Appendix A – Approved Practices

Developed by Vermont's Department of Forests, Parks, and Recreation, the SLoCAMP Program focuses on implementation of four practices that will support AMP compliance, promote climate adaptation, and meet loggers' needs to extend or maintain logging operations in a changing climate. These practices are as follows:

- Hardening Truck Roads and Landings
- Skid Trail Improvement
- Temporary Stream Crossings
- Permanent Stream Crossings

Detailed descriptions of each practice are on the following pages. These practice descriptions can be used to determine what specific measures are eligible for payment under the program. Practice sheets include purpose, general policies, cost-share rates, and technical specifications for each practice. These practice sheets should be considered as a technical guide governing allowable activities for which payments can be made to loggers under this program.

At the end of each section is a list of practices that require pre-award verification site visits, where the Program Administrator must visit the site with the applicant to assess needs and agree on what practices will be funded.

Detailed descriptions of the practices begin on the next page.

PRACTICE 1: Hardening Truck Roads & Log Landings

PURPOSE

The purpose of this practice is to provide for the hardening and draining of existing infrastructure before a timber harvest begins. This practice shall be applied to existing truck roads and landings and to truck roads and landings approved for relocation.

The AMP standards will guide proper design and layout to improve drainage and to harden travel surfaces. This practice provides specifically for gravel, geotextile road fabric, and machine time which will be used to drain, harden, and shape the road or landing. This practice may include additional components such as installing cross-drain culverts, installing crane mats, or relocating the truck road or landing.

The changing climate is leading to more unpredictable harvesting conditions through increasing frequency and intensity of precipitation events and shorter periods of frozen ground conditions. Historically predictable periods of dry summer ground conditions or deep winter freezes are no longer occurring with regularity placing further need and emphasis on harvest planning to reduce unintended impacts from logging equipment.

GENERAL POLICIES

This practice is intended to be used on truck roads and log landings when they are part of an eligible forestry operation. The installation, maintenance, and closeout of this practice must be consistent with Vermont's Acceptable Management Practices (AMPs). Where wetlands occur, the Vermont Wetlands Rules (Section 6) apply and must be followed.

The applicant must submit a SLoCAMP Program Application and be approved before incurring any costs associated with this practice. Costs incurred before being approved are not eligible for reimbursement.

The Vermont Department of Forests, Parks and Recreation, or designee, will review the application for eligibility and assign a cost- share reimbursement value based on the submitted application and field review (if a field review is necessary).

Cost-share reimbursement for the SLoCAMP program is available for all logging contractors in Vermont, regardless of affiliation, and is intended to be used on logging operations where the goal of the harvesting is for long-term forest management.

For this practice, an AMP Planning Map is required as part of the application. All SLoCAMP program implementation practices identified on the AMP Planning Map must also be clearly identified on the ground with flagging or marked with paint.

Appendix A – Approved Practices #1: Hardening Truck Roads & Log Landings

Hardening Truck Roads and Log Landing practice components need pre-award field review only when components are in stream or wetland buffer, or other sensitive conditions. Pre-award visit may be exempted by the Program Administrator when application review indicates that additional evaluation and guidance are not needed to support successful practice implementation.

AMP Planning Map Standards:

- Title block containing the landowner's name, logging contractor, town, parcel SPAN, and date
- Major roads with road names
- North Arrow
- Scale
- Legend identifying these landmarks at a minimum:
  - All landing areas and major skid trails
  - Streams, wetlands, and vernal pools
  - All implementation practices proposed for that harvest area

PRACTICE COMPONENTS, COSTS, AND DETAILS

Costs listed in the table below represent the full cost of implementation. Each practice component is only funded at 90% to account for cost share required by the applicant. The application (Appendix B) reflects the actual incentive rates available to the applicant.

Practice 1: Hardening Truck Roads & Log Landings Rates		
Practice Component	**Unit cost per practice**	**Practice Details**
1.1 Adding gravel to truck road and/or landing to harden travel surfaces.	$34/yd plus woven geotextile road fabric if needed	Properly constructed and maintained throughout the use of that road and/or landing. Includes cost of gravel and trucking to site plus machine time to spread and shape. Closeout to AMP standards when job is completed, road and/or landing is protected from erosion and left in a stable, well-drained condition.
1.2 Installation of geotextile road fabric to improve drainage and harden travel surfaces.	$1.25/linear ft	Properly installed polypropylene fabric. Use 'woven' fabric when adding gravel for separation of road sub-surfaces. Use 'non- woven' fabric for sub-surface drainage structures like a rock sandwich or a French drain.
1.3 Mobilization and installation of crane mats to harden travel surfaces.	$12/linear ft	Properly installed and maintained throughout the use of that road and/or landing. Includes cost of machine time to set the mats. Removal when job is

		completed.
1.4 Construct new ditch to improve drainage on truck roads.	$2.46/linear foot	Properly constructed and maintained throughout the use of that road. Includes cost to seed and mulch all exposed soil within the ditch.
1.5 Clean existing ditch to improve drainage on truck roads.	$1.26/linear foot	Properly cleaned and maintained throughout the use of that road. Includes cost to seed and mulch all exposed soil within the ditch.
1.6 Installation of cross-drain culverts to improve drainage on truck roads.	$2,365/cross-drain	Properly spaced, installed, and maintained throughout the use of that road. Includes cost for culvert, gravel, headwalls, and machine time.
1.7 Installation of a rock sandwich to improve sub-surface drainage. Also known as a French mattress.	$41/linear foot Plus fabric (Practice 1.2)	Properly installed polypropylene fabric for sub-surface drainage. Use 'non-woven' for underdrainage structures like a rock sandwich. Includes cost for stone, gravel, and machine time.
1.8 Installation of a French drain to improve sub-surface drainage.	$32/linear foot Plus fabric (Practice 1.2)	Properly installed polypropylene fabric for sub-surface drainage. Use 'non-woven' for sub surface drainage structures like a French drain. Includes cost for stone, gravel, perforated pipe, and machine time.
1.9 Installation and maintenance of waterbars to improve surface drainage.	$38/Waterbar	Properly constructed and maintained throughout the use of that road. Includes cost for machine time.
1.10 Truck Road Relocation	$6.85/linear ft, plus other components as needed, for road relocation. In addition, $1.00/ linear to stabilize the old road to the AMP standards.	Properly constructed and maintained throughout the use of that new road. Includes cost to cut, skid, stump, and shape relocated road. Also includes cost to stabilize the old road including removing stream crossings, installing water bars, and applying seed and mulch to the expose soil.

1.11 Installation of water deflector belt	$400/water deflector belt	Properly constructed and maintained throughout use of the road. Incudes cost for materials, labor, and machine time.

TECHNICAL SPECIFICATIONS

Definition Purpose: Mobilization and implementation for hardening and draining truck roads and log landings to protect water quality before harvesting activities.

Condition Where Components Applies: Truck roads and log landings where the goal of the harvest is long-term forest management and one or more of the following applies:

1. There is no road base to support trucks and equipment.
2. The travel surface has worn or eroded.
3. The travel surface is soft and wet.
4. Need to relocate the existing truck road because it is located within a buffer, the AMPs cannot be met, and a discharge is likely.

CONSIDERATION FOR EACH PRACTICE COMPONENT

Practice Component 1.1: Adding Gravel

- The intent of this component is to harden truck roads and log landings by adding up to 12" of gravel to approved areas.
- Travel surfaces are assumed to be 12-feet wide for the purposes of estimating costs and material needed.
- Prior to adding new gravel, the road and/or landing should be graded/shaped to an appropriate surface profile to remove any deformities and to establish an ideal shape (crowned, in-sloped, or out-sloped) for shedding water. Scarifying also helps to blend old material with new material and improves compaction.
- New gravel should be 1½" minus crushed gravel or crushed ledge. Other suitable alternatives include 3" dense grade and 6" logger mix.
- Gravel should be applied to a road by running a truck down the center of the roadway and dumping.
- Total unit cost is determined by the number of yards of gravel needed. The calculation is as follows: # of yards = (length (in feet) of road needing gravel * depth (in feet) of gravel being added * 12 ft) / 27 ft3.

- Length of truck road to be hardened and/or location of landing to be hardened shall be clearly marked and located on the ground and on the AMP Planning Map, with yardage indicated for each section to be graveled.

Practice Component 1.2: Geotextile Road Fabric (Woven or Non-Woven)

- The intent of this component is to use geotextile road fabric to harden and drain travel surfaces in approved locations.
- Use 'woven' polypropylene fabric only when adding gravel for the separation of road sub surfaces.
- Use 'non-woven' polypropylene fabric only for sub surface drainage structures such as rock sandwiches and French drains.
- Before fabric is laid down, the road base surface profile should be graded/shaped to remove any deformities and to establish an ideal shape (crowned, in-sloped, or out-sloped) for shedding water.
- When laying down and installing fabric, make sure to overlap joints by at least 12''.
- This practice may be selected for use when adding gravel (Practice 1.1), constructing a rock sandwich (Practice 1.7), installing a French drain (Practice 1.8), or relocating a truck road (Practice 1.10).
- Total unit cost is determined by the length (in feet) of fabric needed.
- Areas where geotextile road fabric will be installed shall be clearly marked and located on the ground and on the AMP Planning Map, with lengths of fabric indicated for each use.

Practice Component 1.3: Mobilize & Install Crane Mats

- The intent of this component is to mobilize and install crane mats to harden travel surfaces in approved locations.
- Crane mats shall be properly installed before the job, maintained throughout the duration of the job, and removed at the end of the job.
- Prior to the crane mats being installed, the site should be graded/shaped to create an appropriate surface profile to remove any deformities so that the mats lie flat on the ground.
- Use of crane mats will be coordinated with Vermont's Crane Mat Program.
- Total unit cost is determined by the linear distance (in feet) for the section of trail, road, or landing needing to be hardened with mats and includes the cost of machine time to transport them from the truck to the site where needed, install them, and then remove them when the job is done.
- The location of crane mats shall be clearly marked and located on the ground and on the AMP Planning Map, with the distance (in feet) needing to be hardened and the number of mats needed for each area.

Practice Component 1.4: Construct Ditch

- The intent of this component is to establish new roadside ditches to improve drainage on truck roads in approved locations.
- No berm shall be left along the road edge between the road surface and the ditch.

- Ditches shall be excavated deep enough to drain the road base and to a minimum depth of 1.5- 2 feet below the road surface.
- Ditch bottom slope should be at a minimum of 2% grade to ensure that water does not stand.
- Ditch backslopes should be at a maximum 2:1 horizontal to vertical ratio.
- Ditches shall be at least 2 feet wide at the bottom forming a slightly rounded or U-shape to help slow and disperse water. Ditches with a V-shape will channelize the flowing water, increasing its velocity and power, and are not recommended.
- All exposed soil within the new ditch shall be seeded and mulched.
- Direct ditch outlets into vegetated areas whenever possible.
- On approaches to stream crossings, ditches shall be diverted into the forest buffer terminating at least 25 feet from the top of the streambank using a "disconnection practice" such as a cross- drain culvert, cross-drain waterbar, or turnout. When a 25-foot forest buffer is not possible, install a catch basin.
- Ditches shall never terminate into surface waters.
- Total unit cost is determined by the linear distance (in feet) of ditch needing to be constructed and includes the cost to apply seed and mulch to the exposed soil.
- New ditches to be constructed shall be clearly marked and located on the ground and on the AMP Planning Map, with length indicated for each section to be constructed.

Practice Component 1.5: Clean Ditch

- The intent of this component is to clean existing roadside ditches to improve drainage on truck roads in approved locations.
- Ditches shall be cleaned by an excavator or backhoe with an articulated bucket to remove sediment and debris.
- After cleaning, re-shape the ditch as necessary as follows:
  - Minimum ditch depth 1.5-2 feet below road surface.
  - Ditch bottom slope at 2% grade to ensure no standing water.
  - Ditch backslope at a maximum 2:1 horizontal to vertical ratio.
  - Ditch at least 2 feet wide at the bottom and with a U-shape or slightly rounded.
- All exposed soil within the cleaned ditch shall be seeded and mulched.
- No berm shall not be left along the road edge between the road surface and the ditch.
- Total unit cost is determined by the linear distance (in feet) of ditch needing to be cleaned and includes the cost to apply seed and mulch to the exposed soil.
- Length of ditch to be cleaned shall be clearly marked and located on the ground and on the AMP Planning Map, with length indicated for each section cleaned.

Practice Component 1.6: Cross-Drain Culverts

- The intent of this component is to properly install cross-drain culverts with headwalls to improve drainage on truck roads in approved locations.
- Cross-drain culverts shall be installed at regular intervals as determined by % slope of the truck road as shown in Table 1 of the AMP Manual.
- Culverts shall be 18" in diameter unless otherwise approved.

- 15” diameter culverts may be acceptable upon approval in cases where ditch, slope, and road characteristics do not allow for a larger pipe. 24” diameter culverts may be acceptable upon approval in cases where there is an insufficient spacing of cross-drain culverts uphill in the ditch due to site constraints or when collecting additional surface water runoff.
- Install culverts at a 2% to 4% slope and at an approximately 30° angle to the road.
- The excavated trench for the culvert shall be dug such that the bottom width of the culvert trench is 2-3 times the width of the culvert to allow for suitable compaction.
- Culvert shall be laid starting at the outlet end and working upslope.
- Culverts shall have sufficient length to extend to the toe of the road. Lengths of culvert shall be joined in accordance with the manufacturer’s specifications.
- Culvert outlets shall not be perched or suspended above the ground.
- Compacted backfill shall surround the culvert for a minimum of 12” on either side.
- Gravel or native borrow material, compacted in 6” lifts, shall be used as backfill material as long as no stones greater than 3" in diameter are contacting the culvert.
- The top of culverts shall be covered with compacted material to the manufacturer’s specifications or, lacking those, a depth of half the culvert diameter or 12” (whichever is greater).
- A ditch plug may be necessary to direct water into the culvert inlet. Ditch plugs shall be at least 6” lower than the road shoulder.
- Cross-drain culverts shall never terminate into surface waters.
- On approaches to stream crossings, cross-drain culverts shall terminate at least 25 feet from the top of the streambank in the forest buffer. When a 25-foot forest buffer is not possible, install a catch basin.
- Stone headwalls shall be installed at the inlet and outlet of all cross-drain culverts to mark the location of the culvert, prevent inlet and outlet erosion, and protect the culvert from damage.
- Construct stone headwalls as follows:
  - Large rocks, at least 18” in one dimension, shall be used. Rocks found on-site or blasted stone/ledge are suitable.
  - Headwalls should be flush with the ends of the culvert.
  - Headwall rocks shall be installed so that joints overlap and so that they are well fitted and tight.
  - Each side of the headwall should be at least 1.5 times the width of the culvert.
  - Headwalls should have one large stable rock over the center of the pipe.
- Total unit cost is for each cross-drain culvert installed and includes 3 hours of excavator time, 30 feet of 18” HDPE culvert, 2 truckloads of gravel in place, and 3 yards of 18” stone for headwall construction.
- New cross-drain culverts to be installed shall be clearly marked and located on the ground and on the AMP Planning Map.

Practice Component 1.7: Rock Sandwich (non-woven geotextile fabric)

- The intent of this component is to install a rock sandwich, also known as a French

mattress, to improve sub-surface drainage on truck roads.

- This component should be used in the following situations:
  - Wet sections of road with a high water table.
  - Where soils are not sufficient for supporting a roadbed.
  - Where concentrated outflow from a pipe is undesirable.
  - Where installing a cross-drain culvert is not practical due to topography.
- This component should NOT be used for concentrated flows such as streams or ditches.
- A rock sandwich shall be as wide as the full width of the roadbed from toe of slope to toe of slope and shall be long enough to capture the wet area of the road.
- A rock sandwich shall be installed to match the slope of the land. In flat areas, a 1% to 2% slope should be used to aid drainage.
- Rock sandwiches can vary in length. They can be as short as 10 feet to as long as over 100 feet.
- Construct the rock sandwich in the following order:
  - Material shall be excavated from the road to the desired depth and width creating the bottom of the sandwich.
  - Non-woven geotextile fabric only shall be placed in the bottom of the sandwich, ensuring there is enough fabric to wrap around the sides.
  - Clean stone 6" to 8" in diameter shall be placed on top of the fabric spread out in a uniform bed 12" to 18" deep.
  - The clean stone shall then be covered with fabric, overlapping the joints by at least 12".
  - A minimum of 12" of gravel shall be compacted over the sandwich.
- Total unit cost is determined by the linear distance (in feet) of each rock sandwich constructed plus the length of non-woven geotextile fabric needed for each sandwich.
- Locations of rock sandwiches to be installed shall be clearly marked and located on the ground and on the AMP Planning Map, with lengths indicated for each sandwich.

Practice Component 1.8: French Drain (non-woven geotextile fabric)

- The intent of this component is to install French drains to improve sub-surface drainage on truck roads.
- Sometimes referred to as "underdrain," a French drain is a drainage system installed under a road or road ditch to collect and transport sub-surface water. Underdrains can help dry out the road base and ditch. These buried conduits come in a variety of shapes and sizes and are usually wrapped in geotextile fabric which allows water to enter the conduit while keeping sediment out. A French drain also prevents sub-surface water from mixing with sediment-laden surface runoff during storm events.
- All French drains should be installed with at least a 1% slope.
- Construct the French drain in the following order:
  - Excavate material from the road to the desired depth and width to form a trench for the French drain. The depth should be low enough to catch the sub-surface flow of water, usually down to an impermeable layer. Be sure to keep a steady slope in the trench and "daylight" in a suitable location away from surface water.
  - Line trench bottom and sides with non-woven geotextile fabric leaving enough fabric to

wrap the entire drain once constructed.
  - 4" diameter perforated pipe shall be placed on top of the fabric with the holes down.
  - Cover the perforated pipe with six inches of ¾" to 2" washed or clean stone. Washed is preferred but clean stone is suitable. Stone shall not be compacted.
  - Fabric shall be wrapped around the washed or clean stone to fully encase the pipe and stone forming the drain.
  - A minimum of 12" of gravel shall be placed and compacted over the French drain.
- On approaches to stream crossings, the French drain outlet shall terminate at least 25 feet from the top of the streambank in the forest buffer. When a 25-foot forest buffer is not possible, install a catch basin.
- French drains shall never terminate into surface waters.
- Total unit cost is determined by the linear distance (in feet) of each French drain installed plus the length of non-woven geotextile fabric needed for each drain.
- Locations of French drains to be installed shall be clearly marked and located on the ground and on the AMP Planning Map, with lengths indicated for each drain.

Practice Component 1.9: Waterbars

- The intent of this component is to properly install and maintain earthen waterbars to improve drainage on truck roads.
- Waterbars shall be properly installed and spaced at regular intervals as determined by % slope of the truck road as shown in Table 1 of the AMP Manual.
- Waterbars shall be installed with a 2% to 6% out-slope to ensure that water is properly shed into the ditch or roadside vegetation and does not pool in the bottom of the waterbar.
- Waterbar dimensions will vary depending on the slope of the road as follows:
  - Waterbars shall be installed at an angle to the road to ensure adequate drainage. The angle of installation will vary depending on the steepness of the road. On low grades, the angle may be as low as 15 degrees while on steeper slopes it may increase to as much as 30 degrees.
  - The depth of waterbars will vary depending on the slope of the road. On low grades, the total depth of the waterbar may be only 6" while on steeper slopes they may be up to 24" deep. Waterbar depth on roads should not impede vehicle passage.
- Waterbar outlets must extend one foot or more beyond the road to keep the diverted water from re-entering the road. The outlets must allow water to flow into a filter area.
- On approaches to stream crossings, waterbar outlets shall terminate at least 25 feet away from the top of the streambank in the forest buffer. When a 25-foot forest buffer is not possible, install a catch basin.
- Waterbars may be armored on the bottom and on the berm with 4" minus stone to make them more durable. Stone shall be compacted to ensure that it stays in place.
- Waterbars shall never terminate into surface waters.
- Total unit cost is for each waterbar installed and maintained.
- Locations of waterbars to be installed shall be clearly marked and located on the ground and on the AMP Planning Map.

Practice Component 1.10: Relocation of Truck Road

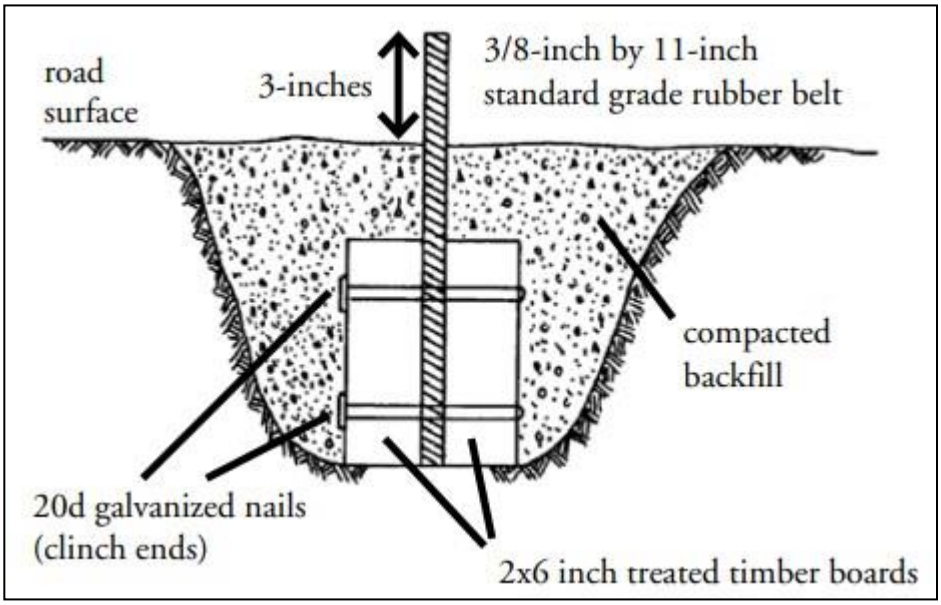
- The intent of this component is to relocate an existing truck road to a suitable location when the existing road location is within a buffer, the AMPs cannot be met, and a discharge is likely. This component also includes the stabilization of the old road and bringing it into a stable condition that is compliant with the AMPs.
- Road relocations must be reviewed and approved prior to commencing the work.
- Road relocations shall adhere to AMP standards and shall be strategically laid out, considering topography, streams, wetlands, soils, and access needs.
- Avoid seeps, wet areas, and steep slopes over 10% while minimizing the number of stream crossings.
- This component may be combined with other components as needed including gravel (Practice 1.1), geotextile road fabric (Practice 1.2), ditching (Practice 1.4), cross-drain culverts (Practice 1.6), and waterbars (Practice 1.9).
- As a condition of relocating the truck road, the old road shall be stabilized according to the AMP standards.
- All exposed soil along the entire length of the old road shall be seeded and mulched.
- Total unit cost to relocate the new truck road is determined by the linear distance (in feet) of the new road and includes machine and truck time only. Total unit cost to stabilize the old road is determined by the linear distance (in feet) and includes machine time to install water bars, remove stream crossings, and to scarify the road surface and the cost to seed and mulch the exposed soil.
- Length of new truck road to be relocated shall be clearly marked and located on the ground and on the AMP Planning Map, with the length clearly indicated. Additional components shall be clearly marked and located on the ground and the AMP Planning Map.
- Length of old truck road to be stabilized, including locations of stream crossings to be removed and waterbars to be installed, shall be clearly marked and located on the ground and on the AMP Planning Map, with the length clearly indicated.

Practice Component 1.11: Water Deflector Belts

- The intent of this component is to properly install and maintain water deflector belts to improve drainage on truck roads.
- Water deflector belts shall be properly installed and spaced at regular intervals as determined by % slope of the truck road, according to Table 1 of Vermont's AMPs.
- Water deflector belts can be used in conjunction with other surface diversion structures, such as broad-based dips or waterbars, to achieve correct drainage structure spacing as defined in Table 1 of the AMPs.
- Proper construction of water deflector belts involves sandwiching a piece of conveyor belt rubber, ideally 12 inches in width, between two 2x6 boards. Pressure treated lumber is preferred but not required. The structure is then buried in the road surface, with only the rubber strip visible. Equivalent materials may be substituted if necessary.
- Belt and boards should be fastened together using galvanized nails or screws to prevent corrosion. Two nails or screws should be installed in a 1x1 vertical pattern at two-foot

intervals along length of structure. The bottom end of the belt should be nearly flush with the 2x6 boards, leaving roughly 5-7 inches of exposed rubber on one end of the structure.

- Ensure deflector belt structure is long enough to extend one foot or more beyond the road shoulder to keep diverted water from reentering the road.
- A trench must be dug to install the belt structure. Dig trenches approximately 9" deep, depending on length of belt to be exposed above the road surface.
- Dig trench at an appropriate angle, depending on slope of road section, to ensure proper drainage. On low grades, the angle may be as low as 15 degrees while on steeper slopes it may increase to as much as 30 degrees.
- The bottom half of structure, with 2x6 boards properly attached, should be seated in the trench, backfilled with native material, and compacted. Ensure a minimum of 3" of rubber belt sits above the road surface.
- Water deflector belts shall never terminate into surface waters.
- On approaches to stream crossings, water deflector belt outlets shall terminate at least 25 feet away from the top of the streambank in the forest buffer. When a 25-foot forest buffer is not possible, install a catch basin.
- Total unit cost is for each water deflector belt installed and maintained.
- Locations of water deflector belts to be installed shall be clearly marked and located on the ground and on the AMP Planning Map.



Water deflector belt cross section. Photo credit: NY State BMP Field Guide

REFERENCES

Vermont Acceptable Management Practices, Manual for Logging Professionals 2nd edition, 2022.

VT AMP App for smartphones. Available at the App store or Google play. https://apps.apple.com/ph/app/vermont-amp/id1567399850

Pre-Award Verification Site Visit Requirements by Practice

Practice 1: Hardening Truck Roads & Log Landings

Practice Component	Pre-Award Visit Needed?
1.1 Adding gravel to truck road and/or landing to harden travel surfaces.	Yes
1.2 Installation of geotextile road fabric to improve drainage and harden travel surfaces.	Yes
1.3 Mobilization and installation of crane mats to harden travel surfaces.	No
1.4 Construct new ditch to improve drainage on truck roads.	Yes
1.5 Clean existing ditch to improve drainage on truck roads.	Yes
1.6 Installation of cross-drain culverts to improve drainage on truck roads.	Yes
1.7 Installation of a rock sandwich to improve sub-surface drainage. Also known as a French mattress.	Yes, but only when rock sandwich is in stream buffer, wetland buffer, or other sensitive conditions (hydric soils, RTE habitat.)
1.8 Installation of a French drain to improve sub-surface drainage.	Yes, but only when drain construction is in stream buffer, wetland buffer, or other sensitive conditions (hydric soils, RTE habitat.)
1.9 Installation & maintenance of waterbars to improve surface drainage.	No
1.10 Truck Road Relocation	Yes
1.11 Installation water deflector belt	No

PRACTICE 2: Skid Trail Improvement

PURPOSE

The purpose of this practice is to provide for the improvement, stabilization, or relocation of skid trails, as well as the implementation of soil protection measures in sensitive conditions, before a timber harvest begins. Objectives include preventing rutting or erosion, enhancing operability, protecting water quality, and ensuring long-term trail resiliency. This practice shall be applied to existing skid trails and to skid trails approved for relocation. The AMP standards will guide proper design and layout for all components falling under this practice. Practice 2 provides specifically for trail relocation, the installation of surface diversion structures such as traditional waterbars, log- reinforced waterbars, or pole bars (log-reinforced waterbars filled with poles for operability), and the use of corduroy or crane mats for soil protection during harvesting operations.

The changing climate is leading to more unpredictable harvesting conditions due to increasing intensity of precipitation and shorter periods of frozen ground conditions. Consequently, skid trails are more vulnerable to heavy rains, free-thaw events, and saturated soils. Such conditions can result in water quality impacts due to erosion and stream sedimentation, or loss of established access due to trail washout, requiring costly repair for landowners and contractors. Proper implementation of the AMPs on skid trails will improve accessibility while protecting soils and water quality, minimizing unintended impacts from logging equipment.

GENERAL POLICIES

This practice is intended to be used on skid trails as part of an eligible forestry operation.

The installation, maintenance and closeout of skid trail improvement practices must be consistent with Vermont's Acceptable Management Practices.

The applicant must submit an SLoCAMP program application and be approved before incurring any costs associated with this practice. Costs incurred before application approval are not eligible for reimbursement.

The Department of Forests, Parks and Recreation, or designee, will review the application for eligibility and assign a cost-share reimbursement value based on the submitted application and field review (if field review is necessary).

Cost-share reimbursement for the SLoCAMP Program is available for all logging contractors in Vermont regardless of affiliation and is intended to be used on logging operations where the goal of the harvesting is for long-term forest management.

Where wetlands occur, the Vermont Wetland Rules (Section 6) apply and must be followed.

Appendix A – Approved Practices #2: Skid Trail Improvement

Skid Trail practice components need pre-award field review only when components are in stream or wetland buffer, or other sensitive conditions. Pre-award visit may be exempted by the Service Provider when application review indicates that additional evaluation and guidance are not needed to support successful practice implementation.

For all components falling under the skid trail improvement practice, an AMP Planning Map is required as part of the application. All SLoCAMP program implementation practices identified on the AMP Planning Map must also be clearly identified on the ground with flagging or marked with paint.

AMP Planning Map Standards:

- Title block containing the landowner's name, logging contractor, town, parcel SPAN, and date
- Major roads with road names
- North Arrow
- Scale
- Legend identifying these landmarks at a minimum:
  - All landing areas and major skid trails
  - Streams, wetlands, and vernal pools
  - All implementation practices proposed for that harvest area.

- For Practice 2, the AMP Planning Map must specifically include (if applicable):
  - Which type of erosion control structures are being proposed (waterbar, log-reinforced waterbar, pole bar)
  - Location of erosion control structures
  - Chart listing total number of each type of erosion control structure

PRACTICE COMPONENTS, COSTS, AND DETAILS

Costs listed in the table below represent the full cost of implementation. Each practice component is only funded at 90% to account for cost share required by the applicant. The application (Appendix B) reflects the actual incentive rates available to the applicant.

Practice 2: Skid Trail Improvement		
Practice Component	**Unit cost per practice**	**Practice Details**
2.1 Trail relocation	$4/linear ft, plus other components as needed, for skid trail relocation $0.75/linear ft to decommission and stabilize old skid trails to AMP standards.	Skid trail relocated to approved location due to sensitive conditions or water quality concerns. Old trail section decommissioned and stabilized to AMP standards.
2.2 Installation of waterbars	$38/waterbar	Properly installed, spaced, and maintained throughout harvest.
2.3 Installation of log-reinforced waterbars	$75/log-reinforced waterbar	Log-reinforced waterbars properly installed, spaced, and maintained throughout harvest.
2.4 Installation of pole bars	$350/pole bar	Pole bars properly installed, spaced, and maintained throughout harvest.
2.5 Installation and mobilization of crane mats to harden travel surfaces	$12/linear ft	Proper installation and maintenance of mats for harvest operability and protection of wet or sensitive soils throughout approved section of trail. Removal when job is completed.
2.6 Installation of corduroy	$6.50/linear ft	Proper installation and stabilization of corduroy for harvest operability and protection of wet or sensitive soils on approved sections of trail.

TECHNICAL SPECIFICATIONS

Definition and Purpose:
Implementation of skid trail improvement practices for the protection of water quality and soils before harvesting activities begin.

Condition Where Practice Applies: Skid trails on logging operations where the objective of harvesting is long-term forest management, and one or more of the following applies:

- The skid trail encroaches on the forested buffer of a stream, wetland, or other waterbody.
- Diversion structures (waterbars, log-reinforced waterbars, pole bars) are lacking, based on AMP spacing requirements, before harvesting begins.
- Wet soil restricts harvesting operations and/or pose a risk to water quality, and soil stabilization measures can be used to meet both harvesting objectives and AMP standards.

Applicants must include a Work Plan and an AMP Planning Map along with the SLoCAMP Application.

CONSIDERATIONS FOR EACH TRAIL IMPROVEMENT COMPONENT

Practice Component 2.1: Trail Relocation

- The intent of this component is to relocate trails which are not suitable for harvesting purposes due to inoperability, gradient, soil conditions, forest buffer encroachment, or other approved conditions, and where a suitable location exists to reroute the trail.
- Trails will not be approved for relocation solely for reasons relating to harvest efficiency or access to standing timber.
- New skid trail routes must be strategically laid out according to AMP standards, considering topography, streams, wetlands, soils, and access needs.
- Ensure that new trail routes are as short as possible and minimize the number of stream crossings and steep sections exceeding 20% grade.
- Utilize NRCS soil maps or USDA Web Soil Survey, along with knowledge of local soil conditions, to locate the new trail route, avoiding wet areas where possible.
- Determine whether trail relocation is necessary for harvesting purposes. In certain instances, soil stabilization measures (e.g. crane mats, corduroy) may provide operability and the establishment of a new trail section is not justified.
- The old trail section to be relocated must be properly decommissioned and left in a state that will allow the trail to naturalize over time, with minimal risk of concentrated flow, erosion, or other potentially destabilizing conditions.
    - Erosion control structures must be installed on decommissioned trail sections at spacing based on Table 1 of the AMPs.
    - Where possible, installation of additional or larger erosion control structures is recommended, to ensure trail naturalization.

  - All stream crossings on trails to be relocated and decommissioned must be removed and brought to AMP standards.
  - Rutting on old trail sections must be smoothed upon trail decommissioning.
  - Exposed soil within the forested buffer must be properly seeded and mulched upon trail decommissioning.
  - Old trail sections that have been decommissioned and relocated may not be reopened or used again for any purpose.
- Total unit cost to relocate trail is determined by the linear distance (in feet) of the new trail section, and includes machine time to clear and establish the new trail only.
- Additional components on the newly established trail section (e.g. waterbars, temporary stream crossing components, etc.) may be combined with trail relocation, but are not included in the unit cost to establish new trail sections.
- Total unit cost to decommission and stabilize an old trail section is determined by the linear distance (in feet) of the old trail, and includes machine time to install water bars, remove stream crossings, and smooth ruts, as well as the cost to seed and mulch exposed soil within the forested buffer.
- Length of new skid trail section, as well as any additional components, must be clearly marked and located on the ground and on the AMP Planning Map.
- Length of old trail to be decommissioned and stabilized, including locations of stream crossings to be removed and waterbars to be installed, shall be clearly marked and located on the ground and on the AMP Planning Map.

Practice Component 2.2: Waterbars

- The purpose of this component is to provide for the installation and maintenance of waterbars on approved skid trails prior to and during harvesting.
- Water diversion structures must be installed strategically and frequently enough to prevent water from accumulating, based on Table 1 of the AMPs.
- Traditional (earthen) waterbars should be at least 12 inches deep and 12 inches high.
- Waterbars should be installed at a 30-degree angle to the trail and with a 2% to 6% out-slope. This will prevent water pooling and sediment filling the structure.
- Extend the waterbar inlet and outlet 1 foot or more beyond the trail to keep the diverted water from re-entering the trail.
- Ensure waterbars do not outlet directly into a stream, wetland, or other water body.
- Surface water runoff from waterbar outlets should filter out and dissipate on the forest floor before reaching forested buffers.
- Inspect and maintain waterbars periodically to ensure integrity of the structure and prevent failure during a severe weather event.
- On sunken or entrenched trail sections where water cannot be diverted to a filter area, strategically place waterbars above and below the sunken trail segment.
- Total unit cost is for each waterbar installed and maintained.
- Waterbar spacing and length of trail where component will be installed must be clearly laid out and located on the ground and on AMP Planning Map.

Practice Component 2.3: Log-reinforced Waterbars

- The purpose of this component is to provide for the installation and maintenance of log-reinforced waterbars on approved skid trails prior to and during harvesting.
- All water diversion structures must be installed strategically and frequently enough to prevent water from accumulating, based on Table 1 of the AMPs.
- Logs used in construction of log-reinforced waterbars should be a minimum 12" DBH, and 4' longer than trail width to allow for outflow.
- Log-reinforced waterbars should be placed at a 30-degree angle to the trail and with a 2% to 6% out-slope. This will prevent water from pooling and sediment filling the structure.
- Ensure that log-reinforced waterbars do not outlet directly into a stream, wetland, or other water body.
- Surface water runoff from log-reinforced waterbar outlets should filter out and dissipate on the forest floor before reaching forested buffers.
- Inspect and maintain log-reinforced waterbars periodically throughout the harvest to ensure structural integrity and prevent failure during a severe weather event.
- On sunken or entrenched trail sections where water cannot be diverted to a filter area, strategically place log-reinforced waterbars above and below the sunken trail segment.
- Total unit cost is for each log-reinforced waterbar installed and maintained.
- Log-reinforced waterbar spacing and length of trail where component will be installed must be clearly laid out and located on the ground and on AMP Planning Map.

Example of log reinforced water bar on active harvest. Photo credit: Vermont AMP Manual

Practice Component 2.4: Pole Bars

- The purpose of this component is to provide for the installation and maintenance of pole bars (log-reinforced waterbars with small-diameter stems used to fill the structure's trench or depression) on approved skid trails prior to and during harvesting.
- Pole bars are more operable and more durable than earthen or log-reinforced waterbars. When installed correctly, pole bars can improve harvest efficiency and minimize required

maintenance of diversion structures throughout the harvest and at closeout.

- Stems used to fill pole bar trenches should be a minimum 8" DBH and 4' longer than trail width. Stems used in the construction of the water diversion berm (the "bump" in a waterbar) should follow the specifications for log-reinforced waterbars.
- Water diversion structures must be installed strategically and frequently enough to prevent water from picking up speed and concentrating, at spacing based on Table 1 of the AMPs.
- Inspect and maintain pole bars periodically throughout the harvest to ensure structural integrity and prevent failure during a severe weather event.
- Ensure that pole bars do not outlet directly into a stream, wetland, or other water body.
- Surface water runoff from pole bar outlets should filter out and dissipate on the forest floor before reaching forested buffers.
- Stems should be removed from pole bars at harvest closeout to prevent the structure from prematurely filling with sediment.
- Total unit cost is for each pole bar installed and maintained.
- Pole bar spacing and length of trail where component will be installed must be clearly laid out and located on the ground and on AMP Planning Map.

Practice Component 2.5: Crane Mats

- The intent of this component is to mobilize and install crane mats to harden trail surfaces in approved locations.
- Crane mats shall be properly installed before the job, maintained throughout the duration of the job, and removed at the end of the job.
- Prior to the crane mats being installed, the site should be graded/shaped to create an appropriate surface profile to remove any deformities so that the mats lie flat on the ground.
- Use of crane mats will be coordinated with Vermont's Crane Mat Program.
- Use the ANR Atlas wetland layer to determine if wetlands are present along length of trail planned for crane mats.
- Where wetlands occur, the Vermont Wetland Rules (section 6) apply and must be followed. Familiarity with the Vermont Wetland Rules and 'Silviculture Allowed Uses' is critical if operating in or around wetlands.
- Total unit cost is determined by the linear distance (in feet) for the section of trail needing to be hardened with mats, and includes the cost of machine time required for mat transportation from the truck to site where mats are needed, installation, and removal at time of job completion.
- The location of crane mats shall be clearly marked and located on the ground and on the AMP Planning Map, with the number of mats indicated for each area.

Practice Component 2.6: Corduroy

- The intent of this component is to use corduroy to harden trail surfaces in approved locations.
- Corduroy is the laying of small logs or poles, sometimes mixed with brush or slash,

perpendicular to the direction of travel along a skid trail. Corduroy can help stabilize soft soils and allow for equipment access in otherwise inoperable areas.

- Poles used for corduroy should be a minimum of 8" DBH, and a minimum of 16' in width.
- Laying corduroy is not a suitable practice in all wet areas; generally, a solid base (rock, hardpan, or clay) is necessary to prevent rutting or dredging. Soils with deep layers of organic matter, such as muck or peat, may not be suited for corduroy, or harvesting in general.
- Use the ANR Atlas wetland layer to determine if wetlands are present along length of trail planned to receive corduroy.
- Where wetlands occur, the Vermont Wetland Rules (Section 6) apply and must be followed. Familiarity with the Vermont Wetland Rules and 'Silviculture Allowed Uses' is critical if operating in and around wetlands.
- Total unit cost is determined by the linear distance (in feet) of section of trail where corduroy will be laid.
- The length of trail where corduroy is to be used will be clearly marked and located on the ground and on the AMP Planning Map.

Corduroy on approach to stream crossing. Photo credit: Vermont AMP Manual

REFERENCES

Vermont Acceptable Management Practices, Manual for Logging Professionals 2nd edition, 2022.

VT AMP App for smartphones. Available at the App store or Google play. https://apps.apple.com/ph/app/vermont-amp/id1567399850

Pre-Award Verification Site Visit Requirements by Practice
Practice 2: Skid Trail Improvement

Practice Component	Pre-Award Visit Needed?
2.1 Trail relocation	Yes
2.2 Installation of waterbars	No
2.3 Installation of log-reinforced waterbars	No
2.4 Installation of pole bars	No
2.5 Installation and mobilization of crane mats to harden travel surfaces	No
2.6 Installation of corduroy	No

Practice 3: Temporary Stream Crossings

PURPOSE

Stream crossings are one of the most important aspects of maintaining water quality on forest operations. They are key in protecting the streams connectivity, as well as preventing sediment and slash from getting into the stream during forest operations. When designing stream crossings, it is important to size them appropriately so that they are flood resilient and durable during high flow events.

The changes in our climate, characterized by more intense rain events, have created a need for larger and more complex crossing structures. In addition, new tools and techniques are available to create better and more efficient stream crossings. This practice is intended to expose loggers to those methods and support their use.

This practice is intended to assist loggers in implementing temporary stream crossings that are appropriate to the site and designed to support the equipment and type of harvesting that is to be done. If a stream crossing is not sufficiently laid out and constructed, that crossing will most likely be unreliable to operate without risking a discharge of sediment and slash to the stream.

GENERAL POLICIES

The installation, maintenance, and close out of temporary stream crossing practices must be consistent with the Vermont's Acceptable Management Practices (AMPs). Where wetlands occur, the Vermont Wetland Rules Apply (Section 6) and must be followed. This practice is intended to be utilized on both skid trails and truck roads.

The applicant must submit a SLoCAMP program application and be approved before incurring any costs associated with this practice. Costs incurred before being approved are not eligible for reimbursement. The Department of Forests, Parks and Recreation, or designee, will review the application for eligibility and assign a cost-share reimbursement value based on the submitted application and field review (if a field review is necessary).

Temporary Stream Crossing components need pre-award field review only when components support crossing of streams with watersheds greater than 40 acres. Pre-award visit may be exempted by the Program Administrator when application review indicates that additional evaluation and guidance are not needed to support successful practice implementation.

Cost-share reimbursement for the SLoCAMP Program is available for all logging contractors in Vermont regardless of affiliation and is intended to be used on logging operations where the goal of the harvesting is for long-term forest management.

For the temporary stream crossing practice, an AMP Planning Map is required as part of the application. All SLoCAMP Program implementation practices identified on the AMP Planning Map must also be clearly identified on the ground with flagging or marked with paint.

AMP Planning Map Standards:

- Title block containing the landowner's name, logging contractor, town, parcel SPAN, and date
- Major roads with road names
- North Arrow
- Scale
- Legend identifying these landmarks at a minimum:
    - All landing areas and major skid trails
    - Streams, wetlands, and vernal pools
    - All implementation practices proposed for that harvest area.

PRACTICE COMPONENTS, COSTS, AND DETAILS

Costs listed in the table below represent the full cost of implementation. Each practice component is only funded at 90% to account for cost share required by the applicant. The application (Appendix B) reflects the actual incentive rates available to the applicant.

Practice 3: Temporary Stream Crossing Rates		
Practice Component	**Unit cost per practice**	**Practice Details**
3.1 Mobilization, installation, and close out of temporary poled crossing (with or without steel culverts).	$350/ crossing	Properly constructed and maintained throughout the use of that trail or road. Removal when job is completed, stream channel re-shaped and seeded and mulched within 50' of stream.
3.2 Mobilization, installation, and close out of temporary brushed in winter crossing (with or without steel culverts).	$350/ crossing	Properly constructed and maintained throughout the use of that trail or road. Removal when job is completed, stream channel re-shaped and seeded and mulched within 50' of stream.
3.3 Mobilization, installation, and close out of temporary wooden skidder bridge.	$450/ crossing	Properly constructed and maintained throughout the use of that trail or road. Removal when job is completed, stream channel re-shaped and seeded and mulched within 50' of stream.

3.4 Mobilization, installation, and close out of temporary steel skidder bridge.	$1,275/ crossing (25' and under) $1,525/ crossing over 25'	Properly constructed and maintained throughout the use of that trail or road. Removal when job is completed, stream channel re-shaped and seeded and mulched within 50' of stream.
3.5 Mobilization, installation, and close out of temporary culvert.	$400/ crossing	Properly constructed & maintained throughout the use of that trail or road. Removal when job is completed, stream channel re-shaped and seeded and mulched within 50' of stream.
3.6 Temporary truck road ford crossing	$1800/ crossing	Properly constructed and maintained throughout the job. Close out includes re-shaping/ re-constructing stream bank to original shape and applying seed and mulch within 50' of stream channel.

TECHNICAL SPECIFICATIONS

Definition and Purpose: Mobilization and excavation for all temporary stream crossing types includes the transfer of the temporary crossing material (culvert, bridge, poles etc.) from the landing to the crossing site. It also includes the excavation and machine work necessary to install the crossing, as well as the removal of the crossing, the excavation necessary to re-shape the crossing to its original profile and seeding and mulching exposed soil within 50 feet of the waterway.

Condition Where Component Applies: Access roads and skid trails on logging operations where the goal of the harvesting is for long-term forest management. Temporary stream crossing practices apply on both intermittent and perennial streams.

Applicants must include a Work Plan and an AMP Planning Map along with the SLoCAMP Program Application.

Stream crossings shall be located and installed in compliance with the VT AMP Manual. Temporary crossings cannot be installed for longer than 18 months. The number of stream crossings should be minimized.

CONSIDERATIONS FOR EACH TEMPORARY CROSSING TYPE

Practice Component 3.1: Temporary Poled Crossing

- Poled crossings are suitable for intermittent stream crossings where the channel is narrow and there is a suitable hard stream bed to support the poles.
- The crossing should be located where approaches are stable and have less than 10% slope.
- Poles should be at least 10" in diameter and long enough to extend beyond the edges of the skid trail.
- Installing a heavy-walled steel culvert in the bottom of the channel is recommended to allow for additional stream flow. The culvert is not back filled with dirt and is not considered a temporary culvert. These crossings are sometimes called a "vented ford".
- The number of poles in the crossing should be enough to fill the channel and protect the stream channel and stream banks from being impacted by the machinery and/or the hitches of wood.
- The approaches to the crossing shall be protected using logging slash and corduroy if necessary and maintained throughout the job.
- Temporary poled fords must be removed as soon as skidding on that trail has been completed, or within 12 months of installation, whichever is sooner.
- Temporary and final closeout of the crossing shall follow the '*Closeout Procedures*' found at the end of this section.

Practice Component 3.2: Temporary Brushed-In Winter Crossing

- This crossing type is suitable for wintertime use only on intermittent stream crossings where the channel is narrow and there is a suitable hard stream bed to support the brush. It is not suitable for summertime use because the brush can block summer rainstorms and wash out the crossing structure.
- The crossing should be located where the approaches are stable and have less than 10% slope.
- Poles should be at least 10" in diameter and long enough to extend beyond the edges of the skid trail.
- Installing a heavy-walled steel culvert in the bottom of the channel is recommended to allow for additional stream flow. The culvert is not back filled with dirt and is not considered a temporary culvert. These crossings are sometimes called a "vented ford".
- The number of poles in the crossing should be enough to fill the channel and protect the stream channel from being impacted by the machinery and/or the hitches of wood.
- Brush made up of tops and branches is then placed on top of the poles to create a smoother crossing and to further reduce the impacts on the stream banks.
- The approaches to the crossing shall be protected using logging slash and corduroy if necessary and maintained throughout the job.
- Temporary brushed-in fords must be removed as soon as skidding on that trail has been completed, or within 12 months of installation, whichever is sooner.
- Temporary and final closeout of the crossing shall follow the '*Closeout Procedures*' found

at the end of this section.

Practice Component 3.3: Temporary Wooden Skidder Bridge

- Temporary wooden skidder bridges are suitable for intermittent and perennial stream crossings.
- The crossing should be located where the approaches are stable and have less than 10% slope.
- All types of temporary wooden bridges can be used in this practice regardless of length or construction, provided they are long enough to span the stream channel.
- Temporary bridges shall be wide enough and constructed in a manner so that logging slash and soil cannot fall through the bridge.
- Bumper logs shall be installed on either side of the bridge to keep machinery and hitches on the bridge and out of the stream channel.
- The approaches to the crossing shall be protected using logging slash and corduroy if necessary and maintained throughout the job.
- Temporary wooden bridges must be removed as soon as skidding on that trail has been completed, or within 18 months of installation, whichever is sooner.
- Temporary and final closeout of the crossing shall follow the '*Closeout Procedures*' found at the end of this section.

Practice Component 3.4: Temporary Steel Skidder Bridge

- Temporary steel skidder bridges are suitable for intermittent and perennial stream crossings.
- The crossing should be located where the approaches are stable and have less than 10% slope.
- All types of temporary Steel bridges can be used in this practice regardless of length or construction, provided they are long enough to span the stream channel.

- Temporary bridges shall be wide enough and constructed in a manner so that logging slash and soil cannot fall through the bridge.
- Bumper logs shall be installed on either side of the bridge to keep machinery and hitches on the bridge and out of the stream channel.
- The approaches to the crossing shall be protected using logging slash and corduroy if necessary and maintained throughout the job.
- Temporary steel bridges must be removed as soon as skidding on that trail has been completed, or within 18 months of installation, whichever is sooner.
- Temporary and final closeout of the crossing shall follow the '*Closeout Procedures*' found at the end of this section.

Practice Component 3.5: Temporary Culvert

- Temporary culverts are suitable for intermittent and small perennial stream crossings.
- Temporary culverts are suitable on crossings where the channel is narrow and relatively deep and does not require moving a lot of cover material.
- The crossing should be located where the approaches are stable and have less than 10% slope.
- All types of pipes can be used, provided they are strong enough to support the backfill material and the equipment, and that they are solid and will not leak water out of the pipe.
- Ensure that the culvert is long enough to prevent dirt and logging debris from falling into the stream channel and plugging the inlet or outlet of the pipe. Bumper logs can be used like headwalls to prevent soil movement over the end of the culvert.
- The diameter of the temporary culvert shall meet the requirements of Table 2A in the VT AMP Manual.
- Installation of temporary culverts should be done in as dry a condition as possible.
- Proper installation is important, starting with placing the culvert in the stream channel, then backfilling with as clean a material as can be found, and compacting with an excavator bucket in 12" lifts. Backfill should match the height of the skid trail approaches and be no less than 12" over the pipe.
- For temporary culverts on truck roads, it is recommended to use crushed gravel as backfill material. This will provide more strength to the pipe itself, as well as preventing rutting and settling around the pipe.
- A properly installed temporary culvert will pass all of the stream flow through the pipe and will not allow water to go sub-surface under the pipe.
- The approaches to the crossing shall be protected using logging slash and corduroy if necessary and maintained throughout the job.
- Temporary culverts must be removed as soon as skidding on that trail has been completed, or within 18 months of installation, whichever is sooner.
- Temporary and final closeout of the crossing shall follow the '*Closeout Procedures*' found at the end of this section.

Practice Component 3.6: Temporary truck road ford crossing

- The intent of this component is to harden the approaches to temporary ford crossings on truck roads.
- Appropriate ford crossings should be located on shallow streams (3 feet or less), where the stream has a stable streambed of cobble or ledge.
- Minimize the amount of streambank disturbance by locating a ford where the streambanks are low and at a gentle slope.
- Prior to adding new material, the approach should be graded/shaped to an appropriate surface profile to remove any deformities and to establish an ideal shape for a level and gradual approach to the crossing.
- New material should be 4-6" clean stone without fines.
- Do not excavate or remove in-stream material and blend the clean stone into the stable streambed to create a smooth approach.
- Practice rate is based on 3 loads of clean stone and 3 hours of machine time.

CLOSEOUT PROCEDURES

These closeout activities are important in stabilizing stream crossings and are required to be done on each crossing site and for each practice. For crossings that are used during winter conditions, frozen ground may not allow for all activities to be completed as soon as the crossing is no longer needed. In these situations, temporary measures should be done to protect the site during snow melt and spring conditions such as removing the structure if possible and installing temporary waterbars. Then, as soon as the ground conditions are suitable, the final closeout procedure below shall be completed.

- Remove temporary structures, slash, and/or other materials from below the normal high-water mark. Do not remove debris that has fallen into the stream naturally.
- For temporary culverts, the channel shall be re-shaped to match the profile of the stream as evident by the channel upstream and downstream.
- Remove logs used for abutments on temporary bridges unless doing so may cause more disturbance.
- Leave brush and corduroy in place on the approaches and banks (above the normal high-water mark). This provides for stabilization and may limit the area of exposed soil and reduce the need for seeding and mulching.
- Re-shape the stream channel to its original profile.
- Stabilize the approaches in the forest buffer by applying seed and mulch to all exposed soil within 50 feet of the waterway.
- Install waterbars on the approaches to the crossing as close to 25 feet from the top of bank as ground conditions allow.

Appendix A – Approved Practices #3: Temporary Stream Crossings

REFERENCES

Vermont Acceptable Management Practices, Manual for Logging Professionals 2nd edition, 2022.

VT AMP App for smartphones. Available at the App store or Google play. https://apps.apple.com/ph/app/vermont-amp/id1567399850

Pre-Award Verification Site Visit Requirements by Practice
Practice 3: Temporary Stream Crossing Rates

Practice Component	Pre-Award Visit Needed
3.1 Mobilization, installation, and close out of temporary poled crossing (with or without steel culverts).	Only for large crossings on streams draining at least a 40-acre watershed.
3.2 Mobilization, installation, and close out of temporary brushed in winter crossing (with or without steel culverts).	Only for large crossings on streams draining at least a 40-acre watershed.
3.3 Mobilization, installation, and close out of temporary wooden skidder bridge.	Only for large crossings on streams draining at least a 40-acre watershed.
3.4 Mobilization, installation, and close out of temporary steel skidder bridge.	Only for large crossings on streams draining at least a 40-acre watershed.
3.5 Mobilization, installation, and close out of temporary culvert.	Only for large crossings on streams draining at least a 40-acre watershed.
3.6 Installation, and close out of temporary ford crossing on a truck road.	Yes

Practice 4: Permanent Stream Crossings

PURPOSE

Stream crossings are one of the most important aspects of maintaining water quality on forest operations. They are key in protecting the streams connectivity, as well as preventing sediment and slash from getting into the stream during forest operations. When designing stream crossings, it is important to size them appropriately so that they are flood resilient and durable during high flow events.

The changes in our climate, characterized by more intense rain events, have created a need for larger and more complex crossing structures. In addition, new tools and techniques are available to create better and more efficient stream crossings. This practice is intended to expose loggers to those methods and support their use.

This practice is intended to assist loggers in replacing undersized crossings on intermittent streams where they cross permanent roads or trails. This practice is not intended for large stream crossings on perennial streams that fall under the jurisdiction of the River Management Engineers.

GENERAL POLICIES

Any permanent stream crossings installed through this practice must be consistent with the Vermont's Acceptable Management Practices (AMPs). Where wetlands occur, the Vermont Wetland Rules (Section 6) apply and must be followed. This practice is intended to be utilized on permanent roads that are used for long-term forest management and access a log landing.

The applicant must submit SLoCAMP Program Application and be approved before incurring any costs associated with this practice. Costs incurred before being approved are not eligible for reimbursement. The Department of Forests, Parks and Recreation, or designee, will review the application for eligibility and assign a cost-share reimbursement value based on the submitted application and field review (if a field review is necessary).

Prior to award and after practice implementation, all applications for this practice will be required to be field reviewed by FPR, or the Program Administrator for the purposes of verifying the stream type, proposed crossing size, location and suitability, and satisfactory implementation.

Cost-share reimbursement for the SLoCAMP Program is available for all logging contractors in Vermont regardless of affiliation and is intended to be used on logging operations where the goal of the harvesting is for long-term forest management.

For the permanent stream crossing practice, an AMP Planning Map is required as part of the

application. All SLoCAMP Program implementation practices identified on the AMP Planning Map must also be clearly identified on the ground with flagging or marked with paint.

AMP Planning Map Standards:

- Title block containing the landowner's name, logging contractor, town, parcel SPAN, and date
- Major roads with road names
- North Arrow
- Scale
- Legend identifying these landmarks at a minimum:
  - All landing areas and major skid trails
  - Streams, wetlands, and vernal pools
  - All implementation practices proposed for that harvest area
- For permanent stream crossings, the location of the crossing and the drainage area for that crossing must be identified and labeled on the map, including the number of acres draining to that crossing site

PRACTICE COMPONENTS, COSTS, AND DETAILS

Costs listed in the table below represent the full cost of implementation. Each practice component is only funded at 50% to account for cost share required by the applicant. The application (Appendix B) reflects the actual incentive rates available to the applicant.

Practice 4: Permanent stream crossing rates		
Practice Component	**Unit cost per practice**	**Practice Details**
4.1 Installation of permanent culvert on truck road over an intermittent stream	$4.30 / in-ft; in-ft is determined by multiplying the diameter in inches of the culvert by the length of the culvert in feet	Properly sized and installed culvert.
4.2 Installation of laminated wooden bridge on truck road over an intermittent stream	$53.30 / sq ft	Properly sized and constructed wooden laminated bridge on intermittent stream.

TECHNICAL SPECIFICATIONS

Definition and Purpose: The permanent stream crossing practice is intended to support the replacement of undersized stream crossings on intermittent streams only. This practice does not include stream crossings on perennial streams that are under the jurisdiction of the River Management Program within VT DEC. This practice is for the replacement of undersized crossings that have been or are at risk of being damaged by flood events.

Condition Where Component Applies: Truck roads and skid trails where the goal of the harvesting is for long-term forest management. Permanent stream crossing practices apply to intermittent streams only.

For permanent stream crossings, the location of the crossing and the drainage area for that crossing must be identified and labeled on the AMP Planning Map with the acres draining to that crossing site. Prior to award all sites will be visited by FPR, or the Program Administrator, and the stream type will be verified as well as the proposed structure size. Following installation, satisfactory implementation of practice will be verified.

CONSIDERATIONS FOR EACH CROSSING TYPE

Practice Component 4.1: Installation of Permanent Culvert on Truck Road Over an Intermittent Stream - 24" to 66" Diameter Culvert

- The crossing should be located where the approaches are stable and have less than 10% slope.
- Work involving stream crossings has an elevated risk of discharging sediment into the stream. Sediment control measures shall be used to prevent a discharge from occurring and includes a variety of temporary barriers such as silt fence, haybale check dams, fiber blankets, filter socks, and straw rolls/wattles.
- Culverts shall be properly sized. The minimum size for permanent culverts on intermittent streams shall be determined by watershed area as outlined in Table 2A of the AMP Manual or shall be sized to accommodate the active channel as observed at the crossing site. Active channel shall be determined by the extent of streambed scour as measured perpendicular to the stream. Active channel width is narrower than backfill width (approximately 75%) and is defined by the break in slope and typically extends to the edge of permanent vegetation.
- The inlet and outlet shall be at grade with the stream bed. No plunge pool shall be present at the outlet. If a plunge pool does exist, it shall be filled with stone matching the size of the largest stone observed within the stream channel.
- Culverts installed on streams with active channel widths equal to or greater than 4' shall be embedded 30% below streambed elevation. Infill material is not required and will occur from natural stream action.
- The trench for the culvert shall be excavated such that the bottom width of the trench is at least 3 feet wider than the culvert to allow for suitable compaction. Remove the old

culvert if doing a replacement.

- Culverts shall be installed on undisturbed or well-compacted base material.
- The longitudinal profile should be set at the same slope as the natural stream gradient if possible, but shall be no less than 0.5%, and no more than 4%.
- Pipe shall be laid starting at the outlet end and working up slope.
- Culverts shall have sufficient length to extend to the toe of the road and shall be flush with the inlet/outlet headwalls. Lengths of culvert shall be joined in accordance with the manufacturer's specifications.
- Culvert outlets shall not be perched or suspended above the ground.
- Culverts shall be back filled with 1 ½" crushed gravel in 6" compacted lifts, with compaction done by a plate compactor.
- Compacted backfill should surround the culvert for a minimum of 12" on either side.
- The top of culverts shall be covered with compacted material to the manufacturer's specifications or, lacking those, a depth of half the culvert diameter or 12" (whichever is greater).
- Stone headwalls shall be installed at the inlet and outlet of all stream crossing culverts to mark the location of the culvert, prevent inlet and outlet erosion, and protect the culvert from damage.
- Construct stone headwalls as follows:
  - Large rocks, at least 18" in one dimension, shall be used. Rocks found on-site or blasted stone/ledge are suitable.
  - Headwalls should be flush with the ends of the culvert.
  - Headwall rocks shall be installed so that joints overlap and so that they are well fitted and tight.
  - Each side of the headwall should be at least 1.5 times the width of the culvert.
  - Headwalls should have one large stable rock over the center of the pipe.

Practice Component 4.2: Installation of Laminated Wooden Bridge on Truck Road Over an Intermittent Stream

- This practice is suitable for larger intermittent streams where the drainage area is less than 160 acres. These permanent crossings do not require a Stream Alteration Permit and can be installed using the basic design included in the practice sheet.
- Work involving stream crossings has an elevated risk of discharging sediment into the stream. Sediment control measures shall be used to prevent a discharge from occurring and includes a variety of temporary barriers such as silt fence, haybale check dams, fiber blankets, filter socks, and straw rolls/wattles.
- Bridges shall be properly sized according to Table 2B in the AMP Manual.
- The low chord of the bridge shall be at least 2.75 feet above average stream bed elevation.
- If the stream bed requires re-construction, as in cases where culverts are replaced with a bridge, the appropriate sized Type E Stone Fill should be used that most closely matches the natural bed material above and below the crossing.
- Proposals to install an intermittent stream bridge crossing shall include watershed area determination, active channel width determination, distance between abutments, length

of deck, alignment, stringer/deck design, abutment design, sediment control measures, water diversion plan, streambank armoring, and any other relevant aspects.

- The state has provided a bridge design, the *FPR Laminated Bridge Design*, for use on streams with bank full widths of 10 feet or less. When all other conditions can be met, these designs shall be used on these crossings. Alternatives to this bridge design shall require approval by the State.

Additional Considerations for Laminated Bridge Design

- This bridge design uses pressure treated lumber that is nail-laminated, and spans from abutment to abutment. With this design, the supporting structure and deck are one and the same, with runners put down on top to protect the deck from tire wear. The capacity of the bridge is based on the Nail Laminated Deck Design Table from the USFS document entitled *'Standard Plans for Timber Bridge Superstructures'* https://www.fpl.fs.usda.gov/documnts/fplgtr/fplgtr125.pdf
- The abutment design used by FPR is very simple and typically made with concrete waste blocks. These bridges are generally short spans, less than 14 feet from face to face of the abutments, and can be designed to be as wide as necessary simply by nail laminating more decking material. The abutments are locked into the streambed by moving the abutments back away from the active channel or bank full width and protecting them with riprap that is keyed in below streambed elevation.
- Nail laminated bridges are good alternatives for large culverts over 48" in diameter where high flows frequently overwhelm the crossing. Extra width can often be attained without significant additional cost.
- Excavation for abutments is often less than for larger culverts that are embedded in the stream channel.

Laminated Bridge Design Details

- Set abutments back from the active channel a distance that is equal to, or more than, the height of the low chord of the bridge. This will allow for a 1:1 slope of riprap from the active channel to the abutment.
- Use only single-pour concrete waste blocks without cold seams.
- The base of the first row of blocks shall be set no higher than average streambed elevation.
- Set blocks on a 2" bed of crushed stone to allow for leveling.
- Blocks shall be level and tight with joints staggered.
- Key in riprap at least 3' below stream bed elevation. Use large 3' plus stone in bottom row. The stone should be set on undisturbed or compacted soil.
- Use pressure treated lumber only for decking, curbs, and runners.
- Use galvanized nails or deck screws for lamination that are long enough to laminate three boards together at a time.
- The bridge deck shall have at least 12" sitting on each abutment.
- On the side of each corner of the deck, there shall be a 6x6 piece of angle iron 10" long attaching the deck to the abutment. See *FPR Laminated Bridge Design* on the following page.

- Curbing and runners shall be constructed as shown in the *FPR Laminated Bridge Design*.

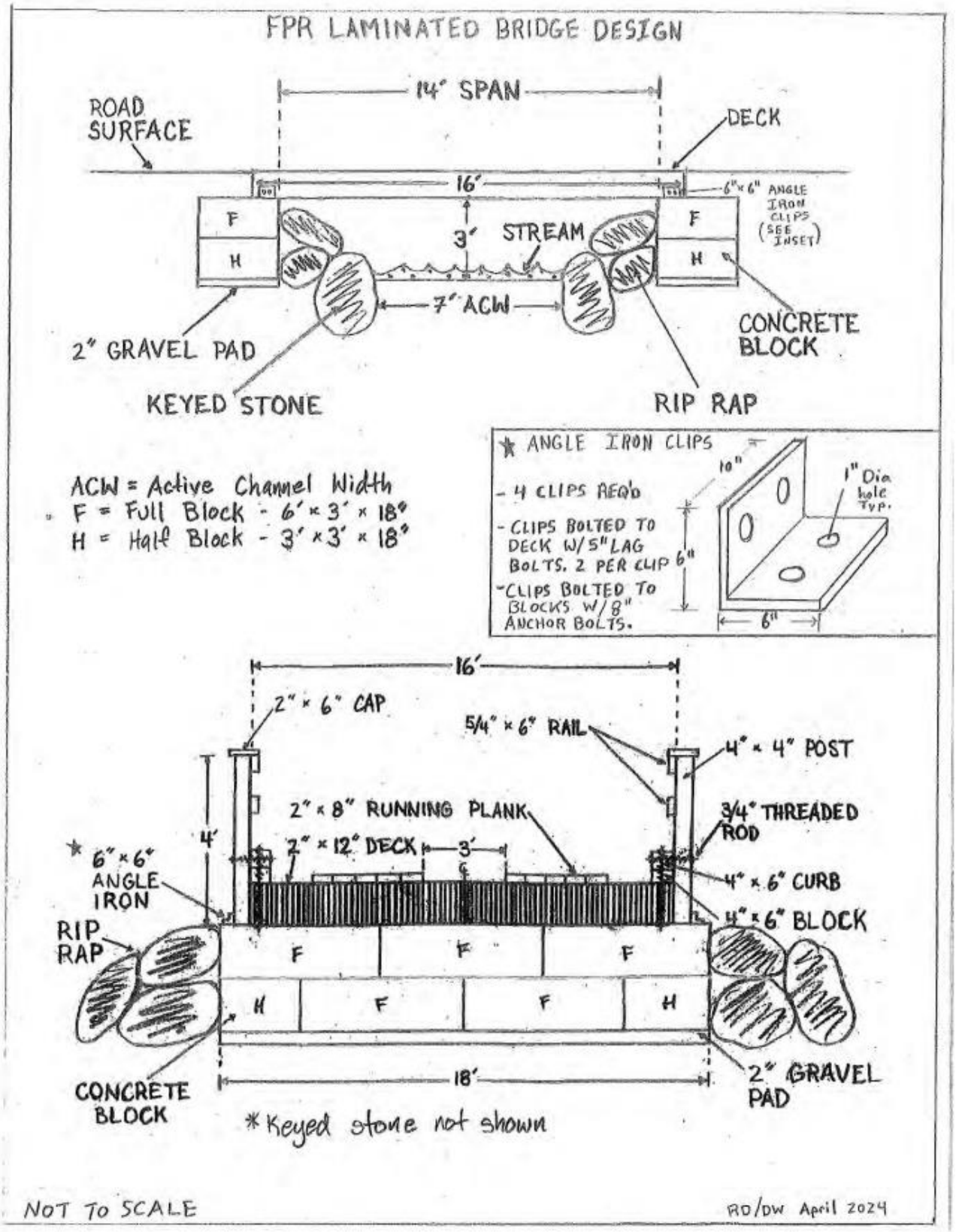
REFERENCES

Vermont Acceptable Management Practices, Manual for Logging Professionals 2nd Ed., 2022.

VT AMP App for smartphones. Available at the App store or Google play.
https://apps.apple.com/ph/app/vermont-amp/id1567399850

Pre-Award Verification Site Visit Requirements by Practice
Practice 4: Permanent stream crossing rates

Practice Component	Pre-Award Visit Needed
4.1 Installation of permanent culvert on truck road over an intermittent stream	Yes
4.2 Installation of laminated wooden bridge on truck road over an intermittent stream	Yes


FPR LAMINATED BRIDGE DESIGN
14' SPAN
ROAD SURFACE
DECK
16'
6"x6" ANGLE IRON CLIPS (SEE INSET)
F
H
3'
STREAM
7' ACW
2" GRAVEL PAD
KEYED STONE
RIP RAP
CONCRETE BLOCK
ACW = Active Channel Width
F = Full Block - 6' x 3' x 18"
H = Half Block - 3' x 3' x 18"
★ ANGLE IRON CLIPS
- 4 CLIPS REQ'D
- CLIPS BOLTED TO DECK W/ 5" LAG BOLTS. 2 PER CLIP
- CLIPS BOLTED TO BLOCKS W/ 8" ANCHOR BOLTS.
10"
6"
1" Dia hole TYP.
16'
2" x 6" CAP
5/4" x 6" RAIL
4" x 4" POST
2" x 8" RUNNING PLANK
2" x 12" DECK
3'
4'
3/4" THREADED ROD
★ 6"x6" ANGLE IRON
4" x 6" CURB
4" x 6" BLOCK
RIP RAP
F
H
18'
2" GRAVEL PAD
CONCRETE BLOCK
*Keyed stone not shown
NOT TO SCALE
RD/DW April 2024