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Clark Fork River Operable Unit

of the Milltown Reservoir/Clark Fork River Superfund Site

Record of Decision

Appendix E:

Grant-Kohrs Ranch National Historic Site

E.1: List of Riparian Plant Communities

E.2: Planting Criteria and Vegetation Performance Standards After 10 years for Remediated Sites (for Individual Habitat Types and Community Types)

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Region 8

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APPENDIX E.1 – GRANT-KOHRS RANCH NATIONAL HISTORIC SITE

List of Riparian Plant Communities

Introduction

As discussed in Section 13.7 and elsewhere throughout the Record of Decision for the Clark Fork River Operable Unit (OU), remedial action within the Grant-Kohrs Ranch National Historic Site (GRKO) must attain location-specific Applicable or Relevant and Appropriate Requirements (ARARs) derived from the National Park Service Organic Act and the enabling legislation establishing GRKO. Attainment of these ARARs requires remedial measures that ensure the historic ranch landscape of the late nineteenth century is reestablished, preserved, and sustained for future generations in a condition unimpaired by hazardous substances. The "Grant-Kohrs Ranch National Historic Site Riparian Plant Communities" and "Planting Criteria and Vegetation Performance Standards after 10 years for Remediated Sites of the Grant-Kohrs Ranch National Historic Site" documents in this appendix (Appendix E.1 and E.2, respectively) define the performance standards by which attainment of these location-specific ARARs will be measured. These performance standards require that the selected remedial action reestablish self-producing native riparian vegetation communities as further described in this appendix.

To facilitate development of these performance standards, GRKO submitted to EPA a list of habitat types (HT) and community types (CT) (Rice 2003) that would be present within the riparian zone of GRKO but for the past and ongoing releases of hazardous substances from upstream mining activities. This list was derived from statistical analysis of a statewide wetland and riparian site classification (Hansen et al. 1995). In this appendix, the GRKO list is further refined to meet the site-specific physiographic conditions encountered within Reach A of the Clark Fork River OU.

Ecological Site Potential for Riparian and Wetland Types

The distribution of natural plant communities in an area, and the relative acres covered by each, depends on site potential and how it varies within the area, as well as on site disturbance. Within a relatively small area, such as the GRKO, the greatest determinant of vegetation potential is hydrology as modified by soil type. This parameter can vary greatly within short distances.

The remedial activities planned for contaminated areas within Reach A of the Clark Fork River OU, which includes the GRKO, include either in-place treatment with lime or removal. These activities may alter every treated site's vegetation potential.

Exotic (Non-native) Species

Non-native, or introduced exotic, species were not considered. However, they will invade remediated sites. Species such as Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), redtop (*Agrostis stolonifera*), common dandelion (*Taraxacum officinale*), and others will inevitably account for some of the understory canopy cover and species diversity. The most (perhaps only)

effective way to prevent their taking dominance of remediated sites is to cover the soil as quickly as possible with desired native species.

Required Types for GRKO

Table E.1-1 presents an estimate of the fractional breakdown of the GRKO floodplain area among the types that, in order to attain the site-specific ARAR, should occupy the remediated floodplain on the GRKO. This breakdown reflects our knowledge of riparian habitat type, community type, and riparian species distribution and relative abundance in the different regions of Montana.

TABLE E.1-1
Fifteen Required Habitat Types (HT) and Community Types (CT) Grouped by Overstory Lifeform Dominance (i.e., trees, shrubs, graminoids, and forbs) and Ranked by Estimated Percentage of Area Represented by the Type

Type	Deer Lodge Valley Distribution Category*	Estimated Percentage (%) of Total Area Represented	Typical Floodplain Position of the Type
Tree Dominated Types			
Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) CT	Minor	8-12	Recent point bars and low floodplain terraces.
Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) HT	Incidental	<1	Slightly moist to mesic floodplain sites
Shrub Dominated Types			
Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT	Major	18-23	Drier areas in old oxbows, floodplain terraces.
Water Birch (*Betula occidentalis*) CT	Major	12-18	Moist areas, old oxbow banks, streambanks.
Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT	Major	12-18	Moist areas, old oxbow, streambanks.
Sandbar Willow (*Salix exigua*) CT	Minor	8-12	Recent point bars, streambanks.
Woods Rose (*Rosa woodsii*) CT	Minor	1-3	Drier areas on upper floodplain terraces.
Western Snowberry (*Symphoricarpos occidentalis*) CT	Minor	1-3	Drier areas on upper floodplain terraces.
Mountain Alder (*Alnus incana*) CT	Minor	1-3	Moist areas, old oxbow banks, streambanks.
Graminoid Dominated Types			
Beaked Sedge (*Carex rostrata*) HT	Minor	5-8	Wet sites, old oxbow, or slough bottoms.
Bluejoint Reedgrass (*Calamagrostis canadensis*) HT	Minor	3-6	Moist areas, old oxbow, and streambanks.
Western Wheatgrass (*Agropyron smithii*) HT	Minor	3-6	Drier open areas away from the river channel.
Water Sedge (*Carex aquatilis*) HT	Minor	2-4	Wet sites, old oxbow, or slough bottoms.
Common Spikesedge (*Eleocharis palustris*) HT	Incidental	<1	Ponded areas, water edges.

TABLE E.1-1
Fifteen Required Habitat Types (HT) and Community Types (CT) Grouped by Overstory Lifeform Dominance (i.e., trees, shrubs, graminoids, and forbs) and Ranked by Estimated Percentage of Area Represented by the Type

Type	Deer Lodge Valley Distribution Category*	Estimated Percentage (%) of Total Area Represented	Typical Floodplain Position of the Type
Forb Dominated Types			
Common Cattail (*Typha latifolia*) HT	Minor	2-4	Ponded areas, old oxbow, and slough bottoms.

*A ***major type*** occupies extensive acreages in at least some portion of the riparian or wetland zone; a ***minor type*** seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone; and an ***incidental type*** rarely occurs within the region, or is limited to narrow site conditions and/or very localized occurrence.

Species Composition of Required Habitat Types and Community Types

The ecological amplitude (the range of distribution across all site parameters—which translates to geographic range) of a habitat type or community type is never identical to that of all its constituent species. For this reason, when designing the species list for a given type, the geographic position of the particular site within the overall range of the type must be considered. Knowledge of the distribution and ecology of local natural vegetation is essential to correct prescriptions for "what and how much to plant where" in any installation of natural vegetation communities onto radically disturbed sites.

Not all species listed for any type can be expected to occur in any given stand of that type. The listed species are those deemed as appropriately adapted and reasonably likely to naturally occur in a stand of that type in the Deer Lodge Valley. Listed species are intended to constitute a design list, from which implementation design and performance standards can be drawn.

Tree Dominated Types

Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) Community Type—Although very little of the Upper Clark Fork River Valley (Reach A) supports any tree types, GRKO does have several small stands of black cottonwood (*Populus trichocarpa*). Re-establishing young stands of black cottonwood (*Populus trichocarpa*) on suitable sites following remedial treatment will require selection of sites with dependable ground water contact, full sunlight, and little competition from other taller plants. This species may seed naturally on moist, suitably bare sites. The seed source is present, but success of this is dependent on flooding events. Competition from aggressive weeds and weedy herbaceous plants is the greatest obstacle to success of natural re-establishment of this type on sites free from excess grazing pressure. Table E.1-2 provides a list of native species that commonly occur in stands of the Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-2
Native Plant Species that may be Present in a Mature Stand of the Black Cottonwood/Red-Osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) on a Typical Stand Having the Species Present
Trees	
black cottonwood (*Populus trichocarpa*)	40-70
Shrubs	
mountain alder (*Alnus incana*)	5-10
western serviceberry (*Amelanchier alnifolia*)	5-10
water birch (*Betula occidentalis*)	5-10
western virgins-bower (*Clematis ligusticifolia*)	1-3
red-osier dogwood (*Cornus stolonifera*)	20-40
common chokecherry (*Prunus virginiana*)	5-10
swamp current (*Ribes lacustre*)	1-3
Missouri gooseberry (*Ribes setosum*)	1-3
woods rose (*Rosa woodsii*)	2-5
common red raspberry (*Rubus idaeus*)	1-3
Bebb willow (*Salix bebbiana*)	5-10
Booth willow (*Salix boothii*)	5-10
sandbar willow (*Salix exigua*)	5-10
Geyer willow (*Salix geyeriana*)	5-10
yellow willow (*Salix lutea*)	2-5
western snowberry (*Symphoricarpos occidentalis*)	2-5
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
fringed brome (*Bromus ciliatus*)	1-3
bluejoint reedgrass (*Calamagrostis canadensis*)	30-60
Canada wildrye (*Elymus canadensis*)	1-3
fowl bluegrass (*Poa palustris*)	1-3
Forbs	
baneberry (*Actaea rubra*)	1-2
western aster (*Aster occidentalis*)	1-3
field horsetail (*Equisetum arvense*)	2-5
sweetscented bedstraw (*Galium triflorum*)	2-5
fringed loosestrife (*Lysimachia ciliata*)	1-2
field mint (*Mentha arvensis*)	1-2
mountain sweet-cicely (*Osmorhiza chilensis*)	1-3
starry Solomon-plume (*Smilacina stellata*)	1-3
streambank groundsel (*Senecio pseudaureus*)	1-2
Canada goldenrod (*Solidago canadensis*)	2-5
western meadowrue (*Thalictrum occidentalis*)	1-3
American vetch (*Vicia americana*)	1-2

Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) Habitat Type— Although quaking aspen (*Populus tremuloides*) is not presently found on the GRKO, the species is recorded on several sites within the Upper Clark Fork River Valley (Reach A) on sites both upstream and downstream from GRKO. The Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) Habitat Type occurs on higher floodplain terrace sites that are not frequently flooded. Table E.1-3 provides a list of native species that commonly occur in stands of the Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-3
Native Plant Species that may be Present in a Mature Stand of the Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) on a Typical Stand Having the Species Present
Trees	
quaking aspen (*Populus tremuloides*)	40-70
Shrubs	
western serviceberry (*Amelanchier alnifolia*)	5-10
water birch (*Betula occidentalis*)	3-5
shrubby cinquefoil (*Potentilla fruticosa*)	1-3
Missouri gooseberry (*Ribes setosum*)	1-3
woods rose (*Rosa woodsii*)	3-5
common red raspberry (*Rubus idaeus*)	1-3
Bebb willow (*Salix bebbiana*)	3-5
western snowberry (*Symphoricarpos occidentalis*)	3-5
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
fringed brome (*Bromus ciliatus*)	1-2
bluejoint reedgrass (*Calamagrostis canadensis*)	50-80
Canada wildrye (Elymus canadensis)	1-3
Baltic rush (*Juncus balticus*)	1-3
fowl bluegrass (*Poa palustris*)	1-3
Forbs	
western aster (*Aster occidentalis*)	2-5
field horsetail (*Equisetum arvense*)	2-5
Virginia strawberry (*Fragaria virginiana*)	1-2
white geranium (*Geranium richardsonii*)	1-2
large leaved avens (*Geum macrophyllum*)	1-2
sweetscented bedstraw (*Galium triflorum*)	1-2
fringed loosestrife (*Lysimachia ciliata*)	1-2
field mint (*Mentha arvensis*)	1-2
mountain sweet-cicely (*Osmorhiza chilensis*)	1-2
streambank groundsel (*Senecio pseudaureus*)	1-2
starry Solomon-plume (*Smilacina stellata*)	1-2

TABLE E.1-3
Native Plant Species that may be Present in a Mature Stand of the Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) on a Typical Stand Having the Species Present
Canada goldenrod (*Solidago canadensis*)	1-2
western meadowrue (*Thalictrum occidentalis*)	1-2
American vetch (*Vicia americana*)	1-2
Canada violet (*Viola canadensis*)	1-2

Shrub Dominated Type

Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) Habitat Type—The Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) Habitat Type represents the potential of a large portion of the area within the floodplain in the Deer Lodge Valley on slightly drier sites than the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) Habitat Type. Presently, as with the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) Habitat Type, much of this area is disturbed to the extent of successional regression to various early seral community types and disclimaxes. Many of the stands still supporting willows have their understories converted to disturbance-induced exotic species. Table E.1-4 provides a list of native species that commonly occur in stands of the Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) Habitat Type at this elevation and in this portion of its range. ***NOTE***: Each stand of this type will not contain all species in this list.

TABLE E.1-4
Native Plant Species That May be Present in a Mature Stand of the Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/ Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
Geyer willow (*Salix geyeriana*)	30-60
Booth willow (*Salix boothii*)	20-40
water birch (*Betula occidentalis*)	5-10
red-osier dogwood (*Cornus stolonifera*)	5-10
sandbar willow (*Salix exigua*)	5-10
mountain alder (*Alnus incana*)	2-5
Bebb willow (*Salix bebbiana*)	2-5
swamp current (*Ribes lacustre*)	1-3
Missouri gooseberry (*Ribes setosum*)	1-3
woods rose (*Rosa woodsii*)	1-3
shrubby cinquefoil (*Potentilla fruticosa*)	1-2
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	40-60
narrow-spiked reedgrass (*Calamagrostis stricta*)	5-10

TABLE E.1-4
Native Plant Species That May be Present in a Mature Stand of the Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/ Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
tufted hairgrass (*Deschampsia cespitosa*)	1-2
bearded wheatgrass (*Agropyron caninum*)	3-5
fringed brome (*Bromus ciliatus*)	1-3
Baltic rush (*Juncus balticus*)	1-3
fowl bluegrass (*Poa palustris*)	1-3
fowl mannagrass (*Glyceria striata*)	1-2
Forbs	
fireweed (*Epilobium angustifolium*)	1-3
cow parsnip (*Heracleum lanatum*)	1-3
common yarrow (*Achillea millefolium*)	1-2
leafy aster (*Aster foliaceus*)	1-2
western aster (*Aster occidentalis*)	1-2
field horsetail (*Equisetum arvense*)	1-2
Virginia strawberry (*Fragaria virginiana*)	1-2
northern bedstraw (*Galium boreale*)	1-2
large leaved avens (*Geum macrophyllum*)	1-2
field mint (*Mentha arvensis*)	1-2
slender cinquefoil (*Potentilla gracilis*)	1-2
starry Solomon-plume (*Smilacina stellata*)	1-2
Canada goldenrod (*Solidago canadensis*)	1-2

Water Birch (*Betula occidentalis*) Community Type—The Water Birch (*Betula occidentalis*) Community Type is appropriate for a large fraction of the floodplain area on moist sites that are in early-to-mid seral successional stage in the Deer Lodge Valley. This type is well represented along the Clark Fork River by older, mature stands on slightly elevated floodplain terraces. Young stands that are to be established with seedling and small sapling nursery stock will need to be located on lower sites, having a shallow water table. Table E.1-5 provides a list of native species that commonly occur in stands of the Water Birch (*Betula occidentalis*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-5
Native Plant Species That May be Present in a Mature Stand of the Water Birch (*Betula occidentalis*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
mountain alder (*Alnus incana*)	5-10
western serviceberry (*Amelanchier alnifolia*)	2-5
water birch (*Betula occidentalis*)	40-60
red-osier dogwood (*Cornus stolonifera*)	5-10
shrubby cinquefoil (*Potentilla fruticosa*)	1-2
common chokecherry (*Prunus virginiana*)	2-5
woods rose (*Rosa woodsii*)	1-3
Bebb willow (*Salix bebbiana*)	2-5
Booth willow (*Salix boothii*)	1-5
sandbar willow (*Salix exigua*)	5-10
Geyer willow (*Salix geyeriana*)	1-5
yellow willow (*Salix lutea*)	1-5
western snowberry (*Symphoricarpos occidentalis*)	1-3
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
bluejoint reedgrass (*Calamagrostis canadensis*)	30-50
Nebraska sedge (*Carex nebraskensis*)	3-5
Baltic rush (*Juncus balticus*)	1-3
fowl bluegrass (*Poa palustris*)	3-5
Forbs	
spreading dogbane (*Apocynum androsaemifolium*)	2-5
wartberry fairy-bell (*Disporum trachycarpum*)	1-2
common willow herb (*Epilobium ciliatum*)	1-2
field horsetail (*Equisetum arvense*)	1-2
smooth scouring rush (*Equisetum laevigatum*)	1-2
Virginia strawberry (*Fragaria virginiana*)	1-2
northern bedstraw (*Galium boreale*)	1-2
Nuttall's sunflower (*Helianthus nuttallii*)	1-2
starry Solomon-plume (*Smilacina stellata*)	1-2
Canada goldenrod (*Solidago canadensis*)	1-2

Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) Habitat Type—The Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) Habitat Type represents the potential of another large fraction of the floodplain in the Deer Lodge Valley. Presently much of this area is disturbed to the extent of successional regression to various early seral community types and disclimaxes. Many of the stands still support willow communities, but have understories converted to disturbance-induced exotic species. Table E.1-6 provides a list of native species that commonly occur in stands of the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex*

rostrata) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-6
Native Plant Species That May be Present in a Mature Stand of the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) Habitat Type Within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
mountain alder (*Alnus incana*)	2-5
water birch (*Betula occidentalis*)	2-5
shrubby cinquefoil (*Potentilla fruticosa*)	1-2
Bebb willow (*Salix bebbiana*)	2-5
Booth willow (*Salix boothii*)	20-40
sandbar willow (*Salix exigua*)	3-5
Geyer willow (*Salix geyeriana*)	30-60
yellow willow (*Salix lutea*)	1-2
Graminoids	
tickle grass (*Agrostis scabra*)	1-2
fringed brome (*Bromus ciliatus*)	1-2
narrow-spiked reedgrass (*Calamagrostis stricta*)	1-2
bluejoint reedgrass (*Calamagrostis canadensis*)	5-10
water sedge (*Carex aquatilis*)	10-30
soft-leaved sedge (*Carex disperma*)	2-5
wooly sedge (*Carex lanuginosa*)	2-5
beaked sedge (*Carex rostrata*)	40-70
inflated sedge (*Carex vesicaria*)	1-2
tufted hairgrass (*Deschampsia cespitosa*)	1-2
fowl mannagrass (*Glyceria striata*)	1-2
Baltic rush (*Juncus balticus*)	1-3
fowl bluegrass (*Poa palustris*)	1-2
Forbs	
leafy aster (*Aster foliaceus*)	1-2
western aster (*Aster occidentalis*)	1-2
large leaved avens (*Geum macrophyllum*)	1-3
common willow herb (*Epilobium ciliatum*)	1-2
field horsetail (*Equisetum arvense*)	1-2
Virginia strawberry (*Fragaria virginiana*)	1-2
small bedstraw (*Galium trifidum*)	1-2
field mint (*Mentha arvensis*)	1-2
starry Solomon-plume (*Smilacina stellata*)	1-2
Canada goldenrod (*Solidago canadensis*)	1-2
Canada violet (*Viola canadensis*)	1-2

Sandbar Willow (*Salix exigua*) Community Type—Sandbar willow (*Salix exigua*) is a major species throughout the Deer Lodge Valley. It is a pioneer of broad ecological amplitude, meaning it can grow on a wide array of site types. It is adapted for most sites of exposed, moist, mineral soil. The Sandbar Willow (*Salix exigua*) Community Type represents an early seral stage that will develop into one of several later seral stages, as late seral species assume dominance. Large amounts of sandbar willow (*Salix exigua*) may be planted throughout the Clark Fork River OU on or near the streambank for stabilization purposes. Most of these sites will proceed along this successional path through the sandbar willow (*Salix exigua*) to one of the other willow dominated habitat types over the coarse of 50 to 75 years. Table E.1-7 provides a list of native species that commonly occur in stands of the Sandbar Willow (*Salix exigua*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-7
Native Plant Species That May be Present in a Mature Stand of the Sandbar Willow (*Salix exigua*) Community Type Within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
mountain alder (*Alnus incana*)	2-5
western serviceberry (*Amelanchier alnifolia*)	1-2
water birch (*Betula occidentalis*)	3-5
red-osier dogwood (*Cornus stolonifera*)	5-10
woods rose (*Rosa woodsii*)	2-5
Bebb willow (*Salix bebbiana*)	1-2
Booth willow (*Salix boothii*)	2-5
sandbar willow (*Salix exigua*)	80-100
Geyer willow (*Salix geyeriana*)	3-5
yellow willow (*Salix lutea*)	1-2
western snowberry (*Symphoricarpos occidentalis*)	2-5
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
western wheatgrass (*Agropyron smithii*)	1-2
bluejoint reedgrass (*Calamagrostis canadensis*)	30-60
narrow-spiked reedgrass (*Calamagrostis stricta*)	5-10
beaked sedge (*Carex rostrata*)	2-5
fowl bluegrass (*Poa palustris*)	1-2
Forbs	
hemp dogbane (*Apocynum cannabinum*)	1-2
field horsetail (*Equisetum arvense*)	1-2
wild licorice (*Glycyrrhiza lepidota*)	1-2
field mint (*Mentha arvensis*)	1-2
Canada goldenrod (*Solidago canadensis*)	1-2

Woods Rose (*Rosa woodsii*) Community Type—The Woods Rose (*Rosa woodsii*) Community Type is appropriate for a small areas on drier sites on upper terraces near the outer edges of the floodplain along the Clark Fork River in the Deer Lodge Valley. Table E.1-8 provides a list of native species that commonly occur in stands of the Woods Rose (*Rosa woodsii*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-8
Native Plant Species That May be Present in a Mature Stand of the Woods Rose (*Rosa woodsii*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
woods rose (*Rosa woodsii*)	50-80
western snowberry (*Symphoricarpos occidentalis*)	10-30
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	5-10
western wheatgrass (*Agropyron smithii*)	20-40
Canada wildrye (*Elymus canadensis*)	1-3
Baltic rush (*Juncus balticus*)	1-3
satin-grass (*Muhlenbergia racemosa*)	1-2
fowl bluegrass (*Poa palustris*)	1-3
Forbs	
common yarrow (*Achillea millefolium*)	1-2
Virginia strawberry (*Fragaria virginiana*)	1-2
northern bedstraw (*Galium boreale*)	1-3
wild licorice (*Glycyrrhiza lepidota*)	3-5
Canada goldenrod (*Solidago canadensis*)	1-3

Western Snowberry (*Symphoricarpos occidentalis*) Community Type—Western snowberry (*Symphoricarpos occidentalis*) is common throughout the Deer Lodge Valley on dry-to-slightly moist sites. It is an early-to-mid seral species that is a common constituent of many other types, but it occasionally develops dominance of stands in open sites. Table E.1-9 provides a list of native species that commonly occur in stands of the Western Snowberry (*Symphoricarpos occidentalis*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-9
Native Plant Species That May be Present in a Mature Stand of the Western Snowberry (*Symphoricarpos occidentalis*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
woods rose (*Rosa woodsii*)	10-20
western snowberry (*Symphoricarpos occidentalis*)	50-80
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
western wheatgrass (*Agropyron smithii*)	20-40
Canada wildrye (*Elymus canadensis*)	2-3
Forbs	
common yarrow (*Achillea millefolium*)	1-2
prairie sagewort (*Artemisia ludoviciana*)	1-2
northern bedstraw (*Galium boreale*)	1-2
wild licorice (*Glycyrrhiza lepidota*)	1-2
satin grass (*Muhlenbergia racemosa*)	1-2
Canada goldenrod (*Solidago canadensis*)	1-2

Mountain Alder (*Alnus incana*) Community Type—The Mountain Alder (*Alnus incana*) Community Type is appropriate for small areas on moist sites along streambanks and edges of sloughs along the Clark Fork River in the Deer Lodge Valley. This type is represented in the Deer Lodge Valley by small stands that are usually associated with entering tributary streams. Table E.1-10 provides a list of native species that commonly occur in stands of the Mountain Alder (*Alnus incana*) Community Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-10
Native Plant Species That May be Present in a Mature Stand of the Mountain Alder (*Alnus incana*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Shrubs	
mountain alder (*Alnus incana*)	50-80
red-osier dogwood (*Cornus stolonifera*)	10-20
stinking current (*Ribes hudsonianum*)	1-3
woods rose (*Rosa woodsii*)	1-3
common red raspberry (*Rubus idaeus*)	3-5
Bebb willow (*Salix bebbiana*)	3-5
sandbar willow (*Salix exigua*)	3-5
yellow willow (*Salix lutea*)	3-5

TABLE E.1-10
Native Plant Species That May be Present in a Mature Stand of the Mountain Alder (*Alnus incana*) Community Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
bluejoint reedgrass (*Calamagrostis canadensis*)	30-50
beaked sedge (*Carex rostrata*)	5-10
drooping woodreed (*Cinna latifolia*)	1-3
tall mannagrass (*Glyceria elata*)	1-3
fowl bluegrass (*Poa palustris*)	1-3
Forbs	
western aster (*Aster occidentalis*)	1-3
ladyfern (*Athyrium filix-femina*)	1-2
common willow herb (*Epilobium ciliatum*)	1-2
field horsetail (*Equisetum arvense*)	1-2
meadow horsetail (*Equisetum pratense*)	1-2
sweetscented bedstraw (*Galium triflorum*)	2-5
large leaved avens (*Geum macrophyllum*)	1-2
cow parsnip (*Heracleum lanatum*)	1-3
field mint (*Mentha arvensis*)	1-2
starry Solomon-plume (*Smilacina stellata*)	1-2

Graminoid Dominated Types

Beaked Sedge (*Carex rostrata*) Habitat Type, Beaked Sedge (*Carex rostrata*) and Water Sedge (*Carex aquatilis*) Phases—Beaked sedge (*Carex rostrata*) is common throughout the Deer Lodge Valley on wet-to-very-wet sites. It is a late seral constituent species of many other types, but that occasionally develops stand dominance on open sites, such as in slough bottoms, along old channels, and around beaver ponds. The Beaked Sedge (*Carex rostrata*) Habitat Type typically forms dense stands that inhibit the invasion of other species, as long as the site remains undisturbed. Table E.1-11 provides a list of native species that commonly occur in stands of the Beaked Sedge (*Carex rostrata*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-11
Native Plant Species That May be Present in a Mature Stand of the Beaked Sedge (*Carex rostrata*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	2-5
narrow spiked reedgrass (*Calamagrostis stricta*)	3-5

TABLE E.1-11
Native Plant Species That May be Present in a Mature Stand of the Beaked Sedge (*Carex rostrata*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
water sedge (*Carex aquatilis*)	10-20
awned sedge (*Carex atherodes*)	2-5
beaked sedge (*Carex rostrata*)	80-100
inflated sedge (*Carex vesicaria*)	10-20
tufted hairgrass (*Deschampsia cespitosa*)	1-2
common spikesedge (*Eleocharis palustris*)	3-5
Baltic rush (*Juncus balticus*)	1-3
Forbs	
common willow herb (*Epilobium ciliatum*)	2-5
water horsetail (*Equisetum fluviatile*)	1-2
small bedstraw (*Galium trifidum*)	1-2
large leaved avens (*Geum macrophyllum*)	1-3
field mint (*Mentha arvensis*)	1-2
water smartweed (*Polygonum amphibium*)	3-5
purple cinquefoil (*Potentilla palustris*)	1-2

Bluejoint Reedgrass (*Calamagrostis canadensis*) Habitat Type— The Bluejoint Reedgrass (*Calamagrostis canadensis*) Habitat Type represents the potential of certain positions on the floodplain of the Clark Fork River floodplain in the Deer Lodge Valley that are slightly drier than the requirements for beaked sedge (*Carex rostrata*), but that do usually receive short periods of springtime flooding. Table E.1-12 provides a list of native species that commonly occur in stands of the Bluejoint Reedgrass (*Calamagrostis canadensis*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-12
Native Plant Species That May be Present in a Mature Stand of the Bluejoint Reedgrass (*Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
tickle grass (*Agrostis scabra*)	1-2
bluejoint reedgrass (*Calamagrostis canadensis*)	80-100
narrow-spiked reedgrass (*Calamagrostis stricta*)	10-20
water sedge (*Carex aquatilis*)	2-5
tufted hairgrass (*Deschampsia cespitosa*)	1-2
Baltic rush (*Juncus balticus*)	1-3
fowl bluegrass (*Poa palustris*)	1-3

TABLE E.1-12
Native Plant Species That May be Present in a Mature Stand of the Bluejoint Reedgrass (*Calamagrostis canadensis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Forbs	
sharptooth angelica (*Angelica arguta*)	2-5
leafy aster (*Aster foliaceus*)	1-2
western aster (*Aster occidentalis*)	2-5
common willowherb (*Epilobium ciliatum*)	1-3
cow parsnip (*Heracleum lanatum*)	2-3
slender leafed licorice root (*Ligusticum tenuifolium*)	1-2
field mint (*Mentha arvensis*)	1-2
elephant's head (*Pedicularis groenlandica*)	2-5
western groundsel (*Senecio integerrimus*)	2-5
arrowleaf groundsel (*Senecio triangularis*)	5-10
Canada violet (*Viola canadensis*)	1-2

Western Wheatgrass (*Agropyron smithii*) Habitat Type—The Western Wheatgrass (*Agropyron smithii*) Habitat Type represents the driest, open areas on the river floodplain that may be flooded for short periods during spring runoff, but that lack potential for natural succession to taller communities. These will be the highest terrace benches that lie within the floodplain. Table E.1-13 provides a list of native species that commonly occur in stands of the Western Wheatgrass (*Agropyron smithii*) Habitat Type, at this elevation, and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-13
Native Plant Species That May be Present in a Mature Stand of the Western Wheatgrass (*Agropyron smithii*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	3-5
western wheatgrass (*Agropyron smithii*)	90-100
Baltic rush (*Juncus balticus*)	1-5
green needlegrass (*Stipa viridula*)	2-5
Forbs	
common yarrow (*Achillea millefolium*)	1-2
prairie sagewort (*Artemisia ludoviciana*)	1-3
wild licorice (*Glycyrrhiza lepidota*)	1-2
American vetch (*Vicia americana*)	1-2

Water Sedge (*Carex aquatilis*) Habitat Type, Water Sedge (*Carex aquatilis*) Phase—Water sedge (*Carex aquatilis*) is common throughout the Deer Lodge Valley on moist-to-wet sites. It is a

late seral constituent species of many other types, but it occasionally develops stand dominance on sites such as sloughs, old channels, and around beaver ponds. The Water Sedge (*Carex aquatilis*) Habitat Type can form dense stands that inhibit the invasion of other species, as long as they remain undisturbed. Table E.1-14 provides a list of native species that commonly occur in stands of the Water Sedge (*Carex aquatilis*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-14
Native Plant Species That May be Present in a Mature Stand of the Water Sedge (*Carex aquatilis*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
Columbia sedge (*Carex aperta*)	3-5
water sedge (*Carex aquatilis*)	80-100
lentil fruited sedge (*Carex lenticularis*)	3-5
Nebraska sedge (*Carex nebraskensis*)	2-5
beaked sedge (*Carex rostrata*)	10-20
short beaked sedge (*Carex simulata*)	3-5
inflated sedge (*Carex vesicaria*)	2-5
common spikesedge (*Eleocharis palustris*)	3-5
few flowered spikesedge (*Eleocharis pauciflora*)	3-5
Baltic rush (*Juncus balticus*)	2-3

Common Spikesedge (*Eleocharis palustris*) Habitat Type—Common spikesedge (*Eleocharis palustris*) occurs throughout the Deer Lodge Valley in very small, usually narrow, linear stands on sites of very specific hydrologic regime at the water's edge along sloughs, ponds, and borrow pits where the water is still or slow moving. Table E.1-15 provides a list of native species that commonly occur in stands of the Common Spikesedge (*Eleocharis palustris*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-15
Native Plant Species That May be Present in a Mature Stand of the Common spikesedge (*Eleocharis palustris*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
western wheatgrass (*Agropyron smithii*)	1-5
short awn foxtail (*Alopecurus aequalis*)	1-2
American sloughgrass (*Beckmannia syzigachne*)	1-2
slender beaked sedge (*Carex athrostachya*)	1-2
needle spikesedge (*Eleocharis acicularis*)	5-10
common spikesedge (*Eleocharis palustris*)	80-100
foxtail barley (*Hordeum jubatum*)	3-5 (on more saline sites)
Nuttall's alkaligrass (*Puccinellia nuttalliana*)	1-2 (on more saline sites)

TABLE E.1-15
Native Plant Species That May be Present in a Mature Stand of the Common spikesedge (*Eleocharis palustris*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Forbs	
common willow herb (*Epilobium ciliatum*)	1-2
field mint (*Mentha arvensis*)	1-2
arumleaf arrowhead (*Sagittaria cuneata*)	1-2
alkali marsh butterweed (*Senecio hydrophilus*)	1-2
simplestem bur reed (*Sparganium emersum*)	1-5

Forb Dominated Types

Common Cattail (*Typha latifolia*) Habitat Type—Common cattail (*Typha latifolia*) occurs throughout the Deer Lodge Valley on sites with ponded surface water. It is a late seral species that develops dense stands on such sites as sloughs, old channels, and borrow pits. The Common Cattail (*Typha latifolia*) Habitat Type typically forms dense stands that inhibit the invasion of other species, as long as they remain undisturbed. Table E.1-16 provides a list of native species that commonly occur in stands of the Common Cattail (*Typha latifolia*) Habitat Type at this elevation and in this portion of its range. ***NOTE:*** Each stand of this type does not necessarily contain all species in this list.

TABLE E.1-16
Native Plant Species That May be Present in a Mature Stand of the Common Cattail (*Typha latifolia*) Habitat Type within the Upper Clark Fork River Valley

Species	Range of Canopy Cover (%) On a Typical Stand Having the Species Present
Graminoids	
softstem bulrush (*Scirpus validus*)	5-10
Forbs	
common willow herb (*Epilobium ciliatum*)	3-5
field mint (*Mentha arvensis*)	1-2
water smartweed (*Polygonum amphibium*)	3-5
common cattail (*Typha latifolia*)	80-90

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APPENDIX E.2—GRANT-KOHRS RANCH NATIONAL HISTORIC SITE

Planting Criteria and Vegetation Performance Standards After 10 Years for Remediated Sites
(for Individual Habitat Types and Community Types)

Overall Planting Criteria and Vegetation Performance Standards

Remedial action will be implemented to achieve the GRKO-specific ARARs on the basis of habitat types (HT) and community types (CT). Therefore, planting criteria must be designed and performance assessed on the basis of those HTs and CTs. Each HT or CT must have individual planting criteria and standards of performance written in terms of species richness and species canopy cover that are to be met after a development period of 10 years after remedy implementation. Implementation of the remedy is understood to mean the first year of full scale on-site revegetation activities at GRKO. Success in achieving the performance standards defining the ARAR will be assessed on polygons drawn around stands of individual types, and will be based on whether or not:

- Prescribed amounts of key species are present;
- Minimum numbers of members from certain species groups or unions are present;
- Minimum canopy cover of members from certain species groups or unions are present;
- A maximum canopy cover by certain species is not surpassed in some types;
- A minimum total canopy cover by the aggregate of all preferred plant species is present;
- No human-caused unvegetated soil surface is present;
- A maximum canopy cover by undesirable herbaceous species (e.g., dandelions, plantains, Kentucky bluegrass, etc.) is not surpassed; and
- Invasive species (noxious weeds) are absent.

A union is defined as a subdivision of a plant association (Daubenmire 1968, 1978). It may be a single species of high abundance and distinctive ecology, or a rather well defined list of species, which are restricted to approximately the same narrow range of environmental variation in the vegetation mosaic. Commonly unions have physiognomic as well as taxonomic distinctiveness, i.e., they may consist of tall shrubs, or herbs, or of tree species, but this is not necessarily true. Therefore, union is a more flexible term than layer, emphasizing ecology as judged by similar patterns of distribution rather than height. The unions in a landscape typically occur in different combinations.

Canopy cover is defined as the percentage of ground covered by the gross outline of an individual plant's foliage; or collectively covered by all individuals of a species within a stand or sample plot (Daubenmire 1959).

Interim Vegetation Performance Standards—To assure that performance standards will be met after the 10 year time frame, interim criteria will need to be developed and evaluated after 1, 2, 4, and 7 years for stands of each HT and CT to provide a means for detecting deficiencies of stand development while there is still time for correcting any problems.

Individual Plant Species Importance—Very few species occur in all the stands that make up a particular habitat type or community type. In addition, not all species normally occurring within a given type are equal in the amount of information their presence conveys. The presence of some species is diagnostic, but others are merely incidental and/or opportunistic in their occurrence. Therefore, the species installed on a stand of a particular type must be carefully chosen using the following criteria:

- Include all overstory and understory diagnostic species (species named in the key);
- Include as many as possible of the species with constancy greater than 20 percent (frequency of occurrence in sampled stands—information available in *Classification and Management of Montana's Riparian and Wetland Sites* [Hansen and others 1995]);
- When using an index that averages abundance across all stands sampled for the type, be careful of species that have great abundance on few stands (i.e., high canopy cover, but low constancy [constancy is defined as the percentage of sampled stands in which a species occurs]);
- It is better to consider constancy (frequency) and average canopy cover (abundance) separately;
- Use the average canopy cover on those stands sampled that have the species present to prescribe the design amount for that species; and
- Consider the local setting with respect to the type's overall distribution range to further screen species selections for ecological appropriateness (look especially at elevation).

Levels of Species Importance—A multi-tier species list approach will be used for assessing performance. Each union represents a different level of species importance. This same list will also be used for planting criteria. The format will be as follows:

- Union A would list essential species and prescribe their required minimum percent canopy cover;
- Union B would list important, but non-essential, species—of which a minimum number must be present with a prescribed minimum total combined percent canopy cover; and
- Unions C, D, and E would list less important species from which a minimum number must be present with a smaller prescribed minimum total combined percent canopy cover.

Woody Types—More complex types, such as the Black Cottonwood/Red-Osier Dogwood (*Populus trichocarpa/ Cornus stolonifera*) CT, or any of the willow types could need as many as 4 or 5 different unions. Simpler types, such as herbaceous ones, might need only two (the required dominant and a few possible other species).

Each union of plant species has a prescribed minimum canopy cover for the group. The top union contains the species that are required to be present. Progressively lower unions tend to

have more species listed, but with a smaller fraction of them required to be present, and with a smaller total canopy cover prescribed.

Herbaceous Types—Some herbaceous types tend to form monospecific stands of a species under favorable conditions. These types may include varying amounts of several other species, depending of the degree of stand development or level of disturbance. For example, a well-developed and undisturbed stand of the Common Cattail (*Typha latifolia*) HT should have very little presence of other species. For this reason, these simpler types, lower unions are prescribed with a maximum total canopy cover (not to exceed), rather than a minimum that must be met.

Geographic Distribution of Plant Species

The *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995) was used as the basis for determining how much of each species to expect on a well developed, remediated site of a given type. However, since types described range over large regions, and GRKO is a localized area within a much broader range, the published type species lists were "customized" to more closely fit local conditions. The information contained in Hansen and others (1995) was modified based upon our understanding of the distribution limitations of individual plant species. For instance, the species list for the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT in Hansen and others (1995) shows a strong presence of bog birch (*Betula glandulosa*). However, we know that this species normally occurs farther to the northwest at lower elevations in Montana, or at higher elevations in southwest Montana, and is not likely to occur in the Deer Lodge Valley. There are many other such examples of species recorded in sampled stands of a type that are unlikely to occur in the Deer Lodge Valley.

Special Considerations

Certain species, such as bluejoint reedgrass (*Calamagrostis canadensis*), are described below with greater canopy cover than is indicated in the documentation for the HT or CT. This is due to the fact that sampling also occurred on slightly to moderately disturbed stands that comprised a HT or CT.

Later seral shrub species, such as Geyer willow (*Salix geyeriana*) and Booth willow (*Salix boothii*) are prescribed for inclusion with the early seral CTs, such as the Sandbar Willow (*Salix exigua*) CT and the Water Birch (*Betula occidentalis*) CT, although these species may not have been recorded with high constancy in the documentation for the CT. This is necessary to provide for a normal seral progression on the GRKO where these willows represent the majority of the climax vegetation area of the floodplain.

Grant-Kohrs Ranch National Historic Site Types

We recommend 15 HTs and CTs that are adapted for this location and appropriate for installation onto remediated sites on GRKO. Table E.2-1 contains a rough estimate of the fractional breakdown of the area each of these types might occupy on the GRKO floodplain after remediation is completed. This breakdown reflects our knowledge of riparian habitat types, community types, and riparian species distribution and relative abundances in the different regions and ecological zones of Montana.

TABLE E.2-1
Fifteen Required Habitat Types (HT) and Community Types (CT) Grouped by Overstory Lifeform Dominance (i.e., Trees, Shrubs, Graminoids, and Forbs) and Ranked by Estimated Percentage of Area Represented by the Type

Type	Deer Lodge Valley Distribution Category*	Estimated Percentage of Total Area Represented	Typical Floodplain Position of the Type
Trees			
Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) CT	Minor	8-12	Recent point bars and low floodplain terraces.
Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) HT	Minor	<1	Drier areas in old oxbows, floodplain terraces.
Shrubs			
Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT	Major	18-23	Drier areas in old oxbows, floodplain terraces.
Water Birch (*Betula occidentalis*) CT	Major	12-18	Moist areas, old oxbow banks, streambanks.
Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT	Major	12-18	Moist areas, old oxbow, streambanks.
Sandbar Willow (*Salix exigua*) CT	Minor	8-12	Recent point bars, streambanks.
Mountain Alder (*Alnus incana*) CT	Minor	2-4	Moist areas, old oxbow banks, streambanks.
Woods Rose (*Rosa woodsii*) CT	Minor	2-4	Drier areas on upper floodplain terraces.
Western Snowberry (*Symphoricarpos occidentalis*) CT	Minor	1-3	Drier areas on upper floodplain terraces.
Graminoids			
Beaked Sedge (*Carex rostrata*) HT	Minor	3-6	Wet sites, old oxbow, or slough bottoms.
Bluejoint Reedgrass (*Calamagrostis canadensis*) HT	Minor	3-6	Moist areas, old oxbow, and streambanks.
Western Wheatgrass (*Agropyron smithii*) HT	Minor	3-6	Drier open areas away from the river channel.
Water Sedge (*Carex aquatilis*) HT	Minor	2-4	Wet sites, old oxbow, or slough bottoms.
Common Spikesedge (*Eleocharis palustris*) HT	Incidental	<1	Ponded areas, water edges.
Forbs			
Common Cattail (*Typha latifolia*) HT	Minor	2-4	Ponded areas, old oxbow, and slough bottoms.

*A ***major type*** occupies extensive acreages in at least some portion of the riparian or wetland zone; a ***minor type*** seldom occupies large acreages but may be common on smaller areas within the riparian or wetland zone; and an ***incidental type*** rarely occurs within the region, or is limited to narrow site conditions and/or very localized occurrence.

Planting Criteria and Performance Standards

Planting criteria and performance standards are specified for each HT/CT individually in terms of species presence and abundance requirements. The required standards are written for the end point of the remedial action phase and/or the beginning point of the operation and maintenance phase of the project, which is set at a period of 10 years after the remedial action is implemented, as defined on page 1 of this document. Therefore, remedial design must be written to accomplish these requirements; and interim monitoring on a 1, 2, 4, and 7-year time frame must be done to detect community development that is not on a trajectory to meet the required performance standard at the end of 10 years. Therefore, additional or supplemental plantings may need to be done 1, 2, 4, and 7 years after initial installation. In the event such additional plantings do not result in attainment of performance standards, previously treated areas of contamination will require removal and revegetation as stipulated in the Record of Decision.

Individual Habitat Types and Community Types

Tree Dominated Types

Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) CT—The Black Cottonwood/Red-osier Dogwood) (*Populus trichocarpa/Cornus stolonifera*) CT is a mid-seral successional type that is common along western Montana riverine floodplains. It is structurally complex, having multiple stories of tall trees over tall shrubs, over short shrubs, over an herbaceous layer. More than 140 species were recorded in 21 stands sampled of this type across its range (Hansen and others 1995). There are four unions described in Table E.2-2:

- Union A lists the type indicator dominants of both the upper and understory canopies, as well as a required grass species as an essential ground cover to reduce weedy species invasion.
- Union B lists a set of important shrubs that constitute most of the tall shrub structural layer and that represent the later successional stage to eventually replace the cottonwood trees as stand dominants.
- Union C contains a longer list of less important shrubs, of which several are typically present in healthy stands of the CT.
- Union D contains a list of herbaceous species that will not individually represent much canopy cover, but which are likely present in smaller amounts in healthy stands of the CT.

TABLE E.2-2
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Trees	
black cottonwood (*Populus trichocarpa*)	MINIMUM CANOPY COVER = 40%
Shrubs	
red-osier dogwood (*Cornus stolonifera*)	MINIMUM CANOPY COVER = 20%
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	MINIMUM CANOPY COVER = 60%
UNION B SPECIES (At least 4 of the following 5 species must be present with combined total canopy cover of at least 15 percent)	
Shrubs	
western serviceberry (*Amelanchier alnifolia*)	
water birch (*Betula occidentalis*)	
Booth willow (*Salix boothii*)	
sandbar willow (*Salix exigua*)	
Geyer willow (*Salix geyeriana*)	COMBINED MINIMUM CANOPY COVER = 15%
UNION C SPECIES (At least 5 of the following 10 species must be present with combined total canopy cover of at least 15 percent)	
Shrubs	
mountain alder (*Alnus incana*)	
western virgins-bower (*Clematis ligusticifolia*)	
common chokecherry (*Prunus virginiana*)	
swamp currant (*Ribes lacustre*)	
Missouri gooseberry (*Ribes setosum*)	
woods rose (*Rosa woodsii*)	
common red raspberry (*Rubus idaeus*)	
Bebb willow (*Salix bebbiana*)	
yellow willow (*Salix lutea*)	
western snowberry (*Symphoricarpos occidentalis*)	COMBINED MINIMUM CANOPY COVER = 15%
UNION D SPECIES (At least 6 [minimum of 2 graminoids and 4 forbs] of the following 15 species must be present with combined total canopy cover of at least 20 percent)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
blue wildrye (*Elymus glaucus*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
baneberry (*Actaea rubra*)	
western aster (*Aster occidentalis*)	
field horsetail (*Equisetum arvense*)	
sweetscented bedstraw (*Galium triflorum*)	
fringed loosestrife (*Lysimachia ciliata*)	
field mint (*Mentha arvensis*)	

TABLE E.2-2
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Black Cottonwood/Red-osier Dogwood (*Populus trichocarpa/Cornus stolonifera*) CT

Species	Percent Canopy Cover
mountain sweet-cicely (*Osmorhiza chilensis*)	
streambank groundsel (*Senecio pseudaureus*)	
starry Solomon-plume (*Smilacina stellata*)	
Canada goldenrod (*Solidago canadensis*)	
western meadowrue (*Thalictrum occidentalis*)	
American vetch (*Vicia americana*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-2, these conditions must be met at the end of 10 years:

- Minimum of 170 percent total canopy cover of individual species listed in Table E.2-2;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) HT— The Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/Calamagrostis canadensis*) HT is a late-seral type that is common along western Montana riverine floodplains but less abundant than it historically was. The type has suffered decline in the past century across most of its range due to understory alteration and prevention of regenerative success of the aspen. The type is structurally complex, having multiple stories of tall trees over a few tall shrubs, over a few short shrubs, over a dense herbaceous layer of grass. There are three unions described in Table E.2-3:

- Union A lists the type indicator dominants of both the upper and understory canopies.
- Union B lists a set of important shrubs and herbaceous species.
- Union C contains a longer list of less important herbaceous species that will not individually represent much canopy cover, but which are likely present in smaller amounts in healthy stands of the type.

TABLE E.2-3
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/ Calamagrostis canadensis*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Trees	
quaking aspen (*Populus tremuloides*)	MINIMUM CANOPY COVER = 40%
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	MINIMUM CANOPY COVER = 60%

TABLE E.2-3
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Quaking Aspen/Bluejoint Reedgrass (*Populus tremuloides/ Calamagrostis canadensis*) HT

Species	Percent Canopy Cover
UNION B SPECIES (At least 6 of the following 11 species must be present [minimum of 1 shrub, 2 graminoids, and 3 forb species] with a combined total canopy cover of at least 30 percent)	
Shrubs	
western serviceberry (*Amelanchier alnifolia*)	
water birch (*Betula occidentalis*)	
Bebb willow (*Salix bebbiana*)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
narrow-spiked reedgrass (*Calamagrostis stricta*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
western aster (*Aster occidentalis*)	
large leaved avens (*Geum macrophyllum*)	
mountain sweet-cicely (*Osmorhiza chilensis*)	
streambank groundsel (*Senecio pseudaureus*)	
Canada goldenrod (*Solidago canadensis*)	
western meadowrue (*Thalictrum occidentalis*)	COMBINED MINIMUM CANOPY COVER = 30%
UNION C SPECIES (At least 6 of the following 17 species must be present [minimum of 2 shrubs, 1 graminoid, and 3 forbs] and a combined total canopy cover of at least 20 percent)	
Shrubs	
shrubby cinquefoil (*Potentilla fruticosa*)	
Missouri gooseberry (*Ribes setosum*)	
woods rose (*Rosa woodsii*)	
common red raspberry (*Rubus idaeus*)	
western snowberry (*Symphoricarpos occidentalis*)	
Graminoids	
fringed brome (*Bromus ciliatus*)	
Canada wildrye (Elymus canadensis)	
Baltic rush (*Juncus balticus*)	
Forbs	
field horsetail (*Equisetum arvense*)	
Virginia strawberry (*Fragaria virginiana*)	
white geranium (*Geranium richardsonii*)	
sweetscented bedstraw (*Galium triflorum*)	
fringed loosestrife (*Lysimachia ciliata*)	
field mint (*Mentha arvensis*)	
starry Solomon-plume (*Smilacina stellata*)	
American vetch (*Vicia americana*)	
Canada violet (*Viola canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-3, these conditions must be met at the end of 10 years:

- Minimum of 150 percent total canopy cover of individual species listed in Table E.2-3;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Shrub Dominated Types

Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT—The Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT is a complex community with a core of key willow and grass species required. There are four unions described in Table E.2-4:

- Union A lists indicator dominants of both upper and understory canopies. Both of these layers may have either of two species in any combination totaling the shown minimum amount.
- Union B lists a set of important shrubs that are usually present in the tall shrub layer.
- Union C contains a list of shorter shrubs and other important herbaceous species, of which several should be present in healthy stands of the CT.
- Union D contains a list of herbaceous species that will not individually represent much canopy cover, but which are likely present in smaller amounts in healthy stands of the CT.

TABLE E.2-4
Plant Community Composition, Separated into Unions with Specified aMounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
Booth willow (*Salix boothii*)	MINIMUM CANOPY COVER = 10%
Geyer willow (*Salix geyeriana*)	MINIMUM CANOPY COVER = 40%
Graminoids (One or both of these species must be present with total combined canopy cover of at least 60 percent)	
bluejoint reedgrass (*Calamagrostis canadensis*)	
narrow-spiked reedgrass (*Calamagrostis stricta*)	COMBINED MINIMUM CANOPY COVER = 60%
UNION B SPECIES (At least 3 of the following 5 species must be present with combined total canopy cover of at least 15 percent)	
Shrubs	
mountain alder (*Alnus incana*)	
water birch (*Betula occidentalis*)	
red-osier dogwood (*Cornus stolonifera*)	
Bebb willow (*Salix bebbiana*)	
sandbar willow (*Salix exigua*)	COMBINED MINIMUM CANOPY COVER = 15%

TABLE E.2-4
Plant Community Composition, Separated into Unions with Specified aMounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Geyer Willow/Bluejoint Reedgrass (*Salix geyeriana/Calamagrostis canadensis*) HT

Species	Percent Canopy Cover
UNION C SPECIES (At least 6 of the following 13 species must be present [minimum of 2 shrubs, 1 graminoid, and 3 forbs] with combined total canopy cover of at least 15 percent)	
Shrubs	
shrubby cinquefoil (*Potentilla fruticosa*)	
swamp currant (*Ribes lacustre*)	
Missouri gooseberry (*Ribes setosum*)	
woods rose (*Rosa woodsii*)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
fringed brome (*Bromus ciliatus*)	
fowl mannagrass (*Glyceria striata*)	
Forbs	
leafy aster (*Aster foliaceus*)	
western aster (*Aster occidentalis*)	
large leaved avens (*Geum macrophyllum*)	
cow parsnip (*Heracleum lanatum*)	
purple cinquefoil (*Potentilla gracilis*)	
Canada goldenrod (*Solidago canadensis*)	COMBINED MINIMUM CANOPY COVER = 15%
UNION D SPECIES (At least 5 of the following 10 species must be present [minimum of 1 graminoid and 4 forbs] with combined total canopy cover of at least 15 percent)	
Graminoids	
tufted hairgrass (*Deschampsia cespitosa*)	
Baltic rush (*Juncus balticus*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
common yarrow (*Achillea millefolium*)	
fireweed (*Epilobium angustifolium*)	
field horsetail (*Equisetum arvense*)	
Virginia strawberry (*Fragaria virginiana*)	
northern bedstraw (*Galium boreale*)	
field mint (*Mentha arvensis*)	
starry Solomon-plume (*Smilacina stellata*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 15%

Additional requirements. In addition to the requirements specified in Table E.2-4, these conditions must be met at the end of 10 years:

- Minimum of 155 percent total canopy cover of individual species listed in Table E.2-4;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Water Birch (*Betula occidentalis*) CT – The Water Birch (*Betula occidentalis*) CT is a mid seral successional community with a minimum canopy of water birch required. There are three unions described in Table E.2-5:

- Union A lists the type indicator dominant species and a required grass species as an essential ground cover to preempt weedy species invasion with minimum canopy cover amounts.
- Union B lists a set of other important tall shrubs that are usually present and that may represent the later successional stage.
- Union C contains a list of other shrubs and herbaceous species, of which several should be present in smaller amounts in healthy stands of the CT.

TABLE E.2-5
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Water Birch (*Betula occidentalis*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
water birch (*Betula occidentalis*)	MINIMUM CANOPY COVER = 50%
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	MINIMUM CANOPY COVER = 60%
UNION B SPECIES (At least 4 of the following 6 species must be present with combined total canopy cover of at least 15 percent)	
Shrubs	
mountain alder (*Alnus incana*)	
western serviceberry (*Amelanchier alnifolia*)	
red-osier dogwood (*Cornus stolonifera*)	
Booth willow (*Salix boothii*)	
sandbar willow (*Salix exigua*)	
Geyer willow (*Salix geyeriana*)	COMBINED MINIMUM CANOPY COVER = 15%
UNION C SPECIES (At least 10 of the following 20 species must be present [minimum 3 shrubs, 2 graminoids, and 5 forbs] with combined total canopy cover of at least 20 percent)	
Shrubs	
shrubby cinquefoil (*Potentilla fruticosa*)	
common chokecherry (*Prunus virginiana*)	
woods rose (*Rosa woodsii*)	
Bebb willow (*Salix bebbiana*)	
yellow willow (*Salix lutea*)	
western snowberry (*Symphoricarpos occidentalis*)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
Nebraska sedge (*Carex nebraskensis*)	
Baltic rush (*Juncus balticus*)	
fowl bluegrass (*Poa palustris*)	

TABLE E.2-5
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Water Birch (*Betula occidentalis*) CT

Species	Percent Canopy Cover
Forbs	
spreading dogbane (*Apocynum androsaemifolium*)	
common willow herb (*Epilobium ciliatum*)	
wartberry fairy-bell (*Disporum trachycarpum*)	
field horsetail (*Equisetum arvense*)	
smooth scouring-rush (*Equisetum laevigatum*)	
Virginia strawberry (*Fragaria virginiana*)	
northern bedstraw (*Galium boreale*)	
Nuttall's sunflower (*Helianthus nuttallii*)	
starry Solomon-plume (*Smilacina stellata*)	
Canada goldenrod (*Solidago canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-5, these conditions must be met at the end of 10 years:

- Minimum of 145 percent total canopy cover of individual species listed in Table E.2-5;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT—The Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT is a complex community with a core of key willow and sedge species required. There are four unions described in Table E.2-6:

- Union A lists type indicator overstory dominants. This layer may have either of these two species in any combination totaling the prescribed minimum amount.
- Union B lists the indicator herbaceous understory dominants. Any combination of one or more of these species totaling the prescribed minimum canopy cover amount must be present.
- Union C lists a set of important shrubs that are usually present in the tall shrub layer.
- Union D contains a list of other less important species, of which several should be present in healthy stands of the CT. These species will not individually represent much canopy cover, but are likely present in smaller amounts in healthy stands of the HT.

TABLE E.2-6
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
Booth willow (*Salix boothii*)	MINIMUM CANOPY COVER = 10%
Geyer willow (*Salix geyeriana*)	MINIMUM CANOPY COVER = 40%
UNION B SPECIES (At least 2 of the following 4 species must be present with combined total canopy cover of at least 60 percent)	
Graminoids	
water sedge (*Carex aquatilis*)	
lentil-fruit sedge (*Carex lenticularis*)	
beaked sedge (*Carex rostrata*)	
inflated sedge (*Carex vesicaria*)	COMBINED MINIMUM CANOPY COVER = 60%
UNION C SPECIES (At least 3 of the following 5 species must be present with combined total canopy cover of at least 20 percent)	
Shrubs	
mountain alder (*Alnus incana*)	
water birch (*Betula occidentalis*)	
Bebb willow (*Salix bebbiana*)	
sandbar willow (*Salix exigua*)	
yellow willow (*Salix lutea*)	COMBINED MINIMUM CANOPY COVER = 20%
UNION D SPECIES (At least 8 of the following 22 species must be present [minimum 4 graminoids and 4 forbs] with a combined total canopy cover of at least 20 percent)	
Shrubs	
shrubby cinquefoil (*Potentilla fruticosa*)	
Graminoids	
tickle grass (*Agrostis scabra*)	
fringed brome (*Bromus ciliatus*)	
bluejoint reedgrass (*Calamagrostis canadensis*)	
narrow-spiked reedgrass (*Calamagrostis stricta*)	
soft-leaved sedge (*Carex disperma*)	
wooly sedge (*Carex lanuginosa*)	
tufted hairgrass (*Deschampsia cespitosa*)	
Baltic rush (*Juncus balticus*)	
fowl bluegrass (*Poa palustris*)	
fowl mannagrass (*Glyceria striata*)	
Forbs	
leafy aster (*Aster foliaceus*)	
western aster (*Aster occidentalis*)	
common willow herb (*Epilobium ciliatum*)	
field horsetail (*Equisetum arvense*)	
Virginia strawberry (*Fragaria virginiana*)	
small bedstraw (*Galium trifidum*)	

TABLE E.2-6
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Geyer Willow/Beaked Sedge (*Salix geyeriana/Carex rostrata*) HT

Species	Percent Canopy Cover
large leaved avens (*Geum macrophyllum*)	
field mint (*Mentha arvensis*)	
starry Solomon-plume (*Smilacina stellata*)	
Canada goldenrod (*Solidago canadensis*)	
Canada violet (*Viola canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-6, these conditions must be met at the end of 10 years:

- Minimum of 150 percent total canopy cover of individual species listed in Table E.2-6;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Sandbar Willow (*Salix exigua*) CT—Sandbar willow (*Salix exigua*) is an early seral, pioneering community type that naturally colonizes streamside sites and other bared, moist sites. There are three unions described in Table E.2-7:

- Union A lists the type indicator overstory dominant and a required grass species as an essential ground cover to preempt weedy species invasion.
- Union B lists a set of important shrubs that are usually present in the tall shrub layer.
- Union C contains a list of other less important shrubs and herbaceous species, of which several should be present in healthy stands of the CT.

TABLE E.2-7
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Sandbar Willow (*Salix exigua*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
sandbar willow (*Salix exigua*)	MINIMUM CANOPY COVER = 60%
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	MINIMUM CANOPY COVER = 50%
UNION B SPECIES (At least 4 of the following 6 species must be present with combined total canopy cover of at least 20 percent)	
Shrubs	
mountain alder (*Alnus incana*)	
western serviceberry (*Amelanchier alnifolia*)	
water birch (*Betula occidentalis*)	
red-osier dogwood (*Cornus stolonifera*)	
Booth willow (*Salix boothii*)	
Geyer willow (*Salix geyeriana*)	COMBINED MINIMUM CANOPY COVER = 20%

TABLE E.2-7
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Sandbar Willow (*Salix exigua*) CT

Species	Percent Canopy Cover
UNION C SPECIES (At least 6 of the following 14 species [minimum 1 shrub, 2 graminoids, and 3 forbs] must be present with combined total canopy cover of at least 20 percent)	
Shrubs	
woods rose (*Rosa woodsii*)	
Bebb willow (*Salix bebbiana*)	
yellow willow (*Salix lutea*)	
western snowberry (*Symphoricarpos occidentalis*)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
western wheatgrass (*Agropyron smithii*)	
narrow-spiked reedgrass (*Calamagrostis stricta*)	
beaked sedge (*Carex rostrata*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
hemp dogbane (*Apocynum cannabinum*)	
field horsetail (*Equisetum arvense*)	
wild licorice (*Glycyrrhiza lepidota*)	
field mint (*Mentha arvensis*)	
Canada goldenrod (*Solidago canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-7, these conditions must be met at the end of 10 years:

- Minimum of 150 percent total canopy cover of individual species listed in Table E.2-7;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Woods Rose (*Rosa woodsii*) CT— The Woods Rose (*Rosa woodsii*) CT is an early to mid seral community that occupies the drier edge of sites that can support woody types. This community usually occurs as small patches, unless some physical disturbance has extended it. Table E.2-8 shows two unions:

- Union A lists the type indicator overstory dominant.
- Union B lists other less important shrubs and herbaceous species, of which several should be present in healthy stands of the CT.

TABLE E.2-8
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Woods Rose (*Rosa woodsii*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
woods rose (*Rosa woodsii*)	MINIMUM CANOPY COVER = 70%
UNION B SPECIES (At least 6 of the following 12 species must be present [minimum 3 graminoids and 2 forbs] with combined total canopy cover of at least 40 percent)	
Shrubs	
western snowberry (*Symphoricarpos occidentalis*)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
western wheatgrass (*Agropyron smithii*)	
Canada wildrye (*Elymus canadensis*)	
Baltic rush (*Juncus balticus*)	
satin-grass (*Muhlenbergia racemosa*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
common yarrow (*Achillea millefolium*)	
Virginia strawberry (*Fragaria virginiana*)	
northern bedstraw (*Galium boreale*)	
wild licorice (*Glycyrrhiza lepidota*)	
Canada goldenrod (*Solidago canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 40%

Additional requirements. In addition to the requirements specified in Table E.2-8, these conditions must be met at the end of 10 years:

- Minimum of 110 percent total canopy cover of individual species listed in Table E.2-8;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Western Snowberry (*Symphoricarpos occidentalis*) CT—Western Snowberry (*Symphoricarpos occidentalis*) is an early to mid seral community that occupies the drier edge of sites that can support woody types. This community usually occurs as small patches, unless some physical disturbance has extended it. Table E.2-9 shows two unions:

- Union A lists the type indicator overstory dominant.
- Union B lists other less important shrubs and herbaceous species, of which several should be present in healthy stands of the CT.

TABLE E.2-9
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Western Snowberry (*Symphoricarpos occidentalis*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
western snowberry (*Symphoricarpos occidentalis*)	MINIMUM CANOPY COVER = 70%
woods rose (*Rosa woodsii*)	MINIMUM CANOPY COVER = 10%
UNION B SPECIES (At least 5 of the following 10 species [minimum 2 graminoids and 3 forbs] must be present with combined total canopy cover of at least 20 percent)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
western wheatgrass (*Agropyron smithii*)	
Canada wildrye (*Elymus canadensis*)	
satin grass (*Muhlenbergia racemosa*)	
Forbs	
common yarrow (*Achillea millefolium*)	
prairie sagewort (*Artemisia ludoviciana*)	
northern bedstraw (*Galium boreale*)	
wild licorice (*Glycyrrhiza lepidota*)	
starry Solomon-plume (*Smilacina stellata*)	
Canada goldenrod (*Solidago canadensis*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-9, these conditions must be met at the end of 10 years:

- Minimum of 110 percent total canopy cover of individual species listed in Table E.2-9;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Mountain Alder (*Alnus incana*) CT—The Mountain Alder (*Alnus incana*) CT is a mid-seral successional community with a minimum canopy of mountain alder required. There are three unions described in Table E.2-10. Union A contains the site indicator dominant and a grass species that is also required:

- Union A lists the type indicator overstory dominant and a required grass species as an essential ground cover to preempt weedy species invasion.
- Union B lists a set of important tall shrubs and herbaceous species that are usually present.
- Union C contains a list of other less important shrubs and herbaceous species, of which several should be present in healthy stands of the CT.

TABLE E.2-10
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Mountain Alder (*Alnus incana*) CT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Shrubs	
mountain alder (*Alnus incana*)	MINIMUM CANOPY COVER = 50%
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	MINIMUM CANOPY COVER = 60%
UNION B SPECIES (At least 5 of the following 11 species must be present [minimum 2 shrubs, 1 graminoid, and 2 forbs] with combined total canopy cover of at least 15 percent)	
Shrubs	
red-osier dogwood (*Cornus stolonifera*)	
Bebb willow (*Salix bebbiana*)	
sandbar willow (*Salix exigua*)	
yellow willow (*Salix lutea*)	
Graminoids	
water sedge (*Carex aquatilis*)	
beaked sedge (*Carex rostrata*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
western aster (*Aster occidentalis*)	
ladyfern (*Athyrium filix-femina*)	
large leaved avens (*Geum macrophyllum*)	
cow parsnip (*Heracleum lanatum*)	COMBINED MINIMUM CANOPY COVER = 15%
UNION C SPECIES (At least 6 of these 13 species [including at least 2 shrubs, 1 graminoid, and 3 forbs] must be present with combined total canopy cover of at least 20 percent)	
Shrubs	
red raspberry (*Rubus idaeus* common)	
stinking currant (*Ribes hudsonianum*)	
swamp currant (*Ribes lacustre*)	
woods rose (*Rosa woodsii*)	
Graminoids	
narrow-spiked reedgrass (*Calamagrostis stricta*)	
drooping woodreed (*Cinna latifolia*)	
tall mannagrass (*Glyceria elata*)	
Forbs	
common willow herb (*Epilobium ciliatum*)	
field horsetail (*Equisetum arvense*)	
meadow horsetail (*Equisetum pratense*)	
sweetscented bedstraw (*Galium triflorum*)	
field mint (*Mentha arvensis*)	
starry Solomon-plume (*Smilacina stellata*)	
Plus other unlisted native volunteer species	COMBINED MINIMUM CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-10, these conditions must be met at the end of 10 years:

- Minimum of 150 percent total canopy cover of individual species listed in Table E.2-10;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Graminoid Dominated Types

Beaked Sedge (*Carex rostrata*) HT—Beaked sedge is a late seral community that naturally dominates very wet sites that are slightly wetter than sites of the Water Sedge (*Carex rostrata*) HT. There are three unions described in Table E.2-11:

- Union A is the type indicator species required to be present.
- Union B species may also be present in large amounts up to an aggregate maximum.
- Union C species may be present, but much less if the stand is healthy and undisturbed.

TABLE E.2-11
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Beaked Sedge (*Carex rostrata*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Graminoids	
beaked sedge (*Carex rostrata*)	MINIMUM CANOPY COVER = 80%
UNION B SPECIES (These species may be present with combined total ***maximum*** canopy cover of 40 percent)	
Graminoids	
water sedge (*Carex aquatilis*)	
awned sedge (*Carex atherodes*)	
lentil fruited sedge (*Carex lenticularis*)	
inflated sedge (*Carex vesicaria*)	***MAXIMUM*** COMBINED CANOPY COVER = 40%
UNION C SPECIES (These species may be present with combined total ***maximum*** canopy cover of 20 percent)	
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	
narrow spiked reedgrass (*Calamagrostis stricta*)	
tufted hairgrass (*Deschampsia cespitosa*)	
common spikesedge (*Eleocharis palustris*)	
Baltic rush (*Juncus balticus*)	
Forbs	
common willow herb (*Epilobium ciliatum*)	
water horsetail (*Equisetum fluviatile*)	
small bedstraw (*Galium trifidum*)	
large leaved avens (*Geum macrophyllum*)	
field mint (*Mentha arvensis*)	
water smartweed (*Polygonum amphibium*)	
purple cinquefoil (*Potentilla palustris*)	
Plus other unlisted native volunteer species	***MAXIMUM*** COMBINED CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-11, these conditions must be met at the end of 10 years:

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-11;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Bluejoint Reedgrass (*Calamagrostis canadensis*) HT—The Bluejoint Reedgrass (*Calamagrostis canadensis*) HT is a late seral herbaceous community that establishes dense grass stands on moist site openings that do not become flooded for too long during the growing season. Normally, when the site is undisturbed, bluejoint reedgrass forms dense mono-specific stands. However, physical or hydrologic disturbance will promote the invasion of other plant species. Table E.2-12 has two unions for this type:

- Union A is the pair of reedgrass species that in combination dominate the site.
- Union B lists other species that may also be present in large or small amounts up to an aggregate maximum.

TABLE E.2-12
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Bluejoint Reedgrass (*Calamagrostis canadensis*) HT

Species	Percent Canopy Cover
UNION A SPECIES (Some combination of these species must be present with the specified minimum combined canopy cover)	
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	
narrow-spiked reedgrass (*Calamagrostis stricta*)	COMBINED MINIMUM CANOPY COVER = 80%
UNION B SPECIES (These species may be present with combined total ***maximum*** canopy cover of 20 percent)	
Graminoids	
tickle grass (*Agrostis scabra*)	
water sedge (*Carex aquatilis*)	
tufted hairgrass (*Deschampsia cespitosa*)	
Baltic rush (*Juncus balticus*)	
fowl bluegrass (*Poa palustris*)	
Forbs	
sharptooth angelica (*Angelica arguta*)	
leafy aster (*Aster foliaceus*)	
western aster (*Aster occidentalis*)	
common willowherb (*Epilobium ciliatum*)	
cow parsnip (*Heracleum lanatum*)	
slender leafed licorice root (*Ligusticum tenuifolium*)	
field mint (*Mentha arvensis*)	
elephant's head (*Pedicularis groenlandica*)	
western groundsel (*Senecio integerrimus*)	
arrowleaf groundsel (*Senecio triangularis*)	
Canada violet (*Viola canadensis*)	
Plus other unlisted native volunteer species	***MAXIMUM*** COMBINED CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-12, these conditions must be met at the end of 10 years:

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-12;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Western Wheatgrass (*Agropyron smithii*) HT— The Western Wheatgrass (*Agropyron smithii*) HT represents drier, open sites that lack potential for woody types. This is one of the driest of functional wetland types, and not all sites dominated by western wheatgrass performs much wetland function. Sites of this type are often on clayey soils along alluvial fans at the outer edges of valley bottoms. Table E.2-13 shows two unions for this type. As with most of the herbaceous types, well developed, undisturbed stands are usually almost mono-specific. However, physical or hydrologic disturbance will promote the invasion of other plant species.

- Union A is the type indicator species required to be present.
- Union B lists other species that may also be present in large or small amounts up to an aggregate maximum.

TABLE E.2-13
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Western Wheatgrass (*Agropyron smithii*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Graminoids	
western wheatgrass (*Agropyron smithii*)	MINIMUM CANOPY COVER = 80%
UNION B SPECIES (These species may be present with combined total ***maximum*** canopy cover of 30 percent)	
Graminoids	
bearded wheatgrass (*Agropyron caninum*)	
tickle grass (*Agrostis scabra*)	
Baltic rush (*Juncus balticus*)	
green needlegrass (*Stipa viridula*)	
Forb	
common yarrow (*Achillea millefolium*)	
prairie sagewort (*Artemisia ludoviciana*)	
wild licorice (*Glycyrrhiza lepidota*)	
American vetch (*Vicia americana*)	
Plus other unlisted native volunteer species	***MAXIMUM*** COMBINED CANOPY COVER = 30%

Additional requirements. In addition to the requirements specified in Table E.2-13, these conditions must be met at the end of 10 years:

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-13;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Water Sedge (*Carex aquatilis*) HT—Water Sedge is a late seral community that naturally dominates very wet sites that are slightly drier than sites of the Beaked Sedge (*Carex aquatilis*) HT. There are three unions described in Table E.2-14:

- Union A is the type indicator species required to be present.
- Union B species may also be present in large amounts up to an aggregate maximum.
- Union C species may be present, but probably not if the stand is healthy and undisturbed.

TABLE E.2-14
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Water Sedge (*Carex aquatilis*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Graminoids	
water sedge (*Carex aquatilis*)	MINIMUM CANOPY COVER = 70%
UNION B SPECIES (These species may be present with combined total maximum canopy cover of 20 percent)	
Graminoids	
Columbia sedge (*Carex aperta*)	
lentil fruited sedge (*Carex lenticularis*)	***MAXIMUM*** COMBINED CANOPY COVER = 30%
UNION C SPECIES (These species may be present with combined total maximum canopy cover of 20 percent)	
Graminoids	
bluejoint reedgrass (*Calamagrostis canadensis*)	
Nebraska sedge (*Carex nebraskensis*)	
beaked sedge (*Carex rostrata*)	
short beaked sedge (*Carex simulata*)	
inflated sedge (*Carex vesicaria*)	
common spikesedge (*Eleocharis palustris*)	
few flowered spikesedge (*Eleocharis pauciflora*)	
Baltic rush (*Juncus balticus*)	
Plus other unlisted native volunteer species	***MAXIMUM*** COMBINED CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-14, these conditions must be met at the end of 10 years:

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-14;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Common Spikesedge (*Eleocharis palustris*) HT—Common spikesedge (*Eleocharis palustris*) HT is a minor type that occurs commonly in very small stands on narrowly defined hydrologic conditions along the edges of ponded or slowly moving water. Although the Common Spikesedge (*Eleocharis palustris*) HT defines site potential, this community is adapted to quickly changing potential. A narrow band of common spikesedge can move up or down slope to follow changing water level rapidly. Table E.2-15 shows two unions for this type:

- Union A is the type indicator species required to be present.
- Union B lists other species that may also be present in large or small amounts up to an aggregate maximum.

TABLE E.2-15
Plant Community Composition, Separated into Unions with Specified Amounts of Canopy Cover, Required 10 Years After Remediation for Stands of the Common Spikesedge (*Eleocharis palustris*) HT

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Graminoids	
needle spikesedge (*Eleocharis acicularis*)	
common spikesedge (*Eleocharis palustris*)	COMBINED MINIMUM CANOPY COVER = 70%
UNION B SPECIES (These species may be present with combined total maximum canopy cover of 40 percent)	
Graminoids	
western wheatgrass (*Agropyron smithii*)	
short awn foxtail (*Alopecurus aequalis*)	
American sloughgrass (*Beckmannia syzigachne*)	
slender beaked sedge (*Carex athrostachya*)	
foxtail barley (*Hordeum jubatum*)	
Nuttall's alkaligrass (*Puccinellia nuttalliana*)	
Forbs	
common willow herb (*Epilobium ciliatum*)	
field mint (*Mentha arvensis*)	
arum leaf arrowhead (*Sagittaria cuneata*)	
alkali marsh butterweed (*Senecio hydrophilus*)	
simplestem bur reed (*Sparganium emersum*)	
Plus other unlisted native volunteer species	***MAXIMUM*** COMBINED CANOPY COVER = 40%

Additional requirements. In addition to the requirements specified in Table E.2-15, these conditions must be met at the end of 10 years:

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-15;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

Forb Dominated Types

Common Cattail (*Typha latifolia*) HT—The Common Cattail (*Typha latifolia*) HT is a late seral type that dominates very wet sites that retain standing ponded water for most of the growing season each year. Under normal hydrologic circumstances, and free of disturbance, this type forms a dense, mono specific stand. Table E.2-16 shows two unions for this type:

- Union A is the type indicator species required to be present.
- Union B lists other species that may also be present in large or small amounts up to an aggregate maximum.

TABLE E.2-16
Plant community composition, separated into unions with specified amounts of canopy cover, required 10 years after remediation for stands of the Common Cattail (*Typha latifolia*) HT (*NOTE: Exempt area of open water more than 2 ft deep from polygon area*)

Species	Percent Canopy Cover
UNION A SPECIES (These species must be present with the listed minimum canopy cover)	
Forbs	
common cattail (*Typha latifolia*)	MINIMUM CANOPY COVER = 80%
UNION B SPECIES (These species may be present with combined total maximum canopy cover of 20 percent)	
Graminoids	
softstem bulrush (*Scirpus validus*)	
Forbs	
common willow herb (*Epilobium ciliatum*)	
field mint (*Mentha arvensis*)	
water smartweed (*Polygonum amphibium*)	
Plus other unlisted native volunteer species	*MAXIMUM* COMBINED CANOPY COVER = 20%

Additional requirements. In addition to the requirements specified in Table E.2-16, these conditions must be met at the end of 10 years (*NOTE: Exempt area of open water more than 2 feet deep*):

- Minimum of 90 percent total canopy cover of individual species listed in Table E.2-16;
- No unvegetated soil surface is present; and
- Maximum canopy cover of undesirable herbaceous species does not exceed 20 percent.

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