

**BIRTLE TRANSMISSION PROJECT
BOTANICAL AND VEGETATION ENVIRONMENTAL MONITORING
ANNUAL TECHNICAL REPORT**

**Prepared for:
Manitoba Hydro**



**Prepared by:
Szwaluk Environmental Consulting Ltd.
and
K. Newman**

December 2021

SUMMARY

Botanical and vegetation resources were assessed in 2021 for Year I environmental monitoring of the Birtle Transmission Project. Surveys were conducted in grassland and forest habitats, with monitoring occurring for traditional use plant species, invasive species, and species of conservation concern, each with botanical summaries presented. The accuracy of effect predictions and the effectiveness of mitigation are discussed.

Twelve grassland sites were visited in the Spy Hill-Ellice Community Pasture. Ten sites are located on the final preferred route, with an additional two sites visited off-RoW. Prairie sites in the community pasture are dominated by native grasses, with a diversity of native forbs, few low shrubs, a general absence of trees and tall shrubs. Very few non-native species are observed in plots. Grassland sites on the RoW averaged 55% total vegetation cover, ranging from 43% to 69%. Richness at sites ranged between 32 to 43 species. On the RoW, there was no significant difference for either mean cover ($p=0.3$) or richness ($p=0.07$) between pre-construction and Year I monitoring. Both the diversity and evenness measures were slightly higher (both $p<0.01$) in 2021 compared to pre-construction values. Three community types were identified based on their vegetation structure, species assemblages and cover. The predicted effects on grassland habitat were minimal, with low disturbance to soils and vegetation. Recommended mitigation was implemented and effective for grassland habitat.

Twelve sites were visited in the community pasture to sample forest habitat. Of these sites, 10 are located on the final preferred route while two sites were selected for monitoring off-RoW. All previously forested sites consist of a young open aspen canopy. The total understory vegetation cover for forested sites on the RoW averaged 43%, ranging from 29% to 57%. On the RoW, mean cover in the herb and low shrub layer in Year 1 monitoring (43%) decreased from pre-construction (67%) values ($p=0.01$), and average species richness showed lower values ($p<0.01$) between pre-construction and Year I monitoring (26.2 and 22.6, respectively). Both mean diversity and evenness measures were higher in the current year (both $p<0.01$) than in pre-construction surveys. Three forest community types were identified based on species composition and structure of the understory, and geographical location. The predicted change in native vegetation cover as a result of the project was accurate for forest habitat. Recommended mitigation was implemented and effective for forest habitat which minimized the disturbance from construction activities.

Invasive plant species were identified as an environmental indicator of both grassland and forest habitat. Sixteen non-native species were recorded within the pasture, including those designated as noxious Tier 3 (seven species) or invasive. Six non-native species are considered invasive in Manitoba due to their tendency to outcompete native species. The remaining three species are considered non-native but non-invasive in Manitoba. No Tier 1

or Tier 2 noxious species were observed in 2021. Most non-native species on the RoW were recorded in the vicinity of the wetland spring (13 species). Within plots, six species were recorded in forested sites and two species were recorded from grassland sites. One off-RoW forested site had a single species. The most frequently observed noxious species is common dandelion followed by common lamb's-quarters.

Traditional use plant species were recorded from quantitative surveys in both grassland and forest habitats in the community pasture. A total of 23 traditional use plant species were observed during all surveys, and included two trees, seven tall shrubs, three low shrubs and 11 herbs. The mean cover of all traditional use species is greatest in forested sites (27.8%), due to the greater presence of woody growth in the understory. Traditional herbs are less abundant in the forest understory (mean cover 1.1%). The lower mean abundance of traditional use plants in grassland sites (4.5% cover) is due to the marked absence of woody seedlings from tall shrubs and trees. Low shrubs in grassland sites consist entirely of prairie rose (mean cover 2.6%), found in every site. Grassland sites have greater abundance of traditional use herbs (mean cover 2.2%), which consist primarily of sages and crocus, with onion, strawberry and wood lily. The mean total traditional use plant cover was comparable to pre-construction values for grassland sites and the understory of forest sites.

Species of conservation concern were recorded from surveys in grassland and forest habitats, and incidentally along the RoW. Thirty-four species of conservation concern were observed in the community pasture in 2021. Among these species, six are ranked Critically Imperilled or Imperilled (S1-S2?) including sun sedge, small-wing sedge, sand millet, tufted fleabane, Geyer's monkeyflower, and showy locoweed. The remaining 28 species are ranked as Vulnerable (S3-S3S5). Twenty-nine species were recorded in grassland sites, while nine are recorded from (previous) openings in forested sites. Three wetland obligate species were recorded uniquely at the wetland spring site. Of the Critically Imperilled species recorded from within the community pasture two species are also Nationally Imperilled: Geyer's monkeyflower and sand millet. No species listed by the federal *Species at Risk Act*, the Manitoba *Endangered Species and Ecosystems Act* or listed by the Committee on the Status of Endangered Wildlife in Canada were observed during fieldwork.

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ACKNOWLEDGEMENTS

The authors thank the following: Manitoba Hydro provided supporting information and documentation for the project; Alanna Sutton assisted with fieldwork; and Zane Fredbjornson, Pasture Manager, accommodated field access at the Spy Hill-Ellice Community Pasture.

1.0 INTRODUCTION

Botanical and vegetation resources were monitored in 2021 as part of Manitoba Hydro's commitment to environmental protection for the Birtle Transmission Project (Map 1-1, Appendix II). On January 30, 2018, Manitoba Hydro submitted the Environmental Assessment Report to Manitoba Sustainable Development, for approval to construct and operate the Birtle Transmission Project, a 46.2 km 230 kV transmission line from Birtle Station to the Saskatchewan border. The Project is defined as a Class 2 Development (under the Classes of Development Regulation). Manitoba Conservation and Climate granted a licence for the Birtle Transmission Project (#3314) on January 14, 2020.

The purpose of the Project was to facilitate the sale of 100 MW of electricity from Manitoba to Saskatchewan, based on a 20-year power purchase agreement signed in January 2016 between Manitoba Hydro and the Saskatchewan Power Corporation (SaskPower).

The Birtle Transmission Project Regional Assessment Area occurs almost entirely within the Ecodistricts of Hamiota and St. Lazare in southwest Manitoba; a small portion of the Project occurs in the Melville Ecodistrict. The Project Right-of-Way (RoW) traverses developed land, agricultural land, and native vegetation including deciduous forest, wetlands and grasslands. The dominant land cover classes within the Project are agricultural cropland and grassland/rangeland. Particular attention was given to the 6.4 km length of transmission line passing through the Spy Hill-Ellice Community Pasture, one of the two largest intact areas of native mixed grass prairie remaining in Manitoba. Native prairie within the community pasture supports impressive botanical diversity including numerous imperilled, vulnerable and uncommon prairie plant species.

This assessment involved pre-construction botanical and vegetation surveys (prior to environmental monitoring) along the final preferred route. Potential environmental effects as a result of the Project are listed in Appendix III, which were identified in Chapter 7.0 of the Environmental Assessment Report (Manitoba Hydro 2018a) and the Biophysical Existing Environment Technical Report (Manitoba Hydro 2018b). Project commitments for pre-construction and environmental monitoring of terrestrial ecosystems and vegetation are identified in Appendix IV. The specific objectives established for this study, based on the Environmental Monitoring Plan (Manitoba Hydro 2020a) and review of the Environment Act Licence (Manitoba Conservation and Climate 2020) were as follows:

- Conduct environmental monitoring for plant species of conservation concern in grassland and forest habitats;
- Conduct environmental monitoring for invasive plant species in grassland and forest habitats; and

- Conduct environmental monitoring for traditional use plant species in grassland and forest habitats.

The following hypotheses were developed for environmental monitoring of botanical and vegetation resources:

Hypothesis 1. *There are observed differences in species composition within sites being monitored over successive years along the transmission line right-of-way.*

Hypothesis 2. *Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way.*

2.0 BACKGROUND

The following section discusses the environmental monitoring background for plant species of conservation concern, invasive plant species and traditional use plant species, in both grassland and forest habitats.

2.1 Plant Species of Conservation Concern

Based on records from the Manitoba Conservation Data Centre (MBCDC) and existing information sources, several (~46) species of conservation concern are known to occur in the Regional Assessment Area (RAA) and surroundings, with increased concentrations located in the vicinity of St. Lazare, including the Ellice Archie and Spy Hill-Ellice Community Pastures. The uplands and river valleys in this region support a number of species considered provincially rare in the province (Hamel and Reimer 2004). According to provincial sources and existing literature, there are about 172 species of conservation concern that can be expected to range within the greater Aspen Parkland Ecoregion. Of these, there are eight species at risk listed in the ecoregion. These include rough purple false-foxglove (*Agalinis aspera*), buffalograss (*Bouteloua dactyloides*), hackberry (*Celtis occidentalis*), smooth goosefoot (*Chenopodium subglabrum*), small white lady's-slipper (*Cypripedium candidum*), hairy prairie-clover (*Dalea villosa*), Geyer's monkeyflower (*Erythranthe geyeri*) and western spiderwort (*Tradescantia occidentalis*). Only one of these species, Geyer's monkeyflower, is known to occur in the RAA setting (Reimer and Hamel 2003).

Baseline surveys conducted in 2017 have helped identify locations of species of conservation concern, while continued monitoring has built up a more comprehensive list of species that occur in the Pasture. Pre-construction surveys in 2019 provided further details for where to apply mitigation measures. Construction activities can potentially negatively affect plant species of conservation concern through the use of heavy equipment (crushing plants) and from clearing and grubbing (removal of roots) of vegetation. Excessive soil disturbance from clearing activities can also lead to introduction of alien species. Herbicide use during maintenance activities can also negatively affect non-target, desirable plants. To validate the Environmental Assessment (EA) predictions, verify implementation of mitigation measures, and to allow for adaptive management, pre-construction and post-construction monitoring will identify any impact to vegetation species of conservation concern in the Spy Hill-Ellice Community Pasture. Monitoring activities for species of conservation concern are identified in Table 2-1.

Mitigation measures identified in the Construction Environmental Protection Plan

- Carry out construction activities on frozen ground to minimize surface damage, rutting and erosion.
- Use existing access roads and trails to the extent possible.
- Remove trees by low ground disturbance methods that protect shrubs and understory.
- Confine vehicle traffic to established trails to the extent possible.
- In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan and for mitigation measures.
- Marshalling yards and/or worker accommodations will not be developed within in Spy Hill-Ellice Community Pasture.
- Tower foundations that limit disturbance of soil will be utilized within grassland habitat areas within the Spy Hill-Ellice Community Pasture.

Table 2-1. Monitoring activities for plant species of conservation concern, grassland and forest habitats.

Phase	Task Description	Parameter(s)	Site Location	Duration	Frequency	Timing	Measurements/ Observations
Baseline Information	Desktop, key person interviews, and field surveys	Species names and locations	Grassland and forest habitat sites in Spy Hill- Ellice Community Pasture PFA, LAA	1 field season	Once	2017	Species presence/ absence
Pre-construction	Ground surveys to record species of concern and protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	1 field season	Once	2019	Species presence/ absence
Post-construction	Ground surveys to monitor species of concern and protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	1 field season	Once	2021	Species presence/ absence

2.2 Invasive Plant Species

As outlined in the Environmental Assessment, the prevalence of non-native and invasive plant species (including noxious species) may increase as a result of the Project. Non-native species are plants that grow outside of their normal range while invasive species are plants that out-compete native species when introduced outside of their natural setting. Noxious plants have the ability to spread rapidly and are designated by regulation, *The Noxious Weed Act* (Manitoba).

Construction equipment and vehicles can introduce non-native and invasive plants during construction activities. During the field assessments in 2017, three non-native or invasive species were recorded from the Spy Hill-Ellice Community Pasture, while eight species were observed at sites on private lands, most of which are under agricultural cultivation or grazing. In 2019 pre-construction surveys, 11 non-native species were recorded, with both noxious (four species) and invasive (five species) designation, on the pasture and river crossings.

Non-native and invasive species are problematic for a number of reasons: these plants are capable of growing under a wide range of climatic and soil conditions; they produce abundant seeds that are easily disseminated and seeds that are long lived or can remain dormant through the winter season; they can continue to persist even after the removal of vegetative portions of the plant, and they often have vigorous growth and produce seeds under conditions adverse for other plants, and can therefore out compete native species. To validate EA predictions, verify implementation of mitigation measures, and to allow for adaptive management, pre-construction and post-construction monitoring will identify changes in baseline composition and abundance of invasive species. Monitoring activities for invasive plant species are identified in Table 2-2.

Mitigation measures identified in the Construction Environmental Protection Plan

- Carry out construction activities on frozen ground to minimize surface damage, rutting and erosion.
- Use existing access roads and trails to the extent possible.
- Remove trees by low ground disturbance methods that protect shrubs and understory.
- Confine vehicle traffic to established trails to the extent possible.
- In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan and for mitigation measures.

- Marshalling yards and/or worker accommodations will not be developed within in Spy Hill-Ellice Community Pasture.
- Tower foundations that limit disturbance of soil will be utilized within grassland habitat areas within the Spy Hill-Ellice Community Pasture.

Table 2-2. Monitoring activities for invasive plant species, grassland and forest habitats.

Phase	Task Description	Parameter(s)	Site Location	Duration	Frequency	Timing	Measurable Parameter(s)
Baseline Information	Desktop and field surveys	Species names and locations	Sites surveyed in PFA, LAA	1 field season	Once	2017	Species composition and abundance
Pre-construction	Ground surveys to record non-native and invasive species and monitor protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	2 field seasons (grassland); 1 field season (forest)	Once	2019, 2020	Species composition and abundance
Post-construction	Ground surveys to identify and measure occurrence of invasive species on ROW and monitor protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	2 field seasons	Annual	2021, 2022	Species composition and abundance

2.3 Traditional Use Plant Species

As outlined in the EA, Project effects to traditional plant species is a concern for Indigenous communities and organizations. These areas are valued for their provision of resources used by Indigenous communities and organizations, including gathering of food and medicines and harvesting plants and trees, particularly in Spy Hill-Ellice Community Pasture. Self-directed studies by Indigenous communities, and baseline vegetation surveys conducted in 2017 identified traditional use plant species and locations where they are found in grassland, forest and wetland habitats. Approximately 20 traditional use plants were recorded from community pasture surveys along the final preferred route, combined in 2017 and 2019.

To validate EA predictions, verify implementation of mitigation measures, and to allow for adaptive management, pre-construction and post-construction monitoring will identify changes in baseline composition and abundance of traditional use plant species. Monitoring activities for traditional use plant species are identified in Table 2-3.

Mitigation measures identified in the Construction Environmental Protection Plan

- Carry out construction activities on frozen ground to minimize surface damage, rutting and erosion.
- Use existing access roads and trails to the extent possible.
- Remove trees by low ground disturbance methods that protect shrubs and understory.
- Confine vehicle traffic to established trails to the extent possible.
- In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan and for mitigation measures.
- Marshalling yards and/or worker accommodations will not be developed within in Spy Hill-Ellice Community Pasture.
- Tower foundations that limit disturbance of soil will be utilized within grassland habitat areas within the Spy Hill-Ellice Community Pasture.

Table 2-3. Monitoring activities for traditional use plant species, grassland and forest habitats.

Phase	Task Description	Parameter(s)	Site Location	Duration	Frequency	Timing	Measurable Parameter(s)
Baseline Information	Desktop, field surveys and reports from Indigenous communities	Species names and locations	Sites identified in PFA, LAA, RAA	1 field season	Once	2017	Species composition and abundance
Pre-construction	Ground surveys to identify traditional use plant species and monitor protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	1 field season	Once	2019	Species composition and abundance
Post-construction	Ground surveys to confirm traditional use plant species presence and monitor protection measures	Species occurrence	PFA in Spy Hill-Ellice Community Pasture	2 field seasons	Annual	2021, 2022	Species composition and abundance

3.0 METHODS

The methods used to assess the botanical and vegetation resources are divided into three general groups, those used for: i) project review and site selection; ii) environmental monitoring; and iii) data preparation and analyses. The following sections summarize the specific techniques used in each of these three groups.

3.1 Project Review and Sample Site Selection

Biophysical information collected and prepared for the Birtle Transmission Project with relevance to pre-construction surveys and subsequent environmental monitoring was reviewed prior to fieldwork. Available documents included the Birtle Transmission Project Environmental Assessment Report (Manitoba Hydro 2018a), the Biophysical Existing Environment Technical Report (Manitoba Hydro 2018b), the Environmental Monitoring Plan (Manitoba Hydro 2020a), the Construction Environmental Protection Plan Mapbook (Manitoba Hydro 2020b), the Botanical and Vegetation Pre-construction Survey (Szwaluk Environmental Consulting and Newman 2019), and the Pre-construction Invasive Plant Survey (Szwaluk Environmental Consulting 2020). The Environmental Monitoring Plan provides information on pre-construction and environmental monitoring requirements for vegetation (see also Appendix IV).

To select preliminary pre-construction and environmental monitoring sites for the Project, Manitoba Hydro's Environmental Protection Information Management System (EPIMS) Map Viewer was used to view proposed project footprint imagery (pre-clearing digital orthorectified imagery). EPIMS Map Viewer imagery includes information on land use, environmentally sensitive sites, and vegetation cover from the Manitoba land cover classification. Eighteen cover classes are identified, with broad vegetation classes including coniferous, deciduous and mixedwood forest, wetland and grassland.

Suitable sites were selected based on vegetation type in the Spy Hill-Ellice Community Pasture (e.g., grassland and forest). In 2021, previously surveyed sites (2017 and 2019) were reviewed to determine their location with reference to the final preferred route (FPR) RoW. Four sites previously sampled off-RoW (2017) were used for control sites during monitoring of the transmission line in the community pasture. Field maps (1:5,000) were provided by Manitoba Hydro prior to fieldwork (Construction Environmental Protection Plan Mapbook; Manitoba Hydro 2020b). The Community Pasture manager was contacted for permission to access sites.

Valued components of the biophysical environment to survey and monitor for the Birtle Transmission Project included grassland and forest habitat. Environmental indicators were identified based on regulatory, environmental and cultural importance, identified through

the environmental assessment process and preparation of the monitoring plan. Indicators included species of conservation concern, invasive plant species, and traditional use plant species.

3.2 Environmental Monitoring

This season (2021) represents Year I of post-construction monitoring. Pre-construction surveys for the project were conducted in 2017 and 2019. All surveys occurred on the final preferred route (with the exception of four off-RoW sites), and focused on collecting detailed vegetation information for the components identified important through the environmental assessment process.

Environmental monitoring involved native vegetation surveys (quantitative) and searches for species of conservation concern (non-quantitative surveys) in selected habitats along the final preferred route in the community pasture. In 2021, environmental monitoring included sites for grassland habitat (PRA), forest habitat (TER) and species of conservation concern (SCC).

3.2.1 Native Vegetation Surveys

Sites previously selected for native vegetation surveys were used for continued monitoring of grassland and forest habitat. The native vegetation survey consisted of establishing sample plots on sites with relatively homogenous vegetation. Vegetation was sampled for composition, abundance and structure.

Sampling of selected sites followed methods outlined by Redburn and Strong (2008) and involved the establishment of five 1 m² quadrats nested within 2.5 m² quadrats to sample herbs and low shrubs (≤ 1 m) and tall shrubs and saplings ($>1 - 2.5$ m), respectively. Quadrats were spaced at 5 m increments along a 30 m transect, starting at the 5 m mark. The composition of vegetation cover >2.5 m tall was estimated using a 20 m by 30 m plot centered on each transect. Plant cover was estimated to the nearest 1% for species $<15\%$ cover and nearest 5% for those with higher cover. Other incidentally observed species were recorded. Ground cover estimates (percent) were recorded and included inanimate cover of exposed soil, litter, rock, water and wood. Site condition measurements included percent slope and aspect. Plot locations were marked at the beginning of each transect with GPS coordinates, and staked with a 30 cm section of conduit pipe driven into the ground with a pin flag inserted.

3.2.2 Species of Conservation Concern

Species of conservation concern encompass plants tracked by the Manitoba Conservation Data Centre (MBCDC), and include those listed provincially under Manitoba's *Endangered Species and Ecosystems Act* (ESEA), or federally under the *Species at Risk Act* (SARA) or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Species are ranked provincially by the MBCDC according to a standardized procedure used by Conservation Data Centres and Natural Heritage Programs in North America on a five-point scale from Critically Imperilled to Secure. Listed below are definitions for interpreting conservation status ranks at the subnational or provincial (S) level. Ranks may also be intermediary between levels.

CRITICALLY IMPERILLED (S1): At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

IMPERILLED (S2): At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

VULNERABLE (S3): At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

APPARENTLY SECURE (S4): At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

SECURE (S5): At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

Under ESEA, SARA and COSEWIC, species are designated into the following categories: Endangered, Threatened, Extirpated, and Special Concern (See Appendix I).

Searches for species of conservation concern initially involve the review of species previously documented along the FPR RoW. Post-construction monitoring occurred at environmentally sensitive sites to investigate species presence/absence after RoW clearing activities.

In the field, a combination of meander and transect plant searches are used following methods outlined by the Alberta Native Plant Council (2012). Parallel transects are favoured

in more open and homogenous landscapes, while meander searches are conducted in areas of difficult terrain, unique habitats, and where unusual landscape features occur. Where tracked plants are observed and monitored, the following information is recorded: GPS coordinates, number of individuals, population extent (metres), phenology and photographs.

3.3 Data Preparation and Analyses

All vascular plants were recorded and voucher specimens were collected for those unidentifiable in the field, where the population size permits. Specimens were collected following guidelines of the Alberta Native Plant Council (2006). Identification of vascular plants followed Flora of North America (1993+), and other flora as needed. Plant nomenclature followed the Manitoba Conservation Data Centre (MBCDC 2020).

Upon completion of field sampling, the data was digitized and verified for accuracy. For each plot with quantitative sampling, mean values for vegetation percent cover were calculated in plots for tree and tall shrub strata, herb and low shrub understory, the non-vascular stratum, as well as inanimate ground cover.

Total species cover (summed % plant cover) and species richness (actual number of species present) were determined for each plot. Species diversity was calculated using the Shannon diversity index which combines species richness with relative abundance. Equitability was calculated to determine the evenness of species in their distribution within the site.

The Shannon diversity index (1) and equitability (2) are calculated as shown below. The diversity index values fall generally between 1.5 (i.e. low diversity) and 3.5 (Kent and Coker 1996, p97). The equitability (or evenness) value, with an upper limit of 1, is a measure of whether species abundance in a community is evenly distributed.

$$(1) \quad \text{Diversity } H' = -\sum_{i=1}^s p_i \ln p_i$$

where s = the number of species

p_i = the proportion of individuals or the abundance of the i th species expressed as a proportion of total cover

\ln = log base _{e}

$$(2) \quad \text{Equitability } J = \frac{H'}{H'_{\max}} = \frac{\sum_{i=1}^s p_i \ln p_i}{\ln s}$$

where s = the number of species

p_i = the proportion of individuals of the i th species or the abundance of the i th species expressed as a proportion of total cover

\ln = log base _{e}

Although recent research suggests that H' is becoming an expected standard for assessing biological diversity, Strong (2016) suggests that this measure be accompanied by independent analyses of richness and evenness to ensure proper representation of abundance data in ecology.

Wilcoxon tests were used to determine if significant ($P \leq 0.05$) differences occurred between paired sets of samples.

Sites were described by classifying community types based on plant species composition and abundance using hierarchical cluster analysis. Ward's method was used as the clustering algorithm, with squared Euclidean distance as the dissimilarity measure. Where vegetation community types are listed, naming was based on their structure and species dominance by stratum. Species separated by a slash (/) indicates a change in stratum, while co-dominant species are separated by a dash (-) indicating similar abundance within the stratum. Stand cover followed categories identified in The Canadian Vegetation Classification System (Strong et al. 1990) and included closed (>60%), open (>25-60%), and sparse ($\leq 25\%$).

Statistical analyses were performed using the R Statistical Package (R Core Team 2019). Cluster analyses followed (Maechler et al. 2019) in the R Statistical Package. Diversity and evenness measures were calculated in Excel.

4.0 RESULTS

The Birtle Transmission Project identified two valued components for vegetation, including grassland habitat and forest habitat. Within each valued component, three environmental indicators were identified: invasive plant species; traditional use plant species; and species of conservation concern.

This section discusses the results for the valued components and environmental indicators as follows: grassland (prairie habitat, PRA), forest (terrestrial habitat, TER), invasive plant species, traditional use plant species, and species of conservation concern. The botanical summary for grassland and forest sites includes total species cover, species richness, and species diversity measures. Approximately 177 plant species, across 43 families were recorded during sampling in 2021. The complete project flora is listed in the Appendix VII.

4.1 Grassland Habitat

Twelve grassland sites (PRA) were visited between July 5 to 10, 2021 within the Spy Hill-Ellice Community Pasture. Ten sites are located on the RoW, last sampled in 2019. An additional two sites, initially sampled in 2017, were visited off the RoW (Map 4-1, Appendix II) (Field Activity ID BTP_LTM_FA563). The initial surveys (2017, 2019) on the RoW represent baseline data collected prior to construction activities.

Prairie sites in the community pasture are dominated by native grasses, with a diversity of native forbs, few low shrubs, and a general absence of trees and tall shrubs. Very few non-native species are observed in plots. Photograph 4-1a shows the grassland after construction activities, near Tower 129.



Photograph 4-1a. Community pasture grassland post-construction, near Tower 129.

4.1.1 Data Analysis of Grassland Habitat

All grassland survey sites are monitored for traditional use species, species of conservation concern, and invasive species. Incidental searches (adjacent to sites but on the RoW) are also undertaken throughout monitoring. As an indication of the diversity of these grasslands, species cover, richness, diversity and evenness are provided in Table 4-1a.

Grassland sites on the RoW averaged 55% total herbaceous and low shrub cover, ranging from 43% to 69%. Richness at sites ranged between 32 to 43 species. A non-vascular cryptogamic cover was observed in all sites, with abundant cover in many sites. This tightly enmeshed assemblage of lichens and mosses has been shown to increase nutrient and moisture availability to plants, and protects against erosion, particularly on sandy soils (Bellnap et al. 2001), reducing the availability of bare soil. On the RoW, there was effectively no change for either mean cover ($p=0.3$) or richness ($p=0.07$) between pre-construction and Year I monitoring. Both the diversity and evenness measures were slightly higher (both $p<0.01$) in 2021 compared to pre-construction values, a pattern that was also noted in the two off-RoW sites sampled in Year I monitoring, Table 4-1a.

Table 4-1a. Vegetation measures in the herb and low shrub layer in grassland (PRA) sites on-RoW, Year I: mean species cover (%), species richness, diversity and evenness. Mean values on-RoW and off-RoW Year I, and pre-construction means (2019).

Sites	Cover	Richness	Diversity	Evenness
PRA-26	50.0	32	2.76	0.80
PRA-51	61.6	35	2.57	0.72
PRA-52	66.2	36	2.76	0.77
PRA-53	43.4	35	2.93	0.82
PRA-54	47.6	40	3.12	0.85
PRA-55	47.6	40	3.14	0.85
PRA-56	63.2	43	2.62	0.70
PRA-57	69.0	33	2.29	0.66
PRA-58	59.8	36	2.75	0.77
PRA-59	43.0	38	3.09	0.85
Year I on-RoW	55.1	36.8	2.80	0.78
Year I off-RoW	65.1	34.5	2.80	0.79
Pre-Constr (2019)	49.3	34.0	2.17	0.61

4.1.1.1 Grassland Cluster Analysis and Community Typing

Hierarchical cluster analyses were conducted for all twelve grassland surveys sampled (ten sites on-RoW, and two off-RoW), to determine whether sites were distinguished based on their vegetation structure, species assemblages and cover. As the inclusion of off-RoW sites did not alter the clustering structure of the sites on-RoW, they are considered in the analysis

of all grassland sites. Sites surveyed were diverse communities made up of a balanced mix of native forbs and grasses, with virtually no non-native or invasive species found in plots. Grassland sites are dominated by a diversity of native grasses and sedges including blue grama grass (*Bouteloua gracilis*) and western porcupine grass (*Hesperostipa curtisetata*), with blunt sedge (*Carex obtusata*), little bluestem (*Schizachyrium scoparium*), sand reedgrass (*Sporobolus rigidus*), and plains rough and rocky mountain fescues (*Festuca hallii* and *F. saximontana*, respectively). Widespread and abundant forbs include three-flowered avens (*Geum triflorum*), prairie rose (*Rosa arkansana*), prairie spike-moss (*Selaginella densa*), pasture sage (*Artemisia frigida*) and great-flowered gaillardia (*Gaillardia aristata*). The three community types are identified (Table 4-1b).

Table 4-1b. Community types for 12 grassland surveys, 2021.

Grassland Community	Surveys	Species, total	Species, mean
Blue Grama-Prairie Crocus-Cryptogam	2	44	34.5
Creeping Juniper-Plains Rough Fescue	4	64	38.0
Three-flowered Avens-Prairie Rose-June Grass, Sand Reedgrass	6	71	36.0

Blue Grama –Prairie Crocus –Cryptogam Grassland

Two sites (BTP-PRA-52, -57) are distinguished by a high cover counts of blue grama and western porcupine grass. Frequent forbs include prairie crocus (*Pulsatilla nuttalliana*), purple prairie clover (*Dalea purpurea*), hairy-golden aster (*Heterotheca villosa*) and prairie spike-moss. Overall, this group of sites has slightly more grass cover than forb cover (57:43), and the least representation of low woody growth overall (0.5%). Cover of ground litter (35%) in these sites is low, relative to other sites. A relatively dense cryptogamic mat of non-vascular plants lichens and mosses (58.8% cover) in this group particularly, keeps bare ground levels very low (2.3%) in these and all sites.

Creeping Juniper –Plains Rough Fescue Grassland

Four grassland sites (BTP-PRA-55, -56, and the two sites off-RoW BTP-28, -32) are grouped together based on an abundant cover of the low shrub creeping juniper (*Juniper horizontalis*), which lends to the relatively high cover of woody growth in these sites (17%). Plains rough fescue is recorded from three grassland sites overall, two of which fall into this community type. Little bluestem and western porcupine grass are present with occasional plains porcupine grass (*Hesperostipa spartea*). Frequent and abundant forbs include hoary puccoon (*Lithospermum canescens*) and beautiful sunflower (*Helianthus pauciflorus* ssp. *subrhomboideus*). Overall, these sites have relatively less grass cover than forb cover (38:62). Cryptogamic ground cover is relatively low in these sites (16.5%), and bare ground cover is negligible (0.4%).

Three-flowered Avens—Prairie Rose Grassland

Six sites (BTP-PRA-26, -51, 53, -54, -58, -59) are distinguished by a higher cover of three grasses: western porcupine grass, with sand reedgrass and june grass (*Koeleria macrantha*). Common and abundant forbs are three-flowered avens, prairie rose and prairie spike-moss. Overall, these sites are balanced in grass and forb cover (50:50) and have relatively reduced cover of low woody growth overall (4.9%). Cryptogamic ground cover is also relatively reduced in these sites (17.5%), as is bare ground cover (2.1%)

4.1.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For project clearing and construction activities in 2020/2021, the effect predictions on grassland habitat, from the EA and Biophysical Existing Environment Technical Report (Appendix III) included the following:

- Disturbance to native grasslands and a reduction in floristic diversity from construction and maintenance activities.
- Introduction and spread of non-native and invasive species during construction and maintenance activities.
- Disturbance or removal of traditional use plants during clearing and construction activities.
- Loss of plant species of conservation concern during construction and maintenance activities.
- Loss or impairment of desirable plant species from herbicide application during maintenance activities.
- Loss or impairment of vegetation from the accidental release of fuels or hazardous substances from construction and maintenance activities.

The predicted effects on grassland habitat were minimal or did not occur as a result of the project, and are discussed below. The grassland sites in the community pasture appear to be in excellent condition after recent clearing and construction activities last winter. The presence of bare ground along the RoW in the vicinity of PRA sites continues to be infrequent, generally due to animal activity. The equipment path is apparent however in some areas of the community pasture on the RoW but appeared to have minimal soil disturbance (Photograph 4-1b). Horizontal juniper (*Juniperus horizontalis*), a low shrub that grows abundantly in some areas of the pasture has appeared to have sustained mechanical damage (broken or dead branches) where juniper growth intersected the equipment path. Tower sites visited had minimal disturbance to soil and vegetation in the footing area, generally restricted to only a small patch (<2 x 2 m) of soil disturbance under each of the four supporting tower feet (Photograph 4-1c). Some tower feet appeared to have a small bowl

around the foot possibly from cattle activity. Floristic diversity in grassland sites after construction activities was slightly higher in the community pasture. Mean on-RoW diversity increased from 2.2 during pre-construction to 2.8 this season, both on and off RoW.



Photograph 4-1b. Equipment path on the RoW of the community pasture.



Photograph 4-1c. Minimal ground disturbance at Tower footing 122, near site PRA-53.

No Tier 1 or Tier 2 noxious species were noted during PRA sampling on the RoW or vicinity, in the community pasture at any time during pre-construction surveys (2017, 2019) or Year I monitoring (2021) (see Section 4.3). Indigenous communities use a variety of plant species that were identified from Indigenous engagement and land use studies. In grassland sites, minimal disturbance of traditional use plants was observed after construction activities. Section 4.4 discusses vegetation cover for traditional use plants on the RoW. As a result of project construction activities, a potential loss of plant species of conservation concern was identified in the environmental assessment. In 2021, species of conservation concern were observed within every grassland monitoring site. Of the Critically Imperilled and Imperilled species, sand millet (*Dichanthelium wilcoxianum*, S2?) was recorded in seven PRA sites (see Section 4.5).

No loss or impairment of vegetation occurred from the accidental release of fuels or hazardous substances from construction activities, and no herbicide application occurred in the community pasture.

Mitigation measures identified in the Construction Environmental Protection Plan Mapbook (Manitoba Hydro 2020b) were assessed at each grassland site sampled, see Table 4-1c. Environmental indicators of grassland habitat included species of conservation concern, invasive plant species, and traditional use plant species. Construction activities occurred on frozen ground conditions minimizing surface damage, rutting and erosion; existing access roads were used and vehicle traffic followed established trails to the extent possible; minimal disturbance occurred at tower foundations; and marshalling yards were not established in the community pasture. Through environmental monitoring, it was determined that the recommended mitigation was implemented and effective for grassland habitat, according to the minimal disturbance observed from construction activities. In particular, the mitigation techniques used to address soil and vegetation disturbance through surface damage, rutting and erosion, and the mitigation around tower erection and foundations were all highly successful in reducing or eliminating instances of grassland habitat disturbance.

Table 4-1c. Mitigation measures assessed at sites monitored for grassland habitat on the RoW.

Mitigation Measure	P R A - 2 6	P R A - 2 8	P R A - 3 2	P R A - 5 1	P R A - 5 2	P R A - 5 3	P R A - 5 4	P R A - 5 5	P R A - 5 6	P R A - 5 7	P R A - 5 8	P R A - 5 9
Carry out construction activities on frozen ground to minimize surface damage, rutting and erosion.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Use existing access roads and trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Remove trees by low ground disturbance methods that protect shrubs and understory.	-	-	-	-	-	-	-	-	-	-	-	-
Confine vehicle traffic to established trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan and for mitigation measures.	-	-	-	-	-	-	-	-	-	-	-	-
Marshalling yards and/or worker accommodations will not be developed within in Spy Hill-Ellice Community Pasture.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tower foundations that limit disturbance of soil will be utilized within grassland habitat areas within the Spy Hill-Ellice Community Pasture.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations.

4.2 Forest Habitat

Twelve sites were visited to sample forest habitat (TER) in 2021 (August 9 to 12) in the Spy Hill-Ellice Community Pasture (Map 4-1, Appendix II) (Field Activity ID BTP_LTM_FA564). Of these sites, 10 are located on the final preferred route while two sites were selected for monitoring off-RoW. Sample sites were previously established in 2017 and 2019, and represent baseline data collected prior to construction activities. All forested and previously forested sites consist of a young open aspen canopy.

4.2.1 Data Analysis of Forest Habitat

All forested survey sites are monitored for traditional use species, species of conservation concern, and invasive species. Incidental searches (adjacent to sites but on the RoW) are also undertaken throughout monitoring. Vegetation descriptions are shown below for species cover, richness, diversity and evenness, provided in Table 4-2a.

The total understory vegetation cover for forested sites on the RoW averaged 43%, ranging from 29% to 57.2%. Species richness on the RoW was generally high. The lower diversity apparent on the western side of the pasture in BTP-TER-67, -68 and -69 may be due to the small, fragmented nature of the original forest patch. In addition, the understory of BTP-TER-68 has a greater representation of non-native smooth brome and naturalized Kentucky bluegrass.

On the RoW, mean cover in 2021 has decreased ($p=0.01$) in the understory (43%) from pre-construction values (67%). Mean understory species richness in 2021 is also slightly lower (23 species) than pre-construction (26 species), ($p<0.01$). However, diversity and evenness measures were higher in the current year (both $p<0.01$) than in pre-construction surveys, Table 4-2a. In two off-RoW sites sampled in Year I monitoring, cover and richness values are higher than those measured on the RoW this year. However, the diversity measures in sites off-RoW show a similar pattern, with higher values in Year I than measured pre-construction.

Table 4-2a. Vegetation measures in the herb and low shrub layer in forested (TER) sites on-RoW, in Year I: mean species cover (%), species richness, diversity and evenness. Mean values on-RoW and off-RoW Year I, and pre-construction means (2019).

Sites	Cover	Richness	Diversity	Evenness
TER-25	52.6	29	2.50	0.74
TER-61	57.2	25	2.47	0.77
TER-62	29.8	28	2.80	0.84
TER-63	29.4	24	2.31	0.73
TER-64	29.0	19	2.29	0.78
TER-65	40.0	24	2.66	0.84
TER-66	40.2	20	2.44	0.81
TER-67	49.8	19	1.92	0.65
TER-68	54.6	16	1.72	0.62
TER-69	47.4	22	2.02	0.65
Year I on-RoW	43.0	22.6	2.31	0.74
Year I off-RoW	58.1	28.5	2.51	0.75
Pre-Constr (2019)	66.6	26.2	1.74	0.54

4.2.1.1 Forest Cluster Analysis and Community Typing

Hierarchical cluster analyses were conducted for ten forest surveys sampled on the RoW. While the clustering of the sites based on understory was very strong, the sites off-RoW were not included as they changed the data structure slightly by pulling a single site (BTP-TER-61) into their otherwise unique off-RoW group. All sites were previously open canopies of trembling aspen, with an understory currently dominated by forb cover (41%) and a very low cover of grasses and sedges (3%). All sites have a very high ground cover of woody debris (99%), and a negligible cover of bare soil (0.3%). Interestingly, the community types were also grouped following the geographic placement of sites, i.e., sites within groups were adjacent to each other. Differences in the composition and structure of the understory among sites, and perhaps their geographical location, resulted in three forest community types, (Table 4-2b).

Table 4-2b. Community types for 10 forest surveys, 2021.

Forest Community	Surveys	Species, total	Species, mean
Herb Rich- Tree and Tall Shrub Seedling	3	46	27.3
Herb Rich- Low Shrub	4	37	21.8
Herb Poor- Tree Seedling and Low Shrub	3	35	19

Herb Rich –Tree and Tall Shrub Seedlings: Trembling Aspen –Bur Oak –Saskatoon Forest Community

Three sites (BTP-TER-25, -62-, -62) are distinguished by a diverse species assemblage (27 species), with an understory cover consisting primarily of herbs (12% mean cover; 16 species) and Saskatoon (*Amelanchier alnifolia*) seedlings. Trembling aspen seedlings are also prominent in the understory, (10%). Occasional bur oak seedlings and trembling aspen saplings occur in two of the three sites in this group. Commonly occurring and relatively abundant herbs include vetchlings (*Lathyrus ochroleucus* and *L. venosus*), two-leaved Solomon’s-seal (*Maianthemum canadense*), Lindley’s aster (*Symphyotrichum ciliolatum*) and poison ivy (*Toxicodendron rydbergii*). The average total vegetation cover in these sites is 47%. These three sites occur on the RoW at the farthest east end of the pasture. Here, the land is slightly more sloped than at the pasture’s western edge. Also, these sites are a part of a much larger patch of forest, originally with fewer openings and less edge habitat.

Herb Rich –Low Shrub: Raspberry and Rose Forest Community

Four sites (BTP-TER-63, -64, -65, -66) are characterized by a predominant understory cover of low shrubs (16%) consisting of wild red raspberry (*Rubus idaeus*) and roses, and diverse herbs (8% mean cover; 12 species). Common and abundant herbs include wild peavine (*Lathyrus venosus*), two-leaved Solomon’s-seal, star-flowered Solomon’s-seal (*Maianthemum stellatum*) and American purple vetch (*Vicia americana*). Trembling aspen seedlings were sparse in sites (4% cover), and graminoid cover is very low (2%). The mean total vegetation cover in these sites is 35%. These three sites were grouped on the RoW in the central portion of the pasture, located along a ridge, within two moderately large patches of forest.

Herb Poor –Tree and Low Shrub: Trembling Aspen, Raspberry and Snowberry Forest Community

Three sites (BTP-TER-67, -68, -69) are distinguished by a predominant cover of aspen seedlings (21%) and low shrubs (18%) in the understory, consisting of wild red raspberry and western snowberry (*Symphoricarpos occidentalis*). Herb cover is low (4%; 8 species) with e.g., northern bedstraw (*Galium boreale*) and smooth aster (*Symphyotrichum laeve*). The mean total vegetation cover is highest in this group at 51%, however the diversity measures

for this group were below average for forest sites overall. These three sites were grouped on the RoW at the farthest west end of the pasture. The land here is quite flat, and the sites sampled represent forests that were originally open, small and fragmented.

4.2.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For project clearing and construction activities in 2020/2021, the effect predictions on forest habitat, from the EA and Biophysical Existing Environment Technical Report (Appendix III) included the following:

- Loss of native vegetation during construction and maintenance activities.
- Modification of vegetation composition and structure adjacent to the project footprint from clearing activities.
- Introduction and spread of non-native and invasive species during construction and maintenance activities.
- Disturbance or removal of traditional use plants during clearing and construction activities.
- Loss of plant species of conservation concern during construction and maintenance activities.
- Loss or impairment of desirable plant species from herbicide application during maintenance activities.
- Loss or impairment of vegetation from the accidental release of fuels or hazardous substances from construction and maintenance activities.

The effect predictions on forest habitat are discussed below. The predicted change in native vegetation cover as a result of the project was accurate for forest habitat. Tree cover in the RoW is required to be removed during clearing and construction activities for safe operation of the transmission line. Removal and long-term loss of RoW forest cover is an effect of transmission line development (Manitoba Hydro et al. 2003). Fragmentation from large-scale corridor projects is frequently an unavoidable consequence. Tree removal was confined to the limits of the RoW and trees were felled into the RoW, to not damage existing forest vegetation. Windfall (blow-down) of susceptible trees along the newly created forest edges was not observed from increased exposure. Modification of vegetation composition and structure adjacent to the Project Footprint due to clearing activities was not observed in the field. Photograph 4-2a shows clearing in forest habitat with low disturbance along the RoW.



Photograph 4-2a. Low disturbance from clearing activities along the RoW in forest habitat.

No Tier 1 or Tier 2 noxious species were noted on the RoW, during sampling in 2021. Occasional non-native species (Tier 3 or SNA) were noted in cleared TER sites, see Section 4.3. In forest habitat, clearing and construction activities have temporarily reduced traditional vegetation cover due to the removal of multiple vegetation strata, including the tree layer, tall shrub, and much low shrub and ground vegetation. Regeneration however was observed in the low shrub and herb stratum (≤ 1 m tall) during current monitoring (Photograph 4-2b). Section 4.4 discusses vegetation cover for traditional use plants on the RoW. Species of conservation concern were present in forest habitat after clearing and construction activities. Four species of conservation concern were recorded in TER plots, although three of these occurred uniquely in an off-RoW control plot (BTP-TER-27). An additional six species of conservation concern were found incidentally to TER plots, along the RoW (see Section 4.5).

No loss or impairment of vegetation occurred from the accidental release of fuels or hazardous substances from construction activities, and no herbicide application occurred in the community pasture.



Photograph 4-2b. Moderate to dense regeneration of trembling aspen and woody shrubs at site TER-64.

Mitigation measures identified in the Construction Environmental Protection Plan Mapbook (Manitoba Hydro 2020b) were assessed at each forest site sampled, see Table 4-2c. Environmental indicators of forest habitat included species of conservation concern, invasive plant species, and traditional use plant species. Construction activities occurred on frozen ground conditions minimizing surface damage, rutting and erosion; existing access roads were used and vehicle traffic followed established trails to the extent possible; trees were removed by low ground disturbance and minor soil disturbance (i.e., bare ground or rutting) was observed; and marshalling yards were not established in the community pasture. Through environmental monitoring, it was determined that the recommended mitigation was implemented and effective for forest habitat, according to the minimal ground disturbance observed from construction activities. In particular, the mitigation techniques used to address soil and vegetation disturbance through rutting and erosion, and tree removal techniques were highly successful in reducing or eliminating instances of ground surface damage in previously forested habitat.

Table 4-2c. Mitigation measures assessed at sites monitored for forest habitat on the RoW.

Mitigation Measure	T E R - 2 5	T E R - 2 7	T E R - 4 3	T E R - 6 1	T E R - 6 2	T E R - 6 3	T E R - 6 4	T E R - 6 5	T E R - 6 6	T E R - 6 7	T E R - 6 8	T E R - 6 9
Carry out construction activities on frozen ground to minimize surface damage, rutting and erosion.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Use existing access roads and trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Remove trees by low ground disturbance methods that protect shrubs and understory.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Confine vehicle traffic to established trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan and for mitigation measures.	-	-	-	-	-	-	-	-	-	-	-	-
Marshalling yards and/or worker accommodations will not be developed within in Spy Hill-Ellice Community Pasture.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations.

4.3 Invasive Plant Species

Invasive plant species were identified as an environmental indicator of both grassland and forest habitat. Surveys for all invasive species were included in quantitative surveys (PRA and TER), as well as incidentally along the RoW within the community pasture, and at in the vicinity of the spring site (SCC-BTP-73) (Map 4-1, Appendix II) (Field Activity ID BTP_LTM_FA563 and 564). Sampling occurred July 5 to 10 and August 9 to 12.

In Manitoba, the Noxious Weeds Regulation lists 89 plant species as noxious under the Noxious Weeds Act (Manitoba Agriculture and Resource Development 2021). The Regulation categorizes noxious weeds into three tiers of severity. Tier 1 noxious weeds are the most threatening species, harmful to livestock or agricultural crops. Responsibilities under the current Regulation include the following:

- Destroy all Tier 1 noxious weeds that are on land that a person owns or occupies;
- Destroy all Tier 2 noxious weeds that are on land that a person owns or occupies if the area colonized by weeds is less than 20 acres;
- Control all Tier 2 noxious weeds that are on land that a person owns or occupies if the area colonized by weeds is 20 acres or more; and
- Control a Tier 3 noxious weed that is on land that a person owns or occupies if the weed’s uncontrolled growth or spread is likely to negatively impact an aspect of Manitoba’s economy or environment of the land, or the well-being of residents in proximity to the land.

4.3.1 Data Analysis of Invasive Vegetation

Sixteen non-native species were recorded within the pasture, including those designated as noxious Tier 3 (seven species) or invasive (six species), either with cover in plot surveys (PRA, TER) or as incidental observations on the pasture. All species are ranked SNA (MB CDC 2020). No Tier 1 or Tier 2 species were observed at any time throughout fieldwork (2017, 2019 and 2021), within the community pasture. In addition, six non-native species are considered invasive in Manitoba due to their tendency to outcompete native species, and dominate habitats once introduced (Canadian Food Inspection Agency 2008; Invasive Species Council of Manitoba 2021). The remaining three species are considered non-native but non-invasive in Manitoba.

Most non-native species on the RoW were recorded in the vicinity of the spring (13 species). Within plots, six species were recorded in forested sites and two species were recorded from grassland sites. Together, the noxious, invasive and non-native species recorded on the RoW include nine plant families. The most prominently represented families are Asteraceae (five species), Fabaceae (three species) and Poaceae (two species). The number and incidence of species for noxious, invasive and non-native species recorded in the community pasture are shown in Table 4-3. The most frequently observed noxious species is common dandelion, followed by common lamb's-quarters (Photograph 4-3), both Tier 3. In PRA and TER sites, five species were recorded quantitatively with negligible cover (<1% on average) in plots, while three species were recorded only incidentally as presence. All species recorded at the spring (13 spp.) were incidentally occurring. Off-RoW, a single species (common dandelion) was found in one forested site.

Table 4-3. The noxious (Tier 3), Invasive (Inv) and non-native (Nn) species recorded in plots and incidentally in 2021.

Species	Common Name	PRA	TER	Spring	Status	Family
<i>Chenopodium album</i>	Common Lamb's-quarters	1	3	X	Tier 3	Chenopodiaceae
<i>Cirsium arvense</i>	Canada Thistle	-	-	X	Tier 3	Asteraceae
<i>Descurainia sophia</i>	Flixweed	-	-	X	Tier 3	Brassicaceae
<i>Fallopia convolvulus</i>	Black Bindweed	-	1	-	Inv	Polygonaceae
<i>Lactuca serriola</i>	Prickly Lettuce	-	1	-	Tier 3	Asteraceae
<i>Lappula squarrosa</i>	Bristly Stickseed	-	-	X	Inv	Boraginaceae
<i>Medicago lupulina</i>	Black Medick	-	-	X	Nn	Fabaceae
<i>Melilotus albus</i>	White Sweet Clover	-	-	x	Inv	Fabaceae
<i>Plantago major</i>	Common Plantain	-	-	x	Inv	Plantaginaceae
<i>Potentilla argentea</i>	Silvery Cinquefoil	2	-	-	Nn	Rosaceae
<i>Sonchus arvensis</i>	Field Sow-thistle	-	1	x	Tier 3	Asteraceae
<i>Taraxacum officinale</i>	Common Dandelion	-	9	x	Tier 3	Asteraceae

<i>Tragopogon</i> sp.	Goat's-beard	-	-	x	Nn	Asteraceae
<i>Trifolium pratense</i>	Red Clover	-	-	x	Inv	Fabaceae
<i>Bromus inermis</i>	Smooth Brome	-	1	x	Inv	Poaceae
<i>Setaria viridis</i>	Green Foxtail	-	-	x	Tier 3	Poaceae
Number of species		2	6	16		
Number of observations		3	16	n.c.*		

Note: n.c.* = not counted. A list of species was collected without noting the number of observations of each species.



Photograph 4-3. Common lamb's-quarters observed at Tower 121.

4.4 Traditional Use Plant Species

Traditional use plant species were identified as an environmental indicator in both grassland and forest habitat. Traditional use plants were recorded from quantitative surveys (PRA, TER) in the community pasture between July 5 to 10 and August 9 to 12, 2021 (Map 4-1, Appendix II) (Field Activity ID BTP_LTM_FA563 and 564).

Indigenous engagement for the Project included values and interest workshops from Canupawakpa Dakota Nation (Manitoba Hydro 2017a), Gambler First Nation (Manitoba Hydro 2017b) and Waywayseecappo First Nation (Manitoba Hydro 2017c), in part to identify traditionally important plant species. Plant and tree species currently used for traditional purposes in the RAA are also identified in the Metis land use and occupancy study

(MNP 2017). Traditional plant species important for sustenance, medicinal and cultural practices include at least 29 species (two trees, nine shrubs, 18 herbs) (Table 4-4a), compiled and summarized in the Biophysical Existing Environment Technical Report (Manitoba Hydro 2018b). Some activities such as berry picking and medicinal plant gathering do not necessarily specify a single plant species, e.g., 'Cranberry' may include several *Viburnum* species. Vegetation or community types identified as important to participants included trees, forests and pastures. Plant names from workshop reports and the land use and occupancy study are preserved here.

4.4.1 Data Analysis of Traditional Use Plant Species

In 2021, a total of 23 traditional use plant species were observed, comparable to pre-construction surveys (21 species) in 2017 and 2019. Species this season include two trees, seven tall shrubs, three low shrubs and 11 herbs (Table 4-4a). Of the traditional use species recorded this season in the pasture, 12 are found uniquely in forested sites, six are found uniquely in grassland sites, while two are found in both habitats. Three traditional use species are found uniquely at the spring site (BTP-SCC-73).

Traditional use plants are found throughout the pasture both in the understory of forested sites and in open grassland, Table 4-4b. The mean cover of all traditional use species is greatest in forested sites (27.8%) in Year I monitoring, due to the greater presence of woody growth in the understory as low shrubs (9.4%; roses, raspberry), tall shrub seedlings (6.4%; Saskatoon, cherries, willows, hazelnuts and cranberry), and tree seedlings (11.0%; primarily trembling aspen and bur oak). Traditional herbs are less abundant in the forest understory (mean cover 1.1%) and consist primarily of common dandelion and strawberry. Tall shrubs or tree saplings in the mid-canopy layer are sparse and infrequent in Year I. Woody growth in the mid-canopy layer in Year I is restricted to very sparse trembling aspen saplings in just four of 10 forested sites.

The lower mean abundance of traditional use plants in grassland sites Year I monitoring (4.5% cover) is due to the marked absence of woody seedlings from tall shrubs and trees. Low shrubs in grassland sites consist entirely of prairie rose (mean cover 2.6%), found in every site. Grassland sites have the greater abundance of traditional use herbs (mean cover 2.2%), which consist primarily of sages and crocus, with onion, strawberry and wood lily. The mid-canopy layer is absent in Year I, in grassland sites.

Table 4-4a. Traditional use plants identified from Indigenous engagement and land use studies, and those recorded in pasture sites in 2021.

Traditional Plants	Scientific Name	2021 Survey
Trees		
Trembling Aspen	<i>Populus tremuloides</i>	TER
Bur Oak	<i>Quercus macrocarpa</i>	TER
Shrubs		
Saskatoon	<i>Amelanchier alnifolia</i>	TER
Hazelnut	<i>Corylus</i> spp.	TER
Pin Cherry	<i>Prunus pensylvanica</i>	TER
Plum	<i>Prunus</i> spp.	-
Chokecherry	<i>Prunus virginiana</i>	TER
Roses*	<i>Rosa</i> spp.	PRA, TER
Raspberry	<i>Rubus idaeus</i>	TER
Red Willow*	<i>Salix</i> spp.	TER
Cranberry	<i>Viburnum</i> spp.	TER
Herbs and grass		
Weke/Rat Root	<i>Acorus americanus</i>	-
Wild Onion	<i>Allium</i> spp.	PRA
Sweetgrass	<i>Anthoxanthum hirtum</i>	-
Sage*	<i>Artemisia</i> spp.	PRA, TER
Prairie Turnip	<i>Brassica napus</i>	-
Lamb's Quarter	<i>Chenopodium album</i>	PRA, TER
Thistle	<i>Cirsium</i> spp.	SCC
Purple Coneflower	<i>Echinacea angustifolia</i>	-
Strawberry	<i>Fragaria virginiana</i>	PRA, TER
Tiger Lily	<i>Lilium philadelphicum</i>	PRA
Common Sweet Clover	<i>Melilotus</i> spp.	SCC
Wild Mint	<i>Mentha arvensis</i>	-
Seneca Root	<i>Polygala senega</i>	-
Crocus	<i>Pulsatilla</i> sp.	PRA
Bulrush	<i>Schoenoplectus</i> spp.	-
Dandelion	<i>Taraxacum officinale</i>	TER, SCC
Cattail	<i>Typha</i> spp.	-
Stinging Nettle	<i>Urtica dioica</i>	-

Note: *More than one species recorded.

The mean total traditional use plant cover before and after construction was comparable for grassland sites (4.0%) and the understory of forest sites (26.9%), as measured pre-construction (data not shown). However, the composition of woody growth in the understory of forested sites showed a change before and after construction. In pre-construction surveys, the mean cover of low growing shrubs in the forest understory was high (21.1%; vs 9.4% in Year I), while the mean cover of tall shrub seedlings (3.7%) and tree seedlings (0.4%) was much reduced, compared to their cover in Year I (6.4% and 11.0%, respectively). This pattern is as expected, as mid- and upper- canopies were removed and regeneration of woody species from these layers takes place. Pre-construction, the cover of

traditional herbs was also comparable to Year I for both grassland (2.0%) and forested (1.8%) sites (data not shown).

Table 4-4b. Traditional Use plants: Total understory vegetation cover by growth form and number of species, by site, 2021.

Sites	Total Understory Cover	Herbs	Low shrubs	Tall shrub seedl.	Tree seedl.	Species
PRA-26	5.8	4.0	1.8	-	-	4
PRA-51	4.2	3.2	1.0	-	-	3
PRA-52	2.4	2.4	-	-	-	4
PRA-53	6.4	1.2	5.2	-	-	3
PRA-54	8.4	2.0	6.4	-	-	5
PRA-55	1.6	1.2	0.4	-	-	3
PRA-56	1.4	0.8	0.6	-	-	4
PRA-57	3.4	2.6	0.8	-	-	5
PRA-58	3.4	1.2	2.2	-	-	4
PRA-59	8.2	3.2	5.0	-	-	5
mean PRA	4.5	2.2	2.6	-	-	4.0
TER-25	27.0	1.2	2.2	10.4	13.2	10
TER-61	37.0	1.8	4.8	19.6	10.8	9
TER-62	14.2	1.6	1.2	4.6	6.8	7
TER-63	21.0	1.4	15.6	1.2	2.8	10
TER-64	18.2	1.0	13.6	3.0	0.6	6
TER-65	26.0	0.6	12.2	6.6	6.6	10
TER-66	25.8	0.6	13.8	5.0	6.4	6
TER-67	37.0	0.8	11.0	3.6	21.6	7
TER-68	35.8	-	6.6	5.2	24.0	6
TER-69	36.4	0.6	13.2	5.2	17.4	8
mean TER	27.8	1.1	9.4	6.4	11.0	7.9

Photograph 4-4 shows a grassland site (PRA-26) sampled with higher cover of traditional use plants. In forested sites, a high cover of traditional use plants is generally represented by sites with good woody regeneration (see also previous Photograph 4-2b).



Photograph 4-4. Grassland site PRA-26 with higher cover of traditional use plants, adjacent to existing trail.

4.5 Species of Conservation Concern

Species of conservation concern were identified as an environmental indicator of both grassland and forest habitat. Species of conservation concern were recorded from quantitative sites, SCC surveys, and incidentally along the RoW, between July 5 to 10 and August 9 to 12, 2021 (Map 4-1, Appendix II) (Field Activity ID BTP_LTM_FA563 and 564). No species listed by the federal *Species at Risk Act*, the Manitoba *Endangered Species and Ecosystems Act* or listed by the Committee on the Status of Endangered Wildlife in Canada were observed during fieldwork.

Thirty-four species of conservation concern were observed along the RoW in 2021, summarized in Table 4-5a. Among these species, six are ranked Critically Imperilled or Imperilled (S1-S2?) including sun sedge (*Carex inops* ssp. *heliophila*, S1?), small-wing sedge (*Carex microptera*, S1); sand millet (*Dichanthelium wilcoxianum*, S2?); tufted fleabane (*Erigeron caespitosus*, S1); Geyer's monkeyflower (*Erythranthe geyeri*, S1); and showy locoweed (*Oxytropis campestris* var. *spicata*, S1). The remaining 28 species are ranked as Vulnerable (S3-S3S5).

Table 4-5a. Species of conservation concern recorded in the community pasture, on the RoW, 2021.

Scientific Name	Common Name	Rank
Critically Imperilled and Imperilled Species (S1-S2?)		
Sun Sedge	<i>Carex inops</i> ssp. <i>heliophila</i>	S1?
Small-wing Sedge	<i>Carex microptera</i>	S1
Sand Millet	<i>Dichanthelium wilcoxianum</i>	S2?
Tufted Fleabane	<i>Erigeron caespitosus</i>	S1
Geyer's Monkeyflower	<i>Erythranthe geyeri</i>	S1
Showy Locoweed	<i>Oxytropis campestris</i> var. <i>spicata</i>	S1
Vulnerable Species (S3-S3S5)		
Ground-plum	<i>Astragalus crassicaarpus</i>	S3S4
Hooker's Oat Grass	<i>Avenula hookeri</i>	S3S4
Porcupine Sedge	<i>Carex hystericina</i>	S3
Blunt Sedge	<i>Carex obtusata</i>	S3S4
Chamaerhodos	<i>Chamaerhodos erecta</i> ssp. <i>nuttallii</i>	S3S4
Goosefoot	<i>Chenopodium pratericola</i>	S3
Smooth Scouring-rush	<i>Equisetum laevigatum</i>	S3S4
Rough Fleabane	<i>Erigeron strigosus</i>	S3S5
Prairie-rocket Wallflower	<i>Erysimum asperum</i>	S3S4
Plains Rough Fescue	<i>Festuca hallii</i>	S3
Beautiful Sunflower	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	S3S4
Needle-and-thread Grass	<i>Hesperostipa comata</i>	S3S4
Western Porcupine Grass	<i>Hesperostipa curtisetata</i>	S3S4
Long-leaved Bluets	<i>Houstonia longifolia</i>	S3S5
Narrow-leaved Puccoon	<i>Lithospermum incisum</i>	S3
Hairy Umbrellawort	<i>Mirabilis albida</i>	S3S4
White Evening-primrose	<i>Oenothera nuttallii</i>	S3S4
Shrubby Evening-primrose	<i>Oenothera serrulata</i>	S3
Indian Breadroot	<i>Pedimelum esculentum</i>	S3S4
White Beard-tongue	<i>Penstemon albidus</i>	S3S4
Lilac-flowered Beard-tongue	<i>Penstemon gracilis</i>	S3S4
Moss Pink	<i>Phlox hoodii</i>	S3
Divided-leaved Cinquefoil	<i>Potentilla concinna</i> var. <i>divisa</i>	S3
Pennsylvania Cinquefoil	<i>Potentilla pensylvanica</i>	S3S4
Little Bluestem	<i>Schizachyrium scoparium</i>	S3S4
Prairie Spike-moss	<i>Selaginella densa</i>	S3
Sand Dropseed	<i>Sporobolus cryptandrous</i>	S3S5
Sand Reedgrass	<i>Sporobolus rigidus</i>	S3S5

The species of conservation concern observed are species restricted to open habitats, either upland prairie (including sandy soils) or wetlands, Table 4-5b. Twenty-nine species were recorded in grassland sites, while nine are recorded from (previous) openings in forested sites. Three wetland obligate species were recorded uniquely at the spring site (BTP-SCC-73).

Table 4-5b. Distribution of species of conservation concern 2021: counts of species by survey and habitat, with total number of observations.

	Total	PRA	TER	Spring
Critically Imperilled and Imperilled: S1-S2?	6	4	-	2
Vulnerable: S3-S3S5	28	25	7	6
Total # species	34	29	13	8
Total # observations	155	142	13	n.c.*

Note: n.c.* = not counted. A list of species was collected from spring, without noting the number of observations of each species.

Of the Critically Imperilled species recorded from within the community pasture two species are also Nationally Imperilled: Geyer’s monkeyflower and sand millet. Habitat and biological information for Critically Imperilled and Imperilled species below are taken from the following references: Leighton and Harms 2014; Leighton 2012; Flora of North America 1993+; and Looman and Best 1987. Saskatchewan sub-national ranks follow the Saskatchewan Conservation Data Center (SK CDC 2021).

- *Carex inops* ssp. *heliophila* (Sun Sedge) S1?; N5; G5. Dry prairie, especially on sandy soils. This species was recorded in one grassland site. Sun sedge is likely more widespread in the community pasture, it is easily overlooked and cannot be identified without the fruiting body, (SK Rank: S5).
- *Carex microptera* (Small-wing Sedge) S1; N5; G5. Edges of moist forest and shrubland clearings, moist coulee bottoms. This species was sparsely distributed, found at several points along the spring (BTP-SCC-73), (SK Rank: S4).
- *Dichanthelium wilcoxianum* (Sand Millet) S2?; N2N3; G5. Dry, well-drained prairie slopes, pastures, sand dunes and open sandy pine woods. Recorded from seven grassland sites, and widespread, yet sparsely occurring throughout grassland sites on the RoW, (SK: S2).
- *Erigeron caespitosus* (Tufted Fleabane) S1; N5; G5. Dry prairie, and rocky or sandy, grassy hills, sagebrush-aspen. Tufted Fleabane is found in five grassland sites in the western portion of the community pasture, sometimes occurring abundantly. White

daisy-like flowers with yellow centers bloom in July-August, (SK: S4) (Photograph 4-5a).

- *Erythranthe geyeri* (Geyer's Monkeyflower) S1; N2; G5T5. Wet places, springs, southeastern parklands, creeping habit, yellow blooms July-August. This species was abundant along the edge of the water at the spring site (BTP-SCC-73), (SK: S2) (Photograph 4-5b).
- *Oxytropis campestris* var. *spicata* (Showy Locoweed) S1; N5; G5. Dry hillsides, grasslands open woods and prairie openings. Pale yellow blooms, May to July. This species was present or abundant in five grassland sites, (SK: S4).



Photograph 4-5a. Tufted fleabane observed at site PRA-57.



Photograph 4-5b. Geyer's monkeyflower observed at SCC-73.

4.6 Vegetation Management and Rehabilitation

In 2021, vegetation management and rehabilitation were provided by the vegetation monitoring team, where required. There continues to be an absence of non-native and invasive species noted in the PRA sampling sites of the community pasture; occasional non-native species (Tier 3 or SNA) were noted in cleared TER sites. Although no Tier 1 or 2 noxious weeds were observed in the community pasture, manual weed control of occasional non-native species (Tier 3 and SNA) elsewhere were managed (e.g., common lambs-quarter's), generally in areas of soil disturbance. Infrequent species were hand pulled, bagged and removed from the pasture.

Adjacent to the wetland spring on the community pasture, certain Tier 3 and non-native species were recorded in disturbed sandy soil on the RoW, early in the season (July), Photograph 4-6a. Whether due to cattle grazing and trampling of the soil later in the season (August), the cover of some of the weedy ruderals was absent or reduced. No weed control was required at the time of the surveys.



Photograph 4-6a. Abundant black medic (SNA) observed along the wetland spring.

Outside of the community pasture, one site was visited (INV-045) where a Tier 2 noxious plant species was observed during roadside surveys of the RoW in 2020. Scentless false mayweed (*Tripleurospermum inodorum*) was previously observed in a single patch with sporadically occurring plants (7 m x 7 m). Management for this species was recommended last season and no individuals were observed at the site in 2021.

Overall, field observations on construction in the community pasture grassland sites were extremely favourable, with minimal soil disturbance recorded. In previously forested sites, small areas of exposed soil were infrequently observed on the RoW. Construction appeared to have been undertaken while the native ground cover was protected by a layer of snow.

Frequently the towers were installed, showing minimal soil disturbance at the footing (e.g., Tower 120), Photograph 4-6b. Little to no bare ground was noted from construction activities, which should contribute to the prairie's resilience against the colonization of non-native and invasive species. Where occasional disturbance was observed, these were small areas of exposed soil 1 to 2 m² (to 4 m²), generally on the equipment path, on slopes, or near tower footings. Photograph 4-6c shows disturbance from a cattle trail in sandy soil. With no larger areas of disturbance during sampling in the pasture, these areas were rehabilitated by hand broadcasting with a prescribed native species blend. After seeding, soil was lightly harrowed to ensure greater seed contact with soil. A custom native reclamation mix was

prepared by Skinner Native Seeds (local supplier) in 2021 for RoW disturbances. The species mix included awned wheatgrass (*Elymus trachycaulus* ssp. *subsecundus*, 20%), blue grama (*Bouteloua gracilis*, 10%), rough fescue (*Festuca hallii*, 10%), little bluestem (*Schizachyrium scoparium*, 10%), western porcupinegrass (*Hesperostipa curtisetata*, 10%), and purple prairie clover (*Dalea purpurea*, 40%).



Photograph 4-6b. Tower 120 installed with minimal soil disturbance.



Photograph 4-6c. Cattle trail along a slope adjacent to TER-63.

4.7 Hypothesis Testing

Two hypotheses were proposed for environmental monitoring of botanical and vegetation resources for the Project, with the intent to focus on the relationship between vegetation growth and clearing and construction activities.

Hypothesis 1 (*There are observed differences in species composition within sites being monitored over successive years along the transmission line right-of-way*) proved to be true in Year I post-construction monitoring for forested sites. Lower mean species richness values ($p < 0.01$) were observed in the herb and low shrub layer between pre-construction and Year I monitoring (26.2 and 22.6, respectively). In grassland sites, average species richness showed similar values ($p = 0.07$) between pre-construction and Year I monitoring (34.0 and 36.8), and values were comparable between on and off-RoW sampling in 2021. Hypothesis 1 will be again tested in Year II post-construction monitoring (2022) for grassland and forested sites.

Hypothesis 2 (*Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way*) appears to be false in Year I post-construction monitoring. There was a remarkable absence of non-native and invasive species in the community pasture during pre-construction surveys. This pattern continues, with low presence and cover of non-native and invasive species observed during Year I monitoring of quantitative sites. Most of the non-native species were recorded in the vicinity of the wetland spring where ground disturbance was apparent. Hypothesis 2 will be again tested in Year II post-construction monitoring (2022) for grassland and forested sites.

5.0 RECOMMENDATIONS

Based on the post-construction vegetation monitoring in 2021, the following are recommendations for the project:

1. In the community pasture, carry out project maintenance activities on frozen (ideally snow-covered) or dry ground conditions to minimize surface damage, rutting and erosion. Sandy soils found throughout the community pasture and along the RoW are extremely susceptible to disturbance. The ground cover of native vascular and non-vascular vegetation on sandy soils has poor resiliency to mechanical disturbance, which increases the prairie's vulnerability to the introduction and spread of invasive species.
2. Care must be taken that equipment and machinery used during maintenance activities does not import any invasive or non-native plant materials into the community pasture grassland. Removal of visible plant materials and mud/gravel from all vehicles prior to accessing the prairie can reduce the possibility of invasive species introduction.
3. In the community pasture, use existing access roads and trails and confine traffic to these locations, to the extent possible during maintenance activities.
4. Greater soil disturbance was noted at the site of the freshwater spring and resulting stream (SCC-73), particularly where clearing was required. Several Tier 3 noxious species (e.g., common dandelion, sow-thistle, common lamb's-quarters, Canada thistle, flixweed) and non-native species (smooth brome, black medick, sweetclovers, green foxtail, a goat's-beard, and bristly stickseed) were observed adjacent to the spring source and along the stream on the RoW where ground disturbance is apparent. Soil in areas where trees were cleared under the wires and adjacent to the spring were most disturbed, as well as along the bare sandy path around the spring. Many of these species were not recorded along the RoW previously in either 2017 or 2019. It is recommended that follow-up monitoring occur in the freshwater spring site to determine if future weed management may be required.
5. Tower 114 on private land in the Assiniboine River Valley (outside of the community pasture) should be visited to assess the rehabilitation implemented by the project contractor and level of revegetation occurring at the site. In 2021, it was learned that the rehabilitation utilized (i.e., straw blankets) in this area and degree of revegetation were unsuccessful on the shallow sandy soils.

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APPENDIX I. Definitions of selected technical terms.

Abundance-Dominance – This term expresses the number of individuals of a plant species and their coverage in a phytosociological survey; it is based on the coverage of individuals for classes with a coverage higher than 5% and on the abundance for classes with a lower percentage (Cauboue et al. 1996).

Angiosperm – A seed borne in a vessel (carpel); thus one of a group of plants whose seeds are borne within a mature ovary or fruit (Raven et al. 1992).

Bryophyte – A plant of the group Bryophyta; a liverwort, moss or hornwort (Johnson et al. 1995).

Canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees (Cauboue et al. 1996).

Canopy Closure – The degree of canopy cover relative to openings (Cauboue et al. 1996).

Classification – The systematic grouping and organization of objects, usually in a hierarchical manner (Cauboue et al. 1996).

Cluster Analysis – A multidimensional statistical technique used to group samples according to their degree of similarity (Cauboue et al. 1996).

Community-Type – A group of vegetation stands that share common characteristics, an abstract plant community (Cauboue et al. 1996).

Coniferous – Narrow-leaved evergreens; a cone-bearing plant belonging to the taxonomic group Gymnospermae (Cauboue et al. 1996).

Cover – The area of ground covered with plants of one or more species, usually expressed as a percentage (Cauboue et al. 1996).

Deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season (Cauboue et al. 1996).

Dicotyledon – One of the two divisions of the Angiosperms; the embryo has two cotyledons, the leaves are usually broad, stalked and net-veined. The flower parts are usually in fours or fives (Usher 1996).

Ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation (Cauboue et al. 1996).

Endangered Species - A species that is facing imminent extirpation or extinction (Government of Canada 2019).

Extirpated Species - A species that no longer exists in the wild in Canada, but exists elsewhere in the wild (Government of Canada 2019).

Flora - A list of the plant species present in an area (Cauboue et al. 1996).

Forb - A broad-leaved, non-woody plant that dies back to the ground after each growing season (Johnson et al. 1995).

Forest - A relatively large assemblage of tree-dominated stands (Cauboue et al. 1996).

Graminoid - A plant that is grass-like; the term refers to grasses and plants that look like grasses, i.e. only narrow-leaved herbs (Cauboue et al. 1996).

Grassland - Vegetation consisting primarily of grass species occurring on sites that are arid or at least well drained (Cauboue et al. 1996).

Gymnosperm - A seed plant with seeds not enclosed in the ovary; the conifers are the most familiar group (Raven et al. 1992).

Habitat - The place in which an animal or plant lives; the sum of environmental circumstances in the place inhabited by an organism, population or community (Cauboue et al. 1996).

Herb (Herbaceous) - A plant without woody above-ground parts, the stems dying back to the ground each year (Johnson et al. 1995).

Invasive - Invasive species are plants that are growing outside of their country or region of origin and are out-competing or even replacing native plants (Invasive Species Council of Manitoba 2021).

Mitigation - Often the process or act of minimizing the negative effects of a proposed action (Cauboue et al. 1996).

Mixedwood - Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover (Cauboue et al. 1996).

Monocotyledon - A class of the Angiosperms; the seeds have a single cotyledon, the floral parts are in three or multiples of three, and the leaves have parallel veins (Usher 1996).

Non-vascular Plant - A plant without a vascular system (eg. mosses and lichens).

Noxious Weed – A plant that is designated as a tier 1, tier 2 or tier 3 noxious weed in the regulations and includes the seed of a noxious weed, whether it is still attached to the noxious weed or is separate from it (Manitoba Government 2021).

Plot – A vegetation sampling unit used to delineate a fixed amount of area for the purpose of estimating plant cover, biomass, or density (Cauboue et al. 1996).

Pteridophyte – A division of the plant kingdom including ferns and their allies (horsetails and clubmosses).

Rare Species – Any indigenous species of flora that, because of its biological characteristics, or because it occurs at the fringe of its range, or for some other reasons, exists in low numbers or in very restricted areas of Canada but is not a threatened species (Cauboue et al. 1996).

Shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base (Cauboue et al. 1996).

Site – The place or category of places, considered from an environmental perspective, that determines the type and quality of plants that can grow there (Cauboue et al. 1996).

Species – A group of organisms having a common ancestry that are able to reproduce only among themselves; a general definition that does not account for hybridization (Cauboue et al. 1996).

Species of Special Concern – A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (Government of Canada 2019).

Stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests (Cauboue et al. 1996).

Stratum – A distinct layer within a plant community, a component of structure (Cauboue et al. 1996).

Terrestrial – Pertaining to land as opposed to water (Cauboue et al. 1996).

Threatened Species - A species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction (Government of Canada 2019).

Understory – Vegetation growing beneath taller plants such as trees or tall shrubs (Cauboue et al. 1996).

Vascular Plant – A plant having a vascular system (Usher 1996). Non-vascular plants include the mosses and lichens.

Vegetation – The general cover of plants growing on a landscape (Cauboue et al. 1996).

Vegetation Type – In phytosociology, the lowest possible level to be described (Cauboue et al. 1996).

Wetland – Land that is saturated with water long enough to promote hydric soils or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to wet environments (Cauboue et al. 1996).

APPENDIX II. Report maps.

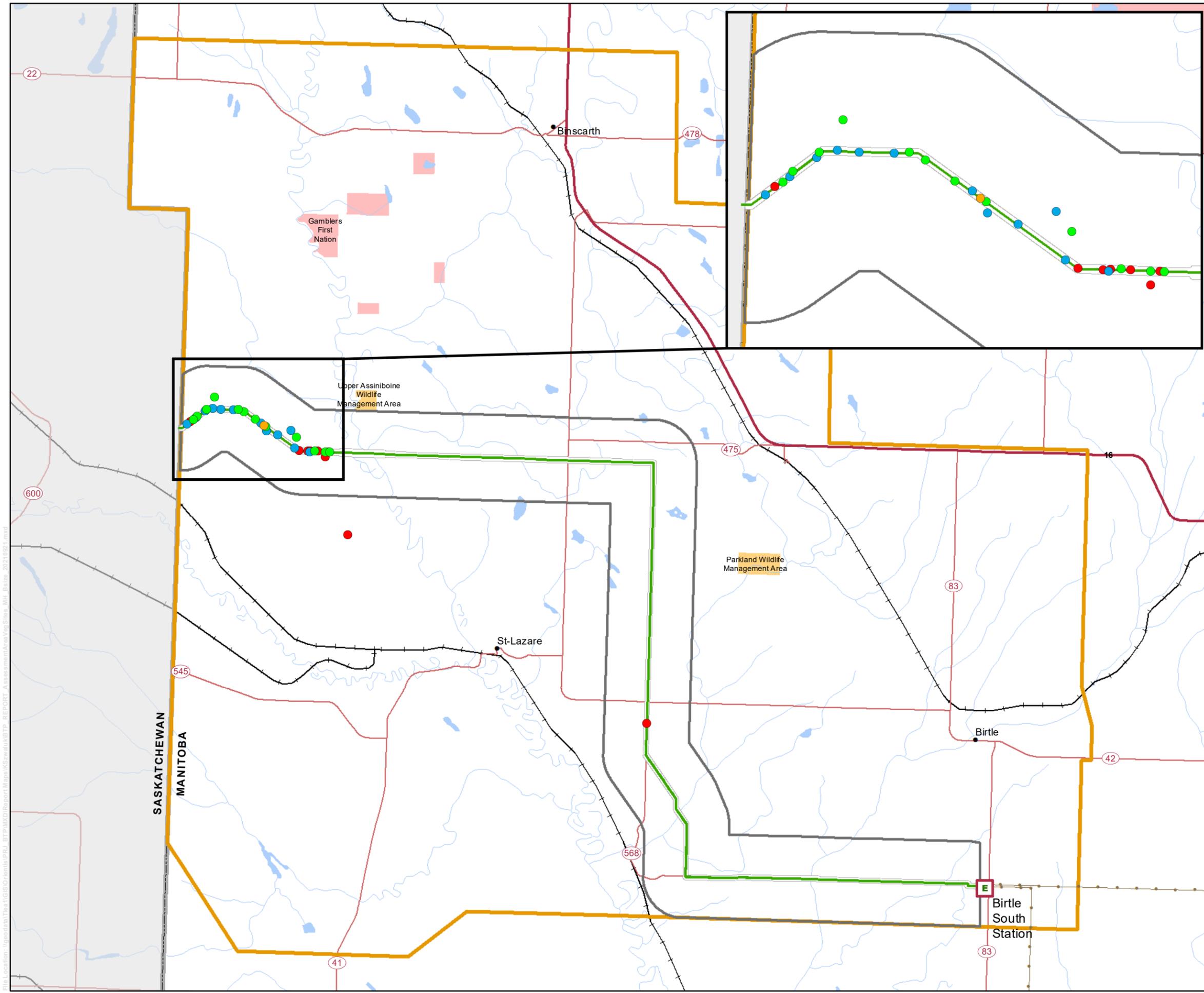
Birtle Transmission Project

- Project Infrastructure**
- Final Preferred Route
- Vegetation Sites**
- Forest
 - Prairie
 - Species of Conservation Concern
 - Invasive
- Assessment Areas**
- Project
 - Local
 - Regional
- Infrastructure**
- Electric Station
 - Transmission Line
- Landbase**
- Community
 - Road
 - Railway Line
 - First Nation
 - National/Provincial Park
 - Wildlife Management Area
 - Province of Manitoba Boundary

Coordinate System: UTM Zone 14N NAD83
 Data Source: MBHydro, ProvMB, NRCAN
 Date: September 21, 2021
 Available in accessible formats upon request.

0 2.5 5 Kilometres
 0 2 4 Miles
 1:140,000

Map 4-1
Distribution of
Vegetation Sites



File Location: \\gpc\share\T14n15\ISO\clients\PRJL\ETP\MCC\Report\Map\K03\env\Map\Birtle_South_20210921.mxd

APPENDIX III. Potential environmental effects on botanical and vegetation resources as a result of the Project. Effects were identified from the Environmental Assessment Report (Manitoba Hydro 2018a) and the Biophysical Existing Environment Technical Report (Manitoba Hydro 2018b).

Number	Potential Environmental Effect
1	Loss of native vegetation during construction and maintenance activities.
2	Modification of vegetation composition and structure adjacent to the project footprint from clearing activities.
3	Disturbance to native grasslands and a reduction in floristic diversity from construction and maintenance activities.
4	Loss of plant species of conservation concern during construction and maintenance activities.
5	Introduction and spread of non-native invasive species during construction and maintenance activities.
6	Loss or impairment of desirable plant species from herbicide application during maintenance activities.
7	Disturbance or removal of traditional use plants during clearing and construction activities.
8	Loss or impairment of vegetation from the accidental release of fuels or hazardous substances from construction and maintenance activities.
9	Disturbance to wetlands during construction activities.

APPENDIX IV. Project commitments for pre-construction surveys and environmental monitoring of botanical and vegetation resources. Reference documents include the Environmental Monitoring Plan (Manitoba Hydro 2020a) and the Environment Act Licence (Manitoba Conservation and Climate 2020).

Commitment Document	Page/Section or Clause	Environmental Component	Commitment Description Summary	Objectives to meet intent of Commitment
Environmental Monitoring Plan	Page 18	Grassland Habitat - Plant Species of Conservation Concern	Survey for species occurrence	Pre-construction survey and environmental monitoring
Environmental Monitoring Plan	Page 21	Grassland Habitat - Invasive Plant Species	Survey for species occurrence	Pre-construction survey and environmental monitoring
Environmental Monitoring Plan	Page 23	Grassland Habitat - Traditional Use Plant Species	Survey for species occurrence	Pre-construction survey and environmental monitoring
Environmental Monitoring Plan	Page 28	Forest Habitat - Plant Species of Conservation Concern	Survey for species occurrence	Pre-construction survey and environmental monitoring
Environmental Monitoring Plan	Page 30	Forest Habitat - Invasive Plant Species	Survey for species occurrence	Pre-construction survey and environmental monitoring
Environmental Monitoring Plan	Page 32	Forest Habitat - Traditional Use Plant Species	Survey for species occurrence	Pre-construction survey and environmental monitoring
Licence	Clause 39	Vegetation Management	The Licensee shall, within six months of the completion of construction of the Development, submit for approval of the Director of the Environmental Approvals Branch, a plan for management of vegetation along the transmission line RoW	Manitoba Hydro to develop and implement a vegetation management plan

APPENDIX V. Location of vegetation sample plots and sites visited.

Site	Component	UTM Zone	Easting	Northing
BTP-PRA-26	Final Preferred Route	14U	329313	5598502
BTP-PRA-28	Final Preferred Route	14U	328602	5599304
BTP-PRA-32	Final Preferred Route	14U	327672	5599289
BTP-PRA-51	Final Preferred Route	14U	328728	5598649
BTP-PRA-52	Final Preferred Route	14U	328087	5599135
BTP-PRA-53	Final Preferred Route	14U	327468	5599587
BTP-PRA-54	Final Preferred Route	14U	326408	5600093
BTP-PRA-55	Final Preferred Route	14U	325928	5600109
BTP-PRA-56	Final Preferred Route	14U	325632	5600135
BTP-PRA-57	Final Preferred Route	14U	325352	5600037
BTP-PRA-58	Final Preferred Route	14U	324994	5599780
BTP-PRA-59	Final Preferred Route	14U	324657	5599531
BTP-TER-25	Final Preferred Route	14U	330069	5598494
BTP-TER-27	Final Preferred Route	14U	328812	5599035
BTP-TER-43	Final Preferred Route	14U	325711	5600547
BTP-TER-61	Final Preferred Route	14U	329887	5598499
BTP-TER-62	Final Preferred Route	14U	329488	5598530
BTP-TER-63	Final Preferred Route	14U	327653	5599441
BTP-TER-64	Final Preferred Route	14U	327233	5599721
BTP-TER-65	Final Preferred Route	14U	326828	5600003
BTP-TER-66	Final Preferred Route	14U	326612	5600113
BTP-TER-67	Final Preferred Route	14U	325391	5600111
BTP-TER-68	Final Preferred Route	14U	325035	5599847
BTP-TER-69	Final Preferred Route	14U	324899	5599706
BTP-SCC-73	Final Preferred Route	14U	327576	5599481
BTP-Tower-115	Final Preferred Route	14U	330007	5598502
BTP-Tower-116	Final Preferred Route	14U	329611	5598515
BTP-Tower-116-117	Final Preferred Route	14U	329339	5598523
BTP-Tower-117	Final Preferred Route	14U	329237	5598519
BTP-Tower-118	Final Preferred Route	14U	328899	5598540
BTP-Tower-129	Final Preferred Route	14U	324783	5599645
BTP-INV-045	Final Preferred Route	14U	342083	5588225
BTP-Accesstrail-1	Local Assessment Area	14U	329888	5598315
BTP-Accesstrail-2	Local Assessment Area	14U	330760	5595367

APPENDIX VI. Species of conservation concern recorded at or near surveys.

Site	Species	Common Name	Rank
BTP-PRA-51	<i>Astragalus crassicaarpus</i>	Ground-plum	S3S4
BTP-PRA-32	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-52	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-53	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-54	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-56	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-57	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-58	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-PRA-59	<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
BTP-SCC-73	<i>Carex hystericina</i>	Porcupine Sedge	S3
BTP-PRA-57	<i>Carex inops</i> ssp. <i>heliophila</i>	Sun Sedge	S1?
BTP-SCC-73	<i>Carex microptera</i>	Small-winged Sedge	S1
BTP-PRA-32	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-26	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-51	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-52	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-54	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-55	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-56	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-57	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-58	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-59	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-TER-27	<i>Carex obtusata</i>	Blunt Sedge	S3S4
BTP-PRA-51	<i>Chamaerhodos erecta</i> ssp. <i>nuttallii</i>	Chamaerhodos	S3S4
BTP-TER-61	<i>Chamaerhodos erecta</i> ssp. <i>nuttallii</i>	Chamaerhodos	S3S4
BTP-SCC-73	<i>Chamaerhodos erecta</i> ssp. <i>nuttallii</i>	Chamaerhodos	S3S4
BTP-PRA-32	<i>Chenopodium pratericola</i>	Goosefoot	S3
BTP-TER-61	<i>Chenopodium pratericola</i>	Goosefoot	S3
BTP-TER-63	<i>Chenopodium pratericola</i>	Goosefoot	S3
BTP-SCC-73	<i>Chenopodium pratericola</i>	Goosefoot	S3
BTP-PRA-28	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-32	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-51	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-52	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-53	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-56	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-57	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?

BTP-PRA-58	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-59	<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
BTP-PRA-26	<i>Equisetum laevigatum</i>	Smooth Scouring-rush	S3S4
BTP-PRA-53	<i>Equisetum laevigatum</i>	Smooth Scouring-rush	S3S4
BTP-PRA-32	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-54	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-55	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-57	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-58	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-59	<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
BTP-PRA-26	<i>Erigeron strigosus</i>	Rough Fleabane	S3S5
BTP-PRA-51	<i>Erigeron strigosus</i>	Rough Fleabane	S3S5
BTP-PRA-56	<i>Erigeron strigosus</i>	Rough Fleabane	S3S5
BTP-PRA-53	<i>Erysimum asperum</i>	Prairie-rocket Wallflower	S3S4
BTP-PRA-59	<i>Erysimum asperum</i>	Prairie-rocket Wallflower	S3S4
BTP-SCC-73	<i>Erythranthe geyeri</i>	Geyer's Monkeyflower	S1
BTP-PRA-54	<i>Festuca hallii</i>	Plains Rough Fescue	S3
BTP-PRA-55	<i>Festuca hallii</i>	Plains Rough Fescue	S3
BTP-PRA-56	<i>Festuca hallii</i>	Plains Rough Fescue	S3
BTP-PRA-28	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-51	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-54	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-55	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-56	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-58	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-59	<i>Helianthus pauciflorus</i> ssp. <i>subrhomboideus</i>	Beautiful Sunflower	S3S4
BTP-PRA-51	<i>Hesperostipa comata</i>	Needle-and-thread Grass	S3S4
BTP-PRA-56	<i>Hesperostipa comata</i>	Needle-and-thread Grass	S3S4
BTP-PRA-28	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-32	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-26	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-51	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-52	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-53	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4
BTP-PRA-54	<i>Hesperostipa curtiseta</i>	Western Porcupine Grass	S3S4

BTP-PRA-55	<i>Hesperostipa curtisetia</i>	Western Porcupine Grass	S3S4
BTP-PRA-56	<i>Hesperostipa curtisetia</i>	Western Porcupine Grass	S3S4
BTP-PRA-57	<i>Hesperostipa curtisetia</i>	Western Porcupine Grass	S3S4
BTP-PRA-58	<i>Hesperostipa curtisetia</i>	Western Porcupine Grass	S3S4
BTP-PRA-59	<i>Hesperostipa curtisetia</i>	Western Porcupine Grass	S3S4
BTP-PRA-56	<i>Houstonia longifolia</i>	Long-leaved Bluets	S3S5
BTP-TER-27	<i>Houstonia longifolia</i>	Long-leaved Bluets	S3S5
BTP-PRA-28	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-26	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-51	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-52	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-53	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-54	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-PRA-55	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-TER-61	<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BTP-TER-61	<i>Mirabilis albida</i>	Hairy Umbrellawort	S3S4
BTP-TER-63	<i>Mirabilis albida</i>	Hairy Umbrellawort	S3S4
BTP-SCC-73	<i>Mirabilis albida</i>	Hairy Umbrellawort	S3S4
BTP-PRA-52	<i>Oenothera nuttallii</i>	White Evening-primrose	S3S4
BTP-PRA-57	<i>Oenothera serrulata</i>	Shrubby Evening-primrose	S3
BTP-PRA-32	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-51	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-53	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-54	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-55	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-57	<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
BTP-PRA-32	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-26	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-51	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-52	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-53	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-54	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-55	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-57	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-58	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-59	<i>Pediomelum esculentum</i>	Indian Breadroot	S3S4
BTP-PRA-52	<i>Penstemon albidus</i>	White Beardtongue	S3S4
BTP-PRA-54	<i>Penstemon gracilis</i>	Lilac-flowered Beard-tongue	S3S4
BTP-PRA-32	<i>Phlox hoodii</i>	Moss Pink	S3

BTP-PRA-52	<i>Phlox hoodii</i>	Moss Pink	S3
BTP-PRA-55	<i>Phlox hoodii</i>	Moss Pink	S3
BTP-PRA-57	<i>Phlox hoodii</i>	Moss Pink	S3
BTP-PRA-59	<i>Phlox hoodii</i>	Moss Pink	S3
BTP-PRA-51	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-52	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-53	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-55	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-58	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-59	<i>Potentilla concinna</i> var. <i>divisa</i>	Divided-leaved Cinquefoil	S3
BTP-PRA-32	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-26	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-51	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-52	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-53	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-56	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-57	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-58	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-59	<i>Potentilla pensylvanica</i>	Pennsylvania Cinquefoil	S3S4
BTP-PRA-32	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-PRA-55	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-PRA-56	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-PRA-58	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-PRA-59	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-TER-61	<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
BTP-PRA-32	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-26	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-51	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-52	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-53	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-54	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-55	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-56	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-57	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-58	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-PRA-59	<i>Selaginella densa</i>	Prairie Spike-moss	S3
BTP-TER-61	<i>Sporobolus crytandrous</i>	Sand Dropseed	S3S5
BTP-TER-63	<i>Sporobolus crytandrous</i>	Sand Dropseed	S3S5
BTP-SCC-73	<i>Sporobolus crytandrous</i>	Sand Dropseed	S3S5

BTP-PRA-28	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-26	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-51	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-52	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-53	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-54	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-55	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-56	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-58	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-PRA-59	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-TER-27	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-TER-61	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5
BTP-SCC-73	<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5

APPENDIX VII. Flora List for the Spy Hill-Ellice Community Pasture, 2021.

Family/Species	Common Name	MB Rank
VASCULAR SPECIES		
Pteridophytes - Ferns and Allies		
EQUISETACEAE	HORSETAIL FAMILY	
<i>Equisetum hyemale</i>	Common Scouring-rush	S5
<i>Equisetum laevigatum</i>	Smooth Scouring-rush	S3S4
SELAGINELLACEAE	SPIKE-MOSS FAMILY	
<i>Selaginella densa</i>	Prairie Spike-moss	S3
Gymnosperms		
CUPRESSACEAE	CYPRESS FAMILY	
<i>Juniperus horizontalis</i>	Creeping Juniper	S5
Angiosperms - Monocotyledons		
CYPERACEAE	SEDGE FAMILY	
<i>Carex aquatilis</i>	Water Sedge	S5
<i>Carex granularis</i>	Meadow Sedge	S4?
<i>Carex hystericina</i>	Porcupine Sedge	S3
<i>Carex inops ssp. heliophila</i>	Sun Sedge	S1?
<i>Carex microptera</i>	Small-wing Sedge	S1
<i>Carex obtusata</i>	Blunt Sedge	S3S4
<i>Carex siccata</i>	Dry-spike Sedge	S5
<i>Carex spp.</i>	Sedges	
IRIDACEAE	IRIS FAMILY	
<i>Sisyrinchium montanum</i>	Blue-eyed Grass	S5
JUNCACEAE	RUSH FAMILY	
<i>Juncus arcticus var. balticus</i>	Baltic Rush	S5
<i>Juncus bufonius</i>	Toad Rush	S5
<i>Juncus nodosus</i>	Knotted Rush	S5
LEMNACEAE	DUCKWEED FAMILY	
<i>Lemna turionifera</i>	Turion Duckweed	SU
LILIACEAE	LILY FAMILY	
<i>Allium stellatum</i>	Pink-flowered Onion	S5
<i>Lilium philadelphicum</i>	Wood Lily	S4

<i>Maianthemum canadense</i>	Canada May Flower	S5
<i>Maianthemum stellatum</i>	Solomon's Seal	S5
POACEAE	GRASS FAMILY	
<i>Agrostis scabra</i>	Ticklegrass	S5
<i>Avenula hookeri</i>	Hooker's Oat Grass	S3S4
<i>Bouteloua gracilis</i>	Blue Grama	S4
<i>Bromus ciliatus</i>	Fringed Brome	S5
<i>Bromus inermis</i>	Smooth Brome	SNA
<i>Bromus sp.</i>	A brome	
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	S4S5
<i>Dichanthelium wilcoxianum</i>	Sand Millet	S2?
<i>Elymus trachycaulus</i>	Slender Wheat Grass	S5
<i>Elymus sp.</i>	A wheatgrass	
<i>Festuca hallii</i>	Plains Rough Fescue	S3
<i>Festuca saximontana</i>	Rocky Mountain Fescue	S4S5
<i>Glyceria grandis</i>	Tall Mannagrass	S5
<i>Glyceria striata</i>	Fowl Manna Grass	S5
<i>Hesperostipa comata</i>	Needle-and-thread Grass	S3S4
<i>Hesperostipa curtisetata</i>	Western Porcupine Grass	S3S4
<i>Hesperostipa spartea</i>	Plains Porcupine Grass	S4
<i>Koeleria macrantha</i>	June Grass	S5
<i>Oryzopsis asperifolia</i>	White-grained Mountain-ricegrass	S5
<i>Piptatheropsis pungens</i>	Northern Rice Grass	S4S5
<i>Poa pratensis</i>	Kentucky Bluegrass	S5
<i>Poa spp.</i>	Bluegrass	
<i>Schizachne purpurascens</i>	False Melic	S5
<i>Schizachyrium scoparium</i>	Little Bluestem	S3S4
<i>Setaria viridis</i>	Green Foxtail	SNA
<i>Sporobolus cryptandrous</i>	Sand Dropseed	S3S5
<i>Sporobolus rigidus</i>	Sand Reedgrass	S3S5

Angiosperms - Dicotyledons

ANACARDIACEAE	SUMAC FAMILY	
<i>Toxicodendron rydbergii</i>	Poison Ivy	S5
APOCYNACEAE	DOGBANE FAMILY	
<i>Apocynum androsaemifolium</i>	Spreading Dogbane	S5
ARALIACEAE	GINSENG FAMILY	
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5
ASTERACEAE	ASTER FAMILY	

<i>Achillea millefolium</i>	Yarrow	S5
<i>Agoseris glauca</i>	False Dandelion	S4S5
<i>Antennaria neglecta</i>	Field Pussytoes	S5
<i>Antennaria parvifolia</i>	Small-leaved Everlasting	S4
<i>Antennaria</i> spp.	everlasting	
<i>Artemisia campestris</i>	Field sagewort	S4S5
<i>Artemisia frigida</i>	Pasture Sage	S4S5
<i>Artemisia ludoviciana</i>	Prairie Sage	S5
<i>Cirsium arvense</i>	Canada Thistle	SNA
<i>Crepis runcinata</i>	Dandelion Hawksbeard	S4
<i>Erigeron caespitosus</i>	Tufted Fleabane	S1
<i>Erigeron glabellus</i>	Smooth Fleabane	S5
<i>Erigeron strigosus</i>	Rough Fleabane	S3S5
<i>Erigeron</i> sp.	Fleabane	
<i>Gaillardia aristata</i>	Great-flowered Gaillardia	S5
<i>Helianthus pauciflorus</i> ssp. <i>subrhomboides</i>	Beautiful Sunflower	S3S4
<i>Heterotheca villosa</i>	Hairy Golden-aster	S5
<i>Hieracium umbellatum</i>	Northern Hawkweed	S5
<i>Lactuca serriola</i>	Prickly Lettuce	SNA
<i>Liatris punctata</i>	Dotted Blazing Star	S4
<i>Packera cana</i>	Silvery Groundsel	S4
<i>Solidago missouriensis</i>	Missouri Goldenrod	S5
<i>Solidago nemoralis</i>	Field Goldenrod	S5
<i>Solidago ptarmicoides</i>	Upland White Goldenrod	S4S5
<i>Solidago</i> sp.	A Goldenrod	
<i>Sonchus arvensis</i>	Field Sow-thistle	SNA
<i>Symphyotrichum ciliolatum</i>	Lindley's Aster	S5
<i>Symphyotrichum ericoides</i>	White Heath Aster	S4
<i>Symphyotrichum laeve</i>	Smooth Aster	S5
<i>Taraxacum officinale</i>	Common Dandelion	SNA
<i>Tragopogon</i> sp.	Goat's-beard	SNA
<i>Xanthium strumarium</i>	Rough Cocklebur	S4
BETULACEAE	BIRCH FAMILY	
<i>Betula papyrifera</i>	Paper Birch	S5
<i>Corylus americana</i>	American Hazelnut	S4
<i>Corylus cornuta</i>	Beaked Hazelnut	S5
BORAGINACEAE	BORAGE FAMILY	
<i>Lithospermum canescens</i>	Hoary Puccoon	S5
<i>Lithospermum incisum</i>	Narrow-leaved Puccoon	S3
BRASSICACEAE	MUSTARD FAMILY	

<i>Descurainia sophia</i>	Flixweed	SNA
<i>Erysimum asperum</i>	Prairie-rocket Wallflower	S3S4
<i>Lappula squarrosa</i>	Bristly Stickseed	SNA
CAMPANULACEAE	BELLFLOWER FAMILY	
<i>Campanula rotundifolia</i>	Harebells	S5
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
<i>Lonicera dioica</i>	Twining Honeysuckle	S5
<i>Symphoricarpos albus</i>	Snowberry	S4S5
<i>Symphoricarpos occidentalis</i>	Western Snowberry	S5
<i>Viburnum opulus</i>	Highbush-cranberry	S5
CARYOPHYLLACEAE	PINK FAMILY	
<i>Cerastium arvense</i>	Field Chickweed	S5
<i>Moehringia lateriflora</i>	Grove Sandwort	S5
<i>Silene antirrhina</i>	Sleepy Catchfly	S4S5
CELASTRACEAE	STAFF-TREE FAMILY	
<i>Celastrus scandens</i>	Climbing Bittersweet	S3S5
CHENOPODIACEAE	GOOSEFOOT FAMILY	
<i>Chenopodium album</i>	Lamb's-quarters	SNA
<i>Chenopodium pratericola</i>	Goosefoot	S3
CORNACEAE	DOGWOOD FAMILY	
<i>Cornus sericea</i>	Red-osier Dogwood	S5
ELAEAGNACEAE	OLEASTER FAMILY	
<i>Elaeagnus commutata</i>	Silverberry	S4S5
<i>Shepherdia canadensis</i>	Soapberry	S5
ERICACEAE	HEATH FAMILY	
<i>Arctostaphylos uva-ursi</i>	Bearberry	S5
FABACEAE	PEA FAMILY	
<i>Astragalus crassicaarpus</i>	Ground-plum	S3S4
<i>Astragalus laxmanii</i>	Ascending Milkvetch	S5
<i>Astragalus sp.</i>	a vetch	
<i>Dalea purpurea</i>	Purple Prairie Clover	S5
<i>Lathyrus ochroleucus</i>	Pale Vetchling	S5
<i>Lathyrus venosus</i>	Wild Peavine	S5
<i>Medicago lupulina</i>	Black Medick	SNA

<i>Melilotus albus</i>	White Sweet Clover	SNA
<i>Oxytropis campestris</i> var. <i>spicata</i>	Showy Locoweed	S1
<i>Pedimelum esculentum</i>	Indian Breadroot	S3S4
<i>Trifolium pratense</i>	Red Clover	SNA
<i>Vicia americana</i>	American Purple Vetch	S5
FAGACEAE	BEECH FAMILY	
<i>Quercus macrocarpa</i>	Bur Oak	S5
GROSSULARIACEAE	CURRENT FAMILY	
<i>Ribes oxycanthoides</i>	Canada Wild Gooseberry	S5
<i>Ribes triste</i>	Wild Red Currant	S5
LAMIACEAE	MINT FAMILY	
<i>Monarda fistulosa</i>	Wild Bergamot	S4
LINACEAE	FLAX FAMILY	
<i>Linum lewisii</i>	Blue Flax	S4
NYCTAGINACEAE	FOUR O'CLOCK FAMILY	
<i>Mirabilis albida</i>	Hairy Umbrellawort	S3S4
ONAGRACEAE	EVENING PRIMROSE FAMILY	
<i>Oenothera nuttallii</i>	White Evening-primrose	S3S4
<i>Oenothera serrulata</i>	Shrubby Evening-primrose	S3
PLANTAGINACEAE	PLANTAIN FAMILY	
<i>Plantago major</i>	Common Plantain	SNA
POLEMONIACEAE	PHLOX FAMILY	
<i>Collomia linearis</i>	Narrow-leaved Collomia	S5
<i>Phlox hoodii</i>	Moss Pink	S3
POLYGONACEAE	SMARTWEED FAMILY	
<i>Fallopia convolvulus</i>	Black Bindweed	SNA
PRIMULACEAE	PRIMULA FAMILY	
<i>Androsace septentrionalis</i>	Pygmyflower	S5
<i>Lysimachia ciliata</i>	Fringed Loosestrife	S5
PYROLACEAE	WINTERGREEN FAMILY	
<i>Pyrola</i> spp.	A Wintergreen	

RANUNCULACEAE	CROWFOOT FAMILY	
<i>Anemone cylindrica</i>	Thimbleweed	S5
<i>Anemone multifida</i>	Cut-leaved Anemone	S5
<i>Caltha palustris</i>	Marsh Marigold	S5
<i>Pulsatilla nuttalliana</i>	Prairie crocus	S4
<i>Thalictrum venulosum</i>	Veiny Meadow-rue	S5
ROSACEAE	ROSE FAMILY	
<i>Amelanchier alnifolia</i>	Saskatoon	S5
<i>Chamaerhodos erecta ssp. nuttallii</i>	Chamaerhodos	S4
<i>Drymocallis arguta</i>	Tall Wood Beauty	S5
<i>Fragaria virginiana</i>	Smooth Wild Strawberry	S5
<i>Geum triflorum</i>	Three-flowered Avens	S4S5
<i>Potentilla argentea</i>	Silvery Cinquefoil	SNA
<i>Potentilla concinna var. divisa</i>	Divided-leaved Cinquefoil	S3
<i>Potentilla pennsylvanica</i>	Pennsylvania Cinquefoil	S3S4
<i>Prunus pensylvanica</i>	Pin Cherry	S5
<i>Prunus pumila</i>	Sand Cherry	S4S5
<i>Prunus virginiana</i>	Chokecherry	S5
<i>Rosa arkansana</i>	Prairie Rose	S4
<i>Rosa spp.</i>	A Rose	
<i>Rubus idaeus</i>	Raspberry	S5
<i>Rubus pubescens</i>	Trailing Dewberry	S5
RUBIACEAE	MADDER FAMILY	
<i>Galium boreale</i>	Northern Bedstraw	S5
<i>Galium triflorum</i>	Sweet-scented Bedstraw	S5
<i>Houstonia longifolia</i>	Long-leaved Bluets	S3S5
SALICACEAE	WILLOW FAMILY	
<i>Populus tremuloides</i>	Trembling Aspen	S5
<i>Salix bebbiana</i>	Bebb's Willow	S5
<i>Salix spp.</i>	A Willow	
SANTALACEAE	SANDALWOOD FAMILY	
<i>Comandra umbellata</i>	Bastard Toadflax	S5
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
<i>Heuchera richardsonii</i>	Alumroot	S5
SCROPHULARIACEAE	FIGWORT FAMILY	
<i>Erythranthe geyeri</i>	Geyer's Monkeyflower	S1
<i>Orthocarpus luteus</i>	Owl's-clover	S4S5

<i>Penstemon albidus</i>	White Beard-tongue	S3S4
<i>Penstemon gracilis</i>	Lilac-flowered Beard-tongue	S3S4
<i>Veronica americana</i>	American Brooklime	S4
VIOLACEAE	VIOLET FAMILY	
<i>Viola adunca</i>	Early Blue Violet	S5
<i>Viola canadensis</i> var. <i>rugulosa</i>	Canada Violet	S5
<i>Viola pedatifida</i>	Purple Prairie Violet	S4
<i>Viola</i> spp.	Violet	
NON-VASCULAR SPECIES		
Lichens		
<i>Cladonia</i> sp.	A Reindeer Lichen	
<i>Cetraria arenaria</i>	Sand-loving Iceland Lichen	SU

