

5.5 Vegetation

5.5.1 Rationale for Selection as Valued Environmental Component

Vegetation was selected as a VEC because of the potential for interactions between Project activities and the vegetated terrestrial and riparian environments. This includes species of special conservation concern, or species likely to be designated as such. This VEC also considers Appalachian Hardwood Forests that were raised as being “environmentally significant areas” in the Guidelines. In the context of this VEC, vegetation is limited to vascular plant life and will focus on species of special conservation concern as indicators of potential environmental effects on vegetation.

5.5.2 Environmental Assessment Boundaries

5.5.2.1 Spatial and Temporal

The spatial boundaries for the Project include the Project footprint, where activities associated with site preparation and construction, operation, and malfunctions and accidents of the Project could potentially result in environmental effects on vegetation. For the purposes of this assessment, vegetation within the limits of clearing for the highway asphalt surfaces and structures is assumed to be permanently removed and this environmental effect is considered irreversible. Other areas to be cleared and landscaped will generally result in a change in vegetation from forest to open habitat.

The environmental effects of vegetation loss and/or habitat degradation on species of special conservation concern are assessed within the context of the regional biogeoclimatic zone (*i.e.*, the Valley Lowlands Ecoregion) and the alternative habitat available within the zone. The environmental effects on mature Appalachian Hardwood Forest are assessed within the context of western New Brunswick, in the former extent of the historic Appalachian Hardwood Forest.

The temporal boundaries of the Project include the periods of construction, and subsequent operation and maintenance of the Project in perpetuity.

5.5.2.2 Administrative and Technical

Endangered and threatened plant species are protected federally under the *Species at Risk Act (SARA)*, as listed in Schedule 1 of the *Act*. As defined in the *SARA*, "wildlife species" means a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. The purpose



of this act is to protect wildlife species at risk and their critical habitat. SARA is administered by Environment Canada, Parks Canada Agency and Fisheries and Oceans Canada.

Endangered plant species are protected provincially under the New Brunswick *Endangered Species Act*. The purpose of this act is to provide protection to endangered species and their habitats. The New Brunswick *Endangered Species Act* is administered by NBDNR. The *Endangered Species Regulations* list those plants considered endangered in the province.

Information used in support of the assessment of vegetation was obtained from NBDNR, the Atlantic Canada Conservation Data Centre (ACCDC), NBDELG, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Nature Trust of New Brunswick (NTNB) Environmentally Significant Areas database, forest inventory mapping, orthographic maps and aerial photography (1999). Knowledge of the vegetation affected by the Project is based on rare vascular plant surveys conducted in 2002, supplementary surveys in June and July 2003, and other information provided by the above sources, and the professional judgement of the study team. Rare vascular plant surveys were carried out along the proposed TCH route to provide a current and thorough examination of baseline conditions. The proposed TCH route was divided into three sections and surveys were conducted by three teams (JWEL 2003a; ACER 2003; Dillon 2003) in 2002. If there was a route alignment change, the need for additional rare plant surveys was examined and executed as required in 2003.

Spatial habitat information used for the assessment includes the Project footprint (1,054 ha including access roads), and is defined by twenty two digital map tiles (78,894 ha) which give a larger view of the area traversed by the Project (Figure 5.8.1 in Section 5.8.2.2). This Agriculture and Forestry Assessment Area (“Assessment Area”) was used for the assessment of agriculture and forestry in the Land Use, and Labour and Economy VECs. The data were obtained from the NBDNR Forest Inventory Mapping (1996/2000).

It is the professional judgement of the study team that the data that are currently available to characterize the existing conditions and the existing knowledge regarding the project-VEC interactions are sufficient to support the environmental assessment.

5.5.3 Residual Environmental Effects Rating Criteria

A *significant residual environmental effect* on rare vascular plant species (*i.e.*, those ranked S1, S2, or S3 by ACCDC and ranked “May Be At Risk” or “Sensitive” by NBDNR) or “At Risk” vascular plant species (*i.e.*, threatened or endangered plant species listed by SARA or the *NB Endangered Species Act*) is one that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable plant population that is dependent upon that habitat, such that the likelihood of the



long-term survival of the population within the Ecoregion (Valley Lowland Ecoregion) is substantially reduced as a result.

A *significant residual environmental effect* on Appalachian Hardwood Forest is one that results in the loss of a substantive amount (greater than 10%) of mature Appalachian Hardwood Forest, or the loss of high priority (as defined by NBNT) Appalachian Hardwood Forest, in western New Brunswick.

Definitions of rarity ranks are summarized in Table 5.5.1 below.

Table 5.5.1 Definitions of Rarity Ranks

ACCDC Ranks Definitions (ACCDC 2003)	
S1	Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations. (21 to 100 occurrences).
S4	Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the species is of long-term concern (<i>e.g.</i> watch list). (100 + occurrences).
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (<i>e.g.</i> , S1S2)
NBDBR General Status Rankings Definitions (NBDNRE 2002a)	
At Risk	Species for which a formal assessment has been completed, and determined to be at risk of extirpation or extinction. To be described by this category, a species must be either listed as Endangered or Threatened under SARA by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as Endangered or Regionally Endangered under the <i>New Brunswick Endangered Species Act</i> and accompanying regulations.
May Be At Risk	Species or populations that may be at risk of extirpation or extinction, and are therefore candidates for a detailed risk assessment.
Sensitive	Species which are not believed to be at risk of extirpation or extinction, but which may require special attention or protection to prevent them from becoming at risk.
Secure	Species that are not believed to be At Risk, May Be At Risk, or Sensitive. These were generally species that were widespread and/or abundant. Although some Secure species may be declining, their level of decline was not felt to be a threat to their status in the province.

5.5.4 Existing Conditions

The proposed TCH will be constructed west of the existing TCH through an area dominated by steep hills and valleys. The total 70 km length of the Project was considered for the assessment. Three environmental background studies were undertaken for the Project, and the complete studies are available in JWEL (2003a), Dillon (2003) and ACER (2003).

The character of the terrestrial habitat changes from north to south along the proposed TCH. In general, the northern section between Perth-Andover and Florenceville has more topographic relief and is more forested. The southern section between Florenceville and Woodstock is a region of rolling hills and



plateaus that has been extensively cleared and is now used primarily for agriculture and grazing. The existing land use conditions are described in more detail in Section 5.8.4.

5.5.4.1 Methodology

Vascular plant surveys were completed along the proposed TCH route from Perth-Andover to Woodstock. Additional vascular plant surveys were completed by JWEL in 2003 and are reported directly in this CSR.

Field investigation methods and reporting followed guidance provided by NBDNR (M. Toner, pers. comm. 2002). Initially, aerial photography, topographic mapping, and forest inventory maps were used to select areas of potential habitat for rare vascular plants. In addition, the ACCDC was consulted to provide data on any rare or uncommon species in their database within 5 km of the alignment. Areas of interest were identified on field maps. Land features in the Assessment Area that were of specific interest for the potential to harbour rare vascular plants included ravines, alluvial flats/gravel strands, riparian habitat, intervale forest, Appalachian Hardwood Forest, cedar swamp, rich fen and other wetlands.

During the initial rare plant surveys conducted in September 2002, experienced botanists walked the proposed TCH route. Areas of active agricultural fields, with crops such as potatoes and grains, were not subjected to a vascular plant survey. While all habitats encountered along the Project footprint were searched, special effort was made to search the entire width of the RoW in areas where less common habitat types, such as riparian zones, rich slope seepages, cedar swamps, rock outcrops, talus and ledges, were encountered. Generally the less common habitat types in a landscape often tend to harbour less common and rare species.

Additional surveys were conducted in the summer of 2003 due to changes in the alignment of the proposed TCH (as of 2002). These alignment changes are described in Section 2.2. These changes were made to avoid rare vascular plants that were identified during the 2002 vegetation surveys. In addition to alignment changes, re-examination of selected previously surveyed areas were conducted June 4-15, 2003, to document the occurrence of species of concern that are not detectable in late summer. The areas resurveyed included mature hardwood stands, mature cedar stands, as well as selected rich habitats discovered during the 2002 survey. These sites were selected in cooperation with NBDNR (Species at Risk Program) and Jim Goltz prior to the field surveys, following a review of NBDOT maps and GIS-based maps showing forest cover.

All vascular plants encountered during the surveys were identified and the population status of each species was checked against lists of provincially rare species, derived from the draft status of vascular plants as designated by NBDNR (NBDNRE 2002a), the ACCDC New Brunswick Vascular Plant



Tracking List (ACCDC 2003) and the *New Brunswick Endangered Species Act*. Hinds (2000) was also used as a reference. Lists of nationally rare species found in New Brunswick were derived from COSEWIC (2003). The locations of rare vascular plants found during the survey were recorded using a GPS instrument. The number of shoots or individual plants was counted and the distributions of the rare vascular plants were mapped. Populations found in close proximity to the proposed TCH route were flagged to facilitate future identification. In areas where rare species were found within the Project footprint, similar habitats outside of the footprint were investigated to determine if the species were also present nearby. These surveys were used to help assess the potential effects of highway construction on local populations of these species.

Any vascular plant species encountered that was not definitely known were examined more closely and if possible identified in the field. If necessary, a specimen was collected to facilitate the identification of plants that could not be identified in the field. These plants were returned to the laboratory for identification. Care was taken to restrict the amount of plant material collected to the minimum required for identification. For specimens that could turn out to be uncommon or rare a GPS location was recorded.

5.5.4.2 Environmentally Significant Areas (ESAs)

Plant-based Environmentally Significant Areas (ESAs) within 2 km of the Project footprint and on the west side of the Saint John River include:

- Perth-Andover Hardwood Forest;
- Summerfield Hardwood Forest;
- Ketch Lake;
- Moody (Iron Ore) Hill Deciduous Stand; and
- Woodstock-Meduxnekeag Bridge.

The Perth-Andover Hardwood Forest is located above Andover, south of the Perth-Andover turn-off, approximately 1.2 km from the Project footprint. This site is a rich alluvial hardwood forest that contains one of only three known sites in New Brunswick for cutleaf toothwort (*Dentaria laciniata*). The Perth-Andover Hardwood Forest has been recently partially cut. Local road construction may have affected the site, however, cutleaf toothwort was recorded at the site by a botanist three years after construction was completed (J. Goltz, pers. comm.). There will be no interaction between the Project and the Perth-Andover Hardwood Forest.

The Summerfield Hardwood Forest is located just east of Summerfield, on the west side of the Saint John River. This site is a rich hardwood forest that contains fragrant black snake-root (*Sanicula*



odorata). The Summerfield Hardwood Forest is approximately 1.2 km from the Project footprint and separated by the Summerfield Road, therefore there will be no interaction with the Project.

Ketch Lake is located southwest of Charleston. Ketch Lake is a small lake associated with acid bog and fen, and numerous orchids. It is the only known site, other than one in Massachusetts, for the Dorcas Copper butterfly (*Lycaena dorcas claytoni*), which depends on bushy cinquefoil as its host. This ESA is approximately 1.5 km from the Project footprint and separated from the Project by a local road, therefore there will be no interaction with the Project.

The Moody (Iron Ore) Deciduous Stand is located west of Jacksonville, between Routes 550 and 560, approximately 1.2 km from the Project footprint. This deciduous forest community has a history of variable disturbance, resulting in densely forested lower slopes and open upper slopes. Butternut and several rare plant species are found at this site, including Goldie's fern (*Dryopteris goldiana*), showy orchis (*Galearis spectabilis*) and maidenhair fern (*Adiantum pedatum*). There will be no interaction between the Project and the Moody (Iron Ore) Deciduous Stand.

The Woodstock-Meduxnekeag Bridge is located on the banks of the Meduxnekeag River west of Woodstock, west of the bridge on the existing TCH. This site is a calcereous woods and river edge with interesting floral assemblage including rare and uncommon species such as Goldie's fern, showy orchis, yellow lady's-slipper (*Cypripedium calceolus*) and maidenhair fern. This ESA is approximately 0.5 km from the Project footprint and separated from the Project by the Meduxnekeag River.

5.5.4.3 Vascular Plant Species of Special Conservation Concern

The locations of thirty-one rare or uncommon vascular plant species encountered along the proposed TCH route during the field surveys are listed in Table 5.5.2. None of the vascular plant species recorded in the Assessment Area are listed as "At Risk" by NBDNR, or listed as threatened or endangered by SARA or the NB Endangered Species Act. Butternut (*Juglans cinerea*) was also encountered along the proposed TCH route. In November 2003, subsequent to the field surveys conducted for the Project, butternut was designated endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). Although butternut is considered by COSEWIC to be widespread in southern Ontario, Quebec and New Brunswick, this species has been designated endangered because of a projected decline due to butternut canker (COSEWIC 2003). Butternut will likely be considered for inclusion as an endangered species in Schedule I of the SARA. Butternut is further discussed in Section 5.5.4.3.4. Most of the rare vascular plants encountered were associated with five particularly rich habitats encountered during the survey in the northern half of the alignment (Figure 5.5.1-A and 5.5.1-B, Appendix D; and Figures 5.5.2, 5.5.3, 5.5.4, 5.5.6, and 5.5.7). Each rare species is discussed below.

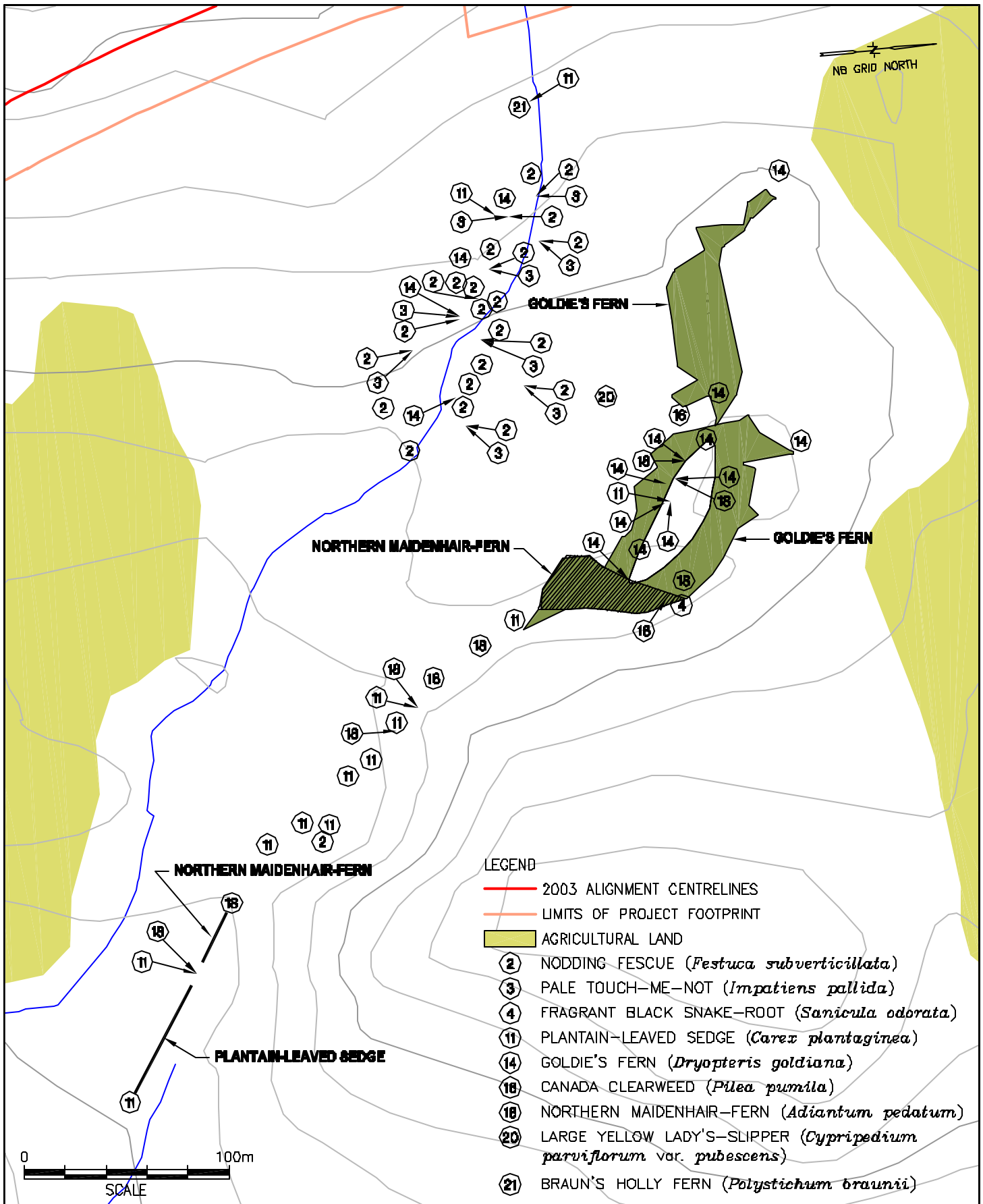


Table 5.5.2 Rare and Uncommon Vascular Plant Species Recorded along the Proposed TCH Route, Including all Areas Surveyed in 2002 Prior to Route Changes

Code Number	Scientific Name	Common Name (Comments)	ACCDC Rank	NBDNR Status
1	<i>Elymus hystrix</i>	bottle-brush grass (one rich area; outside Project footprint)	S1	May Be At Risk
2	<i>Festuca subverticillata</i>	nodding fescue (one rich area; outside Project footprint)	S1	May Be At Risk
3	<i>Impatiens pallida</i>	pale touch-me-not (one rich area; outside Project footprint)	S1	May Be At Risk
4	<i>Sanicula odorata</i>	fragrant black snake-root (single specimen; outside Project footprint)	S1	May Be At Risk
5	<i>Dirca palustris</i>	leatherwood (three areas; outside Project footprint)	S1S2	May Be At Risk
6	<i>Viola canadensis</i>	Canada violet (one rich area; outside Project footprint)	S1S2	May Be At Risk
7	<i>Calypso bulbosa</i>	calypso or Venus' slipper (two locations at one site; single plant inside Project footprint)	S2	May Be At Risk
8	<i>Valeriana uliginosa</i>	mountain valerian (one location; outside Project footprint)	S2	May Be At Risk
9	<i>Agrimonia gryposepala</i>	hooked agrimony (two locations identified; inside Project footprint)	S2	Sensitive
10	<i>Carex magellanica</i> ssp. <i>magellanica</i>	boreal bog sedge (few scattered at Wetland 18; outside Project footprint)	S2	Sensitive
11	<i>Carex plantaginea</i>	plantain-leaved sedge (eight areas; five outside Project footprint)	S2	Sensitive
12	<i>Carex sprengeii</i>	Sprengel's sedge (one small patch; outside Project footprint)	S2	Sensitive
13	<i>Cypripedium reginae</i>	showy lady's-slipper (several patches in cedar stand; most locations outside Project footprint)	S2	Sensitive
14	<i>Dryopteris goldiana</i>	Goldie's fern (11 areas; seven outside Project footprint)	S2	Sensitive
15	<i>Phryma leptostachya</i>	lopseed (two rich areas; one inside, one outside Project footprint)	S2	Sensitive
16	<i>Pilea pumila</i>	Canada clearweed (recorded at three locations within two rich sites, as well as in 13 wet basins; most locations outside Project footprint)	S2	Sensitive
17	<i>Utricularia minor</i>	lesser bladderwort (at two locations; one inside, one outside Project footprint)	S2	Sensitive
18	<i>Adiantum pedatum</i>	northern maidenhair-fern (53 locations within seven general areas; most locations outside Project footprint)	S3	Sensitive
19	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	lance-leaf grapefern (recorded at one location; outside the Project footprint)	S3	Sensitive
20	<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	large yellow lady's-slipper (66 locations in 16 general areas; most outside Project footprint)	S3	Sensitive
21	<i>Polystichum braunii</i>	Braun's holly fern (two locations; one inside, one outside Project footprint)	S3	Sensitive
22	<i>Ranunculus gmelinii</i> var. <i>purshii</i>	small yellow water-crowfoot (five locations; one inside Project footprint)	S2	Secure
23	<i>Gratiola neglecta</i>	clammy-hedge-hyssop (four locations in two areas; two locations inside, two outside Project footprint)	S2S3	Secure
24	<i>Sparganium natans</i>	small-fruited burreed (found within Wetland 3 with <i>Utricularia minor</i> ; inside Project footprint)	S2S3	Secure
25	<i>Caulophyllum thalictroides</i>	blue cohosh (20 locations in four general areas; most outside Project footprint)	S3	Secure
26	<i>Carex rosea</i>	rosy sedge (four locations; all within Project footprint)	S3	Secure
27	<i>Listera cordata</i>	heartleaf twayblade (two locations; one inside and one outside Project footprint)	S3S4	Secure
28	<i>Parnassia glauca</i>	fen grass-of-Parnassus (one plant found near <i>Valeriana uliginosa</i> on the Big Presque Isle Stream; outside of the Project footprint)	S3	Secure
29	<i>Plantago rugelii</i>	black-seed plantain (recorded at two locations, and noted at several others; inside Project footprint)	S3	Secure
30	<i>Carex cryptolepis</i>	hidden-scaled sedge (one area; outside Project footprint)	S3	Secure
31	<i>Carex diandra</i>	lesser tussock sedge (one area; outside Project footprint)	S3	Secure
32	<i>Juglans cinerea</i>	Butternut (three risk areas, 11 other locations, inside and outside Project footprint)	S3	Sensitive







LEGEND

- 2003 ALIGNMENT CENTRELINES
- LIMITS OF PROJECT FOOTPRINT
- AGRICULTURAL LAND
- 2 NODDING FESCUE (*Festuca subverticillata*)
- 3 PALE TOUCH-ME-NOT (*Impatiens pallida*)
- 4 FRAGRANT BLACK SNAKE-ROOT (*Sanicula odorata*)
- 11 PLANTAIN-LEAVED SEDGE (*Carex plantaginea*)
- 14 GOLDIE'S FERN (*Dryopteris goldiana*)
- 16 CANADA CLEARWEED (*Pilea pumila*)
- 18 NORTHERN MAIDENHAIR-FERN (*Adiantum pedatum*)
- 20 LARGE YELLOW LADY'S-SLIPPER (*Cypripedium parviflorum* var. *pubescens*)
- 21 BRAUN'S HOLLY FERN (*Polystichum braunii*)




**RARE PLANT CONCENTRATION
SOUTH OF BEACONSFIELD ROAD
NEW ROUTE 2 TRANS-CANADA HIGHWAY
PROJECT PERTH-ANDOVER TO WOODSTOCK**

Date:
2004 02 12

Job No.:
14677

Scale:
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Fig. No.:
5.5.2

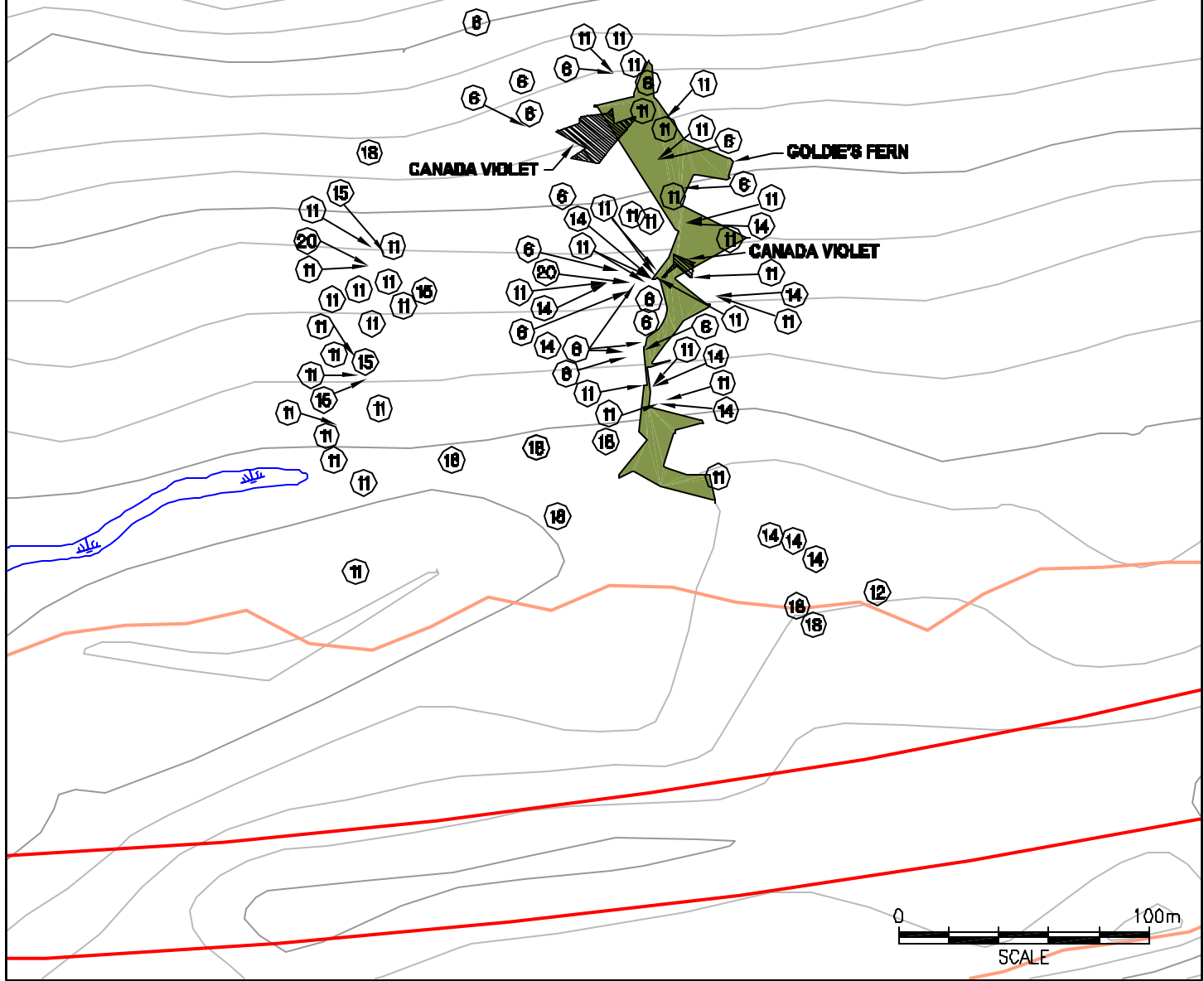
 **Jacques Whitford**
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LEGEND







-  2003 ALIGNMENT CENTRELINES
-  LIMITS OF PROJECT FOOTPRINT
-  WETLAND
-  CANADA VIOLET (*Viola canadensis*)
-  PLANTAIN-LEAVED SEDGE (*Carex plantaginea*)
-  SPRENGEL'S SEDGE (*Carex sprengelii*)
-  GOLDIE'S FERN (*Dryopteris goldiana*)
-  LOPSEED (*Phryma leptostachya*)
-  CANADA CLEARWEED (*Pilea pumila*)
-  NORTHERN MAIDENHAIR-FERN (*Adiantum pedatum*)
-  LARGE YELLOW LADY'S-SLIPPER (*Cypripedium parviflorum* var. *pubescens*)

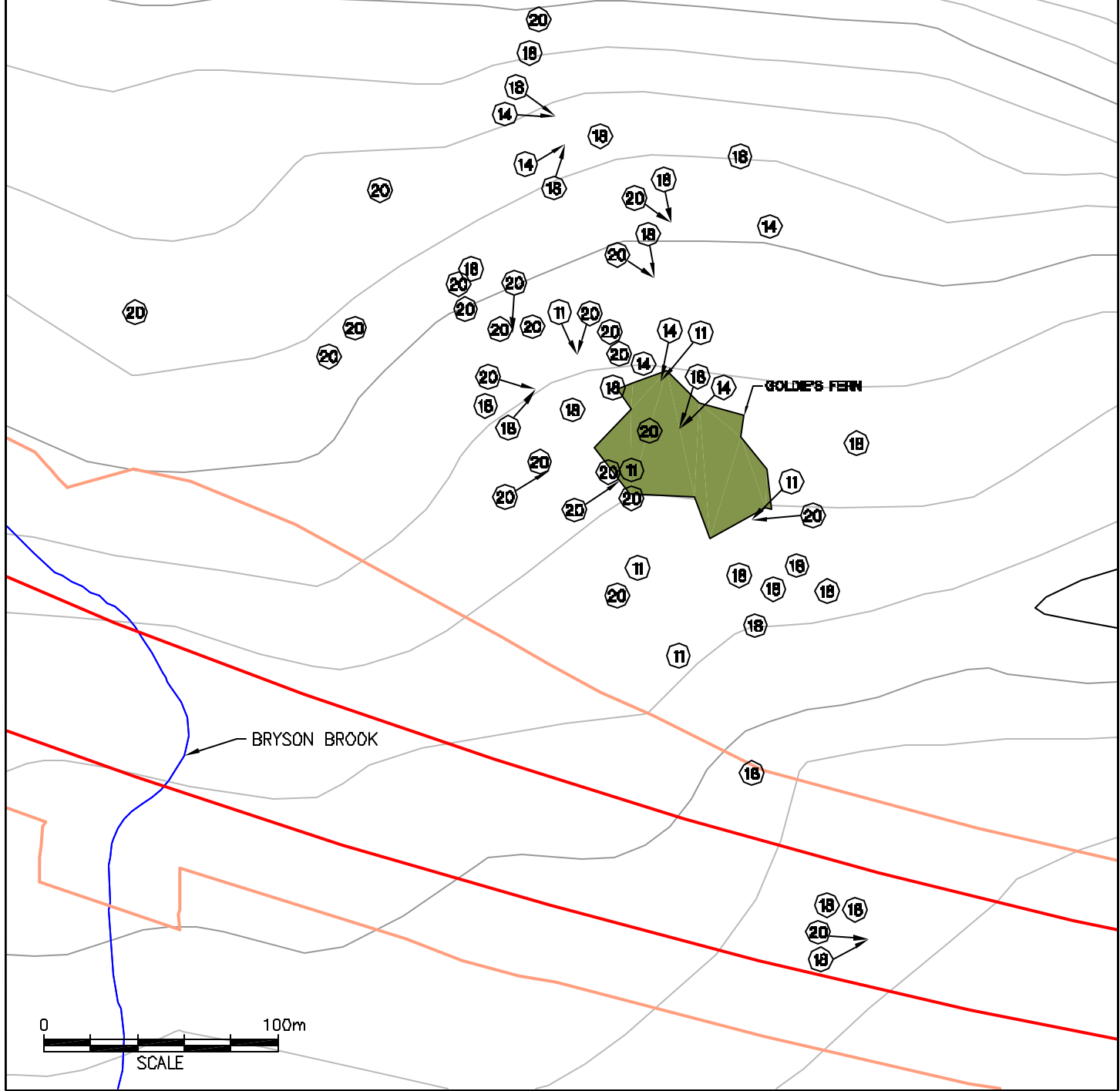



<p>RARE PLANT CONCENTRATION NORTH OF DEMERCHANT BROOK NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK</p>	Date: 2004 02 12	Scale: 1 : 2500	 <p>Jacques Whitford Consulting Engineers Environmental Scientists</p>
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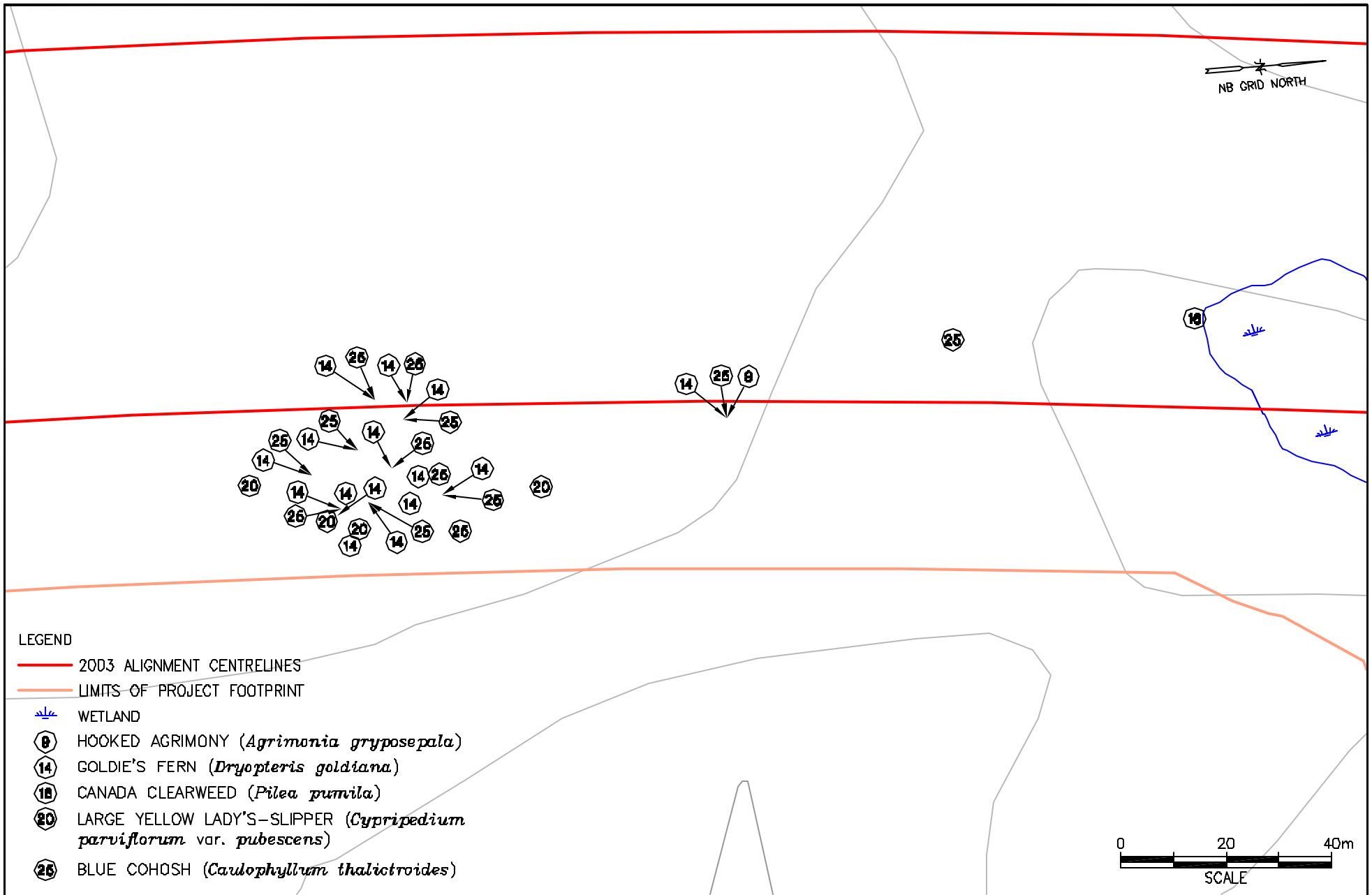
LEGEND

-  2003 ALIGNMENT CENTRELINES
-  LIMITS OF PROJECT FOOTPRINT
-  PLANTAIN-LEAVED SEDGE (*Carex plantaginea*)
-  GOLDIE'S FERN (*Dryopteris goldiana*)
-  NORTHERN MAIDENHAIR-FERN (*Adiantum pedatum*)
-  LARGE YELLOW LADY'S-SLIPPER (*Cypripedium parviflorum* var. *pubescens*)



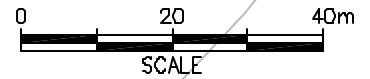
<p>RARE PLANT CONCENTRATION NORTH OF BRYSON BROOK NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK</p>	Date: 2004 02 12	Scale: 1 : 2500	 <p>Jacques Whitford Consulting Engineers Environmental Scientists</p>
	Job No.: 14677	Fig. No.: 5.5.4	





LEGEND

- 2003 ALIGNMENT CENTRELINES
- LIMITS OF PROJECT FOOTPRINT
- WETLAND
- HOOKED AGRIMONY (*Agrimonia gryposepala*)
- GOLDIE'S FERN (*Dryopteris goldiana*)
- CANADA CLEARWEED (*Pilea pumila*)
- LARGE YELLOW LADY'S-SLIPPER (*Cypripedium parviflorum* var. *pubescens*)
- BLUE COHOSH (*Caulophyllum thalictroides*)



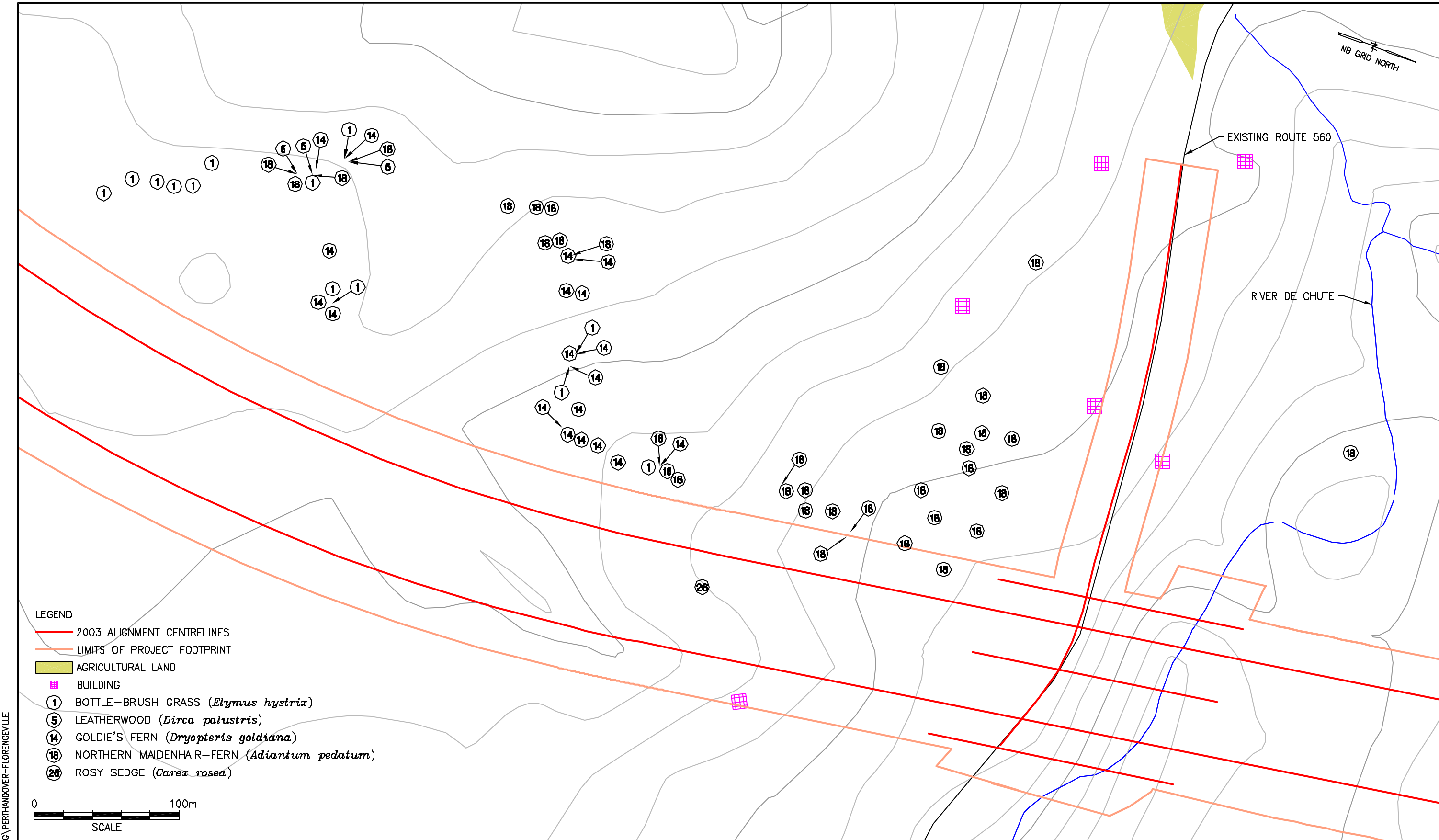
**RARE PLANT CONCENTRATION
SOUTH OF DEAN ROAD
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK**

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14677	5.5.5

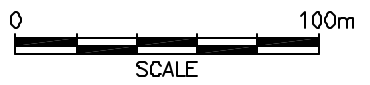
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- LEGEND
- 2003 ALIGNMENT CENTRELINES
 - LIMITS OF PROJECT FOOTPRINT
 - AGRICULTURAL LAND
 - BUILDING
 - ① BOTTLE-BRUSH GRASS (*Elymus hystrix*)
 - ⑤ LEATHERWOOD (*Dirca palustris*)
 - ⑭ GOLDIE'S FERN (*Dryopteris goldiana*)
 - ⑱ NORTHERN MAIDENHAIR-FERN (*Adiantum pedatum*)
 - ⑳ ROSY SEDGE (*Carex rosea*)



**RARE PLANT CONCENTRATION
SOUTH OF RIVER DE CHUTE
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK**

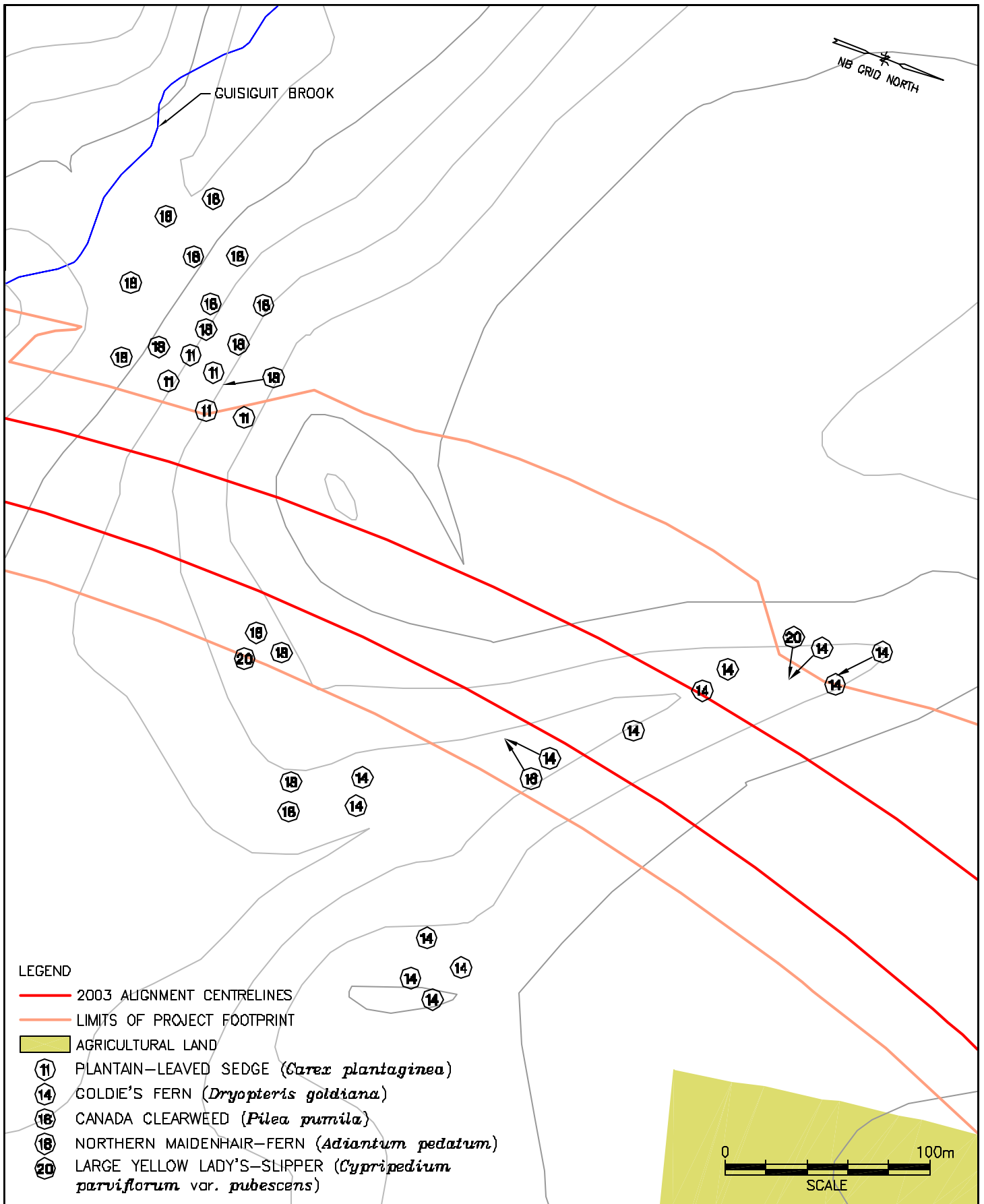
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**RARE PLANT CONCENTRATION
NORTH OF GUISIGUIT BROOK
NEW ROUTE 2 TRANS-CANADA HIGHWAY
PROJECT PERTH-ANDOVER TO WOODSTOCK**

Date:
2004 02 12

Job No.:
14677

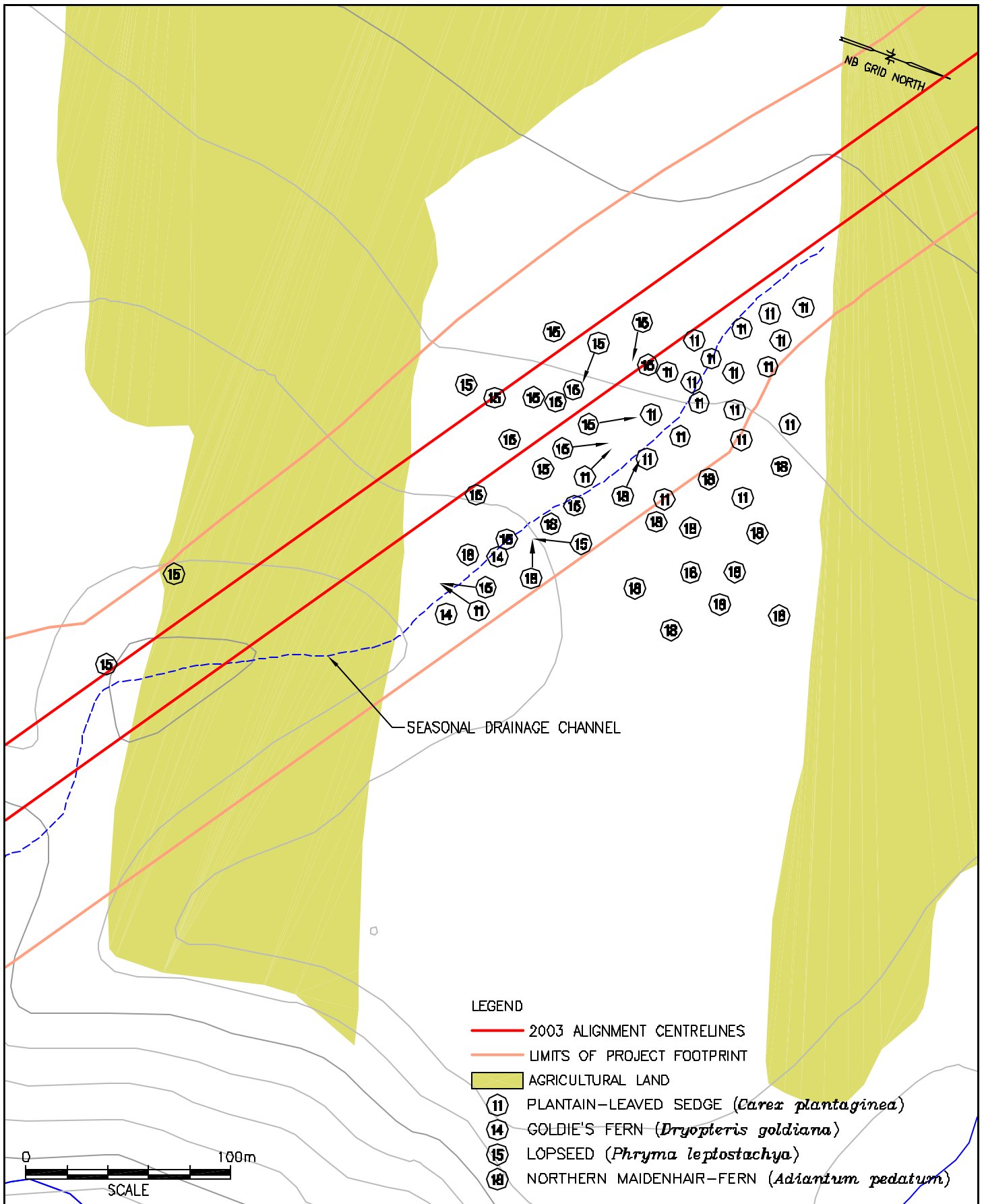
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**RARE PLANT CONCENTRATION
SOUTH OF STAIRS ROAD
NEW ROUTE 2 TRANS-CANADA HIGHWAY
PROJECT PERTH-ANDOVER TO WOODSTOCK**

Date:
2004 02 12

Job No.:
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Fig. No.:
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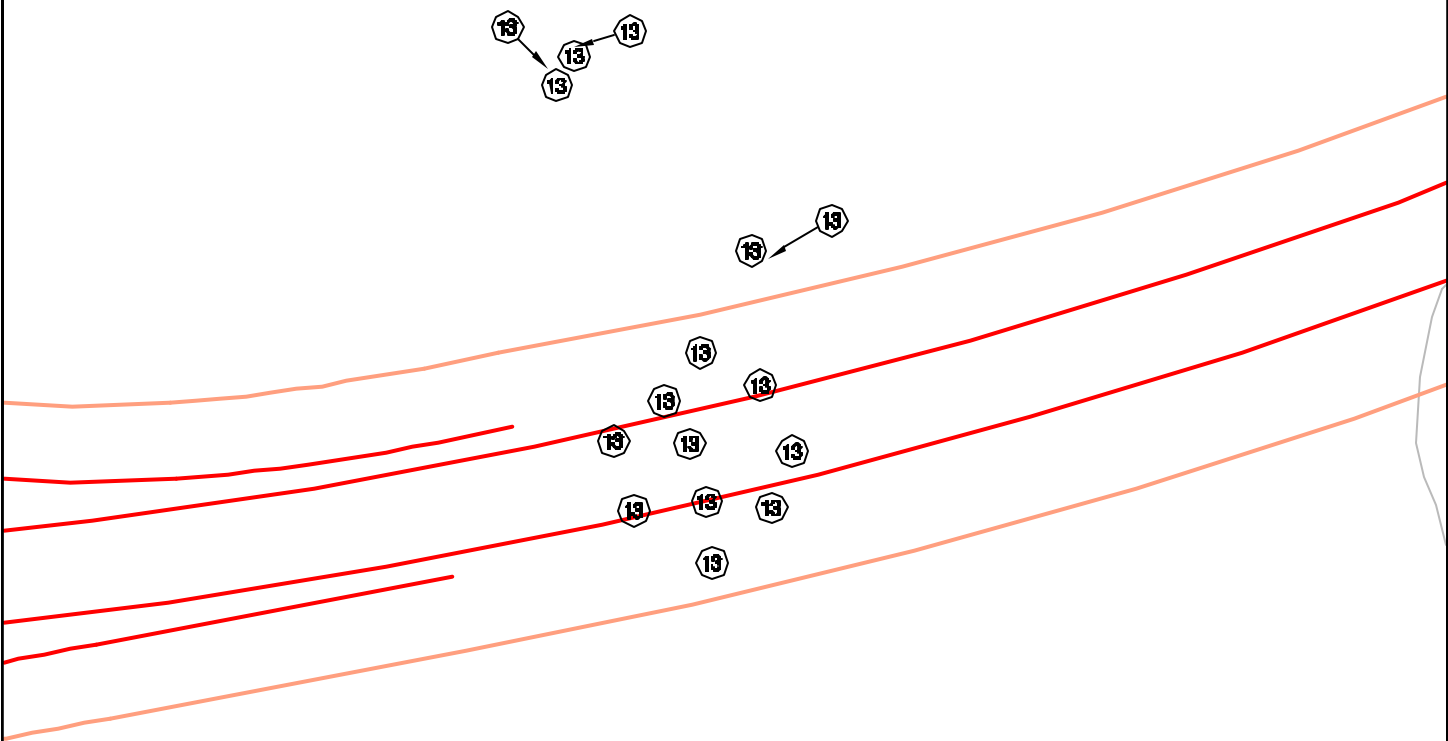
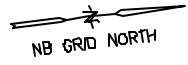


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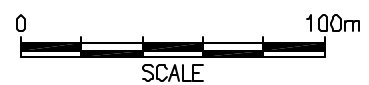
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LEGEND

- 2003 ALIGNMENT CENTRELINES
- LIMITS OF PROJECT FOOTPRINT
- 13 SHOWY LADY'S-SLIPPER (*Cypripedium reginae*)

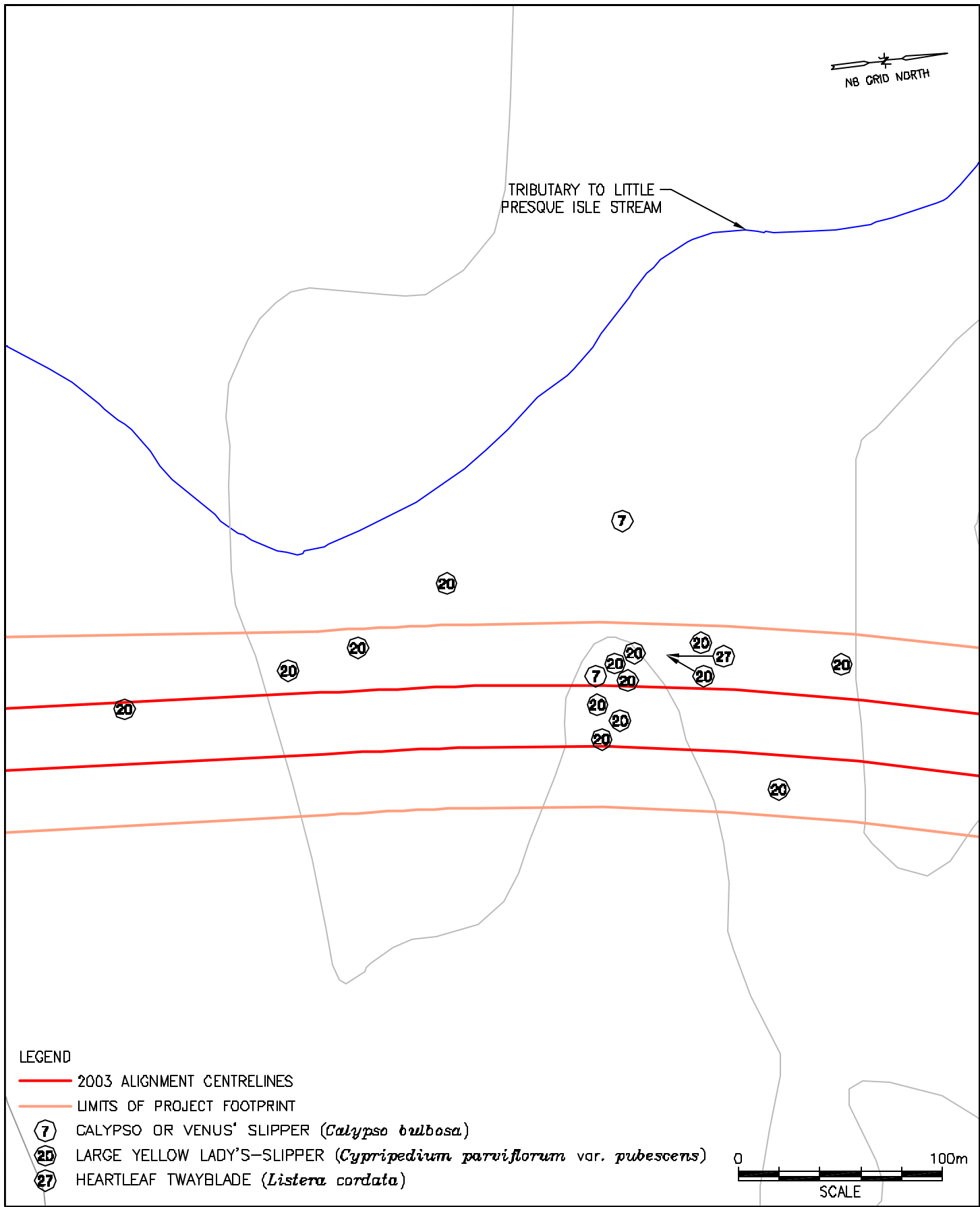


<p>RARE PLANT CONCENTRATION NORTH OF LITTLE PRESQUE ISLE STREAM NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK</p>	Date: 2003 10 03	Scale: 1 : 2500	 <p>Jacques Whitford Consulting Engineers Environmental Scientists</p>
	Job No.: 14677	Fig. No.: 5.5.9	



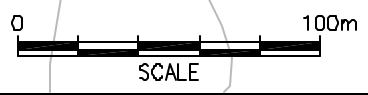


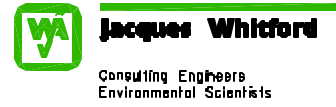
TRIBUTARY TO LITTLE PRESQUE ISLE STREAM



LEGEND

- 2003 ALIGNMENT CENTRELINES
- LIMITS OF PROJECT FOOTPRINT
- 7 CALYPSO OR VENUS' SLIPPER (*Calypso bulbosa*)
- 20 LARGE YELLOW LADY'S-SLIPPER (*Cypripedium parviflorum* var. *pubescens*)
- 27 HEARTLEAF TWAYBLADE (*Listera cordata*)



<p>RARE PLANT CONCENTRATION NORTH OF PALMER ROAD NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK</p>	Date: 2003 10 05	Scale: 1 : 2500	 <p>Jacques Whitford Consulting Engineers Environmental Scientists</p>
	Job No.: 14677	Fig. No.: 5.5.10	
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5.5.4.3.1 “May Be At Risk” Species

Bottle-brush Grass (*Elymus hystrix*)

As of 1998 (MacDougall and Loo 1998), bottle-brush grass was known from only four locations in New Brunswick. Three of these locations are in Carleton County (Eel River, Jackson Falls, and Reid’s Lake) and the fourth site is on the Upsalquitch River near Grog Brook. The Eel River population was revisited in 2003 and found to have a relatively large population along the river (M. Toner, pers. comm.). This species is listed as S1 by the ACCDC (2003) and is considered by NBDNRE (2002a) to be “May Be At Risk”. Bottle-brush grass is typically found in rich hardwoods and clearings.

In the Assessment Area it was found at one site approximately 400 m south of Route 560 (Figure 5.5.1-B, Appendix D, and Figure 5.5.6). A total of 435 plants were recorded at this site. Five sub-populations of bottle-brush grass were found at the site. One patch consisted of 28 plants growing on the edge of a clearing at the junction of three woods roads. These plants were all found growing on the boundary between the clearing and the surrounding immature rich hardwood forest. They were typically associated with Goldie’s fern (*Dryopteris goldiana*). This patch is located approximately 18 m outside of the proposed Project footprint.

The second patch of bottle-brush grass was found in a small clearing approximately 150 m south of the first cluster and consisted of 11 plants. These plants were found in the centre of the clearing in a dense growth of herbaceous species, which included large numbers of Goldie’s fern. All of these plants were found outside the Project footprint.

The third patch contained 149 plants and was also found in a vegetated clearing associated with a woods road, near the cutline of an earlier alignment. The cover of herbaceous vegetation was also heavy at this site. Three other rare or sensitive vascular plant species were found at this location including leatherwood (*Dirca palustris*), maidenhair-fern (*Adiantum pedatum*) and a few Goldie’s fern. This patch is located outside of the proposed Project footprint.

The fourth patch of bottle-brush grass was found south of the third cluster and consisted of 246 plants. This patch is located outside of the proposed Project footprint.

The fifth patch of bottle-brush grass was found north of the first patch and consisted of one plant. This plant is located the closest to the alignment, only approximately 20 m outside the Project footprint.

The results of the field survey suggest that this species prefers areas that are exposed to sunlight and very fertile. The presence of the entire population along logging roads in an area harvested approximately 15 years ago suggests that it is capable of surviving relatively heavy anthropogenic



disturbance. The field observations also suggest that this species is able to tolerate competition from other herbaceous species but does not tolerate heavy shade. Similar habitat preferences were noted for bottle-brush grass on the Eel River (JWEL 1997; M. Crowell, pers. comm. 2003). At this location bottle-brush grass was found in open riparian woodlands with a heavy herbaceous ground cover.

Nodding Fescue (*Festuca subverticillata*)

Nodding fescue is known from four sites in New Brunswick (MacDougall and Loo 1998) including Jackson Falls in the Meduxnekeag River valley, and Reid's Lake just west of the alignment, as well as two sites in the Restigouche River Valley. This species is listed as S1 (ACCDC 2003) and is considered "May Be At Risk" (NBDNRE 2002a).

During the 2003 field survey conducted along the modified alignment south of Beaconsfield Road near Perth-Andover, nodding fescue was found approximately 0.8 km south of the Beaconsfield Road, near the rich hardwood stand identified in 2002 by JWEL (Figure 5.5.1-A, Appendix D, and Figure 5.5.2). This is a new record for this species. Two populations were found at this location. A large population containing 98 plants was found approximately 75 m east of the proposed TCH route. None of these plants were located within the Project footprint, although are within the 1999 alignment. Each plant consisted of an aggregation of stems, which ranged in number from 1 to 40. Lower numbers of stems per plant were typically found under heavy shade where competition was more intense. This population occupied two habitat types, rich riparian forest and recent clear-cut. Five percent of the plants in this population were found in the rich riparian forest habitat along the floodplain of a small brook. At this location, nodding fescue was associated mainly with Canada nettle (*Laportea canadensis*) and silvery spleenwort (*Deparia acrostichoides*).

Several other rare and uncommon species were associated with nodding fescue at the second location including pale touch-me-not (*Impatiens pallida*), plantain-leaved sedge (*Carex plantaginea*), Goldie's fern, and Braun's holly fern (*Polystichum braunii*). Within this habitat type, nodding fescue was found at two locations. Ninety-five percent of the nodding fescue was found in a recent clear-cut located immediately adjacent to the rich riparian forest habitat. The clear-cut appeared to be approximately three years old and was not heavily vegetated. The nodding fescue growing on the clear-cut was more vigorous than the plants found in the intact forest, presumably due to reduced competition for light, water and nutrients. These plants were typically taller and had larger numbers of stems. This would suggest that this species is able to cope with the physical disturbance and changes in light, water and nutrient availability associated with forest harvesting. However, there is some uncertainty as to how well this species will cope with increased competition with tree, shrub and ground vegetation species as the clear-cut becomes fully colonized. Older clear-cuts adjacent to this one support extremely dense plant cover. It is likely that the number of nodding fescue will be substantially reduced but the species probably will not be eliminated from this habitat since it appears to be shade tolerant. All of the plants



present in the area have been flagged so it would be relatively easy to monitor this population during the early stages of secondary succession.

The proposed highway has been re-routed in this area to avoid this and two other rich hardwood sites south of Beaconsfield Road, and therefore nodding fescue will not be directly affected by the Project footprint.

Pale Touch-Me-Not (*Impatiens pallida*)

Pale touch-me-not, when not in bloom closely resembles the similar spotted touch-me not (*I. capensis*), and non-flowering plants can be difficult to distinguish in the field. Pale touch-me-not habitat is generally more calcium rich and often somewhat dryer than the diversity of moist relatively rich habitats occupied by spotted touch-me-not, but the two species can be seen either in close proximity or occasionally growing together. Hinds (2000) and MacDougall and Loo (1998) characterize the habitat for this species as rich, moist and seepy, occasionally rocky calcareous woods and meadows. In Tennessee the species has been noted growing in pure stands on thin but moist humus over limestone ledge outcrops in rich mixed forest.

In New Brunswick, five locality records are shown (Hinds 2002), with one in Carleton County, three from Victoria County and one from Restigouche County. The ACCDC (2003) classes the species as S1, and NBDNRE (2002a) places it in the “May Be At Risk” category.

Pale touch-me-not was encountered at one general location along the proposed TCH route in a rich area around a seasonally intermittent stream located south of the Beaconsfield Road (Figure 5.5.1-A, Appendix D, and Figure 5.5.2). Associated species included Goldie’s fern (*Dryopteris goldiana*), wood nettle (*Laportea canadensis*), plantain-leaved sedge (*Carex plantaginea*), silvery spleenwort fern (*Deparia acrostichoides*) and other species characteristic of calcareous soils. In the location where the majority of pale touch-me-not plants were discovered (100’s of plants scattered in clumps about a rich sloping stream interval), a frequent associate was the rare nodding fescue. Much of the tree cover had been removed by timber harvesting within the last one or two years, from the majority of the pale touch-me-not population distribution. While all or most of the pale touch-me-not population was located within the disturbed area of the original routing of the highway, the population is now avoided by the new routing.

Fragrant Black Snake-root (*Sanicula odorata*)

Fragrant black snake-root is a rare species ranked S1 (ACCDC 2003) and considered “May Be At Risk” (NBDNRE 2002a). This species is considered very rare by Hinds (2000). Fragrant black snake-root is



associated with rich hardwood forest habitats (Hinds 2000). MacDougall and Loo (1998) indicate that fragrant black snake-root has been recorded from five locations, all in Carleton County.

A single specimen of fragrant black snake-root was noted within the rich hardwood stand south of Beaconsfield Road (Figure 5.5.1-A, Appendix D, and Figure 5.5.2). This is a new record for this species in Victoria County. The fragrant black snake-root was located outside the original Project footprint, and is now more than 300 m from the re-aligned route.

Leatherwood (*Dirca palustris*)

MacDougall and Loo (1998) indicate that leatherwood has been recorded scattered between Woodstock and Beechwood in Carleton County, and was previously known only as far north as Reid Lake. It has also been found in York County at two sites near Fredericton and at a site in Albert County near Weldon. Leatherwood is classed as S1S2 (ACCDC 2003) and “May Be At Risk” (NBDNRE 2002a). Three leatherwood populations were found during the field surveys, near Reid Lake, River de Chute and Big Presque-Isle Stream. The Reid Lake population was found approximately 200 m east of the proposed highway, outside of the proposed Project footprint (Figure 5.5.1-B, Appendix D). It consisted of 20 plants growing in a depression in a mature sugar maple/American beech stand at the edge of a small swale. The previously discovered Reid Lake population is located west of the alignment.

The second population was found approximately 450 m south of Route 560 (Figure 5.5.1-B, Appendix D, and Figure 5.5.6). This population was located within the 1999 Project footprint, however, the proposed TCH route has recently been shifted to the east such that this population is well outside of the footprint of the Project. Sixteen plants were recorded at this location. Many of these plants were seedlings. This population was found in an immature rich sugar maple stand approximately 15 years old. At this site leatherwood was associated with several other rare and uncommon vascular plants including bottle-brush grass, Goldie’s fern and maidenhair-fern.

The third population was found along Access Road “J” located north of Big Presque Isle Stream (Figure 5.5.1-C, Appendix D). Leatherwood was found approximately 400 m north of the point where the access road crosses Hunter Brook. This population was found in a mature stand dominated by balsam fir and yellow birch located at the edge of a hay field. Sixty-two plants were recorded at this location. The population was distributed from the top of the slope at the edge of the field, down slope to a poorly drained depression near a small swale. Most plants were found in the depression although none were found in the marsh. The proposed access road has been shifted to the west into the field such that it avoids this population of leatherwood.



Canada Violet (*Viola canadensis*)

Canada violet is a rare species considered borderline between S1 and S2 (ACCDC 2003), and considered “May Be At Risk” (NBDNRE 2002a). This species is associated with rich forest habitats. Although it is relatively common from central Canada westwards, Canada violet is a rare species in the Maritimes, where it is now known only from New Brunswick, though there have been several historical records from Nova Scotia. In Nova Scotia the last known record was from limestone deposits near Windsor, and as of 2001 the plant has been considered extirpated. In New Brunswick, the habitat for Canada violet is rich deciduous woods. Populations have been recorded from Carleton County (seven records in the Meduxnekeag River valley) and Victoria County (one record in the St. John River valley) (Hinds 2000, MacDougall and Loo 1998). River de Chute is on the boundary between Victoria County to the north and Carleton County to the south. Many of these New Brunswick records are quite old, and Canada Violet may no longer be found at some of these locations (S. Blaney, pers. comm. 2002).

Canada violet was found at one very rich site within the Project footprint (Figure 5.5.1-A, Appendix D, and Figure 5.5.3). This location is a new record for this species in Victoria County. The total population at this site is estimated at 1,570 plants distributed within 21 distinct patches, including one large patch containing an estimated 500 plants. The habitat consists of a rich hardwood slope dominated by butternut, sugar maple, American ash and ironwood. This habitat was situated on a shallow seepage track located near the base of a large hill. Canada violet was found on relatively dry areas along this seepage track. At this site Canada violet was associated with a variety of rare or uncommon herbaceous vascular plant species typically found within the Appalachian Hardwood Forest (AHF). These species include Goldie's fern, plantain-leaved sedge, northern maidenhair-fern, yellow lady's-slipper, and blue cohosh. Other more common species characteristic of rich deciduous forest were also found at this site including smooth yellow violet, bloodroot, silvery spleenwort, Dutchman's-breeches, and wild ginger (*Asarum canadense*, uncommonly scattered in New Brunswick, though locally common in some locations). Rerouting of the proposed TCH route now avoids this site.

The microhabitats hosting Canada violet colonies appeared to be low hummocks which were often occupied almost exclusively by this violet. Patches of bare soil were often present (September 2002) and may indicate either allelopathic effects (*i.e.*, inhibition of plant growth by chemicals of another species) or the presence of spring ephemeral species that had ceased growth and died back. While the superficially similar smooth yellow violet was often found in the general vicinity of Canada violet it only rarely appeared to grow directly with the Canada violet. Smooth yellow violet appeared to occupy moister areas than the Canada violet. In general the Canada violet occupied the drier more open hummocks on this rich slope. Canada violet like many violets is primarily myrmecochoric or ant dispersed. Ants are attracted to oily or protein rich tissues presented on the outside of the seed and drag the seed off to the ants' nests. Seeds dislodged from their arils along the way or discarded on nutrient rich ant middens are thus dispersed from the parent plants. Ant dispersal may limit the ability of Canada



violet to spread to suitable habitats. However, other ant-dispersed species such as other violet species and bloodroot are much more widely dispersed on the landscape. This would suggest that a specific requirement for calcium rich soils, in conjunction with other ecological factors limits Canada violet populations in the Maritimes.

One additional patch of Canada violet was noted during the 2003 survey just south of the rich hardwood stand located north of Demerchant Brook however this patch is located approximately 50 m upslope of the proposed TCH route (Figure 5.5.1-A, Appendix D).

Calypso or Venus' Slipper (*Calypso bulbosa*)

Calypso is a diminutive orchid that in flower (mid-May to mid-June) vaguely resembles a small pink lady's-slipper bloom, and has a single, small, shiny round-ovate leaf with prominent veins reminiscent of a lady's-slipper orchid or a plantain leaf.

Hinds (2000) relates that calypso, in New Brunswick (the only Maritime Province portion of its extensive world wide range), occurs primarily in old growth, calcareous, eastern white cedar (*Thuja occidentalis*) forest, in shaded conditions. Calypso is apparently intolerant of too much competition from other small herbaceous species and in these wet forests grows out of moss or thick duff often near the base of cedar trees. The species has also occasionally been recorded from calcareous old growth deciduous forest but again in relation to a thick mossy carpet. Common elements for calypso habitat appear to be mature, shaded, and mesic, calcareous habitats with plenty of moss. Given that old growth calcareous forests are becoming scarce in New Brunswick and mature cedar stands are frequently cut down for cedar shingles and shakes, in addition to occasionally being flooded by beaver activities, it is little wonder that this orchid is scarce in the province.

The ACCDC (2003) classes the species as S2. NBDNRE (2002a) places calypso in the "May Be At Risk" category. Populations of calypso are known from two ESAs in the area: Clark Brook Bog and Ketch Lake.

Calypso was located at only one site (Figure 5.5.1-D, Appendix D, and Figure 5.5.10). Hinds (2000) noted "...only a few plants occurring at any extant location" and indeed this was the case in the white cedar dominated mesic forest where the species was detected. A single calypso plant was found in full bloom, on the current eastbound lane cut line and a single flowering plant and three non-flowering plants 50 m outside the current Project footprint, moved to create this 50 m buffer. Other orchid species found in the same general habitat and site location include yellow lady's-slipper (*Cypripedium parviflorum* var. *pubescens*), Hooker's orchid (*Platanthera hookeri*), and heartleaf twayblade (*Listera cordata*). Calypso plants here were found growing from dense, raised moss hummocks with sparsely



growing associate vascular plants such as bunchberry (*Cornus canadensis*), swamp red raspberry (*Rubus pubescens*) and naked mitrewort (*Mitella nuda*).

Mountain Valerian (*Valeriana uliginosa*)

Mountain valerian has been recorded at a number of locations in New Brunswick mostly on the western edge of the province along the St. John River valley and rivers draining into it. NBDNRE (2002a) lists mountain valerian as “May Be At Risk”. It is listed as S2 by ACCDC (2003). Mountain valerian is generally associated with calcareous swamps and fens.

Mountain valerian was found at one location during the July 2003 field survey on the banks of Big Presque Isle Stream (Figure 5.5.1-C, Appendix D). Four small patches of mountain valerian were present approximately 80 m east of the westbound centreline of the highway. The four patches of mountain valerian were all found on a steep stream bank near the high water mark. The plants were associated with shallow soil deposits at the base of bedrock outcrops. These areas are kept moist by groundwater seepage from the base of the steep slope of the ravine through which the river flows. Mountain valerian was associated with introduced species such as garden loosestrife (*Lysimachia vulgaris*) and creeping bellflower (*Campanula rapunculoides*) and native species such as marsh-marigold (*Caltha palustris*) and fen grass-of-Parnassus (*Parnassia glauca*).

5.5.4.3.2 “Sensitive” Species

Hooked Agrimony (*Agrimonia gryposepela*)

Hooked agrimony is currently listed as S2 by the ACCDC (2003), and is considered “Sensitive” by NBDNRE (2002a). In the Maritimes, hooked agrimony is found in thickets, intervalles, slopes, and the margins of rich woods (Roland 1998), and in rich woods and thickets (Hinds 2000). Hinds (2000) considered the species uncommon (S3). Its precise status is somewhat unclear due to its close similarity to the much more common roadside agrimony (*A. striata*), and it likely belongs in the S3 category (S. Blaney, pers. comm. 2002). The apparent rareness of hooked agrimony may be due to it being passed by as an example of the more common species. It is likely hooked agrimony is more rare along the proposed TCH route than *A. striata*, due to its requirement for more calcium rich soils.

In 2002, no precise locations for the plant were determined. The identification of hooked agrimony came from a piece of stem bearing leaves and relatively early fruit that was collected for later identification. In 2003, hooked agrimony was identified at two locations, both on the westbound lane centreline (Figure 5.5.1-A, Appendix D, and Figure 5.5.5). Although only two locations of this species were recorded, it is the opinion of the surveyors that a viable population of hooked agrimony is located outside the Project footprint.



Boreal Bog Sedge (*Carex magellanica* ssp. *magellanica*)

Boreal bog sedge is associated with sphagnum bogs (Hinds 2000). This species is listed as S2 ACCDC (2003), and is considered “Sensitive” (NBDNRE 2002a). Boreal bog sedge was found at one location along the proposed TCH route (Figure 5.5.1-C, Appendix D), in Wetland 18 scattered in the swamp portion near the bog edge. The Project footprint will avoid this area of the wetland.

Plantain-leaved Sedge (*Carex plantaginea*)

Plantain-leaved sedge is associated with rich or calcareous hardwoods primarily in Carleton County (Hinds 2000; MacDougall and Loo 1998). This species is listed as S2 (ACCDC 2003) and “Sensitive” (NBDNRE 2002a). It can be considered a legitimately rare species restricted to Carleton and Victoria counties in the Maritimes, with the exception of one record near Truro in NS (S. Blaney, pers. comm. 2002).

Plantain-leaved sedge was recorded in three rich mature hardwood slope sites encountered along the route in 2002 by JWEL (Figure 5.5.1-A, Appendix D, and Figures 5.5.2, 5.5.3, and 5.5.4). It was typically found in tolerant hardwood forest dominated mainly by sugar maple, American ash, butternut and ironwood. Sites hosting plantain-leaved sedge were relatively mesic and evidently nutrient and calcium rich. It tended to occur along intermittent watercourses and surface flow channels in the woods and at drier sections of seep sites. At the rich hardwood stand south of Beaconsfield Road it was also found within a regenerating clear-cut. Common herbaceous associates included Goldie's fern, wild ginger, blood root, northern maidenhair-fern, silvery spleenwort, smooth yellow violet, and at some sites blue cohosh.

At the rich hardwood stand south of Beaconsfield Road (Figure 5.5.2), plantain-leaved sedge was noted at 10 locations and along an 80 m stretch of the rich habitat, totaling an estimated 470 plants. At the rich hardwood site north of Demerchant Brook (Figure 5.5.3) that also contains the Canada violet, the sedge was found within 36 patches in two distinct areas, totaling approximately 1,000 rosettes. The rich hardwood stand north of Bryson Brook (Figure 5.5.4) contained an estimated 160 plants found within 6 patches.

All three sites where this species was noted by JWEL will be avoided due to re-routing. The two sites where ACER (2003) reported finding this species were revisited in 2003. The plants near an old bush road north of Upper Guisiguit Brook (Figure 5.5.7) were not relocated, however other species were noted at this site, including Goldie's Fern. Three patches were found approximately 500 m south of Stairs Road (Figure 5.5.8), including a large patch 2 m in diameter.



During other follow-up surveys in 2003, plantain-leaved sedge was noted at three additional locations, including near the nodding fescue site (Figure 5.5.1-B, Appendix D, and Figure 5.5.6), which is outside the Project footprint, and two separate areas south of Dean Road (Figure 5.5.1-A, Appendix D) within and one outside the Project footprint, in the flood plain of McMullin Brook. Overall, five of the plantain-leaved sedge sites are located outside the Project footprint.

Sprengel's Sedge (*Carex sprengelii*)

Sprengel's sedge has been recorded mainly in Carleton County with outlying records in Sussex, Doaktown, near Fredericton, on the Restigouche River and in Victoria County. Sprengel's sedge is listed as S2 (ACCDC 2003) and is considered "Sensitive" (NBDNRE 2002a). This species is associated with rich alluvial hardwood forests as well as calcareous slopes and banks. One small patch of Sprengel's sedge was recorded in 2003 near the Canada violet site (Figure 5.5.1-A, Appendix D, and Figure 5.5.3). It was situated high on the banks of an intermittent stream which drains the Canada violet site. This patch is located just outside of the proposed Project footprint.

Showy Lady's-slipper (*Cypripedium reginae*)

In New Brunswick, showy lady's-slipper is characterized as very rare (S2) by Hinds (2000), as S2 by the ACCDC (2002a), and as "Sensitive" by NBDNRE (2002a).

Showy lady's-slipper habitat is alkaline swamps or bogs (Roland 1998). Hinds (2000) characterizes the habitat as calcareous bogs, fens and edges of Eastern White Cedar swamps. While, mature plants appear to do fine in more open sunlight they are often found in some degree of shade. The basic microhabitat they occupy is moist but not overly so and where water level fluctuations in the soil are not extreme. The common plant associates suggest soil that is moist, and with an unusual mix of acidity and alkalinity. Showy lady's-slipper might be expected within a situation where sphagnum moss and other bog type plants characteristic of acidic sites (*i.e.*, black spruce (*Picea mariana*), bunchberry (*Cornus canadensis*), and mountain holly (*Nemopanthus mucronata*)) grow with plants indicative of more alkaline conditions (*i.e.*, Red Osier (*Cornus sericea*), water avens (*Geum rivale*) and eastern white cedar (*Thuja occidentalis*)). The underlying calcium rich situation may result from calcium rich substrate or calcium particle deposition moving in via water flows from adjacent areas. Hinds (2000) characterization of the showy lady's-slipper occurring at the edge of calcareous Cedar swamps may relate to the greater alkalinity along the edge of such sites from surface and ground water coming in off adjacent uplands.

Showy lady's-slipper in full growth and bloom is unmistakable. Non flowering plants may have a superficial resemblance to Hellebore (*Veratrum viride*), but the two species are not commonly found together. Younger specimens of showy lady's-slipper, at some seasons of growth may resemble the



smaller yellow lady's-slipper, which may occur in the same habitat. Generally the much larger *C. reginae* emerges above ground and flowers later than yellow lady's-slipper in any given general location. The plants identified during the June 10, 2003 survey date were only emerged to some 15 cm and the leaves were yet to unfurl and in a cylindrical shape. The few yellow lady's-slipper encountered in or near this location were far advanced growth wise.

Showy lady's-slipper sites within or immediately adjacent to the Project footprint were detected only in an eastern white cedar stand north of Little Presque Isle Stream (Figure 5.5.1-D, Appendix D, and Figure 5.5.9) near the proposed Hartland Interchange. A diffuse population of 20 plants was reported within the Project footprint by Dillon (2003) in 2002, however this population was not relocated in 2003. Some 10 clumps totaling 37 stems were located in the area during the follow-up survey by JWEL in June 2003. Two clumps of 16 stems are located approximately 15 to 20 m from the realigned Project footprint. The remaining eight clumps are located approximately 75 m from the Project footprint. Plants were mostly growing relatively near an upland edge to the cedar stand. The plants recorded in 2002 are all located inside the Project footprint. Incidentally, an individual stem of *C. reginae* was found at the edge of a wetland just off Wilmot Road near Strong Corner, approximately 900 m west of the Project footprint (Figure 5.5.1-C, Appendix D).

Goldie's Fern (*Dryopteris goldiana*)

Goldie's fern is typically found under heavy shade in hardwood stands on very rich circumneutral soils. It is not rare nationally (COSEWIC 2003), however, Hinds (2000) considered it to be very rare in New Brunswick. The ACCDC (2003) lists it as a rare species (S2). NBDNRE (2002a) considers the species to be "Sensitive". In addition to the recorded locations of Goldie's fern in New Brunswick, this species has recently been found growing near the mouth of the Pokiok River.

In 2002, Goldie's fern was found in two main habitat types, both associated with mature, or recently clear-cut hardwood forests dominated by sugar maple, American ash, black ash, and butternut. The typical sites occurred within and near the margins of intermittent streams or surface water flow areas that were not overly moist in late summer. The soils at these sites could be described as alluvial in nature and very rich. Typical herbaceous associates included wood nettle, and silvery spleenwort fern, along with plantain-leaved sedge, blood root, wild ginger, and Dutchman's breeches. In the same habitat, but generally disjunct from the Goldie's fern colonies, were typically found northern maidenhair-fern and yellow lady's-slipper. In one instance nearby patches of Canada violet and scattered blue cohosh were found.

The second habitat type is associated with mesic areas along seepage tracks. The hardwood forest at this habitat type is similar to that of the first type except that American beech was relatively abundant.



In general, Goldie's fern would be expected to occur in areas of mature tolerant hardwood species dominated by species favouring more mesic sites such as sugar maple, ash, butternut and ironwood. An increased dominance of beech in the forest did not appear to predict this fern's presence. Goldie's fern populations would be expected where seasonal stream or surface water courses were present or where not overly wet subsurface seepage enriched the local soil and decreased soil acidity.

Goldie's fern was one of the most abundant of the rare vascular plants at the three rich areas identified by JWEL in 2002 (Figure 5.5.1-A, Appendix D, and Figures 5.5.2, 5.5.3, and 5.5.4), occupying large areas. These three areas will now be avoided, given the re-routing around these areas. Outside of these three rich habitats, Goldie's fern was recorded at three locations associated with Browns Brook, all outside (east) of the Project footprint (Figure 5.5.1-A, Appendix D). The populations at these locations are small relative to the rich sites, occurring in a large patch or several scattered patches.

ACER (2003) also reported Goldie's fern, approximately 380 m north of Upper Guisiguit Brook (Figure 5.5.1-B, Appendix D). This site was revisited in 2003, and the locations of this species are shown in Figure 5.5.7, both inside and outside the Project footprint. Goldie's fern was also noted in several more areas in 2003, including: the nodding fescue site (Figure 5.5.1-A, Appendix D, and Figure 5.5.2); the largest patch (approximately 150 m X 70 m) noted to date, 75 m east of the Project footprint near Brown Brook (Figure 5.5.1-A, Appendix D); south of Dean Road in a 15-year old clear-cut inside the Project footprint (Figure 5.5.1-A, Appendix D, and Figure 5.5.5); south of Route 560 and River de Chute, outside of the Project footprint (Figure 5.5.1-B, Appendix D, and Figure 5.5.6); and in a hardwood ravine south of Stairs Road at the edge of the Project footprint (Figure 5.5.1-B, Appendix D, and Figure 5.5.8).

Lopseed (*Phryma leptostachya*)

Lopseed is an S2 species (ACCDC 2003) that is considered "Sensitive" (NBDNRE 2002a). Hinds (2000) reports that in New Brunswick lopseed is found in rich hardwoods and in the presence of butternut trees. Within the Maritime Provinces, lopseed is restricted to the very richest forest sites in western New Brunswick (S. Blaney, pers. comm. 2002). The New Brunswick population is substantially disjunct from the nearest populations in Quebec and New Hampshire (the species is extirpated from Maine).

In 2002, JWEL encountered lopseed at the rich hardwood stand located north of Demerchant Brook (Figure 5.5.1-A, Appendix D, and Figure 5.5.3), which is now avoided by proposed TCH route (JWEL 2003a). Lopseed was found growing in four discrete clumps, containing clusters of 40, 25 and three stems, and as a single stem, all within a 100 m radius. The site on which it was growing was an evidently calcium-rich, mature hardwood slope. This forest stand was dominated by mature sugar maple, butternut, American ash and ironwood. Scattered beaked hazelnut and occasional red elderberry



and mountain maple were present in the shrub layer. Ground vegetation layer associates were plantain-leaved sedge, bloodroot, zigzag goldenrod, wild ginger, silvery spleenwort, smooth yellow violet, and great burdock, an invasive exotic species. This section of rich slope hosting the lopseed was largely free of Goldie's fern and Canada violet that grew 50 m to the north. Browse damage likely attributable to deer or moose was apparent in some of the clumps examined and such predation may limit this species, though several of the stems had successfully set seed.

Lopseed was discovered by ACER (2003) at another site in a hardwood ravine south of Stairs Road (Figure 5.5.1-B, Appendix D, and Figure 5.5.8). A follow-up survey was conducted by JWEL in 2003 in this area, at the request of NBDNR. Lopseed was noted in four clusters totaling 12 stems near some maidenhair-fern, and two clusters totaling 7 stems were present adjacent to a large clump of plantain-leaved sedge, in a rich stream area that had been clear cut only 2-3 years earlier. At this location weedy early successional species were competing with remnant, rich hardwood ground flora that included plentiful maidenhair-fern, some plantain-leaved sedge and a few small clumps of Goldie's fern. Lopseed was also detected on two small, rich alluvial ledges along a presently deep cut, intermittent flow stream gully through rich deciduous forest and mixed forest. Here, lopseed populations consisting of 11 clumps and 50 stems, and 7 clumps and 21 stems respectively, noted under shady conditions with associated flora not dissimilar to that described above except for fewer butternut. Despite investigating the feasibility of adjusting the alignment to avoid or minimize the area of disturbance of this site, NBDOT was unable to move the alignment, predominantly due to watercourses in this area. Also, during the early stages of the project during regulatory review of corridor options, DFO recommended that the alignment should be located between the two tributaries of the Lower Guisiguit River.

Historic (within the last six years) records of lopseed indicate that at least four additional lopseed sites are located within the Assessment Area (S. Blaney, pers. comm. 2002). These locations include two recorded by the NTN B within two Appalachian Hardwood Forest stands in 1997, within 4 km of the Stairs Road site. The four historic lopseed sites are located outside the Project footprint.

Canada Clearweed (*Pilea pumila*)

Canada clearweed is generally found growing in alluvial woods and other moist, shaded areas. In New Brunswick it was previously only found in the Saint John River valley in York and Carleton Counties (ACCDC 2002). It is locally abundant along the river in seasonally flooded forest, and less common in seepage areas and along small watercourses away from the river. Hinds (2000) describes clearweed as occupying alluvial woods and other moist shady areas and considered clearweed to be very rare in New Brunswick. The ACCDC (2003) lists it as S2 and it is considered "Sensitive" by NBDNRE (2002a). It occurs in Prince Edward Island and Nova Scotia, and could be found in other counties in New Brunswick (S. Blaney, pers. comm. 2002).



Canada clearweed is an annual species. It is a small plant that rarely exceeds 20 cm in height in the Maritime Provinces (though it may grow to 50 cm further south). In less favourable conditions, or where populations are dense, fruiting individuals may be only 5-10 cm tall. The species gets its name from its water-filled, translucent stems. In this species turgor pressure is the primary means of keeping the plant erect. This adaptation probably reduces the amount of resources required to maintain the plant's structure. This adaptation restricts clearweed to habitats that are continuously moist. In more southern climates it is widespread, secure and able to take advantage of a wide range of habitats.

Canada clearweed is found in continuously moist, nutrient-rich, often shaded sites with limited competition from taller plants. The plant tends to be most abundant in vernal pools or shorelines within swamp forest, where seasonal flooding limits the growth of other species. In New Brunswick it is often associated with silver maple floodplain forest, while elsewhere in the Maritimes it may be found in muddy areas along alder-lined streams, or within mixed-forest swamps or deciduous forest where groundwater seeps to the surface (ACCDC 2002).

Within the Project survey areas this annual species was mostly found in shallow, possibly sinkhole-derived, marshy basins. The basins were dominated by herbaceous species, mainly sensitive fern, along with lesser quantities of common skullcap, mad dog skullcap, common mint, and sedges. Red osier dogwood typically occurred in patches along the edges of these wet basins, along with the occasional willow and tree species. Scattered shallow ephemeral pools occurred within these basins, especially towards the margins. In all habitats in the area matching this description Canada clearweed proved to be present except for one very small example that had only two small pool areas suitable for Canada clearweed.

In such wet basins, Canada clearweed occupied a microhabitat best described as relatively open, dry pool areas where the substrate was not occupied by competing plants, and moisture was abundant. Some plants were also noted to occur on mossy logs above these open pool areas where moisture wicked up from the ground. Canada clearweed appears to be able to germinate later in the season with the water draw down and thus gain a niche relatively free of competition with the dominant perennial herbs. While some shading was present from adjacent forest trees, many of the plants here would be subject to long hours of full sunlight. Canada clearweed was a relatively minor floral component of the habitats occupied.

The sensitive fern basins were relatively easy to distinguish on aerial photographs, and basins outside of the Project footprint were visited following the initial plant survey. As noted above, most were shown to host clearweed populations. Canada clearweed was also found to occur in sections of intermittent streams, in patches of rich hardwood forest dominated by sugar maple, butternut, American ash and black ash, and along woods roads. The ephemeral streams or drainage swales provided rich soil and a shady, moist, seepy microhabitat within the forest. These sites supported rare flora like Goldie's fern,



and northern maidenhair-fern, as well as the more common perennial relative of clearweed, wood-nettle. Here clearweed occurred in small numbers in more open patches amid or at the edge of the larger perennials. The individual specimens were frequently more robust than those in the sensitive fern basin wetlands where soils were perhaps more acidic, germination may have occurred later and crowding of the Canada clearweed plants was more pronounced. At one of the rich sites a small population of Canada clearweed was found growing along a woods road. This population was found on disturbed mineral soil that had a moist aspect, as if lightly suffused by seepage. Again the plant appeared to demonstrate the need for a nutrient rich non-acidic, reliably moist site in which a regime of periodic disturbance kept patches of habitat free from occupancy by perennial species.

In 2002, Canada clearweed was recorded at 17 locations between Perth-Andover and River de Chute (Figure 5.5.1-A, Appendix D), including two of the rich sites (Figure 5.5.1-B, Appendix D, and Figures 5.5.2 and 5.5.3), which contained three of the locations. In addition to these records, this species was only noted south of River de Chute in 2003 near an old woods road approximately 250 m north of Upper Guisiguit Brook (Figure 5.5.1-B, Appendix D, and Figure 5.5.7), and near Big Presque Isle Stream between the proposed TCH route and Access Road “J” (Figure 5.5.1-C, Appendix D). An estimated 15 % of the plants are located within the proposed Project footprint. At the rich site south of Beaconsfield Road, one location is within the re-routed Project footprint (Figure 5.5.1-A, Appendix D), and another is located approximately 200 m downstream of the Project footprint (Figure 5.5.2). At the rich hardwood stand north of Demerchant Brook (Figure 5.5.3), the plants are avoided by the new re-route. The largest populations appeared to be at Wetland 7 and Wetland 8 (Figure 5.6.1-A, Appendix E); of these populations, only a portion of the Canada clearweed plants scattered at the edges of Wetland 8 are expected to be directly affected by the Project footprint. It would likely be difficult to avoid this wetland altogether, as McMullin Brook is located parallel to the proposed TCH route to the west. The re-route near Wetland 7 (south of Graham Brook) places the wetland just west instead of just east of the Project footprint. Of the 13 remaining locations, which were mostly the basin habitats described above, only two small sites, near Bishop Lake (Figure 5.5.1-A, Appendix D) and north of Upper Guisiguit Brook (Figure 5.5.7) are located within the Project footprint.

Lesser Bladderwort (*Utricularia minor*)

Lesser bladderwort is ranked S2 (ACCDC 2003) and is considered “Sensitive” (NBDNRE 2002a). Lesser bladderwort has been recorded from shallow pools and boggy meadows in New Brunswick (Hinds 2000). It is an aquatic species that has probably been overlooked as much as it is rare (S. Blaney, pers. comm. 2002). It is likely present throughout the province in both acidic and basic areas (but probably more common in acidic areas). In addition to available records, ACCDC has a number of probable specimens requiring confirmation (S. Blaney, pers. comm. 2002).



Lesser bladderwort was encountered by JWEL (2003a) in Wetland 3, near the edge of the proposed Project footprint (Figure 5.5.1-A, Appendix D). At this site, the lesser bladderwort occurred within an alder and drowned white cedar swamp wetland present at the margins of a dammed pond, which is part of a larger wetland complex. The wetland element hosting this bladderwort was characterized by scattered drowned white cedar, with higher hummocks occupied by speckled alder (*Alnus incana*) and sedge, alternating with a reticulate network of water filled channels and sloughs supporting a variety of aquatic and semi-aquatic plant species. In the habitat where the lesser bladderwort was found, common associates were nodding beggar-ticks (*Bidens cernua*), small-fruited burreed (*Sparganium natans*), and wild calla (*Calla palustris*). Reddish pondweed (*Potamogeton alpinus*), and variable pondweed (*P. graminus*) were also present in deeper waters. In shallower sloughs and edges several colonies of small yellow water-crowfoot (*Ranunculus gemilini*) were encountered (outside of the Project footprint). Lesser bladderwort was present in the shallows mixed in with the other aquatic species.

Bladderworts, especially those with reduced foliage, are generally rather cryptic as they tend to blend in with the other vegetation or substrates of their habitat. As such, they can be often overlooked except for the more robust species, and are most noticeable when in flower. Given the size of the wetland (6.7 ha) and the nature of this species, and since site conditions (*i.e.*, unstable footing) did not permit a survey of all suitable habitats in the wetland that may have contained this species, lesser bladderwort is likely present elsewhere in the wetland complex.

ACER (2003) also recorded the presence of lesser bladderwort in Wetland 11 (Figure 5.5.1-B, Appendix D). At this site, the lesser bladderwort occurred within a beaver pond, upstream of the Project footprint. Two other uncommon species were recorded in this wetland: lesser tussock sedge and hidden-scaled sedge.

Northern Maidenhair-fern (*Adiantum pedatum*)

Northern maidenhair-fern is an S2 species (ACCDC 2003) considered “Sensitive” (NBDNRE 2002a). In New Brunswick the habitat of northern maidenhair-fern is in rich hardwood forests associated with circumneutral soils (Hinds 2000). It is restricted to rich soiled forests, primarily in western New Brunswick but is somewhat more widespread and tolerant than Goldie’s fern or lopseed. While a few widely scattered records occur elsewhere in the province the bulk of records come from the rich Saint John River Valley Hardwood Forest assemblage in Carleton and southern Victoria counties (MacDougall and Loo 1998). Northern maidenhair-fern was probably fairly common historically within western New Brunswick, but it is now greatly reduced from pre-settlement numbers due to agriculture and forestry. It is also found in Nova Scotia, but is almost extirpated there (there is one known small population).



In 2002, northern maidenhair-fern was recorded by JWEL (2003a) within the three rich areas (Figure 5.5.1-A, Appendix D, and Figures 5.5.2, 5.5.3, and 5.5.4), as well as four other locations (Figure 5.5.1-A, Appendix D). Northern maidenhair-fern may possibly accept a broader range of soil richness or acidity levels than other of the rare hardwood associated flora in the area, as it was about as widely encountered as yellow lady's-slipper. This fern predominantly occurred in association with mature hardwood forests. Forests hosting northern maidenhair-fern were dominated by sugar maple, American ash, black ash, butternut and other tolerant hardwoods. This fern was most common along the edges of intermittent streams, and the largest population of northern maidenhair-fern noted was present along the rich hardwood stand south of Beaconsfield Road (Figure 5.5.2). At this location Goldie's fern and plantain-leaved sedge were notable associates. Northern maidenhair-fern was also present on rich hardwood forest slopes where moist seepage enriched the soil. Here northern maidenhair-fern occurred at the dryer periphery often close to clumps of Goldie's fern and plantain-leaved sedge. Northern maidenhair-fern was also encountered in some instances in regenerating clear-cuts.

Both ACER (2003) and Dillon (2003) reported northern maidenhair-fern. These sites included just south of Route 560 (Figure 5.5.1-B, Appendix D, and Figure 5.5.6), which is now avoided; north of Upper Guisiguit Brook (Figure 5.5.1-B, Appendix D, and Figure 5.5.7); south of Stairs Road (Figure 5.5.1-B, Appendix D, and Figure 5.5.7); an area just south of Big Presque Isle Stream now avoided due to realignment (Figure 5.5.1-C, Appendix D); and an area north of Palmer Road (Figure 5.5.1-D, Appendix D).

In 2003, this species was recorded at 48 locations in 7 general areas, with some sites inside and some outside the Project footprint. In total, this species was noted in 11 general areas in the area surveyed (ten north of Dryer Road), of which a viable population will remain in eight of these. In general, as appears to be the case for yellow lady's-slipper, northern maidenhair-fern was one of the more widely distributed of the "Sensitive" class plants and yet was generally patchy in distribution and always associated with richer sites and microhabitats.

Lance-leaved Grapefern (*Botrychium lanceolatum* var. *angustisegmentum*)

Lance-leaved grapefern is an S3 species (ACCDC 2003) that is considered "Sensitive" (NBDNRE 2002a). Although an uncommon species, it is fairly widespread, tending to be found in richer soiled areas in both deciduous forest and cedar swamp (S. Blaney, pers. comm. 2002). The habitat for lance-leaved grapefern is described as dry to moist open woods and rich deciduous forest (MacDougall and Loo 1998), as well as clearings adjacent to rich hardwoods (Hinds 2000), and rich, wooded hillsides (Roland 1998). It is an erect perennial herb up to 20 cm tall with a single pinnate frond.

One specimen of lance-leaved grapefern was encountered at a single site north of Plant Brook (Figure 5.5.1-A, Appendix D) along a rich slope within a hardwood stand dominated by young white birch and



trembling aspen. This stand was approximately 15 years old. Bunchberry was the dominant ground vegetation in the vicinity of the single grapefern noted. Despite a directed search in the area of the initial sighting no further specimens were encountered. No further lance-leaved grapeferns were encountered anywhere else along the route nor were any other grapefern species found, including the large and relatively common rattlesnake fern (*Botrychium virginianum*). This specimen of lance-leaved grapefern was recorded approximately 35 m outside of the realigned Project footprint.

In general grapeferns are characteristic of richer sites and tend to occur as single plants or small often-diffuse groups within a particular area where they are discovered. While many species of grapeferns are rather small and cryptic this aspect alone does not explain their apparent rarity, especially since other diminutive and cryptic taxa are much more frequently encountered. As ferns, their spores presumably give them great dispersal potential but their requirements for gametophyte generation, growth and subsequent sporophyte generation formation are either very precise and/or infrequent, or other ecological factors limit their presence in the landscape. It does not spread vegetatively by rhizomes. In general the presence of lance-leaved grapefern, in addition to several other rare species of *Botrychium*, often correlates to rich hardwood stands. However lance-leaved grapefern is also found in open habitat in northern areas (NatureServe 2002).

Yellow lady's-slipper (*Cypripedium parviflorum* var. *pubescens*)

Yellow lady's-slipper is an S3 species (ACCDC 2003) that is found in richer soils in most of the areas where it occurs in the province. However, it is a fairly common species in northwestern New Brunswick, and uncommon but dependably present in northeastern and southwestern older growth woods and cedar swamps, usually in lime rich soils (Hinds 2000; S. Blaney, pers. comm. 2002). The total number of known sites in New Brunswick probably exceeds 50. Nonetheless, the species is considered “Sensitive” (NBDNRE 2002a). This species is threatened by picking of flowers and digging of roots (presumably for gardens) and by habitat loss within parts of its range. This species is considered rare in Prince Edward Island and Nova Scotia.

This variety of yellow lady's-slipper is a colony-forming species (*i.e.*, forms clonal patches). Although there may be many thousand populations of this species throughout its extensive range across Canada and the United States, most populations are small. There are very few reports of large, secure populations anywhere in North America (NatureServe 2002). All reported populations contain less than 400 individuals, and most contain less than 30 (NatureServe 2002).

In 2002, yellow lady's-slipper was encountered in greatest numbers in the two rich mature deciduous forest stands (Figure 5.5.1-A, Appendix D, and Figures 5.5.3 and 5.5.4) dominated by sugar maple, American ash, and butternut. In this habitat the greatest number of clumps were found and the largest number of stems per clump were noted. This species was most abundant in the more southerly stand,



where approximately 275 individuals were noted in 39 clumps. The species often occurred to some extent within and near the richest moist (not wet) seepage sites that commonly hosted species such as Goldie's fern, plantain-leaved sedge, and northern maidenhair-fern. These plants are located outside the Project footprint.

Additional sightings in 2002 by JWEL (2003a) included a recent clear-cut in once mature forest, in thickets near a less rich stream site (20 plants), at the edge of a sensitive fern basin marsh (18 plants in 4 clumps), amid some mature white cedar (7 plants in 2 clumps) and at the edge of Wetland 3, outside the Project footprint (Figure 5.5.1-A, Appendix D). Dillon (2003) reported one record of a single specimen in 2002 (Figure 5.5.1-D, Appendix D), however the proposed TCH has been re-routed, and this site is now avoided.

In total, yellow lady's-slipper was recorded at 66 locations in 16 general areas, with 11 areas containing plants outside the Project footprint. In general it was one of the more widely distributed of the "Sensitive" class plants and yet was patchy in distribution and always associated with richer sites and microhabitats.

Braun's Holly Fern (*Polystichum braunii*)

Braun's holly fern has been recorded at least 33 locations in New Brunswick (Hinds 2000). Most records are from northern, western and southern portions of the province. Braun's holly fern is listed as an S3 species (ACCDC 2003) and is considered "Sensitive" (NBDNRE 2002a). In the Maritimes, this lacy, dark green holly fern is generally found in rich woods, primarily on calcareous soils (Hinds 2000). Similarly, Roland (1998) describes the preferred habitat for this species as deciduous forests, ravines and scapy hillsides. In contrast to the more generally distributed (in New Brunswick) and more southern ranging Christmas fern (*P. acrostichoides*), Braun's holly fern is less able to tolerate head and drought than Christmas fern. This need cooler and moister conditions than required by Christmas fern likely explains the fact that Braun's holly fern encountered during surveys for the Project were located along streams and seeps shaded by mature forest.

Braun's holly fern was found at two locations in 2003. One site was located just south of the rich hardwood stand south of Beaconsfield Road (Figure 5.5.1-A, Appendix D, and Figure 5.5.2) and the second was found south of Backland Road (Figure 5.5.1-B, Appendix D). Both records consisted of single plants growing on the fertile banks of intermittent streams. At the site near the rich hardwood stand south of Beaconsfield Road, Braun's holly fern was associated with several rare species including nodding fescue, pale touch-me-not, Goldie's fern, and plantain-leaved sedge. This location is approximately 40 m outside of the Project footprint. At the second site south of Backland Road no other rare or uncommon species were noted. This one plant was found on the westbound lane cutline, within a mature cedar stand.



Historic records of Braun's holly fern indicate that at least five additional sites are located within the Assessment Area (Hinds 2000). These five recorded Braun's holly fern sites are located outside the footprint of the Project.

5.5.4.3.3 "Secure" Species

Small Yellow Water-crowfoot (*Ranunculus gmelinii* var. *purshii*)

Small yellow water-crowfoot is currently ranked S2 (ACCDC 2003), but is considered "secure" (NBDNRE 2002a). It is an aquatic species that is fairly rare in New Brunswick, occurring in neutral to basic (lime rich) pools and still waters essentially throughout the province. It is an uncommon species in both Nova Scotia and Prince Edward Island as well. More records can be expected in New Brunswick and in the future it may well be ranked S3 (S. Blaney, pers. comm. 2002).

This species was recorded at five locations (Figure 5.5.1-A, Appendix D), including open water habitat at Wetland 3, in Wetland 2, in a small pond 300 m east of Wetland 2, and two locations along McMullin Brook to the west of Wetland 8. It covered a 4 m² area of open water in Wetland 3, located approximately 100 m west of the proposed TCH route, and was abundant in the other three locations. In Wetland 2 this species accounted for approximately 5 percent of the vegetation cover. Wetland 2 is bisected by the eastbound lane centreline, and would therefore be directly affected by construction activity.

Clammy-Hedge-Hyssop (*Gratiola neglecta*)

Clammy-hedge-hyssop is a small yellow and white flowered annual that is able to persist in very particular ruderal (disturbed) habitats. Such habitats appear to consistently offer an open sunny, wet muddy substrate which initially at least has a very shallow cover of water, and that never completely dries out. Few perennial competing plants are immediately present to prevent successful germination and growth. Additionally the substrate may be somewhat less acidic than that tolerated by the related perennial, and in N.B. even rarer, golden pert (*G. aurea*). Hinds (2000) describes clammy-hedge-hyssop habitat as muddy shores and in shallow water, and classes the species as extremely rare or S1. Recent clammy-hedge-hyssop population records by the ACCDC, and others, and records along the proposed Pokiok to Longs Creek section of the TCH have supported the classing of clammy-hedge-hyssop by ACCDC as S2/S3, and the NBDNRE (2002a) classification of "Secure".

It is apparent that the species has also found a niche along infrequently used wood roads where conditions of soil type and moisture retention and the creation of rut pools favour it. The plants are able to establish populations and persist where trucks have created shallow rut pools. This is in part due to persistent water and moisture retention, and in part due to infrequent vehicle passage not encouraging or



excluding competing perennial plants establishing. Infrequent vehicle passage is less deleterious, particularly in the seed stage, to an annual species than a perennial. The trucks may even help disperse seed to suitable rut pools up and down the road after initial successful colonization of the road and may also be a significant disperser of clammy-hedge-hyssop from more distant sites. Very frequent passage of vehicles would diminish or extirpate populations in this habitat type.

In the rerouting south of the Dryer Road (Figure 5.5.1-C, Appendix D), four populations of clammy-hedge-hyssop were found in 2003 growing along three infrequently utilized wood roads in habitat situations as described above. The populations comprise estimates of 5, 30, 50 and 100 plants mostly within the Project footprint, however, a viable population is present outside of the footprint.

Small-fruited Burreed (*Sparganium natans*)

Small-fruited burreed is a borderline S2S3 species (ACCDC 2003) which is considered “Secure” (NBDNRE 2002a). Small-fruited burreed is an aquatic species found in alkaline ponds and lagoons, and on pond margins (Hinds 2000).

In the Assessment Area small-fruited burreed was encountered from only one site, in Wetland 3, at the same location as lesser bladderwort was found (Figure 5.5.1-A, Appendix D). The small-fruited burreed occurred within an alder swamp present at the margins of a beaver-flooded pond. The abundance of this species at this location was estimated at 150 plants. As with the lesser bladderwort, small-fruited burreed may be present elsewhere in the wetland complex.

Blue Cohosh (*Caulophyllum thalictroides*)

Blue cohosh is typically found in scattered localities in New Brunswick in rich, circumneutral soils of deciduous woods and alluvial bottomlands. It is not rare nationally, and NBDNRE (2002a) has listed the species as “Secure”. The ACCDC (2003) lists this species as uncommon (S3). This is a perennial herbaceous plant with a smooth purple stem, which can reach 80 cm in height. It is a species of rich soil, occurring in upland forests in Carleton and Victoria counties, but is essentially restricted to floodplains elsewhere. It is most common within the Saint John drainage, where it can be consistently found in suitable habitat (S. Blaney, pers. comm. 2002). Recent work has shown it to be more common in the Miramichi system and northwestern New Brunswick than had been previously known. The total number of locations in the province likely exceeds 50 (S. Blaney, pers. comm. 2002).

Blue cohosh was recorded by JWEL (2003a) in 2002 at least four locations, including two rich hardwood stands (Figure 5.5.1-A, Appendix D, and Figures 5.5.3 and 5.5.4). Outside of these rich areas blue cohosh was found just south of Wetland 8 within the westbound lane (Figure 5.5.1-A, Appendix D, and Figure 5.5.5), and associated with Goldie’s fern east of the proposed TCH route on Brown Brook



(Figure 5.5.1-A, Appendix D). Dillon (2003) also recorded blue cohosh in an area now avoided due to a realignment of the highway. In 2003, blue cohosh was recorded at 20 locations in 4 general areas.

Rosy Sedge (*Carex rosea*)

Rosy sedge is listed as S3 (ACCDC 2003). It is not rare nationally, and NBDNRE (2002a) has listed the species as “Secure”. This species was recorded at four locations (Figures 5.5.1-A, 5.5.1-B, and 5.5.1-C Appendix D, and Figure 5.5.6), all within the Project footprint.

Heartleaf Twayblade (*Listera cordata*)

Heartleaf twayblade is listed by the ACCDC (2003) as borderline S3S4. It is not rare nationally, and NBDNRE (2002a) has listed the species as “Secure”. Heartleaf twayblade typically grows in the shade on moist banks and in coniferous swamps and bogs, particularly cedar swamps and bogs. This species was recorded at two locations, one inside (Figure 5.5.1-D, Appendix D, and Figure 5.5.10) and one outside the Project footprint (Figure 5.5.1-C, Appendix D).

Fen Grass-of-Parnassus (*Parnassia glauca*)

Fen grass-of-Parnassus is uncommon to rare in New Brunswick, typically found on calcareous rocky shores and in marly bogs (Hinds 2000). It is not rare nationally, and NBDNRE (2002a) has listed the species as “Secure”. ACCDC (2003) lists this species as S3. Fen grass-of-Parnassus was found at one location, near *Valeriana uliginosa* on the Big Presque Isle Stream, approximately 90 m downstream of the westbound lane centreline (Figure 5.5.1-C, Appendix D).

Black-seed Plantain (*Plantago rugelii*)

The provincial population status of black-seed plantain (*Plantago rugelii*) has recently (2002) been changed from a ranking of S1 to S3 by ACCDC (2003), and is considered “Secure” by the province (NBDNRE 2002a). This species is native to North America but is believed to have been introduced to New Brunswick. It is easily overlooked because of its superficial resemblance to the common plantain (*P. major*), a common introduced Eurasian species. It is likely for this reason that the population status of black-seed plantain has been changed to S3 and it is now considered secure by the province.

This species was recorded at two locations within the Project footprint (Figure 5.5.1-A, Appendix D), as well as at several others outside the Project footprint, usually along woods roads and trails. One recorded location was on a woods road intersection near the westbound lane centreline, where four specimens were identified among a large population of the common plantain. The second location was identical habitat where a woods road crosses Graham Brook, downstream of the Project footprint. The



species was noted on other woods roads in the area located outside of the Project footprint as well as on an exposed gravel bar on the River de Chute just downstream of the Project footprint.

Hidden-scaled Sedge (*Carex cryptolepis*)

Hidden-scaled sedge is listed by the ACCDC (2003) uncommon (S3). NBDNRE (2002a) has listed the species as “Secure”. This species is typically found in sandy or mucky shores, ditches, swales and occasionally in bogs (Hinds 2000). ACER (2003) reported hidden-scaled sedge at Wetland 11 (Figure 5.5.1-B, Appendix D), outside the Project footprint.

Lesser Tussock Sedge (*Carex diandra*)

Lesser tussock sedge is listed by the ACCDC (2003) as uncommon (S3). NBDNRE (2002a) has listed the species as “Secure”. Lesser tussock sedge is a species with a very broad distribution and in North America occurs from Alaska to Newfoundland and south to California and New Jersey. In the Maritimes, lesser tussock sedge occurs in the northern mainland and on Cape Breton Island in Nova Scotian bogs, cat-tails swales and marshes, where it is said to be common and locally abundant (Roland 1998). In New Brunswick, it is recorded from scattered sites along the north and east coast and parts of Carleton, Victoria and Restigouche Counties. Lesser tussock sedge is typically found in bog or fen lowlands (Hinds 2000). ACER (2003) reported lesser tussock sedge at Wetland 11 (Figure 5.5.1-B, Appendix D), outside the Project footprint.

5.5.4.3.4 COSEWIC Species

In November 2003, subsequent to the field surveys conducted for the Project, butternut (*Juglans cinerea*) was designated endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). Although butternut is considered by COSEWIC to be widespread in southern Ontario, Quebec and New Brunswick, this species has been designated endangered because of a projected decline due to butternut canker (COSEWIC 2003). Butternut canker has been detected in all three provinces and high rates of infection and mortality, observed in Ontario, are predicted for Quebec and New Brunswick populations (COSEWIC 2003).

Butternut is listed by Hinds as “common and native in the Saint John River Valley and Upper Southwest Miramichi River valley” (Hinds 2000). Hinds (2000) indicates the species occurs throughout the above-named valleys, as well as within valleys of several of the major tributary rivers of the lower Saint John River. NBDNR (unpublished) suggests that, relative to overall abundance of other tree species in the province, butternut might be better classed as uncommon, although it is locally abundant on some floodplain sites.



Butternut occurrence is not currently tracked or inventoried by the NB Department of Natural Resources. A conservative estimate indicates a population of between 7,000 and 17,000 mature trees (NBDNR unpublished). The minimum estimate is probably close to true abundance at known sites. However, because sites known constitute an unknown subset of the true total number of sites of occurrence in NB, this minimum abundance estimate is conservative.

Hinds (2000) indicates that butternut occurs or occurred in at least an additional seven sites unfamiliar to NBDNR staff: six within the Kennebecasis and Canaan River drainages (tributary to the lower Saint John River) and a single site in eastern NB. Butternut occurs in three ecoregions within New Brunswick: Eastern Lowlands (Southwest Miramichi River), Valley Lowlands (upper Saint John River), and Grand Lake (lower Saint John River).

Within the Valley Lowlands Ecoregion, the majority of butternut occurrences fall within the Meductic Ecodistrict. This ecodistrict includes much of the upper Saint John River valley (above head-of-tide). The floodplain area of the Saint John River was very narrow within this ecodistrict: most of this area has been lost to hydroelectric development.

Butternut is found on many of the narrow floodplains of tributary streams and on the remaining floodplain of the Saint John River within the Meductic Ecodistrict, but does not form pure stands as in the Aukpaque Ecodistrict. However, in the Meductic Ecodistrict butternut is not largely limited to floodplain soils. Much of the Meductic Ecodistrict is underlain by rich calcareous soils, resulting in butternut being scattered throughout upland hardwood forests.

During the field surveys, no precise data on location and abundance was collected for butternut. In general butternut was found in areas with calcareous soils and was almost always present in rich sites with rare species such as Goldie's fern and plantain-leaved sedge. Butternut was also not infrequently seen along old field edges, and in clear cuts as young trees or semi-suckered growth. In localized rich sites it was considered among the canopy dominants, as a lesser dominant. Three rich hardwood stands (located south of Beaconsfield Road, north of Demerchant Brook and north of Bryson Brook) contained butternut as a dominant canopy species. These three stands are described in more detail in Section 5.5.4.4.2. Butternut was also noted at 11 additional sites within the Assessment Area, including WC4 (Beaconsfield Road), WC7 (Plant Brook), Brown Brook, McMullin Brook, south of Dean Road, in a regenerating clearcut (Figure 5.5.5), south of River de Chute (Figure 5.5.6), north of Guisiguit Brook (Figure 5.5.7), south of Stairs Road (Figure 5.5.8) north of AHF 30A (Figure 5.5.1-C, Appendix D), and north of Palmer Road (Figure 5.5.1-D, Appendix D).

Butternut was encountered during the field surveys frequently enough to not have been considered exceptional. In the site descriptions of rare plant sites, it was included if it was a dominant species,



though it was present at many such rich upland or alluvial sites. In many cases, butternut was noted from areas outside the Project footprint, including along the existing TCH.

5.5.4.4 Appalachian Hardwood Forest (AHF)

5.5.4.4.1 Mature Appalachian Hardwood Forest (AHF) identified by the Nature Trust of New Brunswick

Appalachian Hardwood Forest (AHF), also known as St. John River Valley Hardwood Forest, is defined as a distinct assemblage of tree, understory vascular plant, and bryophyte species found in the central St. John River valley and connecting tributary valleys of western New Brunswick and eastern Aroostook County, Maine. This assemblage type is associated with the moderate climate and well-drained calcareous upland and alluvial bottomland soils of this region (MacDougall and Loo 1998). AHF is a transition forest between southern hardwood forests of central Appalachia and northern hardwood forests of northern New England, the Maritimes, and Quebec.

A very diverse flora that includes 71 vascular plant species (Table 5.5.3) and 116 moss and liverwort species characterizes the AHF. Many of these plant species are rare or uncommon in New Brunswick and are considered to be strongly associated with AHF stands (MacDougall and Loo 1998).

Table 5.5.3 Vascular Plant Taxa Characteristic of Appalachian Hardwood Forest (after MacDougall and Loo 1998)

Scientific Name	Common Name	Scientific Name	Common Name
<i>Acer saccharum</i>	sugar maple	<i>Erythronium americanum</i>	trout lily
<i>Actaea pachypoda</i>	white baneberry	<i>Eupatorium rugosum</i>	white snakeroot
<i>Adiantum pedatum</i>	maidenhair-fern	<i>Fagus grandifolia</i>	beech
<i>Agrimonia gryposepala</i>	agrimony	<i>Festuca subverticillata</i>	nodding fescue
<i>Allium tricoccum</i>	wild leek	<i>Fraxinus americana</i>	white ash
<i>Anemone quinquefolia</i>	wood anemone	<i>Fraxinus nigra</i>	black ash
<i>Aralia racemosa</i>	spikenard	<i>Galearis spectabilis</i>	showy orchis
<i>Arisaema triphyllum</i>	jack-in-the-pulpit	<i>Hepatica nobilis</i>	round-leaved hepatica
<i>Asarum canadense</i>	wild ginger	<i>Impatiens pallida</i>	pale touch-me-not
<i>Betula alleghaniensis</i>	yellow birch	<i>Juglans cinerea</i>	butternut
<i>Botrychium dissectum</i>	dissected grape fern	<i>Ostrya virginiana</i>	ironwood
<i>Botrychium lanceolatum</i>	lance-leaved grape fern	<i>Osmorhiza claytonii</i>	sweet Cicely
<i>Botrychium matricariifolium</i>	daisy-leaf grape fern	<i>Phryma leptostachya</i>	lopseed
<i>Botrychium virginianum</i>	rattlesnake fern	<i>Poa alsodes</i>	grove meadow-grass
<i>Cardamine concatenata</i>	cut-leaved toothwort	<i>Polygala senega</i>	seneca-snakeroot
<i>Cardamine diphylla</i>	toothwort	<i>Polygonatum pubescens</i>	Solomon's-seal
<i>Cardamine X maxima</i>	large toothwort	<i>Polystichum acrostichoides</i>	Christmas fern
<i>Carex cephaloidea</i>	thin-leaved sedge	<i>Polystichum braunii</i>	Braun's holly-fern
<i>Carex hirtifolia</i>	pubescent sedge	<i>Ranunculus abortivus</i>	kidney-leaved buttercup
<i>Carex plantaginea</i>	plantain-leaved sedge	<i>Ranunculus recurvatus</i>	hooked buttercup
<i>Carex sprengelii</i>	Sprengel's sedge	<i>Rubus occidentalis</i>	black raspberry
<i>Caulophyllum thalictroides</i>	blue cohosh	<i>Sanguinaria canadensis</i>	bloodroot
<i>Circaea lutetiana</i>	enchanter's nightshade	<i>Sanicula odorata</i>	fragrant snakeroot
<i>Claytonia caroliniana</i>	spring beauty	<i>Sanicula trifoliata</i>	large-fruited snakeroot



Table 5.5.3 Vascular Plant Taxa Characteristic of Appalachian Hardwood Forest (after MacDougall and Loo 1998)

Scientific Name	Common Name	Scientific Name	Common Name
<i>Cryptotaenia canadensis</i>	honewort	<i>Smilacina racemosa</i>	false Solomon's-seal
<i>Cynoglossum boreale</i>	northern wild comfrey	<i>Solidago flexicaulis</i>	zig-zag goldenrod
<i>Cypripedium oarviflorum</i> var. <i>pubescens</i>	yellow lady's-slipper	<i>Taxus canadensis</i>	Canada yew
<i>Deparia acrosticoides</i>	silvery gladefern	<i>Tilia americana</i>	basswood
<i>Desmodium glutinosum</i>	pointed-leaved tick-trefoil	<i>Trillium erectum</i>	red trillium
<i>Dicentra cucullaria</i>	dutchman's-breeches	<i>Triosteum aurantiacum</i>	wild coffee
<i>Dirca palustris</i>	leatherwood	<i>Ulmus americana</i>	American elm
<i>Dryopteris clintoniana</i>	Clinton's shield-fern	<i>Uvularia sessilifolia</i>	sessile-leaved bellwort
<i>Dryopteris clintoniana</i> X <i>goldiana</i>	simulated log fern	<i>Viola canadensis</i>	Canada violet
<i>Dryopteris goldiana</i>	Goldie's fern	<i>Viola pubescens</i>	yellow violet
<i>Dryopteris</i> X <i>dowellii</i>	Dowell's wood fern	<i>Viola selkirkii</i>	great-spurred violet
<i>Elymus hystrix</i>	bottle-brush grass		

AHF is typically a mature tolerant hardwood forest growing on rich, well-drained soils and is rarely found in younger forested areas subjected to previous agricultural or forestry activities. Sugar maple, beech, white ash, yellow birch and ironwood typically dominate the canopy species of AHF. The presence of basswood and butternut in these stands often indicate a species-rich understory. The understory vascular plant assemblages of AHF are typically associated with moist, seepy areas (MacDougall and Loo 1998).

The St. John River valley, from Meductic to Beechwood, contains the most species-rich assemblages of AHF and typical species assemblages are most concentrated within the Meduxnekeag River watershed (MacDougall and Loo 1998).

The NTNBS initiated a Conservation Stewardship Program to inventory the size, abundance and distribution of AHF fragments in the central St. John River Valley, with the intent to conserve significant AHF fragments identified in the program (MacDougall 1997). AHF fragments were given conservation priority rankings of “very high”, “high”, “moderate” or “low”.

Very high priority sites (MacDougall 1997) were defined as those that:

- contained one or more provincially or nationally “very rare” plant species;
- contained a few or many uncommon or rare AHF plant species;
- contained a rich assemblage of common AHF plant species;
- had limited recent disturbance; and/or
- had largely undisturbed mature tolerant hardwood canopy.



High priority sites (MacDougall 1997) were defined as those that:

- contained a few or many rare AHF plant species;
- contained a rich assemblage of common AHF plant species;
- had limited recent disturbance; and/or
- had a largely undisturbed mature tolerant hardwood canopy.

Moderate priority sites (MacDougall 1997) were defined as those that:

- contained one or a few rare AHF plant species;
- contained a moderate assemblage of common AHF plant species;
- were recently partially clear-cut or selectively cut;
- had largely undisturbed mature tolerant hardwood forest canopy, but limited understory diversity; and/or
- were located near a high or very high priority site.

Low priority sites (MacDougall 1997) were defined as those that:

- displayed an absence of rare AHF plant species;
- contained few or no common AHF plant species;
- were completely or partially clear-cut;
- were heavily select cut with no evidence of mature trees; and/or
- were incorrectly identified as mature tolerant hardwood.

Locations of AHF identified in the program were provided by the NTNB (Betts 1999). A total of 21 AHFs totaling approximately 404 ha were identified within the Assessment Area (*i.e.* 22 map tiles; see Section 5.5.2.2). Six AHF stands are shown in Figure 5.5.1 A-D (Appendix D), between the Project limits; two additional stands occur just outside the limits of the Project in the Perth-Andover and Woodstock areas. Of the stands located in the area, the Project footprint will bisect two of the stands (Hunters Brook AHF and Big Presque Isle Stream AHF) and will just avoid a third stand (Reid Lake AHF). Information collected on the AHF stands in 1997 in the Assessment Area was provided by NTNB (J. Simpson, pers. comm. 2003).

The Hunters Brook AHF (AHF-30a, Figure 5.5.1-C, Appendix D) is bisected by a power line RoW from north to south. The western side of this AHF was relatively undisturbed and described as mature tolerant hardwood with many large sugar maple and American ash. The western side of the Hunters Brook AHF is considered a moderate priority site. Yellow lady's-slipper and northern maidenhair-fern have been recorded in the western side of this AHF. The eastern side of the Hunters Brook AHF was described as young, even-aged tolerant hardwood that is species poor, however, leatherwood has been



recorded in the eastern side. The powerline RoW currently bisects the Hunters Brook AHF in the same area as the proposed TCH route. At the time of the vegetation surveys in 2002 and 2003, the southern half of the site and east of the powerline had been clear-cut. Following a search of the AHF site, concentrating within the footprint, one uncommon species associated with AHF, yellow lady's-slipper, was found in this area, west of the Project footprint. The eastern and southern portion of the Hunters Brook AHF site that will be crossed by the Project footprint would be considered a "low priority" site according to MacDougall's (1997) conservation priority ranking.

The Big Presque Isle Stream AHF (AHF-28, Figure 5.5.1-C, Appendix D) was described by NTN B as a large mature hardwood forest with spring ephemeral species. Although the stand is considered to be "moderate priority" due to its large size and the presence of rare moss species, much of the stand is heavily disturbed and continues to be harvested. A high-tension powerline RoW bisects the stand. The forest stands along the proposed TCH route in the vicinity of Big Presque Isle Stream are described as mature hemlock, white pine, balsam fir and sugar maple stands (Dillon 2003). No rare or uncommon species associated with AHF were found within the original Project footprint by Dillon (2003) in this area, nor in the realigned Project footprint by JWEL in 2003.

At the Big Presque Isle AHF site (#28) along the east and west sides of the transmission line (located west of the Project RoW) within 1 km of the stream, two uncommon to rare mosses (unranked by the ACCDC) *Anomodon rugelii* and *Raiiella scita* were recorded. These same uncommon mosses were discovered at a number of other AHF sites, including Site #17 (Figure 5.5.1-C), located approximately 1 km southwest of Flanagan Hill, 3.5 km southeast of Connell, well outside of the Project RoW. The rare moss *Ditrichum pallidum* (S1) was also found at Site #17. Also of note, a small calcareous fen approximately 1.7 km north of Big Presque Isle Stream and west of the Project RoW contains the rare mosses *Hypnum pratense* (S1S2) and *Helodium blandowii* (S2) and other uncommon bryophytes of fen habitat, including the uncommon mosses *Tomenthypnum nitens*, and *Drepanocladus aduncus*, and the uncommon liverwort *Cololejeunea biddlecomiae*, all currently unranked by the ACCDC. This fen will not be affected by the Project.

The ACCDC rankings and records of mosses are available for the rarest of mosses (S1, S1S2 and S2), however there are no rankings for the other species mentioned above. The two rare (S1 and S1S2) species above were included in the data provided by the ACCDC, however the records are not within the RoW. A status ranking for nonvascular plants by the Province (NBDNR), is not available (Maureen Toner, pers. comm.).

The Reid Lake AHF (AHF-43, Figure 5.5.1-B, Appendix D) was identified by the NTN B as one of the highest priority AHF sites in the Assessment Area. This site is described as a combination of wet seep, dry mature tolerant hardwood and alluvial shoreline with sugar maple, American ash, yellow birch and American elm. The Reid Lake AHF is considered a very high priority site with high species diversity



and rare and very rare plants. Rare vascular plants recorded at the site include Goldie's fern, Braun's holly fern, plantain-leaved sedge, bottle-brush grass, nodding fescue, yellow lady's-slipper, showy orchis (*Galearis spectabilis*) and lopseed. Of the many rich areas within the site, only one seepy site appears to be close to (but still outside) the Project footprint, and it is considered the least rich of the rich areas, with Goldie's fern the only rarity recorded.

Two AHF stands within or near the Assessment Area are also considered to be ESAs. The Moody (Iron Ore) Deciduous Stand is located west of Jacksonville, between Routes 550 and 560, approximately 1.2 km from the Project footprint. This deciduous forest community has a history of variable disturbance, resulting in densely forested lower slopes and open upper slopes. Butternut and several rare plant species are found at this site, including as Goldie's fern, showy orchis and maidenhair fern. The Woodstock-Meduxnekeag Bridge is located on the banks of the Meduxnekeag River west of Woodstock, west of the bridge on the existing TCH, approximately 0.5 km from the Project footprint. This site is a calcareous woods and river edge with interesting floral assemblage including rare and uncommon species such as Goldie's fern, showy orchis, yellow lady's-slipper and maidenhair fern. There will be no interaction between the Project and these two AHF stands.

5.5.4.4.2 Potential Appalachian Hardwood Forest

Although the information collected from the NTNB indicates that there are 404 ha of AHF in the Assessment Area, the digital forest cover data used by the NTNB is from 1981 which precedes current hardwood classification methods updated in 1995. Based on the NTNB query methodology (MacDougall 1997) using 1996 and 2000 forest data including areas with suitable tree canopy (*i.e.*, immature old to mature tolerant hardwood species) and soil type, there are 3,855 ha of "potential AHF" in the Assessment Area. However, these areas of "potential AHF" have not been confirmed by ground-truthing. In New Brunswick's provincial land classification AHF corresponds with Ecosites 7L, 7C, and 8C within the St. John River Valley Ecodistrict (MacDougall 1997).

Five "potential AHF" stands were identified, however, during the vegetation surveys. ACER (2003) reported one area that contained rare and uncommon species associated with AHF (Figure 5.5.8). This area is located south of Stairs Road, in forest Ecosite 7L, identified as mixedwood highly calcareous upper slope, and characteristic of AHF. This site is described as a hardwood ravine and contains plant assemblages characteristic of AHF, including lopseed, plantain-leaved sedge and maidenhair-fern. Goldie's fern was also found in the area by JWEL in 2003. These plants persist, though the area was clear-cut both recently and in the past.

During rare plant surveys in 2003, JWEL reported another area that contained rare and uncommon species associated with AHF. This area is located south of Route 560, in forest Ecosites 7L and 8L, identified respectively as mixedwood highly calcareous upper slope and hardwood highly calcareous



ridge (Figure 5.5.6). Plant assemblages characteristic of AHF included bottle-brush grass, Goldie's fern, leatherwood and maidenhair-fern. This site has undergone significant forest harvesting over the years, but rare species assemblages have been able to persist.

During the vegetation survey carried out by JWEL (2003a) in 2002, three rich hardwood stands (Figure 5.5.1-A, Appendix D) were identified in the Assessment Area. These three stands displayed previously unknown plant assemblages characteristic of AHF and are described below. A shift in the proposed TCH route has resulted in avoidance of these rich hardwood sites; all three are located outside the Project footprint.

Rich Hardwood Stand South of Beaconsfield Road

The rich hardwood stand (Figure 5.5.1-A, Appendix D) is situated in the flood plain of an intermittent stream that flows through a partially harvested rich sugar maple, ash and butternut dominated forest stand. This partially-cut tolerant hardwood site is surrounded on three sides by cleared land, with agricultural land immediately to the north and south, and a recent clear-cut to the east. Rare or uncommon vascular plant species were recorded within approximately 50 m of the drainage channel. A downstream portion of the intervale habitat has been clear-cut to the edge of the channel, yet still contained rare species. This site is located within Ecosites 5 and 8, not consistent with the three ecosites normally associated with AHF.

A total of six rare or uncommon vascular plant species were recorded within the intervale habitat (Figure 5.5.2). Goldie's fern is distributed along the intervale in two large patches separated by a logging road. Canada clearweed is found on the downslope side of the logging road. A second larger population of Canada clearweed is found on a second logging road. A patch of yellow lady's-slipper and a single grouping of 22 plantain-leaved sedge rosettes are located just upslope of the intervale. The remaining rare vascular plants in this intervale include a large patch of northern maidenhair-fern among the Goldie's fern, a single fragrant black snake-root near the Goldie's fern, and various clumps of northern maidenhair-fern and plantain-leaved sedge further downstream. Much of the large patch of Goldie's fern and northern maidenhair-fern, as well as a good portion of the northern maidenhair-fern and plantain-leaved sedge clumps are within a recent clear-cut.

Additional rare species were recorded in 2003 in a nearby intervale habitat 100 m south of this site, however had recently endured even more disturbance from harvesting. These species included pale touch-me-not, nodding fescue, and Braun's holly fern.



Rich Hardwood Stand North of Demerchant Brook

This rich hardwood stand (Figure 5.5.1-A, Appendix D) is located 1 km to the north of the rich hardwood stand located north of Bryson Brook. Both rich hardwood stands are similar in tree and shrub species composition as well as soil fertility, drainage conditions and topography. The forest inventory description for this stand is identical in all respects to that of the rich hardwood stand north of Bryson Brook (see below). The site actually comprises two distinct seepy areas, separated a distance of 50 m by a drier ridge that did not contain any rarities. Downslope of this stand are mature mixedwood stands dominated by poplar and balsam fir. This site is located within Ecosite 8, which is not consistent with the three ecosites normally associated with AHF.

This rich site contained the highest concentration of rare and uncommon species. The nine species include Canada violet, plantain-leaved sedge, Sprengel's sedge, Goldie's fern, lopseed, Canada clearweed, northern maidenhair-fern, yellow lady's-slipper and blue cohosh (Figure 5.5.3). Other more common species characteristic of AHF were also found at this site including smooth yellow violet, bloodroot, silvery spleenwort, trout lily, Dutchman's-breeches, spring beauty, and wild ginger.

This was the only site where Canada violet was recorded. It was found on the more northern seep, mostly at the upper end of the slope. Plantain-leaved sedge was found scattered in both seepage areas, and in total numbered approximately 1,000 individuals in 36 patches. This represents more than two thirds of the total number of individuals of this species recorded during the survey. Goldie's fern was mostly found in one large patch that spanned the length of the more northern seep, but was absent from the other seep. In contrast, lopseed was only found in the more southern seep at four discrete locations. Canada clearweed was found in two patches, one near each of the seeps. Several northern maidenhair-fern and two patches of yellow lady's-slipper were found at this site, one in each seepage area. Blue cohosh was found scattered near the top of the seepage track near the Canada violet distribution.

Rich Hardwood Stand North of Bryson Brook

The rich hardwood stand north of Bryson Brook (Figure 5.5.1-A, Appendix D) is dominated by sugar maple, American ash, black ash and butternut. Scattered beaked hazelnut and occasional red elderberry and mountain maple were present in the shrub layer. This hardwood slope is characterized by the presence of intermittent surface water drainage courses and subsurface seeps that are not overly moist in late summer. The soils of this site are alluvial in nature and are probably very rich in calcium and other nutrients. This site resembles a rich, moist seepy area within a remnant of AHF as described by MacDougall and Loo (1998). However, this site is located within Ecosite 8, which is not consistent with the three ecosites normally associated with AHF.



This forest stand is classed as an immature-old, tolerant hardwood stand on NBDNR Forest Inventory Mapping (1996 aerial photography). The dominant species are sugar maple (60 percent), beech (20 percent), and yellow birch (10 percent), as well as other mature hardwoods (10 percent). Canopy cover is 70-90 percent, canopy height is 18 m, and merchantable trees in the stand have dbh's (diameter at breast height) ranging from 16 to 24 cm. The tolerant hardwood stand contains older individual trees, however the typical elements of a truly mature forest, such as coarse woody debris, are not present. Downslope of this stand are mature mixedwood stands dominated by poplar and balsam fir. Immediately south of this rich area is a recent clear-cut.

A total of five rare or uncommon species were recorded at this site, including Goldie's fern, plantain-leaved sedge, northern maidenhair-fern, yellow lady's-slipper, and blue cohosh (Figure 5.5.4). Other more common herbaceous species included wild ginger, blood root, silvery spleenwort, and smooth yellow violet. Spring ephemeral species recorded in June 2003 included trout lily, Dutchman's-breeches, and spring beauty. The site contains the largest population of yellow lady's-slipper and northern maidenhair-fern recorded along the highway route. Goldie's fern was concentrated mostly in a large, 0.30 ha patch, as well as scattered clusters of plants, while plantain-leaved sedge was restricted to only 6 discrete patches. Blue cohosh was scattered near the large patch of Goldie's fern, with a total of about 15 plants.

5.5.5 Environmental Effects Analysis

5.5.5.1 Project-VEC Interactions

Table 5.5.4 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, including those of past, present and likely future projects. The table is divided according to each of the Project phases assessed (construction, operation and maintenance), as well as malfunctions, accidents and unplanned events. The discussion following the table provides an analysis of key Project-VEC interactions, by Project phase.

Table 5.5.4 Project Activity - Environmental Effects Interaction Matrix for Vegetation

Potential Interactions Between Project Activities and Environmental Effects			
Valued Environmental Component: <u>VEGETATION</u>			
Project Activities and Physical Works	Change in Habitat Quantity	Change in Habitat Quality	Loss of Species of Special Conservation Concern
Construction			
Site Preparation	✓	✓	✓
Roadbed Preparation			
Surfacing and Finishing			
Watercourse Crossing Structures	✓	✓	✓
Ancillary Structures and Facilities Construction	✓	✓	✓



Table 5.5.4 Project Activity - Environmental Effects Interaction Matrix for Vegetation

Potential Interactions Between Project Activities and Environmental Effects			
Valued Environmental Component: <u>VEGETATION</u>			
Project Activities and Physical Works	Change in Habitat Quantity	Change in Habitat Quality	Loss of Species of Special Conservation Concern
Operation			
Winter Safety		✓	✓
Proposed TCH Presence		✓	
Maintenance			
Highway Maintenance			
Vegetation and Wildlife Management			
Accidents, Malfunctions and Unplanned Events			
Hazardous Materials Spills		✓	✓
Erosion and Sediment Control Failure		✓	✓
Bridge or Culvert Washout			
Fires		✓	✓

5.5.5.1.1 Construction

There are several construction activities related to the Project that could affect the Vegetation VEC. The most substantive and likely interactions are a change in habitat quantity or quality (including AHF) and the possible loss of species of special conservation concern if they are present, as a result of the site preparation activities, as well as ancillary structures and facilities. Construction of selected watercourse crossings also have the potential to affect rare vascular plants.

Site Preparation

Clearing and grubbing for site preparation will remove vegetation and, particularly in forested areas, will change the quality of the habitat along the edge of the Project footprint. Vegetation and habitat within the Project footprint will be permanently displaced. Forest clearing will alter the habitat bounding the Project footprint, allowing for more sun-tolerant species to establish and reducing habitat for shade-dependent species.

Rare (“May Be At Risk” or “Sensitive”) species that are potentially directly affected by site preparation activities within the Project footprint or at access roads include calypso, hooked agrimony, plantain-leaved sedge, showy lady’s-slipper, Goldie’s fern, lopseed, Canada clearweed, lesser bladderwort, northern maidenhair-fern, yellow lady’s-slipper, and Braun’s holly fern.

A single calypso (S2, “May Be At Risk”) specimen is located inside the Project footprint. The four specimens found outside the footprint are approximately 50 m outside the Project footprint. As long as the habitat is protected during construction, and design of the highway at this location considers maintenance of hydrology at the site, then the potential for adverse environmental effects on the population of calypso in the area is low.



Hooked agrimony (S2, “Sensitive”) was identified at two locations, both on the westbound lane centreline. Nonetheless, it is the opinion of the surveyors that a viable population of hooked agrimony is located outside the Project footprint. Its precise status is somewhat unclear due to its close similarity to the much more common roadside agrimony (*Agrimonia striata*), and it likely belongs in the S3 category (S. Blaney, pers. comm. 2002).

Plantain-leaved sedge (S2, “Sensitive”) was recorded at eight sites in the Assessment Area. At two of these sites, a portion of the population of this species is located within the Project footprint. Five of the plantain-leaved sedge sites will not be directly affected by the highway.

Of the showy lady’s-slipper (S2, “Sensitive”) recorded in the Assessment Area, only the 20 plants noted in 2002 are within the Project footprint. The remaining 37 plants are 20 to 75 m outside the footprint. Efforts will be made during the design and construction of the TCH at this location to maintain the hydrology of the site.

Goldie’s fern (S2, “Sensitive”) was one of the most abundant of the rare plant at the three rich areas identified by JWEL in 2002, occupying large areas that are avoided due to re-routing of the proposed TCH route. The largest population was recorded 75 m from the footprint at Brown’s Brook. This species was recorded in 11 areas with seven of these outside the Project footprint.

At the lopseed (S2, “Sensitive”) site south of Stairs Road (Dillon 2003), most of the plants are within the proposed Project footprint. Lopseed has been recorded in 2002 at one other site, and previously at four additional sites, all of which are avoided by the Project footprint.

Canada clearweed (S2, “Sensitive”) was recorded at 19 locations between Perth-Andover and Big Presque Isle Stream. An estimated 15 % of the plants are located within the proposed Project footprint, and 14 sites will be avoided. A portion of the plants recorded at Wetland 8 will be lost.

Lesser bladderwort (S2, “Sensitive”) was recorded at two locations in the surveyed area. At one site (Wetland 3), the area where this species was recorded is within the Project footprint, however it is likely that this species is located elsewhere in this wetland.

Northern maidenhair-fern (S3, “Sensitive”) was one of the more widely distributed of the “Sensitive” class plants and yet was generally patchy in distribution and always associated with richer sites and microhabitats. In total, this species was noted in 11 general areas in the area surveyed (ten north of Dryer Road), of which a viable population will remain in eight of these.

Yellow lady’s-slipper (S3, “Sensitive”) was recorded at 66 locations in 16 general areas, with 11 areas containing plants outside the Project footprint. In general, as appears to be the case for northern



maidenhair-fern, it was one of the more widely distributed of the “Sensitive” class plants and yet was patchy in distribution and always associated with richer sites and microhabitats.

Braun’s holly fern (S3, “Sensitive”) was found at two locations in the Assessment Area. One site was located just south of the rich hardwood stand south of Beaconsfield Road (Figure 5.5.2) and the second was found south of Backland Road. Both records consisted of single plants growing on the fertile banks of intermittent streams. At the second site south of Backland Road the specimen was found within the Project footprint. Braun’s holly fern has been recorded at least 33 locations in New Brunswick, and at least five sites are located within the Assessment Area (Hinds 2000). These five recorded Braun’s holly fern sites are located outside the footprint of the Project.

Butternut (endangered) was found frequently in the Assessment Area, mainly associated with rich upland and alluvial sites. This species was not flagged as a species of special conservation concern during the field surveys and details on locations and abundance were not recorded. However, it is not likely that some of the butternut encountered is located within the Project footprint.

Two stands of AHF, Hunters Brook AHF (AHF-30a, Figure 5.5.1-C, Appendix D) and the Big Presque Isle Stream AHF (AHF-28, Figure 5.5.1-C, Appendix D), will be bisected by the Project footprint. Both stands were recently clear-cut within the Project footprint. Although the clearing of the Hunter’s Brook AHF was not likely associated with the Project, cutting within the Big Presque Isle Stream AHF was likely accelerated because of the Project. Only one uncommon species associated with AHF, yellow lady’s-slipper, was found in the Hunters Brook AHF, located west of the Project footprint (AHF-30a, Figure 5.5.1-C, Appendix D). No rare or uncommon vascular plant species associated with AHF were found within the Project footprint in the Big Presque Isle Stream AHF (AHF-28, Figure 5.5.1-C, Appendix D).

Of the 404 ha of AHF known to occur in the Assessment Area, approximately 6.8 ha (1.7 percent) will be cleared during construction of the Project. During the plant surveys carried out by Dillon (2003) and JWEL (2003a) in 2002, and by JWEL in 2003, five sites along the proposed and alternative alignments were identified that display characteristics of AHF. Rare vascular plants in four of these sites will be avoided by the current alignment. Although the information collected from the NTNB indicates that there are 404 ha of AHF in the Assessment Area, the digital forest cover data used by the NTNB is from 1981 which precedes current hardwood classification methods updated in 1995. Based on the NTNB query methodology (MacDougall 1997) using 1996 forest data but including the immature tolerant hardwood forest type, there are 3,855 ha of additional “potential AHF” in the Assessment Area that may have been investigated by the NTNB. However, these areas of “potential AHF” have not been ground truthed.



Watercourse Crossing Structures

The proposed TCH will require the installation of culverts and bridges. Improper installation of watercourse crossings can alter aquatic or wetland habitat on which some plant species are dependent. Improperly installed crossings can result in flooding or extensive erosion.

The Big Presque Isle Stream bridge crossing has the potential to interact with mountain valerian (S2, “May Be At Risk”). Due to the size of Big Presque Isle Stream a freespan structure will be installed. Four small patches of mountain valerian are located approximately 80 m east of the westbound centreline of the highway. Potential interactions will depend on the final design of the bridge structure, however, this species is not expected to be affected.

Patches of rare and uncommon vascular plant species that are not directly affected by watercourse crossing structures may be indirectly affected by changes in hydrology. There is some potential for alteration of the hydrology of the area as a result of Project activities (*e.g.*, ponding if culverts are placed too high, or drainage if they are placed too low). Thus, the final design must ensure the hydrology of each area is maintained.

Eight watercourse crossings have the potential to indirectly affect rare or uncommon vascular plants located upstream or downstream of the crossing due to changes in local hydrology. Refer to Figure 3.2 A to D (Appendix C) for locations of the following watercourses. WC5 (tributary to Saint John River) is located upstream of a rich area where nodding fescue, pale touch-me-not, plantain-leaved sedge, Goldie’s fern and Braun’s holly fern are found. WC6 (tributary to Saint John River) is located upstream of a yellow lady’s-slipper site. WC11 (tributary to Brown Brook) is located upstream of a Goldie’s fern site. WC12 and WC13 (tributaries to Brown Brook) are both located upstream of areas containing Goldie’s fern and northern maidenhair fern. WC16 (Graham Brook) is located upstream of a site containing black-seed plantain. WC20 (Upper Guisiguit Brook) is located downstream of an area containing northern maidenhair fern and plantain-leaved sedge. WC22 (tributary to Lower Guisiguit Brook) is located downstream of an area containing lesser bladderwort, hidden-scaled sedge and lesser tussock sedge.

At WC22, lesser bladderwort (S2, “Sensitive”) occurred within a beaver pond, upstream of the Project footprint. Although the lesser bladderwort is located upstream of the proposed Project footprint, changes in wetland hydrology due to the likely removal of the beaver dam may affect the abundance and distribution of lesser bladderwort at this site. Hinds (2000) describes lesser bladderwort habitat as “...shallow pools and boggy meadows”. Some habitat that can maintain a viable population of lesser bladderwort may remain upstream of the Project footprint after construction.



Ancillary Structures and Facilities

Construction of temporary ancillary structures and facilities, such as access roads, borrow areas and disposal sites, has the potential to have interactions with vegetation similar to those of site preparation activities, though on a smaller scale.

Access Road “F” has the potential to interact with a patch of yellow lady’s-slipper (Figure 5.5.1-A, Appendix D). Yellow lady’s-slipper was recorded at 66 locations in 16 general areas. As discussed previously, this species was one of the more widely distributed of the “Sensitive” class plants, and therefore a viable population will remain following construction.

Access Road “J” will cut through the western edge of the Big Presque Isle Stream AHF (Figure 5.5.1-C, Appendix D). No rare or uncommon species associated with AHF were found within the Project footprint in the Big Presque Isle Stream AHF.

5.5.5.1.2 Operation

Winter Safety

During winter, salt is used by NBDOT on road surfaces to aid in melting snow, and to provide clear road conditions. Road salt can enter into the environment (surface water, groundwater and soil) through storage and application of these salts. The highest concentrations are usually associated with winter and spring thaws. Environment Canada (2001c) cites numerous studies attributing vegetation damage and changes in plant community composition to road salt application. Potential effects of aerial dispersion of salt and/or elevated salt content in soils include: reduced flowering and fruiting; leaf, shoot and root damage; reduced growth; and reduced seedling establishment. Environment Canada (2001c) indicates that vegetation damage from aerial dispersion can occur up to 200 m from salt-treated multi-lane highways and 35 m from salt-treated two-lane highways. Blomqvist (2001) found that, while salt spray deposition can occur several hundred metres from a treated highway, over 90 % of the spray is deposited within 40 m of the highway.

Twenty-four of the rare and uncommon vascular plant species recorded in the Assessment Area are located within approximately 200 m of the highway. The vast majority of these plants will have a forested buffer between the plant location and the highway, therefore salt spray will likely be intercepted prior to reaching these rare plants. “May Be At Risk” or “Sensitive” vascular plant species that may have a greater potential to receive salt spray deposition include bottle-brush grass, calypso, mountain valerian, plantain-leaved sedge, Sprengel’s sedge, Goldie’s fern, northern maidenhair-fern, lance-leaf grapefern, and yellow lady’s-slipper.



Bottle-brush grass (S1, “May Be At Risk”) was recorded at five locations in one site along the proposed TCH route. The four largest patches of this species should not be affected by winter salting. One patch consisting of one plant may be affected by winter salting.

Overall, most of the plantain-leaved sedge (S2, “Sensitive”), Goldie’s fern (S2, “Sensitive”), northern maidenhair-fern (S3, “Sensitive”) and yellow lady’s-slipper (S3, “Sensitive”) sites will not be directly affected by winter salting. Clammy-hedge-hyssop (S2S3, secure) is an annual species, and would not be directly affected during salt application or during snowmelt.

Mountain valerian (S2, “May Be At Risk”), nodding fescue (S1, “May Be At Risk”), pale touch-me-not (S1, “May Be At Risk”), Calypso (S2, “May Be At Risk”), lesser bladderwort (S2, “Sensitive”), and Braun’s holly fern (S3, “Sensitive”) could be affected by winter salting should salt application result in contamination of the habitat. Sprengel’s sedge (S2, “Sensitive”) and lance-leaf grapefern (S3, “Sensitive”) were each recorded at only one location within 40 m of the Project footprint, with one or very few individuals, which may not represent viable populations.

Three stands of AHF may be affected by road salt application. These include the Hunters Brook AHF and Big Presque Isle Stream AHF, which will be bisected by the Project footprint, as well as the Reid Lake AHF, which is adjacent to the Project footprint.

Proposed TCH Presence

During the Project-related activities associated with proposed TCH presence, there is a potential for a change in water quantity, and therefore vegetation habitat quality. The contribution to runoff from the proposed TCH will be more episodic, compared to the more gradual release of water from forested/vegetated areas, however, the potential for a substantive change in the quantity of surface water due to the highway construction is low because the surface area of the highway is relatively small compared to the area of the watersheds upgradient of the crossings of most of the watercourses.

5.5.5.1.3 Maintenance

Clearing along the proposed TCH is part of NBDOT's regular maintenance to maintain sight lines and may involve both manual and mechanized cutting. Vegetation cutting will occur within the footprint of the Project that has been previously disturbed for site preparation and hydroseeded. With the exception of accidents, malfunctions and unplanned events that could occur during maintenance activities, which are discussed in Section 5.5.5.1.4, maintenance activities have little or no potential for interaction with Vegetation.



5.5.5.1.4 Accidents, Malfunctions and Unplanned Events

Accidents, malfunctions and unplanned events that may occur in association with the Project and have and adverse environmental effect on vegetation include:

- hazardous material spills;
- erosion and sediment control failure; and
- fire.

Hazardous material spills may damage habitat and/or cause direct mortality of vegetation. Hazardous material spills could be the result of construction activities (*e.g.*, equipment fuelling or faulty vehicle components), operation activities (*e.g.*, hazardous material transport truck accident, or excessive salt application), or maintenance activities (*e.g.*, equipment fuelling).

Erosion and sediment control measures could fail during heavy precipitation events, resulting in erosion of vegetation habitat.

Fire could remove vegetation and alter habitat in the Assessment Area. Also, burned forest land may be converted for agriculture. Fire may also result in the loss of AHF in the Assessment Area. Fire may be caused as a result of construction activities (*e.g.*, hot equipment), operation activities (*e.g.*, discarded cigarettes or hot exhaust systems in contact with roadside vegetation), and maintenance activities (*e.g.*, hot equipment).

5.5.5.2 Environmental Effects Analysis and Mitigation

The discussion following provides an analysis of key project-VEC interactions, by Project phase.

5.5.5.2.1 Construction

The following provides an evaluation of key potential project-VEC interactions for the construction phase of the Project as summarized in the environmental effects assessment matrix (Table 5.5.5). During construction of the proposed TCH and associated roads and structures, several activities could result in a change in vegetation or habitat. These include any activities that involve vegetation clearing, soil disturbance or hydrological modifications (site preparation, road preparation, watercourse crossing, and ancillary structures and facilities construction). The sections following this table describe the mitigative strategies aimed at mitigating these potential environmental effects.



Table 5.5.5 Environmental Effects Assessment Matrix for Vegetation (Construction)

Environmental Effects Assessment Matrix Valued Environmental Component: <u>VEGETATION</u> Phase: <u>Construction</u>							
Project Activity (See Table 4.1.1 for list of specific activities and works)	Potential Environmental Effects	Mitigation	Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Site Preparation	<ul style="list-style-type: none"> Change in habitat quantity (A) Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Avoidance by re-routing Limit area of disturbance Follow EPP and EFG Develop and implement site specific EPP measures to protect AHF and rare plant concentrations Include AHF and rare vascular plants in employee awareness training Use designated roadways and access; limit off road activity Erosion control measures Purchase of high priority AHF stands and proximal rare plant concentrations that have been avoided 	2	4	5/6	I	2
Watercourse Crossing Structures	<ul style="list-style-type: none"> Change in habitat quantity (A) Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Planning for watercourse installation using NBDOT and Watercourse Alteration Technical Guidelines Follow EPP and EFG Implement site specific EPPs Limit area of disturbance Erosion control measures 	1	1	1/1	R	2
Ancillary Structures and Facilities Construction	<ul style="list-style-type: none"> Change in habitat quantity (A) Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Limit area of disturbance Follow EPP and EFG Use designated roadways and access; limit offroad activity Erosion control measures 	1	1	4/6	R	2

Key:

Magnitude: 1 = Low: e.g., specific group, habitat, or ecosystem localized one generation or less, within natural variation 2 = Medium: e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability 3 = High: e.g., affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation	Geographic Extent: 1 = <1 km ² 2 = 1-10 km ² 3 = 11-100 km ² 4 = 101 - 1,000 km ² 5 = 1,001 - 10,000 km ² 6 = >10,000 km ²	Frequency: 1 = <11 events/year 2 = 11 - 50 events/year 3 = 51 - 100 events/year 4 = 101 - 200 events/year 5 = >200 events/year 6 = continuous	Ecological/Socio-cultural and Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not Applicable (A) = adverse (P) = positive
	Duration: 1 = <1 month 2 = 1 - 12 months 3 = 13 - 36 months 4 = 37 - 72 months 5 = >72 months	Reversibility: R = Reversible I = Irreversible	



Site Preparation

As previously indicated in Section 2.2, the route selection process began in 1987. During the route selection process, regulators and stakeholders identified known locations of environmentally sensitive areas for plants and AHF within the proposed route corridors. AHF lands were avoided to the extent possible.

NBDOT commissioned a number of background environmental data surveys in 2002 and additional surveys in 2003 in support of this environmental assessment. A number of realignments were made as a result of the issues identified during these surveys and subsequent consultation with regulatory agencies. The 2003 alignment includes the changes made from Raymond Road to Big Presque Isle Stream and those made to accommodate issues identified during the environmental field studies.

The alignment was shifted to avoid rare vascular plants and AHF habitat characteristics between Hillandale (north of Beaconsfield Road) and south of River de Chute (shift to the west from Hillandale to Plant Brook; shift to the east from Plant Brook to Brown Brook/Scott Road; shift to the east from Scott Road to Graham Brook and River de Chute area) (Figure 2.1 A, Appendix B). The median was reduced to the minimum between Guisiguit Brook to B. Smith Road to avoid/minimize encroachment on rare vascular plants (Figure 2.1 B, Appendix B). The alignment was shifted to the east for 1.5 km north of Palmer Road to avoid rare vascular plants (Figure 2.1 D, Appendix B). The Hartland Interchange was shifted to the southeast to avoid rare vascular plants (Figure 2.1 D, Appendix B).

With the exception of a single yellow lady's-slipper at Access Road "F", all access roads avoid rare vascular plants recorded along the alignment. The loss of this single site is not significant.

Although not all of the rare plant habitat and AHF were completely avoided, the 2003 realignment very successfully minimizes disruption to these habitats. In addition, NBDOT has purchased, for conservation purposes, a number of the potential high or very high priority AHF stands and rare plant concentrations that have been avoided. These include:

- the rich hardwood stand north of Demerchant Brook, containing the population of Canada violet;
- the rich hardwood stand north of Bryson Brook;
- the site containing bottle-brush grass, south of River de Chute and Route 560;
- the showy lady's-slipper site at the Hartland Interchange; and
- the Calypso site, between Estey and Palmer roads.

The first three sites being purchased total 72.2 ha of AHF. The two additional sites are being acquired as a widening of the RoW being purchased. The environmental effect of removal of vegetation is reversible through natural succession and replanting of appropriate native vegetation. However, within



the limits of clearing for highway asphalt surfaces and structures, the vegetation is assumed to be permanently removed, and this environmental effect is considered irreversible. Losses of AHF and rare vascular plants are minimal. No S1 species are lost.

It is likely that individuals of butternut, designated endangered by COSEWIC, will be lost due to site preparation activities. However, three rich hardwood stands (Figure 5.5.1-A, Appendix D), in which butternut was a dominant component of the tree canopy in at least two of these, have been avoided due to realignment of the Project. Also, AHF being purchased for conservation purposes contain the largest known population of butternut along the route. Loss of habitat or loss of individual trees are not regarded as threats to the butternut population (NBDNR unpublished). However, the potential loss of genetically resistant individuals may affect the long-term survival of this species in New Brunswick (NBDNR unpublished). The long-term viability of the population in the region will depend on the occurrence of individual trees that have resistance to the butternut canker. Mitigation for the loss of individual butternut in the Project footprint will include the collection of genetic material prior to construction of the Project. Therefore, the loss of individuals within the Project footprint will not likely result in a loss of genetically resistant individuals or the long-term survival of this species in New Brunswick.

Site specific EPP measures will be developed and implemented to protect AHF and rare plant concentrations proximal to the Project. This would include the delineation, surveying and flagging of rare plant locations to ensure minimum cutting occurs in these areas. AHF and rare vascular plants will be included in employee awareness training. Site preparation activities will be limited to within the Project footprint. Vehicles and equipment used during site preparation activities will use only designated roadways and access areas. Erosion protection measures are used to reduce or eliminate the removal of soil particles by flowing water. These measures will be placed on or applied to the soil surface and in conjunction with runoff control and sediment interception measures as appropriate. Various geomembranes and geotextiles will be used to minimize erosion as appropriate. In addition, revegetation with native vegetation will occur on slopes and embankments for long term stabilization.

Based on consideration of the potential environmental effects of the activities required for site preparation of the proposed TCH, the proposed mitigation (*e.g.*, avoidance, EPP, EFG, and limited disturbance), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these activities are considered not significant.

Watercourse Crossing Structures

Mountain valerian was found along Big Presque Isle Stream on a steep stream bank near the high water mark (Figure 5.5.1 C, Appendix D). The plants were associated with shallow soil deposits at the base of bedrock outcrops. These areas are kept moist by groundwater seepage from the base of the steep slope



of the ravine through which the river flows. Protection measures that will be considered and reflected in site specific EPPs include flagging of the limits of clearing and at the top of slope in the vicinity of the population in order to avoid accidental trampling of the plants or unnecessary clearing of the vegetated buffer, and revegetation (as required) of recently cleared areas in the vicinity of the population. Protection measures for the population will be included in a site-specific environmental protection plan for the Big Presque Isle Stream crossing.

As outlined above for site preparation, NBDOT will follow their Sections 5.0 of the EPP and Sections 6.0 and 7.0 of the EFG for highway construction and erosion protection measures will be implemented. Based on consideration of the potential environmental effects of the activities and physical works required for watercourse crossing structures of the proposed TCH, the proposed mitigation (*e.g.*, EPP, EFG, and site specific EPPs), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these activities are considered not significant.

Ancillary Structures and Facilities Construction

Mitigation measures will be implemented as described for site preparation. Any ancillary structures and facilities not currently identified that could require areas outside of the RoW and have not been surveyed will be subjected to a vascular plant survey.

Based on consideration of the potential environmental effects of the activities required for ancillary structures and facilities of the proposed TCH, the proposed mitigation (*e.g.*, avoidance, EPP, EFG, and limiting area of disturbance), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these activities are considered not significant.

5.5.5.2.2 Operation

The following provides an evaluation of key potential project-VEC interactions for the operation phase of the Project as summarized in the environmental effects assessment matrix (Table 5.5.6). Operation of the proposed TCH will continue in perpetuity upon completion of the construction phase of the project. During operation of the proposed TCH, winter maintenance and the physical presence of the Project could result in a change in vegetation or habitat. The sections following this table describe the mitigative strategies aimed at mitigating these potential environmental effects.



Table 5.5.6 Environmental Effects Assessment Matrix for Vegetation (Operation)

Environmental Effects Assessment Matrix Valued Environmental Component: <u>VEGETATION</u> Phase: <u>Operation</u>							
Project Activity (See Table 4.1.1 for list of specific activities and works)	Potential Environmental Effects	Mitigation	Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Winter Safety	<ul style="list-style-type: none"> Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Implement EPP and EFG Develop long term salt management plan Buffers/barriers for rare vascular plants as required Design of watercourse crossings 	1	4	1/2	R	2
Proposed TCH Presence	<ul style="list-style-type: none"> Change in habitat quality (A) 	<ul style="list-style-type: none"> Erosion control Implement EPP and EFG 	1	4	1/2	R	2
Key: Magnitude: 1 = Low: e.g., specific group, habitat, or ecosystem localized one generation or less, within natural variation 2 = Medium: e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability 3 = High: e.g., affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation Geographic Extent: 1 = <1 km ² 2 = 1-10 km ² 3 = 11-100 km ² 4 = 101 - 1,000 km ² 5 = 1,001 - 10,000 km ² 6 = >10,000 km ² Duration: 1 = <1 month 2 = 1 - 12 months 3 = 13 - 36 months 4 = 37 - 72 months 5 = >72 months Frequency: 1 = <11 events/year 2 = 11 - 50 events/year 3 = 51 - 100 events/year 4 = 101 - 200 events/year 5 = >200 events/year 6 = continuous Reversibility: R = Reversible I = Irreversible Ecological/Socio-cultural and Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not Applicable (A) = adverse (P) = positive							

Winter Safety

Environment Canada (2001c) recently completed an assessment of road salt under *CEPA*. Recognizing that a total ban of road salt could potentially compromise human safety, the focus of road salt risk management is on implementation measures that optimize winter road maintenance practices so as to not jeopardize road safety while minimizing the potential environmental effects (Environment Canada 2001c). Therefore Environment Canada has categorized road salt as a Track 2 substance, requiring Life-Cycle Management. Management instruments to reduce the potential environmental effects of road salts are being developed through a national multi-stakeholder group (which involves representation from NBDOT) working in conjunction with Environment Canada. Proposed control measures will likely be presented in July of 2004. In accordance with Environment Canada's policy on road salt, all road agencies (e.g., NBDOT) must develop a Salt Management Plan. NBDOT is committed to developing best salt management practices in a continued effort to reduce the environmental effects of road salt on the environment. Currently Section 6.2.1 of the EPP identifies salt application protection measures.



Application rates identified in the Highway Maintenance Management System Field Manual (NBDOT 1992b) will be used to maximize the efficiency of salting and sanding and minimize the potential environmental effects.

At Big Presque Isle Stream and WC5 (tributary to Saint John River), run-off from the watercourse crossings will be redirected away from the rare plant locations.

A sufficient buffer will be maintained in areas where there is a potential for significant salt spray deposition on habitat near areas containing “May Be At Risk” or “Sensitive” vascular plant species. Based on the current Project footprint, however, there should be a sufficient buffer between most of the populations of these plants and the roadway to protect the plants from salt contamination, such that viable populations of these species should be unaffected by salt contamination.

Based on consideration of the potential environmental effects of the individual activities required for winter safety along the proposed TCH and associated roads and facilities, the proposed mitigation (*e.g.*, EPP, EFG, salt management plan and buffers), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these activities are considered not significant.

Proposed TCH Presence

The long-term operation of the proposed TCH may create conditions that allow for erosion. Stabilization during construction and permanent erosion control measures will mitigate long-term environmental effects of erosion. Appropriate erosion control measures for each watercourse bank will be specified in site-specific environmental protection plans developed as part of the highway design. These will minimize the potential for stream bank destabilization and erosion. The presence of the highway is not expected to have a significant environmental effect on area plants due to runoff.

Based on consideration of the potential environmental effects of the individual activities required for the proposed TCH presence, the proposed mitigation (*e.g.*, erosion control), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by the presence of the proposed TCH are considered not significant.

5.5.5.2.3 Accidents, Malfunctions and Unplanned Events

The following provides an evaluation of key potential project-VEC interactions for accidents, malfunctions and unplanned events as summarized in the environmental effects assessment matrix (Table 5.5.7). The issues related to vegetation are hazardous materials spills, erosion and sedimentation



control failures and fires. These accidents are possible during all Project phases. Further discussion of each accident type follows the table.

Table 5.5.7 Environmental Effects Assessment Matrix for Vegetation (Accidents, Malfunctions and Unplanned Events)

Environmental Effects Assessment Matrix Valued Environmental Component: <u>VEGETATION</u> Phase: Accidents, Malfunctions and Unplanned Events							
Project Activity (See Table 4.1.1 for list of specific activities and works)	Potential Environmental Effects	Mitigation	Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Hazardous Materials Spills	<ul style="list-style-type: none"> Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Implement EPP and EFG procedures, and provincial and federal regulations should be followed for storage and handling of materials Contingency Plan Employee training Design highway for safe operation (RAD 120) 	2	1	5/1	R	2
Erosion and Sedimentation Control Failure	<ul style="list-style-type: none"> Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Implement EPP and EFG procedures 	2	1	5/1	R	2
Fires	<ul style="list-style-type: none"> Change in habitat quality (A) Loss of species of special conservation concern (A) 	<ul style="list-style-type: none"> Implement EPP and EFG procedures, and follow provincial and federal regulations Employee training 	2	3	5/1	R	2
Key:							
Magnitude: 1 = Low: e.g., specific group, habitat, or ecosystem localized one generation or less, within natural variation 2 = Medium: e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability 3 = High: e.g., affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation		Geographic Extent: 1 = <1 km ² 2 = 1-10 km ² 3 = 11-100 km ² 4 = 101 - 1,000 km ² 5 = 1,001 - 10,000 km ² 6 = >10,000 km ²		Frequency: 1 = <11 events/year 2 = 11 - 50 events/year 3 = 51 - 100 events/year 4 = 101 - 200 events/year 5 = >200 events/year 6 = continuous		Ecological/Socio-cultural and Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not Applicable (A) = adverse (P) = positive	
		Duration: 1 = <1 month 2 = 1 - 12 months 3 = 13 - 36 months 4 = 37 - 72 months 5 = >72 months		Reversibility: R = Reversible I = Irreversible			

Hazardous Materials Spills

Known hazardous materials that will be used during the construction and operation of the proposed TCH include fuels, lubricants, solvents, windshield washer and antifreeze. There is also a high probability that a large quantity of other various unidentified hazardous materials will be transported along this route. There is a possibility that these materials could be accidentally introduced into vegetation habitat



through a spill of these materials. The likelihood of a hazardous materials spill to occur and affect an entire population of rare vascular plants in the Assessment Area is low.

Employee awareness training will include the handling of hazardous materials. Section 4.19 of the EPP addresses hazardous materials issues. The design of the highway to RAD120 standards will reduce the likelihood of spills of hazardous materials due to accidents during the operation of the highway. NBDOT has spill response contingency procedures identified in Section 8.1 of the EPP and Section 5.7 of the EFG. The transportation of dangerous goods is strictly regulated in New Brunswick and Canada, and the regulatory spill response system is highly co-ordinated and effective.

The magnitude of the environmental effect of a spill would be dependent on a number of factors that are difficult to predict. However, given the mitigation in place, the magnitude of environmental effects attributable to these infrequent and unlikely accidents, malfunctions and unplanned events are likely to be low, and worst case medium. In the unlikely event of a hazardous material spill, the spilled material will be controlled and contained, and NBDOT will assist with the clean-up, as described in Section 5.4.5.2.4. Site-specific EPPs will be developed for work near environmentally sensitive areas and these will address preparedness measures that are necessary to ensure effective emergency response in the event of spills is reflective of the level of sensitivity.

Based on consideration of the potential environmental effects an accident, malfunction, or unplanned event, involving the release of a hazardous material into vegetation habitat along the proposed TCH and associated roads and facilities, the proposed mitigation (*e.g.*, EPP, EFG), contingency plans, and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these accidents are considered not significant.

Erosion and Sedimentation Control Failure

There is a potential during heavy precipitation events or flash floods for erosion control structures (*e.g.*, check dams) to fail. To reduce the likelihood of these failures, protection measures will be followed as described in Section 4.5 of the EPP. Specifically, erosion control structures will be monitored regularly and maintained in a functional condition until the grass on seeded slopes is sufficiently established to be an effective erosion deterrent. During construction, all check dams will be inspected before and after each rainfall and at least daily during periods of prolonged rainfall. All check dams found to be damaged will be repaired immediately. Sediment deposits retained by structures will be removed when the level of sedimentation is within 100 mm of the top of the structure.

The potential for interactions between these failures and rare vascular plants will be reduced by not routing drainage channels in close proximity to rare plants. There are few instances where this type of event could result in the loss of species of special conservation concern.



Based on consideration of the potential environmental effects an accident, malfunction, or unplanned event, involving the failure of erosion control structures along the proposed TCH and associated roads and facilities, the proposed mitigation (*e.g.*, EPP, EFG), and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these accidents are considered not significant.

Fires

The potential environmental effects of a fire in the Assessment Area could be severe. A forest fire could alter habitat quality, resulting in subsequent environmental effects on the population of species of special conservation concern and/or AHF. Fire within the Assessment Area of the highway could occur during any phase of the Project due to lightning or human activities. Factors influencing the severity and duration of environmental effects include time of year, extent of fire damage and type of fire (chemical, forest). Risk of forest fire along the road route is possibly higher than in non-road areas due to the presence of human activity along the road route, which may be recreational or commercial in nature.

The potential for Project-related fires during Construction and Maintenance will be mitigated through equipment maintenance (*e.g.*, power saw mufflers and vehicle exhaust systems) and proper vigilance working with power equipment in forested areas, as per Section 8.4 of the EPP. Also, any burning of vegetative debris will require permits from NBDNR and NBDELG as per Section 4.8.3 of the EFG. All construction activities will be done in compliance with regulations contained within the *Forest Fires Act*.

During all construction activities, NBDOT inspectors will monitor clearing and other relevant operations to ensure equipment is functional and personnel are trained in its use.

Fire fighting services for the Perth-Andover to Woodstock region are located in Perth-Andover, Centreville, Lakeville, Florenceville, Bath, Glassville, Bristol, Hartland, Plaster Rock, Debec, Maliseet and Woodstock. The locations of these fire stations are close enough to provide adequate response to fires during operation of the proposed TCH. Mitigation measures during Operation are prevention oriented through vegetation management (regular mowing and brushing) as per Section 6.1.6 of the EPP to reduce the risk of fires from vehicles parked on the vegetation along the proposed TCH.

In the event of a fire occurring as a result of Construction or Maintenance activities, NBDOT personnel shall be prepared (*i.e.*, will have access to round point shovel or fire extinguisher) to control and fight any fires in and about the work area, as per Section 7.4 and 8.4 of the EPP, and the *Forest Fires Act*. All fires will be reported to NBDNR. Forest fires not related to the Project will be managed by NBDNR.



Reversibility of physical environmental effects is high, but would occur over a number of years. Based on consideration of the potential environmental effects of an uncontrolled fire along the proposed TCH and associated roads and facilities, the proposed mitigation (e.g., EPP, EFG, site specific EPPs), contingency plans, and the residual environmental effects significance ratings criteria, the environmental effects on Vegetation by these accidents are considered not significant.

5.5.5.3 Determination of Significance

Table 5.5.8 evaluates the significance of potential residual environmental effects resulting from the interaction between Project activities and vegetation, after taking into account any proposed mitigation. The table also considered the level of confidence of the study team in this determination and the likelihood of potential environmental effects.

Table 5.5.8 Residual Environmental Effects Summary Matrix for Vegetation

Residual Environmental Effects Summary Matrix Valued Environmental Component: VEGETATION				
Phase	Residual Environmental Effects Rating	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	3	3	3
Operation	NS	3	2	3
Maintenance	NS	3	1	3
Accidents, Malfunctions and Unplanned Events	NS	3	1	2
Project Overall	NS	3	2	3
<p>Key</p> <p>Residual Environmental Effect Rating: S = Significant Adverse Environmental Effect NS = Not-significant Adverse Environmental Effect P = Positive Environmental Effect</p> <p>Level of Confidence 1 = Low Level of Confidence 2 = Medium Level of Confidence 3 = High Level of Confidence</p> <p>Probability of Occurrence: based on professional judgement 1 = Low Probability of Occurrence 2 = Medium Probability of Occurrence 3 = High Probability of Occurrence</p> <p>Scientific Certainty: based on scientific information and statistical analysis or professional judgement 1 = Low Level of Confidence 2 = Medium Level of Confidence 3 = High Level of Confidence N/A = Not Applicable *As determined in consideration of established residual environmental effects rating criteria.</p>				

All very rare vascular plant species (S1 and “May Be At Risk” species) and most populations of the other vascular plants of special conservation concern have been avoided through changes to the alignment. Several areas adjacent the RoW containing rich assemblages of vascular plant species of special conservation concern are being purchased by NBDOT for conservation purposes and future protection. Three of these areas are AHF not previously identified by MacDougall (1997). The protection of 72.2 ha of very high to high priority AHF should be considered more than adequate compensation for the loss of 6.8 ha of moderate priority sites (containing no rare vascular plant species) and a small proportion of populations of S2 to S3 plant species, by the Project. This AHF habitat, with its large number of vascular plant species of special conservation concern including the largest



population of the COSEWIC-listed butternut encountered along the RoW, would otherwise be at risk of future forest harvesting. The protection of two additional areas containing populations of two other vascular plant species of special conservation concern (showy lady's slipper and calypso) should also help protect the habitat from harvesting and development pressures.

The residual environmental effects are considered not significant for construction, operation and maintenance, and malfunctions, accidents and unplanned events, as viable populations of vascular plant species ranked S1 to S3, and "May Be At Risk" or "Sensitive" will remain following construction, and should remain during operation and maintenance of the proposed TCH, such that the long-term survival of these vascular plant species is not likely reduced within the Valley Lowlands Ecoregion, and there will not be a substantive loss of mature AHF as a result of the Project.

Overall, the residual environmental effects of the Project on Vegetation are considered not significant. Increased knowledge and protection of rare vascular plants and AHF in the area is a positive environmental effect that offsets some of the losses of individual plants.

5.5.6 Monitoring and Follow-up

NBDOT will undertake follow-up of rare plants that were observed within 50 m of the proposed RoW in the year following the completion of Construction and in the third year of operation. The follow-up will verify predictions made in the environmental assessment, and confirm the effectiveness of mitigation.



