PLANS AND SPECIFICATIONS

Conduct a site inventory to identify any physical, chemical or biological conditions that could affect the successful establishment of vegetation, and to plan needed site preparations and protective measures.

Prepare plans and specifications for each treatment area and include:

- Practice purpose(s) and site-specific objectives
- Establish monitoring success criteria (e.g., desired minimum percent ground/canopy cover, percent survival, and stand density)
- Aerial photo or topographic map and soil type map of the site
- Site investigation and preparation
- Soil analysis results, as applicable
- Topsoil handling and placement requirements
- Fertilizer and soil amendment rates, timing, form and application method
- Seedbed / planting area preparation
- Species selection
- Seed / plant source
- Timing and method of seeding/planting
- Seed analysis / pure live seed (PLS)
- Seeding rate / plant spacing
- Mulching, PAM, cover crops or other stabilizing materials
- Supplemental water needs for establishment
- Protection of plantings (e.g. fence, tubes)
- Monitor to describe successful establishment (e.g., minimum percent ground/canopy cover, percent survival, stand density)

Use the following forms for planning, as needed:

- Form MT342-JS1, Seeding / Planting Plan - Job Sheet to assist practice planning and documenting herbaceous seeding application.
- Form MT342-JS2, Seeding / Planting Plan - As-Built to assist with certification for herbaceous seedings.
Specification MT342-2

- Form MT612-JS1, Tree / Shrub Establishment (Code 612) or MT391-JS 1, Riparian Forest Buffer (Code 391) to assist practice planning and documenting woody planting applications.

Under severe site circumstances, structural (engineering) practices may be required in association with this practice to ensure long-term site stability.

Conservation Management System

Use Critical Area Planting concurrently with other practices to address site-specific natural resource concerns and the producer’s objectives. Additional practices may include Filter Strips (Code 393), Diversion (Code 362), Streambank and Shoreline Protection (Code 580), Access Control (Code 472), Fence (Code 382), Prescribed Grazing (Code 528), Forage Harvest Management (Code 511), and Nutrient Management (Code 590).

SITE PREPARATION

Site Investigation: Identify any physical, chemical, or biological conditions that could limit the successful establishment of vegetation. Use a soil test to quantify any limiting soil properties. List any limitations in the assistance notes section of the conservation plan. Use site observations and soil tests to recommend soil amendments that would ameliorate or eliminate conditions inhibiting plant establishment and growth. Include the soil recommendations in the conservation plan notes. Limiting soil factors may include soil texture, soil fertility, soil chemistry, soil compaction, average annual precipitation, topography, and site stability. Attach an aerial photograph or topographic map, soil map, and soil test results to the plan.

Soil Amendments: Apply soil amendments including lime, fertilizer, compost or other organic matter to address soil deficiencies identified in the site investigation. Nitrogen fertilizer is not normally recommended. However, if a soil analysis identifies a severe deficit, apply a light rate (i.e. less than 20 pounds nitrogen per acre) prior to seeding. Base fertilizer recommendations on Montana State University Extension Service Publication #EB 161, Fertilizer Guidelines for Montana.

Seedbed Preparation: Clear planting areas of unwanted materials and smooth or shape, if needed, to meet planting purpose(s). If gullies or deep rills are present, fill and level as necessary to allow equipment operation and ensure proper site and seedbed preparation. Rip compacted layers and re-firm the soil prior to seedbed preparation, as needed. As site and construction conditions dictate, stockpile topsoil and redistribute over area to be planted. Prepare a clean, firm, weed-free seedbed for all herbaceous and woody species. Follow guidance in Plant Materials Technical Note MT-58, Seedbed Preparation and Seeding. Align soil tracking, soil texturing, and drill seeding perpendicular to the slope.

Considerations for Site Preparation. Planning and installation of other conservation practices such as Diversion (Code 362), Obstruction Removal (Code 500), Subsurface Drain (Code 606), or Underground Outlet (Code 620) may be necessary to prepare the area or ensure vegetative establishment.

SPECIES SELECTION

Species Selection. Select herbaceous and/or woody species suited to current site conditions and intended uses. Use certified seed or plant stock when available. Attach a photocopy of all seed labels and/or nursery stock certification to the conservation plan. When selecting species:
- Do not select species on federal, state, county or tribal noxious weed lists.
- Consider climate conditions, average annual rainfall, seasonal rainfall patterns, length of growing season, temperature extremes, Major Land Resource Area (MLRA), Ecological Site Descriptions, and USDA Plant Hardiness Zones.
- Consider soil texture and depth, pH, toxic elements, salinity, water table, flooding or ponding, and topographic conditions of slope and aspect.
- Consider plant compatibility among species in a mixture, rate of establishment, phenology, palatability, and growth habit.
- Use rhizomatous, sod-forming species to stabilize soil.
- Use species to improve wildlife and pollinator habitat, where appropriate.
• Select species with the capacity to achieve adequate density and vigor to stabilize the site within an appropriate period.
• For critical areas on forested sites, refer to the practice specification Forest Trails and Landings (Code 655) for site adaptation zones.

Considerations for Species Selection. The following are additional consideration when selecting species:
• Use native species when appropriate for site and management objectives.
• Consider species or mixes with multiple conservation and ecological values.
• In a larger, grass- dominated planting, consider incorporating a small percentage of wildflower species and flowering shrubs that have extensive root systems and soil-holding properties to benefit pollinators and wildlife while stabilizing soils.
• Avoid species that may harbor pests.
• Use a diverse species mix to avoid monocultures that may be affected by species-specific pest outbreaks.

Seed Rate. Calculate seeding rates based on a Pure Live Seed (PLS). Critical Area Plantings are seeded at double (2x) the seeding rate of a full stand, see Montana Plant Materials Technical Note MT-46, Seeding Rates and Recommended Cultivars. Broadcast seeding on Critical Areas requires four times (4x) the seeding rate of a full stand, see Montana Plant Materials Technical Note MT-46. If the site is broadcast seeded followed by a chain or roller harrowed and packed, then the broadcast seed rate can be 2x the full stand rate. Hydroseed at 4x the rate of a full stand.

Woody plant densities and spacing are as recommended:

<table>
<thead>
<tr>
<th>PLANT TYPES</th>
<th>HEIGHT (FEET)</th>
<th>PLANT-TO-PLANT SPACING (FEET)</th>
<th>NUMBER OF PLANTS PER ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrubs</td>
<td>&lt;10</td>
<td>3–6</td>
<td>4,840–1,210</td>
</tr>
<tr>
<td>Shrubs/Trees</td>
<td>10–25</td>
<td>6–10</td>
<td>1,210–436</td>
</tr>
<tr>
<td>Trees</td>
<td>&gt;25</td>
<td>10–15</td>
<td>436–194</td>
</tr>
</tbody>
</table>

Seed Method. Drill seed where practical. Calibrate drills on site to the planned seeding rate, and adjust drill to the desired planting depth, see Montana Plant Materials Technical Note MT-30, Drill Calibration. Use rice hulls or other diluents in seed mixes with fluffy or multiple-size seed in order to facilitate flow and distribution. Refer to Montana Plant Materials Technical Note MT-52, Mixing Seed with Rice Hulls. Drill seed slopes greater than 5% on the contour so rows are perpendicular to the slope for improved erosion control.

Where drill seeding is not practical, broadcast seed on a freshly roughened surface to accommodate seed catchment. After broadcasting, incorporate seed into the soil by hand raking, or dragging harrows, chains, or other suitable equipment over the surface. Improve seed to soil contact by rolling surface.

Use a helicopter or fixed-wing aircraft for seeding large remote areas such as wildland wildfires. Calibrate the aircraft swath width based on the species mix selected. Typically, the swath width from a bucket seeder on a helicopter is 40 to 60 feet and about 40 to 50 feet for fixed-wing aircraft.

Prior to seeding, inoculate legume seed with the Rhizobia nitrogen-fixing bacteria. Store Rhizobia in a cool dry environment and use only Rhizobia stored properly. Do not use inoculants after the expiration date on the container.

Seed Timing. Time seeding to best ensure selected species establishment, and to provide protective cover as soon as possible for minimizing soil erosion. Complete spring plantings before May 15. Plan dormant fall planting after October 15 or when the soil temperature at two-inch depth remains below 40° F for ten or more days. Seeding between May 15 and August 1 only recommended when there is a minimum of two feet of moist soil, and moist soil is within two inches of the surface. Warm season species typically establish better in a spring planting. For seeding that needs to occur outside of optimal spring or fall timings due to the critical nature of the disturbance (e.g. wildfire, flood), consult Montana Area Offices’ Specialist or State Specialists for additional seeding considerations.
ADDITIONAL CONSIDERATIONS FOR IMPROVING ESTABLISHMENT

**Mulching.** Mulch to cover the seed where practical. Mulch plantings as necessary to ensure establishment, maintain moisture, inhibit weed growth, and to prevent erosion. Refer to the standard and specification for Mulching (Code 484) for technical information. Mulching slopes steeper than 2:1 is recommended. Prepare slopes to a roughened state by hand, excavator, dozer or other equipment to leave a loosened surface with divots and mini-basins for broadcast seed catchment. Track slopes perpendicular to the slope to minimize erosion and capture water.

Certified noxious weed-free straw is the preferred mulch. Wheat straw deteriorates slower and contributes less volunteer plants than barley straw. Apply mulch uniformly up to a two inch depth, and anchor straw with rollers or crimpers. Use tackifiers, erosion control blankets or other woven covers to anchor mulch where slopes are too steep for equipment. Apply 10 pounds actual nitrogen per ton of straw to balance the carbon:nitrogen ratio and avoid a nitrogen deficiency during organic mineralization.

When hydro-mulching, a split hydro-mulch – hydro-seeding procedure is recommended. First, apply seed and fertilizer to optimize seed to soil contact, and then hydro-mulch the site. A half inch depth of compost mulch is recommended.

**Sodding.** Keep sod moist prior to placement. The maximum period between cutting and laying is exceed 96 hours. Smooth surfaces prior to sod placement to eliminate air pockets and improve sod to soil contact. Tamp sod strips tightly together and stake sod as needed to protect from movement on steep slopes.

Irrigate sodded areas until sod has become well established and rooted into the soil. Certain species may require permanent irrigation to maintain adequate cover. Do not sod dryland sites receiving less than 18 inches of precipitation unless irrigated. Sod dryland sites receiving greater than 18 inches of precipitation in early spring until May 1st. Sod irrigated sites any time from early spring to September.

The following species are adapted for sod purposes:

<table>
<thead>
<tr>
<th>INTRODUCED SPECIES</th>
<th>NATIVE SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creeping Foxtail</td>
<td>Western Wheatgrass</td>
</tr>
<tr>
<td>Intermediate Wheatgrass</td>
<td>Prairie Sandreed</td>
</tr>
<tr>
<td>Pubescent Wheatgrass</td>
<td>Slender Wheatgrass</td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>Streambank Wheatgrass</td>
</tr>
<tr>
<td>Smooth Brome</td>
<td>Thickspike Wheatgrass</td>
</tr>
</tbody>
</table>

**Irrigation.** When plantings are to be irrigated, use non-erosive methods to maintain adequate moisture in at least the upper six inches of soil during the first four weeks and then in the upper 12 inches until the end of the growing season. Excessive irrigation may hinder the establishment of native seedings. For further technical information, refer to the FOTG, Section IV, Standards and Specifications for Irrigation Water Management (Code 449).

**Cover Crops.** Do not use nurse crops. Where quick protection is required to reduce wind or water erosion, seed a cover crop one season prior to seeding the desired vegetation. Use temporary cover crops for up to two years where cover is needed for stabilizing sites. If construction is delayed on a disturbed site, or if a site will be redistributed in the near future, use temporary cover crops to protect the site against erosion, weed invasion, and stabilize the site for eventual permanent vegetation establishment. In the latter situation, cut or chemically terminate the cover crop prior to seed set to control volunteer competition to new seedlings. Refer to the FOTG, Section IV, Practice Standards and Specifications for Cover Crop (Code 340).
Cover crops and their seeding rates are as follow:

<table>
<thead>
<tr>
<th>CROP</th>
<th>SEEDING POUNDS/ACRE</th>
<th>SEEDS PER FOOT²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Wheat</td>
<td>20</td>
<td>6.7</td>
</tr>
<tr>
<td>Barley</td>
<td>15</td>
<td>4.5</td>
</tr>
<tr>
<td>Oats</td>
<td>20</td>
<td>6.5</td>
</tr>
<tr>
<td>Slender wheatgrass</td>
<td>3</td>
<td>9.6</td>
</tr>
</tbody>
</table>

**Additional Criteria to Stabilize Stream and Channel Banks, Ponds, and Shorelines**

**Bank and Channel Slopes.** Salvage and stockpile topsoil before modifying slopes. Shape channel side slopes to stabilize and allow establishment and maintenance of desired vegetation. Stabilize slopes steeper than 3:1 with a combination of vegetation and natural or abiotic structural measures. Spread salvaged topsoil over planting areas as needed.

**Species Selection.** Select plant materials adapted to the species adapted hydrologic zone (Figure 1). Select plant materials that, when mature, are compatible with the natural plant community of the site and provide bank protection while not restricting channel capacity. For guidance on species selection, refer to:

- Plant Materials Technical Note MT-37, Users Guide to Description, Propagation, and Establishment of Wetland Species and Grasses for Riparian Areas in the Intermountain West
- Forestry Technical Note MT-26, Establishment of Bareroot and Containerized Stock in Riparian Areas
- Plant Materials Technical Note MT-36, Users’ Guide to Description, Propagation, and Establishment of Native Shrubs and Trees for Riparian Areas in the Intermountain West

**Establishment of Vegetation.** Planting rates, spacing, methods and timing for herbaceous species are described in:

- Plant Materials Technical Note MT-37, Users Guide to Description, Propagation, and Establishment of Wetland Species and Grasses for Riparian Areas in the Intermountain West
- Forestry Technical Note MT-26, Establishment of Bareroot and Containerized Stock in Riparian Areas
- Plant Materials Technical Note MT-51, Temporary Handling and Storage of Container, Bareroot, and Cutting Stock

If desirable vegetation exists on the site, identify, mark, and protect it during practice installation where practical. Transplant mature desired vegetation on site as needed to accommodate construction.

Control existing site vegetation that will compete with planted species (e.g., bareroot, containerized, ball-and-burlap, potted) to ensures successful establishment of planted species. Control noxious weeds prior to planting following specification for Herbaceous Weed Control (Code 315). Use herbicides approved for riparian areas and without soil residual activity that may affect planned vegetation.

**Site Protection and Access Control.** Install best management practices (e.g. straw wattles, silt fence, straw bales, erosion control blankets, etc.) according to manufacturer’s specifications to prevent sediment from entering waterway.

Exclude grazing animals from planted areas for a minimum of two growing seasons. Permanently exclude grazing on high hazard sites such as cut banks, seepage or other potentially unstable areas. Design exclusion fencing according to specification for Fence (Code 382). Protect woody plantings from wildlife damage by fencing or protective tubes (see Montana Plant Materials Technical Note MT-45, Proper Installation, Maintenance, and Removal of Rigid Seedling Protector Tubes). All grazing areas will have a grazing management plan according to specifications for Prescribed Grazing (Code 528).

Vegetation established through this practice can create habitat for various types of wildlife. Maintenance activities, such as mowing or spraying, may have detrimental effects on certain vegetation and wildlife.
species. Perform management activities at the times (e.g. nesting season) and in a manner that causes the least disruption to wildlife.

Figure 1. Location of hydrologic zones along a channel or shoreline.

- **Bankfull Discharge Elevation**: In natural streams, is the elevation at which water fills the channel without overflowing onto the flood plain.
- **Bank Zone**: The area above the Toe Zone located between the average water level and bankfull discharge elevation. Vegetation may be herbaceous or woody and is characterized by flexible stems and rhizomatous root systems.
- **Overbank Zone**: The area located above the bankfull discharge elevation continuing upslope to an elevation equal to two thirds of the flood prone depth. Vegetation is generally small to medium shrub species.
- **Toe Zone**: The portion of the bank between the average water level and the bottom of the channel, at the toe of the bank. Vegetation is generally herbaceous emergent aquatic species, tolerant of long periods of inundation.
- **Transitional Zone**: The area located between the overbank zone, and the flood prone width elevation. Vegetation is usually larger shrub and tree species.
- **Upland Zone**: The area above the Transitional Zone; this area is seldom if ever saturated.

Note: some channels or shorelines have fewer than four hydrologic zones because of differences in soils, topography, entrenchment and/or moisture regime.

**Additional Criteria for Areas Burned by Wildfire**

Limit reseeding after wildfire to severely burned sites with high fire intensity. Sites burned by severe wildfire have vegetation and duff layers removed, leaving sites susceptible to erosion and noxious weed invasion (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/programs/planning/ewpp/?cid=nrcs144p2_056249). In general, these were steep, timbered north and east facing slopes containing dense forest canopies. Natural vegetation recovery is approximately five to ten years post fire.

Wildfires prepare a favorable seedbed requiring no further seedbed preparation. Soil nitrogen is typically elevated after a wildfire and no fertilization is recommended.

Seed wildfire affected sites the fall or winter immediately post fire and prior to March 1 the year following disturbance. Aerial broadcasting seed on snow has successfully established native grass and cover crop stands. Calculate seeding rates 2.25 to 2.5 times the recommended stand drilled rates in Montana Plant Materials Technical MT-46, Seeding Rates and Recommended Cultivars (50 to 60 seeds per square foot). For large wildfires, aerial broadcast seeding using helicopter or fixed-wing aircraft is the most efficient and economical. Consult with the aircraft operator for seeding calibration and where possible, verify seed rate on
site by counting seeds within a one square foot frame. Typically, the swath width of a helicopter bucket seeder is 40 to 60 feet and 40 to 50 feet for fixed-wing aircraft.

For examples of seeding after wildfire, see Forestry Technical Note MT-35, Results of Reseeding a Fire Impacted area in western Montana, and Forestry Technical Note MT-28, Results of Reseeding a Fire Impacted Watershed in South Central Montana.

Defer livestock grazing in wildfire area two seasons post seeding using practice Access Control (Code 472).

Additional Criteria for Urban and Conservation Construction Sites, and Mine Lands

Site Preparation. Remove the topsoil and stockpile separately from subsoil layers. To preserve soil flora and fauna important to vegetation establishment and growth, stockpile topsoil for the minimum time required to complete construction and no more than two years. Remove or dispose of toxic materials in an approved manner if they are present on the site. Do not redistribute toxic material on the site. Rip soils compacted by equipment operation and redistribute the topsoil evenly on the site. Prepare the seedbed according to Plant Materials Technical Note MT-58, Seedbed preparation and Seeding.

OPERATION AND MAINTENANCE

Manage the use of critical areas as long as necessary to ensure site stability.

Protect plantings from pests (e.g., weeds, insects, diseases, livestock or wildlife) as necessary to ensure planted vegetation long-term survival. Inventory for plant and insect pests following specification for Integrated Pest Management (Code 595). Mow or spray weeds before seeds develop. Manage weeds by mowing to a six to eight inch height, where practical. Refer to Montana Invasive Species Technical Notes for guidance on weed control, and consult County Extension Agents and Weed Coordinators for specific herbicide and pesticide recommendations.

Maintain fences as needed to exclude livestock and wildlife.

For woody plantings, inspect woven weed fabric, protective tubes and netting each spring and repair or re-stake as needed to prevent girdling or other damage (see Montana Plant Materials Technical Note MT-45, Proper Installation, Maintenance, and Removal of Rigid Seedling Protector Tubes). Remove protective tubes when the growing points exceed the height of browsing animals (two to six years).

Inspect, reseed, replant, and fertilize as needed to ensure practice functions as intended throughout its expected life. Monitor progress and success at regular intervals until the practice has met the success criteria for establishment and implementation. Replant woody plantings in the spring if less than 75% planted trees and shrubs survive after "leaf out" of the second year. Evaluate the establishment of herbaceous seedings using the guidance in Conservation Planning Technical Note MT-5, Evaluating Seeding Success for Forage and Biomass Planting (Code 512) and Range Planting (Code 550).

Avoid use of critical areas during periods of establishment. Base site use after establishment on physiological condition of vegetation and erodibility of the site. Some sites may require permanent protection from both domestic livestock and wildlife. Refer to FOTG, Section IV, Practice Standards and Specifications for Fence (Code 382).