Best Management Practices Manual

Utility Maintenance in and Adjacent to Wetlands and Waterbodies in New Hampshire

New Hampshire Department of
Natural & Cultural Resources

March, 2019

Cover image: wetland crossing at Turtle Pond, Concord, NH

Acknowledgements

To the individuals who assisted in the creation of this manual, a special thank you for your time, commitment, and expertise, and for your dedication to the protection of New Hampshire's environment:

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Josh Holden, National Grid

Amy Lamb, NH Department of Resources and Economic Development

Linda Magoon, NHDES

Fred McNeil, City of Manchester Environmental Protection Division

Thomas Murphy, Unitil Service Corp.

Kurt Nelson, Eversource

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The committee extends its appreciation to Dan Rukakoski of Tighe & Bond for the use of their BMP photos and drawings, and to Doug Cygan, New Hampshire Department of Agriculture, for his review and photos of invasive species.

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Chapter 1: Policy and Scope

1.1 Purpose

Utility service providers furnish electricity, gas, sewer, water and other services to their customers. In doing so, utility service providers are required, by law, to inspect, maintain and repair above- and below-ground distribution and transmission assets and right-of-way (ROW) corridors. These corridors often cross natural resource areas, such as wetlands and surface waters, and other jurisdictional areas regulated by the New Hampshire Department of Environmental Services (NHDES). The purpose of this manual is to provide guidance to above- and below-ground utility service providers and their contractors in order to identify appropriate means and methods for maintaining utility assets in or adjacent to jurisdictional areas. See the "Wetlands Best Management Practice Techniques for Avoidance and Minimization" (2018) for utility projects processed under the standard wetlands application (Chapter 13).

1.2 Scope

NHDES administers the state's wetlands and surface water regulations. These regulations, RSA 482-A and New Hampshire Code of Administrative Rules Env-Wt 100 – 900, protect wetlands from unregulated despoliation by requiring a permit for certain activities, (*e.g.*, dredging, filling, excavating, constructing), whether temporary or permanent, in areas under the jurisdiction of RSA 482-A. The Shoreland Water Quality Protection Act, RSA 483-B and New Hampshire Code of Administrative Rules Env-Wq 1400, protect the state's public waters by regulating activities within the protected shoreland.

This manual is intended to address temporary impacts associated with the inspection, maintenance and repair of existing utility assets and ROWs to jurisdictional areas within the context of the NHDES Utility Maintenance Notification (the Notification). By signing and submitting the Notification to NHDES, the applicant is required to follow the best management practices (BMPs) in this manual. For further information as to the size and type of impacts to jurisdictional areas allowed under the Notification, or for further information on the Notification process itself, visit: http://des.nh.gov/organization/divisions/water/wetlands/index.htm.

This manual describes BMPs for protecting jurisdictional areas when conducting maintenance activities within existing utility ROWs. The BMPs include a wide range of recommended techniques used before, during and after maintenance operations. This manual will allow utility service providers to identify wetlands, sensitive areas, work practices, limitations and activities relevant to work in and adjacent to NHDES jurisdictional areas. This manual addresses work areas, maintenance of access ways, crossings of wetlands, streams and waterbodies, and work in the vicinity of jurisdictional areas necessary for routine maintenance of utility corridors and utility structures.

A standard wetlands or shoreland water quality protection act permit may be needed to conduct the following activities in jurisdictional areas:

- Establishing new access roads.
- Installing permanent crossings of streams and wetlands.
- Constructing new utility corridors or ROWs.
- Installing new utility assets within existing corridors or ROWs.

This manual is divided into two sections: Project Planning and Operational Activities. The Project Planning section (Chapter 2) recognizes that protecting natural resources begins in the early planning stages – long before the actual maintenance activity begins. The Operational Activities Section (Chapter 3) focuses on specific, on-site BMPs. These BMPs primarily address the issue of disturbance and restoration of soil, water and vegetation that may occur during vegetation clearing and maintenance within utility ROWs (both routine and emergency).

Chapter 2: Project Planning

A critical consideration prior to starting a maintenance activity in NHDES-jurisdictional areas is good planning. Planning will help reduce costs, increase efficiency and protect jurisdictional areas. Maintenance projects must follow clear environmental performance standards, which is why these BMPs have been compiled. The NHDES Utility Maintenance Notification process does not apply to new construction but is intended for routine maintenance activities such as in-kind utility pole replacement, guy wire replacement, re-conductoring (transmission and distribution line replacement) vegetation management, and excavation associated with maintenance of underground utilities, including gas, electric, sewer and water lines.

2.1 Fundamental Planning Practices

Prior to undertaking maintenance activities, take measures to avoid and minimize impacts to wetlands. These measures include:

- **Avoidance:** Avoid the wetland if at all possible. However, access issues, poor seasonal conditions, property rights constraints, and/or equipment requirements/constraints may not make avoidance possible. See Chapter 2.2 – Avoidance and Minimization.
- **Minimize the disturbed area:** Limit the area of wetland impacts by accessing project areas through the narrowest portion of wetlands. Limit tracking of vehicles to use one pass in and out when possible, and install temporary matting or other BMPs to limit disturbed areas.
- **Access:** Equipment and general traffic to and from a work site on a ROW must use the established access way when one exists and is readily passable.
- **Pre-Maintenance Meeting:** Conduct a pre-construction meeting between utility service providers and their subcontractors prior to the start of any project. Include in the discussion what is known of the ROW, valuable resource areas, and potential problem areas for which each utility will develop and maintain a checklist. Where it is known that wetlands or streams will be crossed, include expected methods for crossing in the discussion and how to report any problems.
- **Vegetation Management:** Where possible, use selective vegetation management methods to target incompatible species (*e.g.,* growing tree species) for removal while preserving native compatible species and maintaining maximum ground cover.
- **Fueling, Fuel Storage and Dust Control Materials:** Store fuel, oil, hydraulic fluids and dust control substances at least 100 feet away from wetlands or waterbodies. Refuel over-the-road vehicles at least 100’ away from wetlands or waterbodies. Heavy construction equipment may be refueled on the work site only outside wetlands and no closer than 100 feet from watercourses. Place all pumps within secondary containment. Provide a fuel spill control plan and equipment on the site and follow appropriate cleanup and reporting procedures. Inspect machinery for leaks on a daily basis. Fuel vehicles in areas where an accidental spill will not reach a wetland: 100 feet or more from wetlands or surface waters. If equipment cannot be re-located away from wetlands, use drip pans or other secondary containment to avoid spills in jurisdictional areas. Utility service providers and their subcontractors are required to carry spill kits in case of leaks or spills that may impact wetlands.

For assistance with spills of hazardous materials, call NHDES Monday-Friday, 8 AM-4 PM at (603) 271- 3899. Other times, call the New Hampshire State Police at (603) 223-4381.

- **Waste Products:** Certain waste products and miscellaneous debris resulting from maintenance activities require special attention to prevent harm to people, wildlife, water resources or vegetation. At a minimum, take all required precautions to remove and manage these wastes in accordance with the appropriate rules and regulations.
- **Communications:** In the event that a situation arises that is outside the scope of this manual, contact the utility service provider immediately.

2.2 Avoidance and Minimization

Take measures to avoid impacts to wetlands, waterways and sensitive areas. For standard application Utility projects, refer to Wetlands Best Management Techniques for Avoidance and Minimization (Chapter 13).

Consider alternate access routes or staging areas. If avoidance is not possible, use the least-impacting alternative as follows:

- Minimize the width of typical access roads through wetlands (wider than 16 feet is generally unnecessary).
- Use low-impact tracked vehicles and/or vehicles with low ground pressure when driving through wetlands.
- Coordinate the timing of work to cause the least impacts, such as during the low-flow period (July 15 – October 1), when water/ground is frozen or after the spring songbird nesting season.
- Use swamp, timber or similar mats in wetlands to minimize soil disturbance, ground pressure and rutting when work needs to occur during non-frozen ground conditions.
- Use previously-disturbed jurisdictional areas.
- Conduct work manually, whenever possible.
- Maintain stockpile locations outside of jurisdictional areas or include containment of stockpile materials that can be completely removed following maintenance operations.

Auger dredge material stockpile located within a container located on timber mats at Turtle Town Pond, Concord, NH. Credit: Karl Benedict.

The following examples provide guidance for the location of access ways and how to cross wetlands where no apparent access way is available, and buried utility structures will not be impacted.

Figure 1: Avoidance (Source: National Grid)

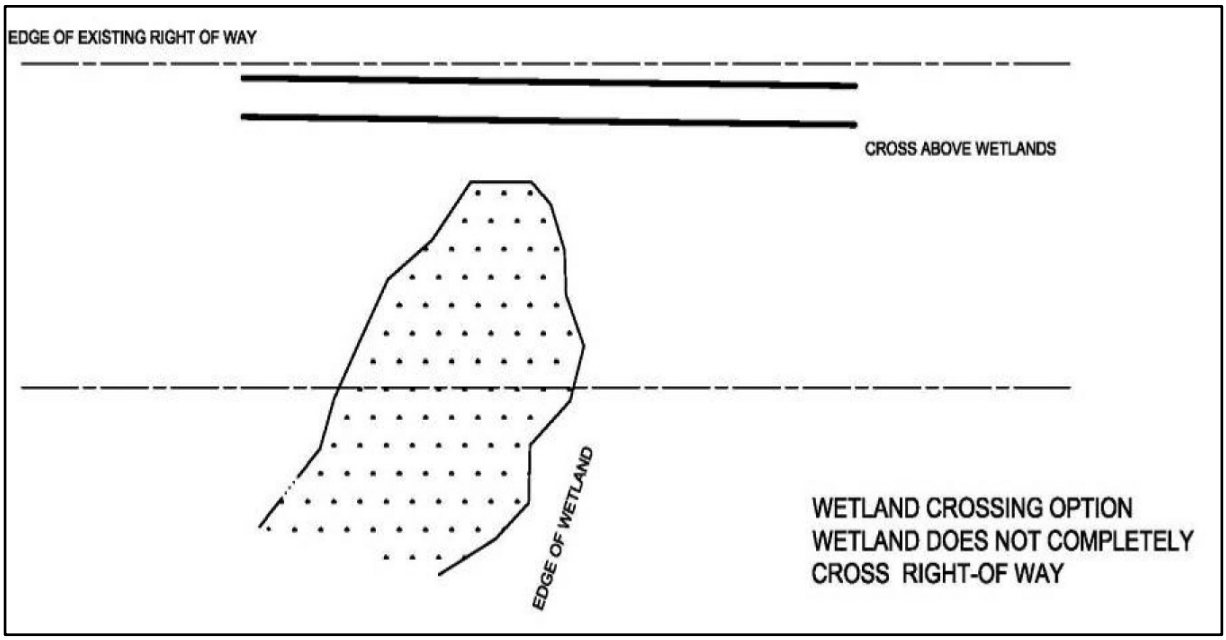


Figure 2: Minimization – Crossing at Narrowest Location (Source: National Grid)

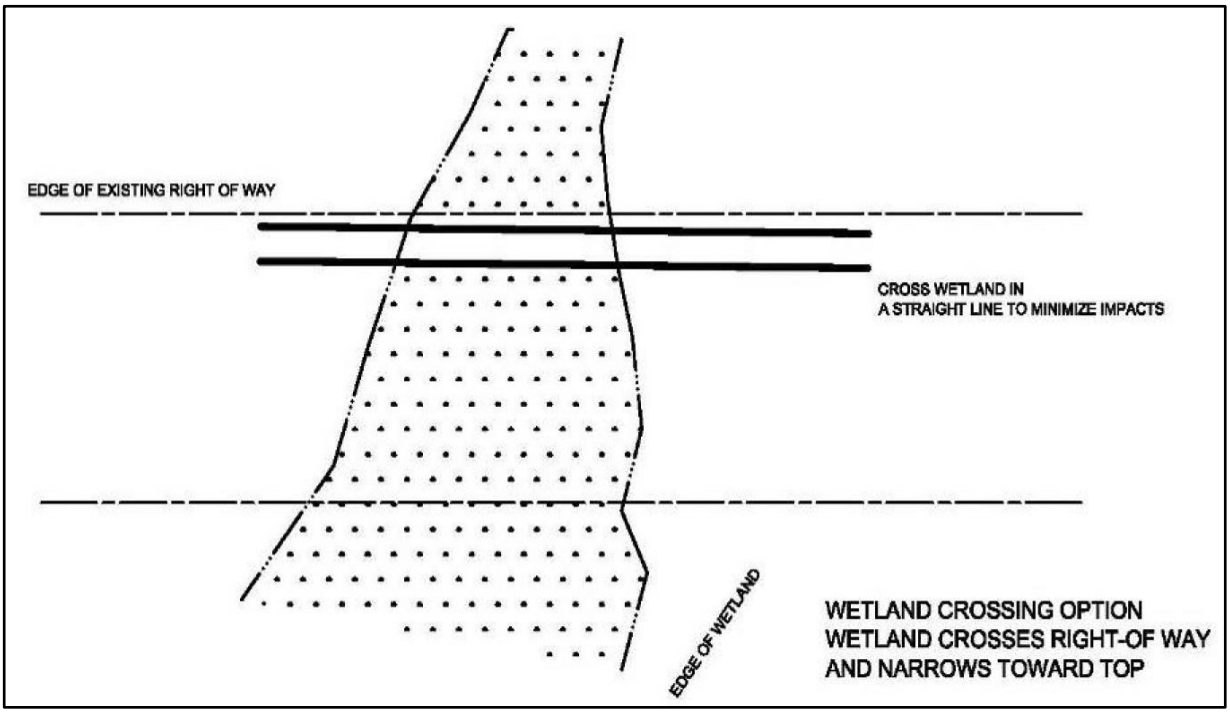
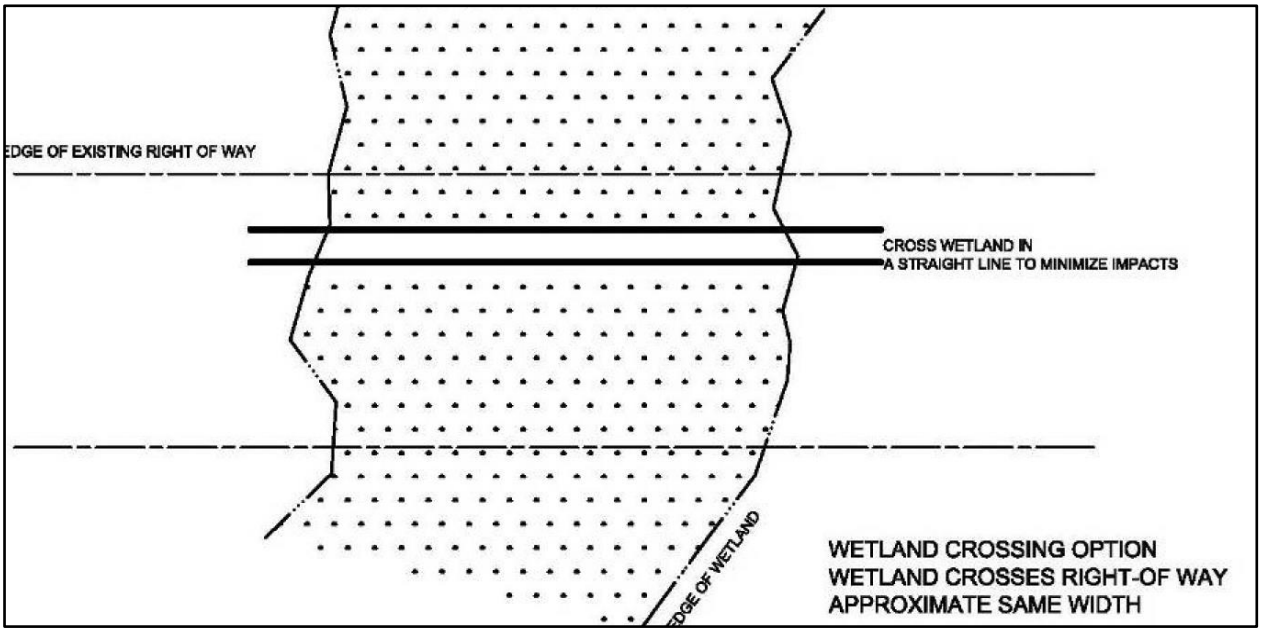


Figure 3: Minimization – Crossing Uniform Width Wetlands in a Straight Line (Source: National Grid)



2.3 Timing of Work

The timing of work is an important consideration in planning to avoid potential impacts.

2.3.1 Work During Frozen Conditions

Activities conducted once wetland areas are frozen can minimize rutting and other impacts to the surrounding environment. Work during this time also generally reduces disturbance of aquatic and terrestrial wildlife movement by avoiding sensitive breeding and nesting seasons.

2.3.2 Work During the "Low Flow" Period

The US Army Corps of Engineers regulatory low-flow period is designated as July 15 through October 1. Conducting work during the low-flow period can reduce impacts to surface water and generally avoids spawning and breeding seasons of aquatic organisms. If the water is above normal seasonal levels, adjustments to work activities and methods are required. In general, in-stream work should occur during low-flow conditions and should be scheduled so that it doesn't coincide with fish migrations, spawning and egg incubation period. Consult with local fish or water resource biologists in order to plan for the best times to avoid fish mating and migration activities in a particular stream. See the New Hampshire Fish Survey Map for documented locations of fish survey records.

2.4 Pre-Maintenance Meetings

Pre-maintenance meetings are typically held prior to the commencement of all work to evaluate sensitive environmental areas, appoint responsible parties, discuss timing of work and further consider options to avoid and/or minimize impacts to sensitive areas. These meetings can occur on- or off-site and should include all the willing and available stakeholders (*e.g.*, utility employees, contractors, consultants, inspectors/monitors and regulatory personnel). It is strongly encouraged, if possible, that a

field review at the job site or along the ROW be conducted with the contractor performing the work to review existing conditions, proposed access routes, construction methodologies and permit conditions before work activities commence.

2.4.1 Pre-Construction Briefings

Daily or otherwise routine meetings conducted on-site with the work crew throughout the duration of the work. These meetings are a way of keeping everyone up-to-date, confirming there is consensus on work methods and responsibilities, and ensuring that tasks are being fulfilled with as little impact to the environment as possible.

2.5 Use of Access Ways for Maintenance

Access ways are used on ROWs where activities involving maintenance occur at a regular interval and good access is essential. The construction of new and permanent access ways for any maintenance project is beyond the scope of this BMP manual and the notification process and requires separate and additional permitting.

Use established access ways to reach a particular portion of ROW whenever possible. Established access ways have often been developed to prevent degradation of the utility corridor and protection of structures, and must be used and maintained in accordance with the measures outlined within these BMPs**.** Use existing access ways to the fullest extent possible.

Alternate Access

Consider alternate forms of access for project areas containing sensitive resources or for those locations that are difficult to access with conventional maintenance equipment.

2.5.1 Access

When possible, access work areas by foot through terrestrial areas and by boat through open water or ponded areas. It is also possible that crews may need to cross frozen ponds or swamps on foot during winter. Smaller projects, such as repair of individual structures, or parts of structures, that do not categorically require the use of heavy machinery, should be accessed on foot to the greatest extent practicable.

2.5.2 Use of Overhead/Aerial Access

Using overhead or aerial equipment can be expensive and is not always feasible, but it may be appropriate in some situations in order to get vehicles, equipment or personnel to a site that may otherwise be very difficult to access. The use of overhead and/or aerial equipment may be beneficial for work in areas where larger water bodies, deep crevices or mountainous areas hinder ground access.

2.6 Operating Adjacent to Wetlands and Waterbodies

Work adjacent to wetlands and waterbodies, but not necessarily in wetlands and waterbodies, can present potential environmental impacts. Care must be taken when working in these areas in order to protect these existing resource buffers.

To minimize erosion potential, preserve low-growing vegetation adjacent to wetlands or waterbodies to the fullest extent possible. Stumps and rocks must not be removed unless required for safety reasons,

and excavations, fills or grading done adjacent to jurisdictional areas should be minimized to that required for a safe work area.

When possible, prevent mixing of topsoil with subsoil during any trenching or grading activities. In areas of deep topsoil, segregate the top 12 inches of topsoil; in areas of thin topsoil make every effort to segregate the entire topsoil layer. Maintain the segregation of topsoil from subsoil through the duration of the maintenance activity. Excess sediment disposal from any activity within the controlled area must be removed and placed at an upland site, and suitably contained to prevent erosion and/or transport to a wetland or waterbody.

Install temporary erosion controls immediately prior to initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction, on a daily basis and reinstalled as necessary until replaced by permanent erosion controls or restoration is complete. Begin restoration immediately following completion of maintenance activity. Complete final grading, topsoil replacement and installation of any permanent erosion control structures within three days. If seasonal or other weather conditions prevent compliance with final cleanup, maintain temporary erosion controls until conditions allow completion. Do not park equipment adjacent to wetlands or watercourses unless required for the maintenance activity. Limit equipment operation adjacent to wetlands and watercourses. Do not re-fuel in wetlands or surface waters.

2.6.1 Crossing Wetlands

Because ROWs are linear and require year-round routine maintenance, crossing of wetlands is often unavoidable. These utility maintenance activities are essential good management practices for providing reliable service.

In deciding if, where and how to cross a wetland, consider the following:

- There should be no need to cross a wetland if the area can be accessed through another part of the ROW. If this is not possible, then the appropriate method of crossing the wetland must be determined (See Chapter 3 – Best Management Practices for descriptions of potential appropriate methods).
- What is the location of buried utility structures, such as cables and pipelines, that may be impacted by the crossing?
- Can the wetland be crossed without disturbing the soils or rutting the wetland? Tracked machines have a lower ground pressure than machines with tires. Crossing on existing woody debris or stones will help minimize soil disturbance.
- To minimize soil disturbance, cross wetlands in the dry or during low-flow or frozen conditions.
- Regrade and restore ruts within three days of work completion.
- To avoid rutting, use temporary matting. The mat can be a corduroy mat made of brush or a manufactured product (see BMPs 8, 9, 10, or 11).
- Once the area has been restored, any areas greater than 100 square feet of disturbance should be over-seeded with an appropriate seed mix (see BMP 17 – Permanent Vegetation).

2.7 Equipment Selection and Usage

The following equipment selections and usage directions will help to minimize impact to wetlands:

2.7.1 Low Ground Pressure Equipment

Use equipment that reduces ground pressure to minimize impacts to sensitive areas. Employing equipment with wide tires, rubberized tracks and low ground pressure (< 3 psi) can help minimize soil compaction.

2.7.2 Wide Tires

Increasing tire width will increase traveling surface area and therefore reduce the amount of ground compaction that the equipment will cause. Ultimately, this will reduce rutting, and allow for easier maneuvering of the vehicle. However, wide tires may be costly and will require a wider travel area.

2.7.3 Rubberized Tracks

Equipment with rubberized tracks spreads the weight of the vehicle over a much larger surface, reducing ground pressure and enabling the vehicle to move more freely through wet substrates. Each track can be between 1.5 feet and 3 feet wide, length depending on the length of the vehicle. This can greatly reduce rutting and allow the vehicle to move with less difficulty through wet substrates.

2.7.4 Lightweight Equipment

Impact in a wetland area can be lessened by reducing the size of equipment used in sensitive areas. This reduces the amount of pressure to the travel surface as well as the necessary width of access ways.

2.8 Stream Crossings

Properly installed and sized stream crossings can preserve and restore stream values and functions, enhance public safety, and minimize impacts to aquatic organisms and water quality.

Bridges that span the stream channel generally have the least impact on stream habitat and aquatic organisms. Poorly designed, installed or maintained crossings can change the physical characteristics of a stream in terms of rate of flow, depth and channel shape.

There are a number of BMPs that can be selected to minimize impacts to streams and their banks. Each situation should take the current site and project needs into consideration in order to select the method that will incur the fewest secondary impacts and be most cost effective. Additional erosion and sedimentation controls may be required in conjunction with the following stream crossing BMPs to protect sensitive areas. Limit clearing of existing vegetation along stream banks to be crossed.

Temporary stream crossings are allowed under the utility notification process as long as appropriate BMPs are implemented. Examples of temporary stream crossing devices include a poled ford, spanning the stream with a temporary mat or equipment bridge, or installing a temporary culvert.

A permanent stream crossing requires a wetlands permit from NHDES. Contact NHDES at (603) 271-2147 or visit www.des.nh.gov for more information.

2.9 Protected Plants and Wildlife

The Native Plant Protection Act (RSA 217-A) and the Endangered Species Conservation Act (RSA 212-A) instruct state agencies, to the extent possible, to avoid jeopardizing threatened and endangered species and their habitats as well as exemplary natural communities and systems (sensitive natural features). The New Hampshire Natural Heritage Bureau (NHB) administers the Native Plant Protection Act including collecting and analyzing data on the status, location and distribution of rare or declining native plants and exemplary natural communities, as well as developing and implementing measures for their protection, conservation, enhancement and management. In cooperation with the New Hampshire Fish & Game's (NHFG) Nongame and Endangered Wildlife Program, which administers the Endangered Species Conservation Act, NHB also tracks and distributes information on at-risk animal species. To implement these Acts, NHDES and other state and federal agencies require an environmental review by NHB as part of the permitting and notification process, including use of the NHDES Utility Maintenance Notification.

2.9.1 Use of the NHB Data Check Tool

The process of performing a NHB review may be initiated by using the NHB DataCheck tool found at https://www2.des.state.nh.us/nhb_datacheck/. To submit a hard-copy form, contact the Ecological Information Specialist at NHB at (603) 271-2215. For long, linear utility maintenance projects, such as state-wide vegetation maintenance in transmission corridors, a utility may elect to engage in a Data Sharing Agreement (DSA) with NHB. A DSA enables a utility to obtain digital data from NHB, to be used for a designated period, usually one year. NHB provides all known sensitive natural feature records within ¼-mile of the proposed work areas, and NHB/NHFG provide species and location-specific recommendations for avoiding and/or minimizing impacts to any species in the vicinity of the work areas.

It is critical for utility staff to consult with NHB and/or NHFG when a sensitive natural resource is known to occur in the proximity of proposed management/maintenance activities. Impacts can often be avoided once the locations of rare species and natural communities/systems are known in relation to the project area. By coordinating with NHB early in the planning process, any design changes or time-of-year considerations can be incorporated into the project. If rare species are in the vicinity of work areas, it is imperative to educate contractors about their location and any BMPs provided by NHB and/or NHFG for avoiding/minimizing impacts. After consulting with NHB and/or NHFG, refer to the general BMPs for working in the vicinity of rare plants, wildlife and natural communities, found in Chapter 3, BMP 1 – Consulting with NHB and NHFG.

2.10 Invasive Plant Species

Invasive plant species are non-native species that invade natural communities and develop self-sustaining populations. The start of many infestations is often tied to a disturbance, and once established, the invasive species spread into undisturbed landscapes. They out-compete native species, disrupting ecological processes, and cause a loss of economic value or output. **It is illegal to transport, to introduce, and to propagate state-listed invasive species.** Cleaning, draining and drying equipment between sites is mandated for aquatic invasives, and recommended for terrestrial equipment. Power washing of equipment and gear between sites is recommended, where feasible. At a minimum, visual

inspection and hand removal of any plants, seeds, propagules, insects, mud, etc. is encouraged to maintain compliance with state laws and rules.

The linear nature of utility maintenance activities in vegetated corridors entails that a range of vegetative communities may be encountered by equipment, vehicles and personnel during the course of a single maintenance project or when mobilizing from one project site to another. It is especially important to follow best management practices when mobilizing equipment, vehicles and personnel from an area infested with invasive species to an un-infested area. See Chapter 3, BMP 2 – Invasive Species Management.

2.10.1 Project Planning – Invasive Plant Species

Prior to starting utility maintenance work, the project area should be evaluated to determine:

- Do invasive plant species exist in the project area?
- Do project activities have the potential to contact invasive plants or disturb soils in a manner that could potentially spread live plant parts or viable seeds?
- If invasive species are not present, or if it is not possible or not feasible to identify invasive plant species within the project area, follow the best management practices found in BMP 2 to minimize the disturbance and spread of soil and/or plant matter.

2.10.2 Species Identification

It is imperative that workers who will be working or operating equipment in areas that may contain invasive plant species be trained in the identification and modes of dispersal of common, highly-prolific aquatic and terrestrial invasive plant species commonly found along road sides and in utility ROWs. **See Appendix B for identification of the more common invasive plants in New Hampshire.**

2.11 Restoration of Disturbed Areas

The Wetlands Utility Maintenance Notification is applicable for projects that include temporary wetland impacts only. If an area has been disturbed, it will require a level of restoration. Areas of temporary impact should be regraded to pre-construction conditions and planted with native plant species similar to those located within the wetland prior to impact.

2.11.1 Wetland Restoration

In the event that rutting or disturbance has occurred within wetland areas, implement the following procedures:

- **Impacts with ruts equal to or less than 8 inches:** After the machine has crossed for the last time, smooth the area either by machine or hand rakes. In general, if the restoration occurs within the same day as the initial disturbance, it is expected that the vegetation will not be significantly disturbed and should regenerate with no other action.
- **Impacts with ruts greater than 8 inches:** This area may also need additional or more substantial regrading. To further augment the restoration, apply seed and mulch to stabilize the area.

2.11.2 Upland Restoration

- If exposed soils present sedimentation issues to adjacent wetlands and waterbodies, provide permanent soil protection.
- On steep slopes, install erosion control blankets as needed. See BMP 15.
- If needed, replace topsoil, seed and mulch.
- Restore access routes and other areas as soon as possible after the project is complete. This includes the reestablishment of water bars or other BMPs to control erosion of the access way as well as the removal of temporary BMPs.
- Perform access road stabilization, temporary or permanent seeding of disturbed areas, seed selection, application rate, timing and method in accordance with BMP 17 .

2.11.3 Regrading

In the event that regrading of either wetland or upland areas is necessary, use one of the following procedures:

- **Hand Methods:** Shovels, rakes and hand tampers can be used to restore rutting/compaction to its pre-existing grade.
- **Machine Methods:** Tracked machines, buckets or backhoes, or other appropriate machines can be used if they do not create additional rutting or compaction of soils.

2.12 Inspection and Maintenance

Inspect work areas where BMPs in Chapter 3 have been implemented. BMPs employed are temporary in nature and require frequent inspection and maintenance to remain effective. Repairs must be performed immediately when a control measure is found to be deficient.

Chapter 3: Best Management Practices

3.1 Key Actions for Successful Erosion and Sediment Control

Successful erosion and sediment control depends on clear coordination of construction activities and a commitment by all project and construction staff to work responsibly to minimize site disturbances and prevent degradation of water quality. Preventing erosion and minimizing sedimentation requires proper site planning, proper application and installation of the appropriate BMPs, and timely inspection and maintenance of BMPs. These measures, when applied pre-and post-construction, will result in minimal degradation to the environment and a cost savings to the utility.

3.2 Considerations

- Plan ahead and phase project to address stormwater issues and construction implementation throughout the project.
- Mark soil disturbance limits on the site before starting construction.
- Identify nearby sensitive areas. See Chapter 2, Section 2.9 for more information.
- Match erosion control strategies with construction activities.
- Communicate changes in construction sequence and resulting erosion control strategies.
- Monitor weather and plan for severe weather events.
- Recognize the potential impact of frozen soils or frost during rain events (½-inch in 24 hours) and spring thaw, particularly in “cut” areas.
- Install erosion and sediment controls prior to disturbing soils.
- Understand the characteristics of site soils (i.e., potential to create off-site turbidity) and limit the amount of soil disturbance at any one time.
- Divert, disperse, and direct water run-off away from construction activity areas and toward stabilized areas.
- Immediately stabilize exposed steep slopes, swales and channels.
- Inspect and repair erosion controls and sediment trapping measures before and after every storm.
- Stabilize all disturbed soils before winter.
- Install permanent erosion controls upon completion of work.
- Remove temporary erosion controls when soils are permanently stabilized.
- Divert, disperse and direct treated stormwater runoff from construction areas away from wetlands and streams to stabilized natural upland areas wherever possible. Management of off-site discharges should be performed in a manner to avoid creating localized flooding or impacts to adjacent properties.
- Stream crossings must be temporary and limited to a maximum installation timeframe of one year.

Table 1 identifies the BMPs by number and measure. Descriptions, including installation, inspection and maintenance, follow each BMP.

Table 1: Construction Sequencing and BMP Selection Guide

Step Number	Description	What to Do	BMP Options
01	**Before Construction**	Project Planning – avoidance and minimization, identifying wetlands, invasive species, sensitive areas, timing of operation, pre-construction briefings.	Chapter 2 BMPs 1 and 2 Appendix A Appendix B
02	**Site Access Areas** (Entrances, Roadways and Parking Areas)	Stabilize site exits and access roads, if applicable, prior to earth disturbance.	BMPs 3, 8, 9, 10, 11, 12, 13
03	**Perimeter Sediment Control**	Install perimeter sediment controls (silt fence, fiber rolls, etc.) as applicable prior to land disturbing activities. Install additional runoff control measures during construction as needed.	BMP 4, 5, 6, 7, 14, 15, 16, 17
04	**Wetland Crossings**	Install appropriate BMPs to minimize erosion and sedimentation.	BMP 4, 5, 6, 7, 8, 9
05	**Stream Crossings**	Install appropriate BMPs to protect water quality.	BMP 9, 10, 11, 12, 13, 14
06	**Inspect and Maintain Erosion and Sediment Controls**	Inspect BMPs before and after rain events (½-inch in 24 hours), and maintain and re-install as needed.	BMP 3-17
07	**Construction and Paving** (Install Utilities, Paving)	Implement applicable control practices as work takes place.	BMP 3, 4, 5, 6, 7
08	**Final Stabilization and Restoration**	Stabilize open areas as applicable. Remove temporary control measures and install final stabilization controls appropriately (permanent seeding, mulching).	BMP 15, 16, 17

Best Management Practice 1: Consulting with Natural Heritage Bureau and New Hampshire Fish and Game Department

Description
The process of performing a NHB review may be initiated by using the NHB DataCheck tool found at https://www2.des.state.nh.us/nhb_datacheck/. Please refer to this section if consultation with NHB has indicated the presence of one or more of the following sensitive natural features within the proposed work area:

- Threatened or endangered plant species.
- Threatened or endangered animal species.
- Exemplary natural communities.
- Exemplary natural systems.

The following generalized BMPs apply when working in a sensitive area, as identified by NHB or the NHFG Nongame and Endangered Wildlife Program. Following BMP guidelines will help ensure that impacts to these at-risk species and natural communities/systems will be avoided and minimized to the greatest extent possible. **In addition**, field crews should follow any and all specific recommendations provided during NHB/NHFG reviews. (Refer to Chapter 2 of this BMP manual for more information about obtaining a NHB review.)

NHB BMP 1A: Vegetation Maintenance (Mowing, Side Trimming)

- **Seasonal Avoidance:** Conduct field work during times of the year when the sensitive species and/or habitat are dormant and/or seasonal conditions minimize disturbance of the species and/or habitat.
- **Threatened or Endangered Species within the Right-of-Way**: Conduct vegetation maintenance outside of the growing season or after a plant has produced mature fruit, or outside of the sensitive life-cycle period of sensitive wildlife species, as the preferred way to avoid and minimize impacts. (Refer to NHB recommendations for species-specific dates.)
- **Exemplary Wetland Communities and Systems:** Conduct vegetation maintenance during frozen-ground conditions to avoid and minimize impacts.

If seasonal avoidance is not possible:

- Flag rare plant populations within the ROW prior to conducting work so that direct impacts can be avoided.
- Hand cutting may need to be employed in the vicinity of rare plant species to minimize impacts.
- Educate on-site personnel of the potential to encounter rare or endangered wildlife and the protocol if such an encounter occurs
- Note that indiscriminate application of herbicides can be harmful to rare species and exemplary natural communities/systems. Avoid using herbicides in areas identified as sensitive by NHB and/or NHFG whenever possible; mowing outside of the growing season or hand cutting (rather than herbicides) is most often preferable in these areas.

NHB BMP 1B: Access

- Accessing sensitive project areas during frozen-ground conditions is the preferred way to avoid and minimize impacts to exemplary wetland communities/systems.
- Consider alternate forms of access to a site for project areas containing sensitive resources, including threatened and endangered species and exemplary natural communities/systems. For example, if a site may be accessed from two different directions, select the approach that is least likely to change local hydrology or cause direct damage (plan routes to avoid a local concentration of rare plant species).
- Avoid using timber matting on top of rare plants during the growing season and flag any known rare plant populations prior to applying matting.

NHB BMP 1C: Restoration

- If project-related soil disturbance occurs in the vicinity of rare plants or exemplary natural communities/systems, the disturbed area should be allowed to revegetate naturally to prevent competition from introduced, fast-growing or invasive species. (See BMP 2 – Invasive Species Management)
- Any seed mix proposed to be used within the ROW, especially near rare plants and exemplary natural communities/systems, should contain only non-aggressive and non-invasive plant species. Any species that form dense mats, would shade out, grow on top of, or otherwise out-compete the native vegetation within the sensitive area should not be used. (See BMP 17 – Permanent Vegetation)
- Fertilizers and pH balancers should not be used in areas with rare plants or exemplary natural communities/systems, as these sensitive natural features often have unique soil chemistry requirements. Changing the soil chemistry of sensitive areas can eliminate populations of rare plant species or cause a transition to a different plant community.
- Any mulch used in the vicinity of rare plants or exemplary natural communities/systems should be free of viable seeds. Contact NHB before applying mulch in these areas.

NHB BMP 1D: Invasive Species

- Take particular care to avoid introducing invasive plant species to areas with rare plants or exemplary natural communities/systems.
- Ensure that any equipment, tools, footwear and clothing are clean prior to entering a sensitive area. (See BMP 2 – Invasive Species Management)

NHFG BMP 1E: Matting and Blanket Selection

- Avoid using matting or blankets that include a welded or woven plastic component (including those that are photodegradable) as they are a source of entanglement and mortality for birds, snakes and other wildlife, including species listed as state threatened or endangered (RSA 212-A, Fis 1000).

Best Management Practice 2: Invasive Species Management

Description

Workers who will be operating equipment in areas that may contain invasive plant species should be trained in the identification and modes of dispersal and spread of common, highly-prolific terrestrial invasive plant species that are commonly found along roadsides and in utility ROWs.

Avoidance and Minimization

- If possible, avoid or minimize contact with invasive species by physically avoiding locations with invasive plant infestations.
- In locations where invasive infestations exist, design the project to minimize contact with invasive species by choosing access routes and staging areas that are outside areas of infestation.
- Sequence work to the extent possible such that work using clean equipment and materials proceeds in un-infested areas prior to moving into infested areas and not vice versa.
- If it is unknown whether invasive species exist, design the project to limit travel across vegetated areas to the extent possible.
- When possible, time work under conditions that minimize the risk of spread, (frozen ground, snow cover, absence of seeds or propagules).

Vegetation Management

- Control of invasive plants by chemical means should be performed by a licensed applicator in accordance with the New Hampshire Department of Agriculture, Markets and Food, Division of Pesticide Control regulations and permitting requirements.
- Mechanical mowing of vegetation should adhere to principals of avoidance and minimization presented in Chapter 2.
- If woody vegetation is removed from a project site, transport it in compliance with invasive pest or disease quarantine zones established by the New Hampshire Department of Agriculture, Markets and Food (http://agriculture.nh.gov/divisions/plant-industry/index.htm).
- Any restoration seed mixes used should be free of any species on New Hampshire's Prohibited Invasive Plant Species List.

Soil Disturbance and Management

- Where possible, avoid soil disturbance as it may increase the chances of colonization by invasive seeds or propagules.
- Stabilize disturbed soils as soon as possible by seeding and/or using mulch, straw or gravel that is free of invasive plant material.
- Where possible, when excavating soils, top layers of soil containing plant material and roots should be segregated from sub soils and left on site.
- Cover soil and other material containing invasive plant material during transport.
- Do not transport fill and material containing invasive plant material onto a project site.
- If fill and materials containing invasive species must be transported off site, do not reuse, stockpile or dispose of these materials in such a manner that could promote the spread of invasive plants.

Decontamination Procedures

When utility maintenance activities require work in areas infested with invasive species, implement decontamination procedures per NHDOT's Best Management Practices for Roadside Invasive Plants manual.

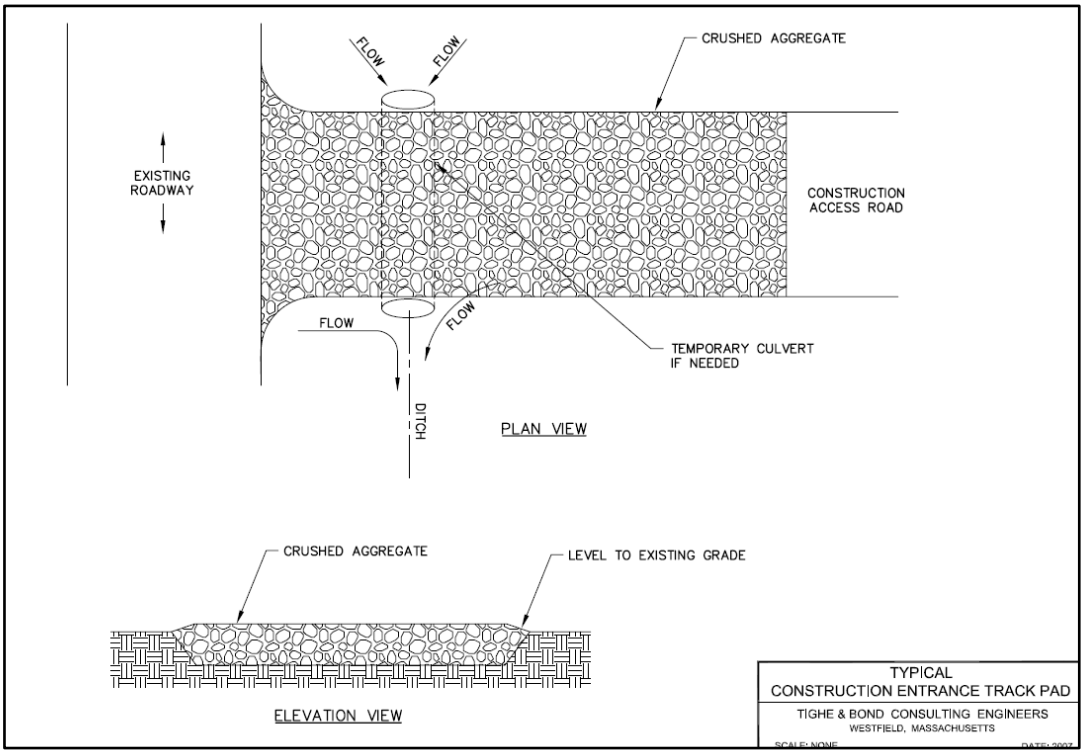
In order to minimize the spread of invasive plant seeds and material:

- Clean vehicles, equipment, materials, gear, footwear or clothing of all visible soil and plant material on site in the infested area, or as near as practical to the infested area, prior to leaving the project site.
- Do not decontaminate equipment next to streams or water bodies that could potentially transport seeds or propagules.
- Decontaminate equipment and materials that may be contaminated by aquatic plant materials adjacent to the surface water they were exposed to prior to use in another surface water body.
- Do not transport water withdrawn from a surface water body and discharge it to another water body.

Methods of Cleaning

- Use a brush, broom or hand tools to manually clean.
- Clean debris off equipment such as construction matting by shaking or dropping mats in a controlled manner to dislodge attached soil and debris.
- Compressed air.
- Containment must be in compliance with wastewater discharge regulations when using low-or high-pressure wash stations.

Best Management Practice 3: Temporary Construction Exit



Description
A temporary stabilized construction exit consists of a pad of stone aggregate placed on a geotextile filter fabric, located at any point where traffic will be leaving a construction site to an existing access road way or other paved surface. Its purpose is to reduce or eliminate the tracking of sediment onto public roads by construction vehicles. This helps protect receiving waters from sediment carried by stormwater runoff from public roads.

Only construction traffic leaving the site is required to use the temporary stabilized exit. Consider providing a separate, unprotected entrance for traffic entering the site. This will increase the longevity of the stabilized exit by reducing heavy loads and the total traffic over the device.

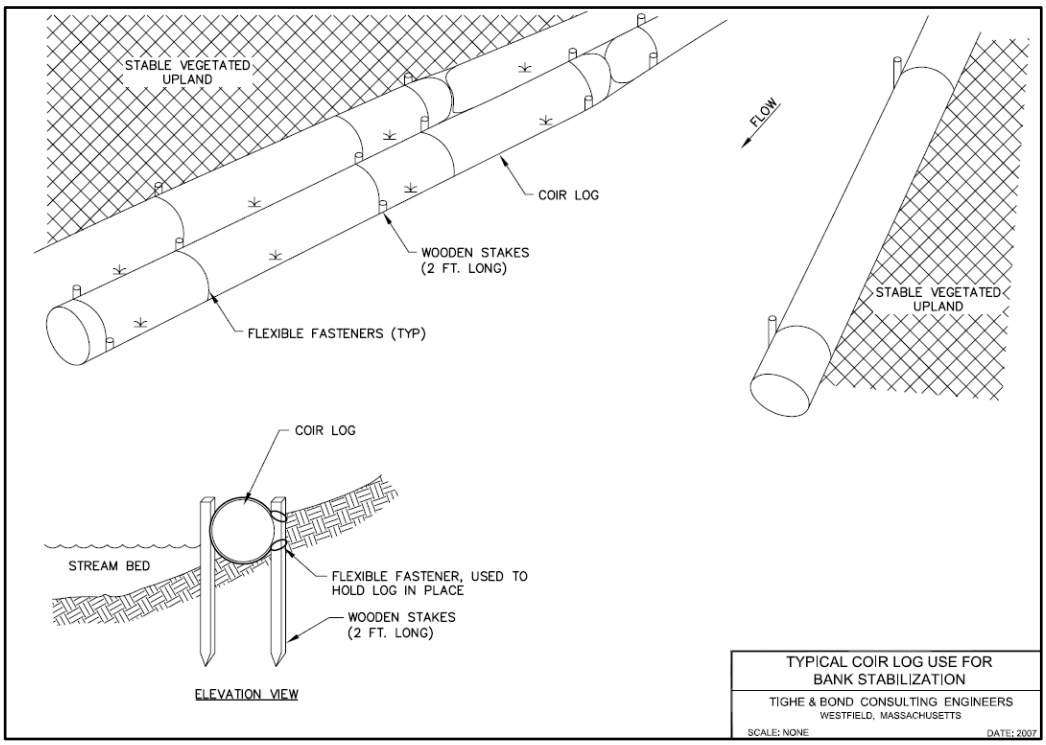
Locate construction entrances and exits to limit sediment leaving the site and to provide for maximum utility by all construction vehicles. Avoid exits that have steep grades or that are located at curves in public roads.

Installation
Temporary stabilized construction exits should meet the following requirements:

- The minimum size stone used should be three-inch crushed stone.
- The minimum length of the pad should be 75 feet, except that the minimum length may be reduced to 50 feet if a three- to six-inch high berm is installed at the exit of the project site. The minimum depth of the pad should be at least six inches thick.
- The pad should slope away from the existing roadway.
- Natural drainage that crosses the location of the stone pad should be intercepted and piped beneath the pad, as necessary, with suitable outlet protection.

Inspection and Maintenance
- Maintain the exit in a condition that will prevent tracking or flowing of sediment onto public ROWs. This may require top dressing with additional stone as conditions demand, and repair and/or maintenance of any measures used to trap sediment.
- Maintain the pad or replace it when mud and soil particles clog the voids in the stone such that mud and soil particles are tracked off-site.
- When the control pad becomes ineffective, remove the stone along with the collected soil material, re-grade on site and stabilize, then reconstruct the exit.

Best Management Practice 4: Coir Logs



Description

Coir logs, also known by the commercial product names as straw wattles, fiber rolls, or SiltSoxx™ are products in which a compressed material, such as weed-free straw fiber or other material, is placed within a photodegradable mesh cylindrical sock. They range from approximately eight to 20 inches in diameter by 25 to 30 feet long. Biodegradable, flexible and simple to install, they are useful in a variety of applications such as streambank, wetland and slope protection. They are considered an alternative to silt fence and hay bales and may also be used in check dam applications, perimeter containment and stockpile containment. Coir logs are especially useful for slope stabilization. They function by shortening slope length, reducing runoff velocity, and trapping mobile soil particles. Coir logs can provide a substrate for plant growth once decay of the fiber roll begins and protects new vegetation growing adjacent to the fiber roll.

Rolled erosion control products last an average of two years, depending on the fiber and mesh used in the manufacturing. This in an important factor to consider when planning how long a slope will need to be stabilized.

Considerations

- Consider using coir logs where slopes are susceptible to sheet and rill erosion, to freeze and thaw activity, or where slopes are difficult to vegetate because of soil movement.
- Coir logs can be staked with live stakes, if site conditions warrant. The moisture retained by the coir log will encourage cutting establishment.

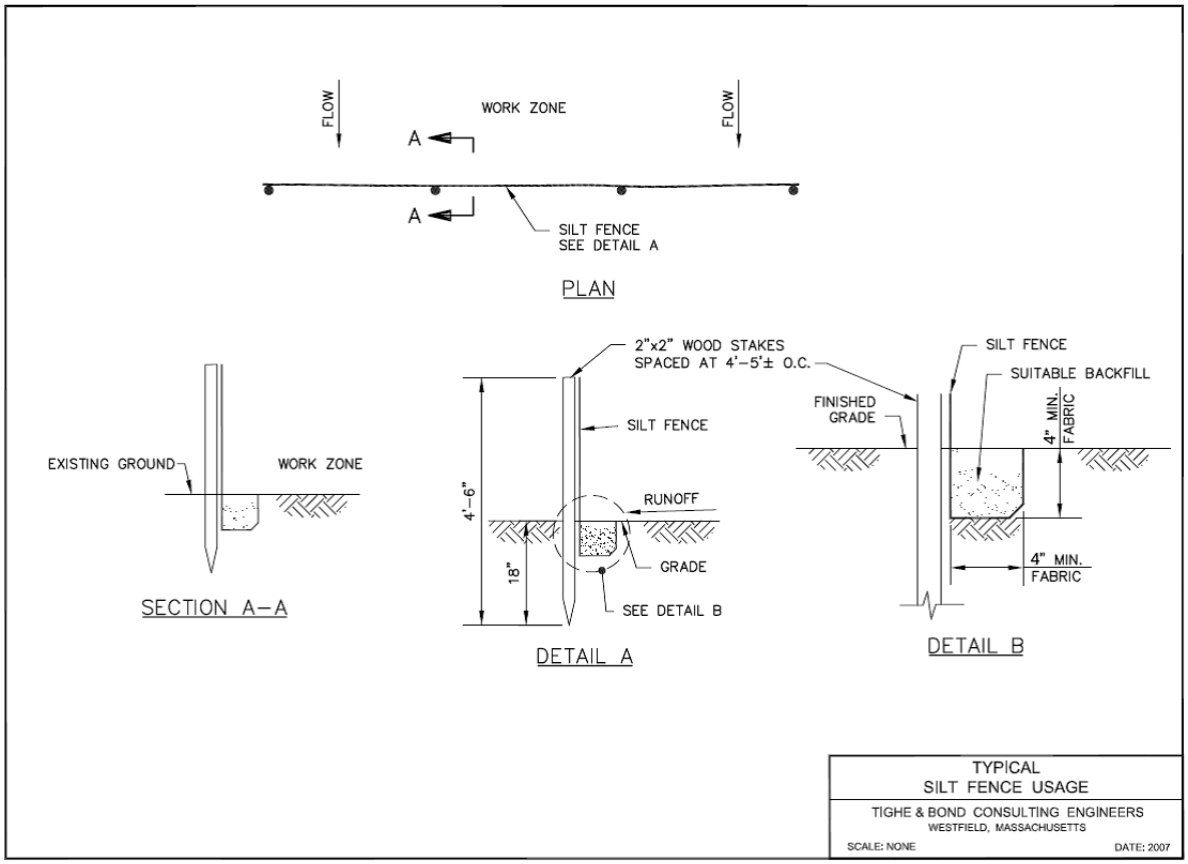
Installation

- For slope stabilization, it is critical that coir logs are installed perpendicular to soil movement and parallel to the slop contour.
- Coir logs, especially if used in slope stabilization, are not effective unless entrenched. Construct trenches half the diameter of the log in which to place the roll. Install rolls from the bottom of the slope and work up.
- Lay the coir log along the trench, snugly fitting it against the soil. Ensure no gaps exist between the soil and the fiber roll.
- Install stakes at least every three feet apart along the length of the roll. Additional stakes may be driven on the downslope side of the trenches on highly erosive or very steep slopes.

Inspection and Maintenance

- Inspect the coir logs and any slopes after a rain event (½-inch of rain within 24 hours). Ensure that the stakes are still holding and that the rolls remain in contact with the soil.
- Properly repair any rills or gullies.
- If used in slope stabilization, reseed or replant vegetation, if necessary, until the slope is stabilized.

Best Management Practice 5: Silt Fence



Description
Silt fence is a temporary sediment barrier consisting of filter fabric attached to supporting posts and entrenched into the soil. This barrier is installed across or at the toe of a slope to intercept and retain small amounts of sediment from disturbed or unprotected areas.

Silt fence has a useful life of one season. They function primarily to slow and pond the water and allow soil particles to settle. Silt fence is not designed to withstand high heads of water and therefore should be located where only shallow pools can form. Their use is limited to areas where overland sheet flows are expected.

Silt fence is a sediment control practice, not an erosion control practice. It is intended to be used in conjunction with other practices that prevent or control erosion. Improperly applied or installed silt fence will increase erosion.

Silt fence should not be used in areas of concentrated flows or across streams, channels, swales, ditches or other drainage ways. Silt fence is not capable of effectively filtering the high rates and volumes of water associated with channelized flow. Silt fence should not be designed to impound sediment or water more than 18 inches high. Silt fence installed across a concentrated flow path is subject to undercutting, end cutting and overtopping. This frequently not only results in the bypass of sediment-laden water, but also in the complete failure of the fence. Such failures typically release the sediment accumulated on the up-gradient side of the fence, and severe erosion of the channel both upstream and downstream of the fence.

Considerations
Consider using silt fence barriers where:

- Flow to the silt fence from a distributed area occurs as overland sheet flow.
- Sedimentation can pollute or degrade adjacent wetlands or watercourses.
- Sedimentation will reduce the capacity of storm drainage systems or adversely affect adjacent areas.

Silt fence is designed to be used when the contributing drainage area is less than ¼-acre per 100 feet of barrier length, the maximum length of slope above the barrier is 100 feet and the maximum gradient behind the barrier is 50% (2:1). If any of these conditions are exceeded, other measures may be necessary to control erosion and to intercept and treat the sediment load.

Silt fence (synthetic filter) generally has a useful life of one season, and should be periodically replaced on longer-duration construction projects. Silt fence is generally a better barrier than hay bale barriers.

Potential causes of silt fence failure include:

- Improper placement on the site.
- Allowing excessive drainage area to the silt fence structures.
- Inadequate trenching depth, and improper backfill and compaction of the bottom of the fabric.
- Improper attachment to posts.
- Inadequate maintenance of the silt fence after installation.

- Installing silt fence with a descending grade along the fence alignment, resulting in the diversion or concentration of runoff.
- Placement of fence at mid-slope of a cut or fill embankment. Because a silt fence works by impounding water, it should be placed at the toe of such slopes, to allow for this function, and to avoid potential diversion or concentration of flows.

Installation

Use silt fences in areas where erosion will occur only in the form of sheet erosion and there is no concentration of water in a channel or drainage-way above the fence. Install silt fence prior to any soil disturbance of the contributing drainage area above them.

- The maximum contributing drainage area above the fence should be less than ¼-acre per 100 linear feet of fence.
- The maximum length of slope above the fence should be 100 feet.
- The maximum slope above the fence should be 2:1.
- Install silt fence following the contour of the land as closely as possible.
- Place silt fence located at the toe of a slope at least six feet from the toe to allow space for shallow ponding and to allow for maintenance access without disturbing the slope.
- Flare the ends of the silt fence upslope.
- Embed the fabric a minimum of four inches in depth and four inches in width in a trench excavated into the ground upgradient from the barrier, or if site conditions include frozen ground, ledge, or the presence of heavy roots, embed the base of the fabric with a minimum thickness of eight inches of ¾-inch stone.
    - Consider installing the silt fence by “slicing” using mechanical equipment specifically designed for this procedure. The slicing method uses an implement towed behind a tractor to “plow” or slice the silt fence material into the soil. The slicing method minimally disrupts the soil upward and slightly displaces the soil, maintaining the soil’s profile and creating an optimal condition for subsequent mechanical compaction.
- Compact the soil over the embedded fabric.
- Size and anchor support posts according to the manufacturer’s instructions with maximum post spacing of six feet.
- Posts for silt fences should be either two-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of five feet. Steel posts should have projections for fastening wire to them. Posts should be placed on the downslope side of the fabric. A manufactured silt fence system with integral posts may be used.
- The filter fabric should be a pervious sheet of propylene, nylon, polyester or ethylene yarn, and should be certified by the manufacturer or supplier.
- Overlap adjoining sections of the silt fence by a minimum of six inches (24 inches is preferred), folded and stapled to a support post. If metal posts are used, wire-tie the fabric directly to the posts with three diagonal ties.
- Do not staple or nail the silt fence to trees.

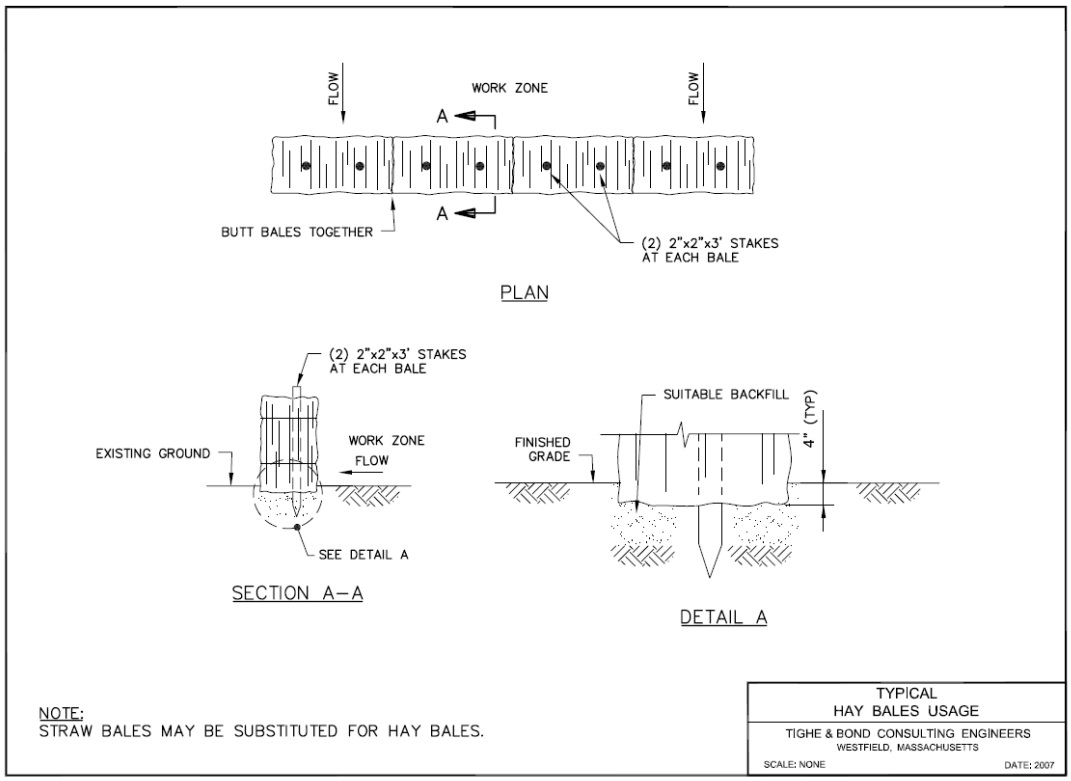
- The height of a silt fence should not exceed 36 inches as higher fences may impound volumes of water sufficient to cause failure of the structure.
- Remove silt fence when it has served its useful purpose, but not before the upslope areas have been permanently stabilized.

Inspection and Maintenance

- Inspect and maintain silt fence at least daily during prolonged rainfall and immediately after each rain event (½-inch in 24 hours) event.
- Remove sediment, at a minimum, when deposition accumulates to one-half the height of the fence, and move to an appropriate location so the sediment is not readily transported back toward the silt fence.
- Immediately repair silt fence if there are any signs of erosion or sedimentation below it. If there are signs of undercutting at the center or the edges of the barrier, or impounding of large volumes of water behind it, replace silt fence with a temporary check dam.
- Promptly replace the fabric on a silt fence if it is decomposing or becoming ineffective prior to the end of the expected usable life, yet the barrier still is necessary.
- Dress any sediment deposits remaining in place after the silt fence is no longer required to conform to the existing grade, prepared and seeded.
- If there is evidence of end flow on properly installed barriers, extend barriers uphill or consider replacing them with other measures, such as temporary diversions and sediment traps.

Best Management Practice 6: Weed-Free Straw or Hay Bales

Properly installed hay bale barrier with silt fence (direction of flow indicated by arrow).



Description
Weed-free straw or hay bales are a type of temporary sediment barrier installed across or at the toe of a slope to intercept and retain small amounts of sediment from disturbed or unprotected areas.

Straw or hay bale barriers have a useful life of less than six months. They function primarily to slow and pond the water and allow soil particles to settle. They are not designed to withstand high heads of water and therefore should be located where only shallow pools can form. Their use is limited to areas that only contribute sheet flow to the device.

Straw or hay bale barriers constitute a sediment control practice, not an erosion control practice. They must be used in conjunction with other practices that prevent or control erosion. Improperly applied or installed straw or hay bales will increase erosion.

Considerations
Straw or hay bale barriers principally trap sediment by temporarily ponding water, allowing particles to settle. These barriers are not designed to withstand high heads of water; therefore they should be located where only shallow pools can form.

- Do not install straw or hay bale barriers across streams, channels, swales, ditches or other drainage ways, or areas with concentrated flows. Such barriers are not capable of effectively filtering the high rates and volumes of water associated with channelized flow. However, they may be used for check dams in applications where installation access or other conditions prevent the use of preferred materials such as stone. In such cases, embed the straw or hay bale bales within the concentrated flow path; otherwise, they are subject to undercutting and end cutting. This frequently not only results in the bypass of sediment laden-water, but also in the complete failure of the barrier. Such failures typically release sediment accumulation on the upgradient side of the barrier and severe erosion of the channel both upstream and downstream of the device.

Under no circumstances should sediment barriers be constructed in live streams or in swales where there is a possibility of a washout.

Use straw or hay bale barriers where:
- Flow to the barrier from a disturbed area occurs as overland sheet flow.
- Sedimentation can pollute or degrade adjacent wetlands or watercourses.
- Sedimentation will reduce the capacity of storm drainage systems or adversely affect adjacent areas.
- The contributing drainage area is less than ¼-acre per 100 feet of barrier length, the maximum length of slope above the barrier is 100 feet, and the maximum gradient behind the barrier is 50% (2:1). If any of these conditions are exceeded, other measures may be necessary to control erosion and to intercept and treat the sediment load.

Installation
- Install prior to any soil disturbance of the contributing drainage area above them.
- Place in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Flare the ends of the barrier up slope.
- Do not construct more than one bale high.

- All bales should be either wire-bound or string-tied. Install so that bindings are oriented around the sides, parallel to the ground surface, to prevent deterioration of the bindings.
- Excavate a trench the width of a bale and length of the proposed barrier to a minimum depth of four inches.
- After staking and chinking the bales, backfill the excavated soil against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier. Ideally, bales should be placed 10 feet away from the tow of slope.
- At least two stakes driven through the bale and penetrating at least 18 inches into the ground should securely anchor each bale. Drive the first stake in each bale toward the previously laid bale to force the bales together. Drive the stakes deep enough into the ground to securely anchor the bales.
- Chink the gaps between bales with hay to prevent water from escaping between the bales.
- Straw or hay bales should be used as a temporary barrier for less than six months.

Potential causes of straw or hay bale barrier failure include:

- Improper placement on the site.
- Allowing excessive drainage area to the barrier.
- Inadequate keying of the bales into the ground surface.
- Inadequate maintenance after installation.

Inspection and Maintenance

- Frequently inspect, and repair or replace bales as needed.
- Inspect bales at least daily during prolonged rainfall and immediately after rain events (½-in in 24 hours).
- Immediately repair bales if there are any signs of erosion or sedimentation below them. If there are signs of undercutting at the center or the edges of the barrier, or impounding of large volumes of water behind the barrier, replace the barrier with an alternative measure to intercept and capture sediment (for example, a diversion berm directing sediment-laden runoff to a sediment trap or basin).
- Remove sediment deposits after each storm event and/or when deposits reach approximately one-half the height of the barrier.
- Promptly replace damaged or decomposed bales.
- Remove bales when they have served their usefulness, but not before the upslope areas have been permanently stabilized.
- Any sediment deposits remaining in place after the filter barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

Best Management Practice 7: Erosion Control Mix Berms

Description
An erosion control mix berm is a trapezoidal berm that intercepts sheet flow and ponds runoff, allowing solids to settle, and filters sediment as well. They are an environmentally sensitive and cost-effective alternative to silt fence. An alternative to a simple erosion control mix berm is a "continuous contained berm," consisting of erosion control mix compost encapsulated in a mesh fabric, or "filter sock."

This barrier is installed across or at the toe of a slope to intercept and retain small amounts of sediment from disturbed or unprotected areas.

Erosion control mix berms and socks sometimes offer a better solution than silt fence and other sediment control methods, because the organic material does not require any special trenching, construction or removal, unlike straw bales, silt fence or coir logs. This makes the technique very cost-effective.

The erosion control mix is organic, biodegradable and renewable, and can be left onsite. This is particularly important below embankments near streams, as re-entry to remove or maintain a synthetic barrier can cause additional disturbance. Silt fence has to be disposed of as a solid waste, and is often left abandoned on job sites.

Erosion control mix berms can be easily and quickly fixed if they are disturbed in the course of construction activity.

Considerations

The berm is used where:

- Sedimentation can pollute or degrade adjacent wetland and/or watercourses.
- Sedimentation will reduce the capacity of storm drainage systems or adversely affect adjacent areas.
- The contributing drainage area is less than ¼-acre per 100 feet of barrier length, the maximum length of slope above the barrier is 100 feet, and the maximum gradient behind the barrier is five percent. If the slope length is greater, other measures, such as diversions, may be necessary to reduce the slope length.

General considerations for sediment barriers are:

- Sediment barriers should not be used in areas of concentrated flows. Under no circumstances should erosion control mix barriers be constructed in live streams or in swales where there is a possibility of a washout.
- Sediment barriers are effective only if installed and maintained properly.
- Sediment barriers should be installed prior to any soil disturbance of the contributing drainage area above them.
- Frozen ground, outcrops of bedrock, and very rooted forested areas are locations where berms of erosion control mix are most practical and effective.
- Other BMPs should be used a low points of concentrated runoff, below culvert outlet aprons, around catch basins and closed storm systems, and at the bottom of steep perimeter slopes.

Specifications

Erosion control mix can be manufactured on or off the project site. It must consist primarily of organic material, separated at the point of generation, and may include shredded bark, stump grindings, composted bark or acceptable manufactured products. Wood and bark chips, ground construction debris, or reprocessed wood products will not be acceptable as the organic component of the mix. Composition of the erosion control mix should be as follows:

- Erosion control mix should contain a well-graded mixture of particle sizes and may contain rocks less than four inches in diameter. Erosion control mix must be free of refuse, physical contaminants and material toxic to plant growth. The mix composition should meet the following standards:
- The organic matter content should be between 25 and 65%, dry weight basis.
- Particle size by weight should be 100% passing a three-inch screen, 90% to 100% passing a one-inch screen, 70% to 100% passing a 0.75-inch screen, and a maximum of 30% to 75%, passing a 0.25-inch screen.
- The organic portion needs to be fibrous and elongated; the mix should not contain silts, clays or fine sands. Soluble salts content should be <4.0 mmhos/cm. and the pH should be between 5.0 and 8.0.
- The barrier must be placed along a relatively level contour. It may be necessary to cut tall grasses or woody vegetation to avoid creating voids and bridges that would enable fine particles to wash under the barrier through the grass blades or plant stems.

- The barrier must be a minimum of 12 inches high, as measured on the uphill side of the barrier, and a minimum of two feet wide.

Continuous Contained Berms

An alternative product, the continuous contained berm, or "filter sock," can be an effective sediment barrier, as it adds containment and stability to a berm of erosion control mix. The organic mix is placed in synthetic tubular netting and performs as a sturdy sediment barrier that is highly durable. It works particularly well in areas where trenching is not feasible, such as over frozen ground or pavement. Seeds may be added to the organic filler material, which can permanently stabilize the shallow slope. The containment will provide stability while vegetation is rooting through the netting.

Maintenance Requirements

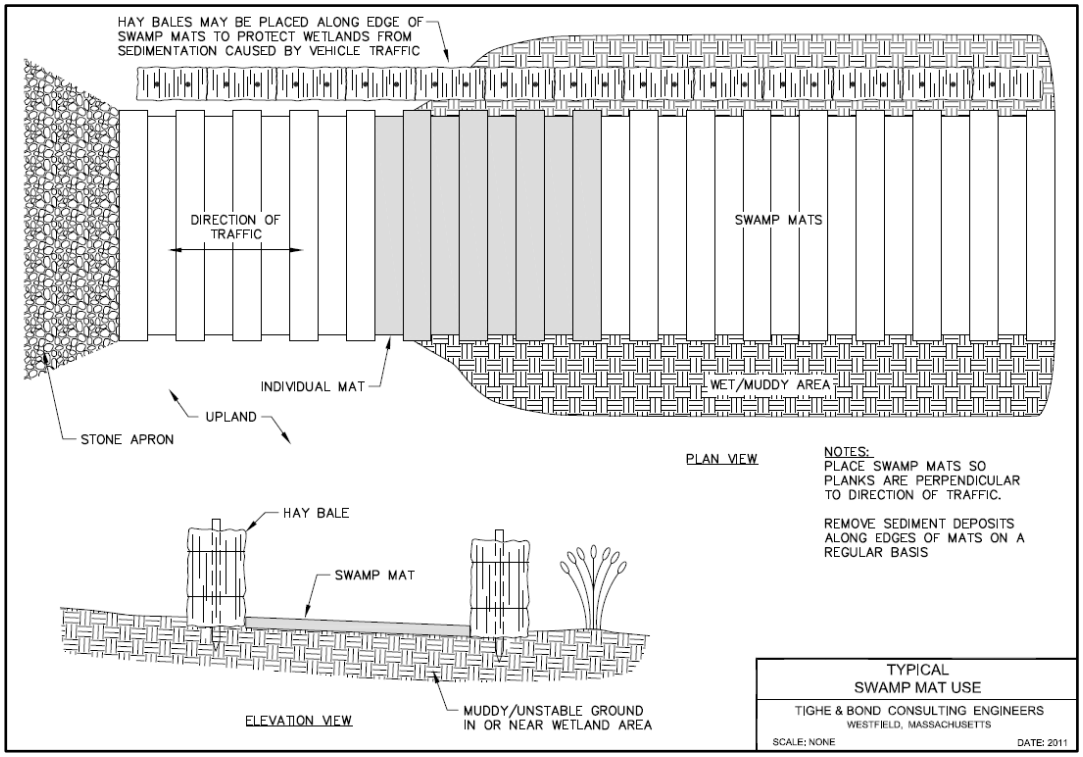
Erosion control mix berms should be inspected immediately after each rain event (½-inch in 24 hours) and at least daily during prolonged rainfall. They require immediate repair if there are any signs of erosion or sedimentation below them. If there are signs of breaching of the barrier, or impounding of large volumes of water behind them, replace them with other measures to intercept and trap sediment.

Remove sediment deposits after each storm event. Remove deposits when they reach approximately one-third the height of the barrier.

Re-shape or reapply berms as needed.

Best Management Practice 8: Swamp Mats

Swamp mats with coir logs wrapped in filter fabric to create a temporary curb.
Turtle Town Pond, Concord, NH. Credit: Karl Benedict



Description

Pre-fabricated mats are pads that can support the weight of equipment and prevent both rutting and disturbance of soils. These mats can be used for crossing wetlands or watercourses, or for providing a stable work platform to conduct repairs and maintenance activities. Mats are constructed of several different types of materials, including wood and plastic.

Considerations

- Minimize impact to wetland areas during installation, use and removal.
- Swamp mats should be removed as soon as possible following completion of maintenance activities to reduce compaction of the underlying soil.

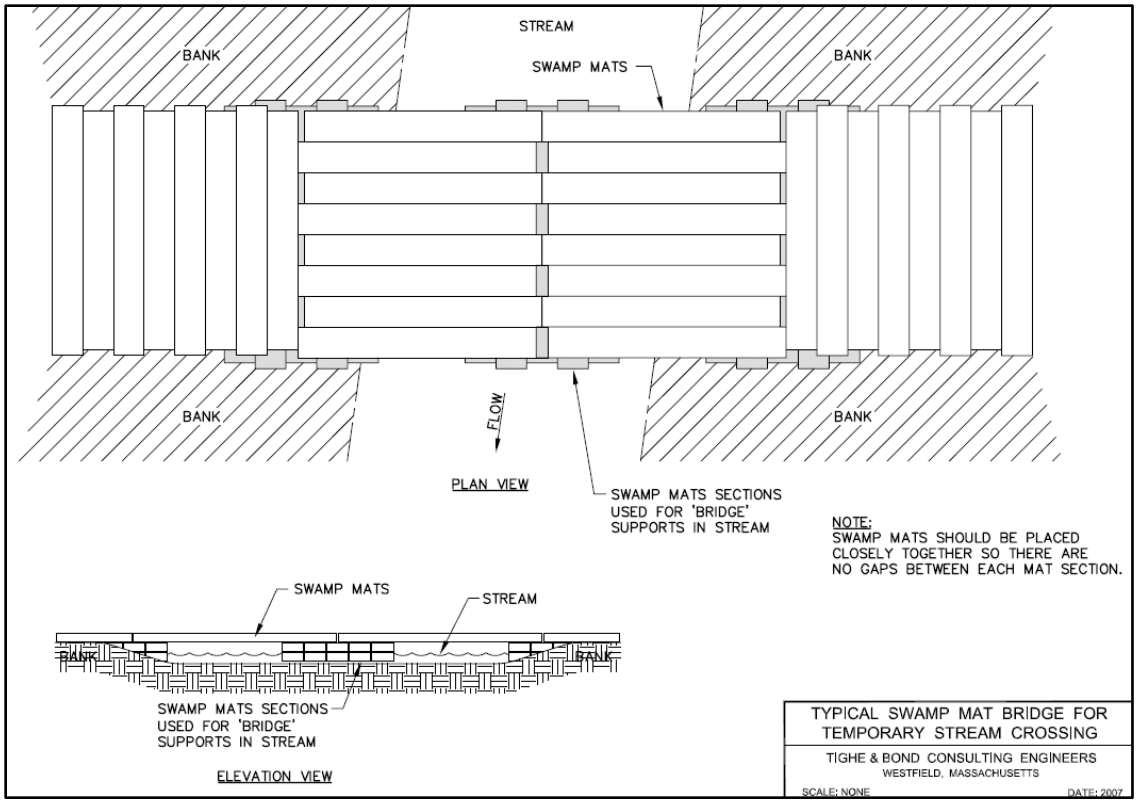
Installation

- Install and remove in accordance with manufacturer's instructions, if applicable.
- Place mats in a location that will minimize the length needed for crossing.
- Mats may be used to cross small streams, provided the mat does not disturb the bed or banking.
- Where possible, place mats so that they are not overtopped with water and equipment can work in the dry.
- Place mats so that they do not restrict the natural flow of water or aquatic organism passage.
- Remove mats from wetland areas once the crossing or maintenance activity is completed.
- Do not reuse mats that have been placed in areas of invasive species until they have been cleaned and inspected. See BMP 2 – Invasive Species Management, for further information.

Inspection and Maintenance

- Inspect after each use.
- Look for any defects or structural problems.
- Remove remaining plant material left on mats.

Best Management Practice 9: Swamp Mat Bridge



Description

Swamp mats may be used as a temporary bridge over a stream to allow vehicles access to the work site. Small sections of mat are placed within and along the stream, parallel to the flow of water. These act as supports. Mats may then be placed perpendicular to the stream, resting on top of the initial swamp mat supports. It may be necessary to place a large steel plate along the top of the swamp mats for extra stability and to minimize the amount of sediment that could fall between the spaces of each timber.

The swamp mat bridge configuration can also be used to span access across wetland areas. The configuration can be used to reduce direct impacts to the wetland surface, provide spanned access to maintain aquatic organism passage or span surface waters. If possible, swamp mat bridges should be constructed to span a stream channel with mat ends located above the top of bank. Mats are constructed of several different types of materials, including wood and plastic. They are considered temporary crossings and should be removed upon the conclusion of the maintenance activity.

Considerations

- Placement of mats should be in a location that would minimize the length needed for crossing. See Chapter 2.2 – Avoidance and Minimization for more information.
- Mats may be used to cross small streams bank-to-bank.

Installation

- Install and remove in accordance with manufacturers applications, if applicable.
- Where possible, install mats so that they are not overtopped with water and equipment can work in the dry.
- Timber Mat Bridge BMPs should be strategically installed to provide aquatic organism passage (see images on following page).
- Remove mats from steam and wetland areas once the crossing or maintenance activity is completed.
- Make every effort to minimize impact to wetland areas during installation, use and removal.

Inspection and Maintenance

- Look for any defects or structural problems.
- Inspect for any plant material left on mats, and remove immediately. See BMP 2 – Invasive Species Management, for more information.
- Monitor potential for high-flow conditions due to ice melt or forecast precipitation events. Remove or anchor mats prior to high flows to avoid potential movement.

Location showing impeded aquatic organism passage due to swamp matting placement.

Constructing a swamp mat bridge span reduces direct impacts to the wetland surface and maintains aquatic organism passage through the construction area. The number of necessary swamp mats may be reduced using this method.

Best Management Practice 10: Corduroy

Description

Corduroy is a soil stability technique where logs and brush are cut from the immediate area and used as a road bed to prevent rutting from equipment crossing. This technique is designed to be used in areas of wetland crossings where there is no standing water, defined channel or stream flow.

Considerations

- Do not install in streams.
- Use in crossing wetlands and wet soils (spring conditions) where soils are subject to rutting.

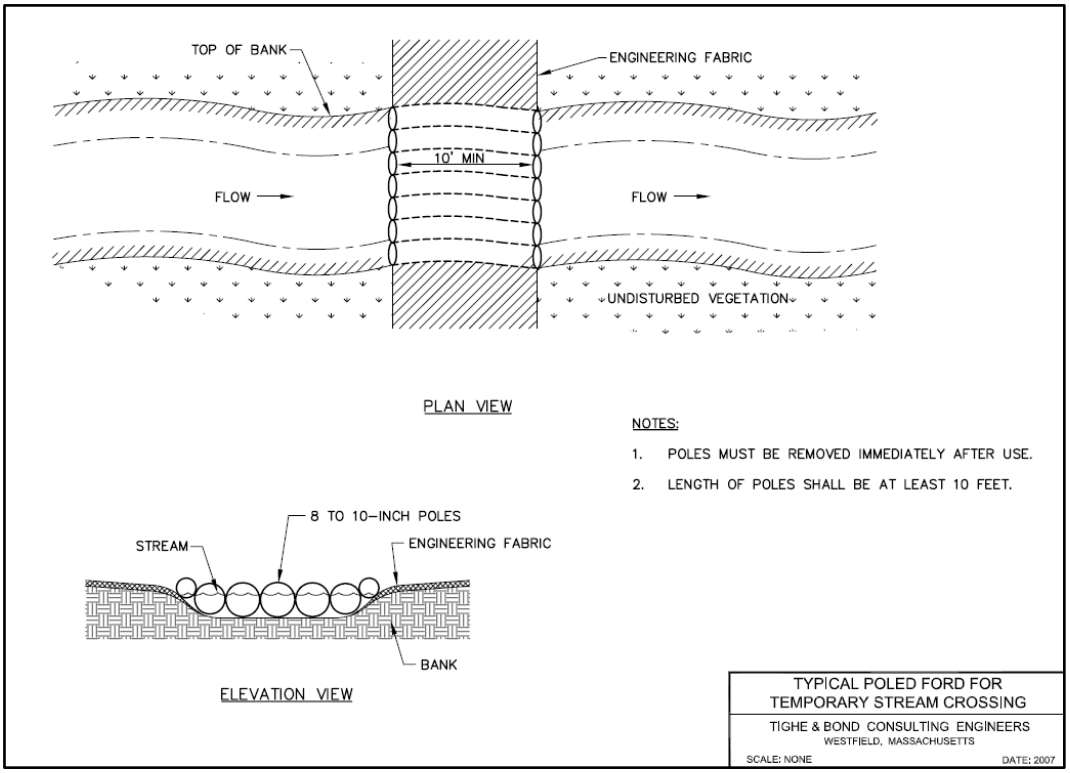
Installation

- Place in the narrowest area practicable for crossing.
- Install eight to 10-inch diameter poles or cull logs side-by-side in wet area to serve as an access way.
- Place poles or cull logs perpendicular to the direction of travel across wet area.
- Do not cross when the poles are overtopped with water.

Inspection and Maintenance

- Inspect corduroy access ways prior to use, and repair as needed.
- Corduroy may be left in place for use on next maintenance cycle.

Best Management Practice 11: Poled Fords



Description

A poled ford is a temporary stream crossing made by stacking logs that are free of limbs and soil within the stream channel high enough so equipment can travel across. Fords are used for crossing streams.

Considerations

- Poled fords can be constructed and used during periods of no or low flow, on a stable stream bottom.
- Locate poled fords where an access road has previously established a perpetual disturbance and where there is limited potential for sedimentation in the stream.

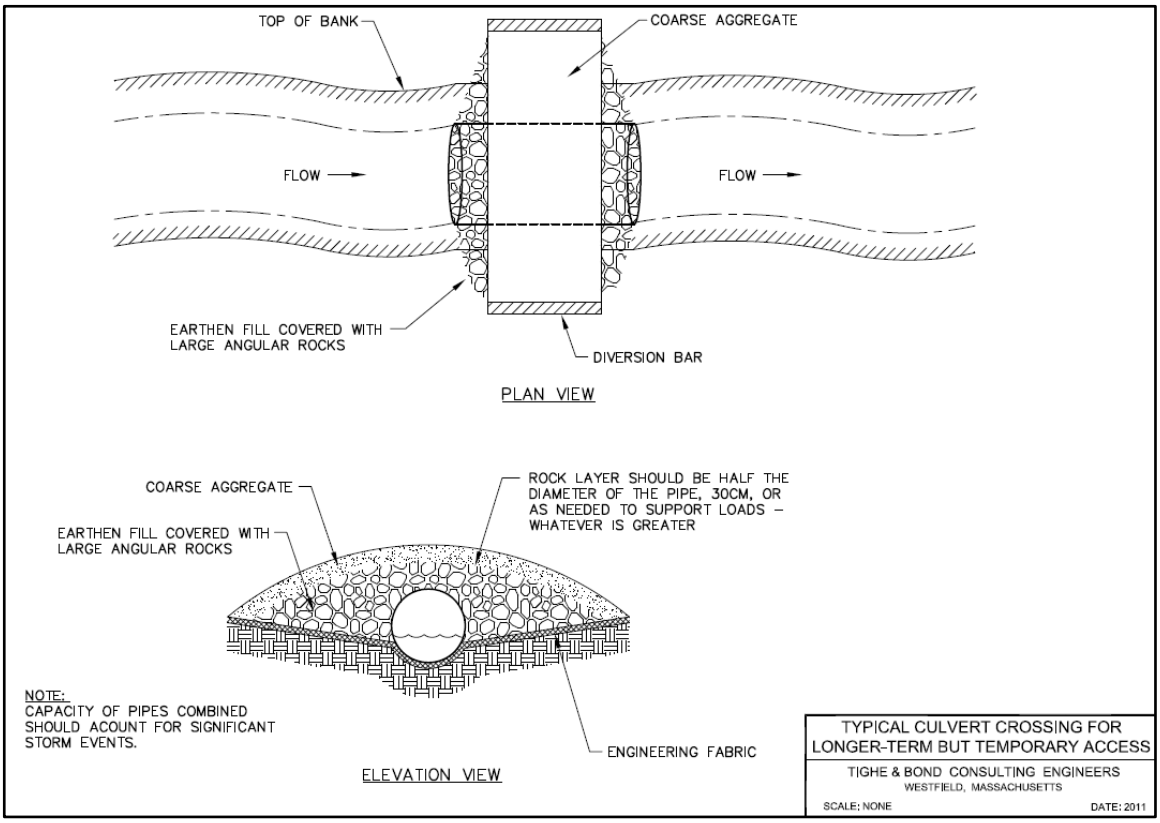
Installation

- Find stream banks that are firm and level with approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.
- Install the poled ford parallel to the flow of the stream in a manner that:
    - Allows water to flow through the crossing location.
    - Does not contribute to accelerated erosion, runoff, or sediment transport.
    - Protects the integrity of the channel's structure.
- Consider placing one or more pipes within the poled ford to allow water to pass through. Use geotextile or other appropriate bedding, if needed, to stabilize the approaches to the crossing.

Inspection and Maintenance

- Do not use poled fords when overtopped with water.
- Monitor the upstream end to ensure that it does not become plugged with debris that impedes stream flow.
- Remove poled fords immediately after use.

Best Management Practice 12: Temporary Culvert



Description

A temporary culvert should be installed when a road crosses a wetland or stream within existing ROW and does not establish new utility roadways. A temporary culvert should maintain the wetland or stream, if properly installed. A project will not qualify for a Utility Notice or BMP if it crosses a (navigable stream) Tier 2, Tier 3 or Tier 4 stream.

Considerations

- May have standard permitting restrictions on use. See Chapter 10 Construction and Maintenance of the Wetlands BMP Practice Techniques for Avoidance and Minimization for good construction and maintenance practices.
- All in-stream work should be conducted during low-flow conditions and in a manner that does not impact water quality.
- All temporary and permanent crossings of water bodies shall be suitably culverted, bridged, or otherwise designed to withstand and prevent the restriction of high flows, and to maintain existing low flows, and so as not to obstruct the movement of aquatic life indigenous to the water body.
- Design the number and size of culverts to handle the maximum expected flow of the wetland or watercourse. All crossings require hydraulic calculations to determine the area that will drain the culvert. Culvert(s) must also be adequately sized to accommodate flows from the 100-year storm, at a minimum (preferably 500-year storm).
- Design and install culverts with minimal disruption to the watercourse and riparian buffer zone.
- Multiple culverts are discouraged. It is better to use one large culvert, if feasible.
- Installation may require in-stream work and practicable dewatering and sedimentation concerns.
- Are susceptible to washouts, sedimentation, erosion and failure during heavy wet weather events and flooding.
- Require routine and long-term maintenance as they often become clogged with debris and other obstructions.

Installation

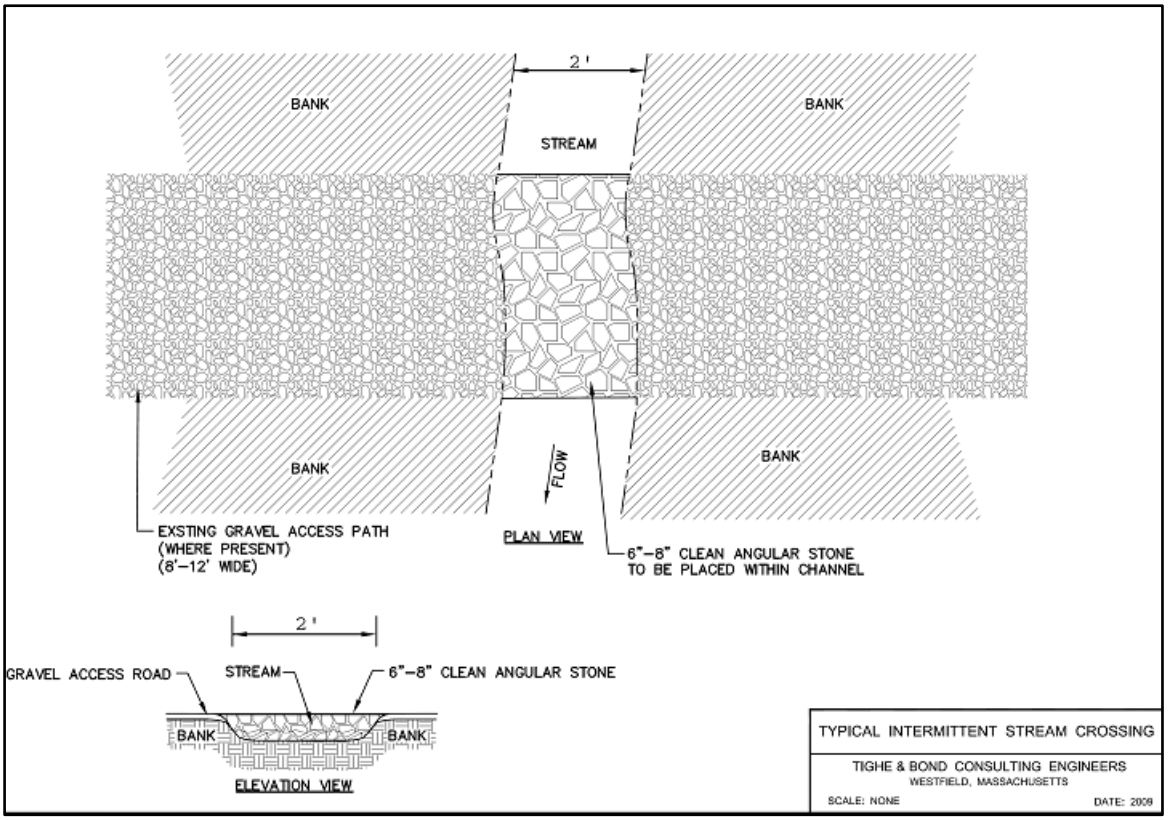
- Minimize the extent of fill needed on top of a crossing structure by limiting the increase of the road grade as it approaches the crossing point.
- Maintain existing side slope grades, as much as possible, to minimize fill and any wetland loss.
- Avoid impounding water up-gradient of the crossing.
- Place swamp mats over culverts to help structurally protect the culvert from heavy loads.
- Backfill culverts with natural substrate matching upstream and downstream streambed substrate, even if fish passage is not a concern. Other aquatic organisms rely on natural stream bed sediment to aid their movement.
- The maximum velocity at the culvert outlet should be consistent with the velocity of the natural channel, or shall be mitigated with outlet protection measures, energy dissipation and, if necessary, channel stabilization.

- The culvert length should be as short a length as practicable. If the installed culvert extends too far into the natural stream bed it must be cut to size.

Inspection and Maintenance

- Maintain culverts to allow flow. Remove debris and sediment on an as-needed basis.

Best Management Practice 13: Stone Ford



Description

A stone ford is a stream crossing used in streams with a solid streambed with banks that are stable and shallow. There are two basic types of low-water fords: unvented and vented rock fords.

Unvented fords are structures that pass all water over the ford surface. The surface of the ford is at or near the level of the stream bed. A vented ford is a ford constructed with a structure, such as a box culvert, that passes low flows. Flood flows are intended to overtop the structure. They are commonly used in low-flow streams. With proper sizing and placement of a structure, a vented ford may be designed to provide for aquatic organism passage.

Considerations

- Stone fords only be used during low-flow conditions when a bridge or culvert is not practical, the stream bed consists of gravel, cobble or bedrock, streambanks are low and stable and/or when traffic is minimal.
- The single most important factor in designing a stone ford is protection against erosion and sedimentation into the waterbody during high flows. Careful consideration of flood size, frequency and site selection is essential. Unvented fords are not the best alternative for streams where fish migration is a consideration.

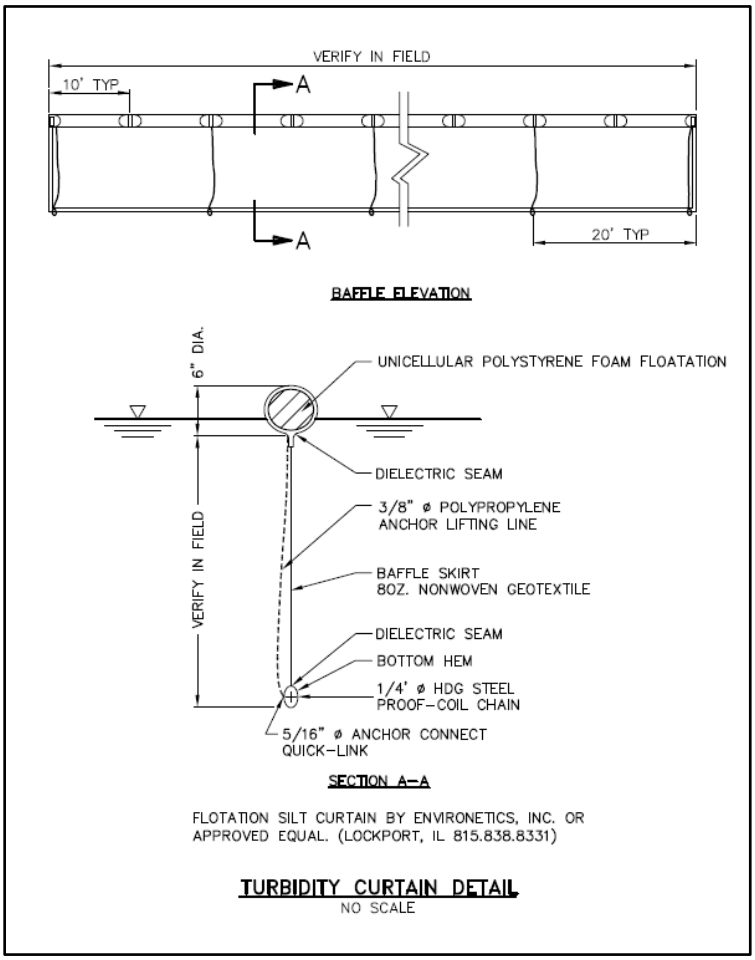
Installation

- To avoid the delivery of sediment into the stream, it is critical to stabilize the approaches with rock, timber mats or other material to prevent tire tracks from carrying or dragging soil into the stream. Install approaches at right angles to the stream.
- **Vented Fords:** Locate fords in areas with a stable rock or gravel streambed and where streambanks are low and stable. Install a vent, such as a box culvert, to allow water to pass through. The sides of the box support layers of 6-inch minus stone to allow water to flood and flow during high water, but keeps truck tires out of the water. Geotextile fabric may be placed over the stone to prevent the spaces between the stones from plugging with debris. A layer of small diameter stone is spread over the top of the fabric to as a paving surface to protect the fabric prevent plugging between the larger diameter stones.
- **Unvented Fords:** Unvented fords are structures that pass all water over the ford surface. The surface of the ford is at or near the level of the stream bed. The height of the stone ford should not be above the grade of the stream. Use round stone on ford surface to protect tires from sharp edges of angular rock.

Inspection and Maintenance

- Equipment crossing the stream should have no leaks of hydraulic oil, engine oil, fuel or any foreign substance.
- The vent in a structure may become clogged with debris; therefore, a vented ford requires routine maintenance. Clean the box culvert periodically to ensure water and fish passage. If the ford has become overtopped with water, repair and maintenance may be needed.

Best Management Practice 14: Turbidity Curtain



Description

Turbidity curtains**,** or turbidity booms, are floating barriers used to control the silt and sediment in a body of water. They are temporary BMPs designed to reduce or eliminate debris, turbidity and sediment transport from a disturbed area adjacent to or within a body of water. Constructed of permeable or non-permeable material, turbidity curtains are suspended vertically in the water with a flotation material enclosed in the top pocket and a ballast chain enclosed in the lower pocket.

Considerations

- Use when working adjacent to or within a waterway, or when dewatering discharge has the potential to enter directly into a waterbody. Variables that influence the distance to the barrier from shore or bank include water velocity, barrier depth and particle size.
- Floating turbidity curtains are not a "one-size fits all" BMP and must be chosen with care and consideration to specific factors, such as tidal vs. non-tidal waterways and direction of water flow.
- Does not work well in swiftly-flowing or very shallow water.

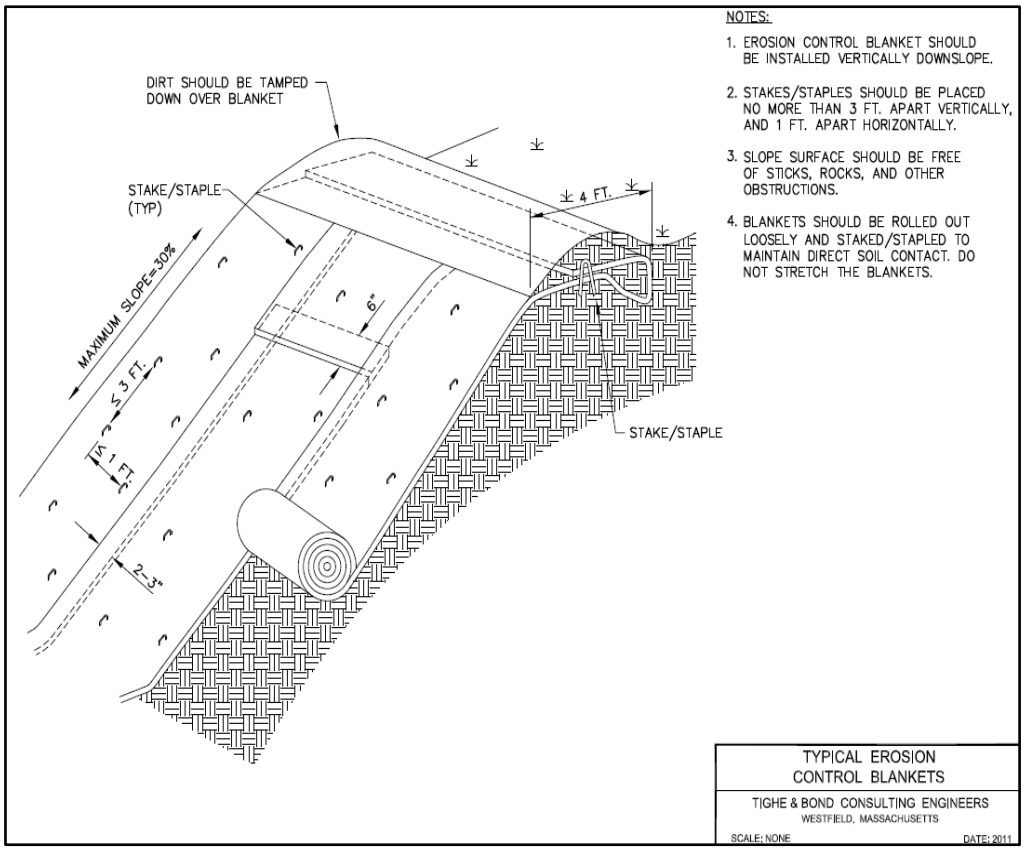
Installation

- Floating turbidity curtains should be of a highly visible color, for the purpose of water travel safety. Install parallel or perpendicular to the direction of flow. Ensure that the ends extending onto the shoreline and stream bank are properly anchored.
- Contain sedimentation in the retention area long enough to allow it to settle out of suspension.
- Current in the containment area must not be so great as to allow particle migration beyond the barrier before settling can occur.

Inspection and Maintenance

- Inspect according to regulatory timetables and any erosion or sediment control plans.
- Ensure the turbidity curtain extends to the entire depth of the waterbody when not subject to tidal action or wind/wave forces.

Best Management Practice 15: Erosion Control Blankets



Description
Erosion control blankets or mats consist of protective manufactured mulch blankets installed on prepared soil surfaces to provide erosion protection and surface stability on steep slopes, vegetated channels or shorelines during vegetation establishment.

Erosion control blankets temporarily stabilize and protect disturbed soil from raindrop impact and surface erosion. Like other types of mulch, the blankets help increase infiltration, decrease compaction and soil crusting, and conserve soil moisture. Erosion control blankets also increase the germination rates for grasses and legumes and promote vegetation establishment by protecting seeds from predators.

Erosion control blankets generally consist of machine-made mats made of organic, biodegradable mulch such as straw, curled wood fiber (excelsior) and coconut fiber, or a combination thereof, evenly distributed on or between manufactured netting. Netting is typically composed of photodegradable polypropylene or biodegradable natural fiber. The blankets are provided in rolls for ease of handling and installation.

Note: The erosion control practice as described in this manual does not cover the selection and installation of **turf reinforcement products**. If such products are used on-site, they must be included in the project plans, designed by a professional engineer registered in New Hampshire, and included in permit approvals.

Considerations

- Erosion control blankets can be applied to steep slopes, vegetated waterways, and other areas sensitive to erosion, to supplement vegetation during initial establishment and help provide for safe conveyance of runoff over the protected surface.
- During the growing season (May 15 – September 15) use blankets (or mulch and netting) on the base of grassed waterways, steep slopes (15-30%) or any disturbed soil within 100 feet of lakes, streams and wetlands.
- During the fall and winter, (October 15 – May 1) use heavy-grade blankets on all areas noted above and use lighter grade blankets (or mulch and netting) on side slopes of grassed waterways or moderate slopes (8-15%). There may be cases where blankets will be needed on slopes flatter than 8%, depending on site conditions and the length of the slope.
- The designer must exercise care to choose the type of blanket or matting that is appropriate for the specific objectives and site conditions of the project. There are many soil stabilization products available, and a thorough review by an engineer or erosion control professional is necessary to evaluate the advantages, disadvantages and construction requirements of the manufactured products, and to select and specify a product for a particular application.

Site Preparation

- The most critical aspect of installing blankets is obtaining firm, continuous contact between the blanket and the soil. Without such contact, the blanket is useless and erosion occurs. Therefore, proper site preparation is essential to ensure complete contact of the protection matting with the soil.

Grade and Shape Area of Installation

- Remove all rocks, clods, trash, vegetation or other obstructions so that the installed blankets will have direct contact with the soil so as not to interfere with seeding.
- Install per the manufacturer's specifications and the following, even if not in the manufacturer's instructions: a) blankets shall be anchored at the top of the slope in a trench; and b) blankets shall be unrolled in the direction of the water flow overlapping the edges and stapling.

Seeding

- Seed the area before blanket installation for erosion control and re-vegetation. Re-seed all check slots and other disturbed areas.
- Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Installation on Flat Surfaces

- Install mats and staple in accordance with the manufacturer's specifications. If the manufacturer's instructions differ from those listed below, the manufacturer's instructions should be followed and in accordance with NHDES Alteration of Terrain rules, Env Wq 1500.
- Install blankets within 24 hours after sowing seed in that area.
- Use U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes to anchor mats to the ground surface.
- Drive wire staples and metal stakes flush to the soil surface.
- All anchors should have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

Installation on Slopes

- Install mats and staple in accordance with the manufacturer's specifications. If the manufacturer's instructions differ from those listed below, the manufacturer's instructions should be followed and in accordance with NHDES Alteration of Terrain rules, Env Wq 1500.
- Loosely lay blankets over the soils, maintaining contact with the soil, but do not stretch.
- Anchor blankets at the top of the slope in a trench to prevent runoff from undermining the mat. Subsequent mats should be overlapped by the upslope mat. Backfill trench and tamp earth firmly.
- Unroll blankets in the direction of the water flow, overlapping the edges by a minimum of four inches and stapling the edges.
- When blankets must be spliced, place blankets end-over-end (shingle style) with six-inch minimum overlap.
- Staple through overlapped area, approximately 12 inches apart.
- Blankets are to be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples are to be placed down the center and staggered with the staples placed along the edges. Stapling pattern and number of staples will depend on steepness of slope.

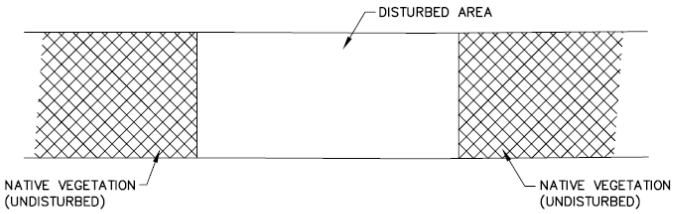
Installation in Channels

- Install mats and staple in accordance with the manufacturer's specifications. If the manufacturer's instructions differ from those listed below, the manufacturer's instructions should be followed and in accordance with NHDES Alteration of Terrain rules, Env Wq 1500.
- Dig initial anchor trench across the channel at the lower end of the project area.
- Excavate intermittent check slots, across the channel at 25-30-foot intervals.
- Cut longitudinal channel anchor slots along each side of the installation to bury edges of the blanket. Whenever possible, extend the blanket two to three inches above the crest of channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices. Note: blanket will initially be upside down in anchor trench.
- In the same manner, position adjacent blanket in anchor trench, overlapping the preceding roll a minimum of four inches.
- Secure these initial ends of the blanket with anchors at manufacturer-specified intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench.
- Unroll adjacent blanket upstream in similar fashion, maintaining a four-inch minimum overlap.
- Fold and secure all rolls of the blanket snugly into all transverse check slots.
- Lay blanket in the bottom of the slot then fold back against itself. Anchor through both layers of the blanket at manufacturer-specified intervals, then backfill and compact soil. Continue rolling all blanket widths upstream to the next check slot or terminal anchor trench.
- Alternate method for noncritical installations: Place two rows of anchors on six-inch centers at 25-30-foot intervals, in lieu of excavated check slots.
- Shingle lap spliced ends by a minimum of one foot with upstream mat on top to prevent uplifting by water or begin new blanket in a check slot. Anchor overlapped area by placing two rows of anchors, one foot apart at one-foot intervals.
- Place edges of outside blankets in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.
- Anchor, fill and compact upstream end of the blanket in a terminal trench.
- Secure mat to ground surface using U-shaped wire staples, geotextile pins, wooden stakes or other anchors as recommended by the manufacturer.

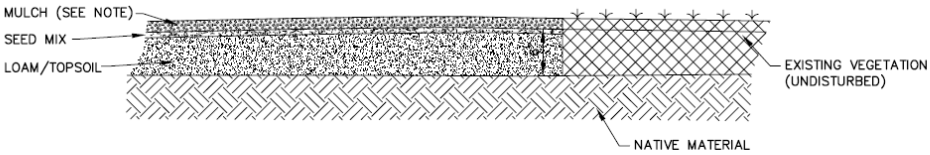
Inspection and Maintenance

- Inspect all blankets weekly during the construction period, and after any rain event (½-inch in 24 hours).
- Immediately repair any failure. If washout of the slope, displacement of the mat or damage to the mat occurs, repair and reseed the affected slope and re-install or replace that area of the mat.

Best Management Practice 16: Temporary or Permanent Mulch



PLAN VIEW



ELEVATION VIEW

NOTES:

1. MULCH MAY CONSIST OF HAY, STRAW OR WOODCHIPS.
2. THICKNESS OF MULCH APPLICATION DEPENDS ON MATERIAL USED.

TYPICAL MULCH APPLICATION

TIGHE & BOND CONSULTING ENGINEERS
WESTFIELD, MASSACHUSETTS

SCALE: NONE DATE: 2007

Description

Temporary mulching consists of the application of plant residues or other suitable materials to the soil surface. Mulching reduces erosion potential by protecting the exposed soil surface from direct impact by rainfall. It also aids in the growth of vegetation by conserving available moisture, controlling weeds and providing protection against extreme heat and cold. Mulches can also protect the infiltration rate of the soil, prevent soil compaction and provide a suitable microclimate for seed germination. This is the quickest and most cost-effective method of preventing erosion on disturbed soils and its value should not be underestimated.

Permanent mulching consists of the application of long-term surface cover such as bark, woodchips or erosion control mix. Permanent mulch can be used as a permanent ground cover, an overwinter stabilization mulch or left to naturalize. It is not designed to support grass vegetation, but legumes or woody vegetation may be established for additional stability. Permanent mulch must not be used in areas of concentrated water flows. Slopes with evidence of groundwater seepage may require the use of other treatments, such as riprap.

The composition of erosion control mix is further described in this section. In addition to its use for the temporary or semi-permanent stabilization of slopes, it can be applied to protect areas from erosion during spring thaw. It can also be used in construction yards to mitigate muddy conditions. In these applications, the erosion control mix application rate will need to be adjusted for the site conditions, use and long-term effectiveness. With time, the organic component of the erosion control mix will decompose and become ineffective. Any required repairs should be made immediately, with additional erosion control mix placed on top to reach the desired thickness.

Considerations

- Apply temporary mulch within 100 feet of streams, wetlands and in lake watersheds within seven days of exposing soil or prior to any storm event.
- Immediately mulch areas that have been temporarily or permanently seeded, following seeding.
- For areas that cannot be seeded within the growing season, mulch for over-winter protection. Seed the area at the beginning of the next growing season.
- Mulch anchoring should be used on slopes with gradients greater than 5% in fall (past September 15), and over-winter (October 15 – May 1).
- Permanent mulch can be used in conjunction with tree, shrub, vine and ground cover planting.

Installation

- Apply mulch prior to a storm event. This is applicable in extremely sensitive areas, such as within 150 feet of lakes, ponds, rivers, streams and wetlands. Closely monitor weather predictions to have adequate warning of significant storms.
- Mulching should be completed within the following specified time periods from original soil exposure:
    - Within 150 feet of rivers and streams, wetlands, and in lake and pond watersheds, the time period should be no greater than seven days. This seven-day limit should be reduced further during wet weather periods.
    - In other areas, the time period can range from 14-30 days, the length of time varying with site conditions (soil erodibility, season of year, extent of disturbance, proximity to

sensitive resources) and the potential impact of erosion on adjacent areas. Other state or local restriction may also apply.

- Choose mulching materials based on site conditions, soils, slope, flow conditions and time of year.

Hay or Straw Mulches

- Air-dry organic mulches (including weed-free hay and straw) so that they free of undesirable seeds and coarse materials.
- Application rate should be two bales (70-90 pounds) per 1,000 square feet or 1.5-2 tons (90-100 bales) per acre to cover 75-90% of the ground surface.
- Anchor hay or straw mulch to prevent displacement by wind or flowing water using one of the following methods:
    - **Netting:** Install jute, wood fiber or biodegradable plastic netting over hay or straw to anchor it to the soil surface. Install netting material according to manufacturer's recommendation. Netting should be used judiciously, as wildlife can become entangled in the materials.
    - **Tackifier:** Apply polymer or organic tackifier to anchor hay or stray mulch. Application rates vary by manufacturer: typically, 40-60 lbs/acre for polymer material, and 80-120 lbs/acre for organic material. Liquid mulch binders are also typically applied more heavily at edges, in valleys and at crests than in other areas.
- When mulch is applied to provide protection over winter (past the growing season), apply it to a depth of four inches (150-200 pounds of hay or straw per 1,000 square feet, or double standard application rate). Seeding cannot generally be expected to grow up through this depth of mulch and will be smothered. If vegetation is desired, remove mulch in the springtime and seed and re-mulch the area.

Woodchips or Ground Bark

- Apply woodchips or ground bark to a thickness of two to six inches.
- Apply wood chips or ground bark at a rate of 10 to 20 tons per acre or 460 to 920 pounds per 1,000 square feet.

Erosion Control Mix

- Erosion control mix can be manufactured on or off the project site. It must consist primarily of organic material, separated at the point of generation, and may include shredded bark, stump grindings, composted bark or acceptable manufactured products. Wood- and bark chips, ground construction debris or reprocessed wood products are not acceptable as the organic component of the mix.
- Composition of the erosion control mix should be as follows:
    - The organic matter content should be between 25 and 65%, dry weight basis.
    - Particle size by weight should be 100% passing a three-inch screen, 90-100% passing a one-inch screen, 70% to 100% passing a 0.75-inch screen, and a maximum of 30%-75%, passing a 0.25-inch screen.

    - The organic portion needs to be fibrous and elongated; the mix should not contain silts, clays or fine sands. Soluble salts content should be <4.0 mmhos/cm and the pH should be between 5.0 and 8.0.
- Place the mixture along a relatively level contour. It may be necessary to cut tall grasses or woody vegetation to avoid creating voids and bridges that would enable the fines to wash under the barrier through the grass blades or plant stems.
- The barrier must be a minimum of 12 inches high, as measured on the uphill side of the barrier, and a minimum of two feet wide.

Inspection and Maintenance

- Inspect all temporary mulches periodically, and particularly after rainstorms, to check for rill erosion or displacement of the mulch. If less than 90% of the soil surface is covered by mulch, immediately apply additional mulch. Inspect nets after rain events (½-inch in 24 hours) for dislocation or failure. If washouts or breakages occur, repair any damage to the slope and re-install or replace netting as necessary. Inspections should take place until grasses are firmly established (85% soil surface uniformly covered with healthy stand of grass).
- Erosion control mix mulch used for temporary stabilization should be left in place. Vegetation adds stability and should be promoted.
- Where permanent mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface. Repair as needed.
- Inspect permanent mulched areas at least annually, and after each large rain event (2.5 inches or more in a 24-hour period). Any required used, place additional mix on top of the mulch to maintain the recommended thickness. Repair or replace when the mulch is decomposed or clogged with sediment.
- If the mulch needs to be removed, spread it out into the landscape.

Best Management Practice 17: Permanent Vegetation

Description

Permanent vegetative cover should be established on disturbed areas where long-lived vegetative cover is needed to stabilize the soil, to reduce damages from sediment and runoff and enhance the environment.

Considerations

- Runoff and sheet erosion by splash erosion (raindrop impact on bare soil) are the source of most fine particles in sediment. To reduce the sediment load in runoff, the soil surface itself should be protected.
- The most effective and economical means of controlling sheet and rill erosion is to establish a vegetative cover.
- Proper seedbed preparation and the use of quality seed are important in this practice. Failure to carefully follow sound agronomic recommendations will often result in an inadequate stand of vegetation that provides little or no erosion control.
- Manage nutrients and pesticides used to establish and maintain vegetation in a way that protects surface water and groundwater quality.

Installation

- Runoff and sheet erosion caused by splash erosion (raindrop impact on bare soil) are the source of most fine particles in sediment. To reduce the sediment load in runoff, the soil surface itself should be protected.

Site Preparation

- Install needed erosion and sediment control measures, such as siltation barriers, diversions and sediment traps.
- Grade as needed for the access of equipment for seedbed preparation, seeding, mulch application and mulch anchoring.
- Divert runoff from the seeded area.
- On slopes 4:1 or steeper, prepare the area to include creating horizontal grooves perpendicular to the direction of the slope to catch seed and reduce runoff.

Seedbed Preparation

- Work lime and fertilizer into the soil as nearly as practical to a depth of four inches with a disc or spring tooth harrow, or other suitable equipment. Perform the final harrowing operation on the general contour. Continue tillage until a reasonably uniform, fine seedbed is prepared.
- Roll all but clay or silty-soils and coarse sands to firm the seedbed wherever feasible.
- Remove all two-inch or larger stones from the area to be seeded.
- Remove all other debris, such as wire, cable, tree roots, concrete, clods, lumps, trash or other unsuitable material.
- Inspect seedbed just before seeding. If traffic has left the soil compacted, till and firm the area.

- Where the soil has been compacted by construction operations, loosen soil to a depth of two inches before applying fertilizer, lime and seed.
- If applicable, apply fertilizer and organic soil amendments during the growing season.
- Apply limestone and fertilizer according to soil test recommendations. If soil testing is not feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 600 pounds per acre or 13.8 pounds per 1,000 square feet of low-phosphate fertilizer (N-P205-K20) or equivalent. Apply limestone (equivalent to 50% calcium plus magnesium oxide) at a rate of three tons per acre (138 lb. per 1,000 square feet).
- Fertilizer should be restricted to a low-phosphate, slow-release nitrogen fertilizer when applied to areas between 25 and 250 feet from a surface water body. No fertilizer except limestone should be applied within 25 feet of the surface water. These limitations are requirements for any water body protected by the Shoreland Water Quality Protection Act.

Seeding

- Select a seed mixture in that is appropriate for the soil type and moisture content as found at the site, for the amount of sun exposure and for level of use. Select seed from recommendations in Table 2 – Seed Mixture Selection Based on Soil Type and Table 3 – Seed Mixture for Permanent Vegetation .
- Inoculate all legume seed with the correct type and amount of inoculants.
- Uniformly apply seed by hand, cyclone seeder, drill, cultipacker type seeder or hydroseeder (slurry including seed and fertilizer via hydraulic application). Normal seeding depth is ¼ to ½ inch. Hydroseeding that includes mulch may be left on soil surface. Perform seeding operations on the contour.
- Where feasible, except where either a cultipacker type seeder or hydroseeder is used, firm the seedbed following seeding operations with a roller or light drag.
- Spring seeding usually gives the best results for all seed mixes or with legumes. Permanent seeding should be completed 45 days prior to the first killing frost. When crown vetch is seeded in late summer, at least 35% of the seed should be hard seed (unscarified). If seeding cannot be done within the specified seeding dates, mulch according to BMP 16 – Temporary or Permanent Mulch, and delay seeding until the next recommended seeding period.
- Temporary seeding should typically occur prior to September 15.
- Areas seeded between May 15 and September 15 should be covered with hay or straw mulch.
- Vegetated growth covering at least 85% of the disturbed area should be achieved prior to October 15. If this condition is not achieved, implement temporary stabilization measures for overwinter protection and complete permanent seed stabilization during the next growing season.

Hydroseeding

- When Hydroseeding, prepare the seedbed as specified above or by hand-raking to loosen and smooth the soil and to remove surface stones larger than two inches in diameter.
- Slopes must be no steeper than two to one (two feet horizontally to one foot vertically).
- Lime and fertilizer may be applied simultaneously with the seed. The use of fiber mulch on critical areas is not recommended (unless it is used to hold straw or hay). Better protection is gained by using straw mulch and holding it with adhesive materials or 500lbs/acre of wood fiber mulch.
- Increase seeding rates by 10% when hydroseeding.

Inspection and Maintenance

- Inspect permanently seeded areas at least monthly during the course of construction. Continue with inspections, maintenance and corrective actions until the owner assumes permanent operation of the site.
- Mow to the height and frequency dependent on type of grass cover.
- Reseed areas based upon inspection to achieve full stabilization of exposed soils.
- At a minimum, 85% of the soil surface should be covered by vegetation.
- If any evidence of erosion or sedimentation is apparent, make repairs and reseed areas with other temporary measures, such as mulch, used to provide erosion protection during the period of vegetative establishment.

Footnotes

- Low-phosphorus fertilizer is defined by the Shoreland Water Quality Protection Act as containing less than 2% phosphorus. The University of New Hampshire (UNH) Cooperative Extension has found through soil tests that New Hampshire's soils have ample phosphorus and recommends low-phosphorus fertilizers with 0% - 1% phosphorus, such as 3:1:3 or 10:0:10 N:P:K. They discourage the use of imbalanced fertilizers.
- Slow-release fertilizers must be at least 50% slow-release nitrogen component, which means that half of the nitrogen will not be immediately available. Typically, it takes 2-24 weeks for all slow-release nitrogen to become available. Slow-release fertilizers do not necessarily reduce nitrogen loading. Nitrogen fertilizers are necessary for grass lawns; however, according to the UNH Cooperative Extension, nitrogen fertilizers are not necessary for lawns that consist of legume and clover.

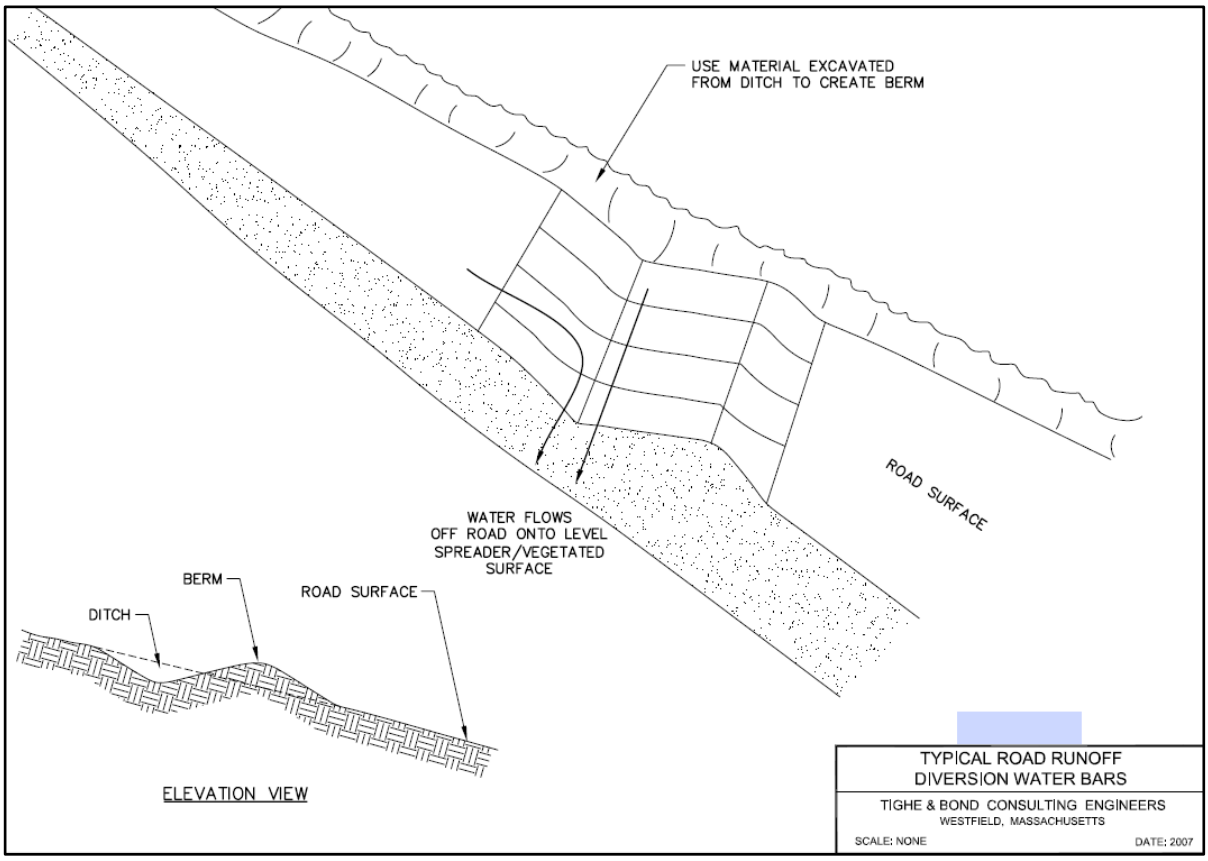
Table 2: Seed Mixture Selection Based on Soil Type

Use	Seed Mixture (See 3)	Soft Drainage			
		Droughty	Well Drained	Moderately Well Drained	Poorly Drained
Steep cuts and fills, borrow and disposal area	A B C D E	Fair Poor Poor Fair Fair	Good Good Good Fair Excellent	Good Fair Excellent Good Excellent	Fair Fair Good Excellent Poor
Waterways, emergency spillways, and other channels with flowing water	A C D	Good Good Good	Good Excellent Excellent	Good Excellent Excellent	Fair Fair Fair
Lightly used parking lots, odd areas, unused lands, and low intensity use recreation sites	A B C D	Good Good Good Far	Good Good Excellent Good	Good Fair Excellent Good	Fair Poor Fair Excellent

Table 3: Seed Mixture for Permanent Vegetation

Mixture	Species	Pounds Per Acre	Pounds Per 1,000 Sq. Ft.
A	Tall fescue Creeping red fescue Redtop **Total**	20 20 2 **42**	0.45 0.45 0.05 **0.95**
B1	Tall fescue Creeping red fescue Crown vetch Or Flatpea **Total**	15 10 15 - 30 **40 or 55**	0.35 0.25 0.35 - 0.75 **0.95 or 1.35**
C3	Tall fescue Creeping red fescue Birdsfoot trefoil **Total**	20 20 8 **48**	0.45 0.45 0.20 **1.10**
D3	Tall trefoil Redtop **Total**	10 5 **15**	0.25 0.10 **0.35**
E	Tall fescue Flatpea **Total**	20 30 **50**	0.45 0.75 **1.20**
F	Creeping red fescue Kentucky bluegrass **Total**	50 50 **100**	1.15 1.15 **2.30**
G	Red fescue*	**150**	**3.60**

Best Management Practice 18: Water Bars



Description

A water bar is a reinforced berm constructed across a road to slow down and divert water off of the road surface. They are best suited for closed or rarely-used roads and trails. The water bar is easy and inexpensive to install. Water bars can be constructed using soil, logs or slash.

Considerations

- Install water bar at top of any sloping road or trail and at spacing according to Table 4, below.
- Water bars may be shallow or deep, depending on the need.
- Water bars should be constructed at a 30-35 degree angle.
- Water bars should drain at a 3% out-slope on to undisturbed litter or vegetation.
- The uphill end of water bar should extend beyond the side ditch line to intercept water flow.
- The downhill end of water bar should be open and extend beyond the edge of the road or trail to disperse runoff water onto the undisturbed forest floor.
- Rocks, logs or slash may be placed at the end of the water bar to disperse but not block the flow of water.

Inspection and Maintenance

- If the road will be used continuously, reinforce the water bars, keep travel to a minimum, use only in dry weather, and inspect and maintain routinely.

Table 4: Suggested water bar spacing.

Slope	Spacing between water bars (ft)
2%	250
5%	130
10%	80
15%	50
25% +	40

Appendix A: Resource Identification

A.1 Wetland Types

Wetlands are defined as areas inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

Stirrup Brook wetland area, Salisbury, NH.
Credit: Kathryn Michener

Wetlands tend to be located in depressions, at the toe of slopes, or in other areas where one might envision water collecting. Wetlands in New Hampshire are identified using a three-parameter approach:

- Hydrophytic (wetland) vegetation.
- Hydric soils.
- Wetland hydrology.

With the exception of heavily disturbed sites, all three parameters are required for an area to be considered a wetland.

If an area is heavily disturbed, all three parameters may not be present and identification of all three would not be required for the area to be considered a wetland. Examples of this would be the complete removal of vegetation or grading of soils within the wetlands. Current practices of utility ROW Vegetation Management do not regularly fall within this guideline because the vegetation is only cut and most of the species re-generate from stump sprouts or existing root stock and can still be used in wetland identification.

A.2 Forested Wetlands

Forested wetlands in New Hampshire are typically drier wetlands with standing water during large rain events (½-inch in 24 hours) and periods of high water (early spring through mid-summer). Red Maple and Hemlock are key identifiers of these wetlands.

These wetlands tend to have pit and mound topography and the trees appear to be standing up on their roots. These wetlands are also typically associated with flowing water contained in ephemeral (seasonal), intermittent and perennial streams and rivers. Forested wetlands may also contain vernal pools (see A.6 – Vernal Pools). Forested wetlands are considered the most common type in New England.

Hulbert Swamp, Stewardstown, NH
Credit: Amy Hudnor

A.3 Scrub-Shrub Wetlands

Scrub-shrub cover on Ponemah Bog, Amherst, NH

Scrub-shrub wetlands tend to be wetter than forested wetlands and may have standing water in places at all times except for the driest time of the year, *e.g.*, late summer. Scrub-shrub wetlands are a common feature in existing utility ROWs and are often maintained in this condition by the frequent trimming and removal of vegetation by utility providers. These wetlands often provide a variety of wildlife habitats for birds, mammals, amphibian and reptiles.

A.4 Emergent Wetlands

Emergent wetlands, such as marshes and wet meadows, can vary by type, however, marshes lack woody vegetation.

Marsh wetland in Washington, NH.
Credit: Sandy Crystall

A.4.1 Marshes

Marshes are areas that are distinguished by the absence of trees and shrubs. Marshes are considered surface water as well as wetlands under state law. These areas are typically dominated by soft-stemmed species such as grasses, cattails, sedges and rushes, and usually have a water table at or above the ground elevation for most of the year. Mucky soils in these wetlands may present access challenges for utility providers and often require the use of swamp mats in these areas. In the deeper marshes, access may not be possible due to water depths and soils.

Wetland monitoring in a wet meadow.
Credit: National Park Service

A.4.2 Wet Meadows

Wet meadows are areas dominated by non-woody species. These areas are typically saturated during the year but usually not flooded. These areas may exist due to frequent mowing to keep vegetation down. Wet meadow vegetation is varied and can include such common species as tussock sedge, rushes, grasses like blue joint and reed canary grass, and flowering herbaceous plants including Joe-Pyeweed, goldenrod, aster and many others. This wetland type is also commonly encountered in utility ROWs.

A.4.3 Bogs

A bog is a non-tidal wetland that is distinguished by stunted evergreen trees and shrubs, peat deposits, poor drainage, and/or highly acidic soil and/or water conditions. Bogs lack any significant inflow or outflow of surface and groundwater throughout the year.

Credit: NHB

A.5 Streams and their Banks

Jurisdictional areas under the wetlands dredge and fill law include streams and their banks. Streams in New Hampshire are defined by NHDES, in accordance with Env-Wt 100 and Wt 900. (See the rules for appropriate methods and times for crossing streams).

Because work takes place year round, it is more important to have guidelines based on the methods appropriate for crossing (see Chapter 2.8 – Stream Crossings).

Disturbance of soil or work near flowing waters can cause water quality problems and violations, therefore particular attention should be given when planning work in these areas.

A.6 Vernal Pools

Vernal pools are those wetlands and temporary ponds that typically have ponded water only part of the year. Because the pool is temporary, they provide critical habitat for certain wildlife to breed and complete their life cycle.

Many of the animals that breed in vernal pools live in the upland areas around the pool during the non-breeding season. When pools dry, wood frogs migrate to forested upland areas that are as much as 1,000 to more than 2,000 feet from their breeding pools. Mole salamanders will migrate to forested uplands that are 1,000 feet from their breeding pools.

Vernal pools are a resource protected from unregulated alteration under the NHDES Wetlands law and rules. The rules provide definitions of vernal pool, primary vernal pool indicators and secondary vernal pool indicators. (See the University of Maine's Vernal Pools Indicator Species identification cards and NHFG's Vernal Pool Documentation Manual.)

Typically, a vernal pool:

- Forms in a shallow depression or basin.
- Holds water for at least 2 continuous months following spring ice-out.
- Cycles annually from flooded to dry conditions, although the hydroperiod, size, and shape of the pool might vary from year to year.
- Has no permanently flowing outlet.

- Lacks a viable fish population.
- Supports one or more primary vernal pool indicators, or three or more secondary vernal pool indicators.

A.7 Wetland Buffers

Wetland buffers are vegetated areas adjacent to wetlands that provide important protections and enhancements to the wetlands. These areas can provide filters to treat polluted water from human sources, such as roads and lawns. They also provide an important wildlife habitat adjacent to wetland areas. When possible, the integrity of a wetland buffer should be maintained during utility ROW maintenance activities. Make sure all appropriate local approvals have been obtained from the affected municipalities, as needed, to work in buffers.

A.8 Wetland Vegetation

Hydrophytes (plants adapted for life in water or saturated soils) are one of the criteria for identifying wetlands. The US Department of Interior – Fish and Wildlife Service has published the National List of Plant Species that Occur in Wetlands – Northeast Region, which is a list that ranks plant species according to their frequency of occurrence within wetlands. These classifications are as follows:

- **Obligate (OBL):** Almost always (approximately 99%) occurs in wetlands.
- **Facultative Wet (FACW):** Usually (approximately 67-99%) occurs in wetlands, but occasionally occurs in non-wetlands.
- **Facultative (FAC):** Equally likely (approximately 34-66%) to occur in wetlands or non-wetlands.
- **Facultative Upland (FACU):** Usually (approximately 67-99%) occurs in non-wetlands but occasionally (approximately 1-33%) found in wetlands.
- **Upland (UPL):** Almost always (approximately 99%) occurs in non-wetlands.

Wetlands must have more than 50% OBL, FACW, or FAC plant species, unless there are plants that have adapted to living in wetlands by growing shallow roots, etc.

Table A-1: Common Plants Found in Different Wetlands in New Hampshire

Obligate (OBL) Wetland Plants *99% of time found in wetlands*		
Tree	**Shrub**	**Herbs/Emergents**
■ Atlantic White Cedar *(Chamaecyparis thyoides)* ■ *Black willow (Salix nigra)* ■ *Buttonbush (Cephalanthus occidentalis)*	■ Buttonbush *(Cephalanthus occidentalis)* ■ Leatherleaf (*Chamaedaphne calyculata* ■ Sweet gale (*Myrica gale*) ■ Swamp loosestrife (*Decadon verticillatus*) ■ Cranberry (*Vaccinium corymbosum*)	■ Common Cattail (*Typha latifolia*) ■ Common rush (*Juncus effusus)* ■ Canadian rush (*Juncus canadensis*) ■ Fringed sedge (*Carex crinata*) ■ Bluejoint (*Calamagrostic canadensis*) ■ Common spike rush (*Eleochoris palustris*) ■ Tussock Sedge *(Carex stricta)* ■ Bulrush (*Scirpus* sp.) Rice cut grass (Leersia oryzoides) Pickerelweed (Pontedaria cordata) Royal Fern (Osmunda regalis) Skunk Cabbage (Symplocarpus foetidus)
Facultative Wet (FACW) and Facultative (FAC) Plants *67%-99% and 34-66% of time found in wetlands, respectively*		
Trees	**Shrubs**	**Herbs/Emergents**
■ American Elm *(Ulmus americana)* ■ Gray Birch *(Betula populifolia)* ■ Red Maple *(Acer rubrum)* ■ Yellow Birch *(Betula alleghaniensis)*	■ Highbush Blueberry *(Vaccinium corymbosum)* ■ Meadowsweet *(Spiraea alba var. latifolia)* ■ Northern Arrow-wood *(Viburnum dentatum)* ■ Silky Dogwood *(Cornus amomum)* ■ Speckled Alder *(Alnus incana spp. rugosa)* ■ Winterberry *(Ilex verticillata)*	■ Cinnamon Fern (*Osmunda cinnamomea)* ■ Common Reed *(Phragmites australis)** ■ New England Aster *(Symphotrichum novae-angliae)* ■ Purple Loosestrife (*Lythrum salicaria)** ■ Reed Canary Grass *(Phalaris arundinacea)** ■ Sensitive Fern *(Ononclea sensibilis)* ■ Woolgrass *(Scirpus cyperinus)*
Upland (UPL) Vegetation *1% of the time found in wetlands*		
Trees	**Shrubs**	**Herbs**
■ American Beech *(Fagus grandifolia)* ■ Red Oak *(Quercus rubra)* ■ Sugar Maple *(Acer saccharinum)*	■ Huckleberry *(Gaylussacia baccata)* ■ Maple-Leaved Viburnum *(Viburnum acerifolium)* ■ Striped Maple *(Acer pensylvanicum)*	■ Bracken Fern *(Pteridium aquilinum)* ■ Partridgeberry *(Mitchella repens)* ■ Tree Clubmoss *(Lycopodium obscurum)*

Trees

Gray Birch (FAC) Betula populifolia
Gray birch is a wetland indicator tree that grows in either wetlands or uplands. This small growing birch is a pioneer species typically found on disturbed sites. It has dirty white bark as it grows older and never reaches taller than 20-25 feet. Even when old, the trees are often weak and it is not uncommon to see them bent over from damage caused by ice storms.

Red Maple (FAC) Acer rubrum

Red maple is the most common New Hampshire wetland indicator species that grows in either wetland or upland areas. The stems have a red hue. The leaves are opposite with distinctive three lobes and very serrated edges. Red maples have red each season – red buds in the winter, red flowers in the spring, red stems in the summer and red leaves in the fall.

Shrubs

Elderberry (FACW) Sambucus canadensis

This facultative wetland shrub has soft, smooth gray-brownish bark with corky bumps and spongy white pith inside the twigs and branches. It flowers in early to mid-summer with clumps of white flowers at the ends of branches. It fruits in the summer and the berries persist to the fall.

Highbush Blueberry (FACW)
Vaccinium corymbosum

This is a common facultative wetland indicator shrub with characteristic summer blue berries that are a wildlife favorite. These multi-stemmed shrubs tend to grow to about eight feet and have scaly bark that sheds like shingles.

Silky Dogwood (FACW) Cornus amonum
These facultative wetland indicator shrubs grow in thick clumps. Dogwood leaves have distinctive, parallel veins, reddish twigs and a dark brown pith. Compare with Redosier dogwood – another FAC Wet shrub with also with bright red stems. The two look similar but Silky has a brown pith (bluish fruit) and Redosier has white pith/fruit).

Speckled Alder (FACW) Alnus incana (subsp. rugosa)

Facultative wetland shrub that typically grows in wetlands. This shrub grows to 20 feet and has small brown catkins (seed pods) that persist through the winter. Its thin bark has pores or lenticels, that give it a speckled look, hence the common name. It often forms dense thickets around wetlands and streams.

Herbs

Cattail (OBL) Typha latifolia

Obligate wetland plants that are readily identifiable with their long, flat blade-like leaves and familiar and distinctive brown sausage shaped flowering heads, topped with a small, sharp spike. Cattails are the classic characteristic indicator of wetlands – located on lakes, ponds and wetlands.

Sensitive Fern (FACW) Onoclea sensibilis

Facultative wetland fern with a light green, wavy-edged distinctive leaf. Also known as "Bead fern," as the fertile fronds or sori are clustered like brown beads and persist through the winter. A trail of sensitive bead fronds can help one find a snow-covered drainage.

Sphagnum Moss

There are 20 species of Spagnum moss in New England (of 380 known species). Sphagnum is spongy and soft, can store water, and slowly spreads, forming blankets or mats across the water in what has become known as a "quaking bog." It creates acidic conditions and slows anaerobic decay. This common moss is widespread in bogs, fens and many forested wetlands. Dried sphagnum is called "peat moss" and is used as a soil conditioner. For centuries and during World War I, sphagnum moss was used for dressing wounds because its absorptive, acidic quality inhibits growth of bacteria and fungi.

Tussock Sedge (OBL) Carex stricta
Obligate wetland herb. This common sedge species almost always grows in wetlands. It is characterized by growing in clumps and is usually surrounded by standing water for some period of time.

A.9 Hydric Soils

A hydric (wetland) soil is a soil that has developed under saturated conditions. The saturated conditions are lengthy enough to produce an anaerobic (lack of oxygen) environment within the soil. The saturation comes from the same water that drives the wetland development. Hydric soils are usually identified by some of the following characteristics:

- A very dark or thick topsoil layer.
- A high amount of organic matter in the topsoil. (Can be tested by squeezing a clump of soil. If the soil flows between the fingers, it is organic).
- Blotchy colors (mottles or redoximorphic features) at or near the surface.
- A gray-colored layer within 20 inches of the surface.

Dark surface layer with redoximorphic features indicates possible wetland soil.

Left: Example of blotches indicating fluctuating (seasonal) water table.
Right: Soil profile matrix with reduced (gray) orange blotches indicate fluctuating water table.

A.10 Wetland Hydrology

The wetland hydrology, the presence or absence of water, is the driving force behind any wetland. Without the presence of water for a minimum of two weeks during the growing season, the soils would not become anaerobic and the wetland vegetation would not be as strongly represented. Indications of hydrology are fairly easy to identify in the spring, when the water table is at its highest and most wetlands are ponded or saturated enough for water to be apparent. However, as spring turns into summer, the water table drops and it is necessary to focus on other indicators for confirmation that the area is a wetland. The following characteristics may be observed:

- Drainage patterns or scoured channels representing intermittent streams.
- Water- or silt-stained plant stems.
- Water-stained (gray or black in color) or silt covered leaves.
- Lines of organic debris, such as leaf litter, on tree and shrub stems above soil surface.
- Soils showing observable features of being saturated or flooded for long periods of time.
- Sphagnum moss on the surface.

A.11 How to Identify Wetlands

Identifying wetlands is usually done by the USACE 1987 method; however, with appropriate background and training, areas that are wetlands or possible wetlands can be identified. The following guidelines will be used in determining if an area is a wetland:

Does the area have standing water or stained leaves? During most times of the year, if there is standing water, the area is most likely a wetland. It is important to note however, that in the spring, when water tables are at their highest, many areas that are not wetlands may have standing water. These areas are still of concern because of the high water table. Any excessive activity in these areas may cause rutting and soil disturbance that can lead to erosion and other issues. Note that many wetlands never have standing water.

Is the area void of any woody plants? Typically, areas that don't have woody plants, such as shrubs and trees, are classified as marsh and wet meadow wetlands. These areas also usually have standing water, except in the drier times of the year.

Is there a defined channel? A defined channel is one of the criteria that the NHDES uses to identify streams, whether they are perennial streams or small intermittent streams.

Do plants typical to wetlands, dominate the area? Knowing a few key species of plants will help in determining if an area is a possible wetland. Areas dominated by shrub species, such as speckled alder, willow, high bush blueberry and meadowsweet are typical of scrub-shrub wetlands. Also areas with tree species such as red maple or large fern species, such as cinnamon fern, are indicators of a forested wetland.

Does the area look like it ponds water during wetter times of the year? While working during dryer summer months, it may seem more difficult to determine if an area is a wetland but the ground will provide clues. Areas with gray- or black-stained leaves on the ground mean that the area was ponded. Look for pit and mound micro-topography where trees and shrubs are growing on the mounds. Carefully investigate low lying areas where it looks like water would collect.

Appendix B: Invasive Species Plant Identification

Those who will be working or operating equipment in areas that may contain invasive plant species should be trained in the identification and modes of dispersal and spread of common, highly prolific terrestrial invasive plant species that are commonly found along roadsides and in utility ROWs.

Autumn Olive (*Elaegnus umbellata*)

- **Description**: Woody, deciduous shrub growing up to 20 feet tall and 20 feet wide. Leaves are alternate, oval, glossy, grayish-green above and silvery below. Fragrant, tubular, whitish flowers in clusters of one to eight bloom from April to June. Bears sharp thorns as spur branches.

- **Habitat:** Common in open fields, roadsides, forest edges and other disturbed areas. Thrives in full sunlight and disturbed areas.

- **Reproduction:** Quarter-inch sized fruit that is silvery with brown scales when immature and speckled-red when mature. Fruits ripen September to October. Reproduces primarily by seed but can vegetatively sprout from stumps and roots.

Common Reed (*Phragmites australis*)

- **Description**: Perennial grass growing up to 15 feet tall. Leaf blades flat, smooth, grayish-green, growing up to 20 inches long. Densely-branched flower clusters at the end of each stem that becomes open, feathery, and reddish at maturity. Can form large dense stands.

- **Habitat**: Found along roadsides and in wetland areas. Can grow in freshwater, brackish and saline marshes.

- **Reproduction**: Spreads primarily by an extensive aggressive system of horizontal and vertical rhizomes (roots) that can live for three to six years.

Glossy Buckthorn (*Frangula alnus*)

- **Description**: Small deciduous tree or shrub growing up to 20 feet tall and 15 feet wide. Leaves are alternate, smooth-edged, oval, green and somewhat glossy, with dull green underside and 6-10 pars of veins. Small greenish-yellow flowers in clusters of two to six. Re-sprouts vigorously and can form a dense thicket.

- **Habitat**: Can grow in both wetland and upland areas, open fields, and forest edges but prefers full sun.

- **Reproduction:** Pea-sized fruit with two to three seeds that ripen from green to red to black from July through September. Seeds are viable for several years and are primarily dispersed by birds. If cut, it can vegetatively sprout from the root crown and produce fruit on new shoots within the same season.

Japanese Knotweed (*Polygonum cuspidatum*)

- **Description**: Perennial herbaceous shrub growing up to 10 feet tall. Soft, fleshy, green and red hollow, jointed stalks resembling bamboo. When stalks die, they dry and persist through the winter. Leaves are large, alternate, semi-triangular and green. Numerous small green to white flowers on a slender stalk bloom August through September. Forms dense thickets.

- **Habitat**: Found along roadsides, open spaces, stream and river banks, wetlands, wet depressions, and woodland edges. Can tolerate a wide array of soil and moisture conditions. Semi-shade tolerant.

- **Reproduction:** Primarily vegetatively through rhizomes. Even very small fragments of root material in soils can sprout to form new shoots.

Oriental Bittersweet (*Celastrus orbiculatus)*

- **Description**: Woody, deciduous, twining vine that can climb to a height of 60 feet in trees and reach a diameter of four inches. Leaves are alternate, glossy, round and finely-toothed and turn yellow in the fall. Roots are a distinctive orange color. Small, greenish-yellow, five-petaled flowers cluster in the leaf axis and bloom May through June.

- **Habitat:** Found in grasslands, open woods, woodland edges, along roadsides, fence rows and stream and river banks. Extremely shade tolerant. Can climb and overtake trees and shrubs.

- **Reproduction:** Fruits are green in summer and turn yellow and orange in the fall. Fruits contain three to six seeds and can remain on the vine throughout winter. Reproduces by prolific seed production (primarily from birds) and spreading underground roots that form new stems.

Purple Loosestrife (*Lythrum salicaria*)

- **Description**: Perennial herbaceous plant growing up to six feet tall. Its stem can become woody with age. Leaves are elongated and opposite or whorled, with lightly heart-shaped bases, producing numerous purple to magenta flowers on a terminal spike that bloom July through September. Flowers produce seed capsules with prolific seed production.

- **Habitat**: Found primarily in sunny, wet areas, such as wet meadows and marshes, but can also spread into uplands. Can tolerate a wide range of soil types but prefers organic soils.

- **Reproduction**: Reproduces prolifically by seed or vegetatively by resprouting from cut stems and regenerating from pieces of root stock.

In accordance with the Invasive Species Act, HB 1258-FN, the New Hampshire Department of Agriculture, Markets & Food, Division of Plant Industry, is the lead state agency responsible for the evaluation, publication and development of rules on invasive plant species for the purpose of protecting the health of native species, the environment, commercial agriculture, forest crop production or human health. The rule, Agr 3800, states "No person shall conduct, transport, import, export, move, buy, sell, distribute, propagate, or transport any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.01, New Hampshire prohibited invasive species list."

Table B-1: New Hampshire Prohibited Invasive Plant Species List (Approved by the New Hampshire Invasive Species Committee on March 17, 2016)
■ Amur Honeysuckle *(Lonicera maackii)* ■ Autumn Olive *(Elaeagnus umbellata)* ■ Bella Honeysuckle *(Lonicera x bella Zabel)* ■ Black Swallow-Wort *(Cynachum nigrum)* ■ Blunt-Leaved Privet *(Lingustrum obtusifolium)* ■ Bohemia Knotweed *(Reynoutria x bohemica)* ■ Burning Bush *(Euonymus alatus)* ■ Common Buckthorn *(Rhamnus cathartica)* ■ Common Privet *(Ligustrum vulgare)* ■ European Barberry *(Berberis vulgaris)* ■ European Black Alder *(Alnus glutinosa)* ■ Garlic Mustard *(Alliaria petiolata)* ■ Giant Hogweed *(Heracleum mantegazzianum)* ■ Giant Knotweed *(Reynoutria sachalinensis)* ■ Glossy Buckthorn *(Rhamnus frangula / Frangula alnus)* ■ Japanese Barberry *(Berberis thunbergii)* ■ Japanese Honeysuckle *(Lonicera japonica)* ■ Japanese Knotweed *(Polygonum cuspidatum / Fallopia japonica)* ■ Japanese Silt Grass *(Microstegium vimineum)* ■ Kudzu *(Pueraria montana)* ■ Mile-A-Minute Weed *(Polygonum perfoliatum)* ■ Moneywort *(Microstegium vimineum)* ■ Morrow's Honeysuckle *(Lonicera morrowii)* ■ Multiflora Rose *(Rosa multiflora)* ■ Norway Maple *(Acer platanoides)* ■ Oriental Bittersweet *(Celastrus orbiculatus)* ■ Ornamental Jewelweed *(Impatiens glandulifera)* ■ Pale Swallow-Wort *(Cynanchum rossicum)* ■ Perennial Pepperweed *(Lepidium latifolium)* ■ Reed Sweet Grass *(Glyceria maxima)* ■ Spotted Knapweed *(Centaurea biebersteinii)* ■ Tartarian Honeysuckle *(Lonicera tartarica)* ■ Tree of Heaven *(Ailanthus altissima)* ■ Water Flag Iris *(Iris pseudacorus)*

Aquatic Invasive Plants

Numerous aquatic invasive plants exist in New Hampshire's surface waters. Though this BMP does not address identification of aquatic invasive plants, workers should be aware of their potential presence and should follow the decontamination procedures in Chapter 2.10 – Invasive Plant Species when working in or near surface water bodies.