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# Planting and Maintenance Recommendations for Wetland Restoration and Buffer Projects

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The following information was developed to guide wetland restoration and buffer projects, and promote consistency in their design, installation, and maintenance. Additional information about planting and maintaining wetlands and buffers can be found in the “Minnesota Wetland Restoration Guide” at:

[www.bwsr.state.mn.us/publications/restoration\\_guide.html](http://www.bwsr.state.mn.us/publications/restoration_guide.html).

Experience from practitioners is also being summarized by BWSR and is available at: [www.bwsr.state.mn.us/grants/WhatsWorking.html](http://www.bwsr.state.mn.us/grants/WhatsWorking.html).

## Site Preparation

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### ***Transition from Agriculture***

Effective control of weeds is essential to get a project off to a good start. Sites that are currently in agriculture often have effective weed control, and are in good condition for seeding. If a site is in perennial weeds (brome, quack grass or bluegrass) and cannot be put into agricultural production, it is recommended to treat the vegetation with herbicide in the fall or spring followed by disking in two directions, or field cultivation to break up rhizomes. A combination of spraying and tilling is then conducted to remove seedlings and re-sprouts before seeding.

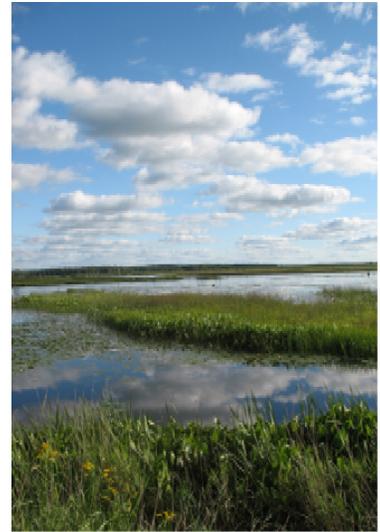
More intensive management may be needed for reed canary grass, as it has large rhizomes, and its seebank must be controlled before seeding.

Following a season of agricultural production, additional spot treatment of weeds (such as Canada thistle) is commonly needed to minimize management needs after seeding.

### ***Reed Canary Grass Control***

Reed canary grass has been a significant problem for many projects and should be taken seriously if it is present. If a project is dominated by reed canary grass it may be difficult to convert the site to native vegetation. If a reed canary grass wetland will be restored, it is essential that the existing populations of grass, and the seed source is thoroughly removed before seeding. It may be difficult to keep reed canary grass out of a project if the site, or the surrounding landscape is dominated with the species.

**Spraying** - The removal of reed canary grass is most often initiated in the fall, as this is the time of year when glyphosate is effectively taken into the rhizomes. A common sequence for removal involves mowing reed canary grass in July or early August, spraying with glyphosate in August or early September, and again in early October. A prescribed burn may then be conducted in early spring to remove the duff layer; and then the site is sprayed with glyphosate again in late April to remove seedlings. The site should be observed between April and the seeding date to see if additional weed removal is needed through tilling and herbicide treatment.



**Scraping** - Scraping of reed canary grass can be an effective strategy for control, however, it can be expensive and there must be a plan for the disposal of scraped material. Scraping is typically conducted to eight inches, though the depth will vary depending on hydrologic conditions and root depth. Scraping should not be conducted in places where upper soil layers are thin.

**Inundation** - If inundation will be used for removal it should be initiated early in the season when the grass is short and snowmelt is contributing to water levels. Mowing is recommended if inundation is started during other times of year. It may take a full growing season at a depth of one to two feet to accomplish full removal, so sufficient hydrology is required. Reed canary grass on the edges of the inundated areas will likely require herbicide treatment. A plan should be in place to control seedling reed canary grass following inundation. Combined with mowing, inundation can also be used for controlling cattails, and giant reed grass.

### **Topsoiling**

Topsoil is sometimes added to constructed wetlands to provide a higher nutrient medium for plants. The decision to use topsoil should be based on the project location, reference wetland soils, risk of invasive species (as higher nutrients may be problematic), project budget, and regulatory requirements. If topsoil will be used for a project it is essential that the topsoil be free of upland and wetland invasive species, particularly reed canary grass. If there is a possibility of reed canary grass seed being present in the soil, the soil should be tested for germination. It is also important that topsoil be mixed into the substrate through periodic disking, and any compaction that results be loosened before final seedbed preparation. Time may also be needed to allow soils to settle before seeding. Any weeds that germinate during this time should be sprayed with aquatically-certified glyphosate.



### **Seedbed Preparation**

Fields that were in soybeans prior to seeding may not require additional site preparation, while cornfields often require corn stubble to be baled. If a traditional native seed drill will be used, a smooth firm seedbed is required. Soybean fields generally are prepared for a native seed drill, but sites that were recently tilled will require additional soil treatment such as harrowing and rolling to prepare an adequate seedbed and prevent seed from being buried too deep. Broadcast seeding can be conducted on soybean or corn fields, or fields that have been disked, as long as the soil is allowed to settle before seeding. It is often recommended to roll or cultipack following broadcast seeding on fields with a smooth surface (such as a soybean field) to prevent the movement of seed, particularly if there is not much plant residue or mulch present.

## Installation

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### **Seed Mixes**

State seed mixes are recommended for wetland mitigation projects [http://www.bwsr.state.mn.us/native\\_vegetation](http://www.bwsr.state.mn.us/native_vegetation). State mixes are designed to increase diversity, create competition for invasive species, and promote plant community stability. Additional cover crops are not recommended in addition to permanent state seed mixes as they already contain oats or winter wheat (depending on the season of planting).

BWSR guidelines for native vegetation establishment and enhancement are recommended for projects. The guidelines cover the topics of diversity levels, seed and plant source, native variety use, seed mixes, yellow tag seed, seed labeling, and protecting existing native prairies. The guidelines are available at [www.bwsr.state.mn.us/native\\_vegetation](http://www.bwsr.state.mn.us/native_vegetation)

The following website lists native seed vendors in Minnesota: <http://www.mnnwgpa.org/>.

## Temporary Cover Crops and Mulch

The use of temporary cover crops helps to stabilize project sites and minimize the need for additional mulch. They can also provide time to observe weed problems, and to allow for proper control before fall seeding. Temporary cover crop such as oats or winter wheat (the two species most commonly used) should be mowed to 10-12 inches before seeds mature (or harvested upon maturity) to prevent re-seeding. Slough grass is also a common cover crop for wet areas. Perennial species are discouraged as temporary cover crops, as they require herbicide application before conducting seedbed preparation.



## Planting Dates

Spring seeding of wetland areas should be conducted before June 30, as summer temperatures can lead to the loss of seedlings. Fall dormant seeding should be conducted after October 15th and before the soil freezes. Dormant seeding is often recommended for wetland seed, as winter freezing and thawing allows for the stratification (breaking of seed coats) of wetland forbs and sedges. Dormant seeding can also aid in the establishment of forbs and sedges in uplands where grasses can become more dominate with spring plantings. Dormant seeding is also beneficial if hydrology will be restored in the fall, as it may be more difficult to access the site after spring snowmelt.

If a site will be constructed in the spring/early summer, or will have flowing or fluctuating water levels it may be better to seed later in the spring after water levels stabilize.

The table to the right summarizes preferred seeding dates for different types of seed.

Containerized and bare root plants should be planted in late spring when there is adequate rainfall and soil moisture. Trees and shrubs can also be planted in late fall, before the ground freezes.

## Seeding

State wet meadow and wet prairie seed mixes should be used from the planned edge of open water (pool elevation) to around 1.5 feet in elevation depending on soil texture and capillary action of soil. Other considerations for the use of wetland seed mixes include the extent of hydric soils, and swales coming into a wetland. Upland mixes are used around 1.5 feet above pool elevation and can be broadcast or drill seeded. The state emergent mix is commonly used in a 6 to 10-foot band that straddles the edge of open water. This strip of emergent seed is hand broadcast after water levels have stabilized within the wetland.

In most cases, wetland seed is broadcast-seeded followed by rolling or packing, as most wetland seed needs light to germinate. Wetland grasses can be drill-seeded followed by broadcasting forbs and sedges. If a seed drill will be used for all seed, drills must be calibrated carefully to ensure that small seed is placed correctly, at the surface.

## Mulching

Care should be taken to ensure that upland soils do not erode into wetland areas and cover wetland seedlings. As much as one centimeter of sediment can prevent germination of many wetland species. If temporary cover crops are not used as mulch, additional mulch is recommended at one-ton per acre in wetland areas, and two-tons per acre in upland areas. It is essential that a weed-free mulch be used; MCIA Certified Weed Free mulch



## Recommended Seeding Dates for Restoration Projects

Recommended Dates / Vegetation Type

Vegetation Type	Spring/Early Summer	Mid-Summer	Early Fall	Late Fall (Dormant Seeding)	Snow Seeding
Prairie Grasses	Apr. 15 - Jun 30	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7
Prairie Sedges and Forbs	Apr. 1 - Jun 30	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7
Wetland Grasses	Apr. 1 - Jun 30	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7
Wetland Sedges and Forbs	Apr. 1 - Jun 30	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7
Native Construction Mix	Apr. 1 - Jun 30	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7
Oats Cover	Apr. 1 - Jun 30	*	**	Oct 15 - Frozen Soil	Feb 15 - April 7
Winter Wheat Cover	**	*	Aug 1 - Oct 1	Oct 15 - Frozen Soil	Feb 15 - April 7

Success Rates:

High Success Rates
Medium Success Rates
Low Success Rates
* Not Recommended Without Watering
** Not Recommended

Note: Planting dates will vary from northern to southern Minnesota.

Notes about success rates: Success is less predictable for optional vegetation types and seeding dates, so use the recommended dates for each vegetation type unless construction sequencing or other factors make that impossible. For example, if the state of Minnesota "Native Construction" mix is used in early fall, watering is recommended to aid establishment.



(Mn/DOT Type 3) is recommended. The mulch should be disk-anchored to prevent movement. If the mulch windrows along the edge of open water, it should be removed or re-spread.

### **Use of Native Seedbank**

Maximizing the use of native seedbank is encouraged for projects as a means to promote the establishment of local seed/species. If native seedbank is planned as a method to establish vegetation, a seedbank test or survey of existing vegetation will assist in determining the need for supplemental seeding. A method for testing seedbank viability can be found in *Section 5, Appendix D* of the “Minnesota Wetland Restoration Guide”: [www.bwsr.state.mn.us/publications/restoration\\_guide.html](http://www.bwsr.state.mn.us/publications/restoration_guide.html). If a survey of existing vegetation has been conducted or will be conducted, overall percent cover of individual species should be recorded to gain an understanding of additional species that may be needed.



The composition of state wetland seed mixes can be used as a reference to see if additional grass, sedge or forbs species should be seeded. Survey information from nearby remnant communities can also be used as a guide for developing a diversity standard and determining what additional species may be beneficial. For mitigation projects the Technical Evaluation Panel (TEP) and Local Government Unit (LGU) often provide guidance about supplementing native seedbank, and inform decisions about how the planting of woody species (willow, alder, tamarack, etc.), and their natural colonization will influence the diversity needs of wetland seed mixes.

### **Tree Planting**

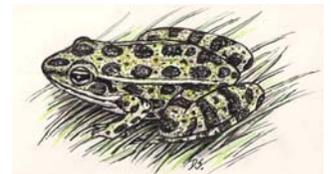
Planting 200 to 400 seedling trees or shrubs per acre is recommended for forested or shrub wetlands. Spacing should depend on the size of plant material, seedbank of woody species, potential for colonization, expected aftercare, and potential losses. It is not uncommon to lose between 25-50% of seedling trees and shrubs or cuttings. Nursery grown plants may not do well when planted in saturated soils, so planting on mounds can be helpful.

As tree and shrub seedlings are susceptible to deer and rodent browsing, protection is often necessary to ensure their survival. An exception is when large numbers are planted through methods such as direct seeding, when some loss is expected. Watering is needed for trees and shrubs if rainfall is less than one inch per week.

### **Aquatic Plant Installation**

For shallow marsh restorations, 100-150 plants per acre will help ensure sufficient establishment in open water areas. Species such as arrowhead, water plantain, giant burreed, bulrushes, sweet flag, wild iris, and pickerelweed can be planted near the edge of open water and allowed to spread into deeper water. Burreed and three-square bulrush are less desirable by muskrats, so they are beneficial where muskrats are a risk.

The edge of open water is often a difficult zone to plant. Containerized emergent plants are commonly installed about 10 feet apart and staggered along the shoreline. It is recommended that aquatic plants be installed in May or June; recent research has shown this to be the best time for establishment. Late summer plantings seem to have low survival rates. Install emergent plants at a depth where they will not be covered with standing water. Waves may also influence plantings, particularly on east shorelines, so it may be beneficial to plant some emergent species a little further up slope from the open water edge to aid establishment. Wave break structures or coconut fiber logs can be used to minimize wave damage. Fencing may be needed for projects where geese may graze young plants; in some cases this can be as simple as flagging tape attached to stakes. Watering may be needed in drought conditions.



Submergent and floating leaved species such as wild celery, coontail, lotus, and sago pondweed can be used in deeper portions of a site. Plant vendors should be contacted for availability of species and propagule types, and to provide recommendations on how best to anchor/establish new plantings.

## Performance Standards

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Performance Standards define expected outcomes for the establishment of native vegetation on mitigation projects. Performance standards typically define allowable percentages of invasive species during the first five years of a project, as well numbers of native species expected for each plant community (by year), and percentages of native species cover for the first five years.

Appendix F of the *Vegetation Section* of the “Minnesota Wetland Restoration Guide” ([www.bwsr.state.mn.us/publications/restoration\\_guide.html](http://www.bwsr.state.mn.us/publications/restoration_guide.html)) provides information about yearly expectations for wetland seed mixes. This information can be useful for the development of project performance standards.

## Maintenance

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Proper site maintenance is essential to ensure the success of a wetland restoration project. A schedule summarizing planned maintenance activities each month is very helpful to guide contractors and project managers. It is also helpful to have information about the most problematic weeds that may establish at a site in restoration plans, as well as details about how they will be controlled. *Appendix A* of the “Minnesota Wetland Restoration Guide” provides information on invasive species control.



### **Mowing**

Mowing is an essential step in the establishment of upland prairie sites. Mowing at least twice the first season and at least once the second season with a flail mower (to prevent smothering plants) is necessary for native vegetation establishment. Weeds should be mowed to between five and eight inches before seed is allowed to set (usually as weeds reach 12-14 inches). Mowing height should be raised as native plants establish. Primary goals of mowing are to allow sufficient light to reach native plant seedlings and preventing weed seed production.

Mowing of annual and biennial weeds is also beneficial in wetland transition areas for species such as giant ragweed and Canada thistle, but should only be conducted if rutting and soil compaction will not result. Pressure from annual and biennial weeds is generally less with increased soil saturation and water depth, and in many cases early successional weeds are displacing native species in wetlands.

### **Spot Treatment of Weeds**

Problematic perennial weeds that typically do not fade away over time often need to be spot treated with herbicide for sufficient control. Examples include reed canary grass, smooth brome, quack grass, purple loosestrife, and Canada thistle, Kentucky bluegrass and birds-foot trefoil. Canada thistle should be spot treated as soon as clumps appear to avoid the need to spray large areas (and lose native forbs). A common practice for Canada thistle control involves clipping seedheads while they are in the bud stage (usually early June) and conducting herbicide application with a broad-leaf specific herbicide in the fall (mid to late October). This timing limits the application of herbicide while pollinators are active.

Grass-specific herbicides are used to control reed canary grass in wet meadow restorations, particularly on sites dominated by forbs and sedges that will not be affected. Grass-specific herbicides work better on young reed canary plants than on mature plants. There is some evidence that using surfactants and disking prior to application may improve effectiveness. It should be noted that grass specific herbicides are not aquatically certified and should not be used near open water.

When using a broad-spectrum herbicide it is important that an aquatically certified form of glyphosate be used near open water.

## ***Burning***

Prescribed burning is beneficial to remove thatch, control invading trees, and maintain diversity in prairie plantings. Burning can also manage the encroachment of woody species in wetlands. Some practitioners feel that burning may increase reed canary grass in wet meadow planting where the species is a threat, likely due to added nutrients and light levels promoting germination. Burning is typically initiated after the third or fourth years of establishment, after native vegetation is reaching maturity. Uplands benefit from burning every three to five years. Fall and spring burns should be alternated periodically to simulate natural variation.



## ***Biological Control***

Biological control is an effective management tool for large infestations and environmentally sensitive areas. Biological control organisms are currently being used for purple loosestrife, leafy spurge, and spotted knapweed and they are in development for several other species. State or federal agencies should be contacted for recommendations on obtaining bio-control organisms. There should be long-term monitoring and management of the bio-control to ensure its safety and effectiveness in the release areas.

## ***Water Level Control***

If water level controls are available, it may be possible to adjust hydrology to allow access to equipment or to flood undesirable species. Available hydrology will influence the effectiveness of this technique. The influence of drawdowns or flooding on wildlife species should be considered, particularly during reproductive periods when nests might be drowned or amphibian eggs dried out by changing water levels.