

Prairie Establishment and Maintenance Technical Guidance for Solar Projects

Minnesota Department of Natural Resources

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Habitat-friendly, high-diversity solar array planted with native wildflowers and grasses at the Minnesota Department of Natural Resources regional headquarters in New Ulm

Introduction

This is a technical guidance document for the establishment and management of perennial native vegetation (prairie plantings) at solar sites. The goal of this document is to provide an overview of the benefits, establishment, and maintenance guidelines for creating native plantings at solar sites that may also meet the Board of Water and Soil Resources (BWSR) habitat friendly solar standard. Other relevant resources for solar developers include the Minnesota Department of Natural Resources (DNR) [Commercial Solar Siting Guidance](#), Minnesota Department of Commerce – Energy, Environmental Review and Analysis (EERA) [Guidance for Developing a Vegetation Establishment and Management Plan for Solar Facilities](#) and the BWSR [Habitat Friendly Solar Program](#). Together, these resources provide a framework that solar developers can use to develop Agriculture Impact and Vegetation Management Plans (VMP) that may be required as part of the Public Utilities Commission (PUC) Site Permit. Additional references that contain more specific planting and maintenance details are included at the end of the document.

The DNR is available to assist solar developers throughout project planning, construction, and post-planting maintenance. This guidance should be used with the DNR's Commercial Solar Siting Guidance to help a developer plan, design and install their project. [BWSR's Sample Habitat Friendly Solar Planting Plan Specifications](#) is best suited to assist developers of community scale solar projects.

BWSR's [Project Planning Assessment Form](#) and [Established Project Assessment Form](#) have been developed to evaluate project design and establishment for projects that are required to meet the state standard as a condition of local ordinances or conditional use permits, or for solar developers who plan to claim that a solar site provides benefits to pollinators, songbirds and game birds (consistent with Minnesota Statute 216B.1642). Solar developers should work with a native seed company to develop the native seed mix(es) (reporting rates in ounces/acre and seeds per sq. ft.), and provide the mix, planting layout and maintenance specifications to local and state agencies that are assisting with the review of projects. This includes the DNR for projects over 50 megawatts that require a PUC site permit.

When planning a solar site, keep in mind the goals of your development. Low impact solar has the potential to improve soil health, retain water, provide refuge for native species, produce food, and provide low-cost energy to communities. Vegetation requirements laid out by statute and permit conditions must be met. Project developers will also want to address front-facing concerns, such as public perception, ethical obligations, and ensuring the overall success of the energy economy. The following table identifies the agencies that assist with navigating these goals.

State Agency	Mission
Minnesota Department of Natural Resources	Conserve and manage the state's natural resources, provide outdoor recreation opportunities, and provide for commercial uses of natural resources in a way that creates a sustainable quality of life.
Minnesota Board of Water and Soil Resources	Improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private Landowners.
Minnesota Department of Agriculture	Enhance all Minnesotans' quality of life by equitably ensuring the integrity of our food supply, the health of our environment, and the strength and resilience of our agricultural economy.
Minnesota Department of Commerce, Energy Environmental Review and Analysis	Provides environmental review and technical support to the Minnesota Public Utilities Commission for the permitting of new energy projects.

Why Establish Native Plantings?

Prairie communities occur in open grass-dominated landscapes with a diversity of forbs (wildflower species) that provide food and habitat for a multitude of mammals, birds, insects, reptiles and amphibians. Historically, these grasslands were abundant in the southern and western part of Minnesota; now much of this habitat is home to agriculture and renewable energy. As we plan for a Minnesota that is inclusive of many land use types, we have a unique opportunity to provide multiple economic and ecological benefits on every site. Solar developers can benefit from the presence of prairie plantings and associated grazing and forage partnership opportunities that contribute to the overall productivity of the site.

Creating native plantings at solar sites can:

- Provide food and habitat for butterflies, bees and other insects that pollinate flowering forbs and some commercial agricultural crops.
- Provide food, cover and nesting habitat for some species of mammals, birds, reptiles and amphibians.
- Significantly reduce wind and surface water erosion.
- Significantly reduce fertilizer, herbicide and pesticide applications, resulting in improved water quality.
- Increase organic matter and water-holding capacity of soils. The result is higher quality

soils for farming after the site is decommissioned.

- Improve the aesthetic look of the solar facility, resulting in better public relations.
- Increase panel efficiency by keeping the panels cooler and thereby producing more energy.
- Reduce long-term maintenance costs of the vegetation on-site.
- Increase water infiltration and decrease runoff.
- Reduce carbon emissions, as a result of less frequent mowing and capturing carbon with perennial vegetation.
- Provide agronomic opportunities such as conservation grazing

State Statute

Minnesota Statute 216B.1642 addresses solar site management. Subdivision 1 of the statute encourages site management practices that provide native pollinator habitat and reduce stormwater runoff and erosion at solar generation sites. The statute states: *To the extent practicable, when establishing perennial vegetation and beneficial foraging habitat, a solar site owner shall use native plant species and seed mixes under Department of Natural Resources "Prairie Establishment & Maintenance Technical Guidance for Solar Projects."*

Subdivision 2 of the statute sets forth the requirements a project must follow to claim that a solar site provides benefits to pollinators, songbirds and game birds. An owner making a beneficial habitat claim must

1. Make the site's vegetation management plan available to the public.
2. Provide a copy of the plan to a Minnesota nonprofit solar industry trade association.
3. Report on its site management practices to the Board of Water and Soil Resources, on a standard reporting form¹ developed by the board for solar site management practices. An owner must report to the board on the progress made toward establishing beneficial habitat on or before June 1 of the year after operations commence and every third year thereafter.

If a solar site does not meet these requirements, the project may not claim that it is beneficial to pollinators, songbirds and game birds. The DNR encourages all solar developers to establish native plantings at all suitable sites, regardless of whether they want to claim the site as beneficial to pollinators, songbirds and game birds. Solar developers may also have permit conditions that require them to establish perennial native vegetation.

¹ The *Solar Site Pollinator Habitat Assessment Form* is available on the Minnesota Board of Water and Soil Resources website.

Vegetation Management Plans

Vegetation Management Plans (VMPs) are not only a requirement of utility-scale solar projects (50 megawatts or greater), they are also a living document that can greatly increase the likelihood of successful native plant establishment. Establishing native vegetation is a process, not an event. Creating a VMP will pinpoint site characteristics, goals, management needs and potential pitfalls that will be necessary to reference as the planting develops. The VMP will include details about site preparation, planting (including seed mix and seeding method), management methods during and after establishment, monitoring and reporting.

The EERA, in collaboration with the DNR and other state agencies, has developed [Guidance for Developing a Vegetation Establishment and Management Plan for Solar Facilities](#). The DNR is available to assist solar developers throughout project planning, construction and post-planting maintenance. In addition to the following DNR guidance, [BWSR's Sample Habitat Friendly Solar Planting Plan Specifications](#) can assist a developer in this phase of their project.

Seed Mix Specifications

There are many options when developing native seed mixes. The DNR has laid out a framework that solar companies should consider when working with a native seed company to design a native seed mix.

Seed Mix Development

Selecting the right plants for the site will improve the success of the planting. Solar developers should design diverse seed mixes that draw from the set of species that contribute to healthy ecosystems in the local area. These species have been categorized as Minnesota native plants and will be referred to throughout this section.

Tailor the seed mix to the characteristics of the site, including region, soil type, soil moisture, slope and drainage. Consider whether the site has existing artificial drainage e.g., tile. Sites often become wetter after farming operations cease; to ensure successful seed mix establishment, developers will need to have a drainage maintenance plan in place. More than one seed mix is often required to match soil variation from poorly drained soils to dry soils; use the [State Seed Mix website](#) as a tool to examine options.

The seed mix can be customized, based on project goals. In shaded areas of the site, such as underneath solar panels, include only low-growing species that can handle heavier traffic and maintenance. For other plantable areas, seed mixes can be adapted to include mid-height-species that will not shade the panel. Keep in mind, shading of the panels should not be an issue even when using some taller species because most of the mass of prairie plants is in the lower portion of the plant, with the majority of the height occurring from flower stalks. Taller seed mixes can also be useful as screens around the perimeter of a site.

Consult with a native seed company to design seed mixes suitable for the site or use an appropriate state seed mix.

Seed Mix Cost

Native seed mixes, in general, cost more than non-native seed mixes. However, the higher seed cost can be offset by the following:

- No fertilizer applications are needed prior to planting.
- Mulch is generally not necessary and erosion control blankets are only needed on the steepest banks and highly erodible areas. In most cases, a temporary cover of 20 lbs. /acre of oats or other suitable nurse crop is sufficient to stabilize the soil.
- Only a limited amount of fertilizer is used post-planting for sites with very poor soils or limited amounts of soil.
- Watering recently established native seed plantings is not necessary, except in years of extreme drought.
- Participating in trading prairie acres as carbon credits may be possible.
- A diverse planting is more likely to be successful in difficult growing years such as drought or flooding, eliminating the cost of reseeding.
- An established prairie planting can function as a source of grazing/forage for nearby landowners.

Seed Source

The DNR recommends planting a high diversity of species using seeds or plugs that are regionally native and follow the recommended seed sourcing sequence from the DNR's Seed Collection and Deployment Zones (Appendix A). This guidance document should be provided to the native seed company that is developing the project seed mix(es). Seeds should first be sourced from areas with similar site conditions that are regionally native, meaning they are native to the county or adjacent county where the project is being constructed. Plants brought from different areas with significantly different climatic conditions may not produce viable seed or may flower at the wrong time—meaning they may bloom earlier or later than when their native pollinators or other beneficial insects are flying on the landscape. Without necessary pollination, plant diversity will decline and the planting will be less successful over time, resulting in increased weed pressure and higher maintenance costs.

BWSR has [specific requirements](#) pertaining to the origin of seed and composition of mixes that will be necessary to follow to meet the Habitat Friendly Solar Standard.

Seed Mix Types

Diversity, meaning a variety of plant species in one place, is key to a planting's success. The more diverse a planting is, the better chance it has at long-term health and self-sustainability, which translates to lower management costs. Over the years, there will be variations in displaced plants (commonly referred to as invasive species), soil conditions, and climate, such as extreme drought or extreme moisture. A diversity of plants ensures that more species are able to adapt to these extremes and can, therefore, respond to changing environmental conditions. To meet the BWSR Habitat Friendly Solar standard, state-developed solar seed mixes (mid-diversity) must be used on a minimum of 70% of the site. To provide a gold standard of ecosystem services and long-term

resilience, high-diversity seed mixes should be used. When determining these percentages, “the site” refers to the plantable areas within the project footprint. The following specification will assist with building a custom seed mix.

High Diversity Upland² seed mixes:

- A minimum seeding rate of 40 seeds/sq. ft.³
- At least 40% of the total seeding rate should be composed of perennial forbs.
- Seven or more native grass/sedge species with at least two species of bunchgrass.⁴
- Twenty or more native forbs with at least three species in each bloom period: Early (April-May), Mid (June-August) and Late (August-October).
- Include species from each group: cool season grasses; warm-season grasses; sedges/rushes; legume; and non-legume forbs.
- Include species from different plant families, to support the widest diversity of pollinator species and enhance the health of the planting.
- Plant species under panel arrays should have a maximum height of 4 feet and should include shade-tolerant species for fixed panel sites.⁵

Mid-Diversity Upland² seed mixes:

- A minimum seeding rate of 40 seeds/sq. ft.³
- At least 30% of the total seeding rate should be composed of perennial forbs.
- Five or more native grass/sedge species with at least two species of bunchgrass.⁴
- Ten to 15 or more native forbs with at least three species in each bloom period: Early (April-May), Mid (June-August) and Late (August-October).
- Include species from each functional group e.g., cool-season grass, warm-season grass, sedges and rushes, legume-forb, non-legume forb.
- Include species from different plant families, to support the widest diversity of pollinator species and enhance the health of the planting. Plant species under panel arrays should have a maximum height of 4 feet and should include shade-tolerant species for fixed panel sites.⁶

² Wetland seed mixes should not be common on solar sites because wetland soils are not ideal for panel construction. If a wetland mix needs to be used, the developer should follow the same guidelines as for upland mixes. The forb seeding percentage may be lower because sedges and rushes play an important role in these seed mixes and will lower the overall seeding rate in the forb category.

³ Site conditions (wet vs. dry), soil types, species selected, time of planting, weather, and other factors can affect seeding rates and seed mix design. Work with a native seed company to ensure proper seeding rate and seed mixes are used.

⁴ Bunch grasses for upland prairie include porcupine grass (*Hesperostipa spartea*), prairie dropseed (*Sporobolus heterolepis*), little bluestem (*Schizachyrium scoparium*), plains muhly (*Muhlenbergia cuspidata*) and grama grasses (*Bouteloua spp.*). <https://www.dnr.state.mn.us/prairie/native/types-prairies.html>

⁵ Fixed panel sites have more shade under the panels than rotating panel sites. For these sites it is recommended to use at least two different seed mixes: shade tolerant for under the panel and sun-tolerant for in between the rows and edge areas.

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Grass-only seed mixes (using grass-only seed mixes on the entire site will not qualify for the habitat friendly solar standard and may not meet permit conditions):

- Seed mixes should have a minimum seeding rate of 40 seeds/sq. ft.⁷
- Seven or more native grass/sedge species with at least two species of bunchgrass.⁸
- Plant species under panel arrays should have a maximum height of 4 feet and should include shade-tolerant species for fixed panel sites.⁶

Wetland/ Farmed wetland seed mixes to be used outside of panel areas:

- Work with a native seed company to select the appropriate [State Seed Mix](#) or develop a custom seed mix using the State Seed Mix Guidance as a template.

We generally recommend not including tall warm-season grasses (big bluestem-*Andropogon gerardii*, Indian grass-*Sorghastrum nutans*, switchgrass-*Panicum virgatum*) in the panel array area at solar sites. The tall warm-season grass height and density may interfere with operations or dominate the stand and outcompete the shorter stature species. If tall warm-season grasses are used, they should comprise less than 5% of the total seed mix. Tall warm-season grasses can be used for perimeter plantings as a visual barrier.

Please note that state-listed species (endangered, threatened, or special concern) seed should not be included in any of the mixes.

Visual Screening

If visual screening is being considered for the project site, native flowering shrubs can be planted around the perimeter to both fulfill this consideration and supplement early blooming species requirements. Suitable shrubs may include red-osier dogwood (*Cornus sericea*), gray dogwood (*Cornus racemosa*), pagoda dogwood (*Cornus alternifolia*), American wild plum (*Prunus americana*), chokecherry (*Prunus virginiana*), and New Jersey tea (*Ceanothus americanus*). Shrub selection should be based on site conditions and species native to the county or adjacent county where the project is being constructed.

Visual screening using tree species should follow the shrub selection criteria above. Tree species should be used in the prairie landscape of Minnesota when required by a permit, to address adjoining landowner concerns, or to provide non-flowering pesticide drift avoidance zones. Companies should not plant potentially problematic tree species; for example, some native trees compete with planted vegetation and can spread aggressively when disturbance is absent. To maintain sensitivity to adjacent conservation easements and public lands that place a high priority on recreation and habitat within the prairie landscape, trees and shrubs should be used

and edge areas

⁷ Site conditions (wet vs. dry), soil types, species selected, time of planting, weather, and other factors can affect seeding rates and seed mix design. Work with a native seed company to ensure proper seeding rate and seed mixes are used.

⁸ Bunch grasses for upland prairie include porcupine grass (*Hesperostipa spartea*), prairie dropseed (*Sporobolus heterolepis*), little bluestem (*Schizachyrium scoparium*), plains muhly (*Muhlenbergia cuspidata*) and grama grasses (*Bouteloua spp.*). <https://www.dnr.state.mn.us/prairie/native/types-prairies.html>

when they have a limited risk of spreading into planted areas of the site and native or restored prairies in the surrounding landscape.

If evergreens are required for the project, choose species that are local to the county whenever possible. If the county in question does not have native evergreens, select the most local option that will not be detrimental to planting health; for example, Eastern red cedar (*Juniperus virginiana*), while native to Minnesota, is a common invader throughout the prairie region and should not be planted, whereas native white spruce (*Picea glauca*) rarely spreads into the surrounding landscape.

Pesticide Drift

Pesticide drift is a concern when plantings occur in agricultural, urban or other working landscapes. Using visual screening of non-flowering shrubs, trees or grasses can be a way to provide a buffer for planted areas, to help minimize the impacts of drift. The following are buffer widths recommended by BWSR and the Xerces Society to help avoid drift:

- Forty feet wide for site adjacent or near ground-based spray applications.
- Sixty feet wide for site adjacent or near the use of air-blast sprayers.
- 125 feet wide for sites adjacent or near aerial spraying or crops treated with neonicotinoids (including application as a seed treatment).

To learn more about pesticide drift, see this fact sheet on [Protecting Conservation Plantings from Pesticides](#).

Planting Specifications

Site Preparation

This is an important part of any planting and sets the stage for success. Important considerations include past land use history, current vegetation, seedbed preparation and, sometimes, reducing pesticide or nutrient carryover. Native seed germinates best in a seed bed composed of loose soil particles, free from furrows.

Converted row crop agriculture may require a dormant period or season of cover cropping to diminish residual pesticides that could be detrimental to native plants. If there is significant weed presence, the site may require additional management such as mowing, haying, smother cropping or chemical application, possibly followed by cover cropping.

For detailed information on site preparation, refer to the [Tallgrass Prairie Center Technical Guide on Site Preparation](#) or BWSR's [planting specifications for the establishment of native vegetation](#).

Planting Method

The DNR recommends that the majority of planting occur after construction of the panels, except in soils that are resistant to compaction, such as those with sand as a major component. Attempting to plant after grading and before post and panel installation can result in poor seed germination, due to compaction from equipment maneuvering. Pre-construction seeding can

work well for the strips under the panel area, but only if compaction concerns are addressed and the site is properly prepped for planting. A temporary cover of 20 lbs./acre of oats can be used as erosion control and site stabilization until construction is complete and the permanent prairie seed mixes are planted.

Drilling seed involves using specialized equipment to place the seed under the surface of the soil and usually requires cleaned seed. If drilling is the planting method, seed drills designed specifically to plant prairie grasses and flowers should be used. Species vary in their optimal planting depth and some drill implements allow for varying depths. An aesthetic disadvantage of drilling is that it leaves rows from planting, though this is not very apparent after the vegetation has established. This can also be reduced by cross planting in different directions.

Broadcasting seed is spreading seed out on top of the prepared soil surface (or over snow in the case of snow seeding). If broadcasting is the planting method, native-seed broadcasters should be used, as they are adapted to spread mixes with different sized seeds. Broadcasting has the advantage that it can handle uncleaned seed. A disadvantage in broadcast seeding is that in windy conditions the lighter seed may be blown farther than the heavier seed, leading to uneven coverage of species. Following up a broadcast seeding with rolling can increase seed to soil contact.

Regardless of planting method, it is vital to get good seed to soil contact during planting, for good establishment. For more information about planting methods, please refer to [Prairies of Minnesota: A Landowners Handbook](#) under Chapter 9: Prairie Restoration and Enhancement.

Best Practices for Erosion Control and Ecologically Undesirable Species Prevention

Use wildlife friendly erosion control:

- Biodegradable netting should be used, preferably natural materials with short degradation periods.
- Erosion control blankets should be limited to bio-netting or natural netting types, due to the risk of entanglement and death of small animals. [2020 MnDOT Standard Specifications for Construction](#) details acceptable materials in Category 3N or 4N mulches.
- Do not use products that require UV-light to degrade (also called “photodegradable”), as they do not degrade properly when covered/shaded.
- Do not use products containing plastic mesh netting or other plastic components.
- Do not use mulch products that contain synthetic (plastic) fiber additives near waterbodies.
- Our agency also advises that the dye Malachite Green, an industrial colorant used in some hydro-mulch, presents an ecotoxicity concern for aquatic species, with a potential for bioaccumulation in insects, amphibians and fish.

See [Wildlife Friendly Erosion Control](#) for more information.

Take active steps to prevent ecologically undesirable plant species introduction and spread:

- Clean all equipment (including but not limited to vehicles, clothing and gear) on site prior to moving to another site. All soil, aggregate material, mulch, vegetation, seeds, animals, etc. need to be removed using a hand tool, brush, compressed air, pressure washer or otherwise.
- If equipment is not cleaned before arriving to a work site, then clean the equipment in the parking or staging area, ensuring no material is deposited at the new site. Material cleaned from equipment should be disposed of legally.
- All equipment (including but not limited to waders, tracked vehicles, barges, boats, turbidity curtain, sheet pile, and pumps) used for work in an “infested water” must be adequately decontaminated. See [Watercraft Decontamination Manual](#) for more information.
- See [Come Clean, Leave Clean](#) for more detailed guidance. This guidance is required for those working on DNR lands as part of a grant or under contract or a permit.

For additional information, refer to DNR guidance on [Cleaning Heavy Equipment used on Land to Minimize the Introduction and Spread of Invasive Species](#).

Timing

Planting can take place during the growing season or dormant season. There will be differences in planting zones from south to north in Minnesota, based on differences in climate.

- Growing season plantings should occur from May 1 - July 1, when the soil temperature is at least 60 degrees Fahrenheit or higher.
- Dormant seeding should occur after soil temperatures fall below 39 degrees Fahrenheit but before soil freezes, approximately after October 15 in the northern half of the state and after November 1 in the southern half of the state. Seeding rates of native grasses may need to be increased by 25 percent for dormant seeding, due to lower germination rates and loss of seed that is consumed by wildlife over the winter months. The DNR has demonstrated success with fall dormant broadcast seeding, as it addresses concerns with seed stratification (a cycle of cold and warm temperatures that helps to break seed coats and initiate germination).
- Frost seeding can take place in the early spring, when temperatures are above freezing during the day and below freezing at night. The freeze-thaw cycle will help to move seed into the soil profile and begin the stratification process. Do not broadcast seed onto ice or frozen bare ground, as this can result in low seed viability, seed predation and erosion of seed from the site.

Because planting dates will vary depending on the weather in a particular year and where the planting site is located (e.g., northern Minnesota versus southern Minnesota), consulting with native seed suppliers and restoration practitioners to determine the best planting dates in a given year is recommended.

For more information on timing your seeding, consult the [Tallgrass Prairie Center Technical Guide](#)

[on Seeding.](#)

Temporary Cover

A temporary cover should be used with the planting to help suppress weeds, stabilize the soil, and limit compaction until the prairie planting becomes established; a temporary cover of 20 lbs./acre of oats is a common recommendation. A native seed supplier may recommend a different cover, based on the season of planting.

Establishment and Maintenance Specifications

Prairie plantings have both an establishment and a long-term maintenance phase. The establishment phase takes approximately zero to five years. Long-term maintenance will begin in year five and continue for the life of the planting. The first year of growth is primarily for root development. In years two to five of establishment, the above-ground growth and flowers become more prevalent as the stand matures.

Native planting management in the first zero to five years may involve spot-spraying or mowing of invasive weeds and tree seedlings. Weed presence is normal for new planting and should naturally decrease over time if a diverse seed mix is used. Highly invasive weeds may require management to aid prairie planting establishment and help prevent future weed growth.

Periodic Mowing (Establishment Phase, zero to five years)

Periodic mowing involves mowing the entire planting throughout the first and second growing seasons to help prevent a weed canopy from forming and to allow slower germinating plants a chance to mature. Frequency and duration of mowing will vary depending on the local climate and weed pressure at the site. Ideally, periodic mowing is meant to keep the vegetation at around knee-height. If weed pressure is high, mowing can take place one or two times a month or after vegetation reaches 12-18" in height. Mowing should be done at a raised height between 4-6 inches. If native wildflowers are already in bloom, consider mowing at a height that would leave flowers intact or wait until they are done blooming. Care should be taken to avoid mowing the planting too frequently or too aggressively, such as weekly or shorter than the recommended height, as this can damage the native vegetation and cause the planting to fail. Avoid mowing during periods of low precipitation or drought. A Flail-type mower is preferred because it cuts the vegetation into smaller pieces and does not leave a thick layer of thatch. If a flail-type mower is not available, mowed vegetation may need to be bagged and moved off-site, to avoid smothering prairie plants.

If mowing large sections of the planting, consider waiting until after July 15 to protect game and songbird nesting habitat and reduce soil erosion from spring rains. Mowing after October 1 also ensures there is forage for monarch butterflies as they migrate south in the fall, typically toward the end of August through mid-September.

Spot-Mowing

Spot-mowing involves mowing only in the areas with ecologically undesirable plants. Spot-mowing can slow some of these fast-growing plants while allowing the native species to become established. Spot-mowing should be done at a raised height between 4-6 inches, to target the ecologically undesirable plants and avoid damaging native species. Spot-mowing can be done every year as necessary to ensure planting health e.g., enhance diversity and functionality. Care should be taken to avoid mowing the planting too frequently or too aggressively, such as weekly or shorter than the recommended height, as this can damage the native vegetation and cause the planting to fail. A list of noxious/invasive weed species that should be addressed can be viewed at the [Minnesota Department of Agriculture's website](#).

Spot-Spraying

Some persistent perennial weeds may require digging, pulling, girdling, smothering or spot treatment with herbicides for sufficient treatment. Persistent perennial weeds that can negatively impact a prairie planting include reed canary grass, smooth brome, quack grass, purple loosestrife, crown vetch, birds-foot trefoil, and woody species such as box elder, common buckthorn, Siberian elm, and Tatarian honeysuckle. Methods should be conducted carefully during the early establishment phase, to avoid adverse impacts to native plant seedlings. Herbicides should only be used on persistent perennial noxious or ecologically undesirable weeds; most other undesirable plants will be excluded or occur in low frequencies and abundance over time as the native planting matures. Herbicide use should be species specific, sprayed in a discriminating and targeted way (minimizing contact with non-target organisms), and applied according to rates specified on the label. A licensed applicator is highly recommended, to ensure selective herbicides are used correctly.

All pesticides should be selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment. Plantings that include both grasses and forbs should never be broadcast-sprayed. Minimal herbicide use is recommended the first year of planting. Targeted spot spraying can begin in year two, unless significant ecologically undesirable species show up.

[The Midwest Invasive Plant Control Database](#) provides a compilation of control methods for many common ecologically undesirable plants. Some species do not respond well to spraying, so managers are encouraged to consider the method that will do the least amount of harm to overall planting health.

To prevent inadvertent aerial spraying of native plantings, it may be advantageous to have them placed on the do not spray list at the local farm co-op. This will help prevent damage to your prairie planting.

For more information about establishment maintenance, please refer to the Tallgrass Prairie Center's [Initial Post-Seeding and Early Reconstruction Management guide](#).

Long-Term Maintenance

Long-term prairie maintenance usually begins in year five and continues throughout the life of the planting. The goal is to introduce disturbance to the planting in a way that approximates natural processes. Disturbance allows prairies to renew themselves while also slowing natural succession (keeping the prairie from becoming a forest). Plan on haying, mowing, burning, grazing or spot-spraying to remove any unwanted trees/shrubs that may be present. It is not necessary to use all options, just one or two, depending upon the planting's progression and operational concerns. After completing the selected maintenance activity in years four and five, you will need to repeat this type of maintenance approximately every two to three years, depending on tree/shrub encroachment, ratios of grasses to forbs, presence of noxious weeds and overall planting health.

Fire and grazing are key natural disturbances of native prairies. These actions bring a flush of new green growth, stimulate flower and seed production, clear thatch, and can help limit ecologically undesirable species and tree encroachment. Since prescribed burning is most likely not an option at solar sites, a combination of other management practices should be used. Introducing a rotation of haying, mowing or conservation grazing is an excellent management approach. When used correctly, as part of an adaptive management strategy, the result is a healthier prairie with native species abundance and diversity maintained or enhanced through time.

Adaptive Management Grazing

Diverse native plantings work well both as habitat and as forage for grazing. Adaptive management grazing is characterized by short-duration, high density livestock impact followed by rest periods long enough to ensure full plant recovery (30-90 days). Observation and monitoring are key components of success that allow for adjustments in grazing timing, frequency and intensity. A high-diversity planting can maximize the benefit of this type of management as it increases soil biological function, which in turn increases forage nutritional density.

It is important to choose compatible livestock for solar sites. Sheep are generally considered the most compatible because of their size and how they graze. Sites using grazing as a management option should develop a grazing management plan in consultation with an experienced conservation grazing specialist.

Haying or Mowing

An alternative to grazing is haying or mowing. This activity should be done at a raised height of 4-6 inches once a season. Haying or mowing below the recommended height can damage the long-term health of the planting. Care should be taken to avoid mowing the planting too frequently or too aggressively, as this can damage the native vegetation and cause the planting to fail. A flail-type mower is preferred because it cuts the vegetation into smaller pieces and does not leave a thick layer of thatch. If a flail-type mower is not available, mowed vegetation may need to be bagged and moved off-site to avoid smothering prairie plants.

Haying or mowing equipment should be cleaned prior to use on site, to prevent the spread of displaced species into the planting. Haying can offer additional biomass reduction, which can remove excess nitrogen from the system. This is important for reducing weedy or undesirable plant invasion. Long term management practices like haying and mowing should not take place during the grassland bird nesting season: May 15-August 1. If necessary to hay or mow within this timeframe, haying or mowing should be done to a height greater than 12 inches, and no more than 2/3 of the planting should be hayed or mowed at a time, to leave refugia for wildlife.

If mowing or haying large sections of the planting, consider waiting until after July 15 to protect game and songbird nesting habitat and reduce soil erosion from spring rains. Mowing after October 1 also ensures there is forage for monarch butterflies as they migrate south in the fall, which typically occurs toward the end of August through mid-September.

Refugia

With any management activity, it is very important to establish refugia (undisturbed areas that are of similar quality and condition as the areas slated for disturbance). These areas play an important role in pollinator conservation and allow for the completion of pollinator life cycles. Ideally, no more than one-third of the site should be disturbed each year during the long-term maintenance phase—especially for large sites. The same one-third should not be disturbed in consecutive years, unless there is a specific short-term goal, e.g., reducing non-native exotics like brome grass. If possible, 10% of the site should be set aside as semi-permanent refugia, which receives limited disturbance on a longer return interval of 15 years or more. Appropriately managed adaptive grazing should provide adequate refugia on a portion of the site. For more information about refugia, consult the [DNR's Pollinator Best Management Practices and Habitat Restoration Guidelines](#).

Monitoring

Vegetation monitoring is a necessary part of ongoing maintenance, as it is the source of information used to make ongoing management decisions. BWSR requires [monitoring and reporting](#) three times per year in the first three years of prairie planting establishment, and twice a year thereafter to keep the designation of a Habitat Friendly Solar Project.

Prairie Seed Suppliers and Restoration Companies:

The DNR recommends you work with companies that specialize in native seed and installing/maintaining prairie restoration projects. Select companies that are experienced and have a history of successful prairie restoration projects. A list of native seed suppliers can be found by visiting the [DNR's Native Plant Suppliers](#) webpage.

The DNR appreciates the efforts of all solar companies that install native seed plantings that are favorable to pollinators and other wildlife.

Additional Information:

[DNR's Prairie Restoration webpage](#)

[Board of Water and Soil Resources \(BWSR\) State Seed Mixes](#)

[BWSR Native Vegetation Establishment and Enhancement Guidelines](#)

[BWSR Habitat-Friendly Solar Program](#)

[Native Plant Suppliers and Landscapers in MN](#)

[Minnesota Wildflowers](#)

[The Midwest Invasive Plant Control Database](#)

[Tallgrass Prairie Center Guide for Initial Post Seeding and Early Reconstruction Management](#)

[DNR's Pollinator Best Management Practices and Habitat Restoration Guidelines](#)

[The Wildlife Fencing Guide](#)

List of Online Resources

Board of Water and Soil Resources:

- Seed Mixes
<https://bwsr.state.mn.us/seed-mixes>
- Sample Specifications for the Establishment of Native Vegetation as Part of Habitat Friendly Solar Projects
https://bwsr.state.mn.us/sites/default/files/2019-05/Solar%20Project%20Seeding%20Specifications-5-9-19_0.pdf
- Habitat Friendly Solar Site Assessment Form for Project Planning
https://bwsr.state.mn.us/sites/default/files/2025-02/Habitat%20Friendly%20Solar%20Project%20Planning%20Assessment_Final%20Feb.2025.pdf
- Established Project Assessment Form
https://bwsr.state.mn.us/sites/default/files/2025-02/Habitat%20Friendly%20Solar%20Established%20Project%20Assessment%20Feb_2025_FINAL.pdf
- Habitat Friendly Solar Monitoring Form
<https://bwsr.state.mn.us/sites/default/files/2021-02/Habitat%20Friendly%20Solar%20Monitoring%20Form.pdf>
- Protecting Conservation Plantings from Pesticides
https://bwsr.state.mn.us/sites/default/files/2020-05/18-023_Protecting%20Conservation%20Plantings%20from%20Pesticides_links-DONE.pdf

Minnesota Department of Natural Resources:

- Commercial Solar Siting Guidance
https://files.dnr.state.mn.us/publications/ewr/commercial_solar_siting_guidance.pdf
- Prairies of Minnesota Landowner Handbook - Chapter 9: Prairie Restoration and Enhancement

- <https://files.dnr.state.mn.us/assistance/backyard/prairierestoration/prairie-handbook.pdf>
- Wildlife-friendly Erosion Control
<https://files.dnr.state.mn.us/eco/nongame/wildlife-friendly-erosion-control.pdf>
- Watercraft Decontamination Manual
https://files.dnr.state.mn.us/natural_resources/invasives/mndnr_ais_decontamination_handbook.pdf
- “Come Clean, Leave Clean”
<https://www.dnr.state.mn.us/invasives/dnrlands.html>
- Cleaning Heavy Equipment used on Land to Minimize the Introduction and Spread of Invasive Species
https://files.dnr.state.mn.us/natural_resources/invasives/terrestrialplants/equipment_cleaning_to_minimize.pdf
- Minnesota Pollinator Resources
https://www.dnr.state.mn.us/pollinator_resources/index.html
- Native plant suppliers, landscapers, and restoration consultants for Minnesota
<https://www.dnr.state.mn.us/gardens/nativeplants/suppliers.html>

Other Agency/Organization Resources:

- Energy Environmental Review and Analysis Guidance for Developing a Vegetation Establishment and Management Plan for Solar Facilities
<https://apps.commerce.state.mn.us/eera/web/project-file/11702>
- Minnesota Department of Agriculture Minnesota Noxious Weed List
<https://www.mda.state.mn.us/plants-insects/minnesota-noxious-weed-list>
- Tallgrass Prairie Center Prairie Restoration Technical Guide Series
 - Chapter 7: Site Preparation
<https://tallgrassprairiecenter.org/sites/default/files/inline-uploads/7-site-preparation-2024.pdf>
 - Chapter 8 Seeding
<https://tallgrassprairiecenter.org/sites/default/files/inline-uploads/8-seeding-2024.pdf>
 - Chapter 9: Initial Post Seeding and Early Reconstruction Management
<https://tallgrassprairiecenter.org/sites/default/files/inline-uploads/9-initial-post-seeding-2024.pdf>
- Midwest Invasive Plant Network Invasive Plant Control Database
<https://mipncontroldatabase.wisc.edu/>

Equal Opportunity Statement

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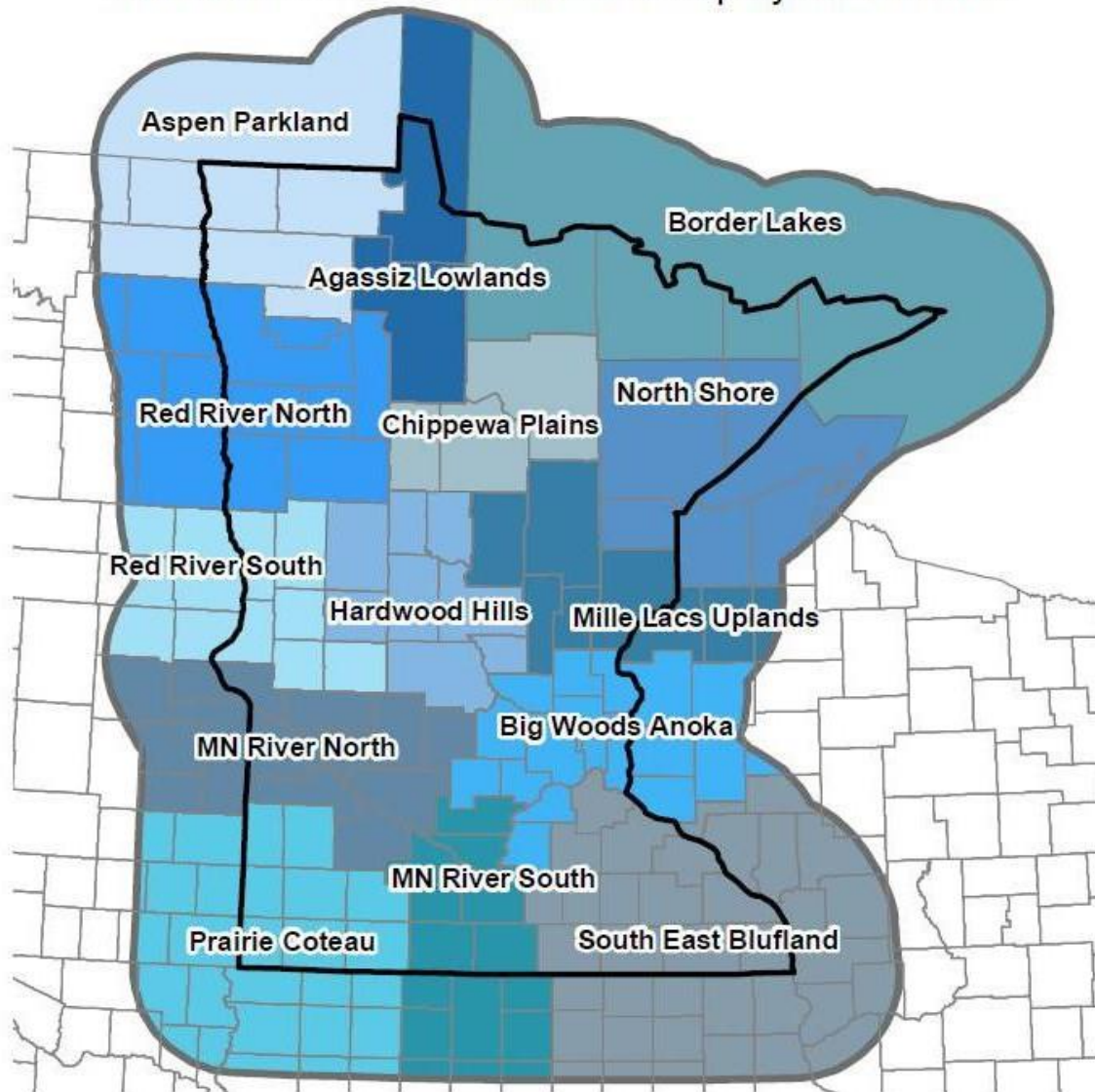
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Appendix A

DNR Seed Collection and Deployment Guidance for Seed Selection

MN DNR Seed Collection and Deployment Zones



Framework for Selecting Plant Material Sources

1. Collect plant materials from areas with similar site conditions that are within or immediately adjacent to the restoration or reconstruction site or nearby. Nearby is defined by the division and generally is considered to be within the same zone.
2. Obtain plant materials from areas with similar site conditions and within the same Seed Zone.
3. Obtain plant materials from areas with similar site conditions in an adjacent Seed Zone.
4. Obtain plant materials from areas with similar site conditions in a Seed Zone that adjoins one of the adjacent Seed Zones.
5. If suitable seed/plant material can't be found, substitute another species with similar attributes.

Note: It is important to recognize that boundaries of the Seed Collection and Deployment Zones are not walls which cannot be crossed. If a restoration/reconstruction area is near one of these boundaries, an appropriate choice for restoration materials may be just across the boundary in an adjacent seed zone. This source of materials may actually be more desirable than a more distant source of plant materials from within the same seed zone. This framework recognizes that seed zones are not static; they may be adjusted over time to reflect new information based on research results from climate change and other analyses.