TECHNICAL NOTE

BIOLOGY TECHNICAL NOTE NO. 16 **OCTOBER 3, 2011**

WETLAND VEGETATION ESTABLISHMENT
Biologist

A. Purpose and Need

This guidance is provided to aid in the development of seeding plans based upon site conditions and expected herbaceous plant communities. Developing community centered seeding plans considering site conditions (e.g., topography, hydrology, soils) and structural and functional diversity is desirable for the restoration of plant communities on all program lands.

Planting (seeding) wetlands will ensure a desirable wetland plant community will develop, which will curb invasion by adventive species, provide quality habitat for a wider range of wildlife species, and be more representative of a natural community. Planting wetlands is not the same as sculptured seeding; users are only asked to differentiate between wetlands (low prairie/wet meadow and wet meadow/semipermanent) and uplands.

Not all sites are conducive for wetland seeding. Before applying a wetland seed mix verify that the conditions of your site warrant planting. Conditions to consider include:

1) Is there an uncontrolled invasive species (e.g., cattail or reed canagrygrass) seed source adjacent to or near the site?

2) Is the site inundated to the point of making ATV access impossible (you may just be able to seed the fringe and not seed the interior)?

3) Does the site have a viable seedbank for desirable species?

4) Does a portion of the site contain native, desirable wetland species that can be used as the local vegetative source?

Establishing vegetation on pothole, floodplain, and other wetland sites is critical in attaining maximum ecological benefits and carrying out program objectives. A well thoughtout revegetation plan and installation process is critical to the effective use of program and landowner resources. In all cases, the appropriate Natural Resources Conservation Service (NRCS) South Dakota (SD) Conservation Practice Standards (CPS): Wetland Restoration (657); Wetland Enhancement (659); and Wetland Creation (658) will be followed.

At this time, Range Technical Note No. 4 does not capture all of the specific needs for designing and seeding wetland projects. Therefore, this document will be followed during wetland seeding plan development and implementation.

The following guidance has been developed to help field staff design and implement wetland seeding on pothole, floodplain, and other types of wetland sites; is program neutral; and can be applied to nonprogram planning as well. Specific program criteria can be found in the appropriate conservation program manuals.

B. Seeding Design Criteria:

Even if a wetland has been drained (manipulated) and cultivated for less than 20 years, only a few species' seeds will remain viable in the seed bank. The existing seedbank should only be used as a diversity supplement to those seeds/species planted with the wetland mixes outlined in this establishment guide. On sites drained and cultivated for more than 20 years, relying on soil seed bank for recruitment is not recommended.

If the wetland has been manipulated and/or cultivated only within the prior five years and invasive species (e.g., reed canarygrass) will not pose a problem, then the seedbank may be a reliable source for wetland vegetation.

While developing seeding plans during conservation planning, the conservationist is to consider the soils, moisture regimes, and topography of the site. From this information, the seed mixes included in this document were developed using the following wetland classification system (Stewart and Kantrud 1971):

Class I Ephemeral Wetland - low prairie zone
Class II Temporary Wetland - low prairie and wet meadow zones
Class III Seasonal Wetland - low prairie, wet meadow, and shallow marsh zones
Class IV Semi-permanent Wetland - low prairie, wet meadow, shallow marsh, and deep marsh zones
Class V Permanent Wetland*

*No seed mix was developed for permanent wetlands (fringes around lakes and ponds).

<u>The seed mixes included within this document are:</u>

Mix A: Low Prairie to Wet Meadow (Class I and Class II)
Mix B: Wet Meadow to Semi-Permanent (Class III and Class IV)

Please remember that if you are working "West River" then some of the ecological sites may be drier and the mixes may not be appropriate.

The broad wetland restoration zones are defined and simplified diagrams of the plant communities at the basin scales are provided in Figures 1 and 2 below.

Figure 1. Class I, Class II, and Class III wetlands.

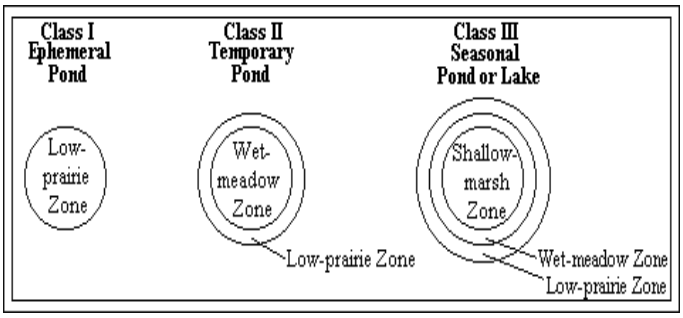
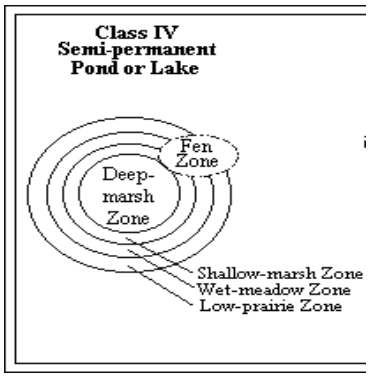


Figure 2. Class IV wetland



A brief description of the wetland class zones follows.

Low Prairie and Wet Meadow Zones
These areas may be seasonally or temporarily flooded, inundated, or saturated. These areas often include soils that are somewhat poorly to moderately well-drained and experience occasional to frequent, brief to very brief flooding/inundation, and soils with a water table within two feet of the surface. These areas may include ephemeral or temporary wetlands but they are often transitional areas between wetlands and uplands. When dry, drawdown areas are commonly colonized by a mix of annual/biannual plant species typically known for their high wildlife food value. The graminoid component of seeding mixes for this zone shall include multiple species of cool season graminoids (sedges, rushes, and grasses).

Shallow Marsh Zone:
This zone occurs in areas where soils are inundated by standing water between six" and three' in depth during portions of the growing season, with semi-permanent to seasonal hydrology. This zone typically occurs within deeper areas of shallow wetlands, is the zone adjacent to the deep marsh or open water zones, or occurs where high water tables persist and saturate soils throughout most or all of the growing season. Soils within this zone are typically poorly to very poorly drained and experience very frequent to occasional long-duration flooding/inundation. Sites that have semi-permanent hydrology may have submergent and floating leaved vegetation in addition to emergents.

[Wet Meadow] Fen Zone
This area commonly undergoes flooding or inundation of seasonal duration in most years, or has permanent soil saturation due to seepage or a high/perched water table. These areas are characterized by soils that are very poorly to moderately well-drained that experience very frequent to occasional flooding/inundation of long to brief duration. This zone is commonly found in wet swales, depressions, seepage areas, or adjacent to the shallow marsh zone. High/perched water table or seepage areas may require specialized seed mixes due to unique soil and water properties (temperature, mineral, or organic content, etc.). The graminoid component of the seed mix shall be primarily composed of cool season graminoids (sedges, rushes, and grasses).

Deep Marsh Zone
These are permanently to semi-permanently flooded/inundated areas with >3' of standing water during the growing season on poorly to very poorly drained soils with very frequent long-duration flooding/inundation. This zone is located within the heart of larger wetland basins and is dominated by floating leaved, submergent and emergent vegetation.

General Procedure
1. As a preliminary measure, use the local soil survey and associated data (historic vegetation, ground water table levels, frequency and duration of flooding, inundation, or saturation) to determine where zone boundaries may occur within the area to be seeded.

2. Determine the wetland class (I, II, III, or IV).

3. Determine the soil series from the soil survey and field verify.

4. Use the "Soil to Wetland Mix" worksheet to determine the potentially appropriate wetland seed mix.

   ****Please remember that without knowing the potential depth of ponding/saturation seed mixes may not be suitable to your site(s). Ecological sites (and soil series) represent a grouped generalization and are not intended to take the place of actual field surveys.****

5. Onsite ground-truthing will be required to verify the wetland class (e.g., low prairie/wet meadow versus semipermant) and the wetland seed mix.

6. Determine the planting strategy.

7. Implement the planting strategy.

C. Seeding Dates

Wetland areas may be seeded throughout the growing season as long as there is sufficient moisture for the young seedlings prior to freeze. However, fall (late October) to midwinter (late January) planting provides seeds the greatest chance to germinate and grow. Exposure to winter elements fulfills the cold, moist-seed stratification needs of most species. Early planting also allows young seedlings to benefit from spring and early summer rainfall.

D. Seed Requirements

Refer to Range Technical Note No. 4 for all requirements involving purity, germination, and certification.

E. Species Substitutions

Due to supply limitations from year-to-year of seed of some wetland species, there will be the need to work out an agreeable substitution for one or more species with your seed supplier. Substitutions should be based on the wetland indicator status, genus of the substitution, and successional status of the species. For the successional consideration, it is recommended to use the species coefficient of conservatism (COC) as guidance. South Dakota has developed coefficients of conservatism for most of the commercially native plants.

For example, if your mix calls for Bebb's sedge (*Carex bebbii)* , an obligate species with a COC of 8, a suitable substitute carex species might be water sedge (*Carex aquatilis),* COC = 10, or tussock sedge (*Carex stricta),* COC = 10. Examples of common obligate Carex species that would be unsuitable substitutes would be fox sedge (*Carex vulpinoidea),* COC = 2, and woolly sedge (*Carex lanuginosa),* COC = 4, as theses species are early successional carex species.

The process for development of Conservatism Guilds is based upon assigning an indicator value termed the "coefficient of conservatism" to species records. Individual species indicators may range from 0–10 with “0” being considered invasive species and “10” being considered the highest fidelity to natural areas. General categories for species assignments consist of the following:

0–1: Taxa that are adapted to severe disturbance, particularly anthropogenic. Disturbance occurs so frequently that often only brief periods are available for growth and reproduction. Generally considered ruderal species–opportunistic invaders.

2–3: Taxa within this category are associated with more stable, though degraded habitat. Generally considered ruderal–competitive species, found in a variety of habitats.

4–6: Taxa that have a high consistency of occurrence within a given community type and will include many dominant or matrix species for several habitats. Species will persist under moderate disturbance.

7–8: Taxa associated mostly with natural areas but can persist where the habitat has been somewhat degraded. Increases in the intensity or frequency of disturbance may result in reduction in population size or taxa may be subject to local extirpation.

9–10: Taxa exhibit a high degree of fidelity to a narrow range of synecological parameters. Species within this category are restricted to relatively intact natural areas.

Source data for assignment of “COC” values were from Northern Great Plains Floristic Quality Assessment Panel (2001), with modification. Modifications in assignments related to nonnative species; nonnative taxa were assigned a “0.”

F. Seedbed Preparation

Wetland sites with excess plant litter, such as sites found in no-till fields, may require prescribed burning or shallow disking or harrowing prior to planting to reduce litter and expose soil to promote good seed-to-soil contact, especially when broadcast seeding. Most farmed soils have been well packed by the tires of farm machinery and do not require further packing. This might not be true for sites recently deeply disked or plowed. Site preparation may involve eliminating undesirable plants from a site. Tillage and/or repeated herbicide application eliminates weeds and invasive species.

In order to avoid costly and time-consuming management of weed species after the restoration is complete, patience is necessary during the site preparation process to ensure that all or the majority of weed seeds and/or rootstock have been eliminated. While this process is absolutely necessary to deplete the soil seedbank of problem species (e.g., reed canarygrass), it unavoidably eliminates desirable species from the soil seedbank as well.

Chemical application and residual vegetation removal may be required. Burn and or mow and rake the site prior to herbicide treatment to reduce litter. Only apply wetland approved herbicides when within 50 feet of wetland sites (or in the wetland itself). Apply all herbicides at approved label rates. Allow at least seven days after herbicide application before disturbing the vegetation with other procedures.

<u>The following additional requirements must be met for broadcast seedings:</u>
1) Substantial bare ground (>50 percent) exists to allow seed to soil contact.
2) Seed application is followed by either multiple freeze-thaw and/or snowfall events.
3) The site can not be prone to excessive erosion by wind or water prior to establishment. If so, then you may need to use a grass drill.

G. Seeding Strategies

A number of sedge meadow species produce seed that floats on the surface of the water. This seed can be placed either in the bottom of a dry basin or placed directly at the water's edge. If water levels fluctuate the seed will simply float to the edges and grow.

Broadcast Seeding

Wetland seeding is best achieved via broadcast seeding. There are two categories of broadcast methods: 1) hand broadcasting or 2) machine broadcasting. The category selection will largely be based on site size(s) and available equipment (including labor).

Category 1: Hand Broadcasting - this method is best when used on small restorations of less than a few acres. This method also works well **<u>if</u>** volunteers are available for restorations up to 50 acres.

Category 2: Machine Broadcasting - this method should be used in all other restorations.

Hand broadcast seeding from an ATV is much faster than broadcasting while walking and works well for seeding wetlands where muddy soils prevent use of mechanical seeders. The perceived uneven seed distribution sometimes resulting from hand broadcasting is not detrimental to wetland vegetation establishment. Those areas receiving little seed may provide space for less aggressive species to establish free of competition. Seeding gaps in restorations usually fill as restorations develop and species spread via rhizomes and seed production.

There are several types of mechanical broadcast seeders. The simplest are the strap-to-chest, hand-cranked machines. More efficient are the pull-type fertilizer spreaders with wheel-driven agitators in the seed bin and adjustable openings in the bottom through which the seed falls. More advanced yet are the tractor-pulled or three-point hitch mounted fertilizer spreaders.

When broadcast seeding, sometimes the seed is mixed with an inert carrier, such as sand or vermiculite, to add bulk for easier spreading and to make it easier to see where you have planted. However, the use of an inert carrier is usually not necessary when using fertilizer spreaders as you can usually follow tire marks, especially when planting in snow. An ATV mounted Global Positioning System (GPS) could be used when planting to display the path traveled and identify planting gaps, and acres planted.

Some additional considerations to keep in mind when broadcast seeding:
1) Broadcast spreaders must be calibrated to distribute the desired amount of seed per acre. You can mark off an area and test plant it with a given amount of seed and adjust bin openings as needed.
2) Broadcast the seed after tile is broken, but before rains fill the restored basin.

3) Frost seeding - If broadcasting seed in the late fall, winter or early spring when freeze thaw action will introduce the seed into the soil, harrowing, raking and packing is not necessary. Frost seeding is preferable prior to heavy snow (one foot) cover so the seed may make good contact with the soil.

DO NOT DOUBLE THE SEEDING RATES WHEN BROADCASTING WETLAND SEEDS.

Grass Drill Seeding
While grass drills may be able to navigate the site and sow the seed caution must be used as noted below. If using a grass drill, then follow Range Technical Note No. 4.
CAUTION: Recent research found that about 0.25 inches of sediment reduced wetland seedling emergence by 91.7 percent and total invertebrate emergence 99.7 percent. Unless the seed is of a species that floats or is of relatively large size, this small amount of sediment has the potential of making your planting a total failure. **Use extreme caution if using a grass drill to seed wetland basins because they may bury the seed too deep and wetland plants may not germinate.**

Neither grain drill or air seeder technologies are recommended.

H. Fertilizing

Fertilizing is generally not necessary in a buffer prairie planting or in a wetland basin. In prairie plantings, fertilizer will primarily aid weed species instead of prairie species, which do not require amendments. In wetland basins, algae will often utilize the fertilizer.

I. Mulching

Mulching is not necessary in wetland plantings unless there is a high erosion potential risk. Consult the Critical Area Planting for further information.

J. Soil Microorganisms

Adding soil amendments to wetland basins in agricultural landscapes is generally not necessary. Normal soil microbiological processes may not be restored for many years after wetland establishment.

K. Management and Protection During Establishment

Grazing - not allowed

Weed Control - refer to Range Technical Note No. 4. Haying is not allowed; but mowing is allowed.

Insect Control - refer to Range Technical Note No. 4.

L. Invasive Species Control

To develop and maintain healthy plant communities invasive species such as reed canarygrass and cattail must be controlled. Eradicating invasive species during the seedbed preparation phase is the first step in control but is not the only requirement. Invasive species control needs to be carried through the establishment phase to the point that hopefully the native plant community is able to maintain its health and vigor to provide the high quality habitat that is expected.

Reed Canarygrass (RCG) - From the MN Board of Water & Soil Resources (Jacobson 2006)

Reed canarygrass primarily outcompetes other plants in situations of high nutrient availability and by shading due to it's accelerated growth rate. Reed canarygrass has a poor germination rate.

The following information may be useful for determining the extent and intensity of RCG control needed.
The percent of RCG cover will in part determine the protocol and timing of control measures.
If RCG has been present for three or more years, there is likely to be a seedbank present that must be dealt with during the seedbed preparation phase and possibly during post-planting followup.

Assessment Steps:

1. Determine if there is RCG growing adjacent or upstream of your site(s). Objectives and expectations may need to be adjusted. Restoration sites need to be closely monitored to ensure the diverse native plant community continues.
2. Determine percent RCG cover (if any) and spray during site preparation follow-up treatments.

    a. If only scattered patches of RCG re-occur (<33 percent of area) then spot spraying may be used.
    b. If >33 percent RCG reoccurrence then full site spraying follow-up treatment is required.

3. Determine whether or not high nutrient agriculture or other runoff inputs to the site eliminated or substantially reduced (e.g., large buffer for water quality, ensuring no tile flow to the site).
    a. If not were amendments (e.g., carbon) or other methods used?
4. Control RCG by mowing during the first one or two years of seeding:
    a. The faster growth rate and spread of RCG grass in the first few years allows RCG to take over native seedings through shading before the native seedings can be adequately established.
    b. Research has shown that mowing new seedings for the first one-to-two years significantly increases the establishment of natives and decreases reed canarygrass and that these natives persist for much longer periods of time.

General Treatment Steps:

1. Is the site inundated or saturated? An aquatically labeled glyphosate must be used.
2. Does the site include water control structure(s)? RCG can be killed from multiple week inundation. However, RCG remaining on the wetland margins will need to be sprayed.
3. Determine if the site(s) RCG mat may be scraped out of the site (dispose in upland). The root depth of RCG varies between 6 and 12 inches. If so, depths must be spot checked during scraping to ensure that all rhizomes are being removed.

    a. Scraping or excavating may cause soil compaction that needs to be loosened prior to seeding.

4. Determine if the site(s) can be burned? Fire by itself will not control RCG, however it can be used in reducing the seedbank and in stimulating seedling growth prior to herbicide treatment.

Herbicide Treatment Protocols **During Site Preparation**:

The most effective treatment involves glyphosate.
The second most effective treatment involves sethoxydim or quizolofop p-ethyl.
*****Sethoxydim and quizolofop do not work as well in the fall.*****

Regardless of which herbicide treatment is used, it's recommended that at least two years of additional spot spraying be done to keep RCG from re-establishing while the desired plant community is developing.

A. Glyphosate Protocol -

Glyphosates are nonselective contact herbicides.

1. Spray in the fall.
2. Burn the residue over the winter or in early spring at least 30 days after the fall treatment.
3. Spray again to control seedlings germinating from the seed-bank.

Results should be seen within 7-10 days.

SPRING TREATMENT ONLY IS NOT RECOMMENDED

This protocol works best on sites with >33 percent RCG cover.

B. Sethoxydim/Quizolofop Protocol -

These compounds are contact herbicides that selectively kill grasses and do not harm forbs, sedges, bulrushes, and rushes. However, they are not 100 percent effective in controlling grasses that have underground buds on their rhizomes.

1. Apply compound in late spring or early summer.

Results will not be seen for four to six weeks so be patient.

This protocol works best on sites <33 percent RCG cover and for spot spraying. They are especially useful if you are treating RCG invaded wet meadow.

NOT RECOMMENDED FOR USE IN NEWLY SEEDED PROJECTS OTHER THAN ON A SPOT SPRAY BASIS.

Herbicide Treatment Protocols **After seeding**:

A. Post-planting Spot spraying:

1. Generally performed using backpack sprayers or ATV mounted sprayers.
2. Applicator must be able to identify RCG versus seeded vegetation.
3. Spray in late spring or early summer.
4. Spraying freshly mowed vegetation is not effective.

B. Post-planting Over Spraying:

1. Use when RCG is growing with desirable native sedge meadow vegetation.
2. Apply glyphosate while RCG is actively growing and the desirable native vegetation is dormant (generally late fall/early spring).
3. Applicator must be able to identify RCG versus desired vegetation.
4. The brand of glyphosate must be labeled for aquatic use.

Mowing Treatment Protocols:

A. Post Planting Mowing (General):

1. Mow to prevent shading. Mower height should be between 6 and 10 inches.
2. Mow in late June and remove residual.
3. Mow prior to July 15th (as a general rule) if planning a fall application of glyphosate.
4. Improper timing of mowing of RCG can seriously adversely affect the success of RCG control.

Narrowleaf Cattail and Hybrid Cattail Control

Aquatically labeled glyphosate applied with backpack sprayers or wick applicators is the most commonly used method to control cattails. Glyphosate is a nonselective herbicide, so care needs to be taken to only treat the target species.

• Cattails establish under fluctuating water conditions when wind-borne seed blows in and lands on mud flats. They won't establish if seed lands on standing water. They can establish on the shoreline and grow down into the water. Young cattails can be pulled out by hand in small areas and they won't re-establish very fast.

• Cattails can also be managed by drawing water down, cutting the growing shoots and bringing the water level back up. This in essence drowns the plants.

Range (Ecological) Site	Series	Wetland Type	Applicable wetland seed mix
Subirrigated	Albaton	Shallow Marsh	Mix B
Limy Surirrigated	Antler	Wet Meadow	Mix A
	Arlo	Low Prairie and Wet Meadow	Mix A
Overflow	Badger	Low Prairie	None
Subirrigated	Badus	Low Prairie	Mix A
Wetland and Shallow Marsh	Baltic	Wet Meadow and Shallow Marsh	Mix A or Mix B
Limy Surirrigated	Bearden	Low Prairie and Wet Meadow	Mix A
Wet Land	Bigwinder	Wet Meadow and Shallow Marsh	Mix A or Mix B
Loamy	Blake	Flood plain - Probably Low Prairie	Mix A
Overflow	Bon	Low Prairie and Wet Meadow	Mix A
Subirrigated	Borup	Wet Meadow	Mix A
Wetland	Calco	Wet Meadow	Mix A
Limy Surirrigated	Canisteo	Low Prairie	Mix A
Wetland	Castlewood	Low Prairie	Mix A
Overflow	Chancellor	Low Prairie	Mix A
Overflow	Chaska	Low Prairie and Wet Meadow	Mix A
Wetland	Clamo	Low Prairie and Wet Meadow	Mix A
Subirrigated	Colvin	Low Prairie and Wet Meadow	Mix A
Saline Subirrigated	Colvin, saline	not applicable	none-saline
Overflow	Crossplain	Low Prairie	Mix A
Limy Surirrigated	Davison	Low Prairie	Mix A
Wet Land	Dimmick	Wet Meadow	Mix A
Saline Lowland	Dogiecreek	not applicable	none-saline
Linear Meadow, Subirrigated	Dovray	Low Prairie, Wet Meadow and Shallow Marsh	Mix A or Mix B
Saline Lowland	Durrstein	not applicable	none-saline
Subirrigated	Elpam	Wet Meadow	Mix A
Subirrigated	Fedora	Low Prairie and Wet Meadow	Mix A
Subirrigated	Flom	Wet Meadow	Mix A
Clayey Overflow	Forney	Low Prairie	Mix A
Subirrigated	Fossum	Wet Meadow	Mix A
Subirrigated	Fulda	Low Prairie and Wet Meadow	Mix A
Wet Subirrigated, Wet Land	Gannett	Wet Meadow	Mix A
Saline Lowland	Glenross	not applicable	none-saline
Limy Surirrigated	Glyndon	Shallow Marsh	Mix B
Wet Meadow	Grat	Low Prairie	Mix A
Subirrigated	Hamar	Wet Meadow	Mix A
Subirrigated	Harps	Wet Meadow	Mix A
Saline Lowland	Harriet	not applicable	none-saline
Closed Depression	Heil	Low Prairie and Wet Meadow	Mix A
Wet Land	Herdcamp	not applicable	none-saline
Subirrigated	Hidewood	Low Prairie	Mix A
Saline Subirrigated	Homquist	not applicable	none-saline
Closed Depression	Hoven	Low Prairie and Wet Meadow	Mix A
Saline Lowland	James	not applicable	none-saline
Closed Depression	Kolls	Low Prairie	Mix A
Subirrigated	Koto	Wet Meadow	Mix A
Subirrigated	Kratka	Low Prairie	Mix A
Wet Meadow	Lallie	Wet Meadow	Mix A

Subirrigated	Lamo	Low Prairie and Wet Meadow	Mix A
Subirrigated	Lamoure	Low Prairie and Wet Meadow	Mix A
Subirrigated	Lawet	Low Prairie and Wet Meadow	Mix A
Wet Subirrigated, Wet Land	Loup	Wet Meadow	none - interdunal
Wetland	Ludden	Low Prairie and Wet Meadow	Mix A
Saline Lowland	Lute	not applicable	none-saline
No Site	Lute, ponded	Shallow Marsh	Mix B
Clayey Overflow	Luton	Low prairie	Mix A
Closed Depression, No site	Macken	Low Prairie, Wet Meadow and Shallow Marsh	Mix A or Mix B
Subirrigated, No Site	Marshbrook	Wet Meadow and Shallow Marsh	Mix A or Mix B
Subirrigated	Marysland	Low Prairie and Wet Meadow	Mix A
Closed Depression	McKenzie	Low Prairie	Mix A
Subirrigated	Minnewauken	Wet Meadow	Mix A
Saline Lowland	Napa	not applicable	none-saline
Closed Depression	Nishon	Low Prairie	Mix A
Deep Marsh	Norway	Unknown	None
Wetland	Oldham	Low Prairie and Wet Meadow	Mix A
Clayey Overflow	Onawa	Low Prairie	Mix A
Subirrigated	Orwet	Wet Meadow	Mix A
Wet Meadow	Overshue	Low Prairie and Wet Meadow	Mix A
Clayey Overflow	Owego	Low Prairie	Mix A
Shallow Marsh	Parnell	Low Prairie, Wet Meadow, Shallow Marsh, and Deep Marsh	Mix B
Closed Depression	Plankinton	Low Prairie and Wet Meadow	Mix A
Saline Subirrigated	Playmoor	not applicable	none-saline
Subirrigated	Ranslo	Low Prairie	Mix A
Wet Land	Rauville	Wet Meadow	Mix A
linear meadow, Wet land	Regan	Low Prairie and Wet Meadow	none - mineral fen ???
Closed Depression	Rimlap	Low Prairie and Wet Meadow	Mix A
Overflow	Roxbury	Low Prairie	Mix A
Saline Lowland	Ryan	not applicable	none-saline
Saline Lowland	Sage	not applicable	none-saline
Saline Subirrigated	Salmo	not applicable	none-saline
Closed Depression	Scott	Low Prairie	Mix A
Subirrigated	Shue	Low Prairie	Mix A
Deep Marsh	Southam	Shallow Marsh and Deep Marsh	Mix B
Subirrigated ??	Stirum	Wet Meadow	Mix A
Limy Surirrigated	Storla	Low Prairie and Wet Meadow	Mix A
Wet Meadow	Tetonka	Low Prairie, Wet Meadow and Shallow Marsh	Mix A or Mix B
Subirrigated ??	Tiffany	Low Prairie	Mix A
Wet Meadow	Toko	Low Prairie and Wet Meadow	Mix A
Wet Meadow	Tonka	Low Prairie, Wet Meadow and Shallow Marsh	Mix A or Mix B
Limy Surirrigated	Ulen	Low Prairie	Mix A
Subirrigated	Vallers	Low Prairie and Wet Meadow	Mix A
Wetland ??	Venlo	Wet Meadow	Mix A
Limy Surirrigated	Wakonda	Low Prairie	Mix A
Overflow	Whitewood	Low Prairie	Mix A
Shallow Marsh	Worthing	Wet Meadow, Shallow Marsh and Deep Marsh	Mix B

Please remember that if you are working "West River" then some of the ecological sites may be drier and the mixes may not be appropriate.

Mix A: Low Prairie to Wet meadow (zero to six inch water depth) Mix for use Statewide

Note: Due to unknown and site specific topographic variations, some seeded species may not grow (e.g. water too deep or not deep enough). If the user wishes to add forbs to the mix then contact a biologist for further assistance.

Common Name	Scientific Name	Habit	Succession	Coefficient of Conservatism[1]	PLS Seeds/LB	#PLS/ Acre	Seeds/ft^2	% of Mix by weight	Cost/LB of PLS	*Cost/Species	full rate
American sloughgrass	*Beckmannia syzigachne*	Grass	Early	1	1,150,000	0.20	5.25	15.00%	$20.00	$3.98	35
bluejoint reedgrass	*Calamagrostis canadensis*	Grass	Mid	5	4,480,000	0.03	3.50	10.00%	$900.00	$30.63	35
Prairie wedgegrass	*Sphenopholis obtusata*	Grass	Early	7	200,000	0.38	1.75	5.00%	$150.00	$57.17	35
switchgrass	*Panicum virgatum*	Grass	Mid	5	390,000	0.39	3.50	10.00%	$10.00	$3.91	35
western wheatgrass	*Agropyron smithii*	Grass	Mid	4	112,000	1.46	3.75	15.00%	$10.00	$14.58	25
Canada wild rye	*Elymus canadensis*	Grass	Early	3	115,000	1.42	3.75	15.00%	$10.00	$14.20	25
prairie cordgrass	*Spartina pectinata*	Grass	Mid	5	183,000	0.60	2.50	10.00%	$120.00	$71.41	25
bottlebrush sedge	*Carex hystericina*	Sedge	Mid	7	480,000	0.36	4.00	10.00%	$120.00	$43.56	40
Bebb's sedge	*Carex bebbii*	Sedge	Late	8	544,000	0.40	5.00	10.00%	$150.00	$60.06	50
Totals						**5.24**	**33**	**100.00%**		**$299.50**	

* All costs are approximate and users are required to contact the seed company for current rates and availability.

1 Coefficient of Conservatism from USACE ERDC/EL TR-06-5, A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes, May 2006

Please remember that if you are working "West River" then some of the ecological sites may be drier and this mix may not be appropriate.

Conservatism Guilds	Species	Seed/ft^2 % mix
EARLY SUCCESSIONAL (0-3)	2	27%
MID SUCCESSIONAL (4-7)	6	58%
LATE SUCCESSIONAL (8-10)	1	15%
	9	100%

Mix Conservatism
5

Floristic Qualtiy Index
15

Evenness Calculation

Sum of Squares	0.12
Simpson's Evenness:	0.93

Floristic Quality Index (FQI)	Recommended FQI is at least 20.0
Mix Conservatism (CC)	Recommended Coefficient of Conservatism is at least 3.0
Simpson's Evenness	Recommended Evenness (balance) of the mix is at least 70%
Conservatism Guilds:	
Early Successional	Recommended range of 15-33%
Mid-Successional	Recommended range of 45-65%
Late Successional	Recommended range of 15-33%
PLS Seeds/ft2	Minimum of 30 seeds/ft^2

Mix B: Wet meadow to Semipermanent (two inches to three feet water depth) Mix for use Statewide

Note: Due to unknown and site specific topographic variations, some seeded species may not grow (e.g., water too deep or not deep enough). If the user wishes to add forbs to the mix then contact a biologist for further assistance.

Common Name	Scientific Name	Habit	Succession	Coefficient of Conservatism[1]	PLS Seeds/LB	#PLS/Acre	Seeds/ft^2	% of Mix by weight	Cost/LB of PLS	*Cost/Species	full rate
common burreed	*Sparganium eurycarpum*	Forb	Mid	4	8,000	2.72	0.50	2.00%	$90.00	$245.03	25
American sloughgrass	*Beckmannia syzigachne*	Grass	Early	1	1,150,000	0.10	2.75	11.00%	$20.00	$2.08	25
American mannagrass	*Glyceria grandis (G maxima)*	Grass	Mid	4	1,200,000	0.16	4.50	10.00%	$75.00	$12.25	45
fowl mannagrass	*Glyceria striata*	Grass	Mid	6	1,440,000	0.21	7.00	14.00%	$375.00	$79.41	50
prairie cordgrass	*Spartina pectinata*	Grass	Mid	5	183,000	0.60	2.50	10.00%	$120.00	$71.41	25
inland rush	*Juncus interior*	Rush	Mid	5	2,800,000	0.05	3.00	6.00%	$225.00	$10.50	50
Torrey's rush	*Juncus torreyi*	Rush	Early	2	1,600,000	0.05	2.00	4.00%	$300.00	$16.34	50
hardstem bulrush	*Schoenoplectus (Scirpus) acutus*	Sedge	Mid	5	320,000	0.54	4.00	10.00%	$375.00	$204.19	40
river bulrush	*Schoenoplectus (Scirpus) fluviatilis*	Sedge	Early	2	68,800	1.74	2.75	11.00%	$90.00	$156.70	25
softstem bulrush	*Schoenoplectus tabernaemontani(Scirpus validus)*	Sedge	Early	3	496,000	0.07	0.80	2.00%	$180.00	$12.65	40
Bicknell's sedge	*Carex bicknellii*	Sedge	Late	10	272,000	0.45	2.80	7.00%	$150.00	$67.26	40
Bebb's sedge	*Carex bebbii*	Sedge	Late	8	544,000	0.28	3.50	7.00%	$150.00	$42.04	50
woolly sedge	*Carex lanuginosa*	Sedge	Mid	4	1,200,000	0.04	1.00	2.00%	$960.00	$34.85	50
bottlebrush sedge	*Carex hystericina*	Sedge	Mid	7	480,000	0.07	0.80	2.00%	$120.00	$8.71	40
fox sedge	*Carex vulpinoidea*	Sedge	Early	2	1,600,000	0.03	1.00	2.00%	$180.00	$4.90	50
Totals						**7.12**	**39**	**100.00%**		**$968.31**	

* All costs are approximate and users are required to contact the seed company for current rates and availability.

1 Coefficient of Conservatism from USACE ERDC/EL TR-06-5, A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes, May 2006

Please remember that if you are working "West River" then some of the ecological sites may be drier and this mix may not be appropriate.

Conservatism Guilds	Species	Seed/ft^2 % mix
EARLY SUCCESSIONAL (0-3)	5	24%
MID SUCCESSIONAL (4-7)	8	60%
LATE SUCCESSIONAL (8-10)	2	16%
	15	100%

Mix Conservatism
5

Floristic Qualtiy Index
18

Evenness Calculation

Sum of Squares	0.09
Simpson's Evenness:	0.73

Floristic Quality Index (FQI)	Recommended FQI is at least 20.0
Mix Conservatism (CC)	Recommended Coefficient of Conservatism is at least 3.0
Simpson's Evenness	Recommended evenness (balance) of the mix is at least 70%
Conservatism Guilds:	
Early Successional	Recommended range of 15-33%
Mid-Successional	Recommended range of 45-65%
Late Successional	Recommended range of 15-33%
PLS Seeds/ft2	Minimum of 30 seeds/ft^2