

# Urban Forest Management Plan

## Addendum: East Campsite Forest

**Prepared by:**  
**Dave Downing, P.Biol, R.P.Bio.**  
**Lane Gelhorn, P.Biol**  
**Jennifer Smith**

**Timberline Natural Resource Group**

**Edmonton, Alberta**

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## Summary

The residents of Spruce Grove deeply appreciate their natural environment and value the forests that form an integral part of the City's fabric. One of the City's Key Initiatives, "Clean and Green", specifically identifies the urban forest as a priority area and provides a number of objectives, action plans, timelines and measures of success for ensuring the sustainability of urban forests.

Timberline Forest Inventory Consultants prepared a Forest Management Plan for the City of Spruce Grove in 2004 to help the City attain objectives relating to Forest Management and Natural Areas development priorities. In 2007, Timberline was contacted by Paul Hanlan, Planning and Development Supervisor for the City of Spruce Grove; he requested that the Forest Management Plan be extended to include the East Campsite Forest, an area of 24.4 ha immediately south of the current industrial park between Golden Spike and Campsite Roads.

The methods applied to the development of the Forest Management Plan for East Campsite Forest involved the same approach (review of existing information, stratification of 1999 1:10,000 scale black and white aerial photographs to identify forest inventory units, fieldwork to collect detailed inventory information within map units, assignment of forest and ecological attributes to map units, data analysis, and GIS data capture) as the 2004 Forest Management Plan.

Clearing for agriculture and to a lesser extent urbanization has left East Campsite Forest as an island surrounded by cultivated fields and industrial development; future plans are to expand the industrial area to include the agricultural lands on the east, south, and west sides of the Forest. Soils are very moist and highly calcareous; the soil profile at sample plots indicates that soils remain moist to wet for much of the year due to precipitation, surface run-off from adjacent areas and possibly near-surface groundwater flow. Forest cover is mostly a mix of balsam poplar and trembling aspen, with a few stands where scattered white spruce occurs in the main tree canopy and in the understory.

There are no management issues requiring immediate attention as development around the East Campsite Forest has not yet started and as recreational use of the Forest is limited by access. The five-year plan for East Campsite Forest identifies water management and possible flooding in storm events as a priority; local hydrology issues should be dealt with through appropriate planning and engineering. If the forest is developed for recreation, selective tree harvest is advisable to remove hazardous trees. Long-term strategies will depend on community objectives and input, and on future environmental states. Changes to the Forest are inevitable because of natural forest succession, urbanization of surrounding areas, and local or regional environmental changes; a flexible approach to long-term planning is therefore advisable.



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# **1 Introduction**

## **1.1 Background and policy context**

The residents of Spruce Grove deeply appreciate their natural environment and value the forests that form an integral part of the City's fabric. One of the City's Key Initiatives, "Clean and Green", specifically identifies the urban forest as a priority area and provides a number of objectives, action plans, timelines and measures of success for ensuring the sustainability of urban forests.

Timberline Forest Inventory Consultants prepared a Forest Management Plan for the City of Spruce Grove in 2004 to help the City attain objectives relating to the Forest Management and Natural Areas development priorities. In 2007, Timberline was contacted by Paul Hanlan, Planning and Development Supervisor for the City of Spruce Grove; he requested that the Forest Management Plan be extended to include the East Campsite Forest, an area of 24.4 ha immediately south of the current industrial park between Golden Spike and Campsite Roads.

This document is an addendum to the 2004 Forest Management Plan. The methods, analyses, and document structure parallel that of the 2004 plan. It includes documentation of the forest resource, identification of current and potential problems with stand health, fire, succession, and regeneration, and presentation of short and mid-term alternatives. The location of East Campsite Forest is shown in context with the other four forested areas (Heritage Grove, Atim Creek, GroveCo 60, and Cooke Lands Forest Reserve) in Figure 1.

## **1.2 Objectives**

The objectives of this plan are to:

1. Provide detailed information on the status and distribution of forest stands within the East Campsite Forest (Figure 1). This information will provide the basis for short-term (one-to five-year) recommendations and a benchmark against which future changes to the forest resource can be compared. It will also provide the City with information needed to review existing long-term strategic goals and develop new ones.
2. Provide recommendations for mitigating problems revealed by the forest inventory that is part of objective 1.
3. Provide tentative recommendations for longer-term policy and planning work.

## **1.3 Document organization**

The Forest Management Plan, East Slopes Addendum is presented in five sections and four appendices. Section 1 (this section) describes background information and objectives. Section 2 provides an overview of the environmental setting within which the East Campsite Forest occurs, and summarizes general forest stand characteristics. Section 3 discusses the methods used to complete the inventory, volume analyses, and mapping themes. Section 4 provides detailed resource information and one to five year suggested plans for the East Campsite Forest. Section

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5 lists the references cited in preparing the Forest Management Plan. Appendix A includes tables summarizing the criteria used to assess fire, blowdown, decay and breakage, and snag habitat potential. Appendix B contains tabular summaries of information for each map unit in East Campsite Forest. Appendix C contains the maps referenced in Section 4. Appendix D includes a subset of the digital photos taken during field surveys in 2007; these photos illustrate features of management interest.

A compact disc containing all of the photos taken during field surveys in 2007 is provided as a separate item along with this report; these photos may provide a useful historic record in future. Photos taken at 16 photo points, captions, and a photo location reference map are provided in Appendix D.

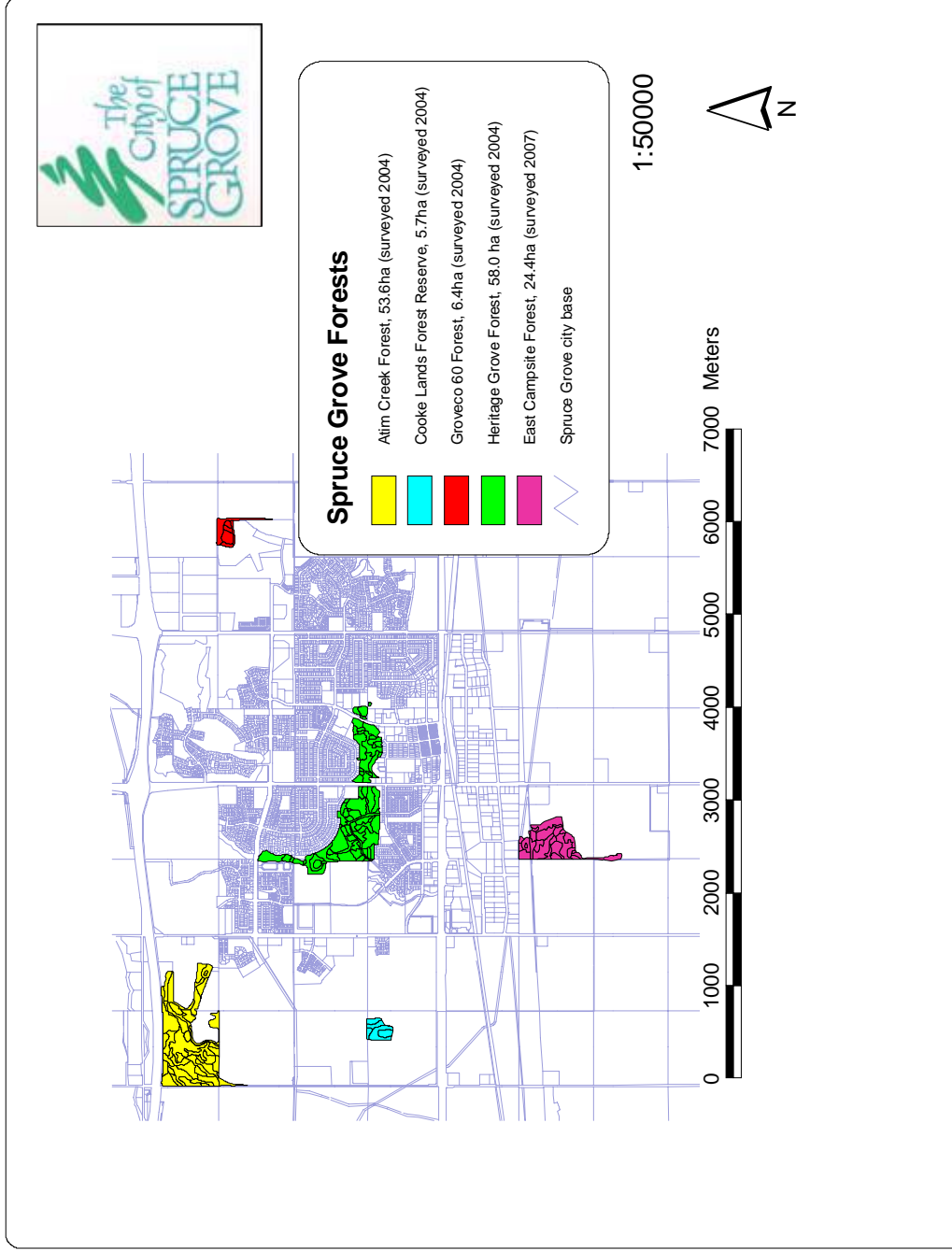


Figure 1. Location of Spruce Grove forests surveyed in 2004 and 2007

## 2 Biophysical Setting and Summary of Forest Characteristics

### 2.1 Biophysical Setting

Climate, vegetation, surficial geology, hydrology and soils information relevant to the East Campsite Forest and the City of Spruce Grove is provided in more detail in the 2004 Forest Management Plan (Downing and Cosco 2004). The City and East Campsite Forest are located entirely within the Parkland Natural Region and the Central Parkland Natural Subregion.<sup>1</sup> Most of the native vegetation within the City limits has been removed or modified by agricultural, residential and industrial activities. As of 2007, there are about 150 ha of natural or semi-natural forests within the five surveyed forests shown above in Figure 1.

Gently undulating lacustrine (lake-deposited) and fluvial (stream-deposited) materials are typical of the Spruce Grove area (Shetsen 1990, in Vujnovic *et al.* 2000). Bowser *et al.* (1962) mapped the soils of the Spruce Grove City area as a complex of silty loam- to loam-textured Orthic Dark Grey Luvisols<sup>2</sup> (Mico series (Mc), Winterburn series (Wb)) and silty loam to loam textured Eluviated or Black Chernozems (Malmo (Mo) series and Ponoka (Pk) series). Much of the Heritage Grove Forest and a portion of the East Campsite Forest were mapped by Bowser *et al.* (1962) as Organic soils composed of sedge and moss peats (Figure 2). Thin Organic soils over wet fine-textured mineral soils are associated with wet meadows and shrublands in the East Campsite Forest. Mineral soils in the East Campsite Forest appear to best fit the Ponoka Meadow series, typically having a thick black upper horizon and mottling indicating imperfect to poor drainage in the lower horizons. The dotted line enclosing diagonal hatching to the left of the organic soils indicates gently rolling terrain in the southern part of East Campsite Forest.

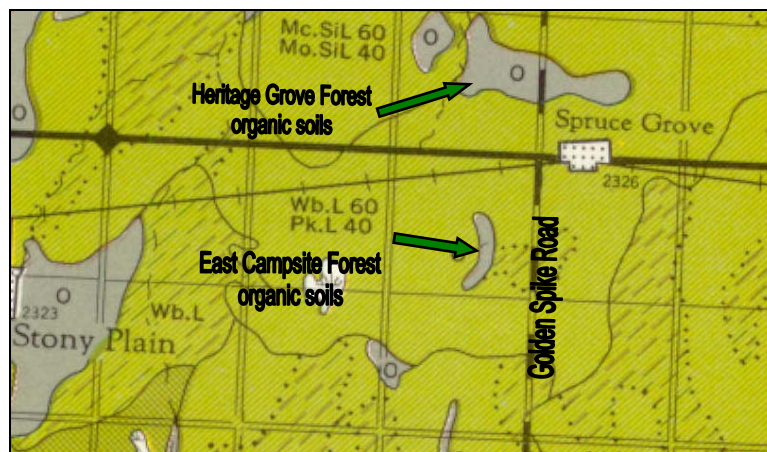


Figure 2. Soils in the East Campsite Forest Area as mapped by Bowser *et al.* (1962)

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<sup>1</sup> Alberta is an ecologically diverse province, and includes six major climatically and ecologically distinct Natural Regions that are further subdivided into 21 Natural Subregions (source: [http://www.tprc.gov.ab.ca/parks/heritageinfocentre/docs/NRSRcomplete%20May\\_06.pdf](http://www.tprc.gov.ab.ca/parks/heritageinfocentre/docs/NRSRcomplete%20May_06.pdf)).

<sup>2</sup> Soils taxonomy and nomenclature follows the Canadian System of Soil Classification (Canadian Soil Classification Working Group 1998) and was determined by matching the profile descriptions provided in Bowser *et al.* (1962) to the best fit in the 1998 taxonomy.

East Campsite Forest occurs within a nearly level plain that slopes very gently to the north and west; the Forest occupies a local topographic low into which water flows, as indicated by wetlands, wet meadows and moist forest soils that have apparently precluded agricultural cropland development. Topographic maps indicate that the Dog Creek drainage includes the East Campsite Forest, but there is no evidence of current stream flow within the Forest, possibly because the old rail bed cutting across the north end and urbanization in the industrial park have blocked the channel.

Groundwater flow patterns have probably had some effect on the East Campsite Forest. The Atim Creek study (Alberta Environment Planning Division 1978, plate 8) indicates that the Wagner and Heritage Grove areas are in a groundwater discharge zone; the recharge area is to the south and west of Stony Plain, and the southern boundary of the mapped discharge area lies just north of East Campsite Forest (Figure 3). Strongly calcareous, very moist soils noted during 2007 field surveys in East Campsite Forest are similar to those noted in Heritage Grove Forest in 2004, suggesting the possibility of similar groundwater influences on soil characteristics.

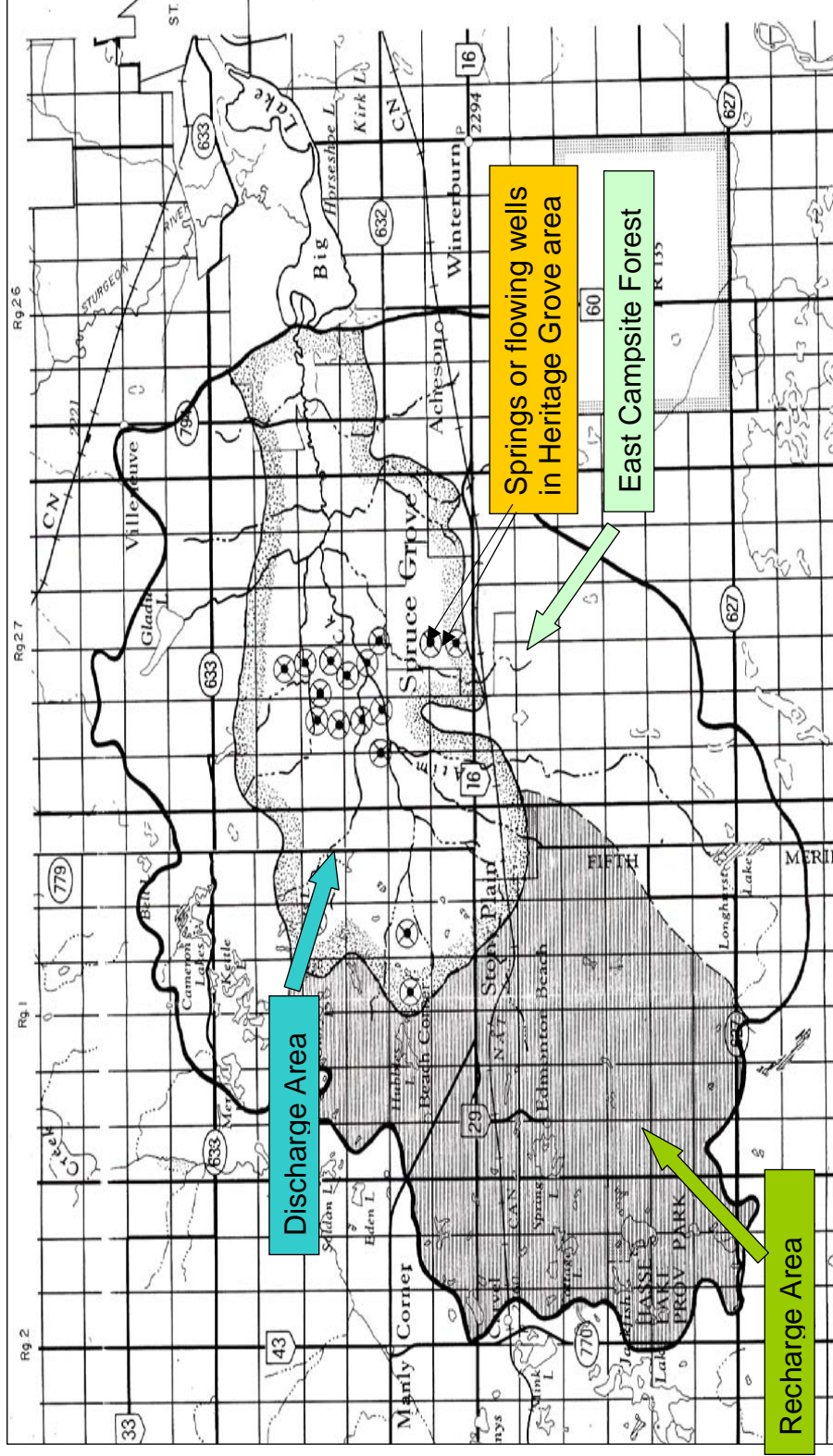
## 2.2 Summary of General Forest Characteristics

Table 1 summarizes total area and volume statistics for all five Spruce Grove forests shown in Figure 1. East Campsite Forest accounts for about 16 percent of the total forested area and about 13 percent of the total standing volume of trees. The average estimated volume per hectare is an indication of relative productivity, assuming a more or less equal age distribution and stand density. By this criterion, East Campsite Forest is about average. The “mean annual volume increment estimate” provides an idea of the amount of wood added due to annual tree growth; it is calculated by taking the total estimated standing volume for each map unit, dividing by the age of the forest in that map unit, and summing the resultant mean annual increment value for each map unit across the entire forest. Section 4 provides a more detailed analysis of forest cover characteristics for East Campsite Forest; refer to the 2004 Urban Forest Management Plan (Downing and Cosco 2004) for detailed analyses of the other four Forests.

**Table 1. Summary of stand area and stand volume characteristics for all four Spruce Grove forests**

	<i>Heritage Grove</i>	<i>Atim Creek</i>	<i>Cooke Lands Forest Reserve</i>	<i>Groveco 60</i>	<i>East Campsite Forest</i>	<i>All forests</i>
Total area (ha)	58.0	53.6	5.7	6.4	24.4	148.1
Total forested area (ha)	50.2	43.9	5.7	6.4	16.2	122.4
Total non-forested area (ha)	7.8	9.7	0	0	8.2	25.7
Total estimated standing volume (m3)	9,040	6,379	814	1,791	2,190	20,214
Total estimated conifer volume (m3)	5,860	2,098	341	905	619	9,823
Total estimated deciduous volume (m3)	3,180	4,281	473	886	1,571	10,390
Average estimated volume (m3) per hectare, total area	156	119	144	281	90	790
Mean annual volume increment estimate, total area (m3/year)	125	112	11	22	34	304

Standing, conifer, and deciduous volume estimates are derived from timber cruise data collected during field surveys in 2004 and 2007. For stands where this information was not collected, 1985 Phase 3 Forest Inventory stand volume tables were used.



**Figure 3. Local groundwater flow patterns, Stony Plain-Spruce Grove area**  
(Source: Plate 8, Atim Creek Study, Alberta Environment Planning Division 1978)

### **3 Methods**

The process used to complete this forest management plan involved review of existing information, initial stratification of 1999 1:10,000 scale black and white airphotos to identify forest inventory map units, fieldwork to collect detailed inventory information within map units, assignment of forest and ecological attributes to map units, data analysis, GIS data capture, and report preparation.

#### **3.1 Forest Inventory**

##### **3.1.1 Pre-field stratification and fieldwork planning**

The detailed inventory required for this forest management plan required large-scale recent photographic coverage. The most recent large-scale available airphoto coverage was 1999 1:10,000 black and white panchromatic. Interpretation was done using an Abrams stereoscope. The criteria used to produce an initial stratification of vegetation cover into map units included tone and texture characteristics related to tree height, stand composition for forested stands and vegetation type or disturbance category for non-forested stands. In addition, map units were recognized by photo-interpretable characteristics such as hydrologic features and topographic location. Field sample plots were located to sample map units that were considered representative of common and recurring forest cover types.

##### **3.1.2 Field sampling**

Field sampling within East Campsite Forest involved one field day and two person-days in total. Site, soil, vegetation and tree growth (mensuration) information was collected at four plots on May 23 2007. The surveyors were Dave Downing and Lane Gelhorn.

Plot locations for East Campsite Forest were determined using a “stratified random” approach. The map unit to be sampled was selected based on preliminary strata and existing information as discussed above. Within the map unit, the plot was located in a location that appeared representative of the stand; the low sampling intensity and short time period precluded random sampling.

At each plot, a soil pit was dug to at least 60 cm and three to four layers were generally differentiated based on texture, structure and color differences. The presence of free carbonates was tested by applying a 10 percent hydrochloric acid solution to soil samples taken from various levels in the soil profile. Observations of depth to water table, effective rooting depth, depth to mottles and gleying (indicative of imperfect to poor drainage) and stoniness were also made.

A list of the vascular species occurring within a 10m by 10m area around plot centre was compiled; relative abundance values for each species were recorded as one of five abundance classes determined by ocular estimates of foliar cover. Tree canopy structure and composition were also assessed. Site attributes (slope, aspect, slope position, landform type, and parent material type) were noted. Tree measurements were taken within a fixed-radius plot of 7.98m. Within each fixed-radius plot, the diameter at 1.3m and health status of all living dominant and co-dominant trees greater than 9.1cm diameter at 1.3m was collected. Representative trees were also sub-sampled to determine heights and ages. Ages were collected with an increment corer and field-counted. Understory species less than 9.1cm diameter at 1.3m were tallied.



The vegetation, site, tree growth, and soil information was then used to develop a qualified judgement of the moisture and nutrient status of each plot and the map unit it represented. Each plot was assigned to one of four subjectively determined moisture classes – moist (average moisture), very moist, wet, and very wet (the latter with standing water at or above the soil surface) and one of two subjectively determined nutrient classes (average and rich).

At each plot, four digital photographs were taken in each of the four cardinal directions and a geographic positioning satellite (GPS) reading was taken at plot centre with a handheld receiver. Generally, location readings were reported as accurate to within 15m of actual location by the GPS device. This photographic and location information may be useful for monitoring stand changes over time; a compact disc with the photographs is provided under separate cover as part of this project.

### 3.1.3 Post-field interpretation

Plot data were used in combination with stereo photo interpretation to assign Alberta Vegetation Inventory (AVI) forest cover labels, general soil types (mineral or organic soils), and moisture and nutrient ratings to each map unit. This information was subsequently used to assign additional attributes such as map unit forest cover type, age class, volume statistics, fire hazard rating and decay and breakage hazard to each map unit. Attributes for East Campsite Forest are presented in Table B-1 (in Appendix B of this volume. AVI standards are fully covered in the *Alberta Vegetation Inventory Standards Manual, Contract Version 2.1* (Alberta Forestry, Lands and Wildlife 1992).

AVI labels recorded in the abovementioned tables are provided for the overstory, or main tree canopy, and occasionally for the understory. A typical AVI label and the meaning of the information in it is shown below.

#### **m-30-22-Pb10-1920-G**

- “m” = moisture regime (m=mesic (average), d=dry, w=wet).
- “30” = percent estimated crown closure.
- “22”= height of main canopy (or understory) in metres.
- Pb10 = 100 percent of the stand composition by crown closure is balsam poplar (Pb); other species codes used are Sw (white spruce) and Aw (trembling aspen). SC and SO stand for closed and open shrub types. HG stands for herbaceous meadow.
- 1920 = stand origin. If reported to the nearest year, the stand age was determined from a sample. If to the nearest decade, stand age was estimated from known ages in surrounding stands.
- G= subjective measure of site quality based on height-age relationships.

AVI labels are too numerous and complex to represent as a readily viewed map theme, therefore, the labels were simplified to a general forest cover type for each map unit based on the following rules:

- If deciduous species accounted for 80 percent or more of the overstory, the stand was considered to be deciduous and was named according to the leading and secondary



species (e.g. if the AVI label read “Pb7Aw3” for composition, the stand was called “Balsam poplar- aspen” for mapping purposes).

- If coniferous species accounted for 80 percent or more of the overstory, the stand was considered to be coniferous and was named according to the leading and secondary species. This classification was not used in East Campsite Forest, as there were no pure conifer stands large enough to be mapped at a scale of 1:10,000.
- If neither coniferous nor deciduous species were clearly dominant, the stand was considered to be “mixedwood” and was named according to the leading, secondary and occasionally tertiary species. For example, if the AVI label read Pb8Sw2, the stand was named “Balsam poplar-white spruce”.

### **3.2 Volume estimates**

Volume estimates were completed for each forested map unit in all forests. Two methods were used to estimate deciduous, coniferous and total volumes:

1. If the map unit had been field visited and mensuration data collected within a fixed radius, this information was considered to represent the stand. Individual tree volumes were calculated using a “13/7” utilization standard, meaning that a minimum diameter at base of 13cm and 7cm as a minimum top was used; this was done to ensure comparability with “Phase III” estimated volumes (see point 2 below). Individual tree volume calculations used published coefficients (Huang 1994) appropriate to the Central Parkland Natural Subregion. Individual tree volumes were then expanded to a per-hectare value using an appropriate conversion from the fixed-radius plot value, and total map unit volumes for conifer, deciduous and total volume were calculated by multiplying the per hectare volume by the area of the map unit.
2. If the map unit had not been field visited, then Phase III Forest Inventory<sup>3</sup> Volume Tables appropriate to the Central Parkland (Zone 4) were used. Each AVI label was converted to the closest matching Phase III label, and volume data were obtained from the appropriate row of the table for a “13/7” utilization standard. Total map unit volumes for conifer, deciduous and total volume were calculated by multiplying the per hectare volume by the area of the map unit.

The total map unit volume information reported in Table B-1 in Appendix B is derived from field plot data in polygons where this information was collected, otherwise, Phase III volume table information was used.

### **3.3 GIS data capture and thematic map preparation**

Map units were digitized and registered to a Spruce Grove city base provided by the City of Spruce Grove. Themes were developed for each map unit as follows:

1. *General forest cover type:* as described in Section 3.1.3.
2. *Age class:* AVI stand label information was used to generalize stand ages into one of three classes: 10-60 years, 61-100 years, and more than 100 years.

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<sup>3</sup> Phase III was an earlier version of forest inventory that was largely replaced by Alberta Vegetation Inventory in the early 1990’s.

3. *Spring/fall and summer fire hazard:* Development of this rating was adapted from *FireSmart – Protecting Your Community from Wildfire* (Partners in Protection, 2003) and is provided in Appendix A, Table A-1.
4. *Blowdown hazard:* Development of this rating was based on soil type, general forest cover type, moisture status, and inferred depth to water table. Ratings are provided in Appendix A, Table A-2. Note that blowdown can be affected by removal of adjacent trees. For example, a tall white spruce stand might be relatively resistant to blowdown if it is protected from direct winds by a surrounding belt of deciduous trees, but if these are removed, the consequent direct exposure of white spruce to winds can result in extensive blowdown. White spruce tends to have a shallow, broad root system.
5. *Decay and breakage hazard:* Development of this rating was based on general forest cover type and age class. Balsam poplar and aspen are susceptible to rot and stem decay at relatively young ages. Ratings are provided in Appendix A, Table A-3.
6. *Wildlife Snag Habitat Potential:* Although wildlife habitat value within Spruce Grove forests might be limited by the isolated nature of these areas and surrounding urban development, snags can provide important habitat for species with a smaller local range, such as songbirds, woodpeckers, squirrels, and bats. Snag habitat ratings are similar to those developed for decay and breakage; older balsam poplar trees tend to rot from the centre out and can provide good habitat. Ratings are provided in Appendix A, Table A-4.
7. *Special features:* Special features are defined as those believed to be locally or regionally uncommon. These are discussed in Section 4.3.

## **4 East Campsite Forest**

### **4.1 Forest Cover**

East Campsite Forest occupies an area of 24.4 ha of which approximately 16 ha is forested and 8 ha is non-forested; 25 map units were identified based on photo-interpretable forest cover attributes (species composition, canopy cover, height, age). To produce readable maps, each map unit has been assigned to one of five general forest cover types or four non-forested types (Figure EC-2, Appendix C), and to one of three broad age classes (Figure EC-3, Appendix C).

Table 2 summarizes area and volume statistics for East Campsite Forest. Figure 4 illustrates that the dominant forest cover types are balsam poplar and balsam poplar-aspen, accounting for about half of the total area. Aspen-dominated stands occupy about 20 percent of the Forest, and non-forested communities occupy about a third of the total area. East Campsite Forest is different from the other four forests surveyed in 2004 because white spruce accounts for comparatively little of its total forested area.

Stands from 61 to 100 years of age account for about 50 percent of East Campsite forested stands, stands more than 100 years old account for about 30 percent, and the remaining 20 percent are between 10 and 60 years old (Figure 5).

### **4.2 Site nutrient and moisture status**

Figure EC-4 in Appendix C shows the distribution of site nutrient and moisture conditions throughout East Campsite Forest. Mineral soils are typically calcareous fine-textured silty clay loams with dark gray to black humic “A” horizons at the surface and mottled “B” and “C” horizons 30 to 50 cm below the mineral surface. All sites were judged to be nutrient-rich<sup>4</sup>.

At the time of sampling in mid-May 2007, a deep spring snowpack had recently melted and heavy rains had fallen just prior to the site visit, resulting in flooding of low-lying areas including parts of some forests adjacent to wet meadows and wet shrublands (Appendix D). Because of the Forest’s location in a local topographic low, site conditions are likely to be significantly wetter during certain times of the year, especially in late May through July when heavy downpours associated with thunderstorms typically occur. Local flooding can be expected in the spring and summer if soils in the surrounding uplands become saturated or if urban developments channel water into the Forest.

### **4.3 Special features**

There appear to be no locally or regionally significant features within East Campsite Forest. It is a healthy and mostly natural forest that provides habitats for a variety of plants, animals, invertebrates, and micro-organisms. It currently adds visual variety to the local landscape and would be an aesthetically pleasing component within the proposed industrial park expansion.

### **4.4 Stand Health Assessment 2007**

Most stands in East Campsite forest are healthy, given their ages and compositions; it is a normal and natural successional process for deciduous forests to self-thin during the early stages of stand development when significant mortality occurs due to intense competition for light, water and

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<sup>4</sup> This conclusion was reached through observations of both soil characteristics (calcareous reactions in many places, well-developed dark humus layers) and plant species occurrence. .

nutrients. In later successional stages, stem disease and rot, top dieback and branch or trunk breakage is also normal.

Figure EC-6 in Appendix C shows the distribution of mainly healthy stands and one with notable age-related health problems. Map unit 7 (Figures EC-1 and EC-5, Appendix C and photo location EC-8, Appendix D, page 46) is an older balsam poplar stand, and the mortality noted is due to normal processes of stem rot and breakage.

#### **4.5 Stand history and future trends**

Industrial developments and agricultural activities surround East Campsite Forest, and historical airphotos indicate that agricultural clearing had largely removed the surrounding forest cover by the 1950's. Figure EC-11 in Appendix C shows the extent (as of 1999) of East Campsite Forest. The Forest is mostly surrounded by a barb-wire fence. Compact soils, bluegrass and clover meadows, snowberry thickets and numerous dried cow pats all indicate a history of grazing throughout the Forest in the recent past.

Like the other forests within Spruce Grove, East Campsite Forest changes in response to internal and external influences. Stands of different ages interspersed with cleared meadows reflect past agricultural activities. Many stands have reached a mature to old successional stage where tree mortality reduces stand density, promotes snag formation, and increases the probability of decay and breakage.

East Campsite Forest may be somewhat influenced by the same groundwater flow patterns that create calcareous wet soils in Heritage Grove to the north. Its position in a minor topographic low and its tendency to collect and hold water are indicated by the presence of herbaceous and shrubby wetlands, the common occurrence of mottled soils throughout the Forest, and the prevalence of balsam poplar-dominated forests. If East Campsite Forest were to receive more moisture than normal because of increased runoff from industrial sites, then forest mortality due to flooding could be a possibility, and wet meadows and shrublands would likely expand at the expense of upland deciduous stands. Conversely, if industrial development led to drainage patterns that diverted water away from the Forest, a gradual drying of the site would occur, and invasion of wet meadows and the large wet shrubland (map unit 9, Figure EC-1 in Appendix C) by balsam poplar and aspen could be expected to occur over several decades.

#### **4.6 Fire hazard potential**

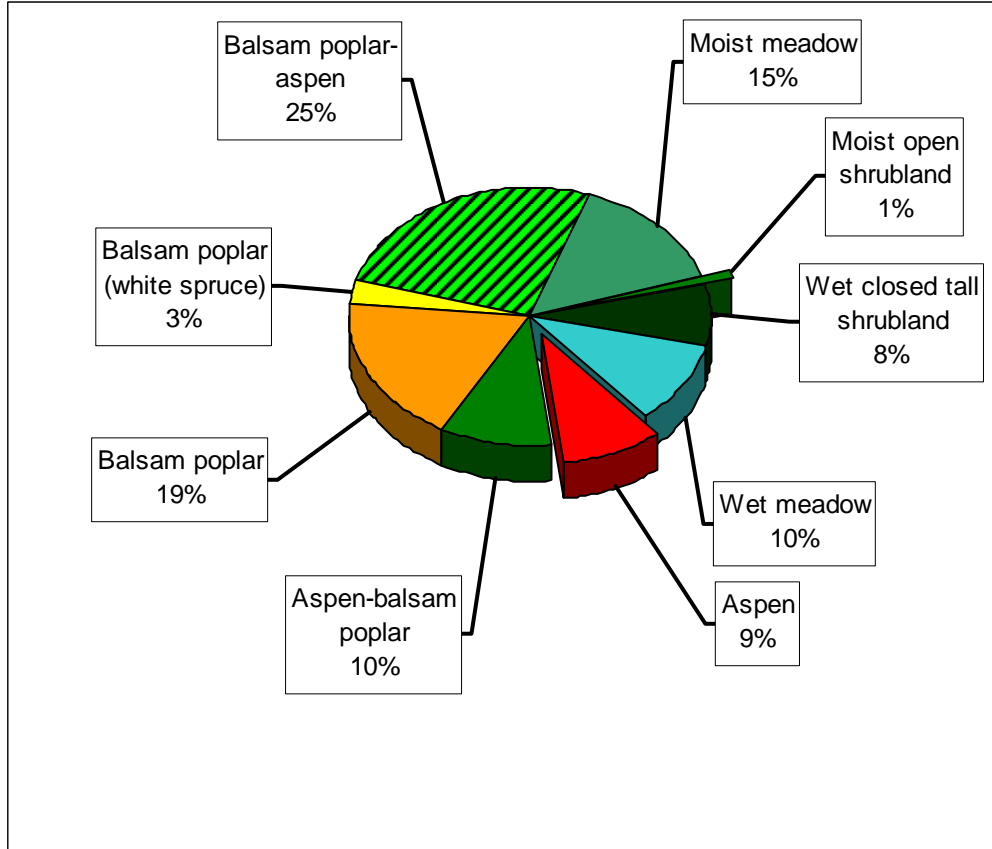
Figure EC-6 and EC-7 in Appendix C show the potential spring/fall and summer fire hazard potential in East Campsite Forest. Refer to Section 3.3 above for a discussion of the assessment method. Most stands are rated moderate to low for spring fire hazard and low for summer fire hazard; the only stand that is rated high in spring and moderate in summer has higher conifer content than other stands.

#### **4.7 Decay and Breakage Hazard and Blowdown Hazard**

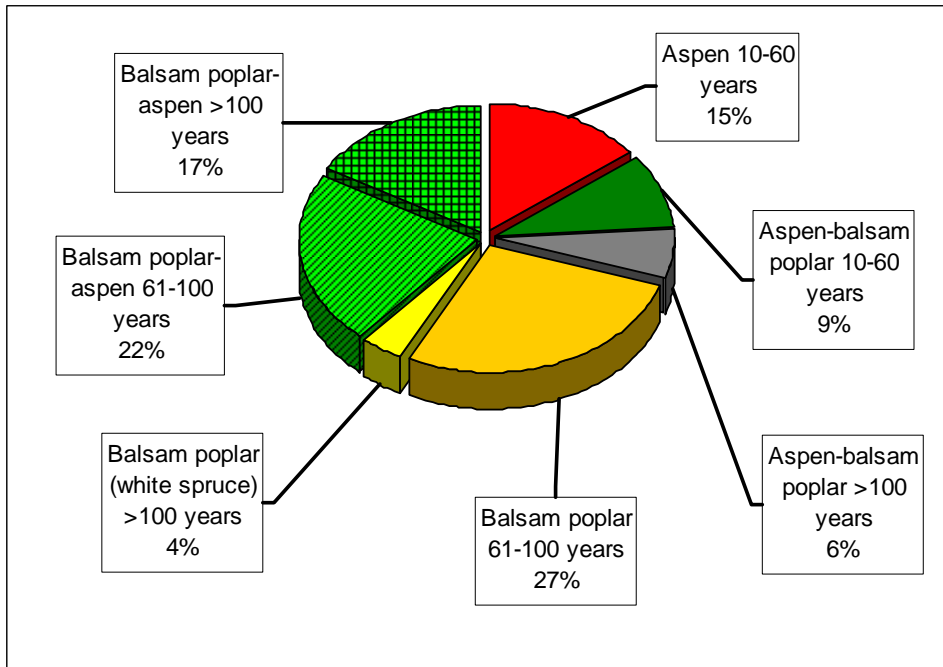
Figures EC-8 and EC-9 in Appendix C show the distribution of stands prone to decay and breakage (mainly balsam poplar stands greater than 60 years old) and blowdown (trees blown over by winds, exposing tree roots and soil). Blowdown hazard is low in forested stands and no exposed root plates were noted during field surveys. The criteria for determining decay, breakage and blowdown hazards are outlined in Section 3.3 (Methods).

**Table 2. Summary of general forest cover types in East Campsite Forest**

East Campsite Mapped Forest Cover Type	Area (ha)	Estimated coniferous volume (m3)	Estimated deciduous volume (m3)	Estimated total volume (m3)	Area (ha) in each stand age class (years) by cover type			
					10-60 years	61-100 years	> 100 years	Not applicable
Aspen	2.3	54	148	202	2.3			
Aspen-balsam poplar	2.4	118	323	441	1.5		1.0	
Balsam poplar	4.5	187	535	722		4.5		
Balsam poplar (white spruce)	0.6	8	52	60			0.6	
Balsam poplar-aspen	6.3	254	513	767		3.6	2.7	
Moist meadow	3.6							3.6
Moist open shrubland	0.2							0.2
Wet closed tall shrubland	1.9							1.9
Wet meadow	2.5							2.5
<b>Total area or volume</b>	<b>24.4</b>	<b>621</b>	<b>1570</b>	<b>2191</b>	<b>3.7</b>	<b>8.1</b>	<b>4.3</b>	<b>8.2</b>



**Figure 4. General forest cover type proportions within East Campsite Forest**



**Figure 5. Stand age distribution by forest cover type within East Campsite Forest**

(percentages in Figure 5 are proportions of the area covered by forests, not the entire area)

#### **4.8 Wildlife Snag Habitat Potential**

Stands judged to have moderate to high snag habitat potential are typically those with high decay and breakage hazard ratings; in East Campsite Forest, these stands include balsam poplar and aspen stands greater than 60 years of age (Figure EC-10 in Appendix C). The criteria for determining snag habitat potential are outlined in Section 3.3 (methods).

#### **4.9 East Campsite Forest Five-Year Management Plan**

Table 3 presents the five-year suggested operational plan for 2007 through 2012. The five-year plan makes general references to planning considerations; those considerations dealing with surface and groundwater flow should be evaluated further by urban hydrologists or civil engineers when development proposals are examined to ensure that industrial infrastructure neither substantially reduces nor increases water flow into the Forest.

**Table 3. East Campsite Forest five-year operating plan (2007-2012)**

<b>Map unit</b> (refer to Figure EC-1 in Appendix C)	<b>Issue</b>	<b>Recommended action</b>
Entire forest	Development planning – groundwater issues	<ul style="list-style-type: none"> <li>• The GroveCo 60 master plan developed by Butler, Krebs and Associates (2003) has some reasonable concepts for green area retention adjacent to forested areas within urban environments to ensure that local groundwater flow regimes are minimally impacted.</li> <li>• Ensure at the planning stages that sufficient infiltration can occur to maintain the current patterns of water flow to the site.</li> <li>• There are some opportunities for stormwater retention within East Campsite Forest if stormwater retention ponds are created, if inflow volumes are controlled to prevent flooding of adjacent forests, and if water quality is not impaired by industrial or agricultural pollutants.</li> </ul>
Entire forest	Development planning – fire issues	<ul style="list-style-type: none"> <li>• This area is not currently in proximity to residences or structures; ensure that if construction does occur, relevant FireSmart recommendations are followed regarding distance to dwellings or other structures, dwelling construction standards etc.</li> </ul>
Entire forest	Education and recreation	<ul style="list-style-type: none"> <li>• Open, park-like stands of mature balsam poplar interspersed with moist to wet meadows and shrublands provide a good diversity of landscapes in a small area and an island of wildlife habitat within an industrial area.</li> <li>• Picnic sites and primitive walking trails could be constructed for the enjoyment of workers in the surrounding industrial areas and Spruce Grove residents.</li> <li>• If recreational use is planned, removal of hazardous trees will be needed particularly in older balsam poplar stands to protect people and structures from harm.</li> </ul>
Entire forest	Invasive species (introduced), particularly noxious weeds such as tansy ( <i>Tanacetum vulgare</i> ) are controlled under the provincial Weed Act and invasive trees such as mountain ash ( <i>Sorbus aucuparia</i> ) may become more prevalent with time and compete with native communities.	<ul style="list-style-type: none"> <li>• Monitor for invasive species and control as needed.</li> </ul>



## 5 Long-term directions

Local surface flow and groundwater patterns are of importance to East Campsite Forest. This forest is not as strongly influenced by groundwater discharge as parts of Heritage Grove, but its current composition and growth patterns are determined by relatively moist conditions created by surface water flow and very likely by groundwater inputs. Urban development planning should consider the influences of built structures and engineered drainage systems on future surface and subsurface water flow patterns. If all of the surrounding area is paved or covered by structures and if engineered drainage systems divert more precipitation into the Forest than it typically receives in wet years, flooding and tree mortality can be expected if water tables remain high for long periods. A good example of tree mortality due to long-term flooding is Stand 10 of Atim Creek Forest (see Downing and Cosco 2004: Volume 2, Figure AT-1) on the south side of the Yellowhead Highway; beavers dammed the drainage culvert in 2005, much of Stand 10 was flooded for months until the dam was removed, and by spring 2006 almost all of the conifers were dead or dying. Conversely, it is possible that industrial infrastructure could divert water away from the Forest and cause a gradual drying of the site; succession over time to aspen and white spruce could be expected.

There are some opportunities within East Campsite Forest for storm water retention. Stand 17 is a moist meadow in a very shallow depression. The depression could be deepened by about a meter in the center of the meadow and some drainage from the east and west could be diverted; it is likely that cattail marshes similar to those in map unit 1 (Figure EC-1, Appendix C) would develop over time if water levels of greater than about 20 cm could be maintained and if water quality were not impaired by industrial or agricultural pollutants.



## 6 References

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- Bowser, W.E., Kjearsgaard, A.A., Peters, T.W., Wells, R.E. 1962. Soil Survey of Edmonton Sheet (83-H). University of Alberta Bulletin No. SS-4 and Alberta Soil Survey Report No. 21.
- Butler, Krebs and Associates. 2003. GroveCo Park Master Plan. Produced for the City of Spruce Grove
- Canadian Soil Classification Working Group. 1998. The Canadian System of Soil Classification, 3<sup>rd</sup> edition. Research Branch, Agriculture and Agri-Food Canada.
- Downing, D., Cosco, J. 2004. The City of Spruce Grove Urban Forest Management Plan. Volume 1. Documentation. Volume 2. Map Folio. Prepared by Timberline Forest Inventory Consultants for the City of Spruce Grove.
- Huang, S. 1994. Ecologically based individual tree volume estimation for major Alberta tree species. Report 1: Individual tree volume estimation procedures for Alberta: methods of formulation and statistical foundations. Alberta Environmental Protection Land and Forest Service Publ. T/288.
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**Appendix A. Criteria used to assign fire hazard, blowdown, decay and breakage, and wildlife habitat ratings**

**Table A-1. Criteria for determining fire hazard potential**

<b>Forest type</b>	<b>Canopy</b>	<b>Season</b>	<b>Moisture</b>	<b>Soil type</b>	<b>Rating *</b>
Conifer	Open	Spring/fall	Dry to very moist	Mineral	High
Conifer	Open	Spring/fall	Wet	Mineral	Moderate
Conifer	Open	Spring/fall	Dry to very moist	Organic	High
Conifer	Open	Spring/fall	Wet	Organic	Moderate
Conifer	Open	Summer	Dry to very moist	Mineral	High
Conifer	Open	Summer	Wet	Mineral	Moderate
Conifer	Open	Summer	Dry to very moist	Organic	High
Conifer	Open	Summer	Wet	Organic	Moderate
Conifer	Closed	Spring/fall	Dry to very moist	Mineral	High
Conifer	Closed	Spring/fall	Wet	Mineral	High
Conifer	Closed	Spring/fall	Dry to very moist	Organic	High
Conifer	Closed	Spring/fall	Wet	Organic	High
Conifer	Closed	Summer	Dry to very moist	Mineral	High
Conifer	Closed	Summer	Wet	Mineral	High
Conifer	Closed	Summer	Dry to very moist	Organic	High
Conifer	Closed	Summer	Wet	Organic	High
Mixed conifer and deciduous	Open	Spring/fall	Dry to very moist	Mineral	High
Mixed conifer and deciduous	Open	Spring/fall	Wet	Mineral	Moderate
Mixed conifer and deciduous	Open	Spring/fall	Dry to very moist	Organic	High
Mixed conifer and deciduous	Open	Spring/fall	Wet	Organic	Moderate
Mixed conifer and deciduous	Open	Summer	Dry to very moist	Mineral	Moderate
Mixed conifer and deciduous	Open	Summer	Wet	Mineral	Moderate
Mixed conifer and deciduous	Open	Summer	Dry to very moist	Organic	Moderate
Mixed conifer and deciduous	Open	Summer	Wet	Organic	Moderate
Mixed conifer and deciduous	Closed	Spring/fall	Dry to very moist	Mineral	High
Mixed conifer and deciduous	Closed	Spring/fall	Wet	Mineral	Moderate
Mixed conifer and deciduous	Closed	Spring/fall	Dry to very moist	Organic	High
Mixed conifer and deciduous	Closed	Spring/fall	Wet	Organic	High
Mixed conifer and deciduous	Closed	Summer	Dry to very moist	Mineral	Moderate
Mixed conifer and deciduous	Closed	Summer	Wet	Mineral	Low
Mixed conifer and deciduous	Closed	Summer	Dry to very moist	Organic	Moderate
Mixed conifer and deciduous	Closed	Summer	Wet	Organic	Low
Deciduous (including shrublands)	Open	Spring/fall	Dry to very moist	Mineral	Moderate
Deciduous (including shrublands)	Open	Spring/fall	Wet	Mineral	Moderate
Deciduous (including shrublands)	Open	Spring/fall	Dry to very moist	Organic	High
Deciduous (including shrublands)	Open	Spring/fall	Wet	Organic	Moderate
Deciduous (including shrublands)	Open	Summer	Dry to very moist	Mineral	Low
Deciduous (including shrublands)	Open	Summer	Wet	Mineral	Low
Deciduous (including shrublands)	Open	Summer	Dry to very moist	Organic	Low
Deciduous (including shrublands)	Open	Summer	Wet	Organic	Low
Deciduous (including shrublands)	Closed	Spring/fall	Dry to very moist	Mineral	High
Deciduous (including shrublands)	Closed	Spring/fall	Wet	Mineral	Moderate
Deciduous (including shrublands)	Closed	Spring/fall	Dry to very moist	Organic	High
Deciduous (including shrublands)	Closed	Spring/fall	Wet	Organic	Moderate
Deciduous (including shrublands)	Closed	Summer	Dry to very moist	Mineral	Low
Deciduous (including shrublands)	Closed	Summer	Wet	Mineral	Low
Deciduous (including shrublands)	Closed	Summer	Dry to very moist	Organic	Low
Deciduous (including shrublands)	Closed	Summer	Wet	Organic	Low

**Table A-1. Criteria for determining fire hazard potential**

<b>Forest type</b>	<b>Canopy</b>	<b>Season</b>	<b>Moisture</b>	<b>Soil type</b>	<b>Rating *</b>
Cultivated areas					Low
Wetlands and flooded areas					Low

\* stands immediately adjacent to occupied lots are rated one class higher unless they are maintained fields or flooded areas

Basic source of information: Canadian Fire Behaviour fuel type descriptions and FireSmart area evaluation tables.

**Table A-2. Blowdown hazard**

Forest type	Canopy	Soil	Moisture	Inferred water table	Class
Deciduous	Open	Mineral	dry-very moist	Deep	Low
Deciduous	Open	Mineral	Wet	Shallow	Low
Deciduous	Open	Mineral	Very wet	At or above surface	Moderate
Deciduous	Open	Organic	dry-very moist	Deep	Low
Deciduous	Open	Organic	Wet	Shallow	Low
Deciduous	Open	Organic	Very wet	At or above surface	Moderate
Deciduous	Closed	Mineral	dry-very moist	Deep	Low
Deciduous	Closed	Mineral	Wet	Shallow	Low
Deciduous	Closed	Mineral	Very wet	At or above surface	Moderate
Deciduous	Closed	Organic	dry-very moist	Deep	Low
Deciduous	Closed	Organic	Wet	Shallow	Moderate
Deciduous	Closed	Organic	Very wet	At or above surface	High
Mixed conifer and deciduous	Open	Mineral	dry-very moist	Deep	Low
Mixed conifer and deciduous	Open	Mineral	Wet	Shallow	Low
Mixed conifer and deciduous	Open	Mineral	Very wet	At or above surface	Moderate
Mixed conifer and deciduous	Open	Organic	dry-very moist	Deep	Low
Mixed conifer and deciduous	Open	Organic	Wet	Shallow	Low
Mixed conifer and deciduous	Open	Organic	Very wet	At or above surface	Moderate
Mixed conifer and deciduous	Closed	Mineral	dry-very moist	Deep	Low
Mixed conifer and deciduous	Closed	Mineral	Wet	Shallow	Low
Mixed conifer and deciduous	Closed	Mineral	Very wet	At or above surface	Moderate
Mixed conifer and deciduous	Closed	Organic	dry-very moist	Deep	Low
Mixed conifer and deciduous	Closed	Organic	Wet	Shallow	Moderate
Mixed conifer and deciduous	Closed	Organic	Very wet	At or above surface	High
Coniferous	Open	Mineral	dry-very moist	Deep	Low
Coniferous	Open	Mineral	Wet	Shallow	Moderate
Coniferous	Open	Mineral	Very wet	At or above surface	Moderate
Coniferous	Open	Organic	dry-very moist	Deep	Low
Coniferous	Open	Organic	Wet	Shallow	Moderate
Coniferous	Open	Organic	Very wet	At or above surface	High
Coniferous	Closed	Mineral	dry-very moist	Deep	Low
Coniferous	Closed	Mineral	Wet	Shallow	Moderate
Coniferous	Closed	Mineral	Very wet	At or above surface	High
Coniferous	Closed	Organic	dry-very moist	Deep	Moderate
Coniferous	Closed	Organic	Wet	Shallow	High
Coniferous	Closed	Organic	Very wet	At or above surface	High

Rationale: Open-grown stands should have some wind resistance vs. closed stands where rooting is probably less extensive. Shallow water tables = shallow rooting. Organic soils don't provide as much strength as mineral soils.



**Table A-3. Decay and bole breakage hazard rating**

<b>Stand type</b>	<b>Age class</b>	<b>Rating*</b>
Aspen	0-60	Low
Aspen	61-100	Moderate
Aspen	>100	High
Coniferous	0-60	Low
Coniferous	61-100	Low
Coniferous	>100	Moderate
Mixed conifer and deciduous	0-60	Low
Mixed conifer and deciduous	61-100	Moderate
Mixed conifer and deciduous	>100	Moderate
Balsam Poplar	0-60	Moderate
Balsam Poplar	61-100	High
Balsam Poplar	>100	Very high

\*High potential for decay and breakage in and adjacent to flooded areas. A map unit was also ranked high if significant disease or damage agents causing whole-tree mortality were noted during field surveys.

**Table A-4. Wildlife snag habitat potential**

<b>Stand type</b>	<b>Age class</b>	<b>Rating*</b>
Aspen	0-60	Low
Aspen	61-100	Moderate
Aspen	>100	High
Coniferous	0-60	Low
Coniferous	61-100	Moderate
Coniferous	>100	Moderate
Mixed conifer and deciduous	0-60	Low
Mixed conifer and deciduous	61-100	Moderate
Mixed conifer and deciduous	>100	Moderate
Balsam Poplar	0-60	Moderate
Balsam Poplar	61-100	High
Balsam Poplar	>100	Very high

\* \*High potential for snags in and adjacent to flooded areas. A map unit was also ranked high if significant disease or damage agents causing whole-tree mortality were noted during field surveys.



## **Appendix B. Detailed map unit characteristics**

**Volumes expressed as cubic metres of wood.**

**Table B-1. East Campsite Forest map unit theme summary**

Map unit number	Area (ha)	Spring and fall fire hazard	Summer fire hazard	Blowdown hazard	Decay and breakage hazard	Wildlife snag habitat potential	Tree health	Moisture and nutrient	Soil type	Calcium and free carbonates	General forest cover	Stand age class (years)
1	1.2	Low	Low	Low	Low	Poor	Not applicable	Rich/wet	mineral	yes	Wet meadow	not applicable
2	0.3	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist meadow	not applicable
3	0.3	Low	Low	Low	Low	Poor	Not applicable	Rich/wet	mineral	yes	Wet meadow	not applicable
4	1.0	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Aspen-balsam poplar	>100
5	0.2	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Wet meadow	not applicable
6	0.9	Low	Low	Low	Low	Poor	Not applicable	Rich/wet	mineral	yes	Wet meadow	not applicable
7	1.5	Moderate	Low	Low	Very high	Good	>10% dead	Rich/very moist	mineral	yes	Balsam poplar	61-100
8	0.2	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist open shrubland	not applicable
9	1.9	Moderate	Low	Low	Low	Poor	Not applicable	Rich/wet	mineral	yes	Wet closed tall shrubland	not applicable
10	2.3	Moderate	Low	Low	Moderate	Fair	Healthy	Rich/very moist	mineral	yes	Aspen	10-60
11	2.7	Moderate	Low	Low	Very high	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar-aspen	>100
12	0.6	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist meadow	not applicable
13	0.6	High	Moderate	Low	Very high	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar (white spruce)	>100
14	1.5	Moderate	Low	Low	High	Good	Not field checked	Rich/very moist	mineral	yes	Balsam poplar	61-100
15	0.4	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar	61-100
16	0.2	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist meadow	not applicable
17	2.4	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist meadow	not applicable
18	0.6	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar	61-100
19	0.1	Low	Low	Low	Low	Poor	Not applicable	Rich/very moist	mineral	yes	Moist meadow	not applicable
20	0.3	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar	61-100

**Table B-1. East Campsite Forest map unit theme summary**

Map unit number	Area (ha)	Spring and fall fire hazard	Summer fire hazard	Blowdown hazard	Decay and breakage hazard	Wildlife snag habitat potential	Tree health	Moisture and nutrient	Soil type	Calcium and free carbonates	General forest cover	Stand age class (years)
21	1.8	Moderate	Low	Low	High	Good	Not field checked	Rich/very moist	mineral	yes	Balsam poplar-aspen	61-100
22	0.7	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar-aspen	61-100
23	0.2	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar	61-100
24	1.1	Moderate	Low	Low	High	Good	Healthy	Rich/very moist	mineral	yes	Balsam poplar-aspen	61-100
25	1.5	Moderate	Low	Low	Moderate	Fair	Healthy	Rich/very moist	mineral	yes	Aspen-balsam poplar	10-60

Table B-1 (continued). East Campsite Forest detailed forest cover label and volume* calculation information															
Map unit number	AVI overstory label	AVI understory label	Visited 2007	Observation type	Equivalent Phase III volume table use	Volume/ha (coniferous) based on Phase III tables	Volume/ha (deciduous) based on Phase III tables	Total map unit volume based on Phase III tables	Volume/ha (coniferous) based on field plot data	Volume/ha (deciduous) based on field plot data	Total map unit volume (coniferous)	Total map unit volume (deciduous)	Total map unit volume	Source of volume data	Mean annual increment (m3) for map unit
1	w-HG-G		Yes	Casual											
2	w-HG-G		No	Photo											
3	w-HG-G, scattered Pb		No	Photo											
4	m-45-22-Aw6Pb4(Sw)-1900-G		Yes	Casual	B3AwPb	47	129	178			47	129	176	Phase III Volume tables	1.6
5	w-HG-G		Yes	Casual											
6	w-HG-G, scattered Pb		Yes	Casual											
7	m-23-30-Pb9Aw1-1910-G		Yes	Plot	A5PbAw				0	48	0	72	72	Field Plot	1.1
8	m-SO-G		Yes	Casual											
9	w-8-SC6-G		Yes	Casual											
10	m-50-20-Aw9Pb1-1952-G	m-20-9Sw10-1965-G	Yes	Plot	B3AwPb	47	129	178	0	0	54	148	202	Averaged: Field Plot and Phase III Volume tables	4.2
11	m-45-22-Pb5Aw5-1900-G	m-20-4Sw10-1985-G	Yes	Plot	B3PbAw				31	18	84	49	132	Field Plot	3.2
12	m-HG-G		Yes	Casual											
13	m-50-24-Pb8Sw2-1898-G	m-20-14Sw10-1923-M		Plot	B3PbSw				14	86	8	52	60	Field Plot	0.3
14	m-70-23-Pb9Sw1-1910		No	Photo	C3PbSw	69	180	251			104	270	374	Phase III Volume tables	5.6
15	m-45-21-Pb10-1930		No	Photo	B3PbSw	47	129	178			19	52	70	Phase III Volume tables	0.3
16	m-HG-G		Yes	Casual											
17	m-HG-G		No	Photo											
18	m-40-23-Pb10-1910-G		Yes	Casual	B3Pb	47	129	178			28	77	106	Phase III Volume tables	0.6
19	m-HG-G		No	Photo											
20	m-70-22-Pb10-1920-G		Yes	Casual	C3Pb	69	180	251			21	54	75	Phase III Volume tables	0.3

**Table B-1 (continued). East Campsite Forest detailed forest cover label and volume\* calculation information**

Map unit number	AVI overstory label	AVI understory label	Visited 2007	Observation type	Equivalent Phase III label for volume table use	Volume/ha (coniferous) based on Phase III tables	Volume/ha (deciduous) based on Phase III tables	Total map unit volume based on Phase III tables	Volume/ha (coniferous) based on field plot data	Volume/ha (deciduous) based on field plot data	Total map unit volume (coniferous)	Total map unit volume (deciduous)	Total map unit volume	Source of volume data	Mean annual increment (m3) for map unit
21	m-50-22-Pb6Aw4-1910-G	m-35-14-Aw8Pb2-1960-G	No	Photo	B3PbAw	47	129	178			85	232	317	Phase III Volume tables	5.2
22	m-50-21-Pb6Aw4-1930-G		Yes	Casual	B3PbAw	47	129	178			33	90	123	Phase III Volume tables	1.2
23	m-30-22-Pb10-1920-G		Yes	Casual	A3Pb	77	48	125			15	10	25	Phase III Volume tables	0.1
24	m-50-21-Pb8Aw2-1920-G		Yes	Casual	B3PbAw	47	129	178			52	142	194	Phase III Volume tables	2.7
25	m-50-18-Aw8Pb2-1960-G		Yes	Casual	B3AwPb	47	129	178			71	194	264	Phase III Volume tables	7.9

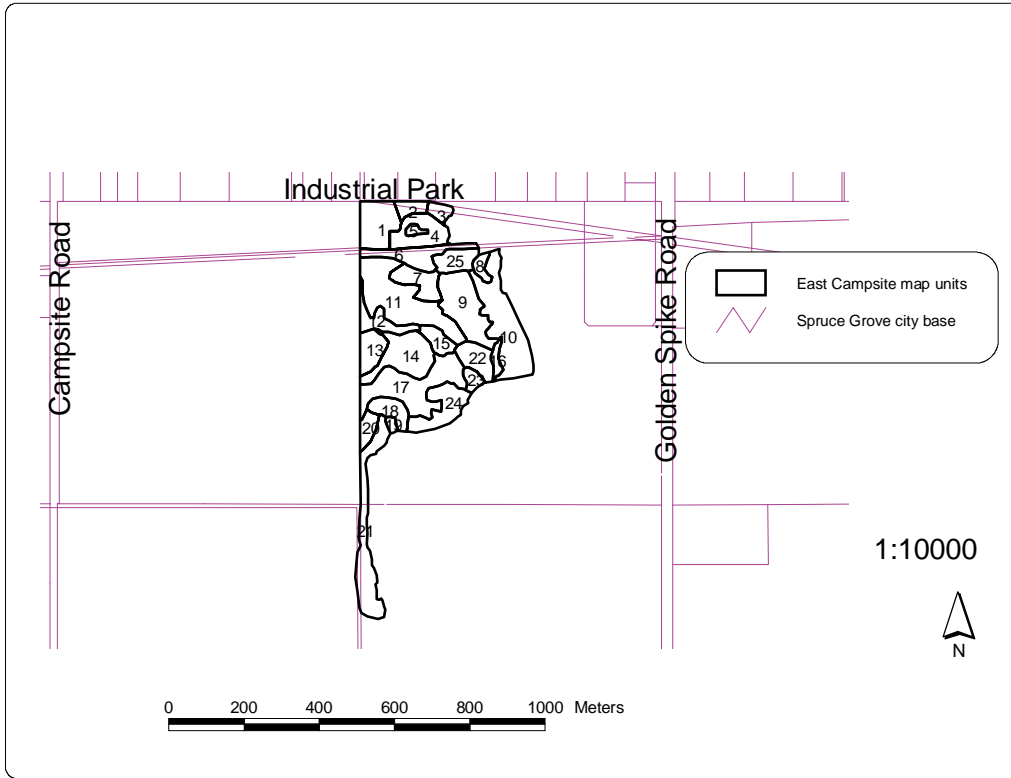
**\*volume in cubic metres**



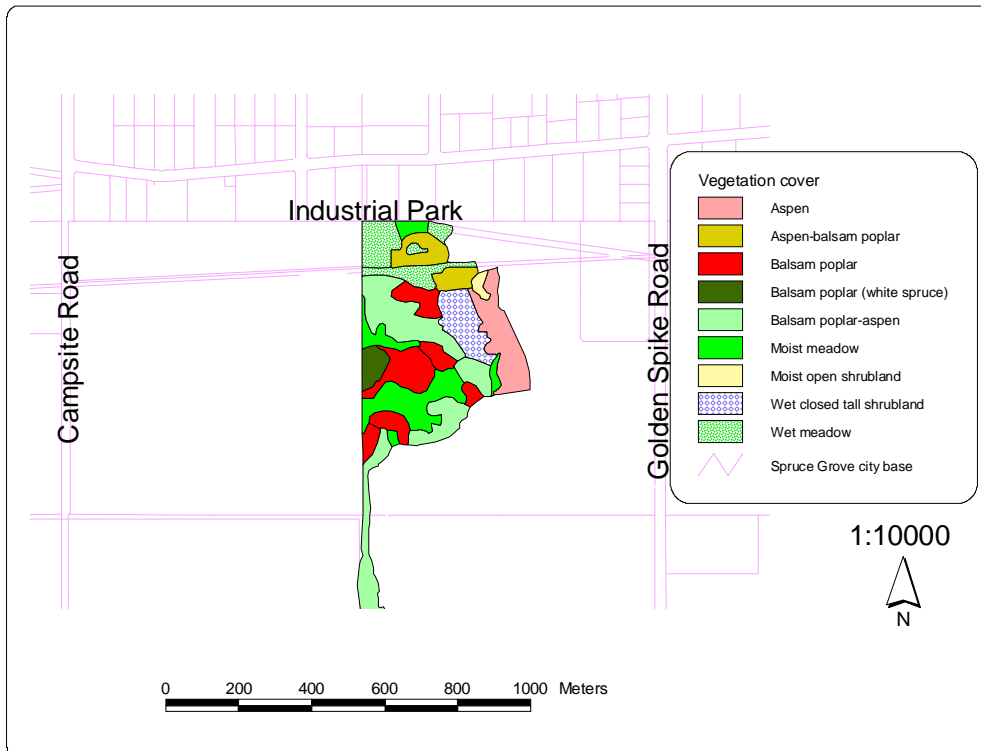


## **Appendix C. Maps**

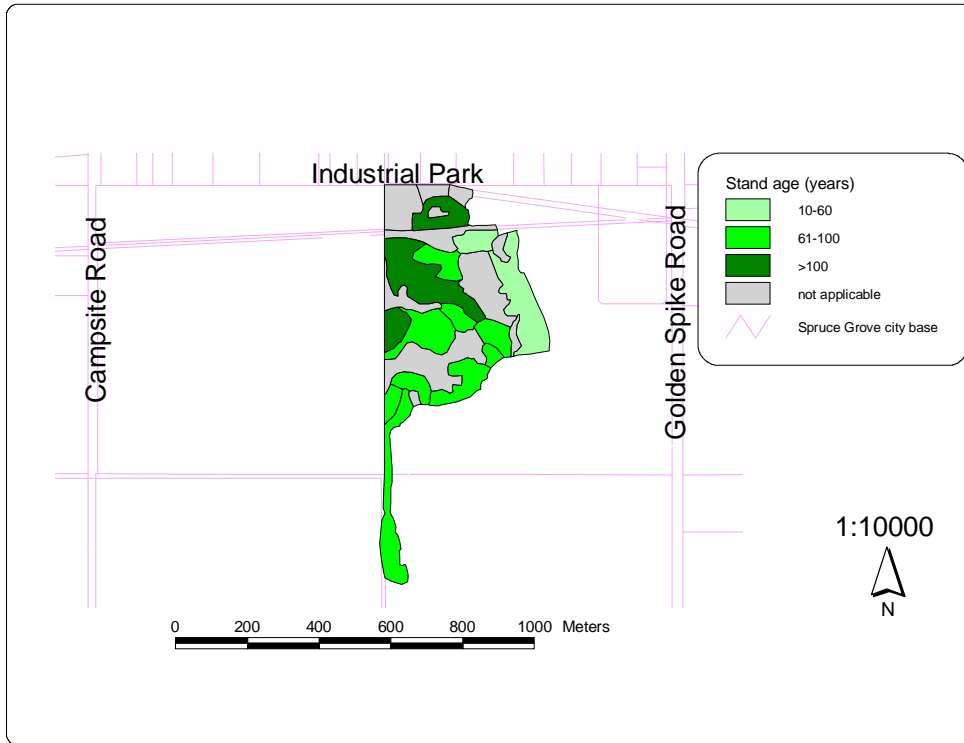
**Figure EC-1. East Campsite Forest Map Units**



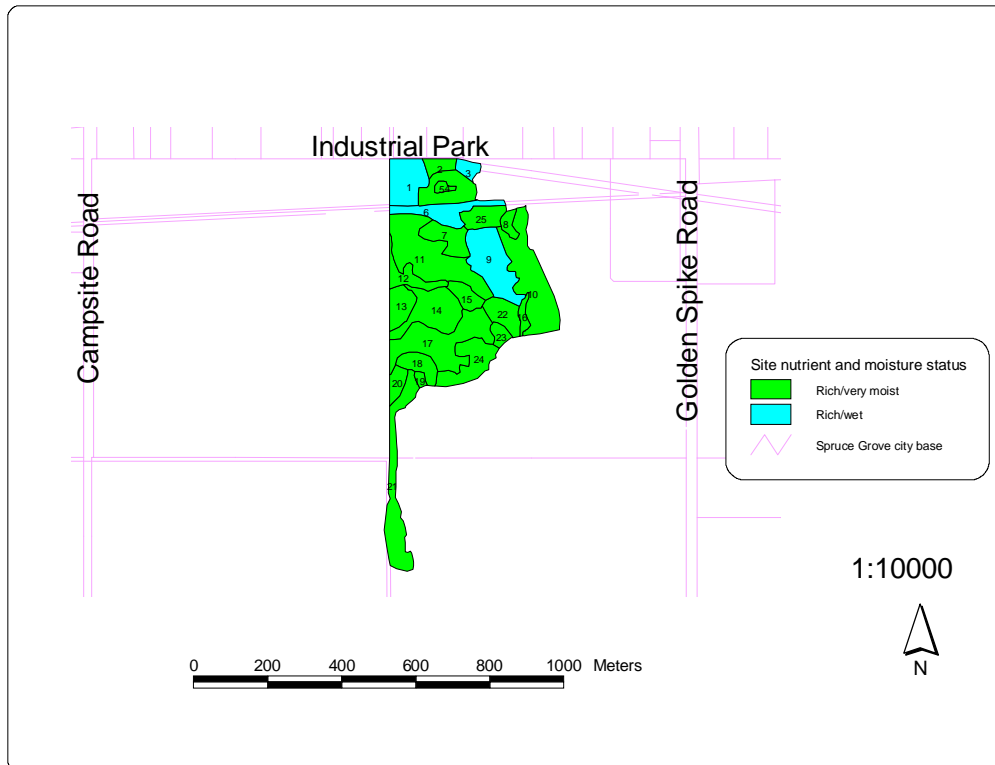
**Figure EC-2. East Campsite Forest Vegetation Cover**



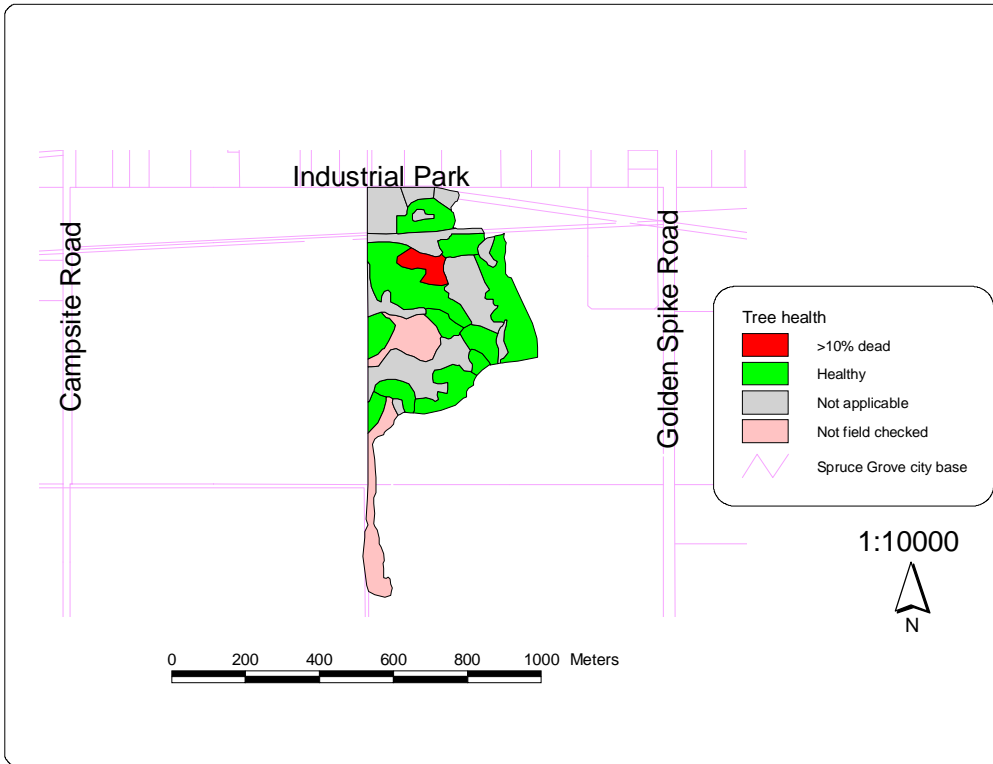
**Figure EC-3. East Campsite Forest Stand Age**



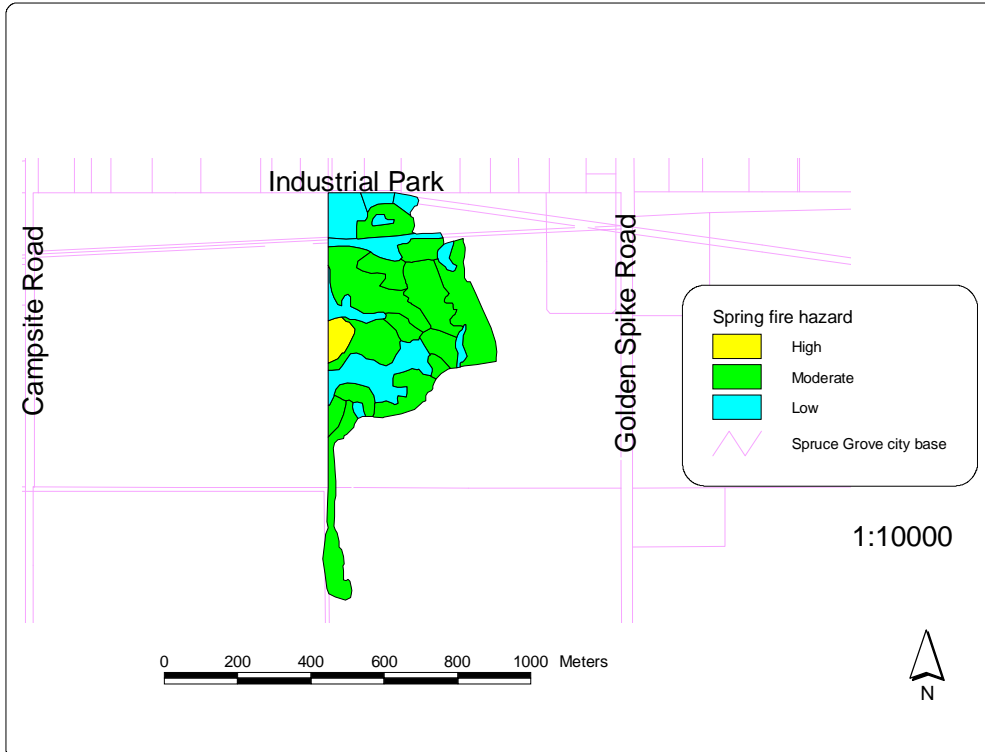
**Figure EC-4. East Campsite Forest Site Nutrient and Moisture Status**



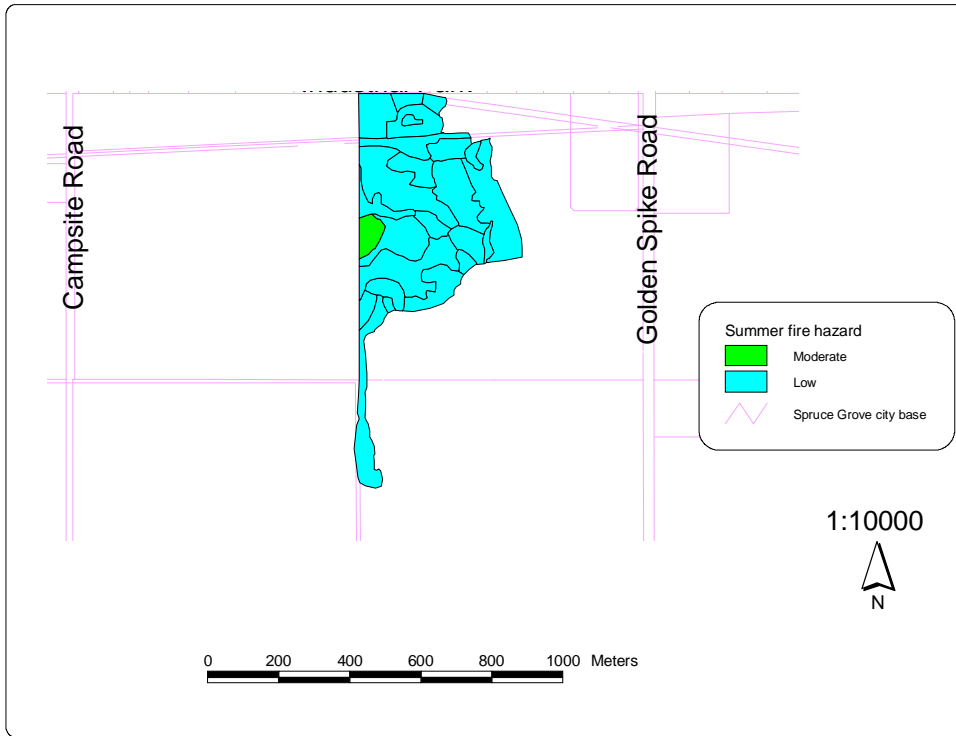
**Figure EC-5. East Campsite Forest Tree Health Assessment 2007**



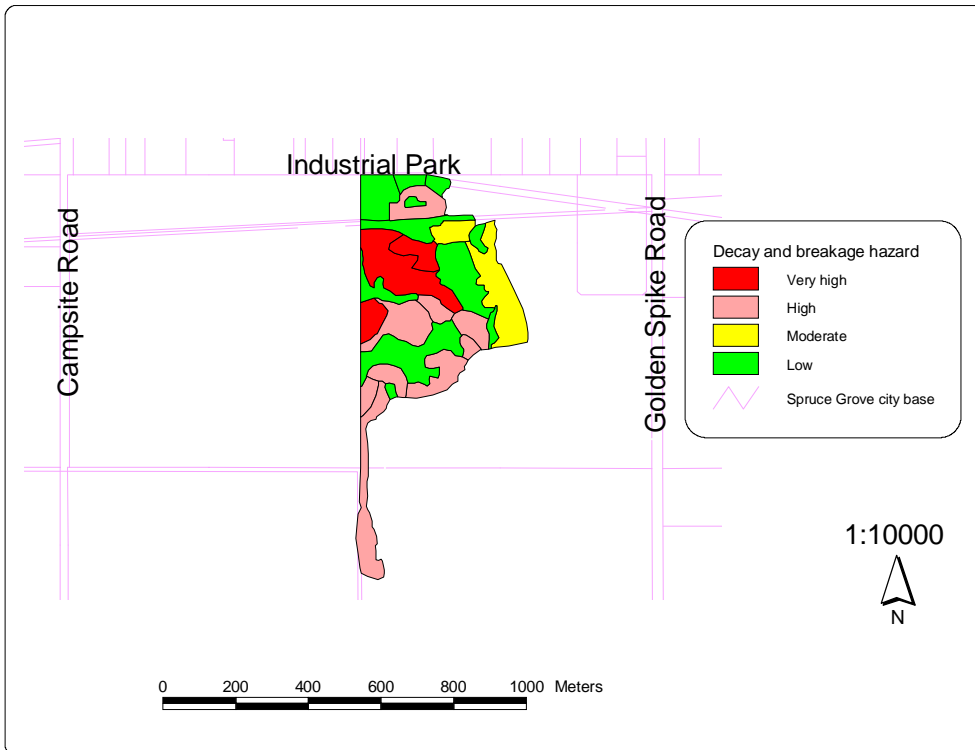
**Figure EC-6. East Campsite Forest Spring/Fall Fire Hazard Potential**



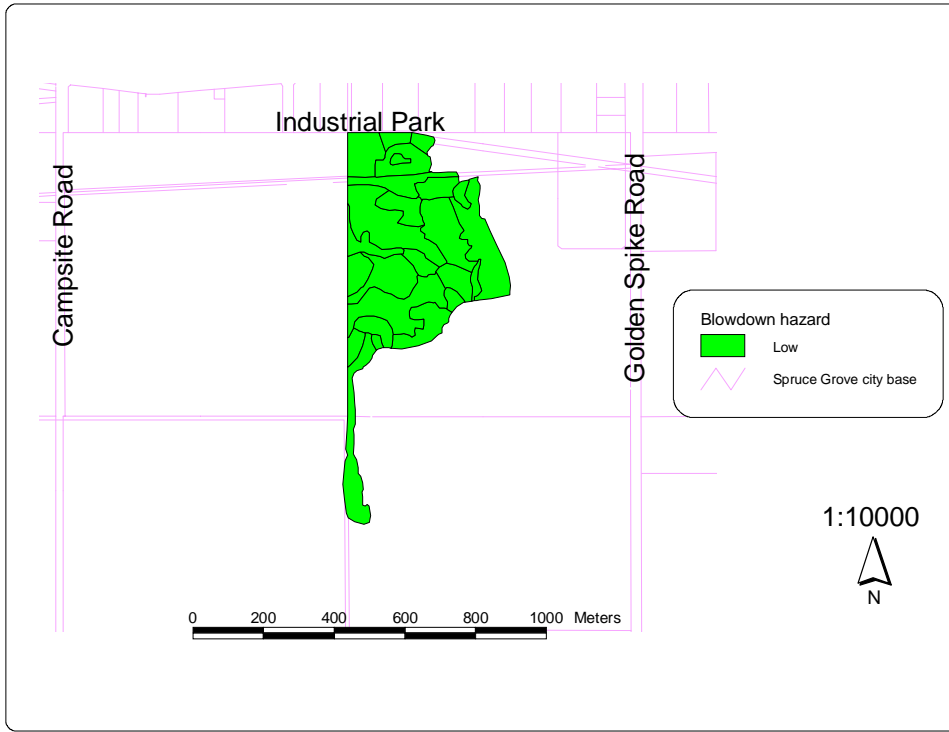
**Figure EC-7. East Campsite Forest Summer Fire Hazard Potential**



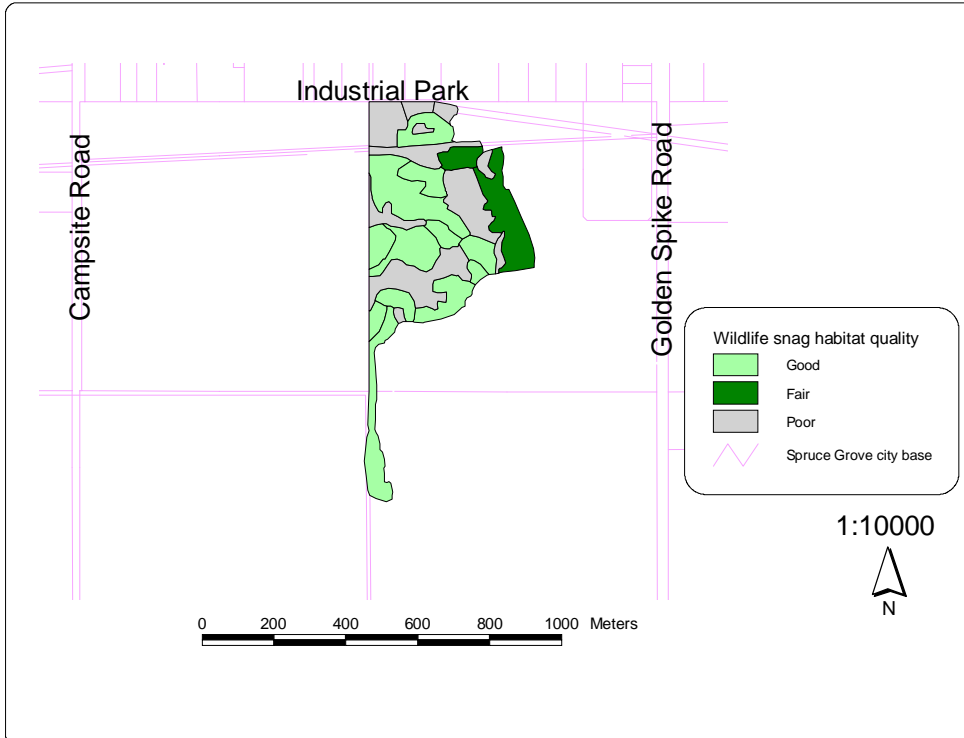
**Figure EC-8. East Campsite Forest Decay and Breakage Hazard**



**Figure EC-9. East Campsite Forest  
Blowdown Hazard**



**Figure EC-10. East Campsite Forest  
Wildlife Snag Habitat Potential**



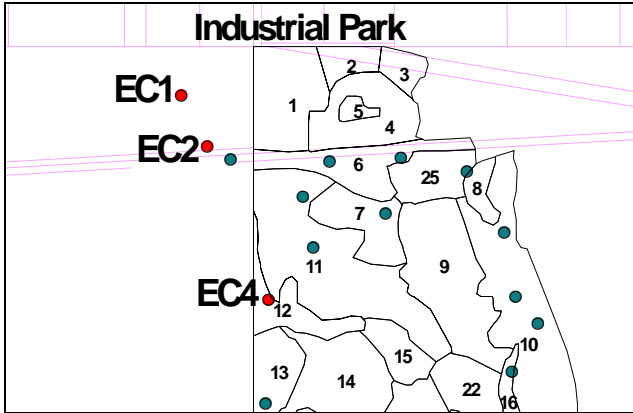
**Figure EC-11. East Campsite Forest (1999 photo)  
Current map unit boundaries and city base**







## **Appendix D. Selected site photographs**



Observation locations EC-1, EC-2, and EC-4 (red dots). Smaller numbers are map unit numbers. Blue dots are other photo locations.

Observation EC-1: Looking SE toward NW corner of Stand 11. The fields were wet at the time of observation, uncultivated areas in the midground are wet and have standing water

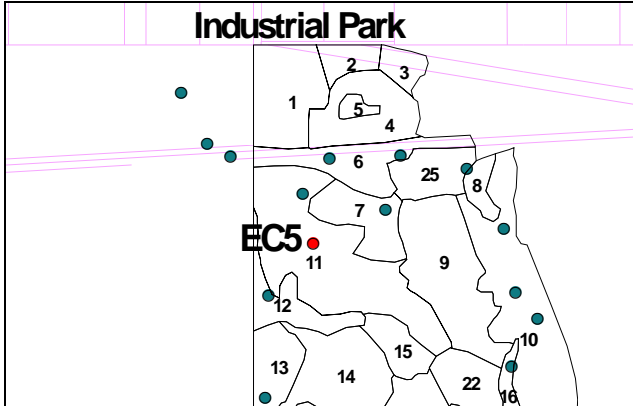


Observation EC-2. Cattail marsh (map unit 1) at northwest corner of East Campsite Forest



Observation EC-4. Looking east across map unit 12; wet sedge-reed canarygrass meadow in foreground and drier, grazed dandelion-bluegrass-snowberry-rose meadow in the midground.





Observation location EC-5 (plot EC1) (red dot). Smaller numbers are map unit numbers. Blue dots are other photo locations.

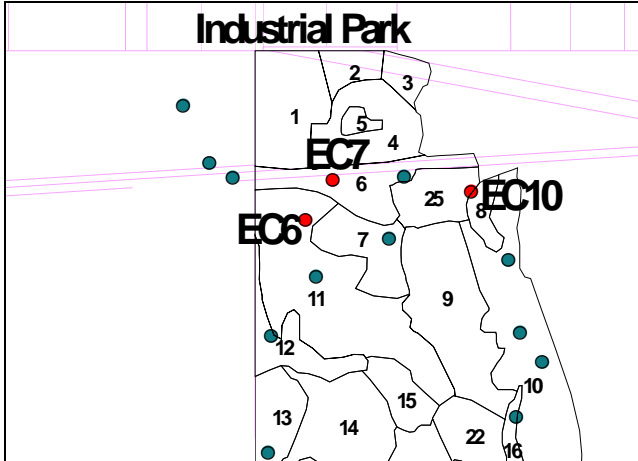
Observation EC-5: View of stand in map unit 11; note the open understory with white spruce.



Observation EC-5. Soil pit at plot EC1. Note the dark humus-enriched surface layer.

Observation EC-5. Soil pit at plot EC1. Layers below the humus-enriched upper horizon (shown in the picture to the left) are typically mottled, with greyish and reddish areas indicating reduced and oxidized iron associated with poorly drained, very moist to wet soils.





Observation locations EC-6, EC-7, and EC-10 (red dots). Smaller numbers are map unit numbers. Blue dots are other photo locations.

Observation EC-6: The north end of map unit 11 has good white spruce regeneration in the understory.

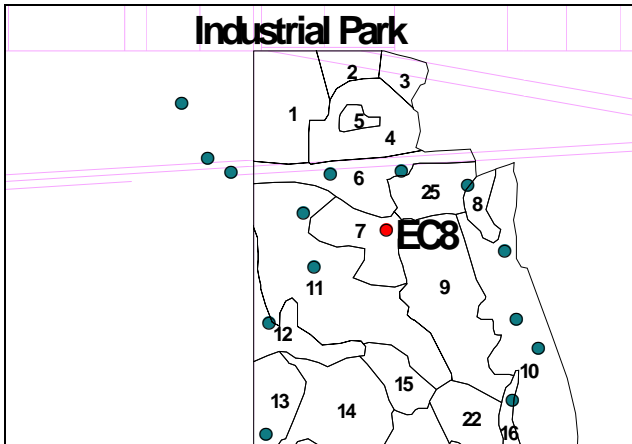


Observation EC-7. Map unit 6 is flooded in this spring photo, but sedges in the central part indicate that parts of it are wet year-round. The old railway bed is the raised area in the background.



Observation EC-10. Seasonal flooding in map unit 8, a grazed dandelion-bluegrass-snowberry meadow. The old rail bed is the raised area in the background; view is to the northeast.





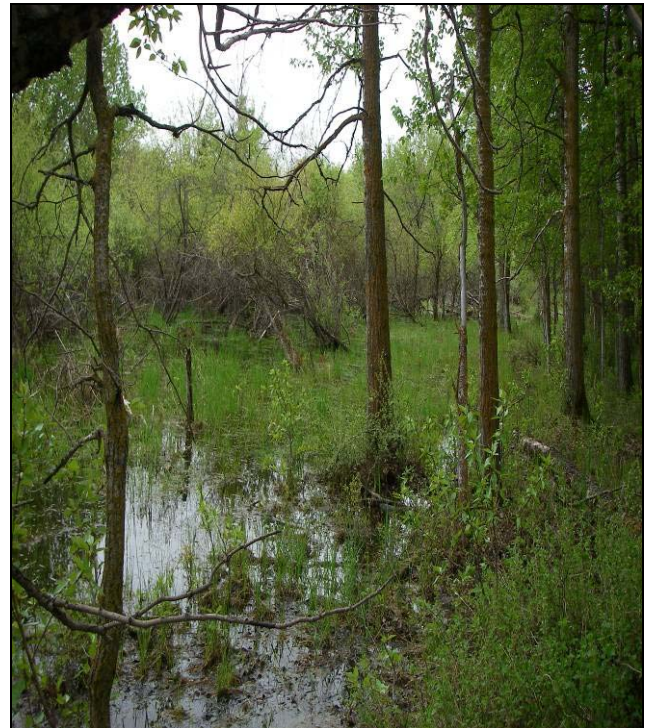
Observation location EC-8 (plot EC-3) (red dot). Smaller numbers are map unit numbers. Blue dots are other photo locations.



Observation EC-8: Map unit 7, plot EC-3. This stand has a high proportion of old, large-diameter balsam poplar; many have broken off, leaving snags that provide habitat for wildlife.

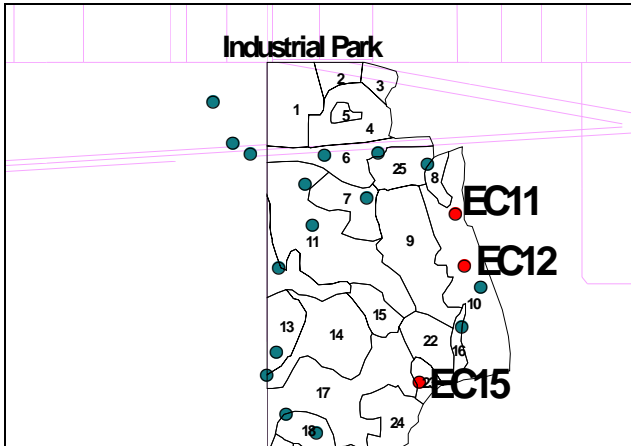


Observation EC-8. Woodpeckers and insects create large cavities in old balsam poplar snags.



Observation EC-8. Map unit 9 (left side of photograph) is a wet tall shrubland to the south of map unit 7.





Observation locations EC-11, EC-12, and EC-15 (red dots). Smaller numbers are map unit numbers. Blue dots are other photo locations.

Observation EC-11: Looking WSW across the northern tip of map unit 10 toward the wet polygon 9. Note that this year the aspen-balsam poplar stand is flooded adjacent to Polygon 9. If water was directed into this forest, flood events could result in damage to trees if the water was standing for a long period of time.



Observation EC-12. Map unit 10 slopes down to the west (up to 6-7% slope); this view looks upslope to the east. Development upslope that reduces infiltration and increases surface runoff could increase flooding here, as map unit 9, a wet shrubland, lies to the west.



Observation EC-15. This view looks WNW across map unit 17, a moist to wet meadow surrounded by balsam poplar forests. This area might be a candidate for stormwater retention pond development. (The white streaks to the right are falling snowflakes).