

## MEMORANDUM FOR RECORD

**SUBJECT: Guidelines for Reach 1 Planting Plan of the Fargo Moorhead Diversion Channel.**  
**Prepared by: Jonathan Sobiech and Megan McGuire**

1. **References:** References and supporting documentation are listed below.
  - a) Minnesota Board of Water & Soil Resources  
([http://www.bwsr.state.mn.us/native\\_vegetation/](http://www.bwsr.state.mn.us/native_vegetation/))
  - b) MN/DOT website (Seed Mix Design Manual)  
<http://www.dot.state.mn.us/environment/erosion/pdf/native-seed-mix-dm.pdf>
2. **Purpose:** To establish guidance for the planting of the Fargo Moorhead Metropolitan diversion channel. The recommended plan will be reviewed by Engineering Division to ensure the recommended plant species will be acceptable for passing the desired flow based on the hydraulic modeling.
3. The planting area consists of the entire diversion channel and its features which include: the excavated material berm piled along the diversion channel (zone 1), the 1V:7H slopes leading down to the bottom of the channel (zones 2 and 3), the 2% slopes leading to the low flow channel (zone 4) and finally the low flow channel (zone 5) see figure 1.
4. There will be no features designed specifically for wetland establishment. Rather, the plant species are chosen based on the survivability of what the diversion channel will support based on the hydrology and soils. Planting a carefully selected species mix will benefit the project in a number of ways to include: wildlife habitat, providing nutrients, water quality, outcompeting less desirable species such as sandbar willow and cattails, and erosion prevention.
5. The hydraulic models for this project assumed a roughness Manning's n value of .03, and assumptions were made early on that any woody vegetation would have n values greater than what was modeled for. Therefore no woody plants are being considered for this planting plan.
6. Performance of the Breckenridge diversion, as well as past experiences with dry dams, have shown that extended inundation (particularly if the entire plant is submerged) during the growing season will kill even hardy species such as cattails, reed canary grass and Phragmites. With the FM project it is possible that the diversion channel will have fairly high elevations of water for up to several weeks into the growing season. Since mudflats may be an unavoidable result in severe cases, the planting plan should include some fast-colonizing species of mudflats (e.g., smartweeds, water plantain, and blunt spikerush). These plants will provide a seedbank which will help rapidly re-colonize the mudflats if/when they develop.
7. Bulrushes and lake sedge stand up well to flowing water (up to a point of course) and can tolerate short-term submergence during the growing season. Prairie cord-grass is excellent for preventing soil erosion if given enough time to develop its root/rhizome system and was the dominant species in wet prairie swales and bed of Glacial Lake Agassiz. These species have been incorporated into the

recommended species mix for this project as well as many more common persistently or temporarily flooded species.

8. Experts from the Engineer Research and Development Center (ERDC), Fish and Wildlife Service (FWS), Natural Resource Conservation Service (NRCS), Corps Regulatory office in St. Paul and the University of Minnesota (UMN) were consulted as to what plants would be the best suited for the diversion plantings. Based on their input the following planting plan criteria were developed.

Criteria:

- a) A diversity of species established to help prevent the introduction of non-native invasive species that are common in the area
  - b) Vegetation selected must have a Manning's 'n' value of approximately .03 (must ensure that the species selected satisfy the roughness that was put into the model).
  - c) Select native plant species common in the area.
  - d) Wetland species at the bottom and near the bottom of the channel.
  - e) Select species that can re-colonize quickly if they die-off.
  - f) A minimum of 4-6 inches of topsoil will be incorporated into existing soil before planting
  - g) Site preparation prior to planting is very important.
  - h) Can be either mowed or burned after establishment.
  - i) Stabilize soils and prevent erosion.
9. Recommended Species Mixes: The seed mixes for this project are designed or selected to increase diversity, create competition for invasive species, and to promote plant community stability. They also are satisfactory to ensure that the roughness created by these plants will not have an adverse impact on the conveyance of channel flows.

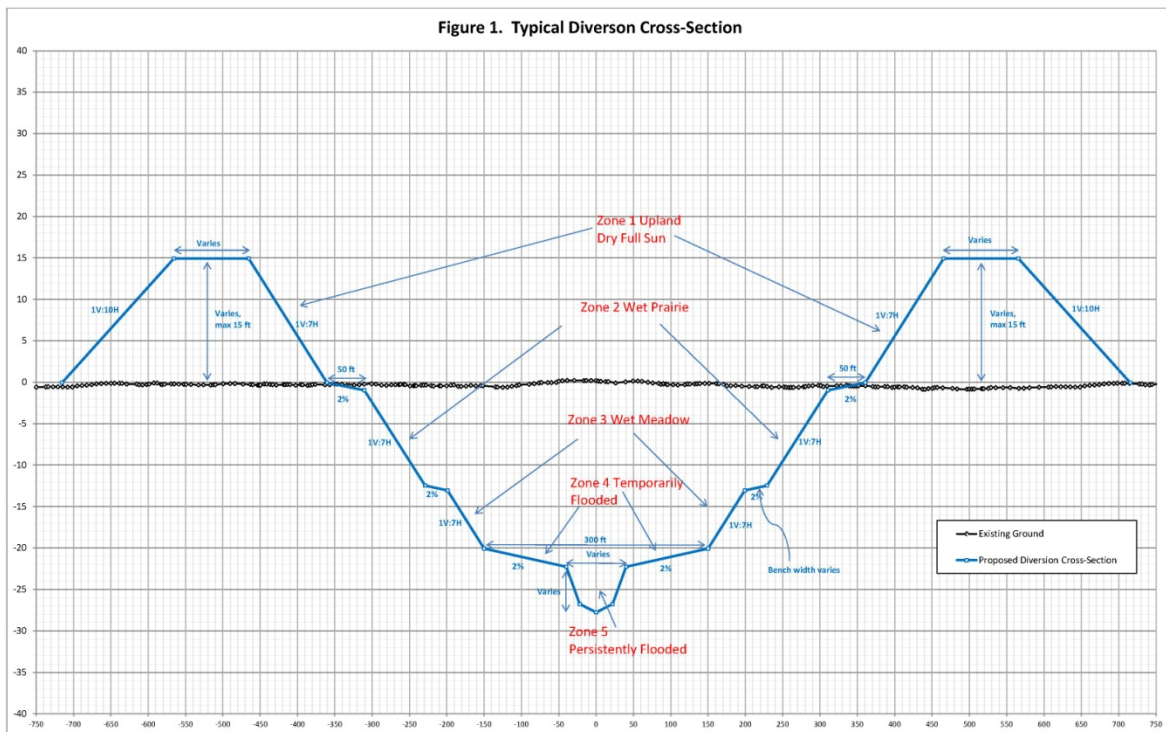
The native seed mix design manual from the MNDOT was used to guide in the selection of seed mixes and/or specific plant recommendations. For zones 1-3 seed mixes were adapted from the manual, and are based on standard mixtures used by MNDOT, BWSR and MNDNR. Additional species were also added for more diversity and enhanced adaptation to the environmental conditions, and plants more adapted to North Dakota were added to the Minnesota mixes. For zones 4-5 the seed mix is made up of a combination of existing seed mixes with additional species incorporated to help satisfy the other criteria of the planting plan.

A cover crop of oats and/or winter wheat with native soil stabilizing grasses will also be used for all seed mixes.

- a) Zone 1: The seed mix proposed for zone 1 is the Mesic Prairie (Table 1). Warm-season prairie grasses will have the highest success rate if planted between April 15 and June 30. Prairie forbs and sedges will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- b) Zone 2: The seed mix proposed for zone 2 is the recommended Wet Prairie Mix (Table 2). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30. Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will

- depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- c) Zone 3: The seed mix proposed for zone 3 is the recommended Wet Meadow mix (Table 3). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30). Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time.
- d) Zones 4 and 5: The seed mix proposed for zones 4 and 5 is a combination of the recommended Temporary Flooded, Persistently Flooded, and from expert opinions to create a combined mix (Table 4). Warm-season prairie grasses will have the highest success rate if planted between April 15 – June 30). Many wetland grasses are cool season grasses and will thus have a higher success rate if planted Oct 15 – frozen soils. Wetland sedges and forbs and prairie sedges and forbs will have the highest success rate if planted from Oct 15 – frozen soils. The majority of species in the wetter zones are cool-season grasses and sedges. The choice for seeding time will depend on construction completion date, site preparation, and weed control needs. Grass and forbs seeding rates may be adjusted to account for seeding time. In addition to seeding, Zone 4 will be planted with plugs of certain species to promote rapid stabilization of the low-flow channel banks. Many wet plant species do not succeed from seed, but have very high success rates and rapid growth from plugs.
10. Site Preparation: The majority of the land that will be impacted for this project will be agricultural. Sites that are currently in agriculture often have effective weed control and are in good condition for seeding. Topsoil from agricultural fields will be spread across the site. This soil will likely have few perennial weeds, but will certainly have annual weeds that will compete with the native vegetation, especially during establishment.
11. Topsoil: Topsoil is proposed for this project to provide a higher nutrient medium for the plants. However, care must be taken to ensure topsoil to be used is free of any upland and wetland invasive species, particularly reed canary grass. Soil stockpiles will be treated with herbicide and/or cover crops during construction to prevent contamination with weed seeds. The topsoil will be incorporated or mixed with the existing substrate through periodic disking, and any compaction that occurs will be loosened before final seedbed preparation. A minimum of 6-8 inches of topsoil should be incorporated to a depth of 2 inches into the clay subsoil.
12. Seedbed Preparation: There will be more information on this as we move closer to planting but for a place holder we will use a couple different methodologies for seedbed preparation. Where we will be planting with a traditional native seed drill we will require a smooth firm seedbed. This will require harrowing and rolling the surface to make it acceptable for this type of planting; this will prevent the seed from being buried too deep. Broadcast seeding will be ok on areas that have been disked or where the topsoil has been incorporated as long as the soil is allowed time to settle. It may be required to roll or cultipack following a broadcast seeding to ensure the seed doesn't blow away. A cover crop will be planted in the topsoil. If we are able to plant directly into standing stubble, the soil

will have settled sufficiently for seeding. If the cover crop must be tilled and incorporated into the topsoil, harrowing, rolling, or cultipacking will be required. Other options for some of the seeding may include hydro seeding or manually planting plants. Regardless of methodology of seed planting, shallow planting is key between 0 to ¼ inch deep depending on the size of the seed. In general, larger-seeded prairie grasses do best with drilling, while, sedges, and smaller seeded grasses do best with broadcast seeding. If the seeding occurs in the spring, consider using broadcast seeding, if possible, because forbs and sedges will already be disadvantaged. Broadcast and drill seeding can be used in combination to ensure the best establishment.



**Table 1. ZONE 1 MESIC PRAIRIE SEED MIX****Forbs**

Description	
<i>Agastache foeniculum</i>	Anise Hyssop
<i>Allium stellatum</i>	Prairie Onion
<i>Apocynum sibiricum</i>	Clasping Dogbane
<i>Artemisia ludoviciana</i>	White sagebrush
<i>Asclepias verticillata</i>	Whorled Milkweed
<i>Astragalus canadensis</i>	Canada Milk Vetch
<i>Dalea candida</i>	White Prairie Clover
<i>Dalea purpurea</i>	Purple Prairie Clover
<i>Desmodium canadense</i>	Showy Tick Trefoil
<i>Galium boreale</i>	Northern Bedstraw
<i>Glycyrrhiza lepidota</i>	Wild Licorice
<i>Helianthus pauciflorus</i>	Showy Sunflower
<i>Heliopsis helianthoides</i>	Early Sunflower
<i>Heuchera richardsonii</i>	Prairie Alumroot
<i>Lathyrus venosus</i>	Veiny Pea
<i>Liatris aspera</i>	Rough Blazing Star
<i>Liatris pycnostachya</i>	Prairie Blazing Star
<i>Monarda fistulosa</i>	Wild Beragmot
<i>Oenothera biennis</i>	Common Evening Primrose
<i>Pedicularis canadensis</i>	Wood Betony
<i>Pycnanthemum virginianum</i>	Mountain Mint
<i>Ratibida columnifera</i>	Long-headed Coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Solidago nemoralis</i>	Old Field Goldenrod
<i>Solidago rigida</i>	Stiff Goldenrod
<i>Solidago speciosa</i>	Showy Goldenrod
<i>Symphyotrichum ericoides</i>	Heath Aster
<i>Symphyotrichum laeve</i>	Smooth Blue Aster
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Zizia aptera</i>	Heart-leaf Golden Alexanders

**TREES, SHRUBS & VINES**

Description	
<i>Amorpha canescens</i>	Lead Plant

**GRASSES, SEDGES & RUSHES**

Description	
<i>Andropogon gerardii</i>	Big Bluestem
<i>Bouteloua curtipendula</i>	Side-Oats Grama
<i>Bouteloua gracilis</i>	Blue Grama
<i>Bromus kalmii</i>	Prairie Brome
<i>Carex brevior</i>	Shortbeak Sedge
<i>Deschampsia cespitosa</i>	Tufted Hairgrass
<i>Elymus canadensis</i>	Canada Wild Rye
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Hesperostipa spartea</i> (syn. <i>Stipa spartea</i> )	Porcupine Grass
<i>Koeleria cristata</i>	June Grass
<i>Muhlenbergia glomerata</i>	Marsh Muly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Pascopyrum smithii</i>	Western Wheatgrass
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Sorghastrum nutans</i>	Indian Grass
<i>Sphenopholis obtusata</i>	Prairie Wedgegrass
<i>Sporobolus heterolepis</i>	Prairie Dropseed
<i>Stipa viridula</i> (syn. <i>Nassella viridula</i> )	Green Needle Grass

**Table 2. ZONE 2 WET PRAIRIE SEED MIX****Forbs**

Description	
<i>Anemone canadensis</i>	Canada Anemone
<i>Apocynum sibiricum</i>	Clasping Dogbane
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Aster puniceus</i>	Swamp Aster
<i>Dalea purpurea</i>	Purple Prairie Clover
<i>Desmodium canadense</i>	Showy Tick Trefoil
<i>Doellingeria umbellata</i>	Flat-Topped Aster
<i>Eupatorium maculatum</i>	Joe Pye Weed
<i>Eupatorium perfoliatum</i>	Boneset
<i>Euthamia graminifolia</i>	Grass-leaved Goldenrod
<i>Galium boreale</i>	Northern Bedstraw
<i>Helenium autumnale</i>	Sneezeweed
<i>Helianthus grosseserratus</i>	Saw-tooth Sunflower
<i>Lathyrus venosus</i>	Veiny Pea
<i>Liatris ligulistylis</i>	Meadow Blazing Star
<i>Liatris pycnostachya</i>	Prairie Blazing Star
<i>Lobelia siphilitica</i>	Great Blue Lobelia
<i>Lysimachia quadriflora</i>	Prairie Loosestrife
<i>Mimulus ringens</i>	Monkey Flower
<i>Pycnanthemum virginianum</i>	Mountain Mint

<i>Solidago gigantea</i>	Late Goldenrod
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Vernonia fasciculata</i>	Common Ironweed
<i>Veronicastrum virginicum</i>	Culver's Root
<i>Zizia aurea</i>	Golden Alexanders

<b>GRASSES, SEDGES &amp; RUSHES</b>
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Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Blustem
<i>Bromus ciliatus</i>	Fringed Brome
<i>Bromus kalmii</i>	Prairie Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Calamagrostis stricta</i>	Northern reedgrass
<i>Carex buxbaumii</i> *	Buxbaum's Sedge
<i>Carex pellita</i> *	Wooly Sedge
<i>Carex praegracilis</i>	Freeway Sedge
<i>Carex sartwellii</i> *	Sartwell's Sedge
<i>Carex stricta</i>	Upright Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Deschamsia cespitosa</i>	Tufted Hairgrass
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Elymus virginicus</i>	Virginia Wild Rye



<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Leymus triticoides</i>	Beardgrass Wild Rye
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Pascopyrum smithii</i>	Western Wheatgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass
<i>Sporobolus heterolepis</i>	Prairie Dropseed
<i>Stipa viridula</i> (syn. <i>Nassella viridula</i> )	Green Needle Grass

\* Indicates species that are highly desired.

**Table 3. ZONE 3 WET MEADOW SEED MIX**

**Forbs**

Description	
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Aster puniceus</i>	Swamp Aster
<i>Boltonia asteroides</i>	False Aster
<i>Doellingeria umbellata</i>	Flat-topped Aster
<i>Epilobium glandulosum</i>	Northern Willow Herb
<i>Eupatorium maculatum</i>	Joe Pye Weed

<i>Eupatorium perfoliatum</i>	Boneset
<i>Euthamia graminifolia</i>	Grass-leaved Goldenrod
<i>Helenium autumnale</i>	Sneezeweed
<i>Helianthus grosseserratus</i>	Saw-tooth Sunflower
<i>Hypoxis hirsute</i>	Yeollow Star Grass
<i>Lobelia siphilitica</i>	Great Blue Lobelia
<i>Lycopus americanus</i>	Water Horehound
<i>Lysimachia ciliata</i>	Fringed Loosestrife
<i>Mentha arvensis</i>	Wild Mint
<i>Mimulus ringens</i>	Monkey Flower
<i>Pascopyrum smithii</i>	Western Wheatgrass
<i>Pedicularis lanceolata</i>	Marsh Betony
<i>Pycnanthemum virginianum</i>	Mountain Mint
<i>Solidago gigantea</i>	Late Goldenrod
<i>Symphotrichum lanceolatum</i>	Panicked Aster
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue
<i>Verbena hastata</i>	Blue Vervain
<i>Vernonia fasciculata</i>	Common Ironweed
<i>Veronicastrum virginicum</i>	Culver's Root
<i>Zizia aurea</i>	Golden Alexanders

### GRASSES, SEDGES & RUSHES

Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Blustem
<i>Beckmannia syzigachne</i>	American Sloughgrass
<i>Bromus ciliatus</i>	Fringed Brome
<i>Bromus kalmii</i>	Prairie Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Calamagrostis stricta</i>	Northern reedgrass
<i>Carex bebbii</i>	Bebb's Sedge
<i>Carex buxbaumii</i> *	Buxbaum's Sedge
<i>Carex comosa</i>	Bottlebrush Sedge
<i>Carex lasiocarpa</i>	Woolyfruit Sedge
<i>Carex pellita</i> *	Wooly Sedge
<i>Carex praegracilis</i> *	Freeway Sedge

<i>Carex sartwellii</i> *	Sartwell's Sedge
<i>Carex scoparia</i>	Broom Sedge
<i>Carex sprengei</i>	Sprengel's Sedge
<i>Carex stipata</i>	Awlfruit Sedge
<i>Carex stricta</i> *	Tussock Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Distichlis spicata</i>	Inland Saltgrass
<i>Elymus trachycaulus</i>	Slender Wheatgrass
<i>Elymus virginicus</i>	Virginia Wild Rye
<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Hierochloa odorata</i>	Sweetgrass
<i>Hordeum jubatum</i>	Foxtail Barley
<i>Juncus tenuis</i>	Path Rush
<i>Leersia oryzoides</i>	Rice Cutgrass
<i>Leymus triticoides</i>	Beardless Wild Rye
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Muhlenbergia richardsonis</i>	Mat Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Scolochloa festucacea</i>	Common Rivergrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass

\* Indicates the species that are highly desired.

**Table 4. ZONE 4 and 5 BOTTOM MIX**

**Forbs**

Description	
<i>Acorus americanus</i>	Sweet Flag
<i>Acorus calamus</i>	Sweet Flag
<i>Alisma trivale</i>	Nothern Water Plantain
<i>Asclepias incarnata</i>	Swamp Milkweed
<i>Bidens cernua</i>	Nodding Bur Marigold
<i>Epilobium glandulosum</i>	Northern Willow Herb
<i>Eupatorium maculatum</i>	Joe Pye Weed

<i>Impatiens capensis</i>	Spotted Touch-me-not
<i>Iris versicolor</i>	Northern Blue Flag
<i>Lycopus americanus</i>	Water Horehound
<i>Lysimachia ciliata</i>	Fringed Loosestrife
<i>Mentha arvensis</i>	Wild Mint
<i>Mimulus ringens</i>	Monkey Flower
<i>Penthorum sedoides</i>	Ditch Stonecrop
<i>Physostegia virginiana</i>	Obedient Plant
<i>Polygonum pensylvanicum</i>	Pinkweed
<i>Polygonum punctatum</i>	Smartweed
<i>Polygonum sagittatum</i>	Tear Thumb
<i>Rumex orbiculatus</i>	Bitter Dock
<i>Sagittaria latifolia</i>	Common Arrowhead
<i>Scutellaria laterifolia</i>	Mad-dog Skullcap
<i>Sium suave</i>	Tall Water Parsnip
<i>Sparganium eurycarpum</i>	Great Bur Reed
<i>Stachys palustris homotricha</i>	Woundwort
<i>Teucrium canadense</i>	Germander
<b>GRASSES, SEDGES &amp; RUSHES</b>	
Description	
<i>Agrostis scabra</i>	Ticklegrass
<i>Andropogon gerardii</i>	Big Bluestem
<i>Beckmannia syzigachne</i>	American Sloughgrass
<i>Bromus ciliatus</i>	Fringed Brome
<i>Calamagrostis canadensis</i>	Blue Joint Grass
<i>Carex aquatilis</i> *	Water Sedge
<i>Carex aurea</i>	Golden Sedge
<i>Carex bebbii</i> *	Bebb's Sedge
<i>Carex comosa</i>	Bottlebrush Sedge
<i>Carex lacustris</i> *	Lake Sedge
<i>Carex lasiocarpa</i> *	Woollyfruit Sedge
<i>Carex pellita</i> *	Woolly Sedge
<i>Carex praegracilis</i>	Freeway Sedge
<i>Carex sartwellii</i> *	Sartwell's Sedge
<i>Carex scoparia</i> *	Broom Sedge

<i>Carex stipata</i>	Awlfruit Sedge
<i>Carex stricta</i>	Tussock Sedge
<i>Carex utriculata</i> *	Common Yellow Lake Sedge
<i>Carex vulpinoidea</i>	Fox Sedge
<i>Distichlis spicata</i>	Inland Saltgrass
<i>Eleocharis obtusa</i>	Blunt Spikerush
<i>Eleocharis palustris</i>	Common Spikerush
<i>Elymus virginicus</i>	Virginia Wild Rye
<i>Glyceria grandis</i>	Reed Manna Grass
<i>Glyceria striata</i>	Fowl Manna Grass
<i>Hierochloe odorata</i>	Sweetgrass
<i>Hordeum jubatum</i>	Foxtail Barley
<i>Juncus balticus</i>	Baltic Rush
<i>Juncus effusus</i>	Common Rush
<i>Leersia oryzoides</i>	Rice Cutgrass
<i>Muhlenbergia glomerata</i>	Marsh Muhly
<i>Panicum virgatum</i>	Switchgrass
<i>Poa palustris</i>	Fowl Bluegrass
<i>Scirpus acutus</i>	Hardstem Bulrush
<i>Scirpus atrovirens</i>	Green Bulrush
<i>Scirpus cyperinus</i>	Woolgrass
<i>Scirpus fluviatilis</i>	River Bulrush
<i>Scirpus pungens</i>	Common Three-Square
<i>Scirpus validus</i>	Softstem Bulrush
<i>Scolochloa festucacea</i>	Common Rivergrass
<i>Sorghastrum nutans</i>	Indian Grass
<i>Spartina pectinata</i>	Prairie Cordgrass

\* Indicates species that are highly desired.