



CULVERT AND PIPE ARCH INSTALLATION

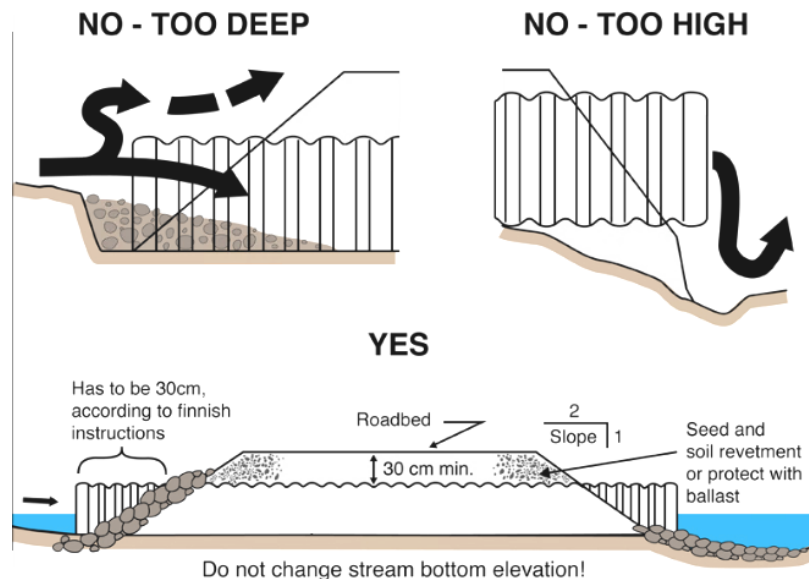
Rationale: To ensure proper installation of culverts and pipe arches associated with road construction, to prevent the sedimentation of streams.

Background: Road building activities, including culvert installations, have the capacity to cause environmental damage around waterbodies. The proper installation of culverts and pipe arches promotes sound environmental construction principles and ensures a long service life of the structure. During sub-grade construction, road drainage culverts should be installed as work progresses to limit water movement.

Water Course Crossings structures should be designed based upon the following criteria:

- ⇒ Structures have to be designed to handle the associated flows for the stream in question.
- ⇒ Structures have to be designed based upon site characteristics and to ensure fish migration is maintained.
- ⇒ Structures have to be designed to prevent erosion and sedimentation that adversely affect water quality

Procedure: The following procedure has been used here and throughout North America to effectively provide access to timber harvesting operations, while protecting the aquatic environment. In addition to following this procedure, contractors must be in possession of and adhere to a Department of Environment and Conservation “Permit to Alter a Body of Water”, and if required, Fisheries Act authorizations and any attached Mitigation Measures. Installation of all culverts and pipe arches must be approved by the Operations superintendent.



Position the structure so as to follow the natural alignment of the stream. If the stream is natural fish habitat, embed the structure a minimum of 150mm below the natural streambed, up a maximum of 1/3 of the culvert diameter, for the entire length of the structure (i.e., inlet and outlet). This will facilitate the passage of fish and the creation of pools. If the subgrade does not allow for the culvert to be sunk, construction of a plunge pool will be required at the outlet of a culvert installation. A plunge pool is created by forming a small pool at the outlet of the culvert, which backs water up into the pipe for fish migration.

Important Notes:

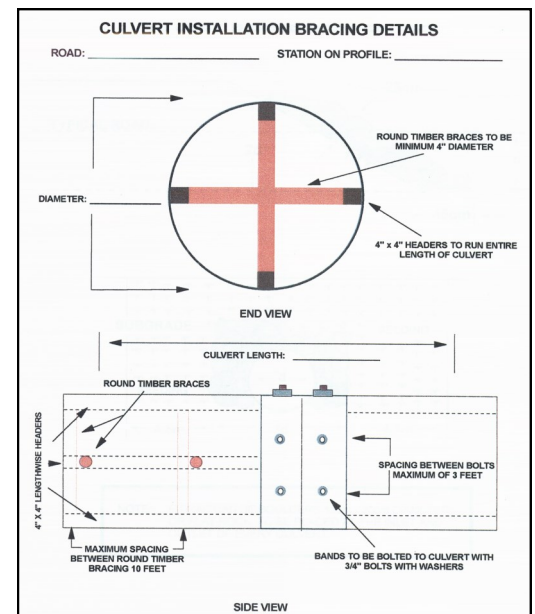
- ⇒ Multiple culvert installations require the bottom of the main culvert to be set into the streambed. A minimum gap of 1 metre between culverts is required to allow adequate compaction of material.
- ⇒ Culverts and pipe structures should be placed on stable foundations. Never install culverts on sod, frozen earth, on beds containing large rock, or an uneven trench bottom.
- ⇒ Construction should be suspended during periods of intensive rainfall or when soils are saturated because of the threat of erosion or sedimentation.
- ⇒ Permanent stream crossing structures should be installed as soon as possible, preferably during subgrade construction.
- ⇒ Joiners are put into position at the end of one section of CSP with the joiner open to receive the next section. The second section is brought against or to within about 2.5 centimeters of the first section. After checking to see that connecting parts of both joiner and CSP sections match, and that the interior of joiners and exterior of CSP are free of dirt, stones, etc., bolts are inserted and tightened. On large diameter CSP, merely tightening bolts may not assure a tight joint, due to the friction between the joiner and the CSP. In such installations, tap the joiner with a mallet to take up the slack as the band is tightened. For CSP culverts 1800 millimeters and greater, the joiners must be bolted to the culvert.

- ⇒ The load carrying capacity of culverts or pipe arches depend on proper backfilling. To obtain maximum strength and prevent washouts and settling, it is necessary that the backfill be made of good material, properly placed and carefully compacted. This is extra important with large diameter culverts. Backfill should be placed under the haunches of the culvert and tamped, using light tamping equipment or 2x4 poles to achieve suitable compaction and to eliminate the possibility of voids under the culvert. Place backfill equally on both sides of the culvert or pipe arch in layers 15-20 centimetres thick, thoroughly tamping each layer. Compacted layers must extend for at least one diameter on each side of the structure, to a depth above the culvert equal to one half the culvert diameter, but not less than 45 centimetres. Care must be taken to prevent water leaking through the fill along the culvert. When granular materials have been added for bedding, the ends of the fill should be sealed against infiltration to avoid undermining the culvert.

Structures greater than 1500mm require bracing before being backfilled. Structures with diameters in excess of 1600mm require joiner bands to be drilled and bolted.

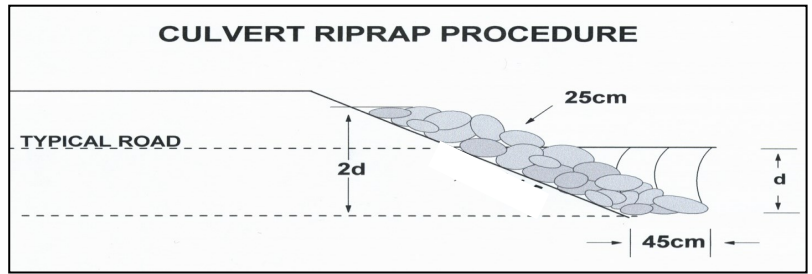
Prior to backfilling, install non-woven, geosynthetic fabric around culverts in permanent water bodies, to prevent fines from entering the stream. The fabric must be a minimum of 4.5m wide, extending to the width and height of the required riprap (or to the road surface if the height of the riprap will be less than the diameter of the structure). Cut two pieces of geosynthetic fabric to the desired length. Make a hole the size of the culvert diameter in each piece and fit them over the openings of the structure. Backfill from the center of the structure to either end, in successive layers, until the required height of fill is reached.

Backfill material must come from outside the established 30m no-grub zone. It can be excavated and pushed to the structure with a tractor, or carried with an excavator. Excavation in the no-grub zone is allowed only if authorized by a CBPPL staff member. Cross-culverts may be required to prevent run-off from entering the stream. If so, they must be properly designed and installed outside the no-grub zone, in a location determined by existing conditions.



Once the structure is backfilled, position the geosynthetic fabric along the top and sides of the structure. Stabilize with riprap comprised of angular rocks, ensuring there are no voids. The height of the riprap should equal the diameter of the structure, with the remaining embankment to the road surface stabilized with alternative methods. If the embankment from the culvert to the top of the road is less than the diameter of the structure, the riprap must extend to the road surface. The riprap must also extend beyond the width of the natural streambed or to a minimum of one culvert diameter on each side of the structure. Side casts are then sloped to prevent erosion of fill material into the stream. Refer to your contract for the appropriate ratio.

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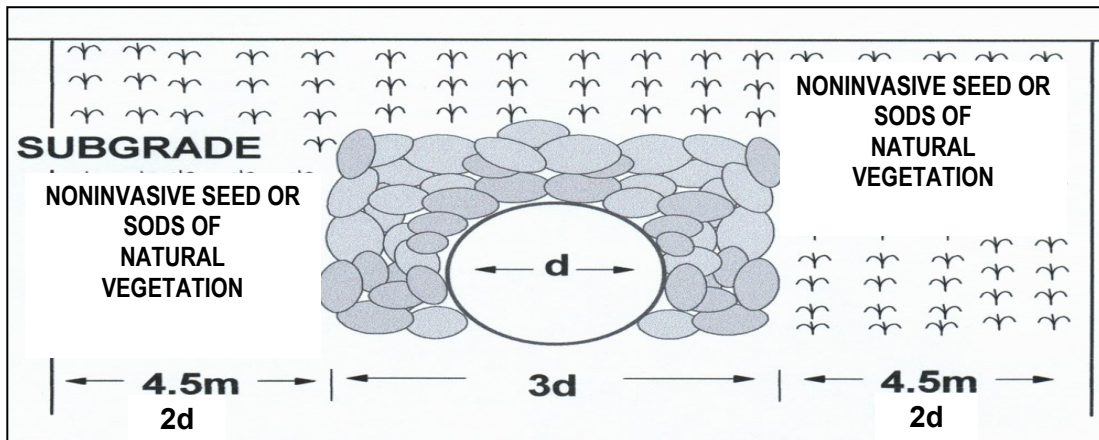


If suitable rip rap is not available on site, it can be transported to the culverts. Rock must be used for stabilization to at least the high water mark. The remaining embankment can be stabilized with a combination of geosynthetic fabric, corduroy, slash, tops, organic mat, and seed, deemed to be adequate by the CBPPL Operations Superintendent or designate.



Stream crossings must be stabilized promptly after construction activities are finished to prevent erosion. For structures installed in permanent water bodies, noninvasive seed or natural vegetation (from outside the no-grub zone) should be placed on exposed mineral soil on each side of the structure for twice the diameter of the structure. The natural vegetation has to be placed in such a manner, and in sufficient quantities, to ensure that re-rooting and stabilization will occur. The Operations Superintendent may waive the requirement for seeding if, in his/her opinion, the embankments are stable and will not erode or cause sedimentation to enter the stream.

Apply hay to exposed mineral soil within the no-grub zone to capture sediment that would have negative impacts on water quality.



Crossings must be monitored during operations to ensure the structure is functioning properly and no negative environmental impacts are evident. If crossing construction activities or active operations create rutting or channeling on the crossing approaches, disperse the water flow to an undisturbed, stable filter area, using water bars, check dams, or similar structures. When operations are finished, it is important to remove any sediment or erosion control structures and/or materials such as silt fence, excessive geosynthetic fabric, etc.