

Final Project Report

US-EPA NonPoint Source (NPS) Pollution Control Grant through Section 319h of the Clean Water Act Administered by the NC Division of Water Quality

“Forestry Stream Crossings BMP Video Series”

NC-DENR Contract E2089
\$5,500 (FY94)
12/31/98 - 12/31/00
Video #1 (Bridgemats)

NC-DENR Contract EW03005
\$5,500 (FY02)
7/15/02 - 7/15/05
Video #2 (Stream Crossings)

North Carolina Division of Forest Resources (NCDFR) NC Department of Environment and Natural Resources



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NCDFR Water Quality & Forestry NPS Project Information:
www.dfr.state.nc.us/water_quality/water_quality.htm



**NONPOINT SOURCE
MANAGEMENT PROGRAM**
Section 319(h) of the Clean Water Act
319 GRANT



North Carolina
Non-point Source
Program

Acknowledgements

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Additional gratitude is expressed to those loggers, landowners, foresters, and DFR field staff that assisted with the coordination of filming sites and in contributing content for these videos.

Special thanks to DFR Webmaster and Videographer Tom James for producing each video, and to Assistant Regional Forester Greg Yates for initiating the concept for this project.

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Executive Summary

The North Carolina Division of Forest Resources (NCDFR) produced two informational videos that address Best Management Practices (BMPs) for the most common types of stream crossings used in forestry operations in North Carolina: Bridgemats, culverts, and fords. A supplemental instructional handout was developed which describes the desired learning objectives for each video and is included with each copy. The handout is also included with this final report.

The logging and forestry sectors of North Carolina are the target audience for these videos. The videos will become a standard teaching tool used in continuing education workshops that are required by the North Carolina Forestry Association's "ProLogger" logger-training program, and are highly anticipated both within NCDFR and by our customers.

Using this video production equipment, we intend to create additional informational and educational videos that promote our ongoing nonpoint source projects across the state. The status of these projects will be updated through the Forestry NPS web site 'Newsdesk', and in the NPS Unit's regular quarterly reports provided to the NC Division of Water Quality.

Introduction & Background

Two stream crossing BMP videos intended for a logging and forestry audience were completely and wholly produced by the Division of Forest Resources as a result of input from NCDFR field staff in western North Carolina during the 1999 to 2000 timeframe.

Stream crossings typically pose the highest risk of nonpoint source pollution during timber harvesting, especially in the rugged terrain and erodible soils of western North Carolina.

Two separate funding-year grants were requested from, and provided by, the 319 Grant Program through the NC Division of Water Quality for the production of these two videos.

NCDFR staff handled all video footage capture, video editing, production, and script development.

This was done in order to maintain efficient and cost-effective project management.

The NCDFR determined that in-kind services provided better cost effectiveness than if an external, third party was contracted to produce these videos.



Figure 1: NCDFR Videographer setting up to capture video footage of a crossing that was established with DFR bridgemats acquired through a 319-Grant in 2003.

Project Purpose & Goals

While the topic of stream crossings has been addressed by instructional videos from other agencies, these productions have not focused solely on North Carolina forest operations, and are in some cases nearly 10 years old. In addition, the presentation of materials and “desired learning objectives” in these older videos has not been aimed at a traditional logger and general public audience, as is the case with NCDFR’s videos.

The goals of this project include:

1. Create two videos to address forestry BMPs related to stream crossings:
 - Video 1 - Bridgemats for Temporary Crossings
 - Video 2 - BMPs for Bridgemat, Culvert, and Ford Crossings
2. Develop complementary “Desired Learning Objectives” instructional handout for audience
3. Produce 250 copies of videos and distribute throughout North Carolina forestry community
4. Integrate videos as a standard component of continuing education workshops for North Carolina “ProLogger” logger training program, administered by the N.C. Forestry Association

Methodology & Execution

The DFR produced both videos in-house, with existing staff that was already trained in videography and competent with video-editing software. This required the purchase of video collection and processing hardware, as well as production and editing software.

During this grant cycle, the State of North Carolina was in the midst of an extreme budget crisis, which necessitated the stoppage of purchasing all non-essential goods and services. For a period of nearly 2 years, the DFR made repeated attempts to secure the video, software, and production equipment needed for this project. This temporary withholding of DFR's purchasing authority, in spite of already-encumbered federal funds, delayed the final development of the two videos.



Figure 2: One suite of video capture equipment used for this project

Once the equipment and software were obtained, DFR solicited field staff and forest industry contacts for suitable stream crossing sites.

DFR collected footage, produced, and released both videos at the same time to maximize efficiency in travel and allocation of staff time investment.

Copies of both videos are recorded and distributed on a single VHS tape or DVD. This was done to:

- Provide “1-stop shopping” for customers who conduct training workshops
- Correlate the similar subject matter of each video
- Maximize the use of media format given the run-time of each; video #1 is +/- 10 minutes, video #2 is +/- 20 minutes

Outputs & Results

A VHS tape and DVD are included with this final report as the final project output / result.

Also included with this report, as an attachment, are the “Desired Learning Objectives” instructional handouts that were developed and included with each copy of the video.

The initial production run for these videos included 100 DVD copies and 150 VHS copies. At the time of this report, a second run of 100 DVD copies has been purchased by NCDFR, since nearly all 250 first-run copies were distributed. The initial distribution included both direct mailings within North Carolina, and filling customer requests from several state and federal natural resources agencies across the United States.

We will distribute a customer feedback survey on these two videos during the latter parts of 2005.

Measurable Outcomes & Conclusions

In spite of the long duration required to produce these videos, the outcome of this 319-Grant funded project is a highly visible success story. These two videos are incorporated as a standard, required component of ongoing continuing education (CE) workshops of the statewide ProLogger logger-training program.

ProLogger has trained over 3,000 individuals since it's beginning in the mid-1990's by the North Carolina Forestry Association, with cooperation and assistance from the NC Division of Forest Resources, and other program partners.



Starting in July 2005, the ProLogger course requires a minimum number of CE credits each year to remain in good standing as a ProLogger. Each year, new workshop topics and educational materials will be developed to address this CE need - - these two videos are the first component of these CE workshops, and will be used in the future within ProLogger courses as the need arises.

These instructional videos will also be used within NCDFR, and be made available to the public upon request. Additional copies are planned to supplement our inventory, since nearly all of the first-run copies have been distributed.

With the advent of continuing education requirements in the logging profession, there will be a need for the kind of instructional videos and lesson plans that this project provides. While this project started slowly due to budgetary constraints beyond our control, all efforts were made to produce a professional, high caliber training tool that is highly anticipated by our customer base.

Project Implications & Lessons Learned

With these two grant-funded videos completed, the NCDFR's Forestry NPS Unit intends to use the existing video hardware and software to develop a broad range of educational and informational videos highlighting the multitude of NPS projects being undertaken across the state.

Video footage has already been captured of existing conditions for our stream and watershed restoration project on Purlear Creek in Wilkes County.

This project is located at Rendezvous Mountain Educational State Forest, and incorporates the use of Sand Wand[®] sediment removal equipment that was acquired via 319-Grant funds in 2004.



Figure 3: Videotaping NCDFR personnel training on use of Sand Wand[®] equipment acquired by a 319-Grant. Purlear Creek in Wilkes County, N.C.

Since this was the first time NCDFR undertook a complete in-house video production, several learning opportunities presented themselves throughout the project. Some 'lessons learned' include:

- Cost effectiveness of in-house video collection and production equipment improves as the number of videos and amount of footage required for each increase. Fortunately, NCDFR has in-house staff who is trained with video equipment and already competent using complex software applications for editing, dubbing, and video production.
- VHS and/or DVD duplication is best handled by external vendors. The high cost of the duplication equipment is not feasible to purchase for a small production run.
- High quality equipment is required to produce the best visual and audio results. This includes the camera, tripod, and storage / carrying gear.
- Filming techniques in the field require hands-on training to get used to the equipment and recognize appropriate lighting, composition, and angles of the video footage captured.
- Develop a solid storyboard or at minimum, a clear direction for tying the storyline to the desired views or images.
- Investigate options of different styles of script writing, and experiment to find the best one.
- A catalog or index is needed to document what footage has been captured on each individual camera tape to insure no raw video footage is lost or taped-over prior to final production. This index will also provide a library of existing footage that can be referenced for future use.
- Maintain a minimal “chain of custody” of the video equipment by only allowing select individuals that have proper training and accountability to handle and use the equipment. This insures the equipment remains in good condition and is available for use on short notice.
- Recognize the potential for a broader audience interest than originally planned. The two videos we produced are targeted for loggers and forestry in North Carolina. However, we have received multiple requests from natural resources agencies located around the country.

Final Budget

Item	Grant Expenditure	DFR In-Kind Match	Total Line Item
Contract E2089			
2 Digital Video Cameras	\$ 4,646.14	\$ 3,098.00	\$ 7,744.14
Camera Supplies	\$ 826.00	\$ 550.00	\$ 1,376.00
Contract EW03005			
Computer to process videos	\$ 2,228.85	\$ 1,486.00	\$ 3,714.85
Camera Supplies	\$ 492.00	\$ 328.00	\$ 820.00
Camera Batteries	\$ 200.00	\$ 132.00	\$ 332.00
Editing & production software	\$ 1,005.84	\$ 670.00	\$ 1,675.84
VHS Duplication: 150 copies	\$ 501.50	\$ 335.00	\$ 836.50
DVD Duplication: 100 copies	\$ 484.00	\$ 460.00	\$ 944.00
Travel	\$ 615.67	\$ 341.00	\$ 956.67
TOTALS	\$ 11,000.00	\$ 7,400.00	\$ 18,400.00

North Carolina Division of Forest Resources (N.C. Forest Service): July 2005
Video Outline & Desired Learning Objectives: Video run time 11:23
“Forestry Stream Crossings with Bridgemats”

Avoid Crossings

Stream crossings can be a primary location for non-point source pollution and runoff from logging.

Because of that, stream crossings should not be installed unless no other way is available to access the land and resources on the other side of the stream.

FPG Summary on Stream Crossings

There are rules in place that specify minimum standards that you must meet if stream crossings are installed or used. These rules fall under Section .0203 of the FPGs. A summary includes:

- If the situation allows, stream crossings should be avoided.
- Stream flow must not be obstructed
- Do not use streams as skid trails or access roads
- Protect the stream banks and channel from damage and erosion
- Divert sediment and runoff from the crossing location
- Provide ground cover within 10 working days of the initial soil disturbance.

The Bridgemat Concept & Bridgemat Examples

If a stream crossing is needed, one option is to use “bridgemats”.

These are portable heavy steel or wooden panels that can be laid across the stream or ditch.

Bridgemat Crossing Locations

When selecting a location to make a bridgemat stream crossing, look for a spot that has:

1. A right-angle crossing over the channel
2. A place where the channel is narrow
3. Solid footing on either side to support bridgemats & equipment
4. High ground on both sides at the crossing location

Other Uses (DOT ditches, soft spots)

Bridgemats can also be used for crossing over DOT roadside ditches, and for use at logging decks, or in soft soil spots on a skid trail.

Installing Bridgemats

When setting the bridgemats in place, keep your equipment out of the stream channel - place the mats across the channel first, then adjust them as needed to insure a firm, stable crossing.

In some cases, brush and small vegetation may not have to be removed since the weight of the mat will hold it down.

X <i>Do not leave a center gap between the travel lanes of the bridgemats</i>

Close this center gap between panels with another mat, strong boards, metal panels, delimbed logs, or something to keep dirt and debris from getting into the water.

Trees can be left standing as ‘bumper trees’ to guide the dragged logs straight-across the bridgemats. These guide trees help keep the tops of the skidded logs or trees from dragging debris into the stream.

Using & Inspecting Bridgemats

Water Quality

- Occasionally inspect the mats while in use and clean off excess mud, soil, or debris.

Safety

- The position of the mats may need re-adjusting as they are being used, if slippage occurs.

Bridgemat Removal & BMPs

Remove the mats carefully to minimize damage to the stream bank and channels.

Use BMP water diversions such as waterbars, sediment pits, turnouts, or other methods to control runoff from getting into the stream.

Establish ground cover to prevent accelerated erosion into the water.

Where to Get Bridgemats?

The N.C. Forest Service has wood & steel bridgemats statewide for temporary loan-out.

We also maintain a list of known builders / sellers of bridgemats & road mats.

This list is available in the “Water Quality” section of NCDFR web site www.dfr.state.nc.us

Or call the nearest NCDFR office, listed below:

Sylva District	(828) 586-4007
Asheville District	(828) 667-5211
Lenoir District	(828) 757-5611
Mount Holly District	(704) 827-7576
Lexington District	(336) 956-2111
Hillsborough District	(919) 732-8105
Rockingham District	(910) 997-9220
Fayetteville District	(910) 437-2620
Rocky Mount District	(252) 442-1626
Whiteville District	(910) 642-5093
New Bern District	(252) 514-4764
Elizabeth City District	(252) 331-4781
Bertie County Headquarters	(252) 794-3725

North Carolina Division of Forest Resources (N.C. Forest Service): July 2005
Video Outline & Desired Learning Objectives: Video run time 24:24
“Forestry Stream Crossings”

Avoid Crossings

Stream crossings can be a primary location for non-point source pollution and runoff.

Because of that, stream crossings should not be installed unless no other way is available to access the land and resources on the other side of the stream.

FPG Summary on Stream Crossings

There are rules in place that specify minimum standards that you must meet if stream crossings are installed or used. These rules fall under Section .0203 of the FPGs. A summary includes:

- If the situation allows, stream crossings should be avoided.
- Stream flow must not be obstructed
- Do not use streams as skid trails or access roads
- Protect the stream banks and channel from damage and erosion
- Divert sediment and runoff from the crossing location
- Provide ground cover within 10 working days of the initial soil disturbance.

Stream Crossing Locations

Get the most “bang-for-your-buck”, to gain as much access as possible to the land on the other side of stream. This avoids the need for several crossings on the same tract.

Cross at a location that has ground suitable for controlling runoff with BMPs:

1. Narrow section of stream / ditch channel
2. Right-angle approach across the channel
3. Firm ground for solid footing on each side
4. Flat ground, where possible

>> If in doubt, seek advice and assistance when scouting a crossing location <<

Using Bridgemats for Crossings

- Consider bridgemats your 1st option for a crossing -- It’s the best way to protect water quality.
- Carefully install the bridgemats in a way that protects the stream or ditch bank.
- Don’t drive your equipment through the stream to install the bridgemats.
- Set the mats in place from one side, then adjust them into proper position.

>> *Don’t leave a center gap between the mat panels!* <<

Use another mat, logs, or something sturdy in the middle to keep debris & soil out of the water

- Select a location that is firm, with solid footing for the bridgemat panels.
- Check the bridgemats periodically to insure safe operations & water quality protection.
- Install BMPs and control runoff on the approachways to the crossing.
- When removing bridgemats, keep equipment out of the stream & rehab the site for close-out.

Using Culverts for Crossings

Use a proper-sized culvert that can handle the heavy flow of water runoff after precipitation. Obtain technical advice on proper sized culvert - - Consider both the pipe diameter and length.

Determine if the culvert will be temporary, or permanent:

For temporary: Suitable to place culvert directly on stream bottom

For permanent: Suitable to place culvert slightly below-grade in the stream bottom

Back-fill with appropriate materials to secure culvert in place and provide adequate traffic support. Periodically pack down the fill material to eliminate air pockets and gaps in the fill.

Top of fill should be no less than 12". Recommended to be equal to ½ the pipe diameter.

Protect the culvert ends and maintain open inlet / outlets, to avoid blockages and water backup.

When removing culverts, try to re-create the natural position of the streambank and stream channel bottom as it was before the culvert was installed.

Rehab and stabilize the area to prevent accelerated erosion.

Using Fords for Crossings

Fords are the least preferred way to cross streams.

>> *Fords should not be used for skid trail crossings* <<

Places where a ford may be appropriate:

1. A stream that has an existing rocky bottom surface
2. Areas with active populations of beavers that could dam-up a culvert pipe crossing
3. Streams that are too wide for bridgemats or multiple culvert pipes

Use geotextile fabric for the approachways and stream crossing. This keeps the stone and rock on the surface, and keeps it from getting packed down into the soil.

Grade the approachways with a gentle slope, and install BMPs to control runoff from flowing into the stream.

Spread stone in the ford as level as possible, and avoid dips or humps that alter the stream flow.

>> *Do not block the natural flow of water in the channel* <<

Only build or use a ford during low water & low-flow conditions ~ Safety First!

- Drive slowly through a ford
- Use an appropriate vehicle
- Stagger the tire-tracks through the ford to minimize creation of tire ruts
- Inspect the crossing to insure safe usage, proper water flow, and water quality protection.

Summary

North Carolina has required FPGs and buffer rules that set standards of performance for stream crossings on forestry operations. Use BMPs to help comply with these rules.

The best BMP for stream crossings is to not have a crossing at all.

If a crossing is needed, only establish as few as needed to access across the stream.

>> *Get the most bang for your buck* <<

When locating a suitable spot for a stream crossing, remember the key elements to look for:

1. A narrow section of stream channel
2. Solid footing on each stream bank
3. Right-angle alignment
4. Efficient site access

Bridgemats can be used over & over again:

- Close-off the center gap between the travel lanes to keep debris & soil out of the water
- Keep equipment out of the stream when installing and removing mats
- Install BMPs to control runoff on the approachways
- Inspect mats for safety and water quality protection

The N.C. Forest Service has wood & steel bridgemats statewide for temporary loan-out. Learn more in “Water Quality” on the Web at: www.dfr.state.nc.us

Culverts may be used for temporary or permanent crossings:

- Size the culvert to allow adequate water flow and prevent ‘blow out’ of the crossing
- Backfill with enough material to support the traffic, and protect the culvert from damage
- Install BMPs to control runoff on the approachways
- Stabilize the crossing when completed, or when it’s removed

Fords should only be used for truck-road crossings:

- Suitable for use in rocky streams or place with a wide crossing
- Install and use fords only during safe, low-water and low-flow conditions
- Use geotextile fabric to secure the stone in place
- Install BMPs to control runoff on the approachways
- Drive slowly through the ford, and stagger the tire tracks