MANITOBA-MINNESOTA TRANSMISSION PROJECT
BOTANICAL AND VEGETATION ENVIRONMENTAL MONITORING

ANNUAL TECHNICAL REPORT – Year IV

Prepared for:
Manitoba Hydro

Prepared by:

Szwaluk Environmental Consulting Ltd.

and

K. Newman

November 2024

SUMMARY

Botanical and vegetation resources were assessed in Year IV post-construction environmental monitoring. Surveys were completed for golden-winged warbler habitat, with botanical summaries presented. The accuracy of effect predictions and the effectiveness of mitigation are discussed for golden-winged warbler habitat. The environmental monitoring schedule for wetlands and traditional use plant species were completed in 2021 (two years post-construction), while the schedule for invasive plant species and species of conservation concern were completed in 2020 (one-year post-construction).

Thirteen sites were re-visited to monitor golden-winged warbler (GWW) habitat that intersects the final preferred route right-of-way (RoW). There is a continued general increase in cover and richness in the lower vegetation canopies between this year and last year's post-construction growth. This season, mean species cover in sites ranged from 69% to complete cover (>100% due to overlapping low vegetation) in the herb and low shrub layer, with an average richness of 35.6 species recorded. Mean diversity and evenness values were relatively high for all sites, 2.6 and 0.7 respectively. Average cover in the tall shrub layer was doubled from the previous monitoring year, currently 13% ranging from zero (in two sites) to 31%, with average richness of 3.5 species recorded. Common species recorded in the tall shrub stratum include trembling aspen, Bebb's willow, balsam poplar, and red-osier dogwood. While the mid-canopy layer continues to regenerate, this is the first monitoring year with species cover and diversity measures that are comparable to the mid-canopy values measured pre-construction. We are still seeing significantly ($p=0.020$) fewer species present in the tall shrub layer than in the original canopy, although richness is up slightly from the last monitoring year (2022). Tree canopy cover is present only in half of the GWW sites, and is very sparse (1.5% average). Primarily made up of trees, there is only a small component of tall shrub cover (0.3%) in this layer. Three community types were identified based on degree of regeneration, vegetation structure and cover, and species assemblages at sites.

Twenty-three noxious, invasive or non-invasive SNA (species rank not applicable) species were recorded along the RoW during vegetation monitoring this season. Species were recorded in surveys for golden-winged warbler habitat. Of these species, eight are listed in the Manitoba Noxious Weed Act as noxious weeds harmful to livestock or agricultural crops. One notable noxious species recorded was Tier 2 oxeye daisy. At least 10 species are considered invasive (not listed noxious) due to their tendency to outcompete native species, and dominate habitats once introduced. An additional five plants are considered non-native species.

During sampling this season, seven species of conservation concern were recorded in plots and as incidentals from sampling, throughout the RoW. Among these, three species were ranked Imperilled (S2 to S2S3), while the remaining four species were ranked Vulnerable (S3S4 to S3S5). One species at risk was observed during project monitoring - Riddell's goldenrod is listed as Threatened under the Manitoba's *Endangered Species and Ecosystems Act* and Special Concern by the federal *Species at Risk Act*.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PHOTOGRAPHS

ACKNOWLEDGEMENTS

The authors thank Brad Kennedy for assistance with fieldwork and project related contributions; and Manitoba Hydro for providing supporting information and documentation for the project.

1.0 INTRODUCTION

On April 4 2019, the Minister of Sustainable Development granted an Environment Act Licence (Class 3 No. 3288) to Manitoba Hydro for the construction, operation, and decommissioning of the Manitoba-Minnesota Transmission Project. On June 13 2019, a Certificate of Public Convenience and Necessity was obtained from the National Energy Board (EC-059). Clearing and construction for the Project began in the fall of 2019 and was completed during the spring of 2020. In the summer of 2024, botanical and vegetation resources were assessed in Year IV of environmental monitoring for the Manitoba-Minnesota Transmission Project.

The Manitoba-Minnesota Transmission Project is a new high voltage alternating current (AC) transmission line required to deliver contracted quantities of power to and from the United States. It will improve reliability through an increase in capacity during drought and emergency situations, and increase Manitoba Hydro's involvement in the electricity markets in the United States (Manitoba Hydro 2015). The Manitoba-Minnesota Transmission Project involved construction of a 500-kilovolt AC transmission line in southeastern Manitoba and upgrades to associated converter stations at Dorsey, Riel and Glenboro. The transmission line starts at the Dorsey Converter Station (located near Rosser, northwest of Winnipeg), travels south around Winnipeg and passes near the Riel Converter Station, east of the city (Southern Loop corridor). The line continues south to the Manitoba–Minnesota border and connects to the Great Northern Transmission Line (Map 1-1, Appendix II).

The Manitoba-Minnesota Transmission Project occurs over four ecoregions including (from west to east) the Aspen Parkland, Lake Manitoba Plain, Interlake Plain, and Lake of the Woods. The Glenboro South Station and connecting transmission line spans are the only project components located in the Aspen Parkland Ecoregion. The Project traverses developed land, agricultural land, and native vegetation including deciduous forest, coniferous forest, mixedwoods, shrubland, grassland, and wetlands. All four ecoregions are heavily influenced by agricultural activities.

This assessment involved environmental monitoring along the final preferred route right-of-way (RoW). Potential environmental effects as a result of the Project are listed in Appendix III, which were identified in the Manitoba-Minnesota Transmission Project Environmental Impact Statement (Assessment of Potential Environmental Effects on Vegetation and Wetlands, Chapter 10; Manitoba Hydro 2015). Project commitments for environmental monitoring of botanical and vegetation resources are identified in Appendix IV. The specific objective remaining for this study, based on the Environmental Monitoring Plan (Manitoba Hydro 2019a), and review of the Report on Public Hearing (Manitoba Clean

Environment Commission 2017), Environment Act Licence, and National Energy Board Certificate, is as follows:

- Conduct environmental monitoring of golden-winged warbler habitat.

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

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 golden-winged warbler habitat.

2.1 Golden-winged Warbler Habitat

The Golden-winged warbler (*Vermivora chrysoptera*) is a species of conservation concern listed as Threatened by *The Endangered Species and Ecosystems Act* (ESEA) in Manitoba, the federal *Species at Risk Act* (SARA), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In Manitoba, the golden-winged warbler is ranked as uncommon throughout its range or in the province, with breeding status (S2S3B), by the Manitoba Conservation Data Centre (MBCDC). Golden-winged warbler nesting and foraging habitat requirements include a patchy mixture of shrubs, saplings, herbaceous openings, scattered canopy trees and mature deciduous forest (e.g., a combination of early successional habitat alongside a mature forest edge). Trees are used primarily for song posts and foraging, and transitional edges of forests are often used for nest placement. The golden-winged warbler is well adapted to the dynamic habitat created by periodic disturbances, which in highly human-modified environments can include utility right-of-way construction and maintenance (Environment and Climate Change Canada 2016). Golden-winged warblers were identified as a species requiring careful consideration due to their Threatened designation, and the identification of critical habitat along a portion of the Project area. As outlined in the environmental assessment, Manitoba Hydro carried out detailed studies on the breeding locations, habitat preferences, and species biology in preparing the Construction Environmental Protection Plan and Environmental Monitoring Plan. Thirteen sites were surveyed for golden-winged warbler habitat along the final preferred route during pre-construction surveys (Szwaluk Environmental Consulting and Newman 2019).

Clearing of the RoW is the primary project activity that may result in a change in habitat for the golden-winged warbler. In recognition of this, Manitoba Hydro has developed a Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat during Construction and Operation of the Manitoba-Minnesota Transmission Project (Environment Canada IR EC/MH-003). To validate EIS predictions, verify implementation of mitigation measures, and to allow for adaptive management, post-construction monitoring will identify changes to golden-winged warbler habitat. Monitoring activities for golden-winged warbler habitat are identified in Table 2-1.

Mitigation measures identified in the Construction Environmental Protection Plan

- Refer to Clearing Management Plan for detailed clearing prescriptions.
- Retain shrubs and herbaceous vegetation <4m tall to the extent possible.

- Typically, 5-10 perch trees must be retained per span where feasible.

Table 2-1. Monitoring activities for golden-winged warbler habitat.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Desktop and field surveys	Habitat location	Identified in PDA, LAA, RAA	1 field season	Once	2014	Habitat composition; auditory or visual detection
Pre-construction	Analyze imagery to confirm location and record baseline vegetation information	Vegetation cover	PDA	Pre-construct-ion	Once	Summer	Species composition and abundance
Construction	Ground surveys to identify vegetation changes not discernible from habitat mapping	Vegetation cover	PDA	During construct-ion	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify vegetation changes not discernible from habitat mapping	Vegetation cover	PDA	2yrs	Annual	Summer	Species composition and abundance

3.0 METHODS

The methods used to assess the botanical and vegetation resources can be 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 Manitoba-Minnesota Transmission Project with relevance to pre-construction surveys and subsequent environmental monitoring was reviewed prior to fieldwork. Applicable documents included the Environmental Impact Statement (Manitoba Hydro 2015), Environmental Monitoring Plan (Manitoba Hydro 2019a), Construction Environmental Protection Plan (Manitoba Hydro 2019b) and Mapbook (Manitoba Hydro 2020), Botanical and Vegetation Pre-construction Surveys (Szwaluk Environmental Consulting and Newman 2017 and 2019), the Invasive Plant Pre-construction Survey (Szwaluk Environmental Consulting 2018), and the Botanical and Vegetation Environmental Monitoring Technical Reports (Szwaluk Environmental Consulting and Newman 2020, 2021 and 2022). Pre-construction and environmental monitoring requirements for vegetation are specified in the Environmental Monitoring Plan (Manitoba Hydro 2019a). Regulatory documents were also reviewed to determine environmental monitoring requirements for vegetation (see Appendix IV).

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

Suitable sites were selected based on vegetation type, accessibility, disturbance and landowner permission. In 2024, previously surveyed sites (2017 through 2022) were reviewed to determine their location along the final preferred route (FPR) RoW. Field maps (1:10,000) were provided by Manitoba Hydro (Construction Environmental Protection Mapbook; Manitoba Hydro 2020).

Valued components of the biophysical environment (i.e., vegetation) were identified to sample and monitor for the Manitoba-Minnesota Transmission Project. Environmental indicators were identified based on regulatory, environmental and cultural importance, identified through the environmental assessment process and preparation of the monitoring

plan. The only remaining indicator for monitoring in 2024 included golden-winged warbler habitat.

3.2 Environmental Monitoring

Post-construction environmental monitoring began in 2020 after clearing and construction activities were completed. This season (2024) represents Year IV of post-construction monitoring. Pre-construction surveys for the project were conducted in 2017, 2018 and 2019.

Environmental monitoring involved native vegetation surveys (quantitative) in selected habitats along the FPR. In 2024, environmental monitoring included sites for golden-winged warbler habitat (GWW). The monitoring schedule for wetlands and traditional use plant species were completed in 2021 (two years post-construction), while monitoring for invasive plant species and species of conservation concern were completed in 2020 (one-year post-construction). No further targeted monitoring for these components occurred in 2024.

3.2.1 Native Vegetation Survey

Sites previously selected for native vegetation surveys were used for continued monitoring of golden-winged warbler 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 m^2 quadrats nested within 2.5 m^2 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 Conservation Status Ranking

Plants species of conservation concern were recorded when encountered during monitoring of GWW sites. 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).

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 (Manitoba Government 2024a).

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.

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

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$_n$

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

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$_n$

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 (≤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 following section discusses the results for the environmental indicator monitored in Year IV, golden-winged warbler habitat (GWW). Monitoring for species of conservation concern (SCC) and invasive plant species (INV) were completed in 2020. Species presence continues to be recorded where observed, although survey effort for species of conservation concern, and noxious and invasive species is reduced as fewer sites and habitat types are visited in the current monitoring of GWW sites.

The following botanical summary includes total species cover, species richness, species diversity index, and species evenness. The complete flora is provided in Appendix VII, with 134 plant species across 37 families, recorded in 2024. Throughout results, plants are referred to by English name, with scientific name included on first mention, trees are referred to by common name. The accuracy of effect predictions and the effectiveness of mitigation for sites are discussed.

4.1 Golden-winged Warbler Habitat

The FPR intersects areas of critical golden-winged warbler habitat, according to the EIS (Chapter 9; Manitoba Hydro 2015). Thirteen sites were sampled for golden-winged warbler (*Vermivora chrysoptera*) habitat (GWW) from August 6 to 8, along the FPR RoW (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_ GWW_CON_813).

4.1.1 Data Analysis of Golden-winged Warbler Habitat

Diversity measures from GWW monitoring are presented in detail for the current year, and means are compared between pre-construction (2019) and four monitoring years (2020-2022, 2024). Vegetation descriptions are provided for the lowest canopy (the understory, <1m) and the mid canopy (>1 to 2.5m), Table 4-1a. The understory includes herbaceous forbs and grasses, low shrubs, and seedlings (<1m) of tall shrubs and trees. The mid-canopy includes tall shrubs, and tree saplings and the occasional low shrub that has exceeded 1m in height. Cover may exceed 100% as individual species cover may overlap within a layer. During monitoring in 2024, the total species understory cover was high, averaging 92% cover, and floristically diverse, with an average species richness of 35.6 species recorded in plots, (16 to 52 species). The mean diversity (2.63) and evenness (0.73) measures continue to be relatively high for most sites.

Table 4-1a. Golden-winged warbler habitat sites: vegetation measures for species cover (%), species richness, diversity and evenness in the low- and mid-canopies, in 2024.

2024	Understory (herbs, low shrubs, seedlings)				Mid-canopy (tall shrubs, saplings)			
Sites	**Cover**	**Species**	**Div.**	**Even.**	**Cover**	**Species**	**Div.**	**Even.**
GWW-001	100.2	52	3.29	0.83	12.6	6	0.61	0.34
GWW-004	109.6	42	2.85	0.76	4.4	3	0.84	0.77
GWW-006	69.2	16	1.37	0.49	6.0	2	0.50	0.72
GWW-008	92.6	30	2.72	0.80	21.0	3	0.63	0.57
GWW-009	71.8	41	2.92	0.79	30.6	3	0.36	0.33
GWW-010	108.4	41	3.00	0.81	8.8	7	0.91	0.47
GWW-013	98.6	47	2.93	0.76	0.0	0	-	-
GWW-015	69.6	18	1.24	0.43	0.0	0	-	-
GWW-016	124.8	37	2.94	0.81	31.0	8	1.28	0.62
GWW-018	69.2	37	3.17	0.88	21.2	5	1.27	0.79
GWW-019	101.4	28	2.21	0.66	14.6	3	0.79	0.72
GWW-022	103.8	37	2.68	0.74	10.4	3	0.67	0.61
GWW-024	77.2	37	2.82	0.78	13.0	2	0.34	0.49
Mean 2024	92.0	35.6	2.63	0.73	13.4	3.5	0.63	0.49

As of this fourth year of monitoring in GWW sites, measures in the understory vegetation have increased significantly compared to pre-construction values, for cover ($p= 0.003$), diversity ($p=0.010$) and evenness ($p=0.008$). Species richness is now comparable ($p=0.126$) to pre-construction counts, 2019.

The mid-canopy woody layer continues to regenerate post-construction, and only the species richness remains significantly lower ($p=0.020$) than pre-construction values. The current cover ($p=0.127$) and diversity ($p=0.126$) values are comparable to baseline measures, while the evenness is significantly higher ($p=0.011$), Table 4-1b.

A more in-depth comparison of the vegetation structure measured pre-construction and throughout monitoring is useful to track, as the golden-winged warbler has specific structural vegetation habitat requirements. Vegetation cover and species counts for all plant growth forms measured during pre-construction surveys and subsequent monitoring surveys Year I through IV are shown in Table 4-1c below. Growth forms include, in the understory, graminoids, herbaceous forbs, low shrubs, and tall shrub and tree seedlings; in the mid-story, tall shrubs, and tree saplings; and in the tree canopy, tall shrubs (>2.5m) and trees.

Table 4-1b. Mean vegetation measures from three vegetation canopies in Golden-winged Warbler habitat sites during pre-construction (2019) and throughout monitoring (2020-2022, 2024) surveys.

	Pre-constr.	Monitoring			
Vegetation Canopies	**2019**	**2024**	**2022**	**2021**	**2020**
Understory (herbs, low shrubs, seedlings)					
Understory Cover (%)	67.2	92.0	81.2	62.9	47.2
Species Richness	31.6	35.6	34.5	34.2	32.1
Diversity	1.94	2.63	2.68	2.77	2.79
Evenness	0.56	0.73	0.77	0.79	0.81
Mid-canopy (tall shrubs, saplings)					
Mid-canopy Cover (%)	17.7	13.4	8.6	6.0	1.8
Species Richness	5.6	3.5	2.5	2.6	1.6
Diversity	0.47	0.63	0.26	0.25	0.31
Evenness	0.29	0.49	0.25	0.20	0.28
Tree canopy (>2.5m tall shrubs, trees)					
Tree Canopy Cover (%)	22.4	1.5	0.8	0.8	0.4
Species Richness	2.7	0.8	0.4	0.4	0.1
Diversity	0.37	0.20	0.03	0.04	-
Evenness*	0.28	-	-	-	-
Number of Surveys	13	13	13	13	13

Note: *Evenness, which measures the degree to which one or more species may dominate vegetation composition, is not calculated where there are 0-1 species present. As three or fewer sites have >1 species in the tree canopy, evenness is not presented.

Table 4-1c. Vegetation structure regrowth in Golden-winged Warbler sites on the RoW, by plant growth form in three canopies. Mean cover (%) is shown from pre-construction (2019) and during four years of monitoring surveys, (2020-2022, 2024).

	Pre-constr.	Monitoring			
Canopy, plant form	**2019**	**2024**	**2022**	**2021**	**2020**
Understory					
Graminoids	24.3	31.4	25.1	17.3	12.8
Herbs	19.7	27.9	27.8	19.9	15.9
Low shrubs	6.1	6.1	5.1	3.8	4.9
Tall shrub seedlings	13.6	15.7	11.9	11.6	7.1
Tree seedlings	3.5	10.9	11.2	10.3	6.5
Total cover, understory:	*67.2*	*92.0*	*81.2*	*62.9*	*47.2*
Mid Canopy					
Tall shrubs	11.3	4.7	1.9	1.2	0.9
Tree saplings	6.4	8.6	6.7	4.8	0.9
Total cover, mid-canopy:	*17.7*	*13.4*	*8.6*	*6.0*	*1.8*
Tree Canopy					
Tall shrubs	1.9	0.3	0.3	0.3	0.0
Trees	20.5	1.2	0.5	0.5	0.4
Total cover, tree canopy:	*22.4*	*1.5*	*0.8*	*0.8*	*0.4*

After five seasons of re-growth since clearing, notable differences in the understory cover and structure in GWW sites include an overall increase of cover, primarily driven by increased growth of herbaceous plants (graminoids, forbs), and tall shrub and tree seedlings. When compared to pre-construction cover, the balance between narrow-leaved (graminoids) and broad-leaved (forbs) herbaceous cover measured in 2024 compares with their proportional cover in pre-construction surveys. Tall woody regeneration is noted in the understory, with 15.7% cover of tall shrub seedlings and 10.9% cover of tree seedlings, averaged over all sites. The current cover of tree seedlings surpasses the pre-construction cover value (3.5%), Table 4-1c.

In the mid-canopy, both tall shrubs and tree saplings continue to expand their coverage. Woody regeneration is noted in the midstory of all but two sites (GWW-13, -15), ranging from 0 to 31% cover per site, represented primarily by tree saplings (in eight sites), and by tall shrubs (in three sites). Mid-canopy tall shrubs, which contribute to the preferred habitat of the golden-winged warbler, are still less than half (4.7%) the cover of pre-construction (11.3%) and continue to be less prominent than tree sapling growth. In terms of species richness this year, the mid-canopy species count is comparable to the last year of monitoring 2022, and has rebounded now to a total of 14 species (3.5/site) among GWW sites. For reference, during pre-construction surveys a total of 18 species (5.6/site) were recorded in the mid-canopy. The same tree species are present in 2024 and 2019, the difference in richness is accounted for by species of tall shrub.

The tree canopy, which continues to be absent or reduced in sites, is included in Table 4-1c below, to show the slow, continued regeneration and development within this stratum. Six sites (up from four sites in 2022), had very sparse growth reaching the tree canopy (>2.5 m in height), including original white spruce (one site), trembling aspen (in five sites), a new addition of balsam poplar (two sites), and tall growing willows (three sites), data not shown. The current absence or sparse cover of trees (1.2% in 2024, 20.5% in 2019) and tall shrubs (0.3% in 2024, from 1.9% in 2019) reflects both the early development of regenerating tall shrubs and trees reaching the upper canopy (>2.5 m), as well as woody growth left uncleared from the RoW during construction. Also of note, as with the mid-canopy, the overall diversity in the tree stratum has not yet returned to pre-construction levels, based on species richness measured. During monitoring years to date, three to five species have been recorded in the tree canopy in the last three years of monitoring (2021, 2022 and 2024), and a single species in 2020. This year, the tree canopy includes three tree species and two species of tall shrub, while the pre-construction canopy consisted of 12 species (six trees and six tall shrubs), data not shown.

4.1.1.1 Cluster Analysis and Community Typing

The golden-winged warbler sites share certain habitat commonalities, all are deciduous trembling aspen communities (seedlings, saplings or trees), although one site is predominantly balsam poplar. Trees >2.5m are absent (seven sites), or sparsely occurring (six sites), and the sparse tall shrub canopy continues to be in the early stages of regeneration. Trembling aspen seedlings and saplings are found in nearly all sites, while balsam poplar (five sites) and bur oak (four sites) are less frequent. On the ground, litter is high, bare soil is generally absent, and woody debris is absent to sparse throughout sites.

Hierarchical cluster analyses of the species composition and abundance in the understory vegetation was completed to determine whether the 13 sites could be grouped into distinct community types. The following three community types (Table 4-1d) are determined based on the still-emerging vegetation structure, the species assemblages and cover in the understory recorded during monitoring surveys.

Golden-winged warblers require a patchy mixture of shrubs, saplings, herbaceous openings, and widely spaced tall trees (Environment and Climate Change Canada 2016). The early successional habitat provided by regenerating woody growth in the mid-canopy, including saplings and diverse tall shrubs, along with the rich herbaceous understory may represent suitable habitat for nesting and foraging, particularly within a larger landscape of mature forests.

Table 4-1d. Community types of thirteen Golden-winged Warbler habitat sites on the RoW, 2024.

Community Type	Surveys	Species, total	Species, mean
Aspen Sapling- Diverse Tall Shrubs/ Herb Rich- Abundant Oak, Aspen, Saskatoon, Hazelnut, Downy Arrow-wood Seedlings	4	93	43.0
Aspen Saplings- Tall Shrub/ Herb Rich- Moderate Aspen, Dogwood, Willow Seedlings	6	80	38.2
Very Sparse Mid Canopy/ Herb Poor- Abundant Kentucky Bluegrass -Sparse Woody Seedlings	3	46	20.7

Aspen Sapling- Diverse Tall Shrubs/ Herb Rich Abundant Oak, Aspen, Saskatoon-Hazelnut-Downy Arrow-wood Seedlings

This group is made up of four sites (GWW-1, -4, -10, -16). and distinguished by a richly diverse and well-developed understory. The high overall vegetation cover (110%, overlapping coverage) consists of abundant woody growth (55%), herbaceous forbs (38%), and grasses (18%). Woody growth consists primarily of a diverse cover of tall shrub seedlings (27%) including beaked hazelnut (*Corylus cornuta*), Saskatoon (*Amelanchier*

alnifolia), and downy arrow-wood (*Viburnum rafinesquianum*), as well as tree seedlings (16%) both trembling aspen and bur oak. A diverse mix of herbaceous forbs are present, most frequent include spreading dogbane (*Apocynum androsaemifolium*), fringed loosestrife (*Lysimachia ciliata*), Lindley's aster (*Symphyotrichum ciliolatum*), veiny meadow-rue (*Thalictrum venulosum*) and poison-ivy (*Toxicodendron rydbergii*). Grasses and occasional sedges are a moderate understory component, accounting for 18% cover of the understory. While diverse grasses are present, Kentucky bluegrass (*Poa pratensis*) dominates, although white-grained mountain rice grass (*Oryzopsis asperifolia*) and hay sedge (*Carex foena*) are frequent. The mid canopy layer is most diverse of all sites, though moderately sparse (14%) cover represented primarily by regenerating trembling aspen, balsam poplar and bur oak saplings, and sparse but diverse tall shrubs such as willows and other woody species noted in the understory. On the ground, litter cover is consistently high (95%), while moss and downed woody debris are absent to sparse.

Aspen Saplings- Tall Shrub/ Herb Rich- Moderate Aspen, Dogwood, Willow Seedlings

This groups is made up of six sites (GWW-8, -9, -13, -18, -22, -24), distinguished by a well-developed understory, with a high (86%) vegetation cover overall. The understory is an even mix of grasses (29%), herbaceous forbs (29%), and woody species (28%), consisting of aspen seedlings (10%), tall shrub seedlings (13%) and low shrubs (5%). Graminoid cover is moderately high with diverse species, although most frequent are Kentucky bluegrass and creeping bentgrass (*Agrostis stolonifera*). Frequent herbaceous forbs include purple-stemmed aster (*Symphyotrichum puniceum*), heart-leaved Alexander (*Zizia aptera*), smooth wild strawberry (*Fragaria virginiana*), dewberry (*Rubus pubescens*), northern bedstraw (*Galium boreale*) and violets (*Viola* spp.). Frequently occurring woody species in the understory are seedlings of trembling aspen, red-osier dogwood (*Cornus sericea*) and Bebb's willow (*Salix bebbiana*).

The mid canopy is moderately sparse (16%), made up primarily of trembling aspen saplings, with occasional sparse Bebb's willow. The ground cover of woody debris is absent or low (0 to 5%), most sites are mossy, but variably so, with 0.2 to 27% cover.

Very Sparse Mid-canopy/ Herb Poor- Abundant Kentucky Bluegrass-Sparse Woody Seedlings

Three sites fall into this group (GWW-6, -15, -19), and are characterized by a poorly developed mid canopy layer with slightly more tall shrubs than tree saplings, with low abundance of replacement tall shrub and tree seedlings in the understory. The understory is dominated by Kentucky bluegrass, with relatively low diversity or abundance of other graminoids and forbs. This group is summarized here using data from three sites, and GWW-19 also is summarized separately, following. Within three sites, the understory cover is moderately well-developed, consisting of grasses (54%) and few herbaceous forbs (13%).

Woody growth is reduced, consisting of aspen seedlings (5%), and seedlings of willow and dwarf birch shrubs (7%), and low shrubs are generally absent.

GWW-19 joins this group though consistently is set apart by the presence of a sparse tree canopy, a slightly higher diversity, and a relative abundance of Canada goldenrod (*Solidago canadensis*), Bebb's willow, creeping bentgrass, and balsam poplar seedlings and saplings. This results in a higher vegetation cover (101% due to overlapping cover) compared to other sites in this group (70% cover). The mid-canopy is sparse (8%) but higher than the group average, made up of balsam poplar saplings and willows (*Salix interior* and *S. bebbiana*). This site differs from all other sites as it was originally dominated by balsam poplar and is the only site with conifers present.

On the ground, moss cover is sparse or absent (0 to 7%), and presence of woody debris is sparse but variable (0 to 9%, absent in GWW-19).

Of note, GWW-6 and GWW-15 were extensively affected by the overspray of herbicide application in 2022 to an adjacent RoW, see Section 4.1.2. Also of note, both GWW-6 and GWW-19 both received reclamation re-seeding in 2021 and 2022 to address disturbance and bare soil, see Section 4.4. The effect of these disturbances on understory vegetation regrowth may be driving these sites to cluster together, more so than other underlying factors.

4.1.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas previously cleared (2019/2020), the effect predictions on golden-winged warbler habitat (Appendix III) included the following:

- Change in vegetation landscape intactness
- Change in native vegetation cover class abundance, distribution and structure
- Change in habitat availability

The Habitat Management Plan (Environment Canada IR EC/MH-003) provided information on RoW clearing activities for critical golden-winged warbler habitat. Mitigation measures identified in the Construction Environmental Protection Plan (Manitoba Hydro 2020) were previously assessed at each golden-winged warbler site sampled, see Table 4-1e. Clearing and construction activities were carried out over the fall and winter months of 2019 and 2020. Mitigation at GWW sites included whether shrubs and herbaceous vegetation <4 m tall were retained to the extent possible; and whether five to 10 perch trees were retained per span where feasible. Perch sites are small groups of three to five trees within 10 m of the cleared edge of the RoW. As identified in 2020, perch trees on the RoW were often absent, however the linear RoW boundaries occasionally supported small clumps of trees or individual stems remaining just inside the RoW edges, which may also provide perch

opportunities for GWW. Golden-winged warbler sites were primarily open hardwood canopies (pre-construction), dominated by trembling aspen (*Populus tremuloides*), with occasional balsam poplar (*Populus balsamifea*) and/or bur oak (*Quercus macrocarpa*). Clearing prescriptions for GWW sites were available for reference in the Clearing Management Plan (Manitoba Hydro 2016) prior to construction.

Table 4-1e. Mitigation measures assessed at sites monitored for golden-winged warbler habitat on the RoW.

Mitigation Measure
Refer to Clearing Management Plan for detailed clearing prescriptions.
Retain shrubs and herbaceous vegetation <4m tall to the extent possible.
Typically, 5-10 perch trees must be retained per span where feasible.

Golden-winged warbler sites were re-sampled again in 2024 along the transmission line RoW roughly between Anola and La Broquerie. The predicted change in landscape intactness was accurate for transmission RoW clearing. Previously, vegetation has been selectively cleared (2019/2020) to accommodate the transmission line and enhance suitability for GWW. Removal and long-term loss of forest cover from RoW clearing is an effect of transmission line development (Manitoba Hydro et al. 2003). Other studies have identified that fragmentation (change in landscape intactness) is frequently an inevitable consequence of large-scale corridor projects (Wildlife Resource Consulting 2010; Joro Consultants 2011; Splitrock Environmental Sekw'el'was 2020).

Increased vegetation cover and a modest change in structure was observed in several sites of the RoW during 2024 sampling. Long-term sample plots are located in Management Zone 2 of the Habitat Management Plan (Manitoba Hydro 2016; Environment Canada IR EC/MH-003). Zone 2 boundaries include 12 to 50 m on either side of the centreline of the RoW between tower footprints, where management involved selective removal of woody vegetation. This season, several sites had a well-developed tall shrub stratum (1 to 2.5 m), with woody growth measured into the tree layer (>2.5 m). Although the tree stratum remains very sparse in the cleared RoW, total cover in this stratum has marginally increased to 1.5% in 2024, from 0.8% in 2022. The original tree canopy in the RoW of the GWW sites was a mixture of mature deciduous species. Photograph 4-1a shows dense deciduous regeneration extending into the tree stratum at GWW-016.

Photograph 4-1a. Dense deciduous regeneration extending into tree stratum, GWW-016.

Mean total tall shrub cover has increased this season to 13.4% from 8.6% in 2022, 6% in 2021 and 1.8% in 2020. Pre-construction values averaged 17.7% in the tall shrub stratum (2019). This season, the most frequent species of tall shrubs, occurring in three or more monitoring sites, included trembling aspen, Bebb's willow (*Salix* bebbiana), red-osier dogwood (*Cornus sericea*), balsam poplar and beaked hazelnut (*Corylus cornuta*).

A well-developed herb and low shrub stratum (<1 m) is present on the RoW, where mulched wood previously covered the ground layer after clearing activities (2019/2020). Ground cover of woody material averaged 2.9% across sampling sites in 2024 compared to 12.5% in 2022, a reduction of 9.6%. Photograph 4-1b shows vegetation regeneration at site GWW-010, with a rich understory of shrubs, forbs and graminoids. Photograph 4-1c shows the RoW Management Zone 2 near GWW-016, with shrub cover interspersed with herbaceous openings, adjacent to mature forest.

In two GWW monitoring sites (GWW-006 and -015), the effects of previous broadleaf herbicide control are having continued impact on the regeneration of vegetation on the RoW. Broadleaf herbicide control was applied in 2022 along an adjacent transmission line RoW, with over spraying extending extensively into areas of the MMTP RoW. The species diversity in the herb and low shrub stratum (≤1 m tall) was notably reduced in these two monitoring sites (16 and 18 species), and well below the average richness for all sites (35.6 species). Both sites had abundant graminoid cover in 2024 (62.6 and 60.2%), twice the value of overall average graminoid cover in all sites 31.5%. Prominent grasses include Kentucky

bluegrass (*Poa pratensis*), bluejoint reedgrass (*Calamagrostis canadensis*) and smooth brome (*Bromus inermis*). While the cover of both bluejoint reedgrass and smooth brome has expanded slightly over monitoring years, Kentucky bluegrass has had a more drastic increase in these sites over time, and particularly since 2022. Pre-construction cover values of Kentucky bluegrass in these two sites were originally measured at 0% and 16% (2019), 11.2 and 10.4% (2022), and finally in 2024 increased to 22.9 and 49% cover. The average cover of this grass for all sites in 2024 is 13%.

Photograph 4-1b. Understory vegetation regeneration at site GWW-010.

Photograph 4-1c. RoW Management Zone 2 near site GWW-016, with shrub cover interspersed with herbaceous openings, adjacent to mature forest.

Tall shrub cover this season was absent in GWW-015 and poorly developed in GWW-006, also markedly reduced from the average cover, although three additional sites had similarly low mid-canopy cover. No vegetation cover was measured in the tree canopy. Photograph 4-1d shows vegetation regeneration two years post herbicide treatment at site GWW-015.

Photograph 4-1d. Vegetation regeneration two years post herbicide treatment at site GWW-015

Near monitoring plot GWW-008, an old-growth oak tree (>100 years) remains unaffected at an environmentally sensitive site (HERT-201) on the RoW, approximately 12 m from the centerline (Photograph 4-1e). Such slow growing old growth trees could remain in their habitat, where they do not interfere with vegetation clearance requirements for safe operation of the transmission line.

Photograph 4-1e. Old-growth bur oak remaining on the RoW at GWW-008.

4.2 Invasive Plant Species

Noxious, invasive, and non-native (ranked SNA) species observations were recorded in and incidental to all GWW quantitative surveys in 2024, (Field Activity ID MMTP_CON_GWW_CON_813) (Map 4-1, Appendix II). In 2020, monitoring requirements for invasive species surveys and roadside invasive surveys were both fulfilled, meeting conditions in the Environmental Monitoring Plan (Manitoba Hydro 2019a).

This year, 23 noxious, invasive or non-invasive SNA species were recorded along the RoW throughout GWW vegetation monitoring. Of these species recorded, eight species are listed in the Manitoba Noxious Weed Act as noxious weeds harmful to livestock or agricultural crops. Noxious weeds may include species that are invasive, non-invasive, or native species. For example, milkweeds (*Asclepias* spp.) and water hemlocks (*Cicuta* spp.) are native species that may be harmful to livestock if ingested. Tier 1 and 2 designations provide the most severe listing for noxious species. The Tier 2 noxious oxeye daisy (*Leucanthemum vulgare*) was observed, with few sporadically occurring individuals along the RoW near GWW-013. The remaining seven noxious species are listed as Tier 3.

While not considered noxious, at least 10 species are invasive (ranked SNA or S5) due to their tendency to outcompete native species, and dominate habitats once introduced (Canadian Food Inspection Agency 2008; Invasive Species Council of Manitoba 2022). An additional five are non-native species (ranked SNA), but considered neither noxious nor invasive. The establishment and persistence of non-native species in an environment may still lead to the exclusion of native plants.

Together, the noxious, invasive and non-invasive SNA species recorded along the RoW in 2024 at GWW monitoring sites include eight families, most prominently represented are Poaceae (seven species), Asteraceae (six species) and Fabaceae (five species). All noxious weed, invasive and non-native (non-invasive) species from GWW monitoring sites are listed in Table 4-2.

Prior to monitoring, during the pre-construction surveys, nine non-native species (SNA) were recorded in total from GWW surveys (noted in Table 4-2a), including three Tier 3 noxious weeds: Canada thistle (*Cirsium arvense*); field sow-thistle (*Sonchus arvensis*); and common dandelion (*Taraxacum officinale*).

Table 4-2. Noxious, invasive and non-invasive non-native (SNA) species recorded, from GWW monitoring sites in 2024.

Species	Rank	Noxious Weed	Invasive Status	Family
Agrostis stolonifera[1]	SNA			Poaceae
Asclepias sp.	-	Tier 3		Asclepiadaceae
Bromus inermis[1]	SNA		CFIA	Poaceae
Cicuta maculata	S4S5	Tier 3		Apiaceae
Cirsium arvense[1]	SNA	Tier 3	CFIA, ISCM	Asteraceae
Cirsium vulgare	SNA	Tier 3		Asteraceae
Convolvulus arvensis	SNA		ISCM	Convolvulaceae
Elymus repens[1]	SNA		CFIA	Poaceae
Hordeum jubatum	S5	Tier 3		Poaceae
Leucanthemum vulgare	SNA	Tier 2	CFIA, ISCM	Asteraceae
Medicago lupulina	SNA			Fabaceae
Melilotus albus[1]	SNA		CFIA	Fabaceae
Phalaris arundinacea	S5		CFIA	Poaceae
Phleum pratense[1]	SNA			Poaceae
Plantago major	SNA		CFIA	Plantaginaceae
Ranunculus acris	SNA		CFIA, ISCM	Ranunculaceae
Setaria viridis	SNA		CFIA	Poaceae
Sonchus arvensis[1]	SNA	Tier 3	CFIA, ISCM	Asteraceae
Taraxacum officinale[1]	SNA	Tier 3	CFIA	Asteraceae
Tragopogon dubius	SNA			Asteraceae
Trifolium hybridum[1]	SNA			Fabaceae
Trifolium pratense	SNA		CFIA	Fabaceae
Vicia cracca	SNA		ISCM	Fabaceae

Note: [1] Species also recorded during pre-construction GWW surveys (2019).

4.3 Species of Conservation Concern

Observations of species of conservation concern (SCC) were recorded in and incidental to GWW vegetation monitoring surveys (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_GWW_CON_813). Post-construction environmental monitoring for species of conservation concern at rare plant sites was completed in 2020.

Seven species of conservation concern were recorded throughout the RoW, in and incidental to five monitoring plots (GWW) in 2024. Five of these species were observed during GWW monitoring in 2022, new this year are wild chess (*Bromus kalmii*) and giant Solomon's-seal (*Polygonatum biflorum*). Among the species of conservation concern recorded in 2024, three species are ranked Imperilled (S2 to S2S3), the remaining four species are ranked Vulnerable (S3S4 to S3S5), Table 4-3. Species of conservation concern were observed from open grass sites and previously deciduous forested sites.

Table 4-3. Species of conservation concern recorded in 2024.			
Species	**Common Name**	**Rank**	**Family**
Imperilled species (S2 to S2S3)			
Bromus kalmii	Wild Chess	S2S3	Poaceae
Fraxinus nigra	Black Ash	S2	Oleaceae
Solidago riddellii	Riddell's Goldenrod	S2S3	Asteraceae
Vulnerable species (S3S4 to S3S5)			
Amphicarpaea bracteata	Hog-peanut	S3S5	Fabaceae
Asclepias incarnata	Swamp Milkweed	S3S4	Apocynaceae
Polygonatum biflorum	Giant Solomon's-seal	S3S4	Asparagaceae
Scirpus pallidus	Pale Bulrush	S3S4	Cyperaceae

One species at risk was observed during project monitoring, listed under the Manitoba's *Endangered Species and Ecosystems Act* (ESEA) and the federal *Species at Risk Act* (SARA). Riddell's goldenrod (*Solidago riddellii,* S2S3) is listed as Threatened by ESEA and Special Concern by SARA. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) also lists this species as Special Concern. Riddell's goldenrod was incidentally observed near GWW-018 during sampling in 2021 and observed again in 2022 and 2024. Approximately 30 plants were observed along the roadside ditch, located on the RoW (Photograph 4-3a).

Photograph 4-3a. Riddell's goldenrod observed near sampling plot GWW-018.

In the vicinity of GWW-019, a black ash (*Fraxinus nigra*) sapling was observed on the RoW in 2024. Black ash is listed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Photograph 4-3b).

Photograph 4-3b. Black ash observed near sampling plot GWW-019.

4.4 Rehabilitation Monitoring and Vegetation Management

This season, re-seeding efforts were not required in the vicinity of two GWW sampling sites, previously monitored and seeded (GWW-006, -019). Areas of soil disturbance observed along the RoW were previously broadcast seeded with a prescribed native seed mix to prevent colonization of exposed soil by non-native, invasive or noxious weeds. Bare ground from prior construction activities was not apparent at these sites this season.

At GWW-006, patches of bare soil previously occurred off the road allowance leading into the RoW. An area approximately 5 x 15 m was broadcast seeded with a native seed mix in 2021 and 2022. Vegetation at this site now consists of a mixture of native and non-native species including bluejoint reedgrass (*Calamagrostis canadensis*), sedges (*Carex spp.*), tufted hairgrass (*Deschampsia cespitosa),* rushes (*Juncus spp.*), slender wildrye (*Elymus trachycaulus*), reed canarygrass (*Phalaris arundinacea*), American sloughgrass (*Beckmannia syzigachne*), creeping bentgrass (*Agrostis stolonifera*), common Timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*). Note that two of the species established (tufted hairgrass and slender wildrye) were present in the

reclamation seed mix, and slender wildrye was not previously noted at this site. Photographs 4-4a and 4-4b show the change in vegetation cover from 2022 to 2024, respectively.

Photographs 4-4a and 4-4b. Vegetation cover along the RoW near GWW-006, in 2022 and 2024, respectively.

Near site GWW-019, an area 10 x 10 m of bare ground previously occurred, with sporadic non-native and noxious Tier 3 plants. The area occurred at the end of an access trail, leading into the RoW. This season, previous bare ground was colonized by species that included Canada wildrye (*Elymus canadensis*), slender wildrye, tufted hairgrass, creeping bentgrass, Canada thistle (*Cirsium arvense*), field sow-thistle (*Sonchus arvensis*) and spotted Joe pye weed (*Eutrochium maculatum*). Note that one of the species established (Canada wildrye) was present in the reclamation seed mix, which was not previously noted at this site. The change in vegetation cover over two monitoring seasons (2022 and 2024) are shown in Photographs 4-4c and 4-4d.

Photographs 4-4c and 4-4d. Vegetation cover along the RoW near GWW-019, in 2022 and 2024, respectively.

The content of the native seed mix applied in 2021 and 2022 was 95:5 grass: forb, and specifically 30% Canada wildrye, 20% side oats grama, 20% slender wildrye, 15% tufted hairgrass, 10% Junegrass, and 5% American vetch. The native seed reclamation mix was prepared by BrettYoung.

4.5 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 again to be true in Year IV post-construction monitoring. Since clearing, and during successive monitoring years, the mean species richness at golden-winged warbler habitat sites (GWW) has been relatively consistent, with a slight upward trend, within each of three vegetation strata (e.g., the low-, mid-, and tree canopies). Since clearing in 2019, the numbers of species recorded in the understory have been slightly higher in monitoring years (2020 through 2024). In the tall shrub layer, there are fewer species recorded in the mid-canopy in 2024 (average 3.5 species), than in 2019 (average 5.6 species). Woody vegetation takes longer reach the upper canopy, and species richness has been consistently low in the tree stratum (>2.5m in height) since clearing. Five tree and tall shrub species were recorded this year from the tree canopy (0.8 species/site), while 12 tree and tall shrub species were recorded in the tree canopy during pre-construction (2.7 species/site). This season, six sites (up from four sites in 2022, three in 2021, and one in 2020), had very sparse growth reaching the tree canopy.

Hypothesis 2 "*Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way*" is also true in Year IV post-construction monitoring. Although the specific monitoring schedule for invasive plant species from pre-construction through one-year post-construction was completed in 2020 (INV sites), these species continue to be observed during monitoring of other components. A total of 23 noxious, invasive or non-native species were recorded this season from existing monitoring sites (GWW), including one Tier 2 and seven Tier 3 noxious species. In 2022 (Year III), 19 noxious, invasive or non-native species were recorded in GWW monitoring sites. Pre-construction GWW surveys (2017) recorded nine non-native species, three of which were Tier 3 noxious species.

5.0 RECOMMENDATIONS

Based on post-construction vegetation monitoring in 2024, the following are recommendations for the project:

1. Where possible, attempt to avoid the locations recorded for Riddell's goldenrod (*Solidago riddellii*, near GWW-018) and black ash (*Fraxinus nigra*, GWW-019) during future vegetation management activities of the RoW. Riddell's goldenrod is listed as Threatened by ESEA, and Special Concern by SARA and COSEWIC, while black ash is listed as Threatened by COSEWIC. Care should be taken at these locations.

2. During 2022 GWW habitat monitoring, it was observed that broadleaf herbicide control extended into the MMTP RoW as a result of vegetation management along an adjacent transmission line RoW. Extensive foliar damage was visible at two monitoring sites (GWW-006 and -015) affecting species composition and cover. This season, the residual effects from past incidental herbicide treatment was still evident at these monitoring sites. Both monitoring sites shared commonalities. Notably species diversity in the herb and low shrub stratum (≤1 m tall) in these two sites was much reduced, compared to all other sites. Tall shrub cover (1 - 2.5 m tall) was absent or lower than average, and neither site had growth measured in the tree stratum. Direct and indirect contact with herbicide may also affect wildlife, including birds and their insect prey. It is recommended that future vegetation management in these areas follow the Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat (Manitoba Hydro 2016; Environment Canada IR EC/MH-003).

3. In Year IV monitoring, total mean plant cover has shown an increase in the understory, particularly in the cover of herbaceous plants (graminoids, forbs), and tall shrub and tree seedlings, since pre-construction surveys. In the tall shrub stratum, species mean cover continues to increase. While seven monitoring sites remain without species in the tree layer (>2.5 m tall), five sites show an increase in species numbers in this layer; one site remains unchanged. Golden-winged warbler territories tend to contain patches of herbs and low shrubs (used for ground nests) and scattered mature trees or forest edge habitat used for song posts and foraging. Hydroelectric utility corridors can become preferred habitat for the golden-winged warbler (Environment and Climate Change Canada 2016; Manitoba Hydro 2016; Environment Canada IR EC/MH-003) if vegetation is suitably managed to maintain an early-successional habitat, e.g., a heterogenous vegetation structure, with scattered mature trees and shrubs, and grassy herbaceous openings. Over the next few years (two to three), vegetation may require management to maintain or enhance critical golden-winged warbler habitat within the project RoW. The Right-of-Way

Habitat Management Plan (Manitoba Hydro 2016) should be adhered to, which outlines vegetation management during the operation phase of the project.

4. An old-growth oak tree remains unaffected at HERT-201, approximately 12 m from the centerline, near monitoring plot GWW-008. Such slow growing old growth trees could remain in their habitat, where they do not interfere with vegetation clearance requirements for safe operation of the transmission line.

6.0 REFERENCES

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, A. Burkinshaw, J. Carlson and K. France. 2009. Range Health Assessment for Grassland, Forest and Tame Pasture. Pub. No. T/044. Revised April 2009. Alberta Environment and Sustainable Resource Development. Edmonton, AB. 152 pp.

Alberta Native Plant Council. 2006. Plant Collection Guidelines for Researchers, Students and Consultants. Published by the Alberta Native Plant Council. http://www.anpc.ab.ca/

Canadian Food Inspection Agency. 2008. Invasive Alien Plants in Canada. Ottawa, ON. 72pp.

Cauboue, M., Strong, W.L., Archambault, L. and Sims, R.A. 1996. Terminology of Ecological Land Classification in Canada. Natural Resources Canada, Canadian Forest Service – Quebec. Sainte-Foy, Quebec. Information Report LAU-X-114E.

Committee on the Status of Endangered Wildlife in Canada. 2022. https://www.cosewic.ca/index.php/en-ca/

Environment and Climate Change Canada. 2016. Recovery Strategy for the Golden-winged Warbler (*Vermivora chrysoptera*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vii + 59 pp.

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford.

Government of Canada. 2021. Species at Risk Act. https://laws-lois.justice.gc.ca/eng/acts/s-15.3/

Invasive Species Council of Manitoba. 2022. http://invasivespeciesmanitoba.com/site

Johnson, D., Kershaw, L., MacKinnon, A. and Pojar, J. 1995. Plants of the Western Boreal Forest and Aspen Parkland. Natural Resources Canada, Canadian Forest Service. Lone Pine, Edmonton, Alberta.

Joro Consultants Inc. 2011. Bipole III Fragmentation: Technical Report Final Draft. Prepared for MMM Group and Manitoba Hydro.

Kent, M. and Coker, P. 1996. Vegetation Description and Analysis, A Practical Approach. England.

Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M. and Hornik, K. 2019. Cluster: Cluster Analysis Basics and Extensions. R package version 2.1.0.

Manitoba Clean Environment Commission. 2017. Manitoba-Minnesota Transmission Project, Report on Public Hearing.

Manitoba Government. 2024a. Manitoba Conservation Data Centre. https://www.gov.mb.ca/sd/environment_and_biodiversity/cdc/index.html

Manitoba Government. 2024b. The Endangered Species and Ecosystems Act. https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php

Manitoba Government. 2024c. The Noxious Weeds Act. http://web2.gov.mb.ca/laws/statutes/ccsm/n110e.php

Manitoba Hydro. 2015. Manitoba-Minnesota Transmission Project, Environmental Impact Statement.

Manitoba Hydro. 2016. Manitoba-Minnesota Transmission Project, Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Habitat during Construction and Operation of the MMTP (Environment Canada IR EC/MH-003).

Manitoba Hydro. 2019a. Manitoba-Minnesota Transmission Project, Environmental Monitoring Plan.

Manitoba Hydro. 2019b. Manitoba-Minnesota Transmission Project, Construction Environmental Protection Plan.

Manitoba Hydro. 2019c. Manitoba-Minnesota Transmission Project, Biosecurity Management Plan.

Manitoba Hydro. 2019d. Manitoba-Minnesota Transmission Project, Rehabilitation and Invasive Species Management Plan.

Manitoba Hydro. 2020. Manitoba-Minnesota Transmission Project, Construction Environmental Protection Mapbook. Environmentally Sensitive Site Locations.

Manitoba Hydro. 2021. Field Survey Report – MMTP Tower 483 Revegetation.

National Energy Board. 2019. Manitoba-Minnesota Transmission Project, National Energy Board Certificate EC-059.

R Core Team 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. http://www.R-project.org/

Raven, P.H, Ray, F.E. and Eichhorn, S.E. 1992. Biology of Plants. Fifth Edition. Worth Publishers Inc. New York, New York.

Redburn, M.J. and Strong, W.L. 2008. Successional development of silviculturally treated and untreated high-latitude *Populus tremuloides* clearcuts in northern Alberta, Canada. Forest Ecology and Management, 255: 2937-2949.

Splitrock Environmental Sekw'el'was LP. 2020. Seton River Conservation/Restoration Management Planning Project Summary Report. Project No. FWCP COA-F19-W-2758. 2018-2019.

Strong, W.L., E.T. Oswald, and D.J. Downing. 1990. The Canadian Vegetation Classification System, First Approximation, Ecological Land Classification Series No. 25. Environment Canada, National Vegetation Working Group, Ottawa, 22 pp.

Strong, W.L 2016. Biased richness and evenness relationships with Shannon-Wiener index values. Ecological Indicators, 67: 703-713.

Sustainable Development. 2019. Manitoba-Minnesota Transmission Project, Environment Act Licence No. 3288.

Szwaluk Environmental Consulting Ltd., K. Newman and Calyx Consulting. 2016. Bipole III Terrestrial Ecosystems and Vegetation Pre-construction and Environmental Monitoring Annual Technical Report (Year II). Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2017. Manitoba-Minnesota Transmission Project Botanical and Vegetation Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting. 2018. Manitoba-Minnesota Transmission Project Invasive Plant Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2019. Manitoba-Minnesota Transmission Project Botanical and Vegetation Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2020. Manitoba-Minnesota Transmission Project Botanical and Vegetation Environmental Monitoring Annual Technical Report. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2021. Manitoba-Minnesota Transmission Project Botanical and Vegetation Environmental Monitoring Annual Technical Report – Year II. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2022. Manitoba-Minnesota Transmission Project Botanical and Vegetation Environmental Monitoring Annual Technical Report – Year III. Prepared for Manitoba Hydro.

Wildlife Resource Consulting. 2010. Fur, Feathers, Fins and Transmission Lines. How transmission lines and rights-of-way affect wildlife. Prepared for Manitoba Hydro.

Usher, G. 1996. The Wordsworth Dictionary of Botany. Wordsworth Editions Ltd. Hertfordshire, England.

APPENDIX I. Definitions of selected technical terms. Taken from Cauboue et al. (1996), unless otherwise noted.

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.

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).

Bog – Ombrotrophic peatlands generally unaffected by nutrient-rich groundwater that are acidic and often dominated by heath shrubs and Sphagnum mosses and that may include open-growing, stunted trees.

Canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees.

Canopy Closure – The degree of canopy cover relative to openings.

Classification – The systematic grouping and organization of objects, usually in a hierarchical manner.

Cluster Analysis – A multidimentional statistical technique used to group samples according to their degree of similarity.

Community-Type – A group of vegetation stands that share common characteristics, an abstract plant community.

Coniferous – A cone-bearing plant belonging to the taxonomic group Gymnospermae.

Cover – The area of ground covered with plants of one or more species, usually expressed as a percentage.

Deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season.

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

Ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation.

Endangered Species - A species that is facing imminent extirpation or extinction (Government of Canada 2021).

Extirpated Species - A species that no longer exists in the wild in Canada, but exists elsewhere in the wild (Government of Canada 2021).

Fen – Wetland with a peat substrate, nutrient-rich waters, and primarily vegetated by shrubs and graminoids.

Flora – A list of the plant species present in an area.

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.

Graminoid – A narrow-leaved plant that is grass-like; the term refers to grasses and plants that look like grasses.

Grassland – Vegetation consisting primarily of grass species occurring on sites that are arid or at least well drained.

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.

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 2022).

Mitigation – Often the process or act of minimizing the negative effects of a proposed action.

Mixedwood – Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover.

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 (e.g., 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 2024c).

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

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.

Shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base.

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

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.

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 2021).

Stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests.

Stratum – A distinct layer within a plant community, a component of structure.

Terrestrial – Pertaining to land as opposed to water.

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 2021).

Understory – Vegetation growing beneath taller plants such as trees or tall shrubs.

Vascular Plant – A plant having a vascular system (Usher 1996).

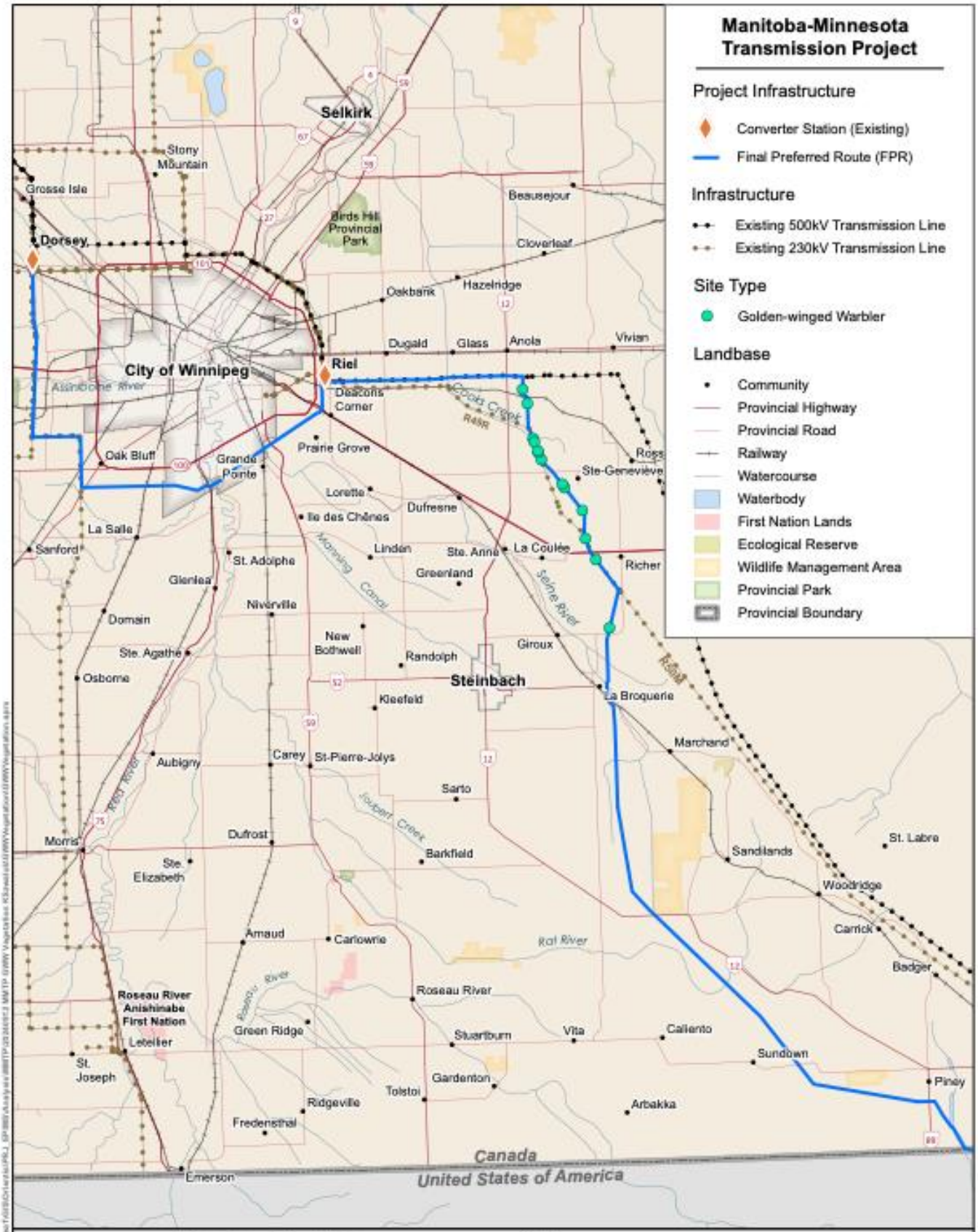
Vegetation – The general cover of plants growing on a landscape.

Vegetation Type – In phytosociology, the lowest possible level to be described.

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.

APPENDIX II. Report maps.


Manitoba-Minnesota Transmission Project
Project Infrastructure
Converter Station (Existing)
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Landbase
Community
Provincial Highway
Provincial Road
Railway
Watercourse
Waterbody
First Nation Lands
Ecological Reserve
Wildlife Management Area
Provincial Park
Provincial Boundary
Selkirk
Stony Mountain
Grosse Isle
Dorsey
Birds Hill Provincial Park
Beausejour
Cloverleaf
Oakbank
Hazelridge
Dugald
Glass
Anola
Vivian
City of Winnipeg
Riel
Assiniboine River
Deacons Corner
Cook Creek
RAW
Prairie Grove
Ross
Oak Bluff
Grande Pointe
Ste-Geneviève
Loretteville
Dufresne
Ile des Chênes
La Salle
Sanford
St. Adolphe
Linden
Ste. Anne
La Coulée
Richer
Greenland
Glenlea
Niverville
Manning Canal
Seine River
Domain
New Bothwell
Giroux
Ste. Agathe
Randolph
Osborne
Steinbach
La Broquerie
Kleefeld
Marchand
Aubigny
Carey
St-Pierre-Jolys
Red River
Sarto
Joubert Creek
Morris
Dufrost
Barkfield
Sandilands
St. Labre
Ste. Elizabeth
Woodridge
Carrick
Amaud
Carlowrie
Rat River
Badger
Roseau River Anishinabe First Nation
Roseau River
Roseau River
Green Ridge
Stuartburn
Vita
Caliento
Sundown
Letellier
St. Joseph
Gardenton
Pilney
Tolstoi
Ridgeville
Arbakka
Fredensthal
Canada
United States of America
Emerson
Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, ProvMB, NRCan
Date Created: September 13, 2024
0 10 20 Kilometres
0 5 10 Miles
1:600,000
N
MMTP Project Area
Draft: For Discussion Purposes Only
Map 1-1


Manitoba-Minnesota Transmission Project
Project Infrastructure
Converter Station (Existing)
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Site Type
Golden-winged Warbler
Landbase
Community
Provincial Highway
Provincial Road
Railway
Watercourse
Waterbody
First Nation Lands
Ecological Reserve
Wildlife Management Area
Provincial Park
Provincial Boundary
Selkirk
Stony Mountain
Grosse Isle
Dorsey
Birds Hill Provincial Park
Beausejour
Cloverleaf
Oakbank
Hazelridge
Dugald
Glass
Anola
Vivian
City of Winnipeg
Riel
Assiniboine River
Deacons Corner
Oak Bluff
Grande Pointe
Prairie Grove
Ross
Ste-Geneviève
Lorette
Dufresne
Ile des Chênes
La Salle
Sanford
Linden
Ste. Anne
La Coulée
Richer
St. Adolphe
Greenland
Glenlea
Niverville
Domain
New Bothwell
Randolph
Giroux
Ste. Agathe
Osborne
Steinbach
Kleefeld
La Broquerie
Marchand
Aubigny
Carey
St-Pierre-Jolys
Sarto
Morris
Dufrost
Barkfield
Sandilands
St. Labre
Ste. Elizabeth
Woodridge
Carrick
Amaud
Carlowrie
Rat River
Badger
Roseau River Anishinabe First Nation
Roseau River
Green Ridge
Stuartburn
Vita
Caliento
Sundown
Letellier
St. Joseph
Gardenton
Piney
Tolstoi
Ridgeville
Arbakka
Fredenstahl
Canada
United States of America
Emerson
Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, ProvMB, NRCan
Date Created: September 13, 2024
0 10 20 Kilometres
0 5 10 Miles
1:600,000
N
MMTP Golden-Winged Warbler Vegetation Monitoring 2024
Draft: For Discussion Purposes Only
Map 4-1

APPENDIX III. Potential environmental effects on botanical and vegetation resources as a result of the Project. Effects were identified from the Environmental Impact Statement, Chapter 9 and 10 (Manitoba Hydro 2015).

Number	Potential Environmental Effect
1	Change in vegetation landscape intactness.
2	Change in native vegetation cover class abundance, distribution and structure.
3	Change in wetland cover class abundance, distribution, structure and function.
4	Change in invasive plant species abundance and distribution.
5	Change in rare plant species abundance and distribution.
6	Change in traditional use plant species abundance and distribution.
7	Change in habitat availability.

APPENDIX IV. Project commitments for botanical and vegetation pre-construction surveys and environmental monitoring. Reference documents include the Environment Act Licence (Sustainable Development 2019), the Report on Public Hearing (Manitoba Clean Environment Commission 2017), the National Energy Board Certificate (National Energy Board 2019), and Environmental Impact Statement (Manitoba Hydro 2015).

Commitment Document	Page/Section or Clause	Environmental Component	Commitment Description Summary	Objectives to meet intent of Commitment
Licence	Clause 1	Future sampling, analysis and reporting	1. The Licensee shall, in addition to any of the specifications, limits, terms and conditions specified in this Licence, upon the request of the Director: a) sample, monitor, analyse or investigate specific areas of concern regarding any segment, component or aspect of the Development for such duration and at such frequencies as may be specified; b) determine the environmental impact associated from the Development; c) conduct specific investigations in response to the data gathered during environmental monitoring programs; and d) provide the Director, within such time as may be specified, with such reports, drawings, specifications, analytical data, descriptions of sampling and other information as may from time to time be requested.	Monitor the transmission line as specified; submit annual technical report detailing results and analysis of sampling program and recommendations for improvements where required.
Licence	Clause 10	Environmental Protection Plan	10. The Licensee shall submit, for approval of the Director of the Environmental Approvals Branch, a construction Environmental Protection Plan prior to construction, and an operations Environmental Protection Plan at least 90 days prior to in-service of the Development. The plans shall describe the approach to be used by the Licensee to ensure that mitigative measures are applied systematically, and in a manner consistent with the commitments made in the EIS and supporting information,	Manitoba Hydro to develop and submit Environmental Protection Plan.

			during construction or operation of the Development. The plans shall: a) include information obtained from Indigenous communities prior to and during construction and operation of the Development regarding the locations of specifically identified sites used for the exercise of Indigenous rights-based activities in the vicinity of the project (such as plant harvesting, ceremonial practices, hunting, and trapping); b) include mitigation measures and/or buffer zones for the specific sites identified to minimize impacts to the sites from construction and operation activities; c) for specifically identified plant harvesting sites, identify measures to minimize impacts to the sites by implementing mitigation measure such as flagging of the area, buffers zones, selective clearing, construction matting, and non-chemical vegetation management; and d) include mitigation measures to reduce adverse effects on wildlife and wildlife habitat (e.g., timing windows, setbacks, and buffers).	
Licence	Clause 12	Invasive species management plan	The Licensee shall, prior to construction of the Development, submit management plans addressing the following topics for review by the Eastern Region IRMT and approval by the Director of the Environmental Approvals Branch: a) erosion protection and sediment control; b) rehabilitation and invasive species management, and c) waste and recycling.	Manitoba Hydro to develop and submit rehabilitation and invasive species management plan.

Licence	Clause 28	ROW clearing plan	The Licensee shall, prior to construction of the Development, submit a plan for clearing of the transmission line right-of-way for approval of the Director of the Environmental Approvals Branch. The plan shall: a) describe the clearing methods to be used; and b) describe opportunities for retention of low-growth vegetation along the transmission line right-of-way, to the extent possible, without impeding maintenance activities or vegetation clearance requirements.	Manitoba Hydro to develop and submit ROW clearing plan.
Licence	Clause 29	Timber Harvesting	The Licensee shall, prior to construction of the Development, consult with the Regional Forester of the Forestry and Peatlands Branch related to the clearing of timber in association with the Development. Where an opportunity exists, a plan for timber operations may be established and timber shall be harvested and delivered to an approved destination identified by a scaling plan. In the event that no market exists, a timber valuation (Timber Damage Appraisal) shall be applied.	Manitoba Hydro to consult with Regional Forester regarding timber clearing.
Licence	Clause 35	Wetlands	The Licensee shall carry out activities associated with the Development that may disturb wetlands in the Caliento, Sundown, and Piney Bogs only under frozen ground conditions. Maintenance activities within these bogs shall be conducted under frozen ground conditions unless required to ensure the safe and reliable operation of the Development, in which case mitigation measures to reduce impacts to the bogs shall be implemented.	Visual observations during monitoring of the transmission line RoW wetlands.

Licence	Clause 36	Wetlands	The Licensee shall, within three months of the completion of construction of the Development, submit a plan for approval of the Director of the Environmental Approvals Branch to ensure that there is no net loss of wetland benefits related to Class 3, 4, and 5 wetlands (as defined by the Stewart & Kantrud Classification System) that are altered or destroyed during construction of the Development.	Monitor wetlands, visual observations during monitoring of the transmission line RoW wetlands.
Licence	Clause 37	Golden Winged Warbler Habitat Management	The Licensee shall implement the plan titled "Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat during Construction and Operation of the Manitoba-Minnesota Transmission Project" submitted as supporting information on April 29, 2016, or any subsequent versions approved by the Director of the Environmental Approvals Branch.	Manitoba Hydro to develop and implement habitat management plan for golden winged warbler.
Licence	Clause 38	Invasive Species	The Licensee shall, prior to construction of the Development, submit a detailed biosecurity plan for approval of the Director of the Environmental Approvals Branch. The plan shall describe measures to be implemented to control the spread of invasive species as well as the spread of soil borne diseases from field to field in agricultural areas during construction of the Development.	Manitoba Hydro to develop and submit biosecurity plan. Follow biosecurity plan when accessing ROW. Monitor transmission line RoW for invasive species.

Licence	Clause 49	Vegetation Management Plan	The Licensee shall, within six months of the completion ·of construction of the Development, submit for review by the Eastern Region IRMT and approval of the Director of the Environmental Approvals Branch, a plan for the management of vegetation along the Dorsey international power line right-of-way. The plan shall describe the methods to be used for vegetation control and for communication to the public and Indigenous communities during operation of the Development.	Manitoba Hydro to develop vegetation management plan.
Licence	Clause 50	Integrated vegetation management review and reporting	The Licensee shall conduct reviews, and report to the Director of the Environmental Approvals Branch, on the results of integrated vegetation management practices implemented on the Dorsey international power line right-of-way of the Development 5 and 10 years after; the completion of construction and as determined by the Director thereafter.	Manitoba Hydro to conduct reviews and report on integrated vegetation management.
Licence	Clause 52	Herbicide Use	The Licensee shall provide notification to local Indigenous communities a minimum of 30 days prior to the application of herbicides within the transmission right-of-way of the Development.	Manitoba Hydro to provide notification to Indigenous communities.
Licence	Clause 53	Monitoring	The Licensee shall, prior to construction, submit a monitoring plan for the Development for the approval of the Director of the Environmental Approvals Manitoba Hydro - Manitoba-Minnesota Transmission Project Branch. The plan shall describe monitoring programs to be undertaken in relation to the Development, including proposed programs for: a) collection of baseline information; b) pre-construction surveys of the eastern tiger salamander and mottled duskywing butterfly	Manitoba Hydro to conduct pre-construction surveys.

			obligate plant host, in areas of likely habitat; c) inclusion of the least bittern and the short-eared owl in surveys; d) pre-construction surveys for traditional use plant species and invasive plant species in areas of the Development where information on these plant species is insufficient.	
Licence	Clause 56	Reporting	The Licensee shall submit annual reports to the Director of the Environmental Approvals Branch, on the results of monitoring programs approved pursuant to Clause 53 of this Licence for the duration of the monitoring programs. The reports shall: a) report on the accuracy of predictions made in the EIS and supporting information, b) report on the success of the mitigation measures employed during construction and operation, c) provide a description of the adaptive management measures undertaken to address issues, and commitments for future mitigation; d) identify any unexpected environmental effects of the Development; e) identify additional mitigation measures to address unanticipated environmental effects, if required; f) report on how input from the monitoring advisory group, formed pursuant to Clause 55 of this licence, was incorporated into the monitoring program; and g) propose changes to the monitoring programs based on the results of the annual assessments.	Manitoba Hydro to submit annual monitoring report.

NEB Certificate	Condition 10	Construction Environmental Protection Plan	Manitoba Hydro must file with the Board for approval, at least ninety (90) days prior to commencing construction, an updated Project-specific Construction Environmental Protection Plan (CEPP) which includes: a) all environmental protection, mitigation and monitoring measures and commitments, as set out in its Application, draft CEPP, or otherwise agreed to in its subsequent filings during both the Manitoba Clean Environment Commission hearing process and the Board's EH-001-2017 proceeding, and including any criteria that will be used to implement those measures; b) any updates from outstanding pre-construction surveys; c) the following plans: i) clearing management plan ii) blasting plan iii) erosion protection and sediment control plan iv) golden-winged warbler habitat management plan v) cultural and resource heritage protection plan vi) navigation and navigation safety plan (see Condition 9) vii) waste and recycling management plan viii) emergency preparedness and response plan (see Condition 14) ix) rehabilitation and invasive species management plan x) biosecurity management plan xi) access management plan xii) environmental monitoring plan xiii) integrated vegetation management plan; d) orthophoto maps of the Project footprint, which include the identification of environmental features, Manitoba Hydro's Environmentally Sensitive Sites, and mitigation measures to be applied.	Manitoba Hydro to develop and file CEPP.

NEB Certificate	Condition 23	Post-construction Monitoring Reports	Manitoba Hydro must file with the Board, on or before 31 January following the first year of Project operations and for a period of at least ten (10) years after commencing operations, annual post-construction monitoring reports. These reports must include: a) a description of monitoring methods used; b) identification, including on a map or diagram, of any reclamation or other environmental issues which arose during construction or in the course of the previous year; c) a description of the valued components or issues that were assessed or monitored, as outlined in Manitoba Hydro's Environmental Monitoring Plan (see Condition 10); d) the monitoring results, including a comparison to measurable goals; e) an assessment of the effectiveness of the mitigation measures implemented and the accuracy the environmental assessment predictions; f) a description of any corrective actions taken, their observed success and current status; and, g) a schedule outlining when further corrective actions will be implemented or monitoring conducted to address any unresolved issues.	Manitoba Hydro to complete post-construction monitoring and submit reports.
NEB Certificate	Condition 26	Wetland Offset Measures	Manitoba Hydro must file with the Board for approval, within ninety (90) days of commencing operation of the Project, a Wetland Offset Measures Plan which outlines how permanent loss to wetlands resulting from the Project will be offset or compensated for. This plan must include: a) a description of site-specific details and maps showing the locations of permanent wetland loss as a result of Project activities at Dorsey Converter	Manitoba Hydro to develop and file wetland offset measures plan.

			Station and the transmission tower locations, as well as any other locations where wetlands were affected by the Project; b) an explanation of how wetland function will be measured during the post-construction monitoring program, and any resulting accidental permanent loss to wetlands quantified and reported to the Board as part of Condition 23; c) a list of the offset or compensation measures that will be implemented to address permanent loss of wetlands as identified in a) and b) above; d) an explanation of the expected effectiveness of each offset measure described in c) and the relative value of each offset measure towards achieving the offset; e) the decision-making criteria for selecting specific offset measures and offset ratios that would be used under what circumstances; f) a schedule indicating when measures will be implemented and estimated completion date(s); g) evidence and summary of consultation with provincial and federal authorities, any non-governmental expert bodies, and any impacted Indigenous communities regarding the plan; and, h) this summary must include a description of any issues or concerns raised regarding the plan by Indigenous communities, and how Manitoba Hydro has addressed or responded to them.	
CEC Report	Page 77	Vegetation and Wetlands	Manitoba Hydro expand traditional-use and invasive-plant surveys, with input from Indigenous and local knowledge holders, prior to construction, to include areas within the Local Assessment Area on Crown and private land that were not	Manitoba Hydro to conduct pre-construction surveys along transmission line ROW for invasive species, and traditional use

			sampled or that were insufficiently sampled in preparation for the EIS. An example would be the area affected by the change to the Piney border crossing.	plants and in areas that were insufficiently sampled during EIS preparation.
CEC Report	Page 143	Integrated Vegetation Management	Manitoba Hydro submit to Manitoba Sustainable Development a review of integrated vegetation-management practices for the ROW on an annual basis for the first 10 years of operations and as determined by the department after 10 years.	Manitoba Hydro to develop and implement vegetation control plan.
EIS, Chapter 10	10-116	Rare Plants	Survey for SCC and SAR plant species in areas not previously surveyed that have the potential to provide habitat for SCC; monitor changes in rare plant species occurrences in areas along the PDA.	Pre-construction surveys and environmental monitoring.
EIS, Chapter 10	10-116	Invasive Plants Species	Monitor existing invasive plant species at construction sites and equipment clearing sites, if construction occurs during the growing season; monitor compliance for clean equipment.	Environmental monitoring.

APPENDIX V. Location of vegetation surveys.

Site	Easting	Northing	Datum	UTM Zone	Date
MM-GWW-001	682148	5494993	NAD83	14 U	08-08-2024
MM-GWW-004	680541	5503310	NAD83	14 U	08-08-2024
MM-GWW-006	679262	5505807	NAD83	14 U	08-08-2024
MM-GWW-008	678933	5509103	NAD83	14 U	08-08-2024
MM-GWW-009	676776	5511944	NAD83	14 U	07-08-2024
MM-GWW-010	676474	5512327	NAD83	14 U	07-08-2024
MM-GWW-013	673975	5515270	NAD83	14 U	07-08-2024
MM-GWW-015	673596	5516107	NAD83	14 U	07-08-2024
MM-GWW-016	673532	5516435	NAD83	14 U	07-08-2024
MM-GWW-018	672979	5517754	NAD83	14 U	06-08-2024
MM-GWW-019	672298	5521970	NAD83	14 U	06-08-2024
MM-GWW-022	671699	5523733	NAD83	14 U	06-08-2024
MM-GWW-024	673133	5517451	NAD83	14 U	06-08-2024

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

Site	Species	Common Name	Rank
MM-GWW-001	*Amphicarpaea bracteata*	Hog-peanut	S3S5
MM-GWW-018	*Asclepias incarnata*	Swamp Milkweed	S3S4
MM-GWW-004	*Bromus kalmii*	Wild Chess	S2S3
MM-GWW-019	*Fraxinus nigra*	Black Ash	S2
MM-GWW-004	*Polygonatum biflorum*	Giant Solomon's-seal	S3S4
MM-GWW-013	*Scirpus pallidus*	Pale Bulrush	S3S4
MM-GWW-018	*Solidago riddellii*	Riddell's Goldenrod	S2S3

APPENDIX VII. List of flora recorded in MMTP surveys, 2024.

Family/Species	Common Name	MB Rank
VASCULAR SPECIES		
Pteridophytes – Ferns and Allies		
EQUISETACEAE	HORSETAIL FAMILY	
Equisetum arvense	Common Horsetail	S5
Equisetum hyemale	Common Scouring-rush	S5
Gymnosperms		
PINACEAE	PINE FAMILY	
Picea glauca	White Spruce	S5
Angiosperms - Monocotyledons		
ASPARAGACEAE	ASPARAGUS FAMILY	
Maianthemum canadense	Two-leaved Solomon's-seal	S5
Maianthemum stellatum	Star-flowered Solomon's-seal	S5
Polygonatum biflorum	Giant Solomon's-seal	S3S4
CYPERACEAE	SEDGE FAMILY	
Carex aurea	Golden Sedge	S5
Carex bebbii	Bebb's Sedge	S5
Carex foenea	Hay Sedge	S5
Carex granularis	Granular Sedge	S4?
Carex vaginata	Sheathed Sedge	S5
Carex spp.	A sedge	-
Scirpus pallidus	Green Bulrush	S3S4
JUNCACEAE	RUSH FAMILY	
Juncus arcticus var. *balticus*	Baltic Rush	S5
Juncus longistylis	Long-styed Rush	S4
Juncus spp.	A Rush	-
JUNCAGINACEAE	ARROW-GRASS FAMILY	
Triglochin maritima	Seaside Arrow-grass	S5
LILIACEAE	LILY FAMILY	
Lilium philadelphicum	Wood Lily	S4
POACEAE	GRASS FAMILY	

Agrostis stolonifera	Creeping Bentgrass	SNA
Andropogon gerardii	Big Bluestem	S5
Beckmannia syzigachne	Slough Grass	S5
Bromus inermis	Smooth Brome	SNA
Bromus kalmii	Wild Chess	S2S3
Calamagrostis canadensis	Bluejoint Reedgrass	S5
Deschampsia cespitosa	Tufted Hairgrass	S4S5
Elymus canadensis	Great Plains Wild Rye	S4S5
Elymus trachycaulus ssp*. trachycaulus*	Slender Wildrye	S5
Koeleria macrantha	Prairie Junegrass	S5
Oryzopsis asperifolia	Rice Grass	S5
Phalaris arundinacea	Reed Canarygrass	S5
Phleum pratense	Timothy	SNA
Poa palustris	Fowl Bluegrass	S5
Poa pratensis	Kentucky Bluegrass	S5
Setaria viridis	Green Foxtail	SNA
Sporobolus michauxianus	Prairie Cordgrass	S4S5
SMILACACEAE	GREENBRIAR FAMILY	
Smilax lasioneura	Carrion Flower	S4S5
Angiosperms – Dicotyledons		
ANACARDIACEAE	SUMAC FAMILY	
Toxicodendron rydbergii	Poison Ivy	S5
APIACEAE	CARROT FAMILY	
Cicuta maculata	Spotted Water Hemlock	S4S5
Sanicula marilandica	Seneca Snakeroot	S5
Zizia aptera	Heart-leaved Alexander	S5
APOCYNACEAE	DOGBANE FAMILY	
Apocynum androsaemifolium	Spreading Dogbane	S5
ASCLEPIADACEAE	MILKWEED FAMILY	
Asclepias incarnata	Swamp Milkweed	S3S4
Asclepias sp	A milkweed	-
ASTERACEAE	ASTER FAMILY	
Achillea millefolium	Yarrow	S5
Antennaria sp.	A Pussytoes	-
Artemisia ludoviciana	Prairie Sage	S5
Cirsium arvense	Canada Thistle	SNA
Cirsium vulgare	Bull Thistle	SNA

Doellingeria umbellata	Flat-topped White Aster	S5
Erigeron glabellus	Smooth Fleabane	S5
Euthamia graminifolia	Flat-topped Goldenrod	S5
Eutrochium maculatum	Spotted Joe Pye Weed	S5
Hieracium umbellatum	Northern Hawkweed	S5
Leucanthemum vulgare	Ox-eye Daisy	SNA
Packera paupercula	Balsam Groundsel	S5
Petasites frigidus var. *palmatus*	Palmate-leaved Colt's-foot	S5
Petasites frigidus var. *sagittatus*	Arrow-leaved Colt's-foot	S5
Rudbeckia hirta	Black-eyed Susan	S5
Senecio sp.	A Groundsel	-
Solidago canadensis	Canada Goldenrod	S5
Solidago riddellii	Riddell's Goldenrod	S2S3
Solidago rigida	Stiff Goldenrod	S5
Sonchus arvensis	Field Sow-thistle	SNA
Symphyotrichum ciliolatum	Lindley's Aster	S5
Symphyotrichum ericoides	Many-flowered Aster	S4
Symphyotrichum laeve	Smooth Aster	S5
Symphyotrichum lateriflorum	Calico Aster	S4
Symphyotrichum puniceum	Purple-stemmed Aster	S5
Taraxacum officinale	Common Dandelion	SNA
Tragopogon dubius	Goat's-beard	SNA
BETULACEAE	BIRCH FAMILY	
Betula pumila	Dwarf Birch	S5
Corylus cornuta	Beaked Hazelnut	S5
BORAGINACEAE	BORAGE FAMILY	
Lithospermum canescens	Hoary Puccoon	S5
CAMPANULACEAE	BELLFLOWER FAMILY	
Campanula rotundifolia	Harebells	S5
Lobelia kalmii	Kalm's Lobelia	S5
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Diervilla lonicera	Northern Bush-honeysuckle	S5
Lonicera dioica	Twining Honeysuckle	S5
Symphoricarpos albus	Snowberry	S4S5
Symphoricarpos occidentalis	Western Snowberry	S5
Viburnum lentago	Nannyberry	S4
Viburnum opulus	High-bush Cranberry	S5

Viburnum rafinesquianum	Downy Arrowwood	S4S5
CONVOLVULACEAE	MORNING GLORY FAMILY	
Convolvulus arvensis	Field Bindweed	SNA
CORNACEAE	DOGWOOD FAMILY	
Cornus sericea	Red-osier Dogwood	S5
ELAEAGNACEAE	OLEASTER FAMILY	
Shepherdia canadensis	Soapberry	S5
ERICACEAE	HEATH FAMILY	
Arctostaphylos uva-ursi	Common Bearberry	S5
Pyrola sp.	A Wintergreen	-
FABACEAE	PEA FAMILY	
Amphicarpaea bracteata	Hog-peanut	S3S5
Lathyrus ochroleucus	Pale Vetchling	S5
Lathyrus venosus	Wild Peavine	S5
Medicago lupulina	Black Medic	SNA
Melilotus albus	White Sweetclover	SNA
Trifolium pratense	Red Clover	SNA
Trifolium sp.	A Clover	SNA
Vicia americana	American Vetch	S5
Vicia cracca	Tufted Vetch	SNA
FAGACEAE	BEECH FAMILY	
Quercus macrocarpa	Bur Oak	S5
GROSSULARIACEAE	CURRANT FAMILY	
Ribes oxyacanthoides	Northern Gooseberry	S5
LAMIACEAE	MINT FAMILY	
Agastache foeniculum	Giant Hyssop	S5
Lycopus americanus	Water Hore-hound	S5
Mentha canadensis	Canada Mint	S5
Prunella vulgaris	Heal-all	S4
Stachys pilosa	Marsh Hedge-nettle	S5
ONAGRACEAE	EVENING PRIMROSE FAMILY	
Oenothera biennis	Evening-primrose	S5

PLANTAGINACEAE	PLANTAIN FAMILY	
Plantago major	Common Plantain	SNA
POLYGONACEAE	SMARTWEED FAMILY	
Persicaria amphibia	Water Smartweed	S5
PRIMULACEAE	PRIMROSE FAMILY	
Lysimachia ciliata	Fringed Loosestrife	S5
PYROLACEAE	WINTERGREEN FAMILY	
Pyrola asarifolia	Pink Pyrola	S5
Pyrola sp.	A wintergreen	-
RANUNCULACEAE	CROWFOOT FAMILY	
Anemone canadensis	Canada Anemone	S5
Anemone cylindrica	Thimbleweed	S5
Anemone quinquefolia	Wood Anemone	S5
Aquilegia canadensis	Wild Columbine	S5
Thalictrum venulosum	Veiny Meadowrue	S5
RHAMNACEAE	BUCKTHORN FAMILY	
Endotropis alnifolia	Alder-leaved Buckthorn	S5
ROSACEAE	ROSE FAMILY	
Amelanchier alnifolia	Saskatoon	S5
Crataegus chrysocarpa	Fireberry Hawthorn	S4S5
Dasiphora fruticosa	Shrubby cinquefoil	S5
Drymocallis arguta	Tall Wood Beauty	S5
Fragaria virginiana	Smooth Wild Strawberry	S5
Geum aleppicum	Yellow Avens	S5
Prunus pensylvanica	Pin Cherry	S5
Prunus virginiana	Chokecherry	S5
Rosa acicularis	Prickly Rose	S5
Rubus pubescens	Trailing Dewberry	S5
Spiraea alba	Meadowsweet	S5
RUBIACEAE	MADDER FAMILY	
Galium boreale	Northern Bedstraw	S5
Galium triflorum	Sweet-scented Bedstraw	S5
OLEACEAE	OLIVE FAMILY	

Fraxinus nigra	Black Ash	S2
SALICACEAE	WILLOW FAMILY	
Populus balsamifera	Balsam Poplar	S5
Populus tremuloides	Trembling Aspen	S5
Salix bebbiana	Bebb's Willow	S5
Salix interior	Sandbar Willow	S5
Salix spp.	A willow	-
SANTALACEAE	SANDALWOOD FAMILY	
Comandra umbellata	Bastard Toadflax	S5
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
Mitella nuda	Mitrewort	S5
VIOLACEAE	VIOLET FAMILY	
Viola spp.	A violet	-