ROADS AND WATER CROSSINGS

APPLICABLE OREGON FOREST PRACTICES RULES

Forest road construction and maintenance

629-625-0100: Written plans for road construction
629-625-0200: Road location
629-625-0800: Road design
629-625-0310: Road prism
629-625-0320: Water-crossing structures
629-625-0330: Drainage
629-625-0410: Disposal of waste materials
629-625-0440: Stabilization
629-625-0600: Road maintenance
629-625-0650: Vacating forest roads and water crossings
629-625-0700: Wet weather road use
629-625-0800: Construction in wetlands
629-625-0900: Forest Road Inventory and Assessment
629-625-0910: State-led abandoned roads inventory
629-625-0920: Road condition assessment

Forest roads are essential to forest management. They contribute to providing jobs, products, tax base and other social and economic benefits.

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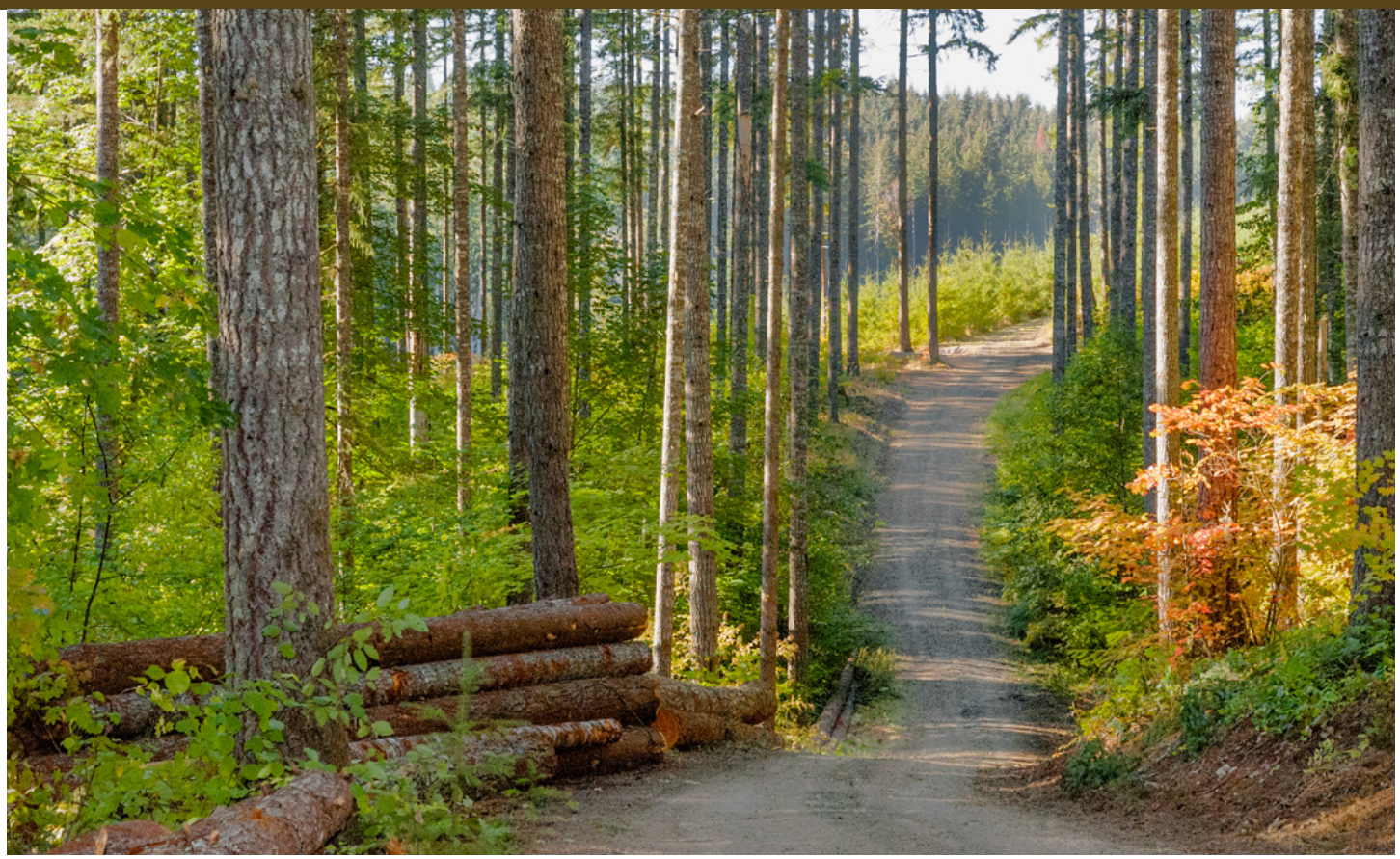


FOREST ROADS ARE ESSENTIAL

In the Oregon Forest Practices Act (OFPA), road construction and maintenance rules establish standards for locating, designing, constructing and maintaining efficient and beneficial forest roads; locating and operating rock pits and quarries; identifying active and inactive roads that have fish-passage barriers or contribute sediment to waters of the state; correcting those conditions; and vacating roads, rock pits and quarries that are no longer needed. The goal is to provide the maximum practical protection to maintain forest productivity, water quality and habitat for fish and wildlife.

All roads must be designed, constructed, improved, maintained or vacated to:

- prevent or minimize sediment delivery to waters of the state
- ensure passage for covered species during all mobile life history stages
- prevent or minimize drainage or unstable sidecast in areas where mass wasting could deliver sediment to public resources or threaten public safety
- prevent or minimize hydrologic alterations of stream channels
- prevent or minimize impacts to stream bank stability, existing stream channels and riparian vegetation
- disconnect forest roads and landings hydrologically from waters of the state to the maximum extent practicable
- avoid, minimize and mitigate loss of wetland function

These road construction and maintenance rules apply to all situations unless otherwise indicated.

NEW CONSTRUCTION

The forest practice rules recognize that roads are important to forest management because they help move people, equipment and products efficiently. Forest road construction planning should consider how the proposed road could affect nearby water systems or change the contour of the land, potentially resulting in unnecessary disturbances.

Road location

Reduce duplicate road systems and associated ground disturbance by using existing stable and functioning roads when practical. If a road traverses land on another ownership, investigate options for using those roads before constructing new roads. Forest operators who submit notifications that include new road construction should affirm such options were investigated.

Locate roads in areas that minimize the risk of materials entering water. When alternatives exist, avoid locating roads on steep slopes, slide areas or high landslide hazard locations (HLHLs), and in wetlands, riparian management areas (RMAs), channels or floodplains. Minimize the number of times the road crosses streams.

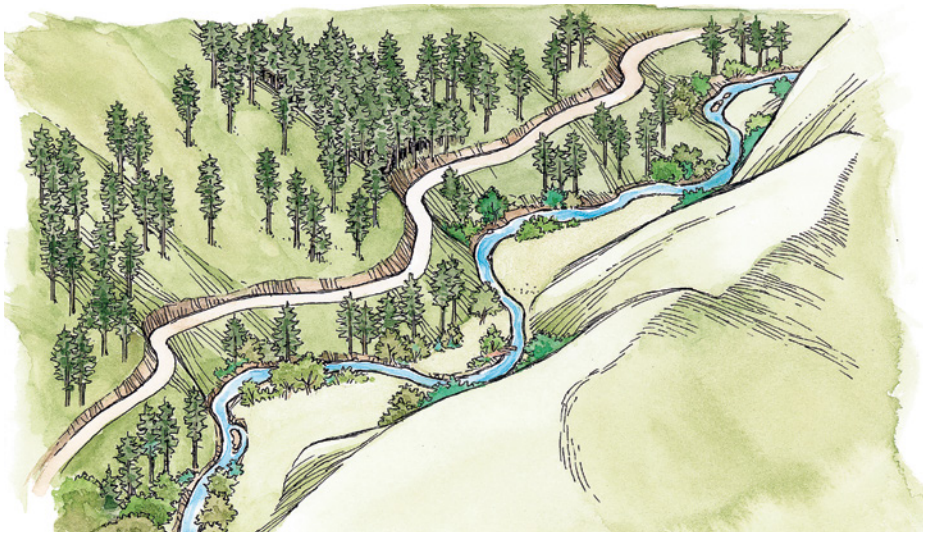
AVOID BUILDING ROADS IN CRITICAL LOCATIONS, WHICH INCLUDE:

- HLHLs – areas that are likely to be the starting point of a rapidly moving landslide
- slopes over 60% grade with decomposed granite-type soils
- locations within 50 feet of stream channels or lakes, excluding crossings and approaches to crossings
- locations within significant wetlands, stream-associated wetlands or other wetlands larger than 0.25 acres
- any active stream channels, exclusive of stream crossings
- locations parallel to or within an RMA, for a distance exceeding a cumulative 500 feet of road length measured from the first point of entry into the RMA to the last point of exit, exclusive of stream crossings
- high landslide hazard situations where rock is likely to be unstable, so a cut slope cannot be excavated
- situations where a cut slope failure may divert road surface drainage to an HLHL and could trigger a debris flow below the road, with potential for delivery to a stream
- locations that cut through the toe of active or recently active deep-seated landslide deposits and where a reactivated landslide would likely enter waters of the state
- highly dissected steep slopes where it is not possible to fit the road to the topography with full-bench end-haul construction

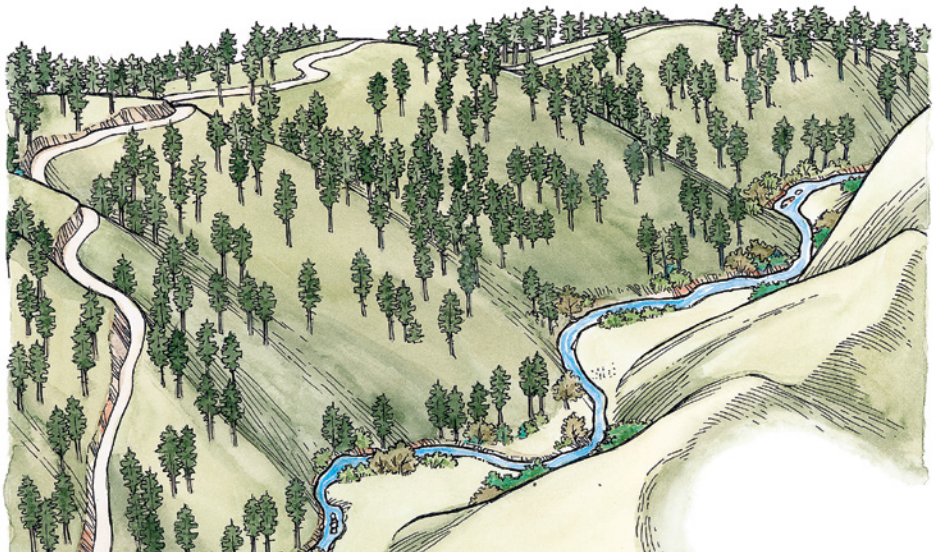
When alternate routes are not legally or physically feasible, or when they may create safety hazards or increase environmental risk, forest operators should submit a written plan to locate roads in critical locations. The plan must describe why alternative routes are not feasible or would increase environmental risk. The Oregon Department of Forestry (ODF) stewardship forester will consult with the Oregon Department of Environmental Quality (DEQ) and the Oregon Department of Fish and Wildlife (ODFW) and will have 14 days from receipt of the written plan to conduct an on-site review, if necessary. If no review happens within 14 days, the operator may continue with operations.

See Avoiding Roads in Critical Areas PDF at **KnowYourForest.org/manual-links**.

UNACCEPTABLE OPTION: Roads built or reconstructed next to a stream channel with multiple crossings are not allowed. Note: Many older roads and highways are in such locations.



ACCEPTABLE OPTION: When no other alternative exists, build roads on 45% side slopes. This option will likely be more difficult to build.



BEST OPTION: Build road on ridge top and plan for cable timber harvesting.

Road design

Design and construct roads to protect water quality by limiting the alteration of natural slopes and drainage patterns to accommodate road use and protect waters of the state. Refer to ODF's Forest Practices Technical Guidance for design specifications on how to avoid and prevent potential impacts to fish, wildlife and habitat resources.

ROAD CONSTRUCTION ON STEEP SLOPES

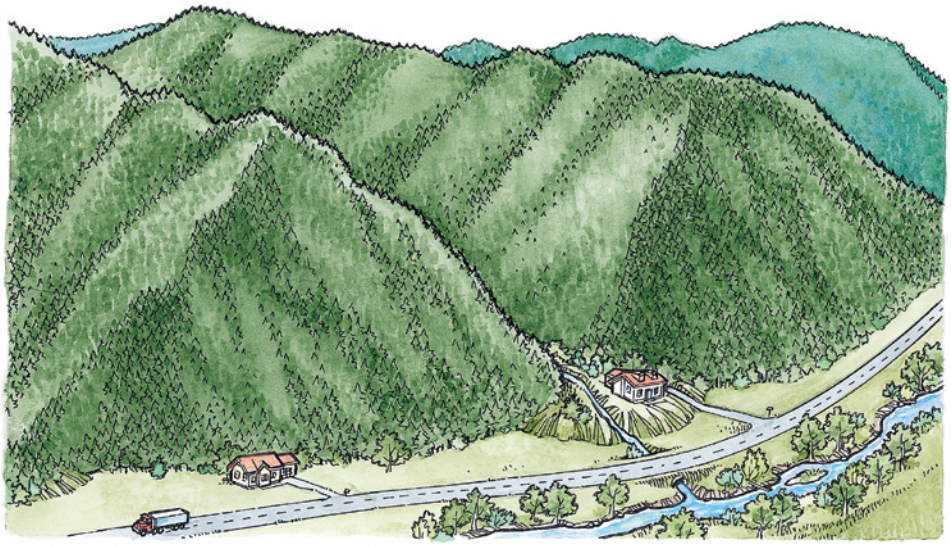
Rapidly moving landslides can be triggered when road fill or sidecast material is pushed or placed onto steep slopes below the road. Movement may occur with the next major storm, or it may not occur for decades. Use end-haul construction for all HLHLs and steep slopes to help prevent landslides (see illustrations, next page).

A road built on a steep slope or that crosses a fish-bearing stream (Type F or Type SSBT) requires a more complicated design that:

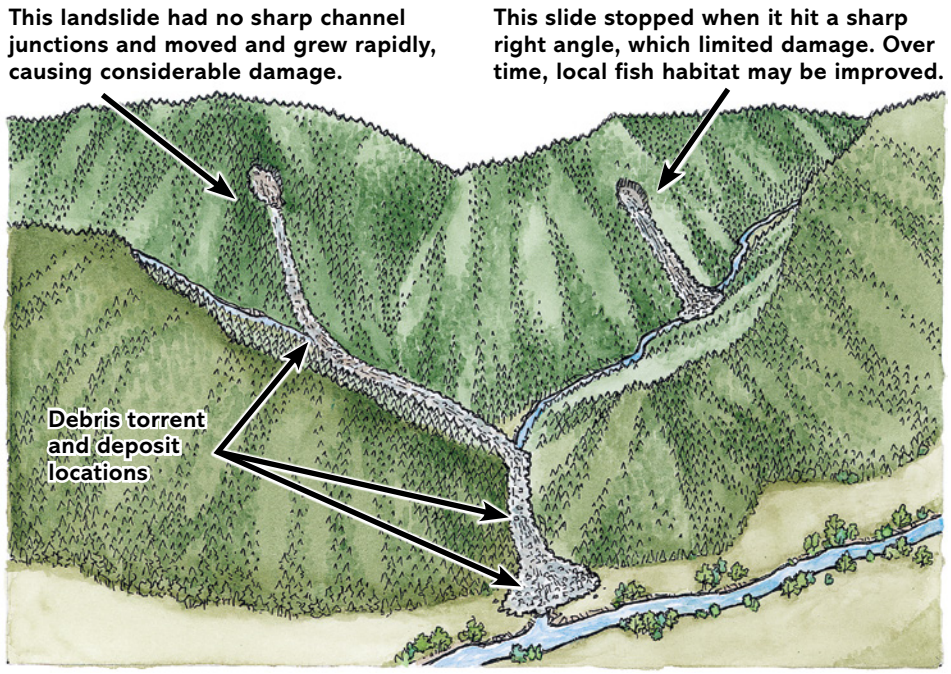
- minimizes disturbing erodible slopes next to stream channels
- avoids damage to side channels
- allows for large flood flows without washing out crossing structures
- provides unimpeded upstream and downstream passage at crossings for all native migratory fish
- allows fish access to side channels
- considers how steep grades (greater than 20%) can create drainage, traction and safety problems
- places cross-drain culverts away from HLHLs

(continued on next page)

- builds roads no wider than necessary to accommodate anticipated use (see Table 7-1) while allowing for two-way traffic, using turnouts on narrow roads in strategic and stable locations
- uses full-bench and end-haul construction for all HLHLs and steep slopes
- stabilizes road fills using compaction, buttressing, subsurface drainage, rock facing or other means
- selects slope angles that are unlikely to result in landslides (consult a geotechnical specialist for roads in HLHLs)



The home at right is on a debris fan at the base of a debris torrent-prone stream that is highly susceptible to landslides from the canyon behind it. Its risk is higher than the home at left that is below a single, uniform steep slope.



This illustration shows the action of two landslides. Landowners who conduct operations on slopes need to evaluate the potential for landslides. Many locations prone to rapidly moving landslides don't show evidence of prior landslides.

When constructing a full-bench road, excavate the entire road surface in the hill. The excavated material should be end-hauled. For example, it could be removed by truck to an area that needs filling, or to a stable disposal area.

Table 7-1 Guidelines* for road widths

Road Use	Maximum Width	Preferred Width
Minor spur and temporary	18 ft.	12 ft.
Collector road (single lane)	20 ft.	16 ft.
Mainline haul road (double lane)	32 ft.	24 ft.

*Exclusive of ditches, plus any additional width necessary for safe operations for fill widening or on curves, turnouts and landings.

Road prism

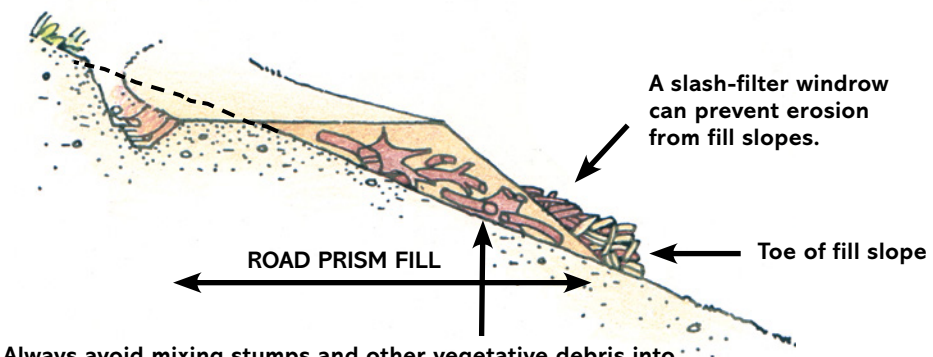
The area of ground containing the road surface, cut slope and fill slope is called the road prism. It should be designed to minimize disturbances to protected resources by avoiding steep sidehills, wet areas and potentially unstable areas. Excess material can be end-hauled to prevent landslides. Both new roads and reconstruction designs should be no wider than necessary to accommodate the anticipated use and should minimize environmental impacts to waters of the state and covered species.

The running surface width should average no more than 32 feet for double-lane roads and 20 feet for single-lane roads, excluding ditches. Additional width may be necessary for safe operations, for fill widening, or on curves, turnouts and landings. Other ways to ensure road construction minimizes potential environmental damage include:

- designing, cutting and filling slopes to minimize the risk of landslides
- stabilizing road fills as needed using compaction, buttressing, subsurface drainage, rock facing or other effective means to prevent fill failure and subsequent damage to waters of the state
- using end-haul construction that does not place fill within the RMA of a stream or within 75 feet of a stream channel where an RMA is not required, excluding stream crossings and approaches to crossings

Cut-and-fill construction is common for gentle terrain. Soil is taken from cuts and pushed or "drifted" to where fill is needed to build up flat areas or cover culverts. Never let sidecast or waste material enter streams, and never place it in unstable areas where it might erode or slide into an RMA or within 75 feet of any stream.

Slash-filter windrows are made of compacted logging slash installed along the base of fill slopes during road construction. Built by excavators, these 3-by-3-foot barriers are very effective at slowing surface runoff and keeping sediment from entering streams.



Always avoid mixing stumps and other vegetative debris into the road fill. Over time, it can lead to road slumping and failure.

Water-crossing basics

- Consider vacating a water crossing first. If that's not possible, prioritize using a permanent channel-spanning structure.
- Design crossings to handle 100-year peak flows.
- Make crossing structures (e.g., culverts) passable by adult and juvenile fish for Type F and Type SSBT streams.
- Allow fish to access side channels.
- Protect the channel, any side channels and the floodplain.
- Pay attention to size restrictions for stream-crossing fills.
- Minimize the total area disturbed by road fill.
- Minimize the excavation of stream-adjacent side slopes.
- Minimize the risk of materials entering water.
- Avoid locating roads in wetlands, RMAs or floodplains if alternative locations exist.

Water-crossing structures

Forest roads that cross or come close to water can affect:

- water quality
- aquatic habitats
- fish migration
- stream and wetland characteristics
- riparian habitats

Stream-crossing structures include culverts (both closed and bottomless arch), bridges and fords. Each is designed to allow water to pass without causing erosion and to provide safe vehicle crossing. Bridges are best for streams more than 10 feet wide and those with high stream gradients. Minimize the number of stream crossings and avoid locating them in steep, narrow canyons.

If a forest road must cross a stream, consider these factors to determine what type of crossing to use:

Type F or Type SSBT streams. Bottomless arch culverts and bridges protect the natural streambed with minimal impact on fish and other aquatic wildlife.

Cost. The following stream-crossing structures are ranked in order of increasing cost for construction and maintenance:

- ford
- round culvert
- squash culvert
- bottomless arch culvert
- bridge

Length/intensity of use. Culverts provide year-round access with a rock surface. Fords suffice if crossings need occur only once per timber harvest rotation and traffic volume is low. Fords have less impact than any permanent stream-crossing infrastructures.

Soil foundation. Bedrock crossings may require bottomless arch culverts, bridges or fords.

Equipment/materials for crossings. For example:

- Culvert installation can include the use of a dozer, backhoe or excavator, portable compactor, bedding gravel, armoring material, culvert outlet downspout and sediment filter.
- Bridges sometimes require cranes, concrete truck access for abutments, piledrivers and high-service-level roads for steel or pre-stressed concrete delivery.
- Fords require armoring of approaches and stream bottom, and possibly geotextile and excavation equipment.

Consultants. ODF must review written plans for any required consultants, such as engineers and hydrologists.

DESIGN AND CONSTRUCTION:

Design and construct all water-crossing structures in all typed waters and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, wetlands, inlets and canals to:

- minimize excavation of side slopes near the channel
- minimize the volume of material in the fill by restricting the width and height of the fill to the amount needed for safety
- prevent erosion of the fill and channel
- minimize hydrologic connectivity to adjacent roadway
- avoid or minimize alterations or disturbances to stream channel, bed, bank or bank vegetation
- stabilize disturbed stream banks using erosion-control techniques (e.g., planting native woody species)
- ensure that stream flow is not likely to be diverted out of its channel if the crossing fails
- preserve water quality and unobstructed flow
- route and deposit temporarily turbid water from crossing projects to the forest floor in an upland area — or above the 100-year flood level, if present — to allow removal of fine sediment and other contaminants prior to discharge to waters of the state

For water-crossing structures on Type F and Type SSBT streams:

- avoid or minimize impacts to fish and their spawning and rearing habitat
- minimize the loss of fish life during the project
- ensure free and unimpeded fish passage at all flows when fish are expected to move

A written plan is required for all water crossings, with extra elements for fills more than 15 feet deep. Include a design that minimizes the likelihood of surface erosion, embankment failure and movement of materials downstream.

When the ODF stewardship forester determines that installing a water crossing in a flowing stream will cause excessive sedimentation and turbidity, divert stream flow using a bypass flume or culvert or pump the stream flow around the work area. In this situation, culverts may be installed within 0.25 miles of a Type F or Type SSBT stream or within two miles of a hatchery intake.

Best management practices for stream culvert installation:

- Develop sediment and pollution control plans and actions.
- Install during in-water work period defined by ODFW.
- Excavate the culvert bed as quickly as possible.
- Use a temporary dam, or pump stream water around installation, if the culvert bed is silt or clay material.
- Use clean gravel for the culvert bed when needed.
- Backfill around the culvert with native soil or gravel.
- Compact the backfill.
- Cover the fill with a gravel surface.

Basic stream culvert installation from start to finish

Construction of culvert stream crossings has the greatest potential to cause immediate sediment pollution. Installing culverts involves more than just placing a pipe in a stream. Complete the work promptly, at a time when the least damage will occur; the ODFW has guidelines for timing on in-water work. A portable pump can be used to carry stream water around the construction site. The channel foundation and trench walls must be free of logs, stumps, limbs or rocks that could damage the culvert pipe.

The culvert bed must conform with the natural streambed. The bed should be either rock-free soil or gravel. The culvert bedding should provide even distribution of the load across the length of the pipe. All stream crossings on Type F or Type SSBT streams must be designed to provide fish passage (see page 201).

Secure each end of the culvert with backfill. Pour backfill material on top of the pipe. This allows finer soil particles to flow around and under the culvert sides. Larger particles roll to the outside. Fine soil particles, close to the culvert, compact more easily. Once the ends are secured by backfill, the center of the culvert is covered.

Tamping fill material throughout the entire backfill process is important. The base and sidewall material should be compacted first to reduce any chance of water seepage into the fill.

Armor the culvert inlet and outlet. Rocks, logs or grass seeding can be used to protect these locations against erosion. Check the area upstream and downstream from the culvert. Clear the upstream area of woody debris that might plug the culvert and place it at the downstream end.

The road approach to the new culvert is the next phase of construction. Be sure that the culvert fill above the top of the pipe is at least 18 to 24 inches high to protect the pipe from damage by traffic.

Layers of fill are pushed into place and carefully compacted to build up and maintain a consistent road grade. The crossing should be rocked to minimize the risk of sediment washing off the road and into the stream.

Seed and mulch are required for bare soils when any sediment may reach waters of the state.

Kinds of pipes and their uses for culverts

When sizing culvert pipe, determine whether the culvert will need to provide fish passage and whether it can handle the peak stream flow without failing. The style of pipe can help minimize the amount of fill material needed and is most often dictated by site limitations and/or cost. Always provide adequate cover above culverts and other drainage structures.

ROUND CULVERTS are used for small streams, and are mostly made of corrugated metal pipes (CMPs) or corrugated polyethylene pipes (CPPs).

Advantages of CMPs:

- more crush-resistant
- fire-resistant
- more easily backfilled with a variety of backfill materials
- available in different lengths and shapes
- easily transported with one inside the other

Disadvantages of CMPs:

- heavy — larger sizes require mechanical placement
- difficult to cut without a cutting torch or power saw

Advantages of CPPs:

- lightweight — easier to transport and install
- can be cut and joined with a handsaw or chainsaw
- flexibility favors its use as downspouts (photo, bottom right)

Disadvantages of CPPs:

- susceptible to melting in a forest fire
- prone to failure if not properly backfilled and compacted
- prone to puncture if coarse material is used for backfill

ARCH (SQUASH) CULVERTS are used for stream crossings with low road clearance.

Advantages and disadvantages:

- offer fish-passage advantages due to larger bottoms
- require less road fill
- are more costly than round culverts

BOTTOMLESS ARCH CULVERTS (pictured on page 201) are three-sided structures that have sides and a top and use the natural channel for the bottom.

Advantages and disadvantages:

- are the most expensive culverts to install
- require a concrete or rock foundation for support
- leave the stream bottom undisturbed

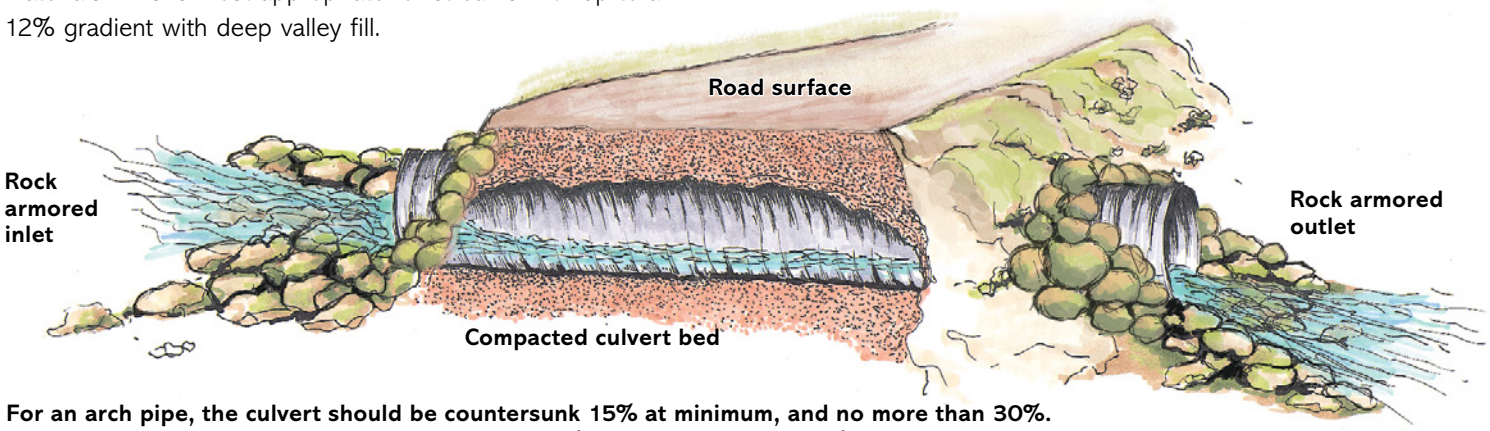
A round galvanized corrugated metal pipe sunk into the streambed to allow for fish passage.

Arch culvert on a low-clearance road, sunk into the streambed to allow for fish passage.

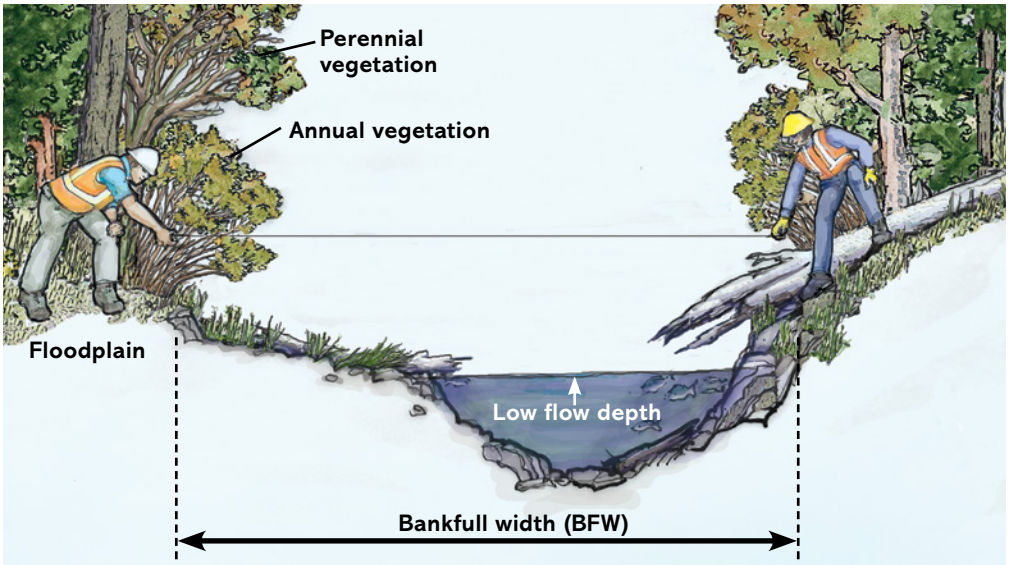
The flexibility of a plastic pipe makes it a popular alternative to a metal culvert.

Stream culvert installation details

To provide for fish passage on Type F and Type SSBT streams, one option is to sink culverts into the streambed and embed them with streambed materials. This is most appropriate for streams with up to a 12% gradient with deep valley fill.

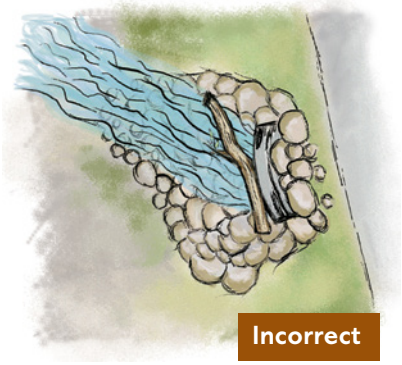


For an arch pipe, the culvert should be countersunk 15% at minimum, and no more than 30%. A round culvert should be countersunk at least 30% and no more than 50%. This partial burial of the culvert into the streambed reduces water velocity in the culvert and allows gravel to deposit in the bottom. For no-slope culverts, the effective width of the culvert should be equal to or exceed the active channel width of the stream. For all other culverts, the effective width must be at least 1.2 times the active channel width of the stream, plus 2 feet.

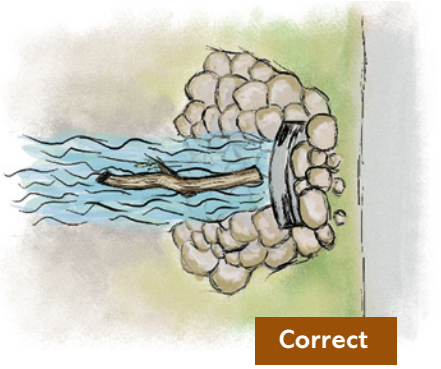


Take several evenly spaced BFW measurements and use the average for your overall BFW measurement.

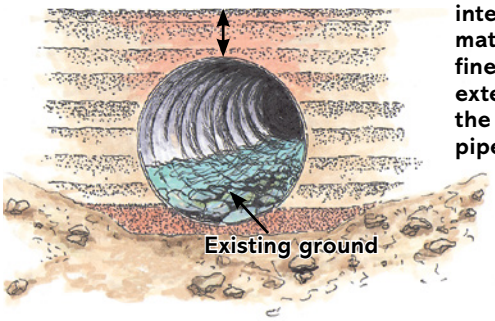
Culvert alignment



When a culvert is incorrectly aligned with a stream, floating debris accumulates and eventually causes inlet plugging (overhead views).



Road surface 2 feet or greater

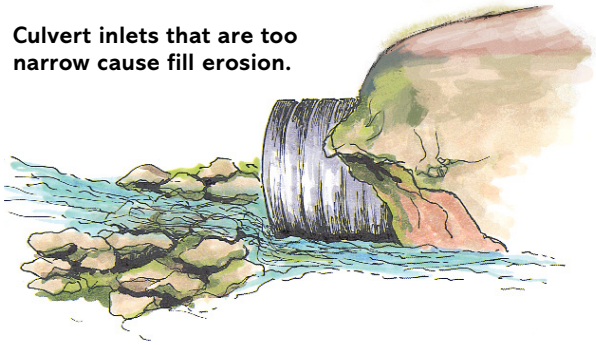


Tamp backfill material at regular intervals. Base and sidewall fill material should be compacted from finer soil particles. Fill height should extend at least 18 to 24 inches above the top of the culvert to protect the pipe from damage by traffic.

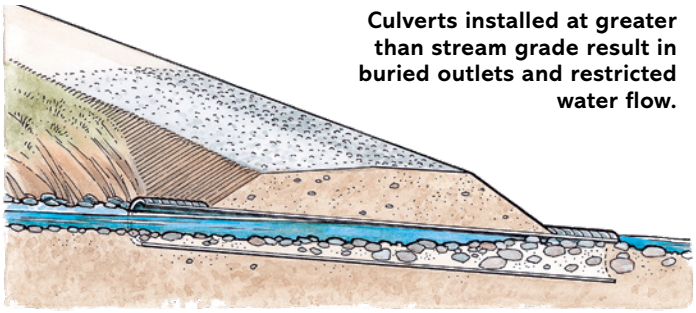
Culvert bed should be free of large rock.

COMMON CULVERT INSTALLATION PROBLEMS

Culvert alignment is critical for proper culvert function. It must fit the natural stream channel. Culverts set at an angle to the channel can cause bank erosion, and skewed culverts can develop debris problems.



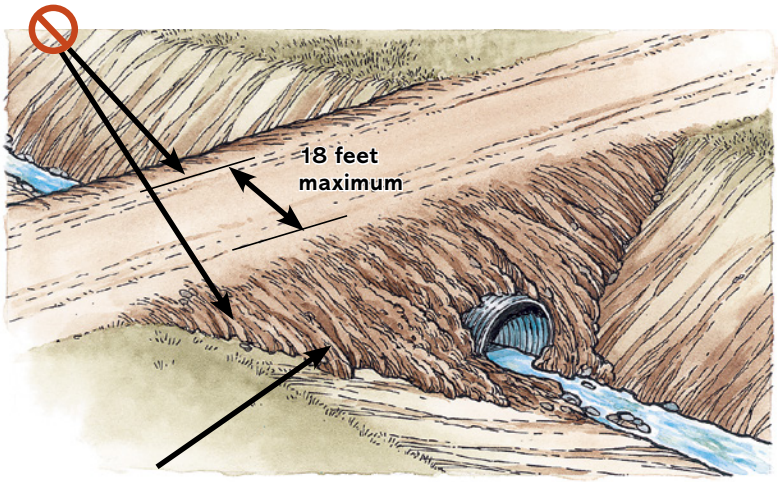
Culvert inlets that are too narrow cause fill erosion.



Culverts installed at greater than stream grade result in buried outlets and restricted water flow.

Culvert outlets that are too narrow and set too high cause water to undercut the road fill and streambed.

Never use a stream crossing to dispose of excess material. The wider road surface increases risk of this material entering the stream.



Set fill slopes at a maximum angle ratio of 1.5:1, and do not use unstable soils such as clays at this angle.

Determining the peak flow

When planning to install or replace a stream crossing, there are various factors to consider. Discuss how to determine a 100-year peak flow with your ODF stewardship forester.

ARE THERE FISH IN THE STREAM?

If yes, it's best to get help from a professional, because designing and installing a stream crossing can get complicated. Crossings must allow for fish passage, which involves multiple considerations. For example, the slope of the stream may require a different crossing design that makes the installation more costly. Remember that if the fill depth for your planned stream crossing is more than 15 feet, it requires a written plan.

HOW MUCH STREAM FLOW MUST THE CROSSING BE ABLE TO HANDLE?

Forest practice rules require that a culvert or bridge crossing be sized to handle at least a 100-year peak flow (sometimes referred to as the 100-year storm or flood). Be sure the structure you're installing can handle a very large storm and its runoff. If the structure fails, damage to the stream and fish habitat below the failure can cause significant environmental harm, and road damage and washout may require inconvenient closure and costly replacement.

The 100-year peak flow refers to the local storm flow that has a 1% chance of occurring in any given year. When averaged across many years, a flow of this size occurs only about once a century.

Determining what size culvert is needed

Table 7-2 lists the flow capacities for common sizes of round culverts. Use this table to find your flow capacity and determine your culvert diameter. If your flow capacity is close to the top of the range, consider sizing up.

Example: The table shows that a 54-inch circular culvert has a capacity up to 87 cfs. With good conditions it would likely handle a flow of 83 cfs, but a larger pipe would provide an extra margin of safety.

Table 7-2 Flow capacity for circular culverts

Diameter (inches)	Capacity (cfs)
18	Less than 5
24	5-11
30	12-20
36	21-31
42	32-46
48	47-64
54	65-87
60	88-113
72	145-178

Removal-fill permits

Some projects involve the removal or filling of areas in or near a water body with large amounts of soil or rock. These activities fall outside the scope of Oregon's Forest Practices Act (OFPA). In such cases where the amount of soil or rock involved is much greater than what is normally moved during forest road and stream-crossing construction, the operation requires a removal-fill permit from the Oregon Department of State Lands (DSL).

More specifically, a removal-fill permit is typically needed for projects involving 50 cubic yards or more of alteration of streambeds, streambanks or wetlands. Moving such large quantities could be part of a major reservoir or irrigation project, or a unique construction situation (see photo below). Beyond forestland, projects located in key salmon habitat waterways or state scenic waterways require a DSL removal-fill permit for any level of alteration.

In reviewing a removal-fill permit application, DSL determines whether the project is consistent with the protection, conservation and best uses of the state's water resources. DSL also assesses whether the project would unreasonably interfere with navigation, fishing and public recreation. The following steps are part of this process:

- The landowner applies for a removal-fill permit and pays the related fee.
- Application processing and review can extend up to 120 days.
- If the application is acceptable, DSL will issue approval of an individual permit.

Projects that move a lot of material in or near a stream channel or wetland, such as this stream-crossing upgrade, may require a removal-fill permit from DSL.

Specific types of crossings

PERMANENT CHANNEL-SPANNING STRUCTURES

These structures include long- and short-span bridges and open-bottom culverts, and should be designed and constructed as follows:

- Allow at least 3 feet of clearance between the bottom of the bridge structure and the water surface at the 100-year peak flow, unless engineering justification shows a lower clearance will allow the free passage of anticipated sediment and large woody debris.
- Span the bankfull width.
- Place the bridge structure to minimize damage to the streambed.
- Tie or firmly anchor one end of each new or reconstructed permanent-log or wood bridge, if any part of the bridge structure is within 10 vertical feet of the 100-year flood level. Install only clean, sorted gravel with a geotextile lining or equivalent barrier, and install curbs of sufficient size to prevent surface material from falling into the streambed.
- Place wood removed from the upstream end of bridges at the downstream end of bridges to minimize obstruction of fish passage. Avoid significantly disturbing sediment in connection with maintenance activities.
- Ensure abutments, piers, piling, sills and approach fills do not constrict water flow to cause any appreciable increase (more than 0.2 feet) in backwater elevation (calculated at the 100-year flood level) or channel-wide scour. Align these structures to cause the least effect on the hydraulics of the watercourse.
- Excavate and place the structure's foundation and superstructure outside the ordinary bankfull width, unless the construction site is separated from the stream by an approved dike, cofferdam or similar structure.
- Cure wood or other materials treated with preservatives, as well as structures containing concrete, prior to contact with water to minimize leaching into the water or stream bed. The use of creosote or pentachlorophenol is not allowed.
- Design permanent channel-spanning structures for Type F and Type SSBT streams using stream simulation, which mimics the natural stream channel, to:
  - > avoid constricting clearly defined channels
  - > establish a low-flow channel that allows for fish movement during low-flow periods

PERMANENT WATER-CROSSING CULVERTS

Permanent water-crossing culverts include associated embankments and fills. Follow these specifications when building permanent culverts:

- Do not scour the streambed or erode the banks in the vicinity of the project.
- Avoid the potential of stream diversion.
- Use sufficient erosion protection to withstand the 100-year peak flow. Erosion protection may include armored overflows or the use of clean, coarse fill material.
- Place wood removed from the upstream end of culverts at the downstream end of culverts to minimize obstruction of fish passage to the extent practical. Avoid significantly disturbing sediment in connection with maintenance activities.
- Limit disturbance of the bed and banks to what is necessary to place the culvert and any required channel modification. Revegetate or stabilize the affected bed and bank areas outside the culvert by filling with native woody plant species or other erosion-control techniques. Maintain native woody species for one growing season.
- Do not use culverts that are less than 18 inches in diameter.

PERMANENT WATER-CROSSING CULVERTS IN FISH STREAMS

In Type F and Type SSBT fish streams, use a stream simulation when designing and constructing culverts. Follow these specifications:

- Use minimum culvert diameters for no-slope culverts and those up to 1% gradient, which is at least equivalent to the active channel width. For other culvert installations, the minimum culvert diameter or span must be at least 1.2 times the active channel width, plus 2 feet.
- Mimic the natural flow of the stream with regards to alignment and slope. The slope of the reconstructed streambed within the culvert should approximate the average slope of the adjacent stream from approximately 10 channel widths upstream and downstream of the site where it is being placed, or in a stream reach that represents natural conditions outside the zone of the road-crossing influence.
- Bury the bottom of any culvert into the streambed, not less than 30% nor more than 50% of the culvert height for round culverts, and not less than 15% nor more than 30% of the culvert height for pipe arch culverts. For bottomless culverts, design the footings or foundation for the deepest anticipated scour depth.
- Use a channel-spanning structure when a new crossing would require a culvert longer than 150 feet, unless the site-specific design constraints preclude it.
- Use culvert bed materials with a similar composition to natural streambed materials in the channels adjacent to the road crossing in the reference reach. Follow these guidelines:
  - > Manually place culvert bed materials during bed construction on new water crossings in Type F and Type SSBT streams. Allowing the natural accumulation of current bed materials for reconstruction of water crossings is acceptable, but not a preferred method and requires monitoring.
  - > Submit required information if the culvert does not meet the natural accumulation threshold after the second winter season.
- Ensure that the maximum velocity in the culvert does not exceed the velocity on the narrowest channel cross-section.

FORDS

A ford is a stream crossing where the vehicle travels on the streambed or other installed structure and, when water is present in the stream channel, the vehicle's wheels touch the water.

Design and construct these structures to meet all the following criteria:

- Entry and exit points of a new ford should not be within 100 feet upstream or downstream of another ford on the same property ownership.
- Use fords only during periods of no or low stream flow (whether dry or frozen) to minimize sediment delivery to the stream.
- Install fords in a dry streambed only, or when a site is dewatered. The written plan must describe sediment control and flow-routing plans, and the project must meet the criteria outlined in the written plan.
- Do not dam the floodplain where substantial overbank flow occurs with approaches to the ford.
- Cross perpendicular to the channel to minimize the disturbance area and reduce post-installation maintenance.
- Minimize flow acceleration through the ford.
- For Type F and Type SSBT fish streams, any ford structure should:
  - > be no wider than 16 feet
  - > ensure scour has not created a barrier to fish passage
  - > ensure free and unimpeded fish passage at all flows when fish are expected to move through the ford

TEMPORARY WATER CROSSINGS

Design and construct these structures to conform with the following:

- Design temporary water crossings in Type N and Type D streams to pass, at minimum, the flows expected during crossing use, with a minimum culvert diameter of 18 inches.
- Use temporary water crossings in Type F and Type SSBT streams only during the in-water work period defined by ODFW.
- Identify temporary water crossings on the forest practices notification and written plan, along with a vacating date for temporary crossings.
- Use only temporary water crossings on Type N and Type D non-fish streams:
  - > in western Oregon if installed after June 1 and removed no later than September 30 of the same year
  - > in eastern Oregon if installed after July 1 and removed no later than October 15 of the same year
- Install temporary water crossings in the dry streambed or in isolation from stream flow by using a bypass flume or culvert, or by pumping the stream flow around the work area. An ODF stewardship forester may grant an exception if siltation or turbidity is reduced by placing the culvert in the flowing stream as an alternative to dewatering.
- Limit the bypass reach to the minimum distance necessary to complete the project.
- Vacate temporary water crossings to the specifications outlined in the OFPA.
- Limit the disturbance of the bed and banks when placing the temporary water crossing and any required channel modification.

OTHER DESIGN STRATEGIES

To propose alternatives to the water crossings allowed in these rules, submit design strategies to the ODF stewardship forester for approval.

Construction of water crossings

When constructing or reconstructing water crossings:

- Comply with all relevant forest road construction and maintenance rules. Nothing in this section affects existing ODFW requirements.
- Control runoff, erosion and sediment through the following actions:
  - > Complete a written plan prior to beginning work. This plan must include, but is not limited to:
    - a site plan with a description of the methods of erosion or sediment control
    - methods for confining, removing and disposing of excess construction materials
    - measures to disconnect road surface and ditch water from waters of the state
  - > Treat areas of bare soil that could deliver sediment to waters of the state. Treatments must include, but are not limited to:
    - establishing effective drainage prior to project construction, before September 30 in western Oregon and October 15 in eastern Oregon; effective drainage may be established at other times when ODF and the applicant can agree to specific dates of installation and removal, and when the extended dates result in equivalent levels of resource protection
    - mulching and/or seeding bare soil areas to reduce surface erosion, before the start of the rainy season, and no later than September 30 in western Oregon and October 15 in eastern Oregon
    - applying native seed and/or invasive species-free mulch to sites with the potential for sediment delivery upon completion of construction.
- Control pollution by doing the following:
  - > During construction, maintain a plan on site for spill prevention and response.
  - > Don't allow uncured concrete or concrete byproducts to enter waters of the state during construction.
  - > Take measures to ensure that all materials and equipment used for construction, monitoring and fish salvage are free of aquatic invasive species.
  - > Don't use wood treated with creosote or pentachlorophenol for parts of the structure over the channel, including pilings, beams, structural supports and decking.
  - > Don't allow toxic chemicals or any other harmful materials to enter waters of the state.
- Develop a written plan for in-water work, worksite isolation and dewatering for water crossings in all waters of the state. The plan should include, but is not limited to, information about fish salvage, worksite isolation and dewatering. It should address in detail all in-channel construction activities and how the activities will adhere to all relevant OFPA forest road construction requirements. For all streams, the written plan should describe:
  - > activities during the in-water work period defined by ODFW

> activities outside the in-water work period when ODF, in consultation with ODFW, and the applicant can agree to specific dates of installation and removal, and the extended dates result in equivalent levels of resource protection

> how water crossings will be constructed in compliance with ODFW's fish-passage and in-water work-period requirements

- For all water crossings in Type F and Type SSBT streams:

Worksite isolation

> Isolate any work area within the width of the bankfull channel from water in the active channel when fish are reasonably certain to be present.

> Maintain an exclusion and recovery plan to ensure safe capture and relocation of fish trapped in the work zone when stream flow has been diverted.

> Capture and relocate fish to avoid direct mortality to the maximum extent practicable prior to construction site dewatering.

> Salvage fish to the maximum extent practicable at any in-water construction site where dewatering and resulting isolation of fish may occur.

> Remove all isolation features after construction is complete, and submit a written salvage report to ODF.

Dewatering

> Do not dewater areas known to be occupied by lamprey, unless the road construction operator submits a lamprey salvage plan to the ODF stewardship forester in consultation with ODFW.

> Dewater isolated areas in a manner that prevents sediment-laden water from reentering the stream.

> Limit dewatering to the shortest linear extent of the stream practicable.

> Conduct dewatering over a sufficient period to allow species to naturally migrate out of the work area.

Monitoring

Develop and implement a monitoring program for periodic inspections of all Type F and Type SSBT stream crossings that:

- confirms the crossing is functional through visual inspection
- monitors the crossing at least once every five years

Drainage

Runoff from forest roads can carry excess sediment into waters of the state. Forest roads can also alter the distribution, storage and movement of overland and subsurface flows. All active, inactive and vacated forest roads and landings should be hydrologically disconnected from waters of the state to minimize sediment entry and reduce the potential for hydrological changes that alter the magnitude and frequency of runoff. Locate drainage structures using the priorities listed below. Each item must be addressed before moving to the next one. When they conflict, prioritize the one listed higher on the list.

- Don't install cross-drains and ditch relief culverts that may cause stream diversion.
- Don't concentrate road drainage water into headwalls, slide areas, HLHLs or steep, erodible fill slopes.
- Don't divert water from stream channels into roadside ditches.
- Install drainage structures at approaches to stream crossings to divert road runoff from entering the stream. If a single drainage structure can't be placed in a location where it effectively limits sediment from entering the stream, use additional drainage structures, road surfacing, controlling haul or other site-specific measures to limit sediment entry immediately prior to the crossing. Operators may also use best management practices to manage sediment at the outflow of the drainage structure nearest to the crossing.
- Provide drainage when roads cross or expose springs, seeps or wet areas.
- Provide a drainage system – using grade reversals, surface sloping, ditches, culverts, water bars or any combination – to minimize gully erosion development at the road prism or slopes below the road. For new road construction, use outsloping whenever possible.

ODF's Forest Practices Technical Guidance helps operators comply with road drainage rules and prevent potential negative impacts to fish, wildlife, habitat resources and waters of the state.

Disposing of road waste materials

During and after road construction, always dispose of end-haul materials in stable areas – don't put debris, sidecast, waste and other excess materials where they could enter waters of the state. Prevent overloading areas that may become unstable. Never place end-haul material, clearing and root debris, or other soil or rock where it could cause slope instability or be eroded by a flood.

Submit a written plan to ODF for any waste disposal areas that have a risk of slope failure. The weight of waste fill can trigger landslides, even when placed on a gentle slope. Before placing waste on a mid-slope bench or a slope steeper than 50%, consult a geotechnical specialist. Be cautious about using mid-slope areas that already contain waste, since additional waste can lead to a landslide.

Stabilization

Establish effective drainage and stabilize exposed material by seeding, mulching, riprapping, leaving light slash, using pullback, or other effective means. Do this as soon as practicable after completing road-building operations or prior to the start of the rainy season, in any areas with the potential for sediment delivery to waters of the state, as well as for unsurfaced road grades, cut slopes, fill slopes, ditch lines, waste disposal sites and rock pits.

During rainy periods, construct roads to prevent sediment from entering waters of the state. Do not incorporate slash, logs or other large quantities of organic material into road fills.

Excavation, fills and erosion

Minimize excavating side slopes near the channel. Use the minimum possible curve radius – about 50 feet for log trucks. Note: This may make access difficult for lowboy heavy-equipment trailer traffic, which requires more gradual curves. Future logging equipment may have to drive to the site instead of being delivered by a lowboy trailer.

Fills more than 15 feet deep present risks if they fail and fill material is carried downstream, so ODF requires written plans for deeper fills. The design must minimize surface erosion, embankment failure and downstream movement of fill material.

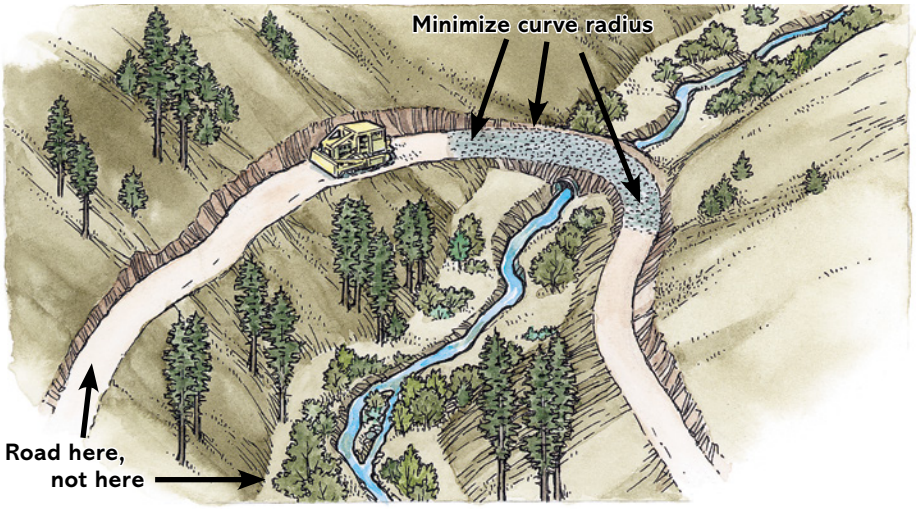
Stream crossing fills may erode and enter the stream. Prevent erosion by seeding and mulching fill slopes with appropriate species, if germination will be successful prior to the wet season. If not, use a non-erodible cover material such as clean gravel or riprap rock.

Avoid erosion of the stream channel below the culvert. Install culverts that are equal to or greater than the width of the stream to prevent water from increasing in speed as it moves through the culvert, and to protect the channel below the culvert from erosion.

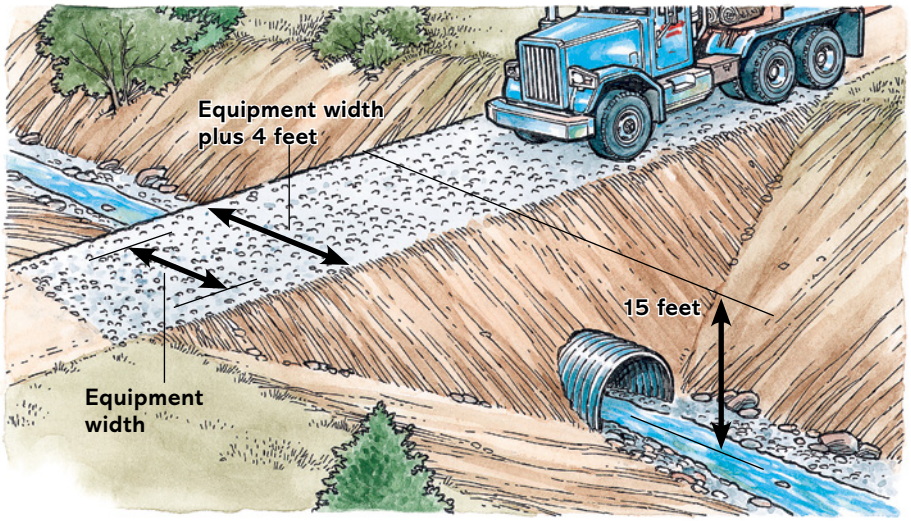
EQUIPMENT RESTRICTIONS

ODF must approve machine activity in Type F, Type SSBT and Type D streams, and in lakes and significant wetlands. Keep streambed machine activity to an absolute minimum. Acceptable machine activity includes crossing the stream as necessary to construct the crossing. This activity is restricted to low flow levels. Clear water and stable flows are indicators of low flow levels. Do not divert water from channels except when necessary to construct stream crossings.

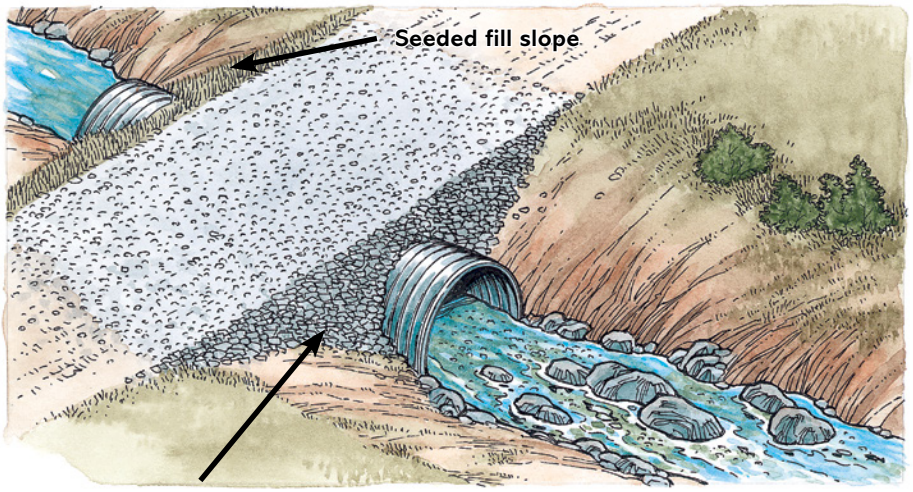
Don't exceed 18 feet of fill width at the height of the pile when crossing streams at right angles, and where it is not necessary to place a curve in the road.



Locate the road on side slopes of up to 50% grade when possible, rather than near the channel.



Measure the fill depth from the road-running surface to the stream bottom at the downstream side.



Use gravel cover on fill slopes if seeding may not be effective.

Fish considerations

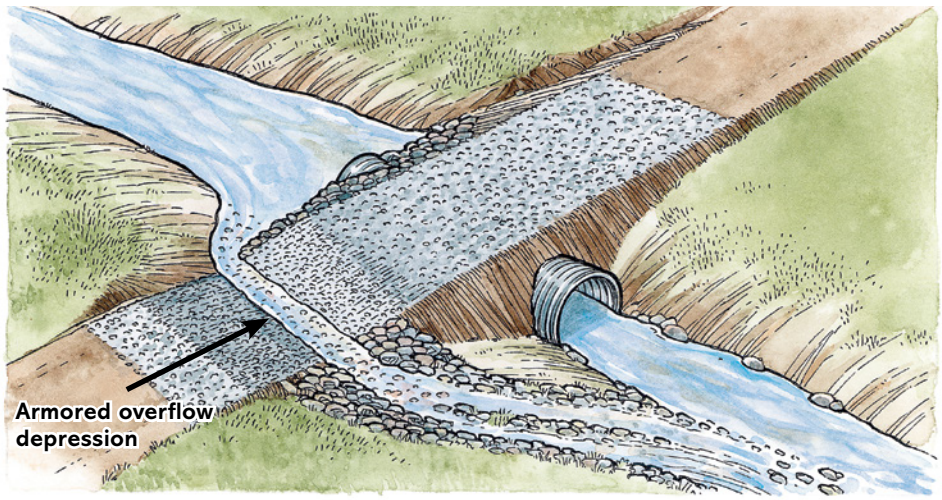
FLOW REQUIREMENTS FOR STREAM CROSSINGS

Stream crossings must be able to handle heavy storm flows and allow for fish passage. Design and construct culverts, bridges and fords to:

- pass the 100-year peak stream flow without washing out
- preclude ponding of water higher than the top of the culvert
- allow migration for adult and juvenile fish upstream and downstream during conditions when fish movement in that stream normally occurs

These requirements apply to all new road construction and reconstruction, as well as reconstruction of any partial or complete stream-crossing washout and replacement of any crossing structure.

Planning for a stream crossing must include considerations for potential flooding. When overlooked, the potential for water-quality damage is enormous. The costs of this plugged culvert road washout repair will far exceed the costs of a properly planned installation.



This vented ford is a cross between a ford and a culvert crossing. Water passes through the culvert during normal flows, but the structure can accommodate peak stream flows across a ford section during large storms. Any permanent culvert in a stream needs to be sized for the 100-year peak flow.

CULVERTS AND FISH

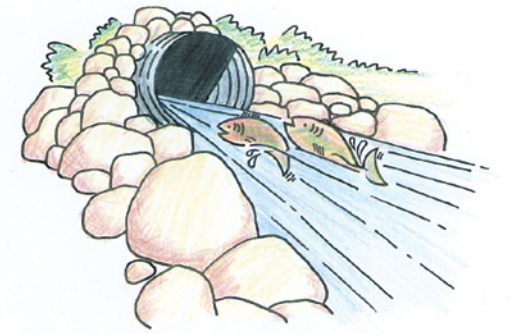
Fish move both upstream and downstream during different seasons to spawn, search for favorable water temperatures and find refuge or food during aquatic insect hatches. On Type F and Type SSBT streams, new stream crossings – or any that are reconstructed or replaced – must provide for upstream and downstream passage of both adult and juvenile fish.

If a culvert is used on a Type F or Type SSBT stream, it may be difficult to provide adequate fish passage, especially upstream against fast-flowing waters. Carefully consider how the local stream features interact with culvert pipe design and placement.

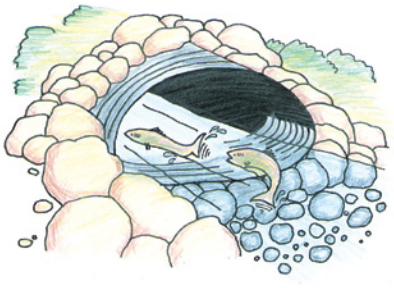
MAKE PASSAGE EASIER FOR FISH

- Don't force fish to jump to enter a culvert.
- Keep culvert openings free of debris.
- Minimize culvert length.
- Locate culverts on a straight part of the stream.
- Set culverts below stream grade so streambed gravels can naturally accumulate. (Note: A larger pipe size may be needed to accommodate a 100-year flood.)

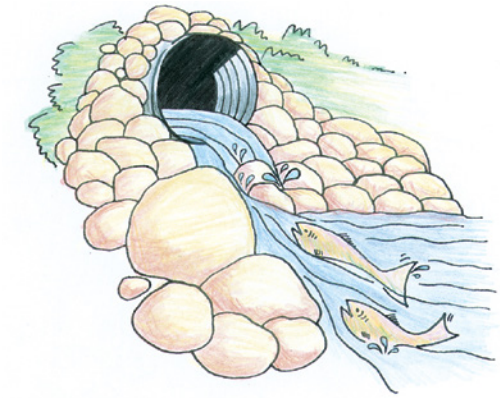
Ensure fish movement is not impeded.



Fish may not be able to swim fast enough to overcome culvert water velocity that develops in culverts narrower than the width of the stream. Rule of thumb: Water moving through a bare culvert that is turbulent (uneven water surface or whitewater) is probably a fish-passage barrier.



Water may be too shallow for fish to swim. Bare pipes frequently result in shallow water, leaving fish only partially submerged and unable to get maximum thrust from tail and body movements.



There's no pool below the inlet for fish to rest in or jump from.

Hanging culverts can be too high to jump.

Bottomless arches leave the streambed intact, so fish can pass through easily. Natural streambed roughness creates pockets of low water velocity where fish can move more freely. Arch footings should be secured to bedrock to prevent the structure from failing.

BEST OPTIONS FOR FISH PASSAGE

Each situation is unique, but this is a general ranking of methods:

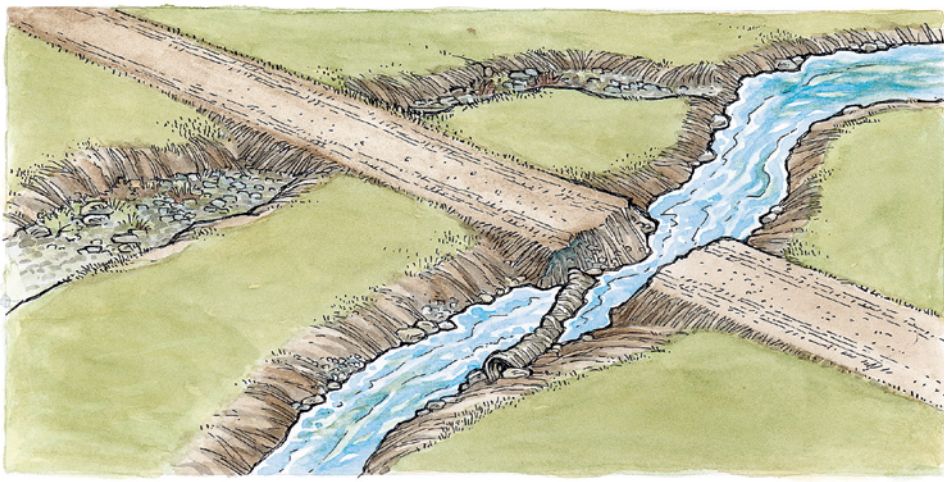
1. re-routed road (avoid/remove stream crossing)
2. channel-spanning structure (long- and short-span bridges with bottomless arches)
3. fords, which are only suitable for low-traffic roads
4. streambed simulation (sunken and embedded culverts)
5. embedded culvert placed at a zero grade (culvert at <1% gradient and sunk for backwatering)

All road projects involving construction or reconstruction work should address local needs for water flow and fish passage. Such projects include:

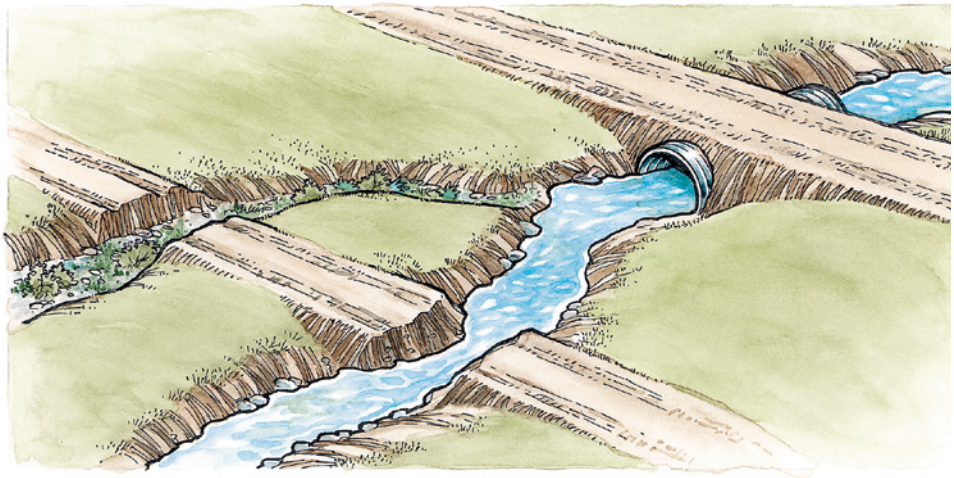
- minor road relocation
- replacement of stream-crossing structures
- any road widening
- clearing of a road closed by trees growing on its surface
- opening of any old road

CROSSING STRUCTURES ON SIDE CHANNELS

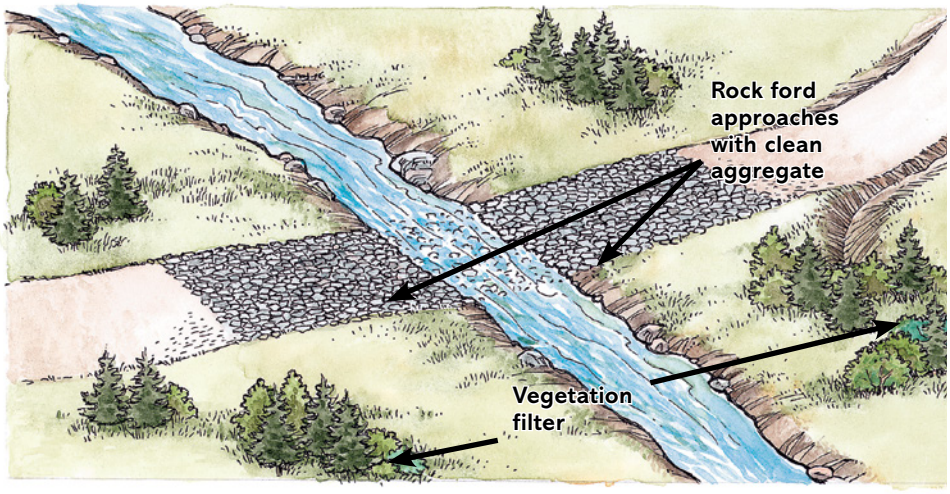
Young fish find protection in wetlands and side channels during high stream flows. When added to old roads, culverts or bridges can reconnect these fish habitats. In some cases, relocating the road can be a more effective way to reduce the number of stream crossings needed to maintain road access (see illustration, next page).



Early road construction techniques often filled side channels and contributed to the failure of main channel culverts during high-water events.



In this example, a minor relocation of the road prism results in only one culvert being reinstalled for road access. This reduces maintenance and allows the side channel below the new crossing to be restored to a more natural condition.



Fords with rocked approaches can be good alternatives to culverts on lightly used roads. Well-designed and located fords can greatly reduce the amount of material at risk of erosion and sediment delivery to streams during high water.

LOCATING A FORD

A ford is a stream crossing option for low-service-level roads that are private, gated and infrequently used. Access control is important to avoid damage to the ford approach when it is vulnerable to damage and erosion. Fords seldom have year-round access. A bedrock stream bottom is ideal for a ford location. Otherwise, the bottom should be armored with suitable rock.

The size and shape of existing in-stream rock can guide the minimum size of armor rock required to resist downstream movement. It should be bigger than the common rock size in the stream bottom. Angular rock is preferred because it resists movement by interlocking. Do not restrict fish passage.

Gently sloping, stable streambank approaches are preferred. Approaches should be covered in rocks to minimize erosion when driving in and out of the ford. Where practical, approaches should be at right angles to the stream. Approaches should dip into and out of the stream, creating a concave shape that ensures the stream cannot be diverted out of its natural channel and down the road.

Unimproved fords, except those on solid rock, are generally inadequate for truck traffic. Traffic breaks down stream gravels and mud is brought into the channel from vehicle tires.

OFPA requirements for locating a ford depend on how much use it will receive.

Bridges and bottomless arches

These structures are the stream crossing of choice for fish passage. They require carefully constructed abutments to avoid erosion and stream damage during high stream flows. Avoid mid-span piers if possible. They are costly, can cause channel scour and are difficult to stabilize. Use riprap rock to protect abutment fills from erosion.

Bridges are best for large streams and those plagued with floatable debris problems. Bridges and bottomless arch culverts have the least impact on fish when installed properly.

Keep road drainage under control. Even with grass cover, runoff and sediment have flowed around this abutment and drained directly into the stream.

Tips for new permanent bridges

- Size bridges to accommodate stream channel width and flood risk.
- Construct bridges and bridge approaches to minimize the amount of soil or other material that reaches the stream.
- Retain existing vegetation and organic material around stream crossings to control erosion. Cover exposed soil with slash or other protective material.
- Use abutments and wingwalls (retaining walls) to prevent material from spilling into the stream.

Consider simple bridges for small Type F and Type SSBT streams. They can be similar or lower in cost compared to large, complex culvert installations.

Advantages of temporary portable bridges

- They're useful for stream crossings on temporary, low-standard roads.
- They're useful when short-term access to forestland is cut off by a stream.
- Installation and removal are quicker, with minimal environmental impact.
- They can be re-used in different locations as needed.
- Streams can be restored to their original condition when temporary crossings are used.

A portable bridge provides access across streams less than 10 feet wide, with minimal disturbance to streambanks or bed. Place portable bridges in locations with firm soil banks, level grade and minimal vegetation.

Along with its portability, this temporary bridge is strong enough to handle logging equipment for all timber harvesting activities.

This 20-foot portable bridge was hauled on a flatbed truck and set into place in one day. The bridge cribbing that supports it is made from 10-foot-long timbers laid on the ground 4 feet from the stream bank.

A small tractor built the road approaches to this temporary bridge. Over a three-week period, the bridge carried approximately 25 truckloads of logs.

When logging was completed, this temporary bridge was removed.

Construction in wetlands

Avoid or minimize all road and landing construction near or within significant wetlands, stream-associated wetlands or wetlands greater than 0.25 acres. When impacts are unavoidable, minimize them and then mitigate for them in the following ways, listed in order of priority:

1. Select the least environmentally damaging landing location, road location and road length. Attempt to minimize road length when avoiding wetlands.
2. Build a temporary road or landing when construction cannot be avoided, and follow these steps:
   - > Minimize impacts by reducing the subgrade width, fill acreage and spoil areas.
   - > Remove temporary fills or road sections upon project completion.
3. Mitigate impacts of permanent road construction by:
   - > reducing or eliminating impacts over time by preserving or maintaining wetland areas
   - > replacing areas of the wetland affected by the road or landing by creating new wetlands or enhancing existing wetlands
4. Replace lost wetland functions and values by substituting or enhancing the road or landing construction site when more than 0.25 acres are filled or drained. The objective of substitution is successful wetland replacement on a two-for-one basis, of the same type and in the same general location. The objective of enhancing wetland function is to replace what was lost with an equivalent amount of function and value.

ODF's Forest Practices Technical Guidance publication can assist with rule compliance for road or landing construction in wetlands. It also explains how to prevent potential impacts to fish, wildlife, habitat resources and waters of the state.

TEMPORARY CROSSINGS

After trees are cut, limbed and bucked into logs, they are moved (yarded) by skidders, tractors or shovels on a skid trail to a landing, where they are loaded onto trucks. Both skid road construction and temporary stream crossings may be needed to yard logs cut in the riparian management area (RMA) or to yard logs to a landing across the stream. Skid roads fall under the harvesting rules (refer to the Harvesting chapter).

Temporary crossing activities have the potential to disturb RMA soils and vegetation, creating muddy runoff and sedimentation and impacting water quality. For this reason, minimize the number of temporary stream crossings.

Areas that must be protected when using temporary crossings:

- fish passage on Type F and Type SSBT streams
- channels and banks
- vegetation left in the RMA
- RMA soils that control runoff and keep sediment out of waters

Planning temporary crossings

A temporary crossing structure is needed when there is stream flow at the time of harvest, if stream flow will occur during harvest, or if streambanks are wet or fragile.

When improperly built, temporary stream crossings are a threat to streams, lakes, wetlands and fish passage. Fish may not be able to migrate upstream or downstream on Type F and Type SSBT streams. High water can erode fill materials and wash out crossing structures, creating sediment.

Do not use tractors, skidders, feller-bunchers and other logging equipment in any stream channel, except as required for temporary stream crossings. Additionally, do not straighten or shorten any stream channel.

A written plan is required when crossing Type F and Type SSBT streams, even if they are dry.

Plan crossings to affect as little of the channel, banks and riparian area as possible by:

- installing crossings only where necessary
- using existing, permanent roads as much as possible
- locating skid trails outside the RMA as much as possible
- building a maximum of one crossing per harvest
- not using crossings to straighten skid roads

Additional temporary crossings can be used when:

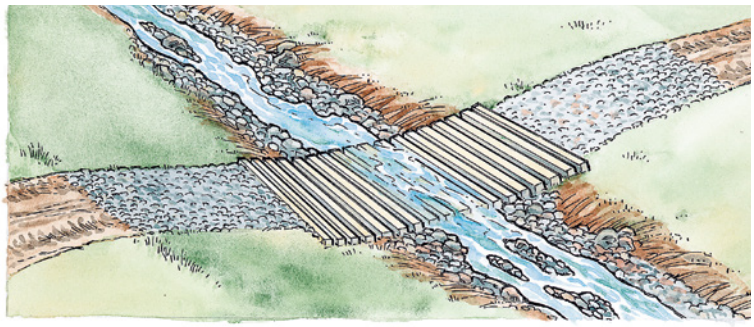
- the alternative involves crossing a landslide
- the alternative is a skid trail on a slope greater than 60% grade
- the alternative is to cross a property line, and the adjoining landowner is unwilling to have skid trails on their property
- the only alternative is a skid trail parallel to and within 100 feet of the stream
- the only alternative is a permanent crossing

Acceptable temporary crossing structures

The choice of temporary crossing structure depends on stream size, time of year, presence of fish and volume of timber moved over the crossing.

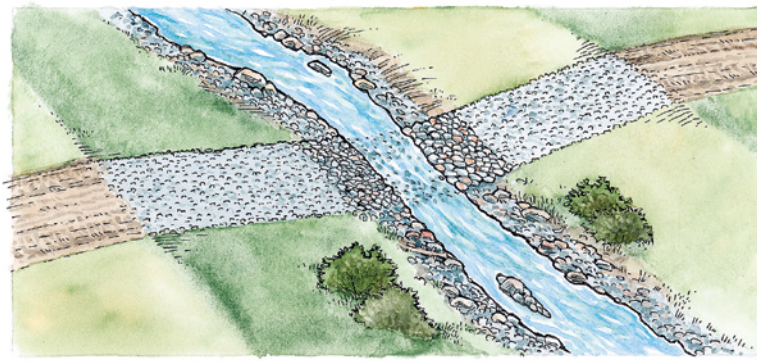
The illustrations on the next page show several temporary stream crossings. The improved mat ford and natural bottom ford are for log truck use only. Yarding across these two temporary crossings would result in sediment or wood debris entering the stream. The other three temporary crossings are for both yarding and truck use. Always remove temporary crossings once yarding is complete (see page 208).

Examples of temporary crossings



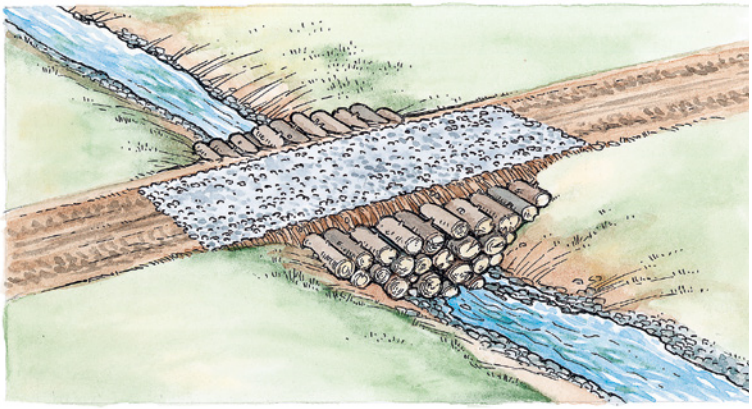
IMPROVED MAT FORD

This crossing may only be used by log trucks. It is constructed with concrete or wood planks fastened together.



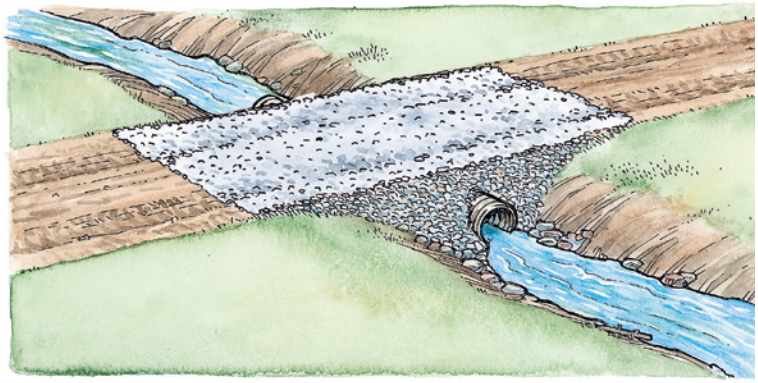
ROCK FORD

Where there is light road use, fords with rocked approaches might be an alternative to culverts. Well-designed and located rock fords need to reduce the amount of material at risk of erosion or delivery to streams during high flows.



LOG CROSSING

Log crossings may only be used for Type N streams with very low flows. Use rock fill over logs, keeping fill back from ends of logs.



CULVERT AND ROCK FILL

Temporary stream crossings with culvert and rock fill must accommodate stream flow during use. Fills over 15 feet require a written plan (see page 221).

BRIDGE

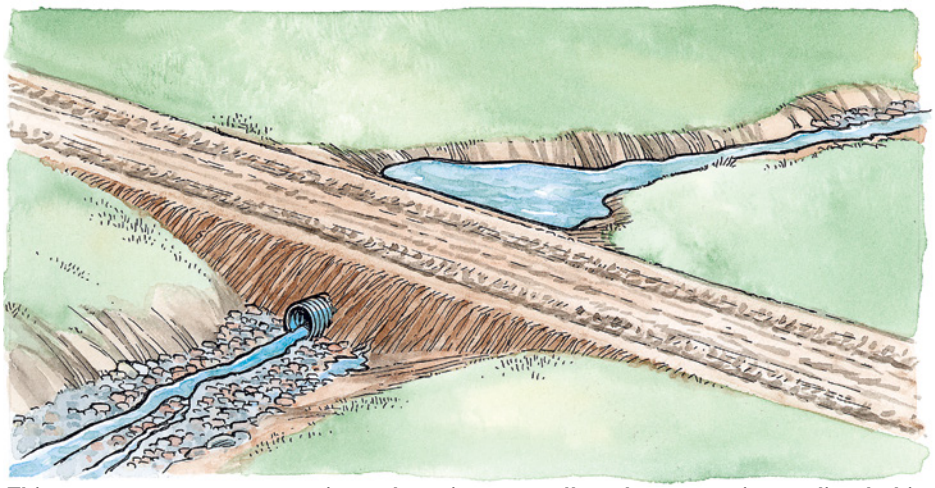
Temporary short bridges provide the greatest stream protection. Use a portion of a rail car or reinforced concrete. Constructed abutments may not be needed; wood timbers placed on the ground some distance back from the bank may suffice.

Location of temporary crossings

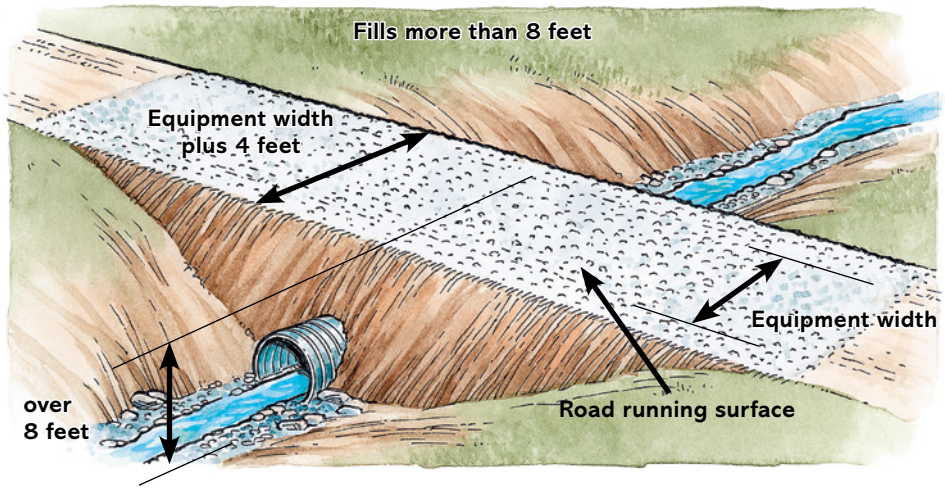
Temporary stream crossing structures such as log crossings, culverts or fords must be capable of passing stream flows likely to occur during use. Be sure the temporary stream crossing can pass the highest flow reasonably expected during the life of the structure, and can pass flows without ponding water behind the fill or saturating the fill soil.

Follow these location guidelines:

- Choose a single channel that is narrow and not deeply incised.
- Avoid multiple, braided or side channels.
- Avoid eroded areas or streambanks with exposed soils.
- Keep banks under 5 feet high; bridges are better where banks are higher than 5 feet.
- Look for rock, cobble or gravel, rather than clay, decomposed granite soils or sand.
- Avoid very wet or weak soils.
- Avoid slide areas, gullies or active erosion areas.
- Approach the crossing at a right angle and move away from the stream as quickly as possible.
- Minimize cuts, fills or other bank disturbance.
- Provide cross-drainage on nearby roads and skid trails to prevent runoff and sediment delivery to the stream.



This temporary stream-crossing culvert is too small — the stream is ponding behind the culvert and seeping through the fill. The culvert could fail, sending fill soil downstream.

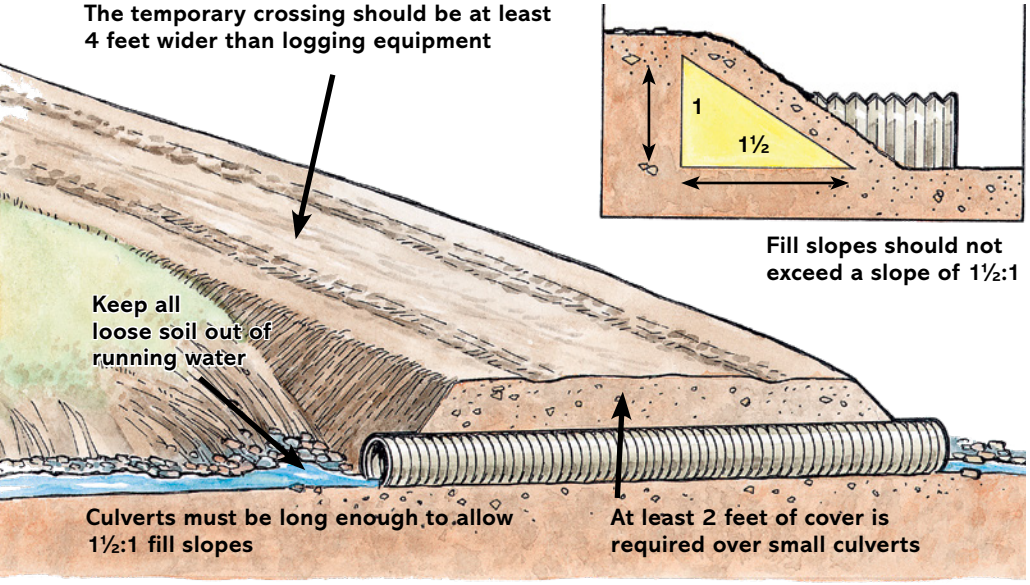


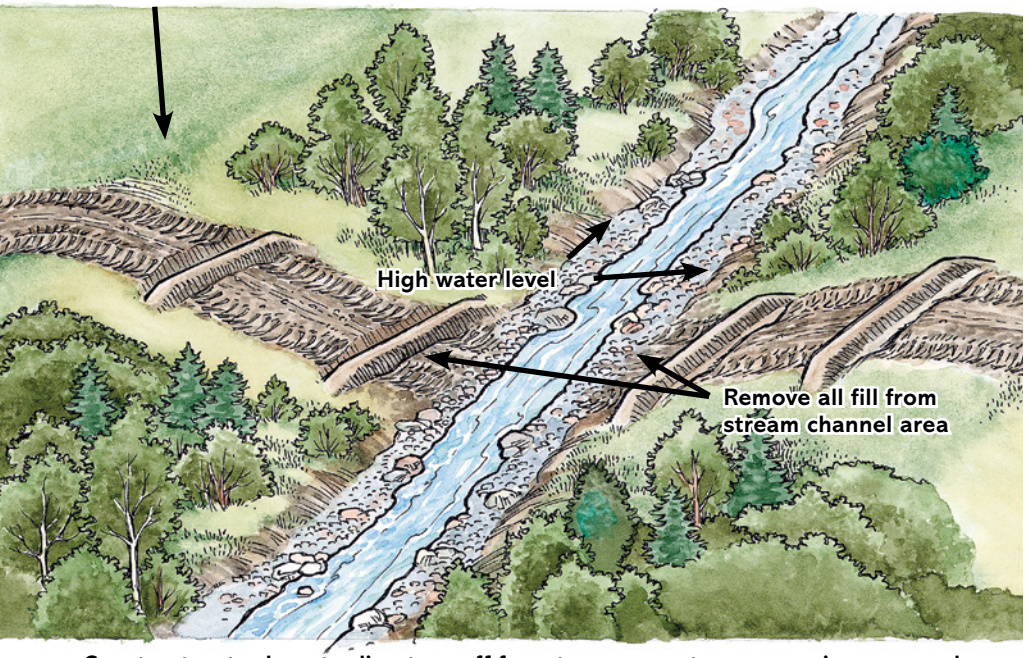
Fill depth is measured from the road running surface to the stream bottom at the downstream side. Fills more than 8 feet deep must be designed in accordance with road construction and stream crossing fill rules, except that temporary crossings are not required to withstand a 100-year flood.

Constructing temporary structures in live streams

When building temporary structures in live streams:

- Keep equipment out of the water.
- Minimize sediment entering water. Temporary water diversions are okay during low flows and if fish are not affected. Either pump stream water around the construction site or use a temporary trench.
- Use rock instead of soil as fill for a temporary crossing, as it is easier to remove after completion.
- Protect streambed and banks from damage.
- Make sure the temporary structures can withstand erosion.





Construct water bars to divert runoff from temporary stream-crossing approaches. Construct them as soon as crossing use has ended and before the rainy season.

Constructing temporary crossings in dry streams

When the channel is dry and will remain dry during the operation, no temporary crossing is required as long as disturbance is no greater than what would occur if structures were constructed.

Locate crossings where bed and banks are clean gravel, cobbles or bedrock. If wetlands or any other wet soils are present, use temporary structures.

A written plan is required when heavy equipment crosses a Type F, Type SSBT or Type D stream, even when dry.

Removing temporary crossing structures

Remove temporary stream-crossing structures after completion of the operation or prior to seasonal runoff, whichever comes first. Place fill material where it cannot enter the water. Any material that might make its way into the stream should be removed. Remember soil and slash left below the high-water level may be carried into the stream if not placed in a stable location.

Decommissioning a temporary crossing in a dry stream

To decommission a temporary crossing in a dry stream:

- Remove soil from the channel after the operation or before stream flows, whichever comes first. Place material where it will not enter water.
- Construct water bars, dips or other water diversions on stream-crossing approaches after the operation or prior to the rainy season.

MAINTAINING ROADS

Terms to know

ACTIVE ROADS are currently used and maintained for the purpose of removing commercial timber from the forest.

INACTIVE ROADS are used for forest management purposes, but not for removing commercial timber.

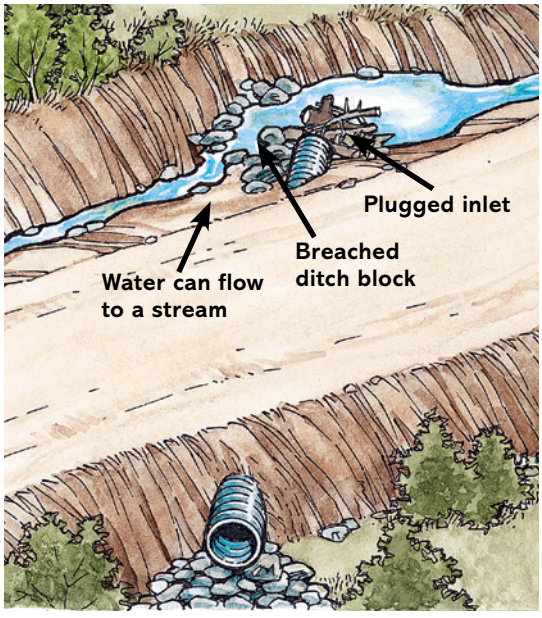
VACATED ROADS have been made impassable and are no longer used for forest management purposes or commercial timber harvesting activities.

ABANDONED ROADS were constructed prior to 1972 and do not meet the criteria of active, inactive or vacated roads. Skid trails are not included in this definition.

Maintenance of roads on forestlands is a key forest practice. Because dirt or rocked roads exist on most forest ownerships, maintenance work is a common need. Some older or heavily used roads can also benefit from improvements, including better drainage or surfacing.

Complete timely maintenance of active and inactive roads to protect water quality, and ensure the integrity of waters of the state to the maximum extent possible by:

- minimizing surface and subgrade erosion
- minimizing direct delivery of surface water to waters of the state
- minimizing sediment entry to waters of the state
- directing any groundwater that is captured by the road surface onto stable portions of the forest floor
- ensuring durable, properly functioning drainage features
- avoiding overcleaning ditch lines on existing roads with inboard ditches



This undersized ditch relief culvert resulted in a breached ditch block and sediment flowing directly into the stream. A culvert width of at least 18 inches is recommended.

Not a major sediment problem yet — but when roads become channels for drainage, major sediment pollution can result.

Watch for damaged culverts that need replacement. Repair work should be completed during dry weather.

Poor road surface drainage caused this fill-slope erosion.

Soil sloughing off a road cut.

Forest road operator responsibilities

Forest road operators are responsible for the following maintenance tasks:

- Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the rainy season to minimize the likelihood of impeding flow and the possibility of structure failure.
- Provide effective road surface drainage – such as water barring, surface crowning, outsloping or constructing sediment barriers – prior to the rainy season.
- Plan and apply road oil or other surface-stabilizing materials to prevent entry of these materials into waters of the state.
- Maintain and repair active and inactive roads to minimize damage to waters of the state. This may include maintenance and repair of all portions of the road prism during and after intense winter storms.
- Place material removed from ditches in a stable location.
- Install drainage structures on ditches that capture groundwater.
- Maintain fish passage through water-crossing structures by:
  - > maintaining conditions so passage of adult and juvenile fish is not impaired when fish movement normally occurs
  - > keeping structures cleared of woody debris and sediment deposits that may impair fish passage
  - > protecting water quality – such as placing additional cross-drainage structures on existing active roads within their ownership, prior to hauling – as directed by an ODF stewardship forester
  - > adhering to other fish-passage requirements administered by other state agencies that may be applicable to water-crossing structures

Cut-and-fill slopes

The following are recommendations for cut-and-fill slopes:

- In steep terrain, cut-slope ravel and slides are common if soils are thick or the rock is fractured.
- Sidecast fill on steep slopes can begin to fail years after initial construction. Tell-tale signs are arc-shaped cracks along the outside edge of the road. An excavator should be used for sidecast pullback, especially if debris could move into a creek.
- Debris collects in ditches, and dense vegetation may block water flow; however, light vegetation can stabilize ditches.
- Ditch inspection should be done during storm events when problems are most obvious. Watch for blockage, overflow problems and ditch downcutting.
- Don't delay cleanup. Move soil and debris to a location where they will not create additional erosion problems.
- Reduce erosion by seeding and mulching bare cut-and-fill slopes.
- Ditch-line erosion may indicate a need for more or larger culverts, or armoring with rock (see ditch gradients, page 212). Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid side-casting in locations that might become unstable, or where erosion will carry materials into a stream.

Road grading

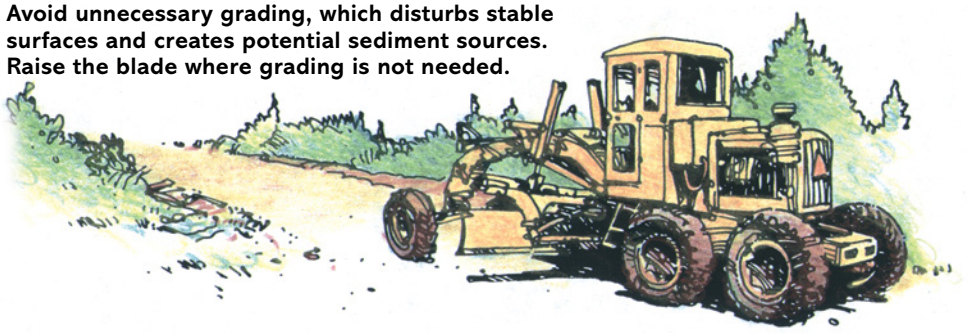
Recommendations when road grading:

- Maintain road surfaces – either crown, in-slope or outslope (see page 212).
- Maintain cross-drain structures on road surface.
- Correct road surface damage resulting from vehicle traffic and freeze-thaw cycles that reduce drainage effectiveness.
- Protect drainage on unimproved roads; this is helped further by road-use restrictions during wet weather.
- Maintain a stable running surface and adequate surface drainage.

Grading has many advantages. However, it should only be performed as necessary, keeping in mind the following precautions:

- Grade when roads are neither dusty nor muddy; moist roads are more easily shaped and compacted by grading machinery.
- Watch for steep sections or curves where added wear and rutting take place.
- Avoid cutting the toe of cut slopes when grading roads, pulling ditches or plowing snow.
- Plan and conduct the application of road oil or other stabilizing materials in a manner that prevents these materials from entering waters of the state.

Avoid unnecessary grading, which disturbs stable surfaces and creates potential sediment sources. Raise the blade where grading is not needed.



Roads receive heavy use during logging. Be aware of early signs of damage. Serious damage to road surfaces starts with excess water. Standing water is a sure sign of road-drainage problems. Ruts indicate that road strength is deteriorating.

Grader damage to inside ditch toe slopes exposes an easily erodible surface and is a source of sediment.

Slow, controlled grader operation is key to reducing culvert inlet and outlet damage. Reduce damage by keeping graders on the road running surface. Never side-cast gravel toward culvert inlets or outlets.

An operating drainage system

An operational and effective drainage system:

- moves water across or under the road before it causes erosion
- proactively identifies locations where ditches may be blocked by slides or gravel
- uses additional ditch relief culverts or changes the road surface (in-slope, cut slope or crown – see next page) to carry water around the problem
- treats unanticipated problems as quickly as possible
- filters muddy runoff so minimal sediment enters waters of the state
- is inspected before and during the rainy season to diminish the likelihood of clogging and the possibility of washouts

No matter their age, forest roads need effective drainage to remain functional and avoid erosion and sedimentation problems. Roadway surfaces are normally crowned or sloped to remove surface water. Other key features of effective drainage systems include road grade changes, adequate ditches and ditch relief culverts that control drainage and ensure water quality.

Most landowners in western Oregon prefer to use crowned roads with ditches and cross-drain culverts. Outsloping is most suitable for low-service roads with gentle grades (less than 7%) and those where frequent surface grading prevents rutting.

Even for temporary or inactive roads, drainage must be provided to give the same level of water-quality protection as required of active roads. When work is stopped on road improvements or new construction and there is potential for erosion, cross-drainage with culverts, water bars, dips or other means is required (see following pages for details).

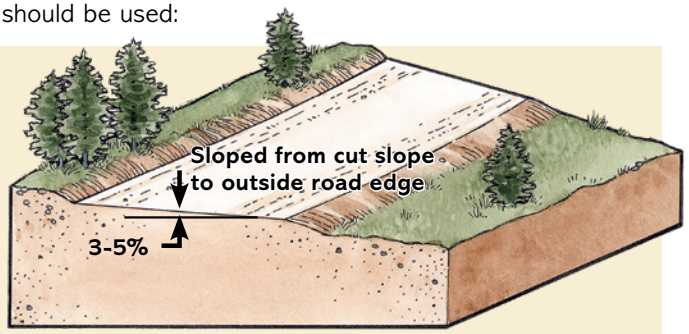
Landowners are required to take whatever reasonable action is necessary to prevent material from entering waters of the state. Road repair includes replacing or adding culverts, performing sidecast pullback and removing debris in the road. Soil and debris removed from ditches during road grading and/or cleaning should be placed in a location that does not cause slope instability, and where it will not wash back into the ditch.

Waste oil is prohibited on forest roads. Any materials applied must not enter or wash into streams, lakes and wetlands.

Here are three types of forest roads, with a description of when each should be used:

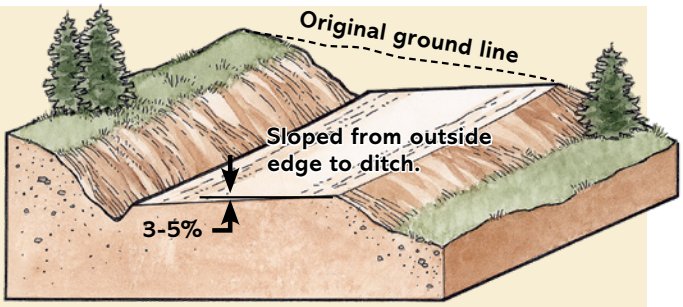
OUTSLOPE ROADS

- Road grade is gentle or flat (<7%).
- Ditch or cut slope is unstable.
- Surface can be kept smooth.
- Road is vacated.
- Rutting can be controlled.
- Road use is seasonal and traffic is light.



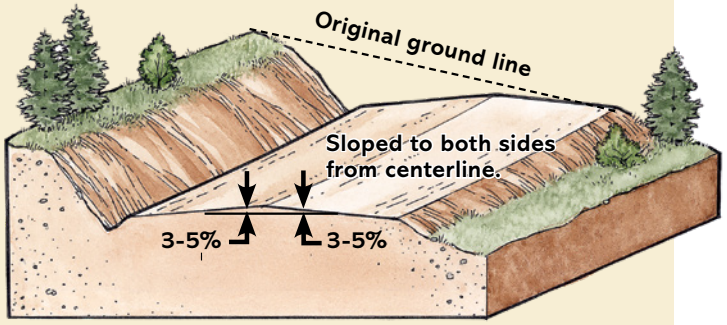
IN-SLOPE ROADS

- Road grade is steep (>7%).
- Surface drainage is carried to a ditch or surface drain.
- Outslope causes fill erosion.
- Outslope is ineffective due to ruts.
- Slippery or icy road conditions are prevalent.



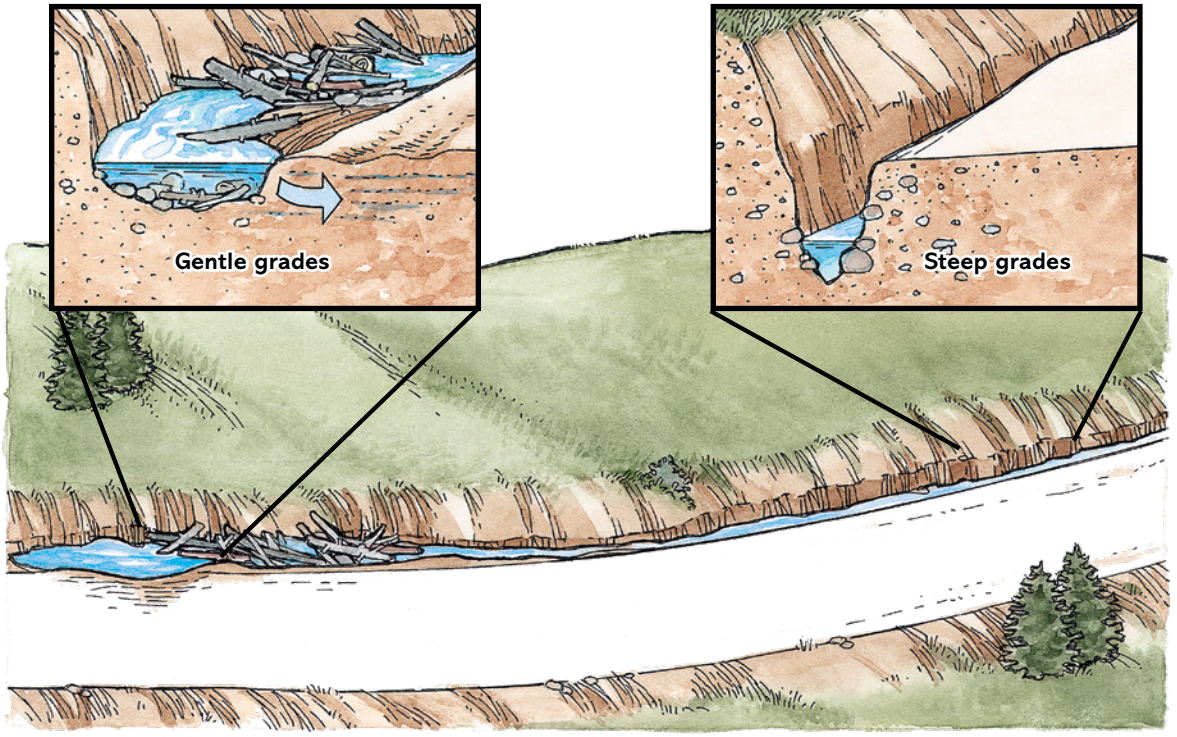
CROWN ROADS

- Road grade is flat.
- Two traffic lanes are needed.
- There is a single lane on steep grade.
- Regular maintenance of ditches, crown and cross drains is possible.
- Slippery or icy road conditions are prevalent.



Ditch grade basics

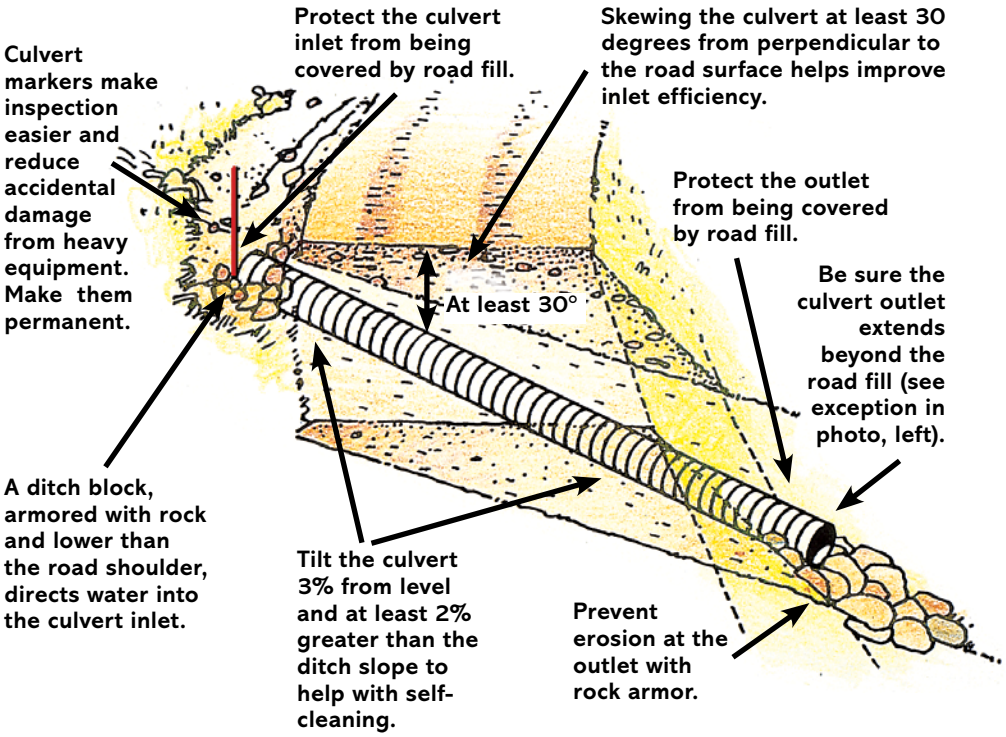
Steep ditch gradients without adequate ditch relief culverts give water too much momentum and can scour and carry sediment and debris for great distances. Where the ditch levels off, debris settles and clogs ditches. This runoff sometimes carries sediment to streams. Some steep ditches are unavoidable. Control erosion with an adequate number of ditch relief culverts, armoring ditches with rock and using a ditch block at the culvert inlet.



Ditch relief culverts

Ditch relief culverts move water from the ditch on the uphill side of the road, taking it under the road and releasing it onto a stable area on the downhill side. They prevent water from crossing the road surface and softening the roadbed. Use culverts with an 18-inch diameter where soil- and debris-plugging are a concern.

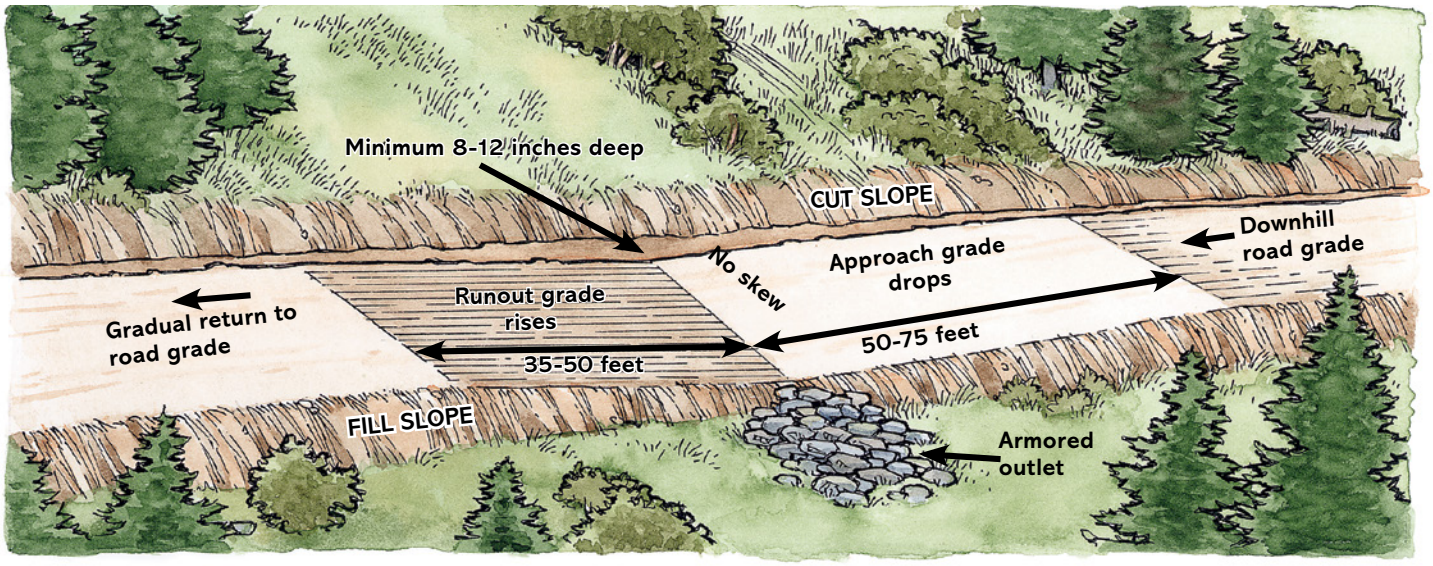
It may not always be possible to have the culvert extend beyond the fill. For steep fills, a half-round or flume should carry water beyond the fill.



Drain dips

Drain dips are gentle rolls in the road surface that are sloped to carry water to the outside, onto natural ground. They:

- provide drainage without being a driving hazard, because of their approach, depth and runout features
- are used on roads with or without ditches
- are effective on roads with gentle grades
- may be difficult to construct on steeper grades, where ditch relief culverts are preferred
- may be difficult for log trucks to negotiate because of dimensions and locations



This drain dip bottom is sloped to carry water from the inside to the outside of the road surface and onto natural ground.

Water bars

Water bars are small earth dams or humps built into the road surface that divert road surface water so it will not cause erosion. They:

- are used on inactive roads and skid trails
- are constructed with mechanical equipment (better excavation and compaction) but can be built with a shovel
- use basic spacing guidelines based on soil type and slope (see Table 7-3); other factors such as road dimensions, aspect (compass direction the hillside faces) and climate also should be considered

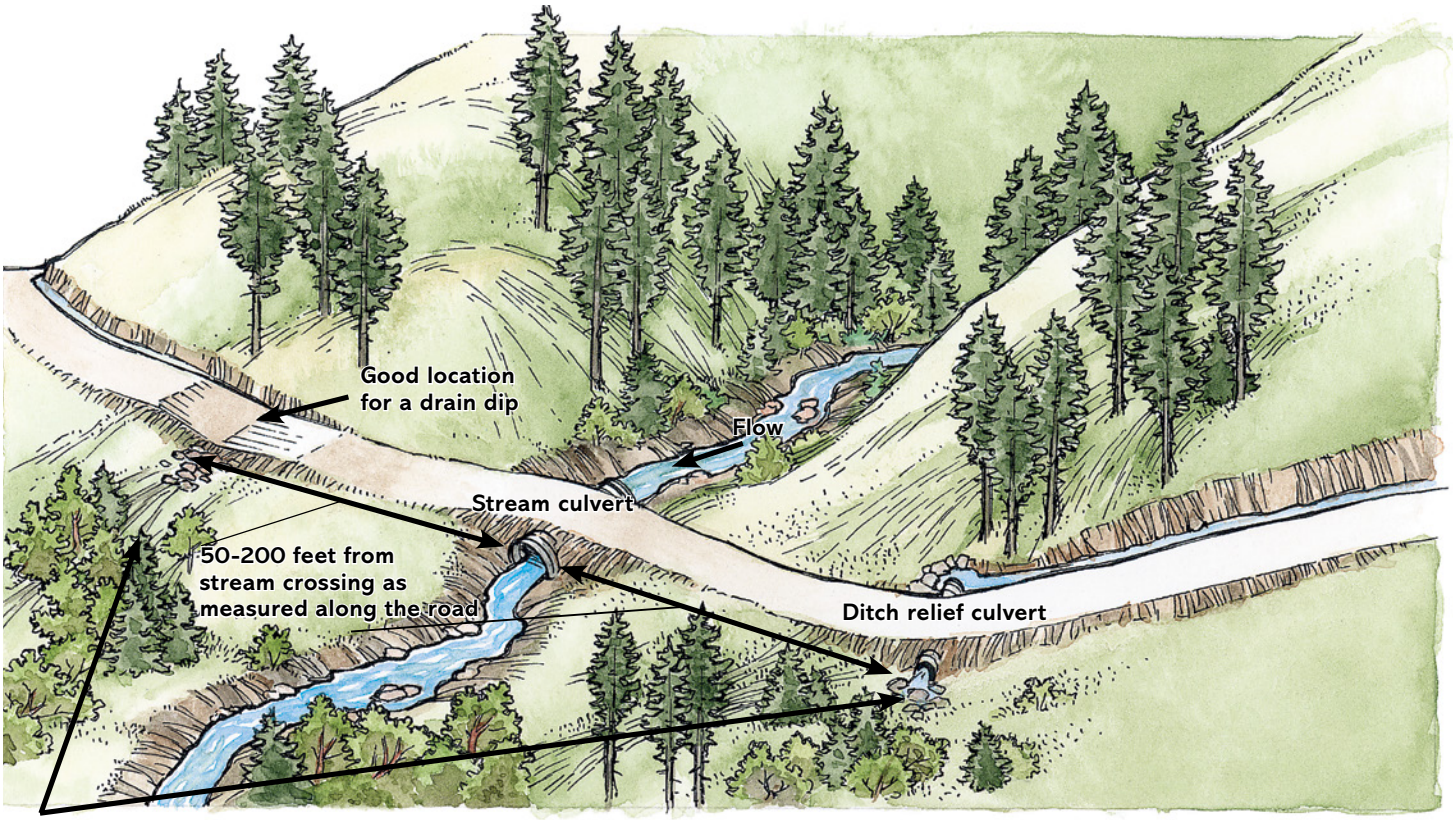
Table 7-3 Water bar spacing guidelines (feet)

Slope	Erodible Soil (sand, ash, etc.)	More Stable Soil
2-5%	400	600
6-12%	200	300
13-18%	100	200
19% and over	50	150

Responsibility for road drainage near streams

Install dips, water bars or cross-drain culverts above and away from stream crossings so road drainage water filters through ground vegetation before entering the stream. Drainage water should be directed onto undisturbed, vegetated soil.

Route ditch drainage through a filter of vegetation and undisturbed soil so sediment can be removed before water reaches the stream.



Ditch drainage should be directed into vegetation and undisturbed soil filter, and not allowed to continue flowing down the ditch and into the stream.

Cross streams at right angles to the main channel. Road grades that drop into the stream can increase sediment delivery to the stream. Grades that dip very gently or not at all toward the stream deliver less sediment. Never allow road ditches or ditch relief culvert drainage to flow into a stream. Culvert drainage and road ditches should always be directed through a vegetation filter before reaching the stream. Be aware of the risk of causing slope failure on steep slopes if water is concentrated into very steep areas or old landslides where water hasn't been flowing.

Straw bales or small heaps of slash can reduce stream sedimentation by slowing surface water and trapping sediment.

Road surfacing can double the cost of a road. However, gravel roads can provide all-weather access, reduce road maintenance costs and protect water quality by covering the soil with a weather-resistant surface.

Wet weather road use can create muddy runoff, which is a common source of fine sediment and stream water turbidity. Turbidity refers to the very small, dissolved materials that remain suspended in water and prevent light from penetrating. High turbidity levels can cause stress in fish, affect their feeding and growth rates, and impair their homing instincts. Sediment can smother fish eggs, called redds, and affect aquatic insect life.

Springs or seeps near roads

When roads cross or expose springs, seeps or wet areas, drainage must be provided to all hillslope wet areas regardless of whether they were known before construction.

Do not place road fill on top of springs. In areas with high groundwater, it may be necessary to use French drains in the ditch area, or use a free-draining fill.

Where cut slopes or road surfaces expose flowing water, roads must be graded and cross-drained to remove this water before ditch cutting occurs.

Clear channels and ditches of slash and other construction debris that can interfere with effective roadway drainage.

Road work and use generate debris that can impact both natural and constructed drainages. All floatable material should be removed from ditches for a minimum of 25 feet above ditch relief culvert inlets.

Road use during wet weather

Traffic on forest roads during wet weather can generate fine sediment that, with surface runoff, may reach and pollute streams. Wet weather is any period when rain or snowmelt normally occur. In western Oregon, this period typically extends from October through April. In eastern Oregon, this includes wet periods from both snowmelt and rainstorms.

A durable surface can resist deep rutting or the development of a layer of mud on top of the road surface. If that occurs, stop using the road. Fractured rock packs and fines (small rocks) help seal the surface from water, improving its performance. Sometimes adequate rock, called pit run, can be dug directly from quarries. In other cases, rock should be crushed, sized and mixed to provide the needed quality. Rock surfacing depth should be thick enough to prevent serious rutting.

Avoid round or weak rock. Instead, use hard, fractured rock with sharp corners, a mix of sizes and some fines (small pieces). The goal is to avoid fine sediment entering streams.

Use quality rock near stream crossings, as it can affect water quality. Use of quality aggregate can reduce sediment and water turbidity during wet weather road use (see box on page 215).

Durable rock surface on a log-hauling road during heavy rain. Notice that the water in the ditch is clean.

Roads where snow and freezing weather occur

WHAT'S THE GOAL?

Ensuring that the road surface is well-frozen or otherwise stable during use, and that it will drain properly during thaw periods. This helps protect both the road and water quality.

REASONS FOR SNOW PLOWING

- enhances deep-freezing of the road surface
- keeps water off the road during melt periods

WHEN PLOWING SNOW, PAY ATTENTION TO SNOW BERMS

- Provide breaks in snow berms to allow for road drainage.
- Locate breaks above a vegetated filter area and away from streams.
- Locate breaks away from steep fills, headwalls or landslide areas.
- Plow a snow berm along the road edge to keep runoff from flowing directly into a stream.

BE PREPARED TO SUSPEND ROAD USE

- when thawing occurs and traffic damages the road surface
- at the sign of surface rutting
- when there is potential for road runoff to reach streams

Snow berm breaks allow for drainage during snowmelt without damaging the road surface. They also serve as escape corridors for wildlife.

During snowmelt periods, water is directed through the snow berm break.

Benefits of durable surfacing

Durable material resists deep rutting and the development of a layer of mud on the road surface. Durable material may be quarry aggregate or pit run rock (see page 215). It does not include crushed sandstone, decomposed granite or similar material. Durable rock has a small percentage of fines (very small pieces) because too many fines can wash into streams (see box on page 215). Apply rock in layers. A base layer of hard, 3- to 12-inch angular rock with no fines provides for good drainage. A surface layer of hard, ¾-inch angular rock or smaller, with some fines, provides cohesion and stability. The rocks must be piled thick enough that mud can't be pumped up through them. Geotextiles can minimize pumping and reduce the need for a thick rock layer (see below).

Note that even durable surfacing may develop ruts that channel runoff and sediment toward streams, requiring grading or resurfacing.

Ceasing road use

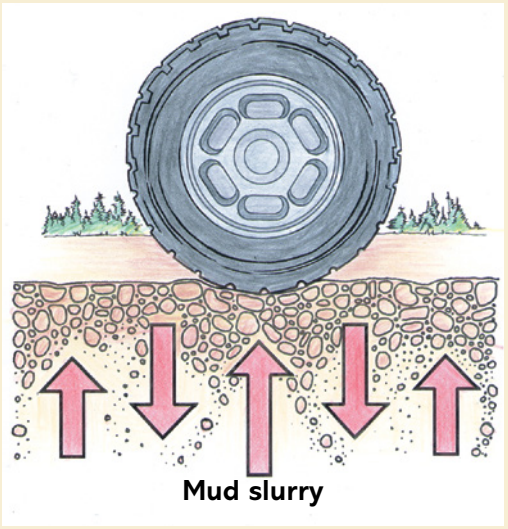
Active road use must cease when runoff from a deeply rutted or muddy surface causes a visible increase in turbidity of a Type F, Type SSBT or Type D stream. There is also cause for concern when such an increase in turbidity is seen in a Type N stream, as this could reflect inadequate road maintenance and could eventually result in sediment reaching a Type F, Type SSBT or Type D stream.

How to use geotextiles

Geotextiles are synthetic, permeable fabrics that reduce rutting, stabilize the ground and increase the load-carrying capacity of both paved and unpaved roads. They separate rock surfacing materials from subgrade soils while allowing for water passage.

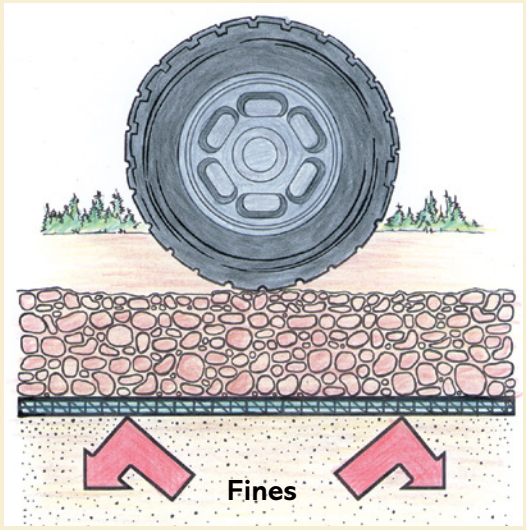
Geotextiles can reduce the amount of rock surfacing needed and reduce overall road costs.

Geotextiles reinforce subgrades by spreading the load across a larger area to reduce the chance of settling and failure. They also allow road construction across wet areas, reducing the need to remove unsuitable roadbed material.



ROADWAY WITHOUT GEOTEXTILE

Mud slurry mixes with surface aggregate. Mud may pump up through the rock surface.



ROADWAY WITH GEOTEXTILE

Fines are stopped by geotextile.

Geotextiles can keep weak or wet subgrade soils from moving into the road-base rock layer and reducing its weight-carrying effectiveness.

Road closures

Forest roads remain part of the landscape long after logging, site preparation and reforestation are completed. If access is not needed after successful reforestation, roads may be temporarily closed, permanently closed or vacated. A plan for road closure should always consider local wildlife-suppression concerns.

Temporary road closure is easiest. Permanently closing or vacating a road involves specific actions described below.

Consider gates, barricades or signs to limit use of roads during wet weather. Such barriers also effectively reduce the chance of human-caused fires, vandalism and other illegal activities. Develop a plan for allowing timely access to emergency responders (e.g., firefighters or sheriff deputies).

Temporary road closures

Most commonly, they occur during wet periods when road use is likely to damage road drainage structures. Temporary closures are also useful when roads are not needed for extended periods.

Before temporarily closing a road, ensure that drainage structures are fully functional. The road surface should be crowned, outsloped, in-sloped or water-barred. Remove berms from the outside edge where runoff is channeled.

Vacating roads and water crossings

Vacating a forest road requires dismantling it to provide a stable, revegetated condition. It is more than just blocking the road from traffic. Vacating can eliminate costly road maintenance requirements, but it requires preparation. Vacated roads must be left in a condition that will not cause damage to the waters of the state.

Vacated roads must provide adequate drainage and stability without further maintenance, which requires measures such as traffic barriers, frequent cross-ditches, and scarification and/or seeding of exposed soils. Block the road to prevent continued use by vehicular traffic and take all reasonable actions to leave the road in a condition that makes road-related damage to waters of the state unlikely. Complete the following to vacate a road:

- Outslope, add water bars, or stormproof roads to leave them in a condition suitable to control erosion and maintain water movement within wetlands and natural drainages.
- Leave ditches to reduce erosion.
- Remove water-crossing structures and fills on waters of the state, unless ODF determines other measures would adequately protect public resources.

Completely and permanently remove all water-crossing structures, including bridges, culverts, fords and associated fills, to vacate water crossings. Natural drainage must be re-established with no additional maintenance required. Be sure to complete these procedures:

- Re-establish channel connectivity.
- Meet all ODFW fish-passage requirements and in-water work-period timelines.
- Ensure that vacating the road does not result in an artificial fish-passage barrier at the time of project completion.
- Restore the channel, banks and side slopes to:
  - > establish the natural streambed and banks as close to the original location as possible, to restore or enhance stream conditions and processes to an equivalent width, depth, gradient, and substrate composition as the channel segments upstream and downstream from the crossing
  - > ensure stable side slopes that do not exceed a 2:1 horizontal-to-vertical ratio, unless matching the natural stream bank or valley walls
  - > incorporate large wood, if appropriate, to expedite restoration of the channel and fish habitat
- Address sediment delivery from exposed slopes with erosion control.
- Place all excavated material in stable locations outside of the floodplain.
- Ensure zero or near-zero road-related hydrologic connectivity at the entire site.
- Plant exposed stream banks or valley walls with native trees or shrubs to help expedite development of a functioning riparian condition.

The landowner should notify the ODF stewardship forester that a road or crossing has been vacated. The ODF stewardship forester then has 30 days to determine whether the road or crossing has been vacated and to notify the landowner in writing. If the state forester does not respond within 30 days, the road is presumed to be vacated.

Roads and crossings are exempt from maintenance under this section only after all the above procedures are completed.

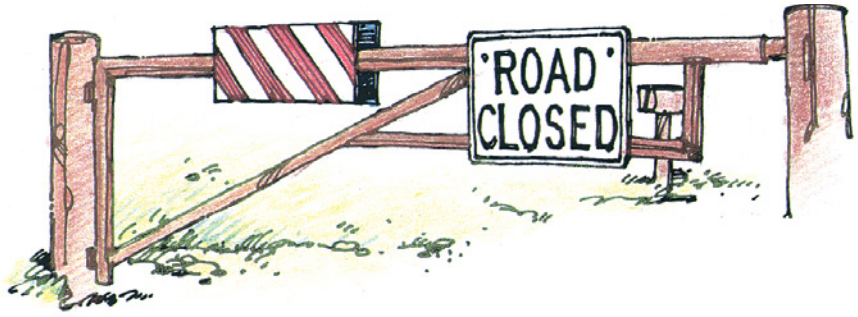
ODF's Forest Practices Technical Guidance publication can assist with rule compliance for vacating forest roads. Long-term needs for access should be carefully considered before vacating a road, because the costs of reconstruction can be substantial. However, it may be desirable to vacate a road in these instances:

- when the road no longer serves a useful purpose
- when there's a need to eliminate or discourage access
- when it's necessary to reduce erosion and sedimentation from a poorly located road
- when it will correct unstable road cuts and fills

It may be necessary to vacate only some road segments, such as recontouring a road junction and its initial stretch of road. Other segments may be stable and can be revegetated as-is.

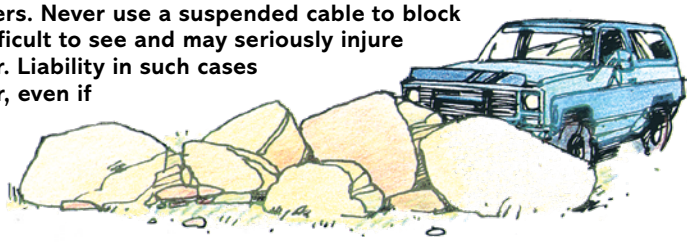
In addition to preventing traffic, culverts that might carry flowing water (including all stream-crossing culverts) should be removed, and unstable side-cast should be pulled back. Reasonable actions to vacate a forest road may include:

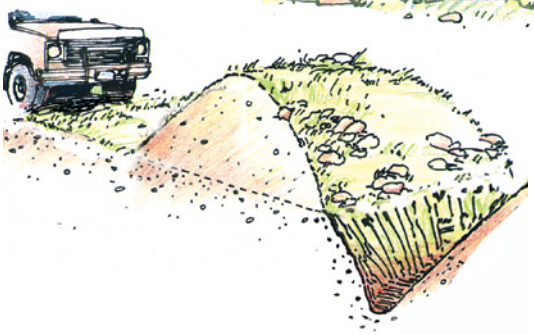
- removal of stream-crossing fills
- pullback of fills on steep slopes
- frequent cross-ditching
- vegetative stabilization



Traffic control effectively reduces road maintenance costs and provides protection for other forest resources. Traffic control can include full road closure, temporary or seasonal closure, or restriction to only light use. All traffic-control options require regular maintenance inspections.

Alternatives to gates include large berms or trenches, logs, stumps or large boulders. Never use a suspended cable to block a road, as it can be difficult to see and may seriously injure an unsuspecting visitor. Liability in such cases lies with the landowner, even if signs are displayed.





A tank trap must be deep enough and located where vehicles cannot go around it. Warning signs for the trap should be displayed in advance, preferably at a turnaround area.

It may be necessary to physically block road access. Gates provide temporary closure along with quick access if needed. To prevent vandalism, gates and other barriers must be well-anchored.

When vacating a road, removal of all stream-crossing culverts and associated fill material is required. Non-drivable water bars (cross-ditches) should be installed to drain the road surface. Space water bars more closely, because with time they may fill with sediment.

Remove all steep sidecast fill. Place removed fill and debris away from streams, and off steep slopes or old slide areas.

Restore all stream crossings to a stable, self-maintaining condition. This includes reseeding both the road surface and cut-and-fill slopes.

Road segment before vacating.

Excavator dismantling the road corridor.

Vacated road segment with large wood in place, before reseeding the surface with grass.

Rock pits and quarries

Local development, use and abandonment of quarries or rock pits/storage areas for forestland management normally follow requirements under the OFPA. However, where quarry operations on forestlands involve large quantities of commercial products sold for non-forest uses off-property, Oregon's mining regulations apply. These are administered by the Oregon Department of Geology and Mineral Industries (DOGAMI).

For rock projects related to normal forest management, forest practice rules focus on maintaining stable slopes and protecting water quality. Do not locate quarry sites in streams or channels. Prevent overburden or waste from entering waters. Stabilize banks, headwalls and other quarry surfaces to prevent surface erosion and landslides. Quarries or rock pits that may impact specially protected resource sites (e.g., sensitive bird nesting, roosting and watering sites) are subject to all related forest practice rules.

Large commercial rock-quarry operations are subject to mining regulations and DOGAMI oversight. Such operations require a fee-based permit for mining activities that exceed one acre and/or 5,000 cubic yards of new disturbance in any 12-month period, unless the excavated material stays on the property. Under these fee-based permits issued by DOGAMI, reclamation is also required, and a related security deposit must be made.

When a quarry or rock pit is inactive or vacated, stabilize banks, headwalls and other surfaces, and remove from the forest all petroleum-related waste material associated with the operation. Dispose of all other debris so those materials do not enter waters of the state.

Do you need help?

A consulting forester, road engineer or geotechnical specialist may be able to help with a difficult or complex situation involving a forest road, water crossing, rock pit or quarry. Getting such help could avoid not only a violation of the OFPA, but also damage to your property and associated repair costs.

WRITTEN PLAN BEFORE CONSTRUCTION

A properly located, designed and constructed road greatly reduces potential impacts to water quality, forest productivity, and fish and wildlife habitat. To prevent improperly located, designed or constructed roads, a written plan is required for road construction.

The written plan must include:

- the risk of material entering water from direct placement, rolling, falling, blasting, landslide or debris flow
- machine activity in streams (Type F, Type SSBT, Type D or Type N), lakes or significant wetlands
- operations in an RMA
- water-crossing structures in any body of water, including wetlands
- critical locations (see road location, page 182)
- stream crossings with fills more than 15 feet deep
- placement of woody debris or boulders in a channel for stream enhancement
- HLHLs

Written plans for Type F and Type SSBT fish streams must include:

- stream name, size, type and basin
- watershed tributary area
- calculated 100-year peak flow, developed using Forest Practices Technical Guidance
- measured stream gradient
- bankfull channel width
- water-crossing structure location, type and size, including culvert diameter, rise, span, length and bridge width
- planned culvert grade or elevation change, embedment depth range and material the culvert is made from
- calculated structure flow capacity and bridge freeboard, as applicable
- road name or number and road surface type
- drainage plan, including:
  - > installation time frame and equipment access
  - > stream isolation method, including but not limited to stream diversions, bypasses or pumping
  - > expected RMA tree removal

Assess these factors:

- transportation needs, road location, road-management objectives and land ownership
- resources that may be impacted by a water crossing, including aquatic species, habitats and conditions, along with floodplain values, terrestrial species and water uses
- risk factors at the watershed scale, e.g., geologic and geomorphic hazards, event history, past and projected land management, crossing maintenance history, regional channel stability and projected watershed conditions over the life of the crossing structure
- risk factors at the site scale, e.g., channel stability, potential for blockage by debris, floodplain construction, large elevation changes across infrastructure, channel sensitivity to change, consequences of site failure, and potential stream geomorphic changes over the life of the structure
- techniques and methods to protect natural resources
- additional information required by the state forester

Submit a written plan for fills over 15 feet deep to your ODF stewardship forester. Describe the fill and drainage-structure design, and include a design that minimizes the likelihood of:

- surface erosion
- embankment failure
- downstream movement of fill material

SMALL FORESTLAND OWNER (SFO) ROAD CONDITION ASSESSMENT

Under the Oregon Forest Practices Act (OFPA), all private forest landowners are required to inspect road conditions on their properties. The requirements are different for large and small forestland owners. Instead of the forest inventory process required for large forest landowners, SFOs must complete a road condition assessment when filing notice with the state of plans to harvest timber.

The Small Forestland Owner Office, housed at Oregon Department of Forestry (ODF), will help SFOs with road condition assessments and written plans. When an SFO submits a notification of timber harvest using ODF's reporting and notification system, they will need to complete a road condition assessment for the harvest unit. Without a planned timber harvest, SFOs are encouraged, but not required, to complete the road condition assessment for all roads in their forested parcel.

The road condition assessment must include all roads in the parcel where the harvest will take place, including:

- road conditions that could contribute to active or potential delivery of sediment to waters of the state
- water-crossing locations and the status of compliance with the forest practice rules
- potential fish-passage barriers on Type F and Type SSBT streams
- abandoned roads
- roads with a perched fill that present a significant hazard to fish-bearing streams

SFOs are not required to undertake the following road improvement projects without funding by the State of Oregon:

- replacement of culverts for Type F and Type SSBT streams
- repair of abandoned roads
- reconstructing, vacating or relocating roads with a perched fill that present a significant hazard to fish-bearing streams

ODF, in consultation with ODFW, will review eligibility for state grants to improve the road conditions. If the state of Oregon, under the Small Forestland Investment in Stream Habitat (SFISH) program, fails to fund an eligible and approved road improvement project for an SFO, that action will not prevent the SFO from using the road for any purpose, except:

- when the road is actively delivering sediment to waters of the state
- when the road has one or more culverts with an imminent risk of failure

If the road condition assessment identifies necessary road repairs other than those conditions in the previous paragraph, there will be no time limit for the SFO to complete those repairs. The obligation to improve roads when used for logging remains.

See also Road Condition Assessment for Small Forestland Owners PDF at **KnowYourForest.org/manual-links**.

Applies to small forestland owners only

FOREST ROAD INVENTORY AND ASSESSMENT (FRIA)

The purpose of the FRIA requirement for large private forest landowners is 1) to reduce chronic and catastrophic sediment entry to waters of the state and 2) to ensure fish passage for covered species during all mobile life-history stages by identifying and bringing into compliance existing roads not meeting the Oregon Forest Practices Act (OFPA) rules.

FRIA does not apply to small forestland owners (SFOs), who must instead submit a road condition assessment when they notify the state of a timber harvest operation that will use forest roads to haul timber. ODF's Forest Practices Technical Guidance educates large forest landowners on how to complete this required road inventory. The inventory must be completed in three phases: pre-inventory, initial inventory and annual inventory.

Pre-inventory

Large forest landowners must submit a pre-inventory of sites with high conservation value on each road management block to the state forester no later than January 1, 2025. The pre-inventory should address the following sites:

- areas of known chronic sedimentation
- fish-passage barriers known to be of significant concern, especially where fish passage would provide the greatest benefit to native migratory fish
- ongoing stream diversions at stream crossings and areas with stream-diversion potential
- areas of known hydrologic connectivity

Then prioritize projects on high conservation value sites that:

- remove fish-passage barriers consistent with ODFW requirements
- minimize the potential for sediment delivery to waters of the state
- minimize stream diversions at water crossings
- minimize hydrologic connectivity between roads and waters of the state
- meet other relevant criteria, as determined by ODF in consultation with other state and federal agencies

Large forest landowners must meet with ODF and ODFW to review the pre-inventory list no later than January 1, 2026. Landowners must address prioritized pre-inventory projects after ODF's review no sooner than January 1, 2026, and no later than January 1, 2029.

Landowners must report annually to ODF and ODFW on the status and completion of pre-inventory projects through January 1, 2029.

Initial inventory

Large forest landowners must submit an initial inventory of all active, inactive and known vacated or abandoned roads no later than January 1, 2029. It must include three documents:

- paper or electronic maps showing the roads within each road-management block
- work matrix documenting actions necessary to bring all roads into compliance with the OFPA, including prioritization of work
- FRIA initial inventory plan describing how the landowner intends to bring the road network into compliance no later than January 1, 2044

At minimum, the FRIA initial inventory plan submission must include:

- location and length of active roads, inactive roads and vacated roads within each road-management block
- location and classification of streams within the road-management block
- known or potential road-related fish-passage barriers
- prioritization of known or potential road-related fish-passage barriers, including the location, categorization and status of all water-crossing culverts
- identification of each road segment as:
  - > meeting the forest practice rules
  - > not meeting the forest practice rules
  - > vacated
  - > abandoned

CLASSIFY EACH WATER-CROSSING CULVERT AS:

- a fully functioning culvert in a Type F or Type SSBT stream
- a fully functioning culvert in a Type N or Type D stream
- a culvert with imminent risk of failure
- a culvert with minimal risk to public resources
- undetermined status; culverts with undetermined status must be prioritized for improvement, and the status may be changed as more detailed information is gathered

Annual inventory

Beginning in the year after submitting the initial inventory, but no later than January 1, 2029, large forest landowners must submit annual inventory reports and plans until January 1, 2044, including updates to maps, the work matrix and the annual plan. Details about work completed, as well as a work forecast for subsequent years, must be provided.

Landowners will be expected to improve all road segments identified in the initial inventory as not meeting the forest practice rules so that those segments either meet the rules or are vacated no later than January 1, 2044.

STATE-LED ABANDONED ROADS INVENTORY

ODF, in consultation with the U.S. Environmental Protection Agency, will lead a cooperative effort to identify abandoned forest roads and bring them into compliance with the forest practice rules to reduce the potential that they will be a source of chronic sediment or will increase the risks of mass wasting and stream diversions.

After identifying abandoned roads, ODF and cooperators will prioritize those with a high level of risk to waters of the state or infrastructure. Results of the inventory will be provided to forest landowners no later than January 1, 2026. The following criteria will be used to order priority:

- ongoing stream diversion at stream crossings
- diversion potential at stream crossings
- likelihood of hydrologic connectivity
- comparative risk of producing chronic sediment
- risk of contribution to mass wasting
- other criteria, as determined by the department in consultation with state and federal agencies

Following the identification of high-risk abandoned road segments, ODF will coordinate with landowners to identify high-priority abandoned road segments from the list of high-risk locations.

Landowners must complete a field verification of all high-priority abandoned road segments. This work may be reviewed by ODF, DEQ and ODFW. As part of the field verification, landowners will:

- Confirm the high-priority site is on an abandoned road.
- Determine whether the segment is diverting the stream or has diversion potential.
- Determine if the segment is actively contributing sediment or has a high risk of contributing significant quantities of sediment to waters of the state, and include an analysis of net benefit for waters of the state to improve the abandoned road segment.
- Determine practicability of alternatives to improve the abandoned road segment and address risks.
- Present alternatives that may include vacating the segment, taking no action, and any other reasonable alternative; landowners must propose the most practicable alternative as part of the annual report.

Landowners must add the verified high-priority abandoned road segments to the FRIA initial inventory and improve the abandoned road segments as part of the FRIA process in consultation with ODF.