US Army Corps of Engineers®
St. Paul District

Appendix K: Environmental

Fargo Moorhead Metropolitan Area
Flood Risk Management Project

Reach 2

Engineering and Design Phase

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Appendix K: Environmental

Table of Contents

ATTACHMENTS

Attachment K-1 MFR Guidelines for Reach 1 Planting Plan of the Fargo Moorhead Diversion Channel

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Appendix K: Environmental

K.1 SUMMARY OF IMPACTS

Impacts identified in the 2011 Fargo-Moorhead Metropolitan Area Flood Risk Management Feasibility Report and Environmental Impact Statement includes impacts to aquatic habitat, fish passage and connectivity, floodplain forest, wetland resources, and cultural resources.

K.1.1 Aquatic Habitat

Impacts to aquatic habitat includes riverine habitat directly affected by individual project features to include the Red River Control Structure, Red River Outlet Structure, Wild Rice River Control Structure, Sheyenne River Aqueduct, Maple River Aqueduct, Wolverton Creek Tie-back Levee, and the abandonment of 6 miles of channel on the Rush and Lower Rush Rivers.

K.1.2 Fish Passage and Connectivity

Impacts to fish passage and connectivity result from staging water during operation of the flood control project reducing connectivity.

K.1.3 Floodplain Forest

The project will result in a loss of 117 acres of forested land consisting of floodplain forest, shelterbelts, and small pockets of trees around farmsteads.

K.1.4 Wetlands

The project will impact 990 acres of wetlands; the majority (790 acres) of the wetlands impacted is low functioning farmed, seasonally flooded type.

K.1.5 Cultural Resources

Phase 1 cultural resource testing has been ongoing for the entire project area; weather permitting the phase 1 surveys should be completed in 2012. Areas where phase 2 surveys will be needed have been identified and will continue to be identified as the phase 1 surveys are completed. The only cultural resources along the adjusted Reach 2 alignment is prehistoric isolated find spot 32CSX382, a Knife River Flint scraper, which is not eligible to the National Register of Historic Places. No further cultural resources work is needed at its location.

K.2 OVERALL MITIGATION FEATURES

K.2.1 Aquatic Habitat Mitigation Features

Measures considered for aquatic habitat mitigation include performing full stream restoration, stream improvement via riparian corridor restoration, designing the low-flow channel to meander, and construction of fish passage.

K.2.2 Fish Passage and Connectivity

Fish Passage and connectivity impacts will be mitigated for by designing the outlet structure to be passable to fish, providing fish passage channels around the Red River and Wild Rice River Control Structures, and providing fish passages at other existing dams in the region to include Drayton Dam, Hanson Dam and Wild Rice Dam.

K.2.3 Floodplain Forest

Mitigation to offset the impacts to floodplain forest includes converting 239 acres of floodplain farmland or pastured land into floodplain forest.

K.2.4 Wetlands

The channel will be planted with native wetland species on the bottom and the fringe of the side slopes of the channel, with the remainder of the side slopes being planted as a prairie swale type community. Appropriate native seed are included in attachment K-1 Planting Guidelines. A buffer strip of several hundred feet on either side of the diversion channel up to the embankment top will help limit encroachment from agricultural activities and will provide filtering of surface runoff into the diversion channel wetlands. Grade control structures will be required to avoid erosion during high flow events in the diversion channel. These structures will also facilitate the development of wetland conditions in the diversion channel.

K.2.5 Cultural

Cultural resources mitigation for each Reach must be completed prior to the start of construction for that Reach. In addition monitoring by a professional archeologist will be required during construction in select reaches of the project.

K.3 REACH 2 MITIGATION FEATURES

The environmental consideration for mitigation for this reach includes designing the outlet structure to function as fish passage, provide planting guidance to facilitate wetlands in the bottom of the diversion channel, and to ensure the low flow channel is designed to meander. These efforts are discussed in the Feasibility Report and Environmental Impact Statement (EIS).

K.3.1 Wetland Planting Guidelines

To meet the mitigation requirements for planting the diversion channel with wetland species, the vegetation establishment guidelines for the diversion channel that have been developed (Attachment K-1) should be used for vegetating the diversion channel. The goal of the planting plan is to limit the potential for the establishment of undesirable species (such as cattails, willow, etc.), compatible with Conveyance criteria (resulting in a Manning's roughness n value of .03 or less), and resilient to maintenance activities.

K.4 ENVIRONMENTAL SURVEYS AND MONITORING

Raptor surveys were conducted by the Corps and the USFWS during the spring of 2012. Surveys will be conducted each spring prior to construction for the outlet area. Based on the cultural resources programmatic agreement, any project excavation within 100 meters (328 feet) of any river (Red River outlet, Rush River, Lower Rush River, Maple River, Sheyenne River, Wild Rice River, and Red River inlet), at the proposed crossing location as well as the portion of the diversion alignment where it crosses through the oxbow area south of the Maple River should be monitored by a qualified professional archeologist.

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Attachment K-1: MFR Guidelines for Reach 1 Planting of the Fargo Moorhead Diversion Channel

Fargo Moorhead Metropolitan Area
Flood Risk Management Project

Reach 2

Engineering and Design Phase

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P2# 370365

21 June 2013

MEMORANDUM FOR RECORD

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

1. **References:** References and supporting documentation are listed below.

    a) Minnesota Board of Water & Soil Resources
    (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 seed 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 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 seed 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 select 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 Seed 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 taken right from the manual, and are standard mixtures used by MNDOT, BWSR and MNDNR. 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 will also be used for all seed mixes.

a) Zone 1: The seed mix proposed for zone 1 is the Dry Prairie Northwest (Table 1). Recommended planting times for this is between April 1 – June 30 for the highest success rate. If this is planted during the early fall watering is recommended to aid in establishment.
b) Zone 2: The seed mix proposed for zone 2 is the recommended Wet Prairie Mix (Table 2). Wetland Grasses and Prairie Grasses will have the highest success rate if planted between April 1 – June 30 for Wetland Grasses and April 15 – June 30 for Prairie Grasses (BWSR). Wetland Sedges and Forbes and Prairie Sedges and Forbes will have the highest success rate if planted from Oct 15 – frozen soils.
c) Zone 3: The seed mix proposed for zone 3 is the recommended Wet Meadow mix (Table 3). Wetland Grasses and Prairie Grasses will have the highest success rate if planted between April 1 – June 30 for Wetland Grasses and April 15 – June 30 for Prairie Grasses (BWSR). Wetland Sedges and Forbes and Prairie Sedges and Forbes will have the highest success rate if planted from Oct 15 – frozen soils.

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). Wetland Grasses and Prairie Grasses will have the highest success rate if planted between April 1 – June 30 for Wetland Grasses and April 15 – June 30 for Prairie Grasses (BWSR). Wetland Sedges and Forbes and Prairie Sedges and Forbes will have the highest success rate if planted from Oct 15 – frozen soils.

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. This project is unique in that planting zones 2-5 the soil to be planted will be excavated at a depth that should be free of most if not all rooted material or seeds so the need for spraying may not be necessary. Zone 1 consists of excavated material so depending on where this material comes there may be some existing seeds in the soil.

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. 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 4-6 inches of topsoil should be incorporated to a depth of 12 inches.

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. 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 ¼ to ½ inch deep depending on the size of the seed.

Figure 1. Typical Diverson Cross-Section

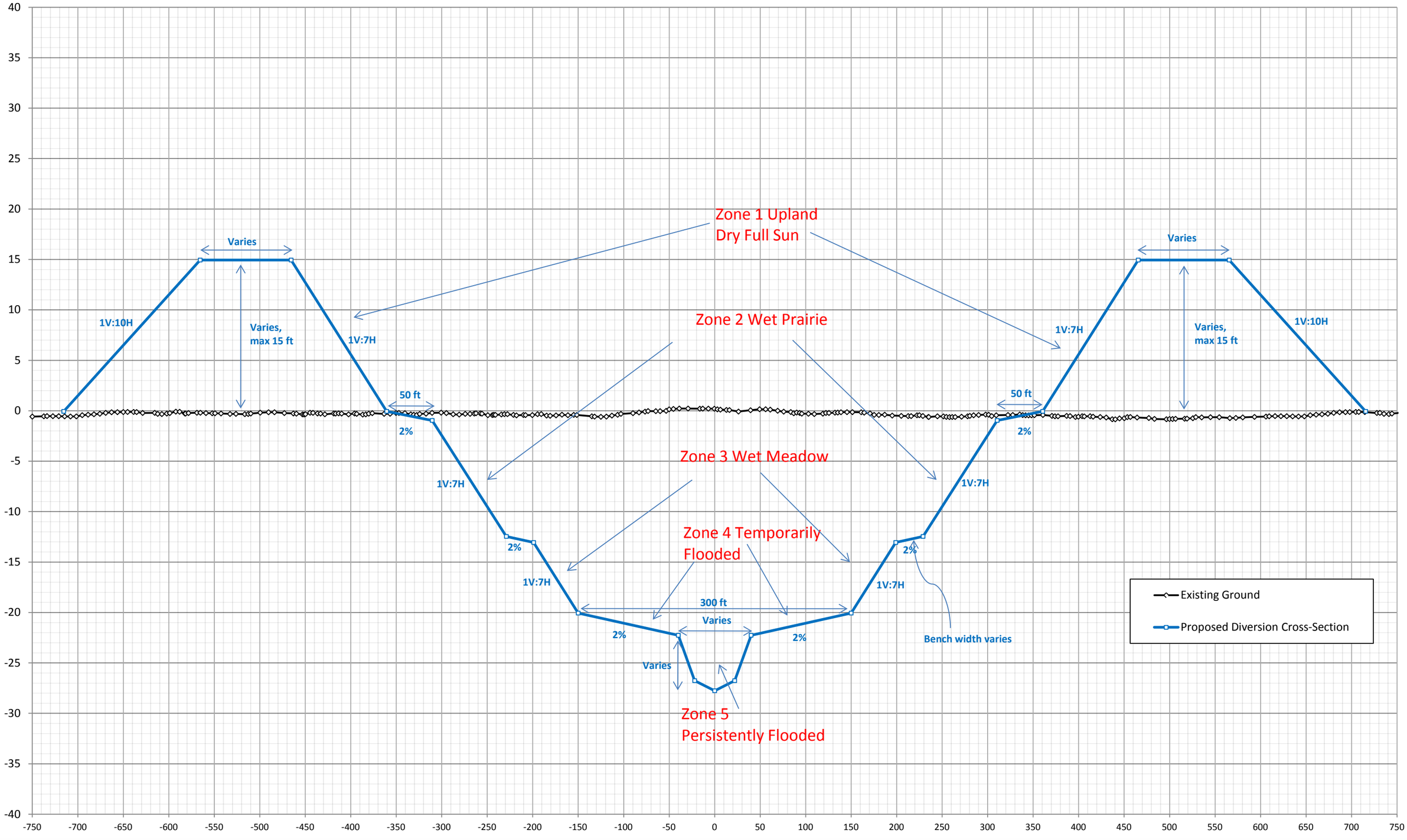

Table 1 Dry Prairie Northwest to be Used for Zone 1

Common Name	Scientific Name
Total Grasses	
side-oats grama	*Bouteloua curtipendula*
blue grama	*Bouteloua gracilis*
kalm's brome	*Bromus kalmii*
nodding wild rye	*Elymus canadensis*
slender wheatgrass	*Elymus trachycaulus*
porcupine grass	*Hesperostipa spartea*
junegrass	*Koeleria macrantha*
little bluestem	*Schizachyrium scoparium*
sand dropseed	*Sporobolus cryptandrus*
Total Forbs	
Prairie Wild Onion	*Allium stellatum*
Canada milk vetch	*Astragalus canadensis*
white prairie clover	*Dalea candida*
purple prairie clover	*Dalea purpurea*
Canada tick trefoil	*Desmodium canadense*
stiff sunflower	*Helianthus pauciflorus*
ox-eye	*Heliopsis helianthoides*
rough blazing star	*Liatris aspera*
dotted blazing star	*Liatris punctata*
wild bergamot	*Monarda fistulosa*
stiff goldenrod	*Oligoneuron rigidum*
prairie coneflower	*Ratibida columnifera*
black-eyed susan	*Rudbeckia hirta*
gray goldenrod	*Solidago nemoralis*
heath aster	*Symphyotrichum ericoides*
smooth aster	*Symphyotrichum laeve*
heart-leaved alexanders	*Zizia aptera*
Cover Crop	
Oats or winter wheat (see note at beginning of list for recommended dates)	

Table 2 Wet Prairie to be used for Zone 2

Common Name	Scientific Name
Grasses	
big bluestem	*Andropogon gerardii*
fringed brome	*Bromus ciliatus*
bluejoint	*Calamagrostis canadensis*
Virginia wild rye	*Elymus virginicus*
tall manna grass	*Glyceria grandis*
fowl manna grass	*Glyceria striata*
switchgrass	*Panicum virgatum*
fowl bluegrass	*Poa palustris*
Indian grass	*Sorghastrum nutans*
prairie cordgrass	*Spartina pectinata*
Sedges and Rushes	
wooly sedge	*Carex pellita*
tussock sedge	*Carex stricta*
fox sedge	*Carex vulpinoidea*
dark green bulrush	*Scirpus atrovirens*
woolgrass	*Scirpus cyperinus*
Forbs	
Canada anemone	*Anemone canadensis*
marsh milkweed	*Asclepias incarnata*
Canada tick trefoil	*Desmodium canadense*
flat-topped aster	*Doellingeria umbellata*
common boneset	*Eupatorium perfoliatum*
grass-leaved goldenrod	*Euthamia graminifolia*
spotted Joe pye weed	*Eutrochium maculatum*
autumn sneezeweed	*Helenium autumnale*
sawtooth sunflower	*Helianthus grosseserratus*
great blazing star	*Liatris pycnostachya*
great lobelia	*Lobelia siphilitica*
blue monkey flower	*Mimulus ringens*
Virginia mountain mint	*Pycnanthemum virginianum*
red-stemmed aster	*Symphyotrichum puniceum*
blue vervain	*Verbena hastata*
bunched ironweed	*Vernonia fasciculata*
Culver's root	*Veronicastrum virginicum*
golden alexanders	*Zizia aurea*
Cover Crop	
Oats or winter wheat (see note at beginning of list for recommended dates)	

Table 3 Wet Meadow to be used for Zone 3

Common Name	Scientific Name
Total Grasses	
fringed brome	*Bromus ciliatus*
bluejoint	*Calamagrostis canadensis*
Virginia wild rye	*Elymus virginicus*
rice cut grass	*Leersia oryzoides*
tall manna grass	*Glyceria grandis*
fowl manna grass	*Glyceria striata*
fowl bluegrass	*Poa palustris*
Total Sedges and Rushes	
bristly sedge	*Carex comosa*
pointed broom sedge	*Carex scoparia*
awl-fruited sedge	*Carex stipata*
tussock sedge	*Carex stricta*
fox sedge	*Carex vulpinoidea*
path rush	*Juncus tenuis*
dark green bulrush	*Scirpus atrovirens*
Long Beaked Sedge	*Carex sprengelii*
woolgrass	*Scirpus cyperinus*
Total Forbs	
marsh milkweed	*Asclepias incarnata*
common boneset	*Eupatorium perfoliatum*
grass-leaved goldenrod	*Euthamia graminifolia*
spotted Joe pye weed	*Eutrochium maculatum*
autumn sneezeweed	*Helenium autumnale*
sawtooth sunflower	*Helianthus grosseserratus*
great lobelia	*Lobelia siphilitica*
blue monkey flower	*Mimulus ringens*
Virginia mountain mint	*Pycnanthemum virginianum*
giant goldenrod	*Solidago gigantea*
eastern panicled aster	*Symphyotrichum lanceolatum*
red-stemmed aster	*Symphyotrichum puniceum*
tall meadow-rue	*Thalictrum dasycarpum*
blue vervain	*Verbena hastata*
bunched ironweed	*Vernonia fasciculata*
Culver's root	*Veronicastrum virginicum*
golden alexanders	*Zizia aurea*
Total Cover Crop	
Oats or winter wheat (see note at beginning of list for recommended dates)	

Table 4 Diversion Bottom to be Used for Zone 4 and Zone 5

Grasses	
American slough grass	*Beckmannia syzigachne*
Bluejoint	*Calamagrostis canadensis*
Tall manna grass	*Glyceria grandis*
Rice cut grass	*Leersia oryzoides*
Prairie cord-grass	*Spartina pectinata*
Big bluestem	*Andropogon gerardii*
Virginia wild rye	*Elymus virginicus*
fowl bluegrass	*Poa palustris*
Northern reedgrass	*Calamagrostis stricta ssp.inexpensa*
Indian grass	*Sorghastrum nutans*
Sedges and Rushes	
River bulrush	*Schoenoplectus fluviatilis*
Hardstem bulrush	*Scirpus acutus*
Dark green bulrush	*Scirpus atrovirens*
Woolgrass	*Scirpus cyperinus*
Marsh spikerush	*Eleocharis palustris*
Soft stem bulrush	*Schoenoplectus tabernaemontani*
Blunt spikerush	*Eleocharis obtusa*
Lake sedge	*Carex lacustris*
Soft rush	*Juncus balticus*
Woolly Sedge	*Carex lanuginosa*
Beaked sedge	*Carex rostrata*
Knotsheath sedge	*Carex retrorsa*
Forbes	
Sweet flag	*Acorus calamus*
Common water plantain	*Alisma triviale*
Swamp milkweed	*Asclepias incarnata*
Nodding bur marigold	*Bidens cernua*
Northern blue flag	*Iris versicolor*
Broad-leaved arrowhead	*Sagittaria latifolia*
Giant bur reed	*Sparganium eurycarpum*
Spotted Joe pye weed	*Eutrochium maculatum*
Obedient plant	*Physostegia virginiana*
Smartweeds	*Polygonum spp.*
Total Cover Crop	
Oats or winter wheat (see note at beginning of list for recommended dates)	