies and installing water diversions.
- Set the fireline along the contour and avoid straight uphill/downhill placement when possible.
- Fireline slope should be 25 percent or less if possible.
- Stay out of marsh areas.
- Promptly remove debris or soil that was deposited into a stream during fireline installation.
- Revegetate exposed soil in firelines to control erosion.

BMPs for Wildfire Control

- Protect surface waters from sedimentation and pollution.
- Minimize the number of stream crossings. Promptly rehabilitate them afterward.
- Keep fire-retardant chemicals out of surface waters.
- Clean and maintain firefighting equipment away from surface waters.
- If water retention areas are constructed, return them to their preexisting condition afterward.
- Stabilize and/or retire firelines, trails or roads.
- Install water diversions where needed to control runoff.
- Establish groundcover, revegetate or stabilize areas that are high risk for accelerated erosion.

A plowed line can funnel runoff and accelerate soil erosion.

Smooth over firelines and establish groundcover.

This site prep prescribed fire was allowed to burn into the SMZ with little to no damaging impacts.

This fireline was rehabilitated and stabilized.

Part 10: Fluids, Waste and Spill Control

State Law Requirements for Petroleum Spill Notification

Notify NCDEQ / DWR within 24 hours of discharge or spill if:
-- Amount is 25 gallons or more, **or**
-- Spill causes a sheen on nearby surface water, **or**
-- Spill occurs within 100 feet of any surface water.

Notification is not needed, but you must still cleanup if:
-- Amount is less than 25 gallons, **and**
-- No sheen is produced on nearby surface water, **and**
-- The spill is more than 100 feet from surface water.

Notify NCDEQ / DWR immediately if:
-- Amount is less than 25 gallons, **and**
-- You cannot effectively clean it up within 24-hours, **or**
-- Spill causes a sheen on surface water.

NC-DEQ Regional Offices			
Asheville	828-296-4500	Washington	252-946-6481
Fayetteville	910-433-3300	Wilmington	910-796-7215
Mooresville	704- 663-1699	Winston-Salem	336-776-9800
Raleigh	919-791-4200		

N.C. Emergency Management 24-Hour Line 1-800-858-0368

No matter how much petroleum or chemical is leaked, spilled, or discharged, immediate containment and cleanup is required by state law.

BMPs for Fluid Spill/Leak

- Protect yourself, others and water quality.
- Check equipment. Shut down and lock out the machine.
- Control the spill and stop the leak.
- Contain the fluid and create a temporary dirt berm or dike around the spill.
- Apply absorbent material to soak up the fluid (sawdust, wood chips, oil-dry, cat litter, etc.)
- Dig up contaminated soil and dispose off-site at an appropriate facility.

Tools and Supplies for Controlling Spills:

- ✓ Absorbent powder, granules, booms or pads.
- ✓ Plugs, clamps and locking pliers to control a hose leak.
- ✓ Shovels to dig a berm or trench to contain a spill and remove contaminated soil.
- ✓ Empty buckets to contain fluids and contaminated soil.
- ✓ Tarps to prevent fluid from soaking into the ground.

BMPs for Managing Fluids

- Keep fluids away from streams, ditches, ponds, lakes, wetlands or groundwater wells.
- Frequently inspect equipment for leaks and repair them promptly, especially working near water.
- When washing equipment in the woods, only use water.
- Designate areas for equipment maintenance and fueling on level ground away from water.
- Park and service equipment at least 100 feet from all streams, wetlands, ditches, and ephemeral drainages if site conditions allow.
- Use suitable secured containers with lids to store oils, fuels and other fluids in a manner that controls or minimizes leakage and spillage.

⊗ ***Do not use degreasers or detergents.***

1 fluid drop per second = 5 gallons per day!
That adds up to 1,825 gallons per year.
How much money is leaking out of your machines?

BMPs for Managing Waste

- Keep garbage in a container for proper disposal. If left uncontrolled, garbage and waste may pose a risk to water quality.

⊗ ***Do not bury or burn fluid containers, tires, trash or other waste on the job site.***

Fluids contained in a trailer are upright and lids attached.

Unacceptable disregard for environmental protection and unprofessional.

Part 11: Rehab and Stabilization

Rule Requirements:
FPG .0203 requires stabilization of stream crossings.
FPG .0209 requires rehab and stabilization on the job site.

BMPs for Site Rehab

- Install effective diversion and catchment structures where needed across the job site to control runoff and capture sediment.
  -- Focus on sloping skid trails, roads, firelines, log decks or truck turnaround areas.

- If needed, disk or till compacted soil to create a suitable seedbed for revegetation groundcover and to promote infiltration of rainfall runoff.

- If needed, incorporate appropriate soil amendments such as fertilizer, lime or organic matter.

- Apply groundcover seed on critical bare soil that requires prompt revegetation.

- After broadcasting seed, apply mulch (such as straw) to retain moisture and shield the seed from wildlife browsing. Straw should cover at least 75 percent of the seeded area but not completely smother the seed.

- Instead of grass seed, a thick layer of wood chips, bark, or mulch may be suitable to provide groundcover.
  -- If applied, material should cover almost all of the exposed soil at a depth of at least 4 to 6 inches thick. This treatment is best on flat ground and away from waterways, ensuring the mulch will not wash downslope or float away during flooding.

- Consider working with the landowner to control access to the rehabilitated site so groundcover vegetation can become established. Gates, fences, brush piles, trenches or tall waterbars/berms are good methods.

- Monitor and make repairs until the forestry related work is permanently stabilized effectively to restrain accelerated erosion and prevent visible sedimentation into intermittent streams, perennial streams and perennial waterbodies. Checking the site after heavy rain is helpful.

Timber Harvests:

- Deposit, crush and pack down leftover slash (limbs, tops) on critical bare soil areas to provide groundcover during and after the logging operation.
  -- Focus on the approach ways to skid trail waterway crossings, on sloping or erodible sections of skid trails or temporary roads, and on log decks.
  -- This is not suitable on firebreaks or permanent roads.

Waterway Crossings:

- Stabilize bare soil on the channel banks.
- Remove temporary crossings promptly when not needed.
- Remove excessive debris and soil introduced during the forestry operation to prevent obstructing waterway flow.
- Recontour the channel bank and approach ways as needed to stabilize them.

Do not widen or deepen the channel beyond its original size.

Groundcover Vegetation Seed Mixes

Spring Application Mix	Seeding Rate
Creeping Red Fescue	20 pounds / acre
Red Clover	10 pounds / acre
Oats	1 to 2 bags / acre
Summer Application (Temporary Cover)	**Seeding Rate**
German Foxtail or Browntop Millet	25 pounds / acre
Early Fall Application Mix	**Seeding Rate**
Creeping Red Fescue	20 pounds / acre
Red Clover	10 pounds / acre
Wheat	1 to 2 bags / acre
Late Fall Application Mix	**Seeding Rate**
Creeping Red Fescue	20 pounds / acre
Annual Ryegrass	10 pounds / acre
Rye	1 to 2 bags / acre
Winter Application (Temporary Cover)	**Seeding Rate**
Annual Ryegrass	20 pounds / acre

There is a list of hydroseeding and hydromulching contractors on the NCFS website at this QR code:

Stream debris was removed and groundcover established.

Part 12: Laws and Rules

***DISCLAIMER*: This section does not include all applicable laws, rules or guidance that governs forestry related, land-disturbing activities. Review Chapter 2 and Appendix 10 of the N.C. Forestry BMP Manual for a summary and citations of regulations.**

The most frequent water quality rules that apply to forestry operations are listed below, and where they apply:

Statewide

- *Forest Practice Guidelines Related to Water Quality* ("FPGs").
- State laws prohibit obstructing a stream/waterway/ditch.
- State law requires notification of a petroleum discharge. (See Page 10-1 for those requirements).

Certain River Basins or Watersheds

- EMC / DWR riparian buffer rules in these areas:
  -- Catawba River and mainstem lakes
  -- Goose Creek watershed (Mecklenburg/Union co.'s)
  -- Randleman Lake watershed
  -- Jordan Lake watershed
  -- Neuse River basin
  -- Tar-Pamlico River basin

- Federal 4(d) Rules and/or Critical Habitat, along certain waterways to protect aquatic T&E species.

North Carolina FPGs

Note: The FPGs were revised and re-adopted in 2018. The rules printed here include those changes.

02 NCAC 60C .0101 INTRODUCTION AND PURPOSE

(a) The rules in this Subchapter establish performance standards for the protection of water quality during silvicultural activities. Persons shall adhere to the standards related to silvicultural land disturbing activities in order to retain the forestry exemption provided in G.S. 113A-52.1, the N.C. Sedimentation Pollution Control Act of 1973, as amended in 1989.

(b) Implementation of the rules in this Subchapter shall recognize that extreme and unusual weather may cause reasonable and otherwise adequate application of protective measures to fail. Where such measures fail and the resulting effect is not in compliance with a rule of this Subchapter, the responsible party(ies) shall implement corrective measures. The Forestry Best Management Practices Manual, developed and published by the North Carolina Forest Service Division, contains specifications for a variety of practices that may be used to meet the performance standards set forth in this Subchapter. Best Management Practices (BMPs) should be developed and selected to allow for the variation in weather, topography, soil, and vegetation expected for the site and season. This manual and the rules in this Subchapter may be obtained by contacting the, Assistant Commissioner, North Carolina Forest Service Division, Raleigh, North Carolina.

02 NCAC 60C .0102 DEFINITIONS

In addition to the terms defined in G.S. 113A-52, the following definitions shall apply throughout this Subchapter:

(1)"Accelerated Erosion" means any increase over the rate of natural erosion, as a result of land-disturbing activities.

(2)"Access Road" means a temporary or permanent access route upon which wheeled vehicles are intended to operate with repeated passes.

(3)"Adverse Impact" as used for pesticides and fertilizers means actions that result in a violation of water quality rules 15A NCAC 02B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina, 15A NCAC 02L .0200 - Classifications and Water Quality Standards (related to groundwater) and 02 NCAC 09L .1005 - Restricted Areas, which are incorporated by reference including subsequent amendments.

(4)"Best Management Practice" (BMP) means a practice, or combination of practices, that is determined to be an effective and practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. The Best Management Practices may be found in the North Carolina Forestry Best Management Practices Manual to Protect Water Quality and is incorporated by reference including subsequent amendments

(5)"Channel" means a natural water-carrying trough cut vertically into low areas of the land surface by erosive action of concentrated flowing water, a ditch, or canal excavated for the flow of water.

(6)"Colloidal Particles" means fine grained materials, organic or inorganic, that are suspended such as clay particles.

(7)"Ground Cover" means any natural vegetative growth, or other natural or manmade material that renders the soil surface stable against accelerated erosion.

(8)"Groundwater" means phreatic water or subsurface water in the zone of saturation.

(9)"Land-Disturbing Activity" means the same as defined in G.S. 113A-52.

(10)"Log Deck" means a place where harvested trees or logs are gathered or staged in or near the forest for handling, sorting, merchandizing, temporary storage, or further transport.

(11)"Mill Site" means any place where forest products are stored, altered, or processed.

(12)"Permanently Stabilized" means the site is protected to the state at which no further accelerated erosion is expected to occur from the forestry-related, land-disturbing activities.

(13)"Pesticides" means a chemical used to kill pests. The term includes insecticides, fungicides, herbicides, and rodenticides.

(14)"Site Preparation" means a forest activity to prepare the site for reforestation.

(15)"Skid Trail" means a temporary pathway used to drag or transport felled trees or logs or other woody material to a log deck or portable mill site.

(16)"Stream" means a body of concentrated flowing water in a natural low area of the land surface.

(a)"Ephemeral stream" means a stream that flows only during and for short periods following precipitation and flows in low areas that may or may not have a well-defined channel.

(b)"Intermittent stream" means a stream that flows only during wet periods of the year (30-90 percent of the time) and flows in a continuous well-defined channel.

(c)"Perennial stream" means a stream that flows throughout a majority of the year (greater than 90 percent of the time) and flows in a well-defined channel.

(17)"Streamside Management Zone (SMZ)" means an area along both sides of intermittent streams and perennial streams and along the margins of perennial waterbodies where extra precaution is used in carrying out forestry-related, land-disturbing activities in order to protect water quality.

(18)"Visible Sediment" means solid particulate matter, both mineral and organic, which may be seen with the unaided eye that has been or is being transported by water, air, gravity, or ice from its site of origin. This does not include colloidal sized particles.

(19)"Waterbody" means a natural or man-made basin that stores water, not including jurisdictional wetlands or beaver ponds.

(20)"Working Days" means days exclusive of Saturdays and Sundays during which weather conditions or soil conditions permit land-disturbing activity to be undertaken.

SECTION .0200 FPG PERFORMANCE STANDARDS

02 NCAC 60C .0201 STREAMSIDE MANAGEMENT ZONE

(a) A streamside management zone (SMZ) shall be established and maintained along the margins of intermittent streams, perennial streams and perennial waterbodies. The SMZ shall confine visible sediment resulting from accelerated erosion.

(b) Ground cover, or best management practices, within the SMZ shall restrain accelerated erosion.

(c) Access roads, skid trails, except as provided in Rule .0203 of this Section, logging decks and mill sites shall be placed outside of SMZs. When barriers such as property lines or limiting land features prohibit the location of any of these outside of SMZs, they can be located within the SMZs. When located within SMZs, there shall be effective erosion control and sediment control structures or measures installed to restrain accelerated erosion and prevent visible sediment from entering intermittent streams, perennial streams or perennial waterbodies.

02 NCAC 60C .0202 PROHIBITION OF DEBRIS ENTERING STREAMS AND WATERBODIES

Stream obstruction and the impediment of stream flow or degradation of water quality shall be prevented by keeping soil and debris from forestry-related, land-disturbing activities out of intermittent streams, perennial streams and perennial waterbodies.

02 NCAC 60C .0203 ACCESS ROAD AND SKID TRAIL STREAM CROSSINGS

Access roads and skid trails that cross an intermittent stream, a perennial stream or a perennial waterbody shall be installed so as to minimize the amount of visible sediment that enters that stream or waterbody. These crossings shall be installed so that:

(1) stream flow will not be obstructed or impeded;

(2) no intermittent stream channel, perennial stream channel, or perennial waterbody shall be used as an access road or skid trail;

(3) crossings are provided with effective structures or ground cover to protect the stream banks and stream channel from accelerated erosion;

(4) crossings shall have sufficient water control devices to collect and divert surface flow from the access road or skid trail into undisturbed areas or other control structures to restrain accelerated erosion and prevent visible sediment from entering intermittent streams, perennial streams, and perennial waterbodies; and

(5) ground cover, or best management practices, that prevent visible sediment from entering intermittent streams, perennial streams, and perennial waterbodies shall be provided within ten working days of initial disturbance and will be maintained until the site is permanently stabilized.

02 NCAC 60C .0204 ACCESS ROAD ENTRANCES
A forest access road entrance that intersects a paved road shall be installed and maintained to prevent visible sediment or other debris from being deposited onto the paved road to the extent that the visible sediment or other debris would enter an intermittent stream, a perennial stream, or a perennial waterbody.

02 NCAC 60C .0205 PROHIBITION/WASTE ENTERING STREAMS / WATERBODIES / GROUNDWATER
Measures shall be taken to prevent equipment servicing waste, petroleum, fertilizers, or other chemical waste from entering streams, perennial waterbodies, and groundwater that results in a violation of an water quality standard of 15A NCAC 02B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina, and 15A NCAC 02L .0200 - Classifications and Water Quality Standards (related to groundwater).

02 NCAC 60C .0206 PESTICIDE APPLICATION
Application of pesticides shall be limited to those labeled for that intended use, shall be used in accordance with labeling and rules adopted by the N.C. Pesticide Board as set forth in 02 NCAC 09L .1005, Restricted Areas, and applied in a manner to prevent adverse impacts on water quality.

02 NCAC 60C .0207 FERTILIZER APPLICATION
When used, fertilizers shall be applied in a manner to prevent adverse impacts on water quality.

02 NCAC 60C .0208
PERENNIAL STREAM TEMPERATURE

Shade within SMZs associated with natural perennial streams shall be retained to protect those streams from temperature fluctuations that result in a violation of a water quality standard of the Environmental Management Commission as contained in Rule 15A NCAC 02B .0211 - Fresh Surface Water Classifications and Standards which is incorporated by reference including subsequent amendments.

02 NCAC 60C .0209
REHABILITATION OF PROJECT SITE

Areas on the project site that have the potential for accelerated erosion to cause visible sediment to enter an intermittent stream, a perennial stream, or a perennial waterbody, shall be provided with ground cover or best management practices of adequate sedimentation control within 30 working days after ceasing any phase of an operation or beginning a period of inactivity. Sedimentation control measures or ground cover shall be required for any area that is contributing or has contributed visible sediment into an intermittent stream, a perennial stream, or a perennial waterbody, regardless of when the visible sedimentation occurred as a result of the forestry-related, land-disturbing activity. Treatment and maintenance of those areas shall be sufficient to restrain accelerated erosion and prevent visible sediment from entering intermittent streams, perennial streams, and perennial waterbodies until the site is permanently stabilized.

Stream and Ditch Obstruction Laws

G.S. 77-13. Obstructing streams a misdemeanor.

If any person, firm, or corporation shall fell any tree, or put any obstruction, except for the purposes of utilizing water as a motive power, in any branch, creek, stream, or other natural passage for water, whereby the natural flow of water through such passage is lessened or retarded, or whereby the navigation of such stream may be impeded, delayed, or prevented, the person, firm, or corporation so offending shall be guilty of a Class 2 misdemeanor. In addition to any fine or imprisonment imposed, the court may, in its discretion, order the person, firm, or corporation so offending to remove the obstruction and restore the affected waterway to an undisturbed condition, or allow authorized employees of the enforcing agency to enter upon the property and accomplish the removal of the obstruction and the restoration of the waterway to an undisturbed condition, in which case the costs of the removal and restoration shall be paid to the enforcing agency by the offending party. Nothing in this section shall prevent the erection of fish dams or hedges across any stream which do not extend across more than two thirds of its width at the point of obstruction. If the fish dams or hedges extend more than two thirds of the width of any stream, the said penalties shall attach. This section may be enforced by marine fisheries inspectors and wildlife protectors. Within the bounds of any county or municipality, this section may also be enforced by any law enforcement officer having territorial jurisdiction, or by the county engineer. This section may also be enforced by specially commissioned forest law-enforcement officers of the Department of Agriculture and Consumer Services for offenses occurring in woodlands. For purposes of this section, the term "woodlands" means all forested areas, including swamp and timber lands, cutover lands, and second-growth stands in previously cultivated sites.

G.S. 77-14. Obstructions in streams and drainage ditches.

If any person, firm or corporation shall fell any tree or put any slabs, stumpage, sawdust, shavings, lime, refuse or any other substances in any creek, stream, river or natural or artificial drainage ravine or ditch, or in any other outlet which serves to remove water from any land whatsoever whereby the drainage of said land is impeded, delayed or prevented, the person, firm or corporation so offending shall be guilty of a Class 2 misdemeanor: Provided, however, nothing herein shall prevent the construction of any dam or weir not otherwise prohibited by any valid local or State statute or regulation. In addition to any fine or imprisonment imposed, the court may, in its discretion, order the person, firm, or corporation so offending to remove the obstruction and restore the affected waterway to an undisturbed condition, or allow authorized employees of the enforcing agency to enter upon the property and accomplish the removal of the obstruction and the restoration of the waterway to an undisturbed condition, in which case the costs of the removal and restoration shall be paid to the enforcing agency by the offending party. This section may be enforced by marine fisheries inspectors and wildlife protectors. Within the boundaries of any county or municipality this section may also be enforced by any law enforcement officer having territorial jurisdiction, or by the county engineer. This section may also be enforced by specially commissioned forest law-enforcement officers of the Department of Agriculture and Consumer Services for offenses occurring in woodlands. For purposes of this section, the term "woodlands" means all forested areas, including swamp and timber lands, cutover lands and second-growth stands on previously cultivated sites.

River Basin and Watershed Riparian Buffer Rules

The Forest Harvest Requirements of each buffer rule are described in Forestry Leaflets and a 1-page quick reference matrix table on the NCFS website, accessible by scanning this QR code.

Federal 4(d) Rules for Threatened Species

Some aquatic species listed as federally threatened have rules that must be followed. The rule requirements are very similar to the FPGs and Buffer Rules. There are information leaflets on the NCFS website that can be accessed by scanning this QR code (on the web page, scroll to the bottom and look in the section for "*Federal 4d-Rules and Critical Habitat for Aquatic T&E Species*").

North Carolina Forestry BMP Field Guide, 2022 Edition.

5000 copies were printed at an approximate cost of $23,953. 10/2022.

Funds for preparation and printing provided by the following:

North Carolina's State Implementation Committee of the Sustainable Forestry Initiative.

N.C. Department of Agriculture and Consumer Services, North Carolina Forest Service.

USDA Forest Service, Forest Stewardship Program.

USEPA Nonpoint Source 319-Grant, via the N.C. DEQ Division of Water Resources.

SUSTAINABLE FORESTRY INITIATIVE NORTH CAROLINA

SFI-01134

Nonpoint Source 319-Grant

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Steve Troxler, Commissioner of Agriculture