7. Roads and Bridges

Roads, as linear structures, often traverse nearby wetlands. As road travel increases, it is often necessary to upgrade roads for safety and ease of travel. Improvements might include new surfaces, lane widening, new drainage structures, bridge reconstruction, or the addition of safety features. As with any project, one of the first steps when designing a new or upgraded road is to avoid wetland areas, and, if this is not possible, then to minimize impacts to wetlands as much as possible.

Design

During the design stage, it is vital to identify techniques to protect wetland characteristics, functions and values. It is often times a challenge to balance safety and design standards with wetland protection. These mitigation techniques may be implemented before, during or after construction. Although an activity may not be employed until post-construction, it should still be included on design plans submitted with the wetland application.

New roads and road upgrades often go hand in hand with subdivisions or new commercial projects. For a new road, nearby resources and geographical features must be identified in order to find the most suitable location for the road. It's also important to consider how the road may affect nearby wetlands and how to best eliminate or minimize those effects. Adding a thick buffer of varied vegetation between the road and the wetland is one of the best practices. A buffer will help to absorb light and sound pollution, in addition to offering food and shelter for wetlands wildlife. It will also act as an additional treatment for water and sediment runoff from the road. The following list gives a few more best management ideas.

- Avoid widening or extending roads into wetlands.
- Consider shifting the geometry or alignment of the road to avoid wetlands.
- Plan new roads to follow the contours of the existing land, which will minimize grading.
- Span as much of a wetland as possible if crossing is necessary in order to maintain connections between wetland systems.
- Consider alternative designs that will fulfill the same purpose.
- Propose steeper road side-slopes, such as a 2:1 grade instead of a 4:1 grade to avoid excess fill into wetlands.
- Utilize slope alternatives that avoid filling, yet prevent erosion and sedimentation into wetlands.
- Consider keeping existing bridge abutments by building new abutments behind the old ones if it will help to reduce wetland impacts.
- Plan ahead for temporary crossings that may be needed for construction access, travel, or utilities.

Roads & Driveways

Please see Chapters 2 and 3 for several examples of road and driveway designs that avoid wetland areas.

Please refer to the *Rhode Island Stormwater Manual* (pending revision 2010) for complete Best Management Practices.

Drainage concerns

- Reduce the amount of paving by decreasing lane width and shoulders.
- If possible, avoid installing sidewalks to limit the amount of paving, or consider installing sidewalks on only one side of the road.
- Maximize infiltration through the use and maintenance of open drainage systems, which also prevent small mammal and amphibian entrapment.
- To lower runoff volumes and maximize infiltration, consider use of porous pavements.
- Avoid discharging stormwater directly into wetlands.
- If discharging into a wetland is unavoidable, the discharge must be treated.
- Make sure temporary dewatering basins are correctly located and large enough to support the project.

Birdproofing Bridges

Bridges crossing over wetlands should be designed to discourage the nesting or congregating of birds. Pigeons and starlings are especially problematic due to the large amount of droppings they produce which pollutes wetlands. Some good structure options include:

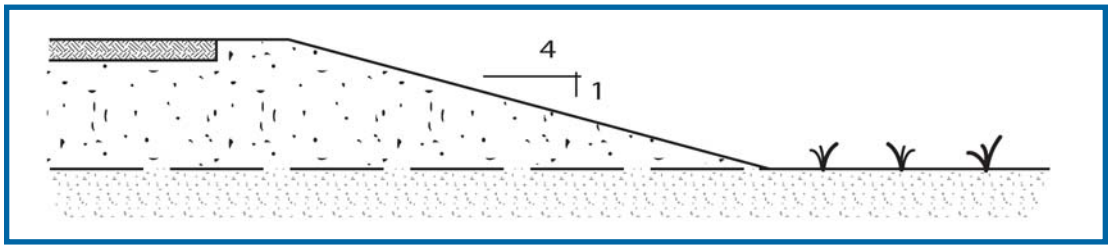
- Concrete box culverts
- Concrete arch culverts
- Concrete rigid frames
- Concrete slabs
- Prestressed concrete slabs
- Prestressed concrete butted boxbeams

These structure types, by design, have fewer places for birds to perch or roost. Other treatments are available to further discourage birds from perching on the beam seats, such as screening with mesh chain link fence.

Example 22: Typical Slope Treatments

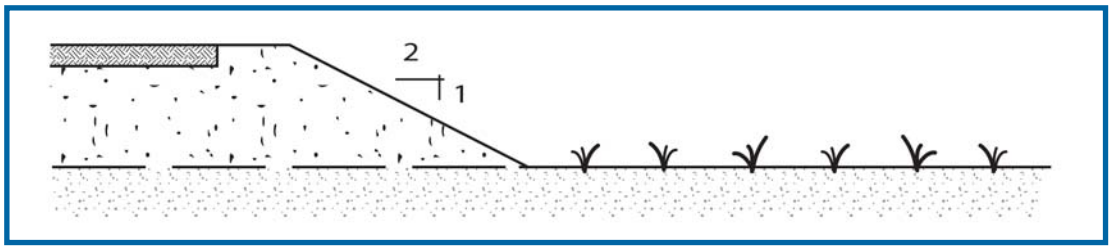
The following illustrations show a variety of slope treatments.

1. **Gradual Slope:** In upland areas with plenty of space a 4:1 slope may be preferred because it's easy to plant, mow, and maintain. However, it requires a large amount of fill to create the gradual slope and is not preferred if there are wetlands immediately adjacent to the road.



Example 22a

2. Steeper Slope: Generally, the steepest slope that can be vegetated to reduce erosion is a 2:1 slope. At this ratio, a grass cover can still be planted and maintained and less fill is needed, thus reducing the amount of wetland impact.

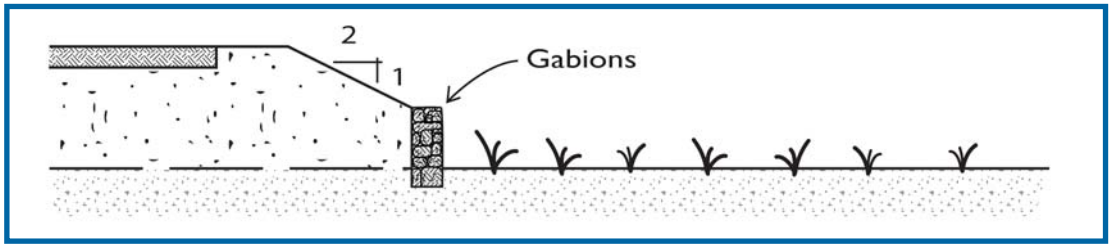


Example 22b

3. Gabions: To further reduce the amount of wetland fill required to construct a small road, the use of gabions is another option. Gabions are a type of rock-filled wire mesh berm that contains the earthen material. They can be lightly vegetated; often ivy and grasses will grow to cover up the wire. If a wetland is directly adjacent to the road, gabions can cut the amount of fill required nearly in half.

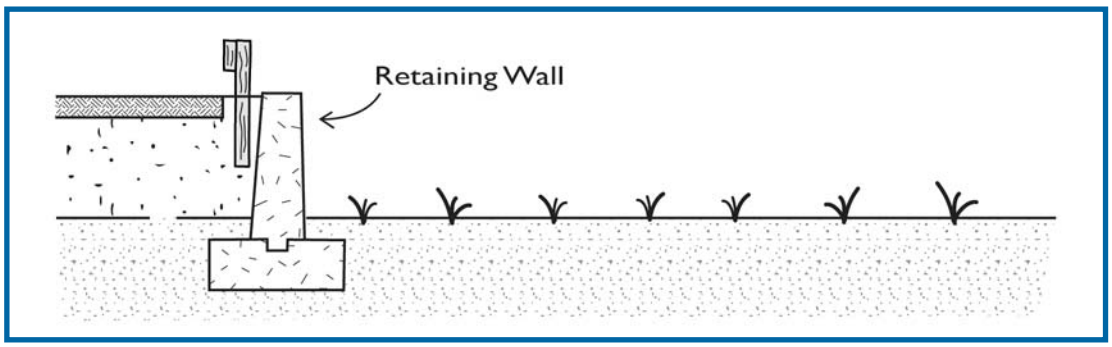
Gabions and Walls

Gabions and Retaining Walls can also be used in your backyard at the Limits of Clearing and Disturbance line to reduce the amount of fill. (See Example 9 in Chapter 4.)



Example 22c

4. Retaining Walls: A final method illustrated below is a retaining wall, which can be stone masonry, boulders, concrete, reinforced earth, or bioengineered materials. Retaining walls can function in place of slopes, thereby eliminating the areas of wetland alteration caused by slopes. However, retaining walls may not be appropriate in many circumstances where their installation will interfere with wildlife travel and dispersal. Fill slopes (2:1) may actually be more beneficial to wetland wildlife.



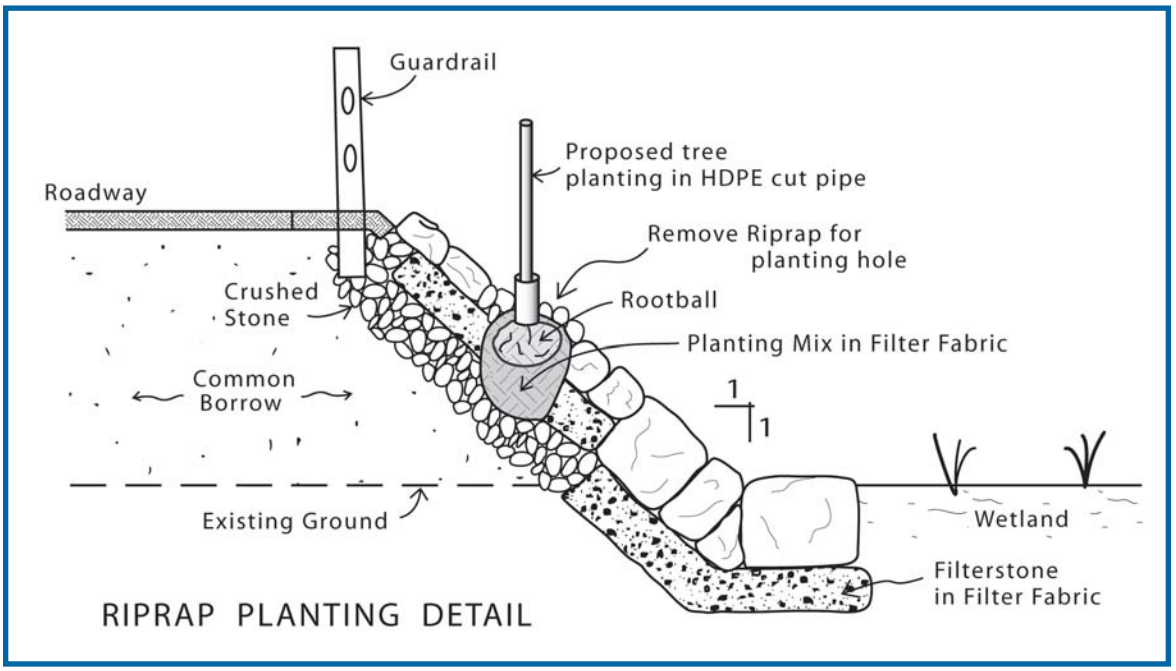
Example 22d

Example 23: **Special Slope Treatments**

The following illustrations show two special slope treatments. These methods, modified from a permitted project, may be used for a new road where the wetland cannot be entirely avoided.

This first example shows a steep 1:1 slope that resulted in minimal wetland fill beyond the roadway. Although the slope cannot be directly vegetated, trees were planted through the use of an HDPE-cut pipe and planting mix in the filter fabric. A guardrail was installed for safety along the side of the road, then the slope was covered with a mixed rock and larger cut rock riprap. This example is good because:

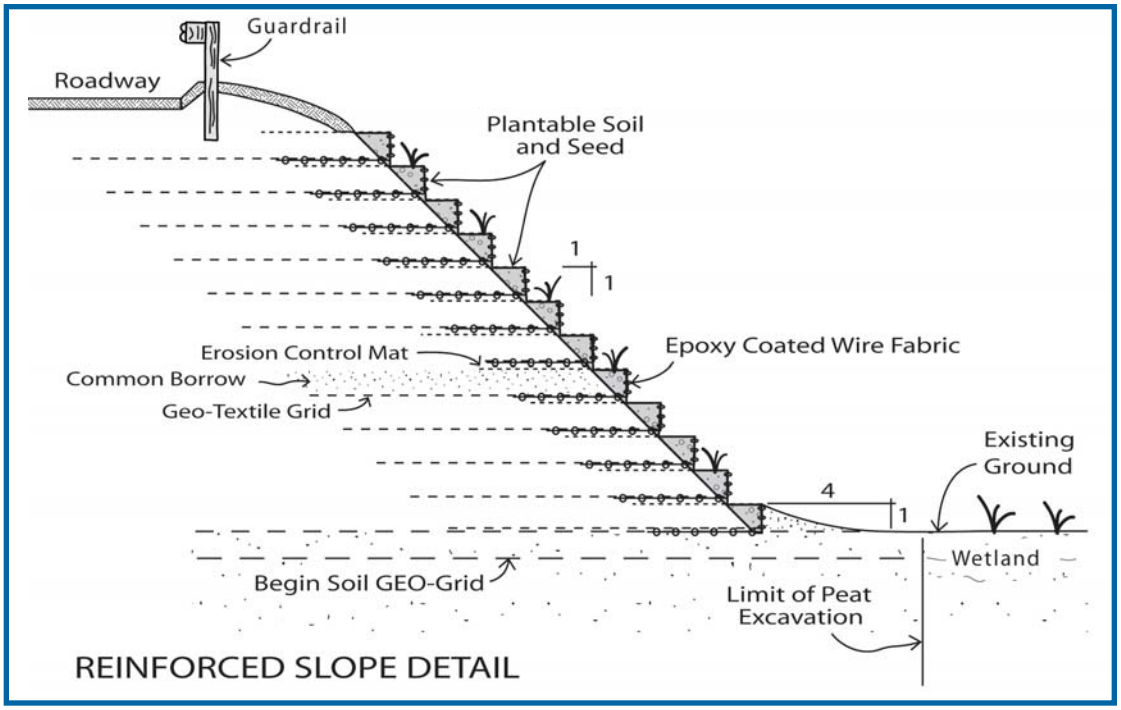
- Fill was reduced.
- A vegetative screen was planted (preferably with more than a single row of plantings).
- Sediment and erosion were controlled through the use of the stones on the slope.



Example 23a

For an even larger roadway, a reinforced slope, such as the one shown at right, is another option. A plastic geotextile grid was used to establish a flat surface, the common borrow was placed on top of this, and an erosion control mat on top in repetitive layers. A wire fabric material was then wrapped around the outside steps that were exposed. This layering system helped to create a steep slope with plantable soil. This example illustrates:

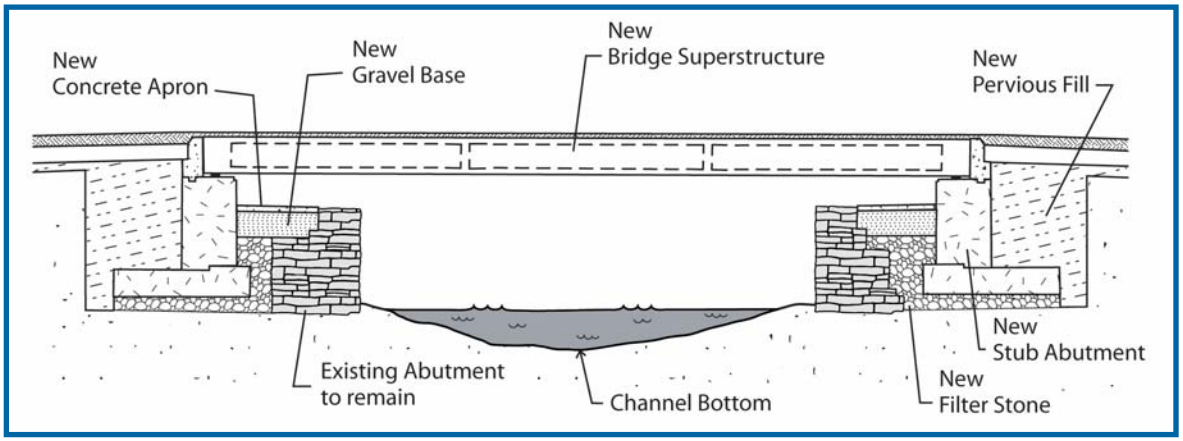
- Minimized wetland fill.
- A fully plantable slope.
- Extensive sediment and erosion control measures through the use of the wire fabric, geotextile grids, and common borrow.



Example 23b

Example 24: Bridge Upgrade

This is an example of a multi-lane bridge that was in disrepair and needed to be upgraded for traffic and safety. While there are many ways to replace or reconstruct bridges, while also protecting wetlands, this example minimizes impacts in specific ways. In some situations it can be beneficial to carefully remove the old abutments and restore the area adjacent to the watercourse.



Example 24

How wetland impacts were minimized:

- ✓ The new abutments were built behind the old ones, allowing for less wetland fill and disturbance.
- ✓ The old abutments remained in place to avoid disturbance of the watercourse.
- ✓ The bridge superstructure was dropped into place from overhead to further avoid disturbance of the watercourse.
- ✓ The bridge design preserved the hydraulic characteristics of the original opening.
- ✓ No further obstruction to the floodway was necessary.
- ✓ The butted prestressed concrete box beams helped prevent bird nesting and roosting.

Construction

- Before widespread clearing and grubbing occurs, sediment and erosion controls must be properly installed.
- Place bales of hay a foot out from the toe of the proposed slope to prevent erosion when they are removed.
- Do not clear any more land than is absolutely necessary for the project.
- Cofferdams, sandbags, silt curtains, or a combination of the three should be installed if working in a watercourse.
- Work in the watercourse should be confined to the low flow season (July - Oct.) if possible.
- Drive sheeting right before beginning work in the area, and remove it immediately afterward to minimize disturbance to the watercourse as much as possible.
- Take advantage of already cleared areas for staging areas and for material and equipment storage that are outside of regulated wetland.

Maintenance

- All drainage structures and the surrounding area must be cleaned and maintained so that they do not clog and become ineffective.
- A responsible party should be named in the plan notes to ensure long-term maintenance and inspection.

References

This list provides additional sources for information on roads and bridges. See Chapter 12 for complete citations arranged by author.

- *Best Management Practices for Routine Roadway Maintenance Activities in New Hampshire* by K.T. Nyhan (2001)
- *Ecological Road-Effect Zone of a Massachusetts Suburban Highway* by R.T.T. Forman and R.D. Deblinger (2000)
- *Estimate of the Area Affected Ecologically by the Road System in the United States* by R.T.T. Forman (2000)
- *Highway Traffic Noise* by Federal Highway Administration (undated)
- *Overview of Transportation Impacts on Wildlife Movement and Populations* by S.D. Jackson (2000)
- *Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities* by S.C. Trombulal and C.A. Frissell (2000)
- *Rhode Island Standard Details* by Rhode Island Department of Transportation (2008)
- *Roads and Their Major Ecological Effects* by R.T.T. Forman and L.E. Alexander (1998)
- *Strategy for Mitigating Highway Impacts on Wildlife* by S.D. Jackson and C.R. Griffin (2000)