

Bridge and Culvert Installation The MDEQ-WRD Perspective

Water Resources Division
Michigan Department of Environmental Quality

The installation of a new or replacement bridge or culvert in a stream/drain generally requires a permit from the Water Resources Division (WRD) of the Michigan Department of Environmental Quality under Part 301, Inland Lakes and Streams and the State's Floodplain Regulatory Authority found in Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

Under Part 301, the WRD reviews a permit application to ensure the project will not adversely affect the public trust or riparian rights. The WRD shall not grant a permit if the proposed project unlawfully impairs or destroys any of the waters or other natural resources of the state. The WRD also reviews a project to ensure that it does not structurally interfere with the natural flow of the stream or drain. Some of the major concerns when reviewing an application under Part 301 are as follows:

1) Spanning the Bottomland

As a general rule, the WRD prefers stream crossings that at a minimum span the bottomland of the stream or drain. Bottomland is defined as the land area that lies below the ordinary high-water mark and that may or may not be covered with water. Structures that do not span the bottomland cause higher velocities, which lead to the formation of scour holes in the downstream and/or upstream channel. This unnecessary channel erosion may also cause the culvert to be perched such that there is a small waterfall at the structure outlet. Perched culverts can prevent the migration of fish and impact other biological habitat. Where there is evidence that the floodplain corridor is used by wildlife, consideration should also be given to adding another span adjacent to the main crossing to allow for wildlife passage. When trying to estimate the average width of the bottomland, the applicant should go 100 feet to 200 feet upstream and downstream of the structure to determine average conditions outside the influence of the crossing.

2) Multiple Culverts

Multiple culverts placed in a stream or drain tend to require more maintenance work. One or more of the culverts often becomes plugged with sediment. This in turn increases the velocity in the remaining culvert(s), which leads to increased scouring of the channel. Multiple culverts are also more likely to become clogged with debris, which could cause structural failure. If multiple structures must be used, it is recommended that the main culvert span the baseflow channel. Additional culverts should be placed in the overbank area above the normal water surface elevation.

3) Eliminating Direct Road Runoff

New or replacement stream or drain crossings should be designed such that the runoff from the road is diverted away from the crossing into a vegetated area before entering the watercourse. Use of a curb section on the portion of the roadway that is over the stream or drain will also prevent road runoff and its associated pollutants from directly entering the watercourse. Storm sewer pipes should not empty directly into a stream or drain. They should be discharged through a vegetated area which allows pollutants to settle out before entering the watercourse. Oversized sediment sumps in the storm sewer system can be used in the vicinity of a stream or drain. In order to be effective, the sediment sumps need to be regularly cleaned out when they are 40 to 60 percent full.

4) Minimizing the Loss of Natural Stream Bottom

The loss of stream bottom habitat resulting from excessively long culverts or the use of a culvert with an unnatural bottom is a concern with regard to the biological integrity of the stream or drain. The loss of stream bottom habitat can be mitigated using a couple of methods. The first method requires that the culvert be recessed 6 to 12 inches to allow the natural stream bed materials to migrate into the recessed area. The depth that the culvert is recessed is dependent on the natural down cutting that is occurring in the stream system and on any anticipated drain cleanouts. A larger culvert may be required to accommodate the loss of end area caused by recessing the culvert. The second method to reduce the loss of natural stream bottom habitat involves the use of steeper fill slopes and a headwall at the ends of the structure in lieu of a culvert protruding from the fill slope. This allows for the use of a shorter structure.

5) Proper Soil Erosion Controls

Permits issued by the WRD include provisions requiring that proper soil erosion and sedimentation controls be used to prevent sediment from entering the stream or drain during and after construction. Most road agencies are Authorized Public Agencies (APA) under Part 91, Soil Erosion and Sedimentation Control (SESC), of the NREPA. As such, APAs are required to prepare a soil erosion control plan for most earth change activities. If the road agency is not an APA, a SESC permit must be obtained from the appropriate County or Local Enforcing Agency responsible for administering Part 91. Temporary soil erosion control methods shall be installed before or upon the commencement of the earth change. Soil erosion controls shall be maintained to prevent sediment from leaving the site of the earth change and entering a waterbody. The road agency is responsible for any sediment that leaves the disturbed site and enters a stream, drain, or wetland.

6) Alignment

New or replacement structures should be aligned with the baseflow channel or the floodplain/floodway depending on site conditions. Poor structure alignment can accelerate bank erosion and channel scour.

7) Navigational Concerns

Navigational issues are generally not a concern in smaller streams/drains. However, if the stream/drain could potentially be used by canoeists or boaters it is desirable to maintain a sufficient underclearance to allow this activity to continue. An underclearance of 4.3 feet is desired for canoeists.

The WRD has control, under Part 31, over the alterations of natural or present watercourses to assure that the channels and the portions of the floodplains that are floodways are not inhabited and are kept free and clear of interference or obstruction. The WRD reviews a permit application to ensure that a new or replacement bridge or culvert does not harmfully interfere with the discharge or stage characteristics of the stream or drain that could result in damage to property, a threat to life, a threat to personal injury, pollution, impairment, or destruction of the water or other natural resources.

A bridge or culvert project including any increase in the road grade must be evaluated hydraulically for a range of discharges up to and including the 100-year discharge to insure that it does not cause a harmful interference on streams or drains with a drainage area of 2 square miles or more. If the proposed project causes an increase in the floodplain elevation (energy grade line) when compared to existing conditions, the applicant has the following options:

- 1) Withdraw the application.
- 2) Re-design the project such that it does not cause an increase in the floodplain elevation.
- 3) Certify that the project and the increase do not cause a harmful interference, if the increase is confined to the applicant's property.
- 4) Notify all affected property owners and also certify that the project and the increase do not cause a harmful interference, if the increase goes off the applicant's property.

Some Michigan communities that participate in the National Flood Insurance Program (NFIP) do not allow a project to cause any increase in the floodplain elevation. In these communities, options 3 and 4 listed above could not be used without a variance from the community. In addition, if the proposed project causes a change in the location of the floodway or an increase in the floodplain elevation in an NFIP community, a letter of map revision will be required from the Federal Emergency Management Agency.

Some of the major concerns when reviewing an application under Part 31 are as follows:

1) Reduced Structure Area

If the proposed structure has a smaller flow area than the existing structure, there may be an increase in upstream floodplain elevations. Sometimes, using a smoother structure can mitigate for the reduction in flow area. For example, given two structures of equal length and waterway area, a concrete structure will be hydraulically more efficient than a corrugated metal structure. Another mitigation technique is to use a hydraulically more efficient inlet configuration. A structure with a headwall is more efficient than a culvert that protrudes from the fill slope. Reducing the flow area will also increase the outlet velocities of the structure. When this occurs, additional riprap to protect the channel and bank areas may be required.

2) Increasing the Road Grade

If water flows over the existing road grade during a flood event, any increase in the road profile can cause higher upstream floodplain elevations. One of the mitigation techniques includes using a larger structure to compensate for the loss of flow area. If weir flow over the roadway can be left in place, it is preferable to have the weir flow not directly over the structure. Locating the weir flow away from the structure will reduce the chance of flood damage to the structure and minimize the volume of sediment entering the stream. Replacing a damaged section of roadway is much quicker and less expensive than repairing or replacing the structure.

3) Lengthening the Structure

Increasing the length of the proposed structure over the length of the existing structure may cause an increase in upstream floodplain elevations and should be carefully evaluated.

4) Increasing the Structure Roughness

Replacing an existing structure with one that has a higher roughness coefficient will cause an increase in upstream floodplain elevations and should be carefully evaluated.

Changes in any of the four characteristics listed above generally require a hydraulic evaluation to determine if the proposed project will cause a harmful interference when compared to existing conditions. In addition, the WRD requires compensating cut for fill placed below the 100-year floodplain elevation if the volume of fill exceeds 300 cubic yards.

If there are any questions on WRD requirements for bridge and culvert installations please contact your local WRD transportation specialist. For more information, please refer to our website at www.Michigan.gov/EGLEtransportationreview.