Appendix F

Environmental Features

Note

Prior to the release of the Draft EA, the Project was referred to as the *Island Falls Hydroelectric Project*. Following release of a draft environmental assessment report for review by First Nations, agencies, and members of the public, numerous comments were received. As a direct result of agency and public consultation, YFP made a decision to relocate the Project two kilometres upstream of Island Falls to Yellow Falls. Accordingly, the Project name has changed to the "Yellow Falls Hydroelectric Project" and the Project nameplate capacity has changed from 20 MW to 16 MW.

The following Environmental Features report details existing natural and socioeconomic conditions and was prepared for the Island Falls location. Project relocation has not appreciably altered descriptions of existing natural and socioeconomic conditions. The Yellow Falls Project location has been provided on figures to indicate how the revised location corresponds with existing natural and socioeconomic environmental features.

Appendix F1

Environmental Features Report

ISLAND FALLS HYDROELECTRIC PROJECT
APPENDIX F1 – ENVIRONMENTAL FEATURES

File No. 160960168

Prepared for:

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February 2009

ISLAND FALLS HYDROELECTRIC PROJECT
APPENDIX F1 – ENVIRONMENTAL FEATURES

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1.0 Introduction

Yellow Falls Power Limited Partnership (“YFP”) is proposing to build, own, and operate the Island Falls Hydroelectric Project (the “Project”), a 20 megawatt (“MW”) run-of-river waterpower generating station at Island Falls on the Mattagami River. Island Falls is located approximately 16 km upstream from the Town of Smooth Rock Falls, Ontario (**Figure F2-1, Appendix F2**).

The Study Area for the Project extends from the Town of Smooth Rock Falls, south to the Lower Sturgeon Generating Station, east to Provincial Highway 655, and west to the western boundaries of the geographic townships of Haggart, Sydere, Laidlaw, Kirkland, and Wilhelmina.

This report provides a description of the existing environmental and socio-economic features in the Study Area. Corresponding environmental and socio-economic features mapping is contained in **Appendix F2**.

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2.0 Land

This section describes the physical features in the Study Area; including geology, physiography, soils, seismicity, and climate. Information resources used to determine the physical characteristics of the Study Area include site photographs, aerial photography, and publications by the Ontario Geological Survey ("OGS"), Environment Canada ("EC"), and Natural Resources Canada ("NRCan"), the Ontario Ministry of Northern Development and Mines ("MNDM"), and the Ontario Ministry of Natural Resources ("MNR").

2.1 BEDROCK GEOLOGY

The Study Area is located in the Superior geological province of the Canadian Shield (NRCan, 2006a). The Superior Province can be generally characterized as containing metamorphosed sedimentary and volcanic rocks from the Archean period of the Precambrian era (more than 2.5 billion years BP). Geologists have further divided the Superior Province into a number of subprovinces. The Study Area is situated in the Abitibi subprovince, which is mostly composed of metavolcanic and metasedimentary rock. "Meta" rock is either volcanic (igneous) or sedimentary rock that has been subjected to enormous pressure over millions of years.

The Study Area contains both metavolcanic and metasedimentary rock types. The dominant rock type is biotite-quartz-feldspar gneiss and granitic gneiss. Gneiss exhibits similar characteristics to granite, but has a layered structure, having evolved through sedimentary and metamorphic processes. Mafic to intermediate metavolcanic rocks are common throughout the lower half of the Study Area, south of Davis Rapids. Mafic rocks are igneous rocks primarily composed of iron and magnesium minerals. A geologic fault represents a division between the area of gneiss rock and the area of mafic metavolcanic rocks (Ontario Department of Mines, 1968; MNDM, 2003a; MNDM, 2003b). Bedrock type throughout the Study Area is shown in **Figure F2-2**. A summary of the site-specific geotechnical analysis is provided in **Appendix J.**

2.2 PHYSIOGRAPHY

Physiography, or physical geography, refers to the shape of the land and how it has influenced natural and human usage. The Study Area is located in the Canadian Shield physiographic region, an upland area with topography that is mainly influenced by the underlying bedrock.

The last ice age, which ended about 8,000 years ago, brought immense changes to the landscape of the Study Area. Glacial advance and recession sculpted the most prominent land features, and deposited the major soil components (Poehlmann and Associates, undated). Surficial features within the Study Area were deposited by two major events around the end of the ice age. Firstly, a major glacial re-advance (the Cochrane advance) formed many surficial deposits such as eskers, and moraines. Secondly, a large lake, known as Lake Barlow-Ojibway, formed as a result of subsequent glacial recession. Thick layers of clay were deposited in the lake, developing the Northern Clay Belt on which the northern part of the Study Area is located. Clay deposits and relatively impermeable bedrock have led to the formation of

peat bogs throughout the Study Area since precipitation has little chance to percolate through the soil (Poehlmann and Associates, undated).

Since glaciation, the land in the Study Area has continued to rise at the rate of between 0.7 and one metre per century through a process called isostatic rebound. The land has risen about 315 m over the last 8,300 years. It is estimated that Timmins (south of the Study Area) will rise another 90 m before the land reaches equilibrium. Isostatic rebound can be expected to greatly influence drainage patterns over the next 9,000 years (Poehlmann and Associates, undated). However, such changes are well outside the expected life of the Project.

In addition to isostatic rebound, geology has influenced drainage patterns. Rivers are usually found along fault lines or other geological features. Bedrock can also control how much a river meanders. In order for a river to meander, it must be able to erode one side of the bank, and deposit this material on the other side of the bank. This creates an undercut bank on one side, and a point bar of depositional material on the other side, creating a bend, or meander in the river. The limiting characteristics of bedrock on river morphology can be seen by the lack of meandering exhibited by the Mattagami River and tributaries throughout the Study Area due to the resistance of the rock to erosion.

Surface water drainage in the Study Area is northward to James Bay. Since the bedrock is very old, close to the surface, and soft, erosion over time has smoothed topographic relief, resulting in relatively flat land (MNDM, 2003a). Topographic relief ranges from about 225 m above sea level ("asl") at the north end of the Study Area to localized hummocks of about 335 m asl in the south-west corner of the Study Area (Energy, Mines, and Resources Canada, 1986a; 1986b; 1989)

2.3 SOILS

The Study Area is located in a lacustrine plain, formed by the post-glacial Lake Barlow-Ojibway. Surficial deposits in the Study Area are primarily lacustrine and morainal clays laid down during deglaciation (Buttle et al, 1998). Alluvial deposits of clay can be found as substrate in the Mattagami River (see **Appendix G,** Aquatic Resources).

Surface soil types were identified using Soil Landscapes of Canada Version 3.1 data, published by Agriculture and Agri-Food Canada (2006). Soil Landscapes of Canada data describes soil types throughout Canada at a 1:1 million scale. Soil types are listed in **Table 2.1**, and depicted in **Figure F2-3**.

The most common classifications of soil texture within the Study Area are sandy loam, loam, or loamy sand. The three most abundant soil types are Granby loamy sand, Guerin sandy loam, and Grenville sandy loam respectively. Drainage varies from poorly drained (Gerow) to well-drained (Harkaway, Grimsby, and Grenville). However, poorly to imperfectly drained soils are dominant throughout the Study Area. Soils and parent material tend to be calcareous, indicating that acidic inputs such as acid rain are buffered to a certain extent (AAFC, 2006; Griffith et al., 1984)

Drift thickness varies considerably, from less than one metre to eight metres deep in the vicinity of the North Muskego River (see **Figure F2-4** for the location of the North Muskego River). East of the Mattagami River, drift is considerably deeper, and is generally greater than eight metres. However, outcrops of bedrock and areas of thin drift occur throughout the Study Area.

Table 2.1 Study Area Soil Types

Soil Name	Soil Code	Soil Texture	Parent Material Texture	Drainage	Mode of Deposition	Area (ha)
Gerow	GOW	Clay Loam	Moderately Fine	Poorly drained	Till (Morainal)	4,149
Granby	GNY	Loamy Sand	Very Coarse	Poorly drained	Lacustrine	70,582
Grenville	GVI	Sandy Loam	Medium	Well drained	Till (Morainal)	32,888
Grimsby	GMY	Sandy Loam	Coarse	Well drained	Lacustrine	60
Guerin	GUR	Sandy Loam	Medium	Imperfectly drained	Till (Morainal)	6,385
Haldimand	HIM	Sandy Loam	Fine	Imperfectly drained	Lacustrine	55,605
Harkaway	HKY	Loam	Medium	Well drained	Till (Morainal)	23,900
Total						**193,569**

2.4 SEISMICITY

Seismic activity and risk is recorded and estimated by the Geological Survey of Canada, and the probability of seismic activity is rated as low (NRCan, 2006b). The risk of seismic activity is described by estimating the likelihood of exceeding a certain spectral acceleration (the vibration experienced by a building during a seismic event) based on a 2% probability over 50 years.

Values for the probability of seismic activity at Island Falls are shown in **Table 2.2**. Sa represents spectral acceleration in seconds, expressed as a fraction of gravity. As an example, the vicinity of the Island Falls site has a 2% chance of experiencing a vibration at 0.185 times the force of gravity lasting 0.2 seconds over the next 50 years. For comparison, Vancouver Island has 2% probability of experiencing a vibration of twice the force of gravity lasting one second over 50 years (NRCan, 2006b).

Table 2.2 Seismic Values for Island Falls Hydroelectric Project Site				
2% probability over 50 years				
Spectral Acceleration (seconds)	Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)
Acceleration value (g)	0.185	0.089	0.042	0.013

2.5 CLIMATE

The weather station nearest to the Study Area is located at the Timmins Airport. Climate normals and averages are published by EC from 1971 to 2000. The Climate of Northern Ontario (Chapman and Thomas, 1968), containing data from 1931 to 1960, was used to provide climate information specific to growing conditions. The climates of Toronto and Ottawa are provided for comparison.

2.5.1 Temperature and Growing Season

The Study Area is located in the Northern Clay Belt Climatic Region (Chapman and Thomas, 1968). The Northern Clay Belt is characterized by a cold climate and a short growing season. January is the coldest month of the year, with an average temperature of –17.5°C. July is the hottest month, with an average temperature of 17.4°C. Overall, Timmins has a mean annual temperature of 1.3°C (**Figure 2-1**). For comparison, Ottawa has a mean annual temperature of 6.3°C, and Toronto has a mean annual temperature of 7.5°C (EC, 2006a).

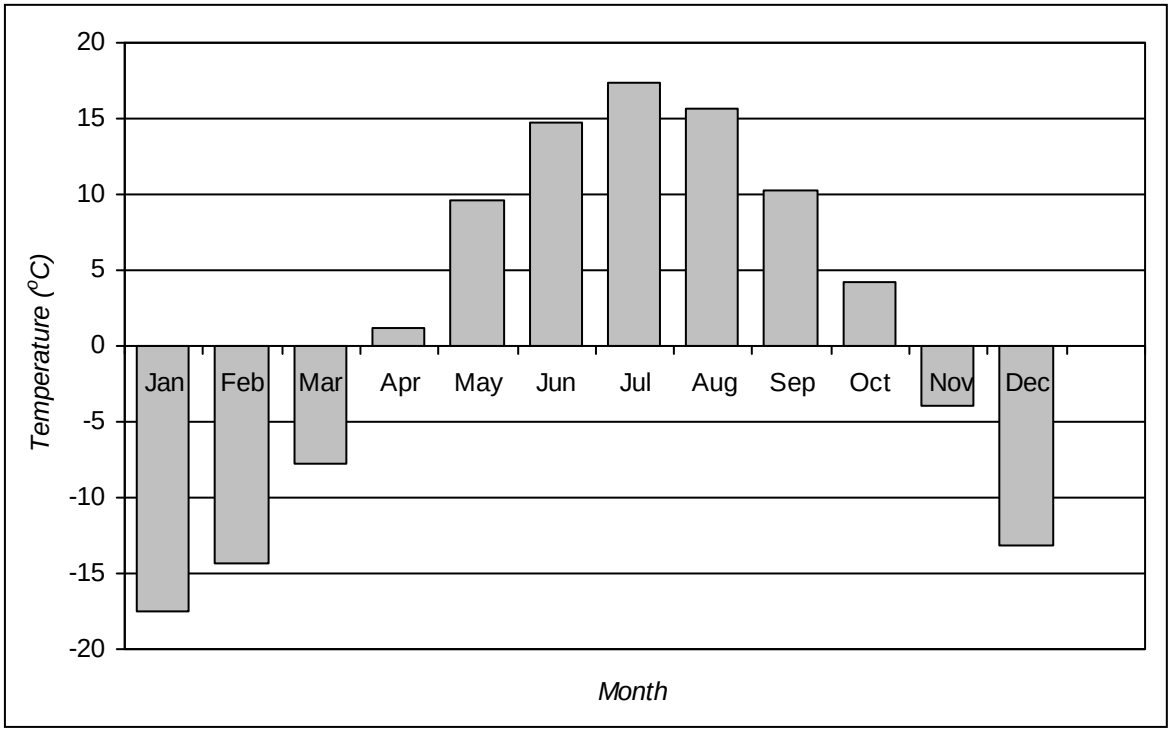

Figure 2-1 Average Monthly Temperature (1971 to 2000) at Timmins Airport (EC, 2006a)

The growing season in the Study Area begins later and is shorter than Toronto and Ottawa. **Figure 2-2** shows the number of days above 0°C (EC, 2006a). Consistently frost-free days occur from about the end of April to the beginning of October. The annual frost-free period is about 92 days (Chapman and Thomas, 1968).

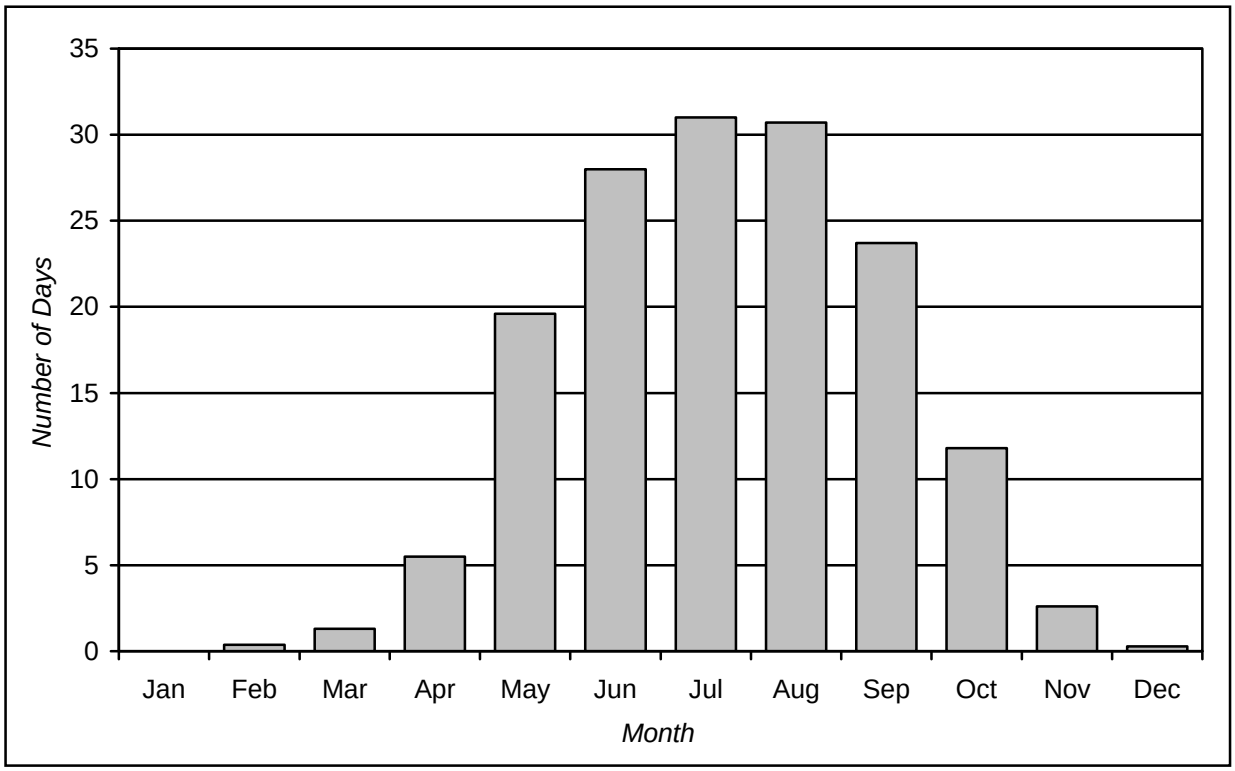

Figure 2-2 Number of Days Above 0°C (1971 to 2000) at Timmins Airport (EC, 2006a)

As a result of the cold climate, the growing season begins about May 7, and ends about October 13 (Chapman and Thomas, 1968). The comparatively short growing season is also depicted in **Figure 2-3**, which shows Growing Degree Days. Growing degree-days are calculated by averaging the maximum and minimum temperatures for each day, and subtracting a baseline temperature (usually 10°C), and adding the daily values throughout the growing season. Growing degree days are used to estimate the growth of plants during the growing season (OMAFRA, 2003) and can assist in assessing the plant growth capability of an area. Using a 10°C baseline, the annual number of growing degree days in Timmins is 1,033 (**Figure 2-3**). In comparison, Ottawa and Toronto have 1,975 and 2,018 growing degree days, respectively. The growing season is limited to between May and September and the rate of plant growth is slower than in more temperate climates. Vegetation and wildlife must therefore be adaptable to a wide range of temperature conditions.

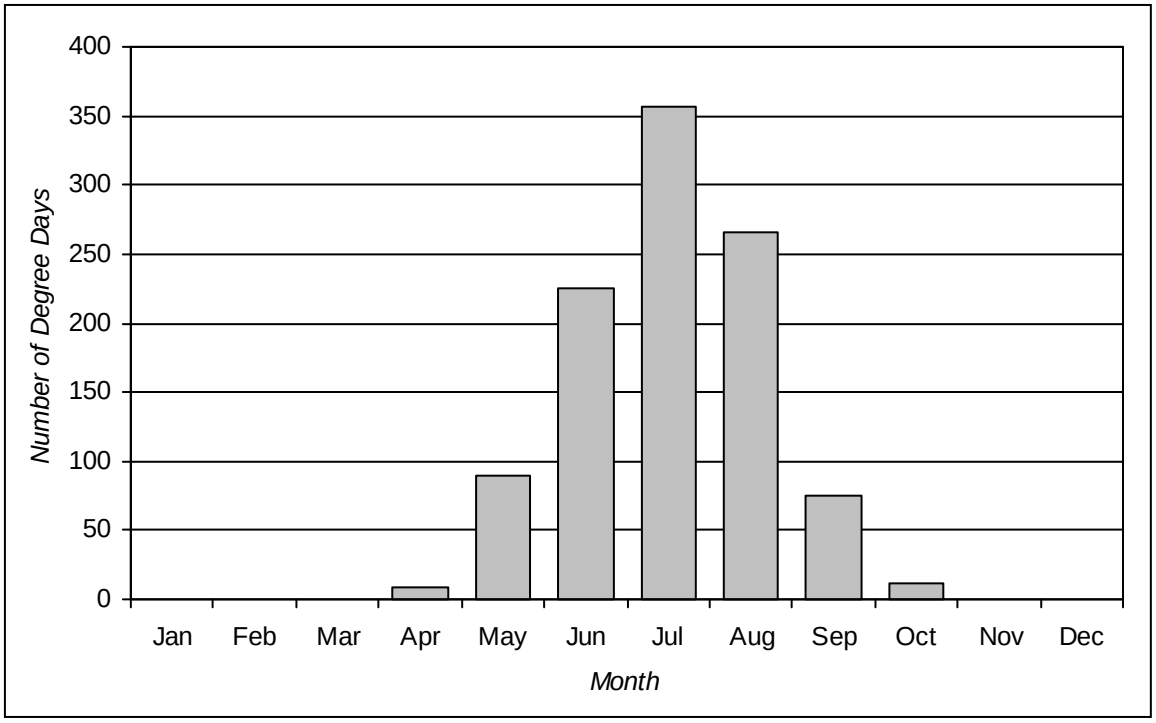

Figure 2-3 Growing Degree-Days (1971 to 2000) at Timmins Airport (EC, 2006a)

2.5.2 Precipitation

On average, Timmins receives about 831 mm of precipitation per year. December receives the most snowfall, while July receives the most rainfall. On average, total rainfall is 558 mm, while total snowfall is 313 cm. Summer and autumn months receive the most precipitation, while the winter is comparatively dry. Since snow has a relatively low density, most of the precipitation falls as rain. The total amount of precipitation received in Timmins is comparable to other areas of Ontario such as Ottawa and Toronto, which receive annual precipitation of about 944 and 793 mm, respectively. Seasonal distribution of precipitation does vary more than other parts of Ontario (EC, 2006a). Average monthly precipitation, which measures the water equivalent of all types of precipitation (rain, drizzle, freezing rain, freezing drizzle and hail), and monthly amounts of rain and snow are shown in **Figures 2-4** and **2-5**.

Potential evapotranspiration represents the amount of water that may be lost to the atmosphere through plant transpiration and evaporation. Potential evapotranspiration is approximately 480 mm per year (Chapman and Thomas, 1968). In the Mattagami River watershed, the rate of evaporation ranges from 426-450 mm per year (Buttle et al., 1998).

Mean annual water deficiency provides an estimate of the amount of water plants could use that is not available in the form of precipitation. Throughout most of Northern Ontario, more than enough water is available for plant uptake and there is no mean annual water deficiency (Chapman and Thomas, 1968).

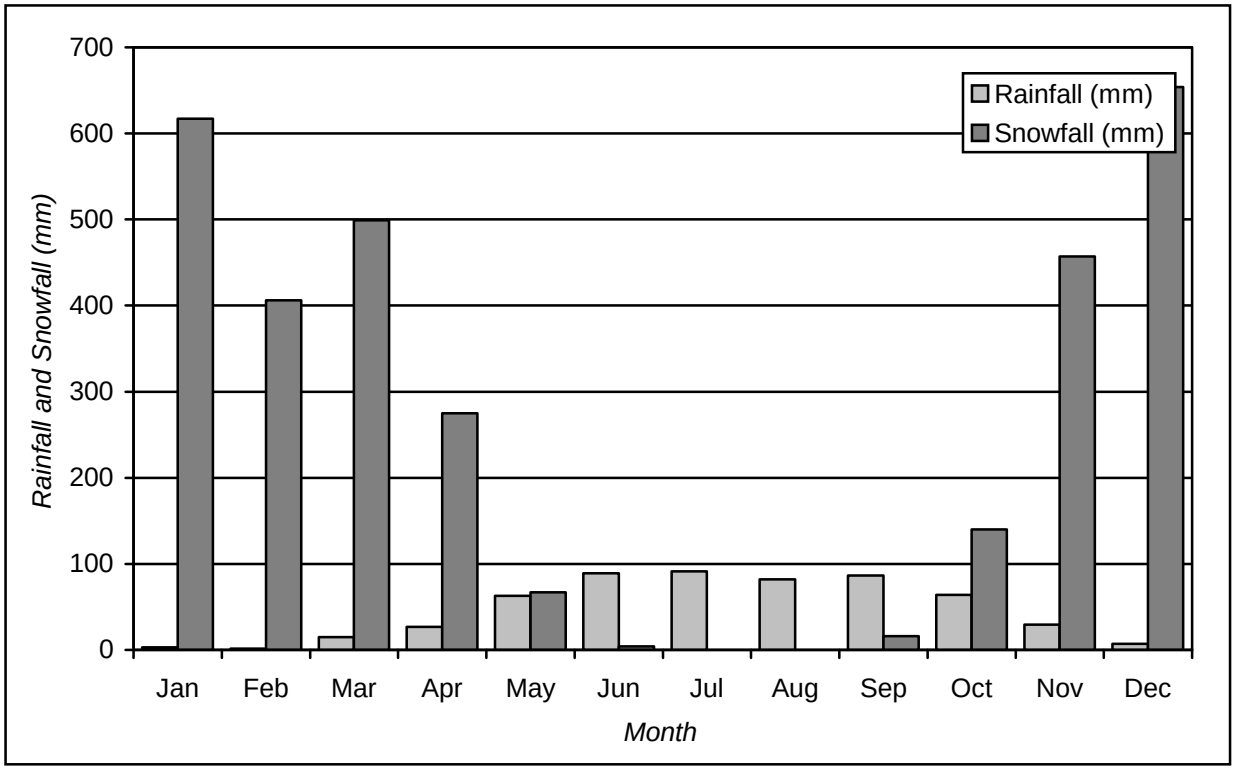

Figure 2-4 Average Monthly Rainfall and Snowfall at Timmins Airport (EC, 2006a)

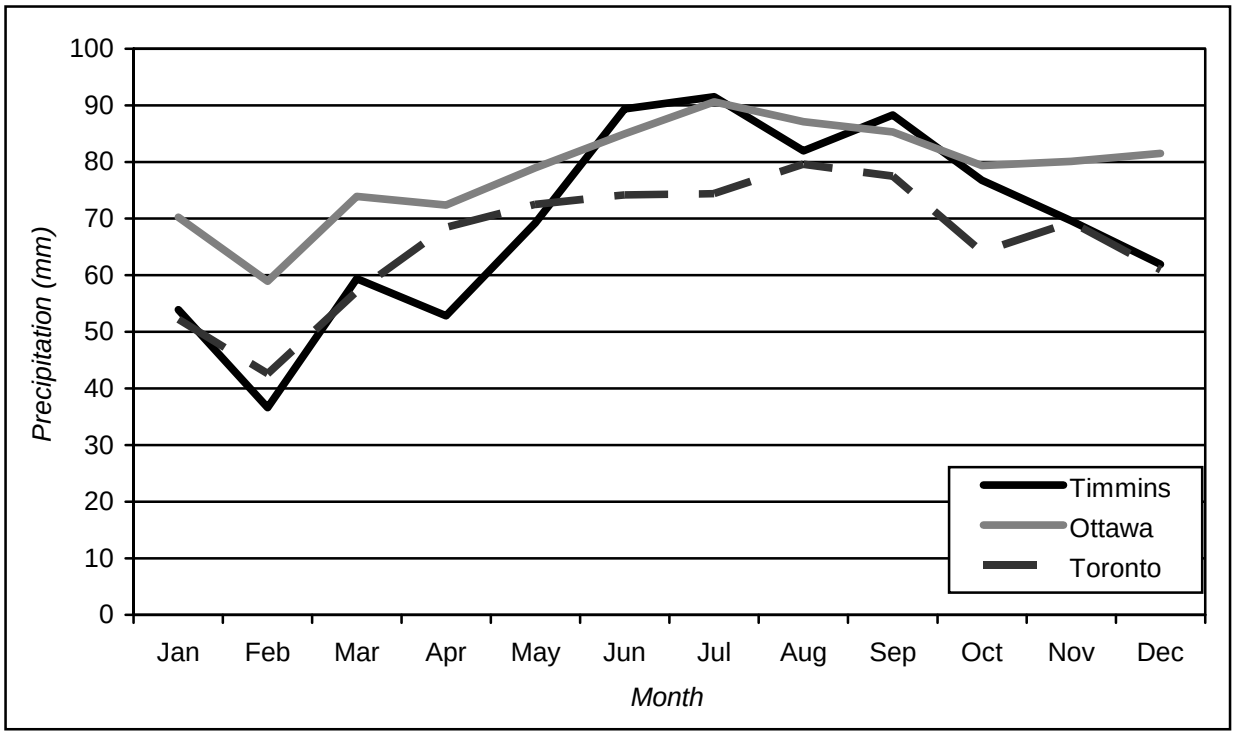

Figure 2-5 Average Monthly Precipitation (EC, 2006a)

2.5.3 Extreme Weather

Almost all of the extreme weather events recorded at the Timmins weather station have occurred in the last 30 years. Extreme weather events are shown in **Table 2.3** (EC, 2006a).

Table 2.3 Extreme Weather Events

Weather Event	Date	Value
Extreme Maximum Temperature (^{o}C)	31 July 1975	38.9
Extreme Minimum Temperature (^{o}C)	1 February 1962	-45.6
Extreme Daily Rainfall (mm)	29 July 1990	87.6
Extreme Daily Snowfall (mm)	19 March 1983	482
Extreme Snow Depth (mm)	24 December 1968	1570
Extreme Hourly Wind Speed (km/h)	3 August 1967	72

3.0 Water

This section provides a general description of existing surface and groundwater conditions in the Study Area. Water balance, watercourse characteristics, surface water quality, river ice formation, and groundwater are discussed. Further detail is provided for the Mattagami River.

3.1 SURFACE WATER

The Study Area is located in the Mattagami River watershed, a sub-watershed of the Moose River Basin. The Mattagami River is a large tributary of the Moose River. Other large Moose River tributaries include the Abitibi, Kwataboahegan, Missinaibi, and North French Rivers. The Moose River flows into James Bay. Major tributaries of the Mattagami River include the Kapuskasing and Groundhog Rivers (Buttle et al., 1998).

The largest tributary of the Mattagami River in the Study Area is the North Muskego River, south of the Town of Smooth Rock Falls. Other named tributaries include Aubin Creek, Bradburn Creek, Dargavel Creek, Jocko Creek, Pullen Creek, Rat Creek, Thorburn Creek, and White Caribou River. Watercourses in the Study Area are shown in **Figure F2-4**. In addition to watercourses, wetland areas and numerous small lakes and ponds dot the landscape surface, resulting in a considerable amount of available surface water storage.

3.1.1 Water Balance

Water balance is generally defined as the total amount of precipitation, evapotranspiration, ground water inflow, ground water outflow, and stream outflow within a specific area (Dingman, 2002). Three factors play a major role in controlling the water balance in the Study Area. Existing vegetation likely has a considerable effect on water infiltration and evaporation. Soil and bedrock influences the rate at which water can infiltrate, and climate determines the amount of precipitation and evaporation that takes place.

Densely treed areas, particularly those populated by conifers, tend to hold precipitation within the canopy. In winter, this process can redistribute the amount of snow accumulation on the ground, increase the rate of snowmelt, and result in greater sublimation (change in state from snow to water vapour). In warmer months, water evaporates more easily and remaining water takes longer to reach the ground. In the Study Area, large amounts of forest have been harvested. Large-scale forest disturbances like harvesting or substantial fires tend to result in greater snow pack accumulation, along with more water reaching the ground at faster velocities during rainfall events than would normally occur (Dingman, 2002; Buttle et al, 1998).

The presence of several wetlands in the Study Area indicates that some soil at least, is at or close to the saturation point. Saturated soil and areas of shallow drift occurring in high frequency (**Section 2.3**) indicate that surface and subsurface run-off is probably the major contributor to stream flow.

The largest proportion of surface run-off occurs during spring, when large amounts of surface water are available due to snow melt, evaporation rates are low due to temperature, and infiltration rates are also controlled by the rate of soil thawing. In harvested areas, the rate of run-off is greater than in mature forest stands as a result of soil compaction, lower interception rates, and reduced transpiration.

Although a high volume of run-off probably occurs during spring snow melt, the Study Area receives a comparatively high quantity of precipitation during the summer months. The amount of precipitation received is partially offset by higher rates of evapotranspiration, but surface run-off can still be expected to contribute to stream flow.

3.1.2 Watercourse Characteristics

The headwaters for the Mattagami River stem from Lake Mesomikenda, southwest of Gogama, Ontario (MNR et al, 2004). The Mattagami River flows approximately 443 km north from its source, southwest of the city of Timmins, to its confluence with the Missinaibi River to become part of the Moose River. The Mattagami River has a total drainage area of approximately 37,000 square km, and falls 329 m over its length (NRCan, 2004). The overall gradient of the Mattagami River is 0.74 m fall per km.

The Mattagami River has been used to produce electricity for more than 90 years. Today, the River supports eight generating stations. Seven generating stations (“GS”) are operated by Ontario Power Generation (“OPG”) and one is operated by Tembec Industries Inc. (“Tembec”). Locations of hydroelectric generating stations and other control structures in the Moose River Basin are shown in **Figure F2-5**. The Lower Sturgeon GS (OPG) is located at the southern limit of the Study Area, while the Smooth Rock Falls GS (Tembec) is located at the northern limit.

The current production capacity of generating stations on the Mattagami River is about 501 MW. However, as shown in **Table 3.1**, OPG plans to redevelop its existing stations using updated technology, resulting in a proposed capacity increase of about 413.5 MW (OPG, 2007; OPG, undated).

Table 3.1 Mattagami River Hydroelectric Generating Stations and Control Structures

Name	Type	Capacity (MW)	Proposed Capacity (MW)	Owner
Harmon GS	Generating Station	141.0	211.0	OPG
Horwood Lake Dam	Control Structure	0.0	0.0	OPG
Kipling GS	Generating Station	149.0	219.0	OPG
Little Long GS	Generating Station	133.0	203.0	OPG
Lower Sturgeon GS	Generating Station	5.0	14.0	OPG
Mattagami Lake Dam	Control Structure	0.0	0.0	OPG
Mesomikenda Lake Dam	Control Structure	0.0	0.0	OPG
Minisinakwa Lake Dam	Control Structure	0.0	0.0	MNR
Peter Long Lake Dam	Control Structure	0.0	0.0	OPG
Sandy Falls GS	Generating Station	3.0	5.5	OPG
Smoky Falls GS	Generating Station	52.0	240.0	OPG
Smooth Rock Falls GS	Generating Station	6.7	6.7	Tembec
Wawaitin GS	Generating Station	11.0	15.0	OPG
Total	**Generating Stations (8)**	**500.7**	**914.2**	
	Control Structures (5)	**0.0**	**0.0**	

The Water Survey of Canada (WSC, 2003) records river flow data from two hydrometric stations near the Study Area. The Timmins hydrometric station (Stations Nos. 04LA001 and 04LA002), located approximately 80 km south of the Project, was established in 1965 and moved 13 km downstream in 1968. Historic water flow data is available from 1965 to 2003. Since only 35 years of data (1968 to 2003) at the same location are available for the Timmins hydrometric station, long-term averages, minimums, and maximums cannot be assumed. The data is presented for comparison only. The Smooth Rock Falls hydrometric station (Station No. 04LB001) is located in the Town of Smooth Rock Falls. Data from the Smooth Rock Falls hydrometric station is available from 1920 to 1997.

During the month of May, the Smooth Rock Falls hydrometric station has a monthly average discharge of approximately 320 m^3/s, while the Timmins station has a monthly average discharge of about 138 m^3/s. Lower flow conditions usually occur from August to March at both stations. The substantial spring discharge volumes are most likely indicative of spring snow melt, which contributes a significant volume of water to the watershed over a short time period. The difference in flow volume between the Smooth Rock Falls hydrometric station and the Timmins hydrometric station is a result of effective watershed areas of 9,787 km^2 and 5,564 km^2, respectively. **Figures 3-1** and **3-2** show monthly average, maximum, and minimum discharge volumes.

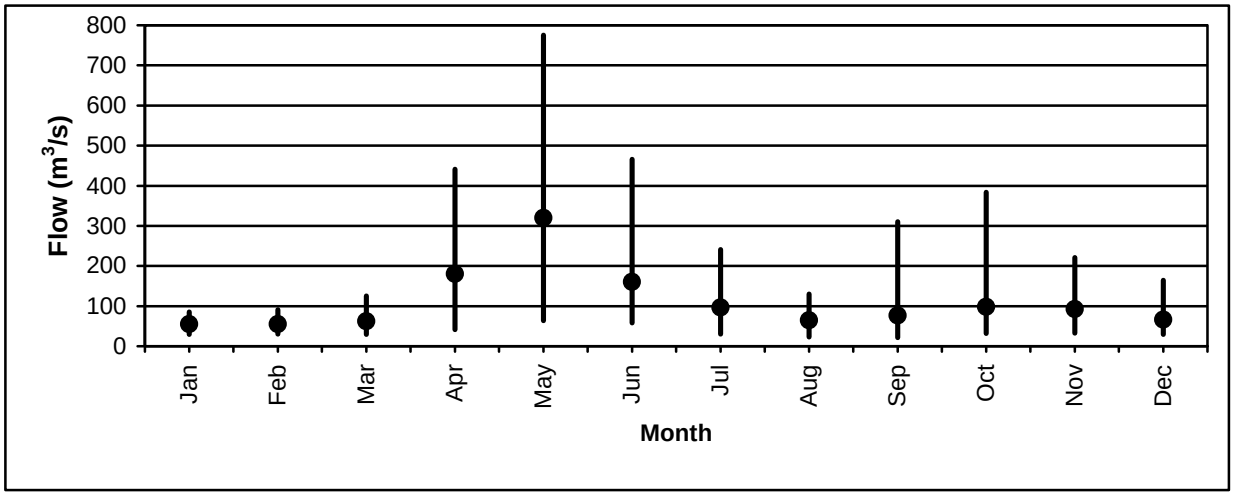

Figure 3-1 Monthly Flow at Smooth Rock Falls 04LB001 (1920 to 1997)

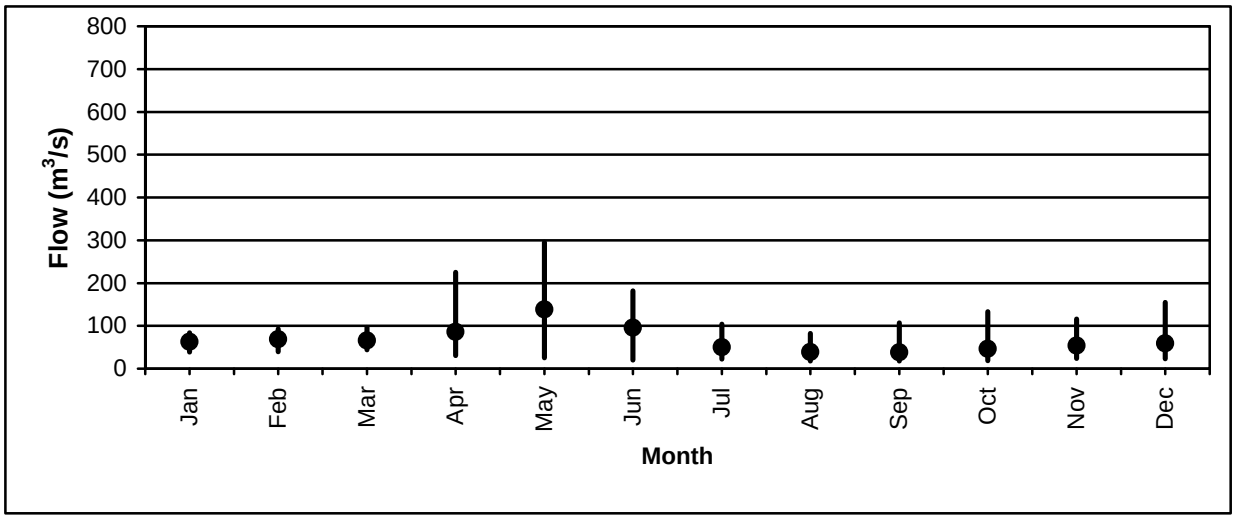

Figure 3-2 Monthly Flow at Timmins Stations 04LA001 & 04LA002 (1968 to 2003)

Extreme recorded values for the Smooth Rock Falls and Timmins hydrometric stations are provided in **Table 3.2**. The extreme maximum value exhibited at the Smooth Rock Falls hydrometric station is approximately equal to the estimated one in 20 year flood discharge volume.

Table 3.2 Extreme Recorded Flow at Smooth Rock Falls and Timmins

Station	Extreme Maximum Flow (m^3/s)	Date	Extreme Minimum Flow (m^3/s)	Date
Smooth Rock Falls	1,230.00	10 May 1960	8.21	18 October 1967
Timmins	539.00	21 May 1996	9.69	14 August 1992

Figure 3-3 shows a flood frequency analysis at the Smooth Rock Falls hydrometric station performed by Acres International Limited ("Acres"; 1990) based on a lognormal distribution. One in 1,000 and one in 10,000 year values have been extrapolated using existing data.

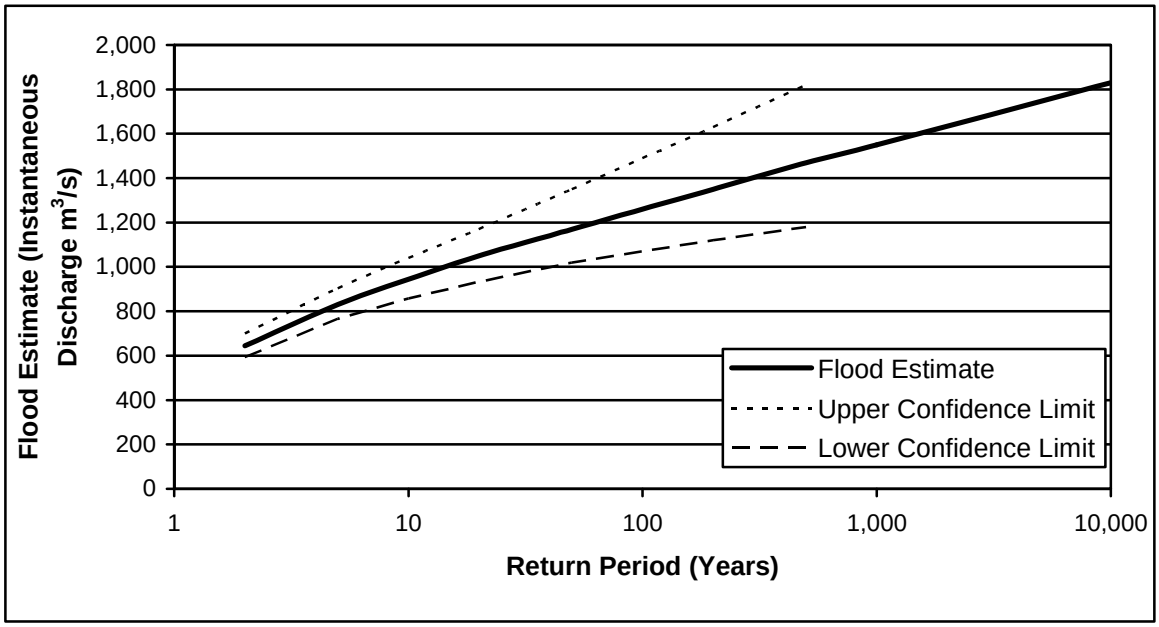

Figure 3-3 Flood Frequency Analysis (Acres, 1990)

The characteristics of several other watercourses in the Study Area are provided in **Table 3.3**. Length and gradient calculations were based on topographic information from 1:50,000 National Topographic maps with a 15 m contour interval. As such, the lengths and gradients listed below are approximate values only (Energy, Mines, and Resources Canada, 1986a; 1986b; 1989).

Table 3.3 Characteristics of Major Watercourses in the Study Area

Watercourse	Approximate Length (km)	Approximate Gradient (m/km)
Aubin Creek	5	5
Bradburn Creek	27	1
Dargavel Creek	13	2
Jocko Creek	50	1
North Muskego River	74	1
Pullen Creek	14	2
Rat Creek	7	3
Thorburn Creek	38	2
White Caribou River	48	1

3.1.3 Lower Sturgeon GS and Smooth Rock GS Operating Characteristics

As previously mentioned, two hydroelectric generating stations provide some water flow regulation through the Study Area, although both stations operate as run-of-river facilities. Operating regimes for the Lower Sturgeon GS and the Smooth Rock Falls GS were determined as part of the Mattagami River System Water Management Planning ("WMP") exercise (MNR et al., 2004). **Table 3.4** shows simulated natural and as-measured regulated flow measurements for the Lower Sturgeon and the Smooth Rock Falls Generating Stations.

Table 3.4 Simulated Natural Flow and Regulated Flow at Lower Sturgeon and Smooth Rock

Description	Lower Sturgeon GS		Smooth Rock Falls GS	
	Natural Flow	Regulated Flow	Natural Flow	Regulated Flow
Mean Annual Flow (m^3/s)	100	87.3	121	93.2
Average Rising Rate Change of Flow ($m^3/s/day$)	19.6	15.8	22.7	21.2
Average Falling Rate Change of Flow ($m^3/s/day$)	-13.3	-12.7	-14.8	-17.4

The data presented in **Table 3.4** indicates that simulated natural flow is imitated by regulated flow. The rate of change is slower than would naturally exist, and flow is significantly less than predicted in both instances.

Both generating stations are required to operate reservoir levels within maximum and minimum boundaries, measured as height above sea level ("asl"). Operating limits are described in **Table 3.5**.

Table 3.5 Operating Limits for Lower Sturgeon and Smooth Rock Falls Hydroelectric Generating Stations

Description	Lower Sturgeon GS	Smooth Rock Falls GS
Absolute maximum (m asl)	258.60	228.99
Absolute minimum (m asl)	254.17	223.28
Normal maximum (m asl)	258.42	228.92
Normal minimum (m asl)	254.17	228.77
Absolute summer minimum (m asl)	257.7	Not applicable
Other comments	Maintain daily average minimum flow of 15 m^3/s to Smooth Rock Falls for dilution of pulp and paper mill effluent	

3.1.4 Surface Water Temperature and Quality

Environment Canada (1976) recorded water temperature of selected streams throughout Ontario. Water temperature data is not available for the Mattagami River, but is available for the Groundhog River (a tributary to the Mattagami), and the Moose River, of which the Mattagami River is a tributary. Monthly average water temperature for the Groundhog River and the Moose River is presented in **Figure 3-4**. Both rivers exhibit winter temperatures at the freezing point, while summertime maximums in the Moose River can reach approximately 21°C. Since the temperature sampling location on the Groundhog River was located at about the same latitude, it is expected that temperatures on the Mattagami River are similar, or slightly higher due to the effects of impoundment upstream of the Study Area.

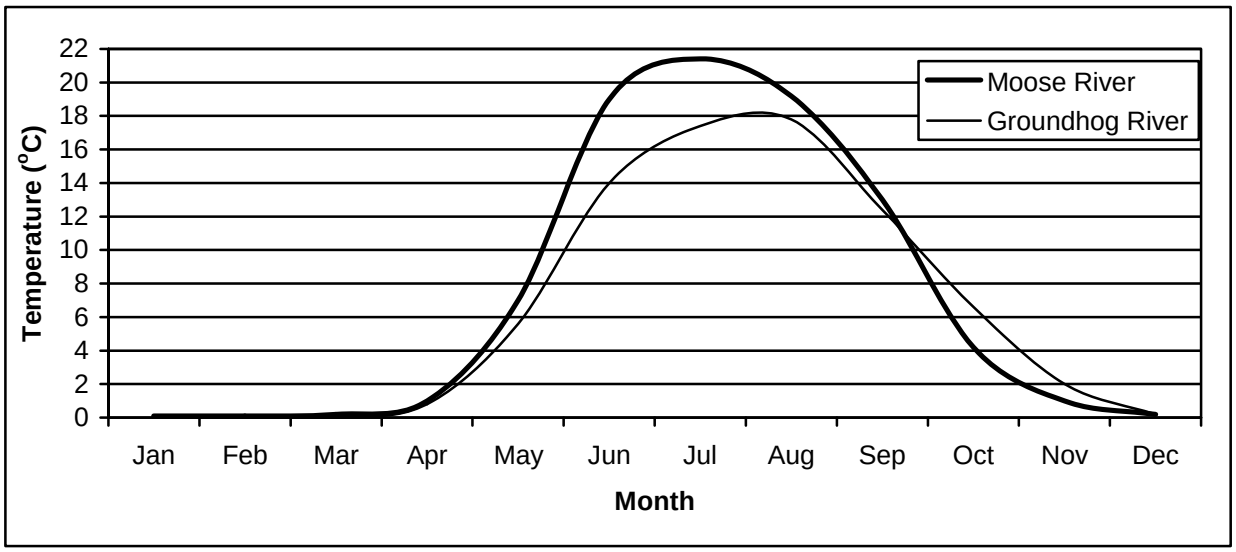

Figure 3-4 Water Temperature in the Moose and Groundhog Rivers (EC, 1976)

Water quality samples in the Study Area were taken as part of the Island Falls Hydroelectric Project Aquatic Assessment (see **Appendix G**). Water quality analysis was performed for 35 metals, inorganics such as arsenic, sodium, selenium, cyanide, nitrates and nitrites, and nutrients such total phosphorus and other factors such as nitrogen, hardness, suspended solids, and dissolved solids. A total of 18 samples were taken from 9 different locations. The results of water quality analysis at Island Falls are presented in **Figure 3-5**.

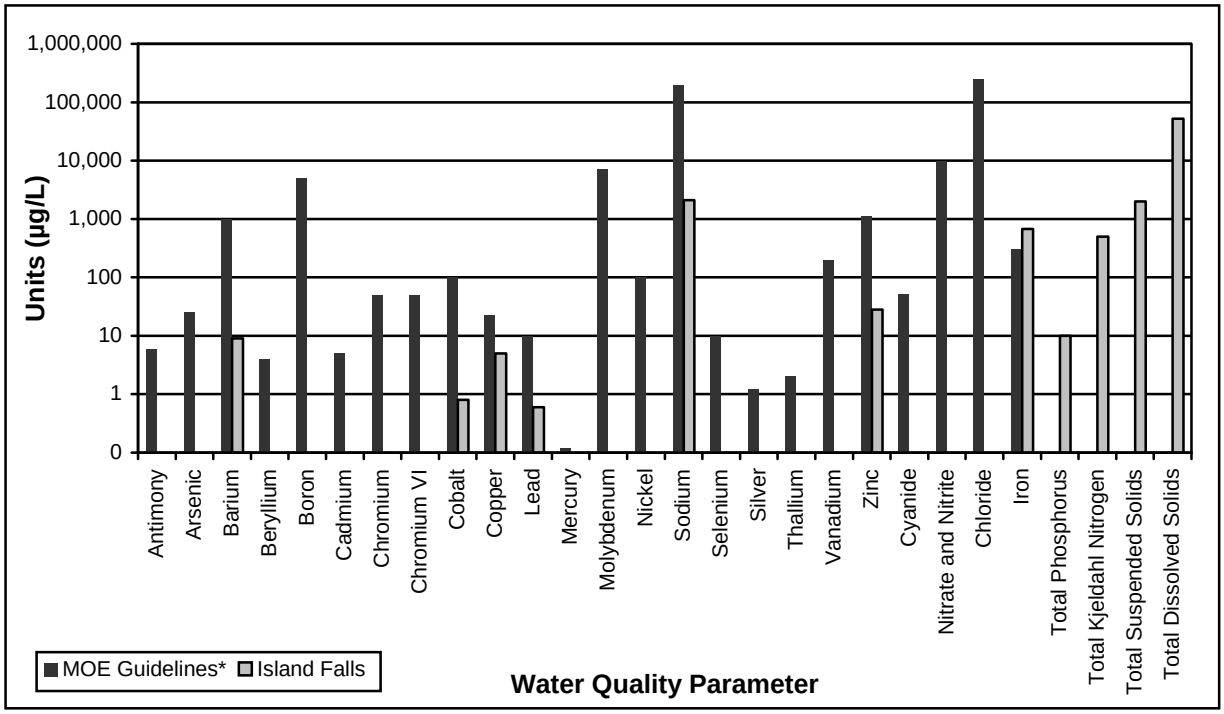

Figure 3-5 Water Quality Parameters at Island Falls

The water quality parameters listed **Figure 3-5** are within MOE guidelines for potable water in fine-grained soils (MOE, 2005). However, iron exceeds MOE aesthetic objectives for drinking water (MOE, 2006a) as is common in rivers throughout the Canadian Shield. Naturally occurring iron gives the water in the Mattagami River its yellowish colour.

3.2 ICE

The Study Area is characterized by two major drops in water elevation that result in waterfalls (Island and Yellow Falls) as well as two major sets of shallow, wide flowing, high gradient areas known as rapids (Davis and Loon Rapids). The aforementioned areas are conducive to zones of extremely high water turbulence, which favour the development of frazil ice.

Frazil ice is a natural and common occurrence on the Mattagami River during the winter months. The cold air temperatures and high surface area contact with water typical of turbulent

* Criteria shown by black bars refers to MOE 2005 Soil, Ground Water and Sediment Standards Table 2 – Full Depth, Potable (Fine Grained). In some instances, no Island Falls data is visible. In these cases, the parameter is below the range visible in the figure or below detectable range.

regions drives generation of these fine ice particles, which coagulate into frazil clusters or flocs. The flocs often grow in size until they form ice pans that eventually form a continuous ice cover. Alternatively, the flocs attach and accumulate underneath an existing ice cover, forming hanging dams that may cause natural flooding (Beltaos et al., 1989).

3.3 GROUNDWATER

Generally, groundwater provides base-flow to streams throughout the year. Groundwater moves through cracks or fissures in the bedrock, so groundwater entering at one point in the Study Area might take tens or even hundreds of years to reach a stream in another part of the Study Area. Groundwater is usually significantly cooler than surface runoff and subsurface flow, so it may provide a mitigating effect on stream temperature, especially during the summer.

According to MOE records, there are 113 water wells in the Study Area. The earliest well on record was drilled in November 1948 and the latest was drilled in August 2005. On average, water wells are drilled to a depth of about 50 m. The shallowest well is 2 m, while the deepest is 126 m (MOE, 2006b). Water well use is provided in **Table 3.6** and approximate well locations are shown in **Figure F2-4**.

Table 3.6 Water Well Use

Water Well Use	Number of Wells
Domestic	83
Livestock Use	3
Commercial Use	6
Public Supply	4
Municipal	1
Dry or Not Recorded	16
Not used	4

4.0 Air Quality and Noise

4.1 AIR QUALITY

The MOE conducted an air quality study in Timmins in 2003 with results published in 2004. The study measured concentrations of ozone ("O_3"), fine particulates ("$PM_{2.5}$"), sulphur dioxide ("SO_2"), and nitrogen dioxide ("NO_2"). Measurement of these four pollutants from July to August 2003 indicate that the Timmins area enjoys better air quality than other less northerly cities of Sault Ste. Marie, Sudbury, and North Bay. Throughout the study period, pollutant levels remained well below the Ontario Ambient Air Quality Criteria. **Figure 4-1** shows the Air Quality Index (AQI) measured during the study (MOE, 2004).

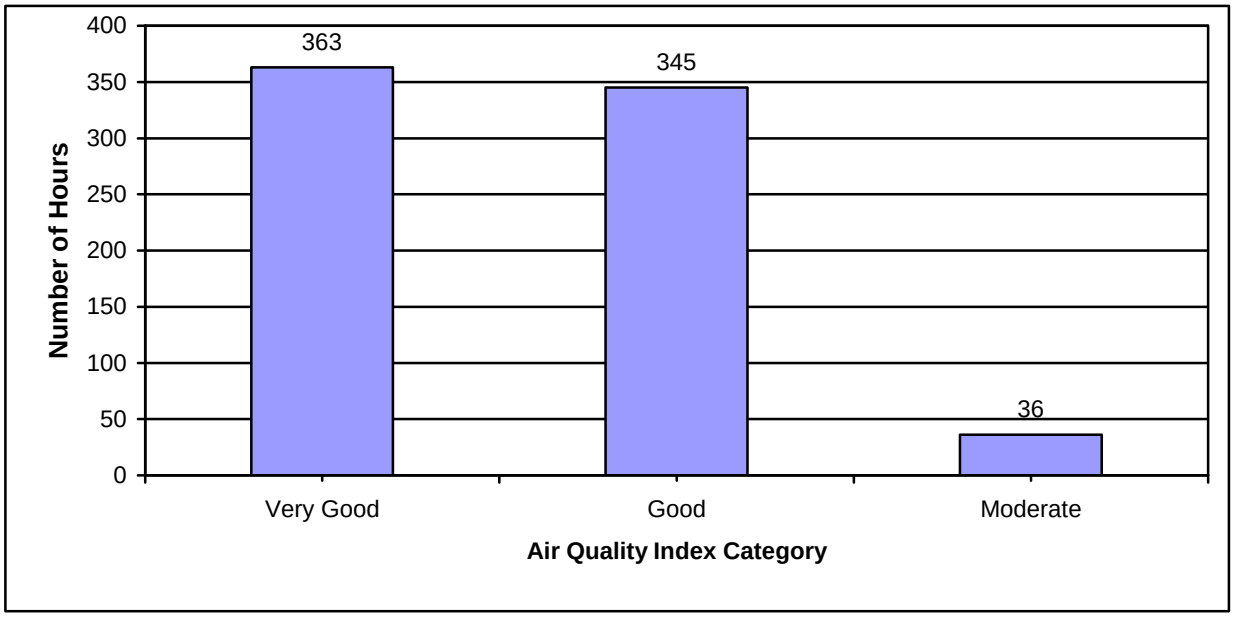

Figure 4-1 Water Quality Parameters at Island Falls

4.2 NOISE

The MOE designates "Points of Reception" for noise effects into three classes: Class 1, 2, or 3. Class 1 refers to an acoustical environment typical of a major population centre where the background noise is dominated by the urban hum. These areas are highly urbanized and have moderate to high noise levels throughout the day and night. Class 2 areas have an acoustic environment that has low ambient sound levels between 19:00 hours and 07:00 hours; where the evening and night time levels are defined by natural sounds, infrequent human activity, and there are no clearly audible sounds from stationary sources (e.g., industrial and commercial facilities). Finally, Class 3 areas are those that are rural and/or small communities with a

* Criteria shown by black bars refers to MOE 2005 Soil, Ground Water and Sediment Standards Table 2 – Full Depth, Potable (Fine Grained). In some instances, no Island Falls data is visible. In these cases, the parameter is below the range visible in the figure or below detectable range.

population of less than 1,000 with an acoustic environment that is dominated by natural sounds and little or no road traffic.

The main sources of ambient sound within the Study Area include:

- Natural sounds from wind, flowing water and other atmospheric effects as well as wildlife, etc.
- Low vehicle traffic volumes on Red Pine Road, logging roads, and ATV trails throughout the Study Area.
- High vehicle traffic volumes on Highway 11
- Human activity in the Town of Smooth Rock Falls

Most of the Study Area would be classified as a Class 3 area. However, human activity in the Town of Smooth Rock Falls, and along Highway 11 would likely result in Class 2 categorizations in those areas.

Trapper's cabins are located approximately 1,600 m and 4,700 m downstream from Island Falls respectively. Several cottages are located approximately 7,000 m or more downstream from Island Falls. One MNR Land Use Permit holder has a seasonal residence located approximately 500 m southwest of the Project site and may be a potential noise receptor.

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5.0 Natural Environment

5.1 TERRESTRIAL ENVIRONMENT

Forested areas dominate the Study Area, providing important habitat for a variety of common species of flora and fauna. The location of terrestrial environmental features is shown on **Figure F2-7.** Refer to **Appendix H** for detailed information regarding the vegetation communities within the vicinity of Project components.

5.1.1 Vegetation

Most of the Study Area is forested to some degree, as the Study Area lies within the Boreal Forest zone. The most common tree species found in this forest zone are black spruce (*Picea mariana*), white spruce (*Picea glauca*) and jack pine (*Pinus banksiana*). Other common conifer species are balsam fir (*Abies balsamea*), tamarack (*Larix laricina*) and eastern white-cedar (*Thuja occidentalis*). Tamarack and eastern white-cedar are generally found on wetter soils. Common deciduous hardwood species are trembling aspen (*Populus tremuloids*), balsam poplar (*Populus balsamifera*), and white birch (*Betula papyrifera*). Shrubs and small trees of willow (*Salix sp*.), alder (*Alnus sp*.), and other genera comprise major components of the Boreal Forest zone (*Armson, 2001*). Forest types are shown in **Figure F2-6**.

Vulnerable, Threatened, and Endangered Vegetation

In general, rare species may be at the northern or southern end of their range, and are not populous in a particular area. At-risk species are those considered to be in danger of extinction or extirpation globally or within a particular area. Rare and at-risk species may be determined at national, provincial, and municipal levels. The Government of Canada ranks species as endangered, threatened, or special concern by the Committee on the Status of Endangered Wildlife in Canada (“COSEWIC”). The Government of Ontario ranks species as endangered, threatened, or special concern by the Committee on the Status of Species at Risk in Ontario (“COSSARO”).

According to Natural Heritage Information Centre (“NHIC”) records, one provincially rare plant species has been reported within the Study Area. *Sphagnum jensenii*, a moss, is found in peatland under coniferous forests or on wet rocks near streams. It is ranked by NHIC as S2 which means that it is “imperiled in the province because of its rarity due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the province” (NHIC, 2005). The last recorded sighting of *Sphagnum jensenii* was in 1976.

5.1.2 Wetlands

Major wetland types include bogs, fens, marshes, and swamps. The MNR classifies wetlands into two categories: provincially and non-provincially significant, based on an evaluation system developed by the province. The Northern Ontario Wetland Evaluation System (OMNR, 1993) is used when evaluating wetlands north of the Canadian Shield. An evaluated wetland may be one contiguous unit, or may be a series of smaller wetlands functioning as a complex unit. Evaluated wetlands that do not qualify as provincially significant may be designated locally significant and may be protected through local planning and policy.

No wetlands in the Study Area have been identified as provincially or locally significant. Bogs and fens are abundant in the Boreal Forest zone, but few occur near Project components. Peatland and non-peatland wetland ecosystems are found along major rivers, such as the Mattagami. Please see **Figure F2-7** for the location of wetlands in the Study Area.

5.1.3 Wildlife

Wildlife depends on specific habitat types for survival, but some species are more sensitive to disturbance than others. For example, raccoons are highly adaptable to suburban environments, while grey wolves are usually found in large tracts of relatively undisturbed wilderness. Species that are less adaptable may experience a population decline if habitat is lost or if major disturbance occurs. Usually, habitat type is indicative of the types of species that may potentially occur in the area. Detailed information regarding wildlife in the vicinity of the Project is provided in **Appendix H.**

The Study Area is predominantly uninhabited forest. However, extensive logging practices over the last century have altered the forest from its natural state. Many wildlife species within the Boreal Forest zone have adapted to old growth forest conditions, and logging practices can have an effect on their natural habitat. There are several moose feeding areas, early wintering areas, and wintering areas throughout the Study Area. Beaver dams are also prevalent throughout the Study Area **(Figure F2-7)**.

Common wildlife species within the Study Area were determined through use of the *Atlas of the Mammals of Ontario* and the Ontario Herpetofaunal Summary Atlas (Dobbyn, 1994; OMNR, 2002; **Table 5.1**). The Atlas of the Breeding Birds of Ontario (2006) lists 180 species that were recorded during 2001-2005 in the 100 x 100 km block (UTM reference 17ME) that includes the Study Area. For a list of common bird species, refer to **Attachment C** in **Appendix H**.

Table 5.1 Common Wildlife (Recorded 1970 to 1993)

Common Name	Scientific Name
Carnivores	
Black Bear	*Ursus americanus*
Bobcat	*Lynx rufus*
Canada Lynx	*Lynx canadensis*
Fisher	*Martes pennanti*
Gray Wolf	*Canis lupus*
Marten	*Martes americana*
Mink	*Mustela vison*
Raccoon	*Procyon lotor*
Red Fox	*Vulpes vulpes*
River Otter	*Lontra canadensis*
Striped Skunk	*Mephitis mephitis*
Ungulates	
White-tailed Deer	*Odocoileus virginianus*
Moose	*Alces alces*
Rabbits and Hares	
Snowshoe Hare	*Lepus americanus*
Rodents	
Eastern Chipmunk	*Tamias striatus*
Woodchuck	*Marmota monax*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Flying Squirrel	*Glaucomys sabrinus*
Beaver	*Castor canadensis*
Muskrat	*Ondatra zibethicus*
Porcupine	*Erethizon dorsatum*
Herpetofauna	
American Toad	*Bufo americanus*
Northern Leopard Frog	*Rana pipiens*
Eastern Garter Snake	*Thamnophis sirtalis*

Vulnerable, Threatened, and Endangered Wildlife

A search of the NHIC database (NHIC, 2005) found two rare species: Red-disked Alpine, and Lake Emerald (**Table 5.2**).

Table 5.2 Vulnerable, Threatened, and Endangered Wildlife (NHIC, 2005)

Scientific Name	Common Name	MNR Ranking (Srank)	COSEWIC	Date
Erebia discoidalis	Red-disked Alpine	Vulnerable (S3)	n/a	1992-05-30
Somatochlora cingulata	Lake Emerald	Imperiled-vulnerable (S2-S3)	n/a	

The Red-disked Alpine is a butterfly that is generally found throughout Boreal Canada. It may be locally abundant in eastern Canada, but is widespread in the west. The Red-disked Alpine prefers moist prairie habitats and grassy areas on bog margins; in Manitoba it also occurs along forest edges and in dry meadows and sandy ridges in open jack pine forests; in Saskatchewan it is reported from gravelly prairie knolls. Their flight is very weak and close to the ground; they usually perch on grasses or on the ground. The upper wing surface is dark brown with a reddish flush in the center of the forewing. A reddish patch is revealed on the underside of the forewing as well. There are no eyespots (Bryan, 2006).

The Lake Emerald is a species of dragonfly that inhabits lakes and occasionally large rivers. It is present throughout Southern Canada and the northernmost eastern United States, although it is uncommon. They feed high, with the males flying over open water without hovering and they seldom come near shore. They are not a territorial species (Dunkle, 2000). The Lake Emerald is ranked as “Imperiled-vulnerable” by the NHIC which indicates that its rarity may be due to restricted range, very few or relatively few populations (20 to 80 or fewer), steep or recent and widespread declines, or other factors making it vulnerable to extirpation from the province (NHIC, 2005).

5.2 AQUATIC ENVIRONMENT

The Mattagami River and tributaries support a wide variety of aquatic fauna and flora. A general overview of the aquatic environment is provided below. A detailed assessment of the aquatic environment is provided in **Appendix G**.

5.2.1 Aquatic Habitat

The Study Area contains a diversity of fish habitats including riffle, run, and pool habitats. Pool and run habitats dominate the reaches between the two impoundments at Smooth Rock Falls and Lower Sturgeon Falls. Abundances of these morphological features within the Study Area are generally similar to occurrences elsewhere in the middle reaches of the Mattagami River. Five areas of high-velocity morphology (riffles or falls) occur in this approximately 60 km reach,

four of which fall within the Project Study Area. The fifth occurs at the base of Lower Sturgeon Generating Station.

The riffle extending from the base of Lower Sturgeon Generating Station to the northern boundary of Mahaffy Township has been designated as a fish sanctuary by the MNR (see **Figure F2-7**), primarily due to recreational angling during walleye spawning season. No fishing is allowed from 1 April to 14 June (MNR 2005, 2006a).

5.2.2 Aquatic Fauna

The Mattagami River contains approximately 29 fish species (**Table 5.3**; Seyler, 1997). White sucker are the most common large-bodied fish within the Study Area, followed by walleye, northern pike, and lake sturgeon respectively. Walleye and northern pike are major sport fish throughout the Study Area.

Table 5.3 Fish Species in the Mattagami River Watershed (from Seyler, 1997)

Common Name	Scientific Name	Comments
Lake sturgeon	*Acipenser fulvescens*	Resident in lower reaches only
Brook trout	*Salvelinus fontinalis*	Resident in tributaries only
Lake whitefish	*Coregonus clupeaformis*	
Lake herring	*Coregonus artedii*	
Northern pike	*Esox lucius*	
Goldeye	*Hiodon alosoides*	Resident in lower reaches only
Longnose sucker	*Catosotomus catostomus*	
White sucker	*Catosotomus commersoni*	
Redhorse	*Moxostoma sp*	
Lake chub	*Couesius plumbeus*	
Golden shiner	*Notemigonus crysoleucas*	
Emerald shiner	*Notropis atherinoides*	
Common shiner	*Notropis cornutus*	
Blacknose shiner	*Notropis heterolepis*	
Spottail shiner	*Notropis hudsonius*	
Fathead minnow	*Pimephales promelas*	
Longnose dace	*Rhinichthys cataractae*	
Fallfish	*Semotilus corporalis*	Found in lower reaches only
Pearl dace	*Semotilus margarita*	

Table 5.3 Fish Species in the Mattagami River Watershed (from Seyler, 1997)

Common Name	Scientific Name	Comments
Burbot	*Lota lota*	
Brook stickleback	*Culaea inconstans*	
Nine-spine stickleback	*Pungitius pungitius*	
Trout-perch	*Percopsis omiscomaycus*	
Smallmouth bass	*Micropterus dolomieui*	Resident in upper reaches only
Yellow perch	*Perca flavescens*	
Walleye	*Stizostedion vitreum vitreum*	
Johnny darter	*Etheostoma nigrum*	
Logperch	*Percina caprodes*	
Mottled sculpin	*Cottus bairidi*	

Vulnerable, Threatened, and Endangered Aquatic Species

Lake Sturgeon are distributed extensively throughout the Laurentian Great Lakes, Hudson Bay/James Bay, and the Mississippi River System, as well as the Moose River. Their distribution in Canada spans the five provinces of Alberta, Saskatchewan, Manitoba, Ontario, and Quebec (Scott and Crossman, 1973). More effort has been directed toward understanding the biology of lake sturgeon in the Moose River Basin than any other fish species (Seyler, 1997). Sturgeon presence in the Moose River Basin is essentially limited to major rivers.

Lake sturgeon are listed as a species of special concern in the Southern Hudson Bay/James Bay area (COSEWIC, 2007), but have not been listed in the *Species at Risk Act* ("SARA"). The NHIC ranks Lake Sturgeon as vulnerable (S3), but they are considered to be "not at risk" by COSSARO, since a risk category has yet to be assigned by the MNR (MNR, 2006).

5.3 DESIGNATED NATURAL AREAS

No Areas of Natural and Scientific Interest ("ANSIs") exist in the Study Area (NHIC, 2005). However, there are three conservation reserves and one forest reserve in the Study Area (NHIC, 2005).

Practices that are not permitted in a conservation reserve include aggregate extraction, commercial power generation development, commercial timber harvesting, new energy transmission and communication corridors, mineral exploration and development, peat extraction, off trail ATV and snowmobile use, collecting for science, education or heritage appreciation or the establishment of new private recreation camping or non-resident guided bear hunting. Depending on certain conditions, there may be other practices that are not permitted in conservation reserves (MNR, 2006f, 2006g).

Practices that are not permitted in a forest reserve include, aggregate extraction, commercial power generation development, commercial timber harvesting, peat extraction, Crown Land disposition for agriculture, cottaging, rural residential or urban development, and new road development and maintenance, unless for resource extraction or mineral exploration and development (MNR, 2006h).

The Geary Township Shoreline Bluff is a 610 hectare conservation reserve in the south end of the Study Area in the District of Timmins. It is a shoreline bluff cut into a till covered upland area. The shoreline bluff may represent a water level of Glacial Lake Barlow-Ojibway. It was designated as a conservation reserve because the bluff is a good example of a raised erosional shoreline (MNR, 2006e).

The Mahaffy Township Ground Moraine is a 640 hectare conservation reserve in the south end of the Study Area within Mahaffy Township, approximately 2 km north of Sturgeon Falls GS on the Mattagami River. It was approved as a Conservation Reserve in 2004 since it contains locally significant broken ground moraine, glaciolacustrine, and organic deposits supporting complex vegetation including old growth spruce, alder, and treed muskeg (MNR, 2004).

The North Muskego River Mixed Forest Conservation Reserve is a 3,823 hectare conservation reserve in the southwest section of the Study Area in the Cochrane District. This conservation reserve contains areas designated old growth forest with vegetation types such as old growth spruce, and poplar and white birch stands.

The North Muskego River Mixed Forest is a 6 hectare forest that comprises a small portion of land located on the eastern boundary of the North Muskego River Mixed Forest Conservation Reserve. It was originally part of the conservation reserve, however, during the preparation of the North Muskego River Mixed Forest Conservation Reserve in the Ontario Living Legacy Land Use Strategy and through subsequent boundary refinement and inventory process, it was found that there was an existing mining claim within the area. This resulted in this area being defined as the North Muskego River Mixed Forest. Within the forest reserve, protection of natural heritage and special landscapes is a priority. However, some resources can be used in certain conditions. If the mining claim is retired through normal processes, resulting in no further potential for resource use in the area, the forest reserve will once again be considered part of the North Muskego River Mixed Forest Conservation Reserve.

Refer to **Figure F2-7** for the locations of these natural areas.

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6.0 Resources

6.1 MINERALS, AGGREGATES, AND HYDROCARBONS

6.1.1 Aggregate and Mineral Resources

No major producers or exploration projects for base metals, coal, ferrous, or precious metals exist in the Study Area (Natural Resources Canada, 2004). There are no abandoned mines in the Study Area (MNDM, 2004a). There are 18 areas identified by the MNDM as pits and quarries in the Study Area (**Figure F2-8**).

According to the MNDM Mineral Deposit Inventory Version 2 ("MDI2"), the following element and mineral deposits may occur within the Study Area: apatite, rare earth elements, copper, nickel, gold, iron, magnetite, nickel, zinc, and peat. Most of these mineral deposits are found in the southern portion of the Study Area. There are areas of active mining leases and patents, as well as active mining claims, throughout the Study Area, predominantly in the southern portion, generally coinciding with the element and mineral deposits (MNDM, 2004b).

There are six areas identified as land withdrawals and notifications (Crown land that is unavailable for resource extraction, exploration, or claims according to MNR policy) in the Study Area. The three largest areas, located in the southern portion of the Study Area, are the North Muskego Forest Conservation Reserve, Geary Township Shoreline Bluff Conservation Reserve and Mahaffy Township Ground Moraine Conservation Reserve.

The location of the mineral and element deposits, pits and quarries and the areas under active mining claims, active mining leases and patents and land withdrawls and notifications are shown in **Figure F2-8**.

6.1.2 Hydrocarbon Resources

Oil and gas are usually found in sedimentary rocks. The Study Area is located on the Canadian Shield, and the bedrock is mostly composed of metavolcanic and metasedimentary rock, which do not support hydrocarbon resources.

6.2 AGRICULTURE

Agricultural information and statistics were obtained from Statistics Canada ("StatsCan") 2001 census data and Ontario Ministry of Agriculture, Food, and Rural Affairs ("OMAFRA") statistics (2001). As statistical agricultural data is not available specifically for the Study Area, data for Cochrane District, which includes the Study Area, is used.

Agriculture has not played a predominant role in the Study Area due to poor soil quality. There are 204 farms in the Cochrane District, with a total area of 31,109 hectares. The majority of this land is cropped (11,805 hectares) and the main crop is hay (9,857 hectares). The major product for farms with sales greater than $2,500 is cattle (74 of 174 farms or 43%).

6.3 SOIL CAPABILITY FOR AGRICULTURE

Agricultural soils and soil capability were determined using soil maps and descriptions published by OMAFRA, and the Canada Land Inventory for Agriculture ("CLI").

6.3.1 Canada Land Inventory for Agriculture

The CLI categorizes land into seven classes that reflect the capability of soil to support agriculture. Class 1 lands are considered the most productive, while Class 7 lands are least productive. Classes 1 to 4 represent arable land. Organic soils are not rated. The classification system reflects limitations such as slope, shallow soil, climate, excess water, drainage, and fertility.

The dominant agricultural limitations of the soils within the Study Area are adverse climate (subclass c), and excess water (subclass w). Adverse climate denotes insufficient growing-season temperatures to bring crops to maturity. Excess water indicates that soils have an excess of water that may result from inadequate soil drainage, a high water table, seepage, or runoff from surrounding areas (AAFC, 1998).

Class 3 soils have moderately severe limitations that restrict the range of crops or require special conservation practices. The limitations affect one or more of the following practices; timing and ease of tillage, planting and harvesting, choice of crops, and methods of conservation. Under good management they are fair to moderately high in productivity for a range of crops.

Class 4 soils have severe limitations that restrict the range of crops, require special conservation practices, or both. The limitations seriously affect one or more of the following practices; timing and ease of tillage, planting and harvesting, choice of crops, and methods of conservation. The soils are low to fair in productivity for a fair range of crops but may have high productivity for specially adapted crops.

The three dominant CLI capability classes in the Study Area are Class 4 (29% or 55,279 ha), Class 3 (25% or 49,166 ha), class 5 (9%, 16,736 hectares), and class 7 (1%, 1,926 hectares) soils. Organic soils make up 36%, or 70,456 ha within the Study Area (**Figure F2-9**).

6.4 FORESTRY

A forest dependent community is one that depends on a forest region for at least 50% of its total economy. The Town of Smooth Rock Falls is a 75-100% Forest Dependent Community. The remainder of the Study Area is a 50-75% Forest Dependent Community (NRCan, 2004b). In 2004, the Town of Smooth Rock Falls was a 75-100% Forest Dependent Community, and the remainder of the Study Area was a 50-75% Forest Dependent Community (NRCan, 2004b). It is unknown at this time what affect the closure of the Tembec Pulp and Paper Mill will have on the dependence of these communities in the Study Area on the forestry industry.

The forest in the Study Area lies within the Smooth Rock Falls Forest, and is entirely within the Boreal Forest region of Canada. It consists of a total area of 533,785 hectares, of which 502,267 hectares is publicly owned Crown land. The remainder is private land (4,917 hectares), provincial parkland (1,803 hectares), and land identified by the Ontario Living Legacy as future parks or conservation areas (24,798 hectares, referred to as Crown non-Managed). The forest lies within 30 townships and three un-surveyed areas. Two major rivers, the Mattagami and the Abitibi, traverse the forest longitudinally (SmartWood, 2005).

The administration of this forest is the responsibility of the Northeastern Ontario Forest Operations Forest Resource Management, Tembec, and the MNR. Under MNR regulation, Ontario's Crown forests are divided into geographic planning areas referred to as forest management units. The majority of these units are managed by independent forest companies that have acquired a Sustainable Forest License ("SFL"). Before any forestry activities can take place in a management unit, there must be an approved forest management plan in place for each management unit. The MNR Cochrane District oversees the development of the forest management plan.

The Smooth Rock Falls Forest Management Plan (2005) states that Tembec must comply with the following wood supply commitments:

- Make available annually to Norbord Industries Inc. (Cochrane veneer and plywood mill) 400 m^3 of veneer quality Aspen logs.
- Make available on the open market to Columbia Forest Products for use in their plywood mill at Rutherglen, Ontario a target volume of 400 m^3 of veneer quality white birch logs.
- Make available to Grant Forest Products Inc. for use in their oriented strandboard mill at Timmins, Ontario a target volume of 7,600 m^3 of non-veneer quality aspen poplar logs and 3,300 m^3 of non-veneer quality white birch logs.

Projections of the Available Harvest Area within the Smooth Rock Falls Forest for the next five-year term (2005-2010) of the plan are 17,184 hectares. The planned harvest area however, is 2,450 hectares less than this at 14,735. An approved amendment will attempt to more closely approach the available harvest area (Unknown, 2005).

Once the logs are cut, they are shipped to Tembec's mill in Timmins, Ontario. Tembec is a large, diversified and integrated forest products company. They are principally located in North America and France and employ approximately 10,000 people. On 31 July 2006, Tembec's Smooth Rock Falls pulp mill was closed. This was due in part to the increased value of the Canadian dollar and high manufacturing costs at the site in comparison to global competition. This paper mill produced 200,000 tonnes of Northern Bleached Softwood Kraft ("NBSK") pulp annually and the decision to make it idle will affect approximately 230 employees. Tembec will continue to monitor the market to determine when, or if, a future resumption of operations is possible (Toronto Stock Exchange, 2006).

Natural disturbances contribute to the landscape diversity of the boreal forest. Fire, insect infestation (such as the spruce budworm), disease and windthrow occur at different times and places across the forest. The result of this is a patchwork or "mosaic" of many different sized, even-aged groups of trees at different stages of growth (**Figure F2-6**; NRCan, 2004).

The spruce budworm is a destructive defoliator of coniferous species. Prolonged outbreaks cause severe branch and top kill and ultimately lead to tree mortality (NRCan, 2006). As shown in **Figure 6-1**, insect infestation is a significant disturbance in the eastern and central regions of Canada where outbreaks of spruce budworm cause extensive damage to commercially valuable stands of fir and spruce. Between 1980 and 1993 over 6.6 million hectares of forest land in the eastern boreal forest were affected by the spruce budworm. Had it not been for extensive aerial spraying, the affected area would have been much more widespread (NRCan, 2004b).

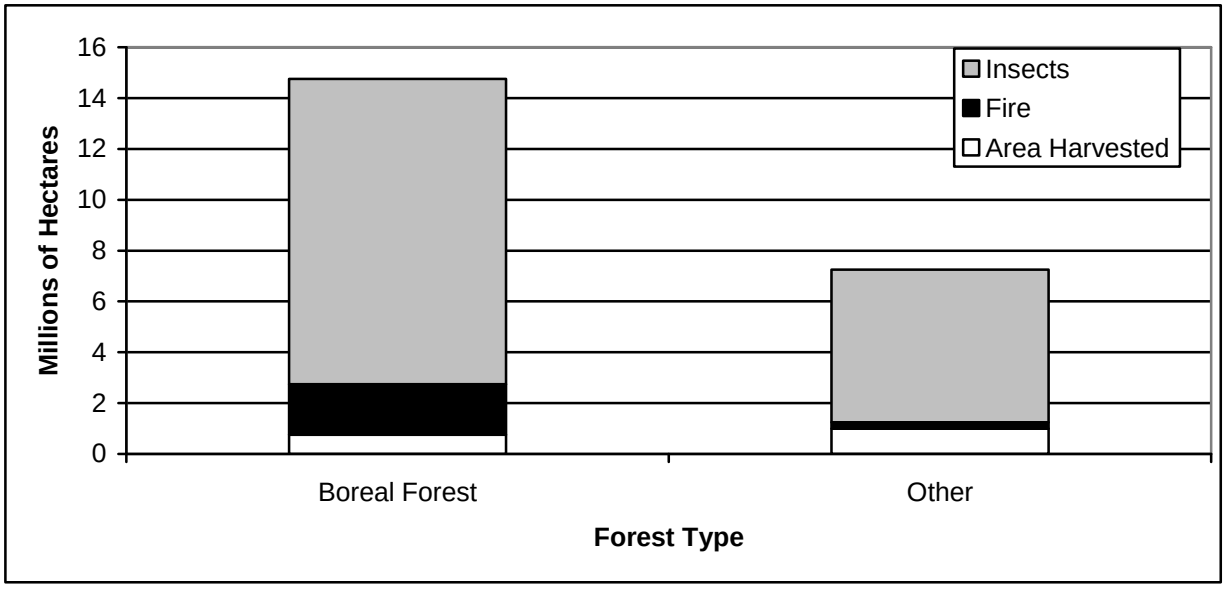

Figure 6-1 Boreal Forest Disturbances

Source: Policy and Economics Directorate, Canadian Forest Service, Ottawa.

6.4.1 Forest Fire Management

The province is divided into two forest fire regions under the Forest Fire Management Unit of the MNR. The Study Area is located in the East Fire Region. As a result of extensive forest cover, forest fires are a fairly common occurrence. From 1 January 2006 to 17 October 2006, 43 forest fires had occurred in the MNR's Cochrane District, consuming over 2,000 hectares. Over the last ten years, 44% of forest fires were caused by people (MNR, 2005).

6.5 GAME, FISH, AND WILD FOODS

Portions of 11 registered trap line areas (MNR Trap Line reference numbers CC32, CC61, CC63, CC64, CC66, CC67, CC68, CC69, CC117, CC121, and TI35) are located in the Study Area (See **Figure F2-10**). Target animals for traps include beaver, muskrat, otter, weasel, marten, fisher, raccoon, badger, coyote, wolf, lynx and bobcat (Fur Trade Institute of Canada, 2004). Trapping is encouraged in the area in order to meet quota levels. Requests for new trap lines are assessed by the MNR on a case-by-case basis.

More than 30 species of fish are present in the Study Area including three common game species: walleye, pike, and whitefish. Proposed commercial fishing operations are considered by the MNR for only coarse fish species (MNR, 2005b). Sturgeon are absent upstream of Yellow Falls due to a historical commercial fishery that operated between the 1930's and 1970's. The fishery was closed after catches significantly declined (See **Section 5.2.2**).

Under the Crown Land Use Policy Atlas, wild rice harvesting is permitted in the Study Area. Wild rice stands have been identified in the Study Area (**Figure F2-10**), however no commercial areas exist.

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7.0 Socio-Economic Features

7.1 MUNICIPAL STRUCTURE

The Study Area is located in the District of Cochrane and includes the Town of Smooth Rock Falls. Most of the Study Area is comprised of Crown Land. MNR policies determine which activities may occur on Crown Land.

The Town of Smooth Rock Falls provides services to approximately 1,600 residents located within the municipal boundaries. Municipal departments include administration, public works, recreation and the fire department. The Town Council is comprised of four councilors and the mayor. A new council is elected every four years. A committee system is also operated by the Council, including the following committees - administration and finance, public works, recreation, planning, and by-law/policies (Town of Smooth Rock Falls, 2006)

7.2 POPULATION

The Town of Smooth Rock Falls and the Village of Departure Lake are the only population centres in the Study Area. Although census data for the entire Study Area is not available, census data for Smooth Rock Falls can be seen as representative. 2006, 2001 and 1996 census data is used where appropriate. For comparison, census data from the District of Cochrane and the Province of Ontario is shown.

The population of Smooth Rock Falls has decreased significantly over the past ten years. As shown in **Table 7.1**, the population in 2001 was 1,830, a decrease of 7.7% since the 1996 Census, when the population sat at 1,982. Between 2001 and 2006, the population decreased another 19.5% to 1,473. The District of Cochrane also showed decreasing population trends over the two Census periods. Between 1996 and 2001, the population decreased 8.6%, and between 1001 and 2006, it decreased another 3.2%. The population of Ontario has continually increased from the 1996 Census. At the time of the 2001 Census, the population had risen 6.1%, and it rose another 6.6% at the time of the 2006 Census. From 1991 to 2001, the population decreased 10.4% in Smooth Rock Falls (Smooth Rock Falls Community Adjustment Committee, 2005).

Table 7.1 Study Area Population

Area	1996 Population	2001 Population	2006 Population	1996-2001 Population Change (%)	2001-2006 Population Change (%)
Smooth Rock Falls	1,982	1,830	1,473	-7.7	-19.5
District of Cochrane	93,240	85,247	82,503	-8.6	-3.2
Ontario	10,753,573	11,410,046	12,160,282	6.1	6.6
References: Statistics Canada 2001(a)(b), 2006(a)(b)					

The population of Smooth Rock Falls is older than that of the District of Cochrane or Ontario (**Figure 7.1**) People between the ages of 5 to 44 represent a smaller percentage of the population in Smooth Rock Falls than they do in the District of Cochrane or Ontario (Statistics Canada, 2006). Similar to many rural and northern communities, it is possible that younger people are leaving the community in search of employment or educational opportunities elsewhere.

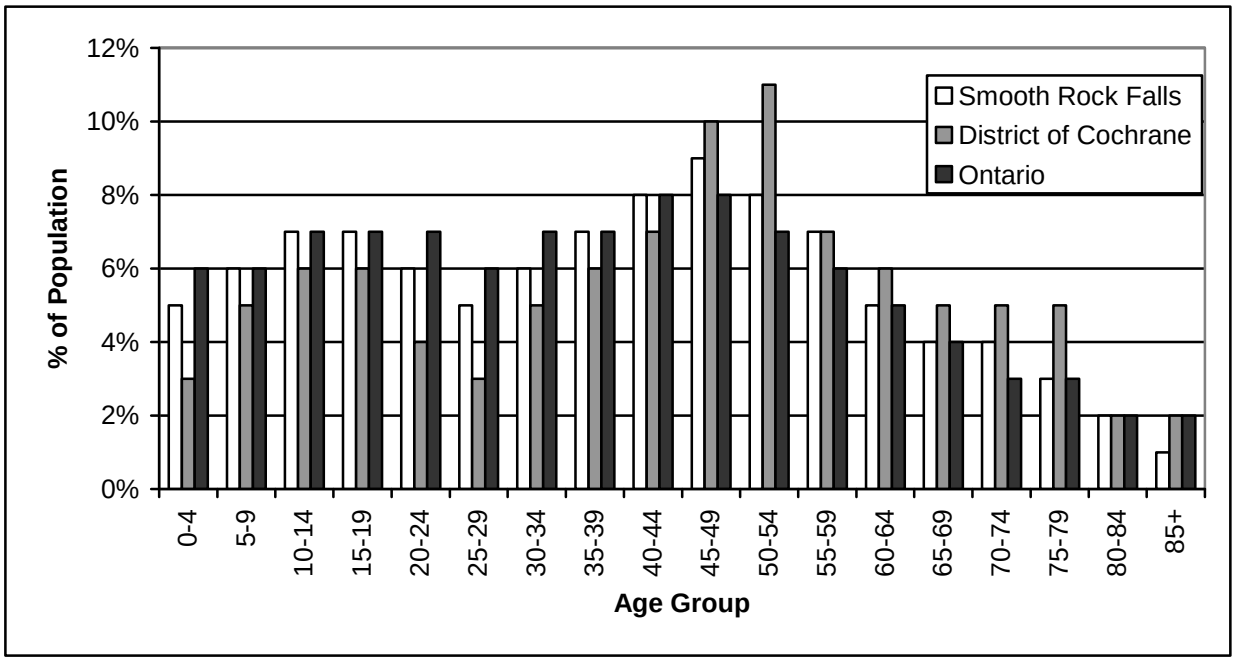

Figure 7.1 Age Distribution

Most of the people living in the Study Area (98%) were born in Canada. No visible minorities are represented. In contrast, 72% of the people living in Ontario were born in Canada, and 18% of the population represents visible minorities. Comparatively, the Study Area is less diverse than the population of Ontario. Approximately 45 aboriginals are located within Smooth Rock Falls (Statistics Canada, 2006).

The education level of people living in the Study Area varies from the population of Ontario in general. A smaller percentage of residents of Smooth Rock Falls and the District of Cochrane complete high school than the population of Ontario. However, a greater percentage of the populations of Smooth Rock Falls and the District of Cochrane achieve a trade school diploma. A smaller percentage of the populations of Smooth Rock Falls and the District of Cochrane have completed a university degree or diploma than the general Ontario population (**Figure 7-2**; Statistics Canada, 2006a,b).

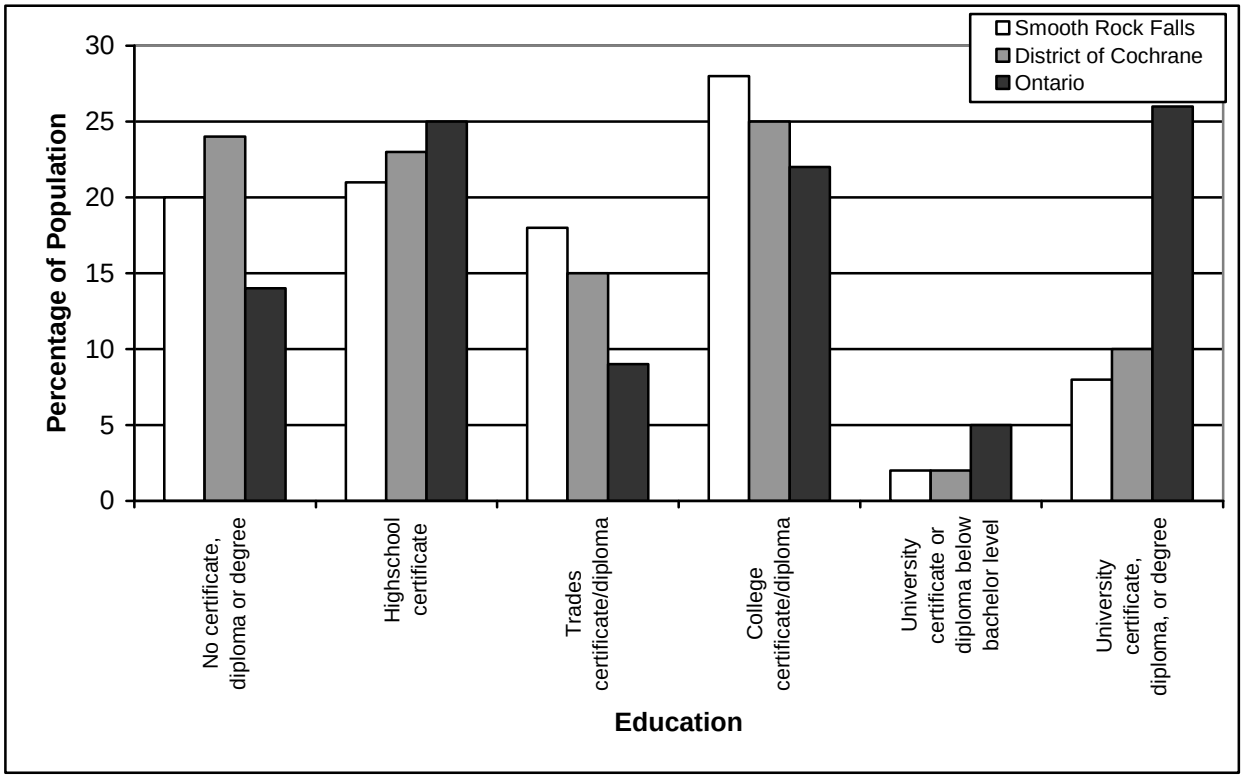

Figure 7-2 Education for Population Aged 20 to 64 Years (2006)

Language preferences in the Study Area also vary significantly from the population of Ontario. A greater percentage of the population of Smooth Rock Falls speaks French only, or is bilingual. **Figure 7-3** shows knowledge of official languages for populations of Smooth Rock Falls, the District of Cochrane, and the Province of Ontario (Statistics Canada, 2006a,b).

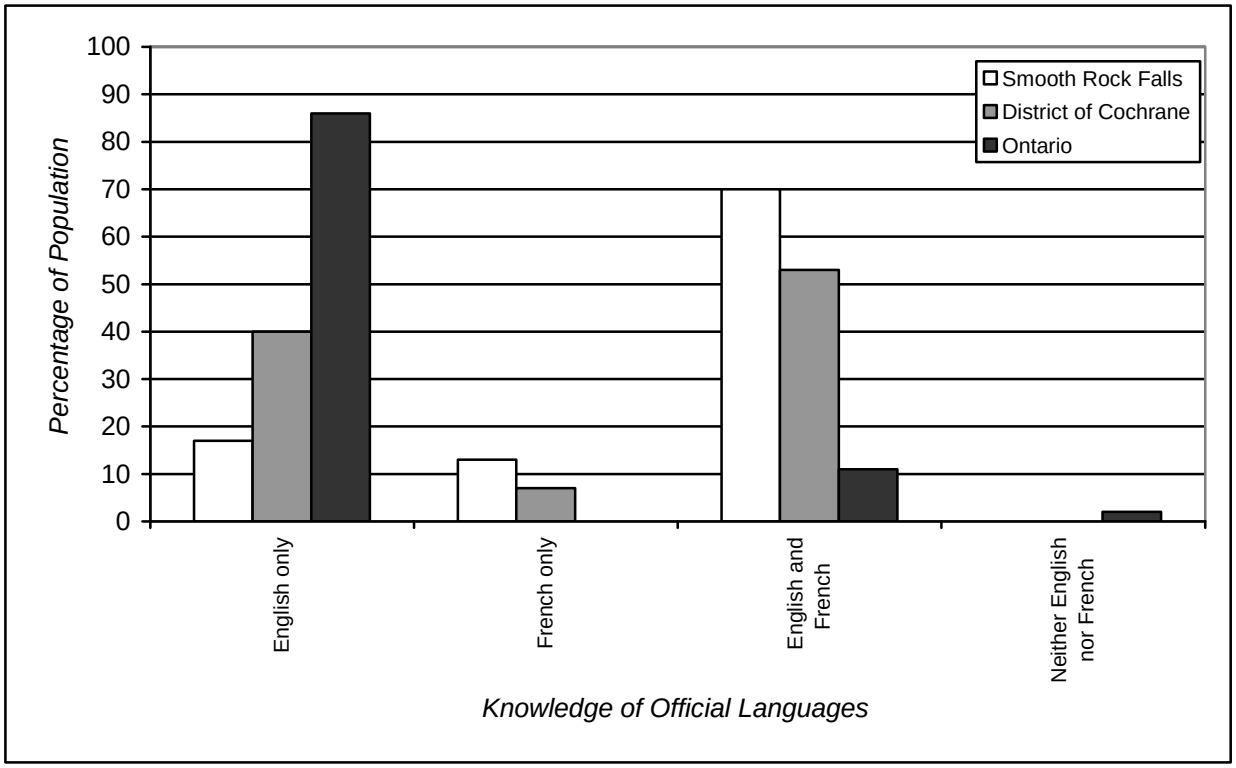

Figure 7-3 Knowledge of Official Languages (2006)

7.3 INSTITUTIONAL CHARACTERISTICS

Institutions in the Study Area include schools, hospitals, and libraries. Education is provided at three schools in the Study Area in both official languages, including L'Ecole catholique Georges-Vanier, governed by the Conseil scolaire catholique du district des Grandes-Rivieres, (Kindergarten to Grade 12), the Smooth Rock Falls Public School, and the Smooth Rock Falls Secondary School. Both are housed at the Basil Merchant Education Centre and directed by the District School Board Ontario North East.

Primary health care is provided by the Smooth Rock Falls Hospital. The hospital provides 24-hour emergency care along with 14 acute care beds and 20 long-term care beds. The local ambulance service is also located at the hospital. The North Cochrane Detoxification Centre, funded by the Ontario Ministry of Health, provides services to people who are addicted to alcohol or drugs. Health services are shown in **Figure F2-10**.

The Public Library in Smooth Rock Falls offers reading and visual materials in both English and French languages, including video footage of historical events. There is a full time librarian to assist customers and Internet access is also available.

7.4 SOCIAL SERVICES

Fire services within municipal boundaries are provided by the Town of Smooth Rock Falls (Smooth Rock Falls, 2006). The Ontario Provincial Police's Northeast Region is responsible for providing police services to the Study Area. A satellite detachment is located in Smooth Rock Falls with a host detachment in nearby Cochrane (Ontario Provincial Police, 2006).

7.5 RECREATION AND TOURISM

Numerous recreational opportunities are present within Smooth Rock Falls and the surrounding natural area. Within Smooth Rock Falls, the Reg Lamy Cultural Centre is the home to indoor hockey, curling and figure skating. The town also has an outdoor public swimming pool, movie theatre, baseball diamond, the Mattagami Cross-Country Ski Club, Liz McCafferty Park and a 9-hole public golf course (Smooth Rock Falls, 2006). Recreational features are shown on **Figure F2-10**.

Outdoor recreation is important to Study Area residents from economic, cultural, and social perspectives. In particular, recreational fishing and hunting are some of the most popular and culturally important activities for residents within the Study Area. Numerous snowmobile and ATV trails range throughout the Study Area. In the winter, out-of-town residents make considerable use of the snowmobile trails.

Additionally, there are recognized tourist establishment locations in the general vicinity of the Study Area including outfitters and tour companies. Polar Bear Outfitters hold a land use permit for a commercial outpost camp upstream of Loon Rapids. Two other businesses based in Smooth Rock Falls (Howling Wolf Guide Services, and Northern Spirit Adventure) plan to offer services in the Study Area. Howling Wolf Guide Services would offer canoe, kayak, whitewater instruction, wilderness trips and educational programs between Smooth Rock Falls and Loon Rapids. Northern Spirit Adventure is planning to offer Voyager canoe trips, water instruction, wilderness trips, camping, and educational programs. Howling Wolf Guide Services was registered in October, 2007. It plans to employee between 2 and 12 people, offering 20 to 30 trips per year depending on demand.

The stretch of the Mattagami River from Gogama to Smooth Rock Falls is designated as a provincial canoe route. Through the Study Area, portages are required at Lower Sturgeon GS (250 m), Loon Rapids (135 m), Davis Rapids (135 m), Yellow Falls (185 m), and Island Falls (25 m) for a total portage length of 730 m (MNR, 1990).

A multi-use tourism facility has been proposed that would promote private sector tourism investment in the community. Currently, Smooth Rock Falls is a gathering point for thousands of snowmobile riders annually due to its location and abundance of natural areas to ride and explore. It is hoped that a multi-use tourism facility along with new market-driven opportunities will generate private sector investment in the tourism sector (Community Adjustment Committee, 2005).

7.6 ECONOMY AND EMPLOYMENT

As of 2006, the industry category with the highest employment rate in the Study Area is the manufacturing and construction industry, comprising approximately 39% of the work force (Statistics Canada, 2006b). Most of the people employed in this industry are assumed to have been involved in the manufacture of pulp and paper. Given that a hospital and detoxification centre are located in Smooth Rock Falls, health and education was also an important industry in 2006 (**Figure 7-4**).

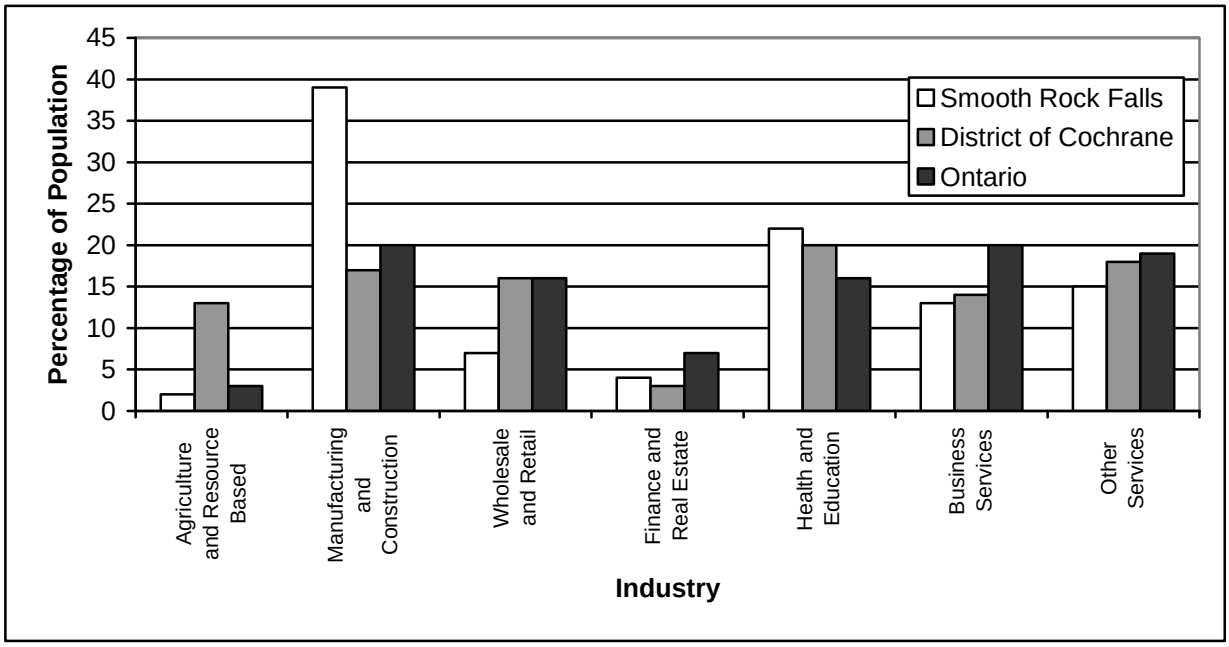

Figure 7-4 Employment by Industry (2006)

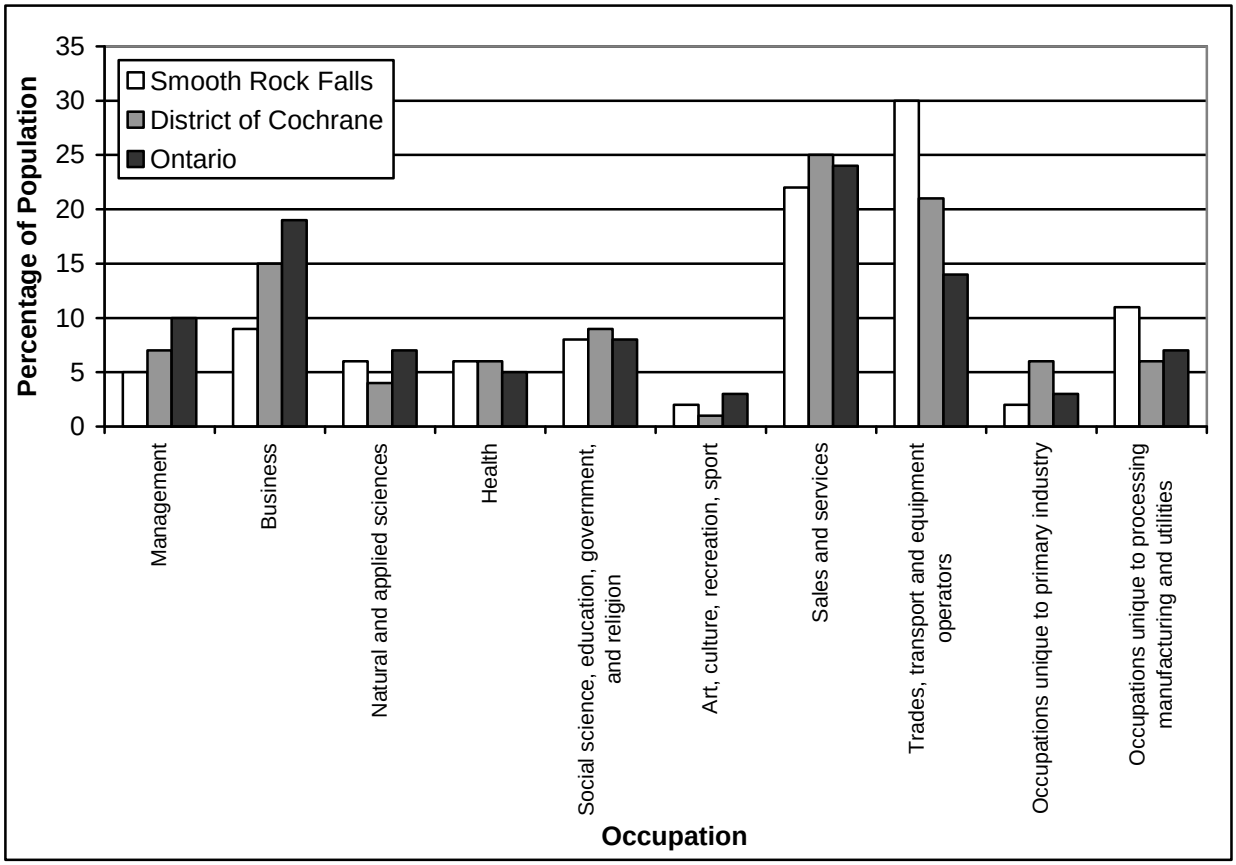

Figure 7-5 Employment by Occupation (2006)

In comparison to the District of Cochrane and the Province of Ontario, a greater percentage of people in Smooth Rock Falls are employed in trades, or as transport and equipment operators, in occupations unique to processing, manufacturing, and utilities, or in health services. Fewer residents of Smooth Rock Falls are employed in occupations unique to primary industry when compared to the District of Cochrane and the Province of Ontario (**Figures 7-4** and **7-5**).

The Tembec Pulp and Paper Mill, located in Smooth Rock Falls, employed 36% of the local labour force in 2001 (Community Adjustment Committee, 2005). The plant was closed on July 31, 2006, and as a result, the 2001 unemployment rate was10.3% . As a comparison, the Ontario unemployment rate was 6.1% (Statistics Canada, 2001a, 2001b). Smooth Rock Falls' unemployment rate decreased to 7.5% in 2006, but still remained higher than the unemployment rate of Ontario at 6.4% (Statistics Canada, 2006b).

In 2001, the average annual income per person in Smooth Rock Falls was $39,050. In comparison, the average annual income per person in Ontario was $35,185. The median income for a family in Smooth Rock Falls was $66,957, and for comparison, in Ontario was $61,024 (Statistics Canada, 2001a, 2001b).

An increasing number of residents are relying on some form of government contribution. Pensions and Old Age Security account for 20% of Smooth Rock Falls $46.3 million income

base. As a result, this limits labour pool growth and caps the volume of disposable income that is needed to induce economic change and growth within the community (Community Adjustment Committee, 2005).

8.0 Land Use

8.1 LAND OWNERSHIP

The majority of lands within the Study Area are Crown Lands owned by the Government of Ontario in trust for the people of Ontario (151,735 ha or 78%). The remainder (41,835 ha or 22%) is patent land (privately owned). Most patent land in the Study Area is found in the Abitibi Freehold in the geographic townships of Mabee, Dargavel, Aubin, Kingsmill, Lennox, Nesbitt, and Crawford. Patent land is also concentrated in the populated areas of Smooth Rock Falls, Departure Lake, and Driftwood (**Figure F2-12**)

8.2 LAND USE PLANNING

The Town of Smooth Rock Falls and the Ministry of Natural Resources (through the Crown Land Use Policy Atlas for the Mattagami River Area) administer land use planning within the Study Area.

The primary objectives of the Town of Smooth Rock Falls Official Plan (1979) are to:

- Enhance and preserve the environment
- Accommodate residential development
- Preserve forestry lands
- Accommodate industrial and commercial development
- Accommodate recreational development
- Manage natural resources
- Develop aggregate resources
- Encourage property maintenance and improvement
- Prevent land use conflicts

Land use zoning is shown in **Figure F2-12**. Although Smooth Rock Falls is within the Study Area, the Town of Smooth Rock Falls Official Plan does not apply to the Project because the proposed location is outside the boundaries of the Town of Smooth Rock Falls, with the exception of the proposed access road and transmission line corridor. The corridor will cross Crown land designated as “natural resource area” by the Town of Smooth Rock Falls. Utility and road corridors in natural resource areas are not excluded land uses in the Official Plan.

MNR Crown Land Use Policy determines land use on Crown Land throughout the Study Area. Seven policy areas are located in the Study Area (**Figure F2-12**).

The Mattagami River Area (Policy number G1744) determines land use within 120 m from each shore of the Mattagami River. The primary land use for the Mattagami River area is recreation,

including cottaging and commercial tourism. Hydroelectric power generation is also a priority in this area. Commercial fishing, fur harvesting, timber harvesting, and mineral development are permitted land uses. Land uses that are not permitted include aggregate extraction, agriculture, rural residential and urban development (MNR, 2006b).

The Southern Resource Area (Policy number G1745) determines land use throughout most of the Study Area. The Southern Resource Area contains valuable mineral, forest, and recreational resources. As a result, there are a comparatively high number of developments such as logging camps, communications towers, cottages, and power lines. A considerable number of forest roads allow access for recreational fishing and hunting. In this area, aggregate extraction, mining, timber harvesting, and road development and maintenance are all permitted land uses. Commercial fishing is not permitted (MNR, 2006c).

Portions of the Great Claybelt Agricultural Area (Policy number G1760) are located near the Town of Smooth Rock Falls. This land use area is designed to promote the use and protection of Canada Land Inventory ("CLI") Class 3 and 4 agricultural land. The main uses of this area are urban and rural residential, farming, and cottaging. Aggregate extraction, as well as road development and maintenance, are permitted land uses (MNR, 2006d).

Small portions of Critical Aggregate Areas (Policy number G1759) are located throughout the Study Area. The intent of this policy area is to promote protection and utilization of aggregate resources. Aggregate extraction is discouraged within 120 m of watercourses. Structural developments such as rural residential, cottaging, and tourism operations are not permitted (MNR, 2006e).

The Mahaffy Township Ground Moraine Conservation Reserve (Policy number C1586) and the Geary Township Shoreline Bluff Conservation Reserve (Policy number C1581) are also located in the Study Area. The land use policy for these reserves prevents activities that may harm locally significant natural features. For example, aggregate extraction, mineral development, and commercial timber harvesting are not permitted (MNR, 2006f; MNR, 2006g)

The North Muskego Mixed Forest Conservation Reserve (Policy number C1578) is located near the south-west boundary of the Study Area. Permitted uses include fishing, hunting, and fur harvesting. Mineral extraction, power generation, and timber harvesting are not permitted (MNR, 2006h)

8.3 INFRASTRUCTURE

8.3.1 Roads

The Ministry of Transportation ("MTO") and MNDM are responsible for provincial highways in Northern Ontario. The North Branch of the TransCanada Highway (Highway 11) crosses the Mattagami River in Smooth Rock Falls. The eastern boundary of the Study Area is Highway 655, which connects to Highway 11. From Smooth Rock Falls, Highway 634 travels north out of the Study Area. Red Pine Road travels south from Highway 11, just west of the Town of

Smooth Rock Falls. This road turns east and joins the Mattagami River at the Project site. There are also several trails and logging roads utilized by ATV and snowmobile operators during the year.

The Town of Smooth Rock Falls is responsible for the construction and maintenance of local roads within Town boundaries. Northern local roads outside of an organized municipality are generally maintained through cost sharing agreements between the province, Local Roads Boards, Statute Labour Boards, cottagers and First Nation communities (MTO, 2005).

Table 8.1 provides annual average daily traffic counts ("AADT") recorded by the MTO (2005):

Table 8.1 Traffic Volumes

Road Network	AADT	Distance
Hwy 11 from 655 to 634	2550	26 km
Hwy 655 from Timmins to Hwy 11	1300	47.1 km

Within the Crown Land Use Policy Atlas, road development and maintenance is permitted for both new and existing roads. However, road development north of Smooth Rock Falls is discouraged while new road development south of Smooth Rock Falls is permitted.

8.3.2 Hydrocarbon Transmission Facilities

TransCanada Pipelines Ltd. owns and operates a natural gas pipeline right-of-way bisecting the Study Area north of Island Falls. The right-of-way consists of three pipelines and generally parallels the Ontario Northland Transportation Commission (ONTC) Railway that passes through the Study Area. The pipelines are buried approximately 32 inches underground. The pipeline right-of-way crosses Red Pine Road south of Hwy 11.

8.3.3 Electricity Transmission Lines and Facilities

Electricity distribution networks service residences and businesses in the area. Hydro One Networks Inc. ("Hydro One") also has an existing 115 kV transmission line (H9K) that is located along the north side of HWY 11.

8.3.4 Railways

The only operating railway in the Study Area crosses the Mattagami River approximately 3 km south of HWY 11. The rail line also crosses Red Pine Road just south of Hwy 11. The rail line is owned and operated by Ontario Northland Transportation Commission, and is shown in **Figure F2-10**.

8.4 SEWAGE AND WASTE DISPOSAL

The location and classification of active and closed landfill sites in the Study Area was determined through a review of the MOE Waste Disposal Site Inventory (1991) and a review of

the Town of Smooth Rock Falls Official Plan. The location and type of waste disposal site is used to identify potentially contaminated areas.

Landfills are classified by the MOE based on their potential to affect human health or the environment. Class "A" sites are within 1 km of a dwelling, well, or watercourse used for domestic water. A site may also be categorized as Class "A" if it is in an area that is likely to be developed in the future, if there is a significant aquifer within 10 m of the surface, or if there have been past problems at the site. Landfills that do not meet these criteria are categorized as class "B." **Tables 8.2** and **8.3** list classification types for active and closed landfills.

Table 8.2 Classification of Active Landfills

	Industrial Liquid or Hazardous Waste		**Municipal or Domestic Waste**	
	Urban	*Rural*	*Urban*	*Rural*
Class "A"	A1	A2	A3	A4
Class "B"	B1	B2	B3	B4

Table 8.3 Classification of Closed Landfills

	Industrial Liquid or Hazardous Waste		**Municipal or Domestic Waste (Years Closed)**					
			Urban			*Rural*		
	Urban	*Rural*	*<10*	*10-20*	*>20*	*<10*	*10-20*	*>20*
Class "A"	A1	A2	A3	A5	A7	A4	A6	A8
Class "B"	B1	B2	B3	B5	B7	B4	B6	B8
NP	No potential for impact on humans or the environment							

According to the MOE 1991 Waste Disposal Site Inventory, four closed landfills and six active landfills are located within the Study Area (**Table 8.4**; **Figure F2-10**). The landfills were closed between 1973 and 1983 (MOE, 1991), and contain mostly rural municipal and domestic waste. One landfill contains urban municipal waste. Active landfills contain rural and urban domestic/municipal waste (MOE, 1991).

Table 8.4 Active and Closed Landfills

Status	Site No.	Municipality	Lot	Concession	Date Closed	Class
Active	580604	Smooth Rock Falls	PT 2-3	5-6	N/A*	B4
Active	580605	Smooth Rock Falls	24	10	N/A	A3
Active	580606	Kendrey	23-24	10	N/A	A4
Active	7023502	Calder	PT 10-11	4	N/A	B4
Active	7065401	Haggert	PT 19 W1/2	8	N/A	B4
Active	7065402	Smooth Rock Falls	PT 19	12	N/A	B4
Closed	7023501	Calder	PT 16 E 1/2	6	1977	A4
Closed	1624	Calder	16	6	1973	A7
Closed	580601	Smooth Rock Falls	24	10	1982	A6
Closed	580603	Smooth Rock Falls	PT 24	10	1983	A6

*N/A – Not Applicable

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9.0 Heritage, Culture, Landscape and Archaeological Resources

Designated historical sites are different from registered archaeological sites in that designated features are usually marked in some way and public access is encouraged. The database of registered archaeological sites is available only to registered archaeologists and public access is not usually encouraged in order to preserve the sites. No designated heritage, cultural, or landscape monuments or features exist in the Study Area. Two registered archaeological sites have been recorded by the Ministry of Culture ("MOC").

However, it is likely that the Mattagami River was used for thousands of years by First Nations for travel, food, and water. In the 17th and 18th centuries, the River was used for exploitation of fur resources. In the early 1900's, the River was heavily used by geologists, agricultural experts, and surveyors. Throughout the last century, the River has also been used by the timber industry to transport and mill logs (MNR, 1990).

Stage I, II and III Archaeological/Cultural Heritage Assessments were conducted by Woodland Heritage Services Limited in 2006. These assessments included preliminary research of background materials followed by field inspections and excavations of the area surrounding the Mattagami River from approximately 1 km north of Island Falls to approximately 1 km south of Loon Rapids. The complete Archaeological/Cultural Heritage Assessment is provided in **Appendix I**.

The purpose of the Stage I Archaeological Assessment was to identify any areas of high archaeological potential that may be affected by the proposed Project. An archaeological record review was conducted, and a variety of information from a 1989 site visit along with LIDAR images, topographic maps and historical information was used to help assign site potential and rate the model variables. Through the use of these methods, nine areas of high potential were identified within 100 meters of the Mattagami River.

Upon completion of a Stage I archaeological study, a Stage II Assessment, was undertaken. Artifacts recovered from test pits were typical of pre-contact sites, and included fire-cracked rock, calcined and burned bone, chert and quartz flakes and a chert scraper tool.

Due to the discovery of a number of artifacts during the Stage 2 Archaeological Assessment, further investigation was needed at a site near Yellow Falls that could be sensitive to development. A Stage 3 Archaeological Assessment was conducted, and a total of 476 artifacts were recovered including 26 pre-contact tools, 99 chert percussion reduction flakes and 13 chert pressure-thinning flakes. No pre-contact ceramics were recovered.

As a result of the excavated material recovered from this investigation, it would appear that this location represents a 'multiple component' site, which is a number of different occupations by separate cultural traditions over a long time span. Recovered artifacts indicate occupation of the Yellow Falls site by aboriginal peoples as long ago as 5,000 years ago. The recovery of bi-polar pebbles, thin micro-blade like flakes of chalcedony and other rare lithic material also

indicates a later occupation by Woodland era peoples dating some 1,200 to 2,000 years ago. Finally, pulp cutters and loggers occupied the site from 60 to 80 years ago.

10.0 First Nations

Native Peoples occupied the general area of the Mattagami River, north of Timmins, for a minimum of 6,000 years before present. Archaeologists refer to the earliest peoples to inhabit the area after the last glacial ice age as the Shield Archaic Tradition who were big game hunters. About 2,000 years before present, these people shifted to an economy of smaller game and fish, which resulted in the need for smaller tools and a more seasonal lifestyle that would enable them to exploit various resources at differing times of the year. The Laurel Tradition or Middle Woodland Culture also added fired clay pottery to the material culture at this time. This culture gradually evolved into the late Woodland Blackduck (Ojibway) and Selkirk (Cree) pottery styles. These people were the ancestors of present day regional cultural/social groups such as the Mattagami First Nation and the Taykwa Tagamou Nation (Woodland Heritage Services Limited, 2006).

The Project is located within the traditional area of the Taykwa Tagamou Nation. The Taykwa Tagamou Nation has a population of 333 (INAC, undated), with a reserve located between Cochrane and Moosonee. However, the reserve was never occupied due to isolation and resulting lack of employment opportunities. In the early 1980's initiatives were taken by the Chief and Council to find a new home for the Taykwa Tagamou Nation. In 1984, a new site was chosen and this has become the current location for Taykwa Tagamou. The community is located at New Post, a 177-hectare site, approximately 20 km west of Cochrane on Highway 574 (Mushkegowuk Council, 2006).

During the environmental assessment process, the Mattagami First Nation, Flying Post First Nation, and the Wahgoshig First Nation have also indicated an interest in the Project. YFP and the TTN are actively participating in discussions with these communities regarding the Project

Mattagami First Nation people are descendants of the Ojibway, a nomadic people. The First Nation community is located on a reserve located approximately 80 km south of Timmins, Ontario on the Northwest side of Lake Mattagami. The reserve was surveyed in 1909. However, hydroelectric development flooded the area in the 1920s. Subsequently, an additional 200 acres was added to the reserve for a new town site. In 2005, 116 people lived on the reserve (James Bay Frontier Travel Association, 2001; Chiefs of Ontario, 2005).

The Flying Post First Nation has a reserve located approximately 43 km southwest of Smooth Rock Falls. The 163 members of the First Nation do not live on the reserve. Band council maintains a mailing address in Nipigon, Ontario (INAC, n.d.).

The Wahgoshig First Nation is located on Lake Abitibi, approximately 50 km west of Matheson, Ontario, a few kilometres from the Quebec border. Approximately 121 people live on the reserve, while a further 134 band members live off-reserve. The reserve contains a band office, a health clinic, a warehouse / fire hall, a garage, and a storage garage which serves as the existing community hall (INAC, n.d.; Township of Black River-Matheson, 2007)

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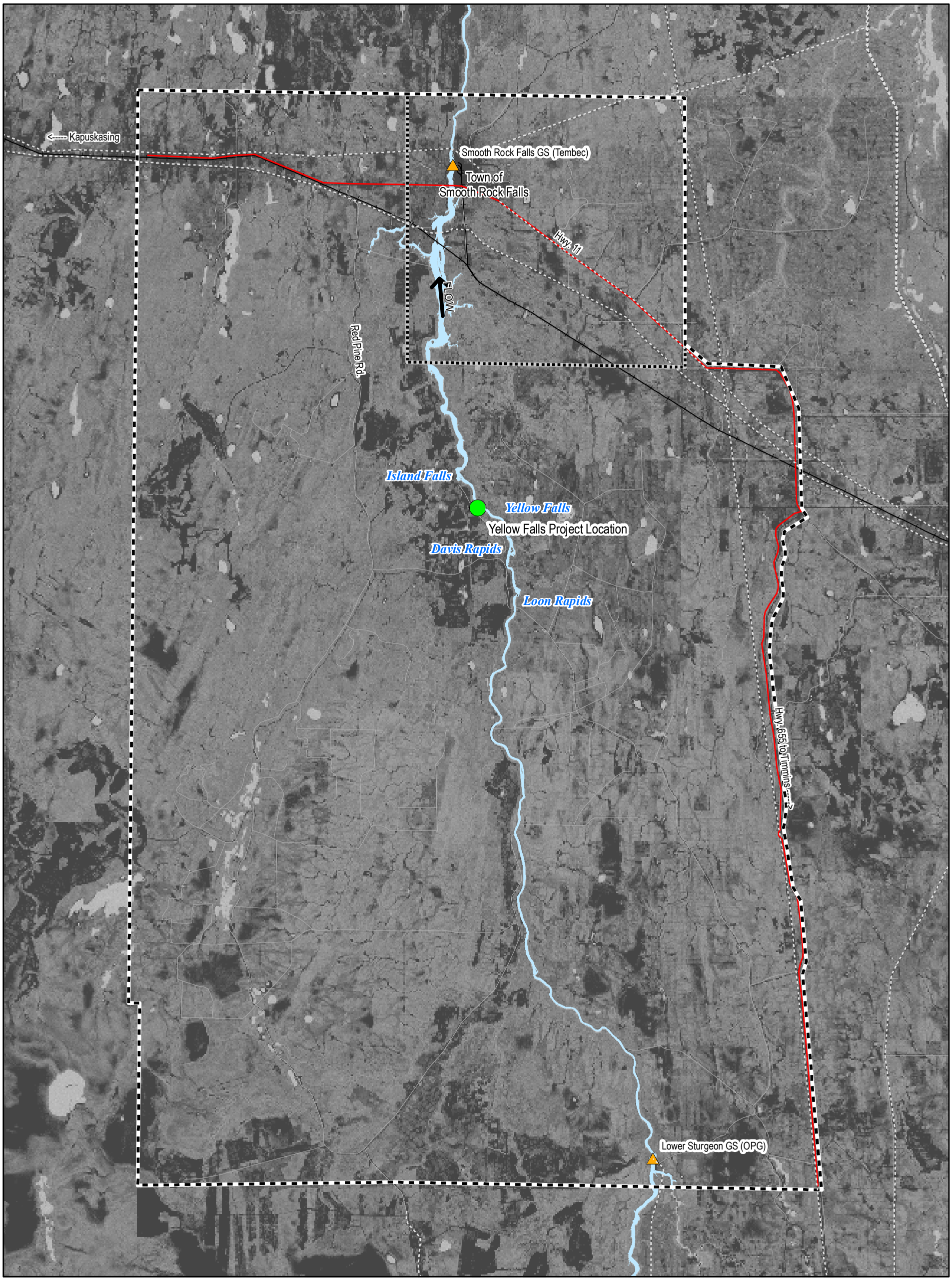
Appendix F2

Environmental Features Figures



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.

Study Area
Smooth Rock Falls Town Limits
Generating Stations
Yellow Falls Project Location
Existing 115 kV Power Line
Main Road
Secondary Road
Railroads
Mattagami River

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Stantec

0 1 2 3 4 Kilometers
1:200,000

Key Map

PREPARED FOR:
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-1

STUDY AREA

Initiated: October, 2007
Revised: October, 2008

Smooth Rock Falls GS (Tembec)

Hwy. 11

FLOW

Red Pine Rd.

Island Falls

Yellow Falls

Yellow Falls Project Location

Davis Rapids

Loon Rapids

Hwy. 655 to Timmins

Lower Sturgeon GS (OPG)

File: W:\active\60960108\graphics\GIS\MXD\FINAL\Baseline Environmental Features\60960108_BEF_02.mxd

Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Geology: National Bedrock Geology Layer - Geological Survey of Canada, 2005.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Main Road
- Secondary Road
- Railroads
- Mattagami River

Bedrock Geology

- Felsic to intermediate metavolcanic rocks
- Foliated tonalite suite
- Mafic and ultramafic rocks
- Mafic to intermediate metavolcanic rocks
- Mafic to ultramafic metavolcanic rocks
- Massive granodiorite to granite
- Metasedimentary rocks

N W E S

Stantec

0 1 2 3 4 Kilometers

1:200,000

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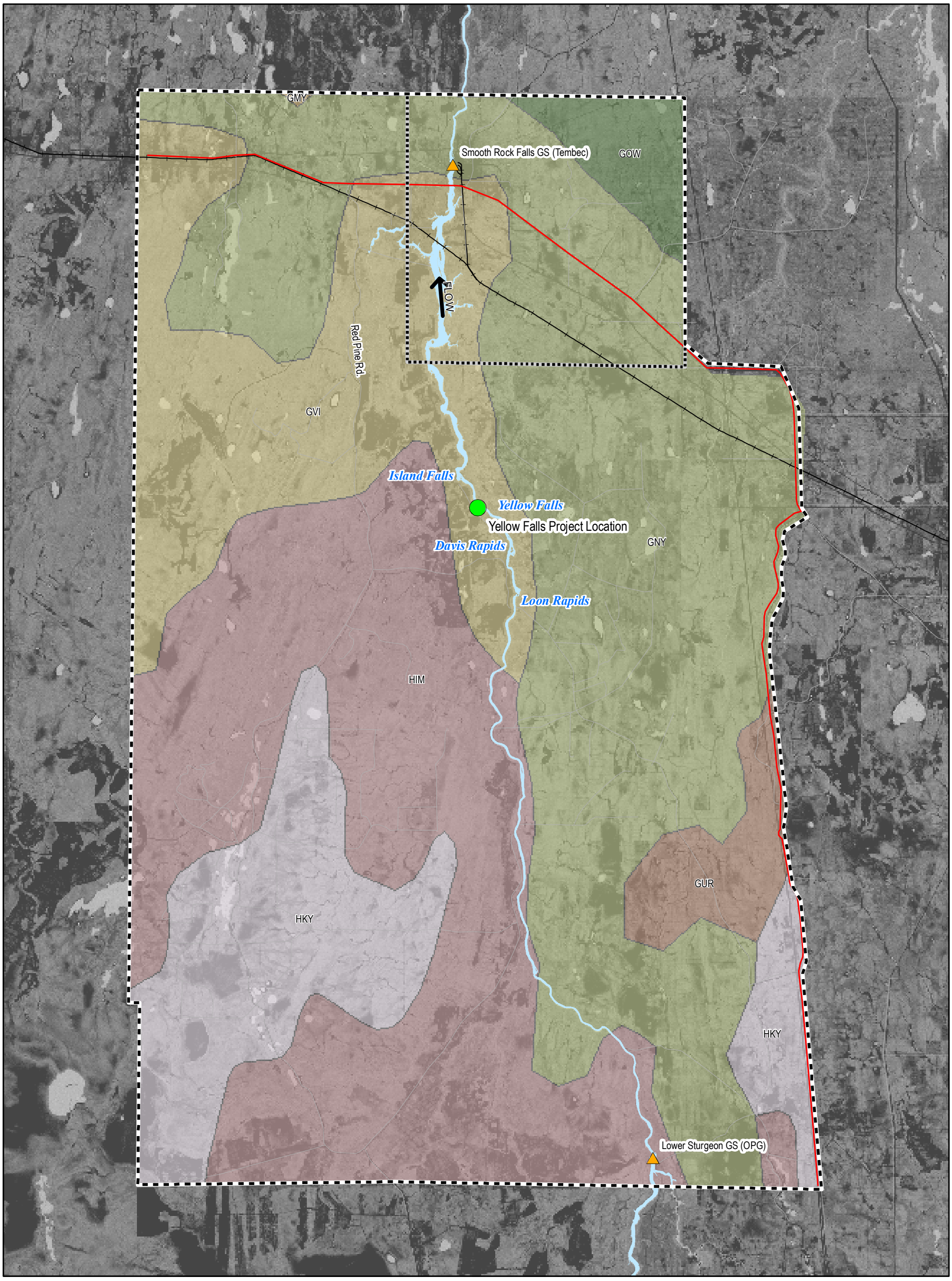
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-2

GEOLOGY

Initiated: October, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Soils: Agriculture and Agri-Food Canada, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Main Road
- Secondary Road
- Railroads
- Mattagami River

Soils

- GOW - Gerow - Moderately Fine Clay Loam
- GNY - Granby - Very Coarse Loamy Sand
- GVI - Grenville - Medium Sandy Loam
- GMY - Grimsby - Coarse Sandy Loam
- GUR - Guerin - Medium Sandy Loam
- HIM - Haldimand - Fine Sandy Loam
- HKY - Harkaway - Medium Loam

N W E S

Stantec

0 1 2 3 4 Kilometers

1:200,000

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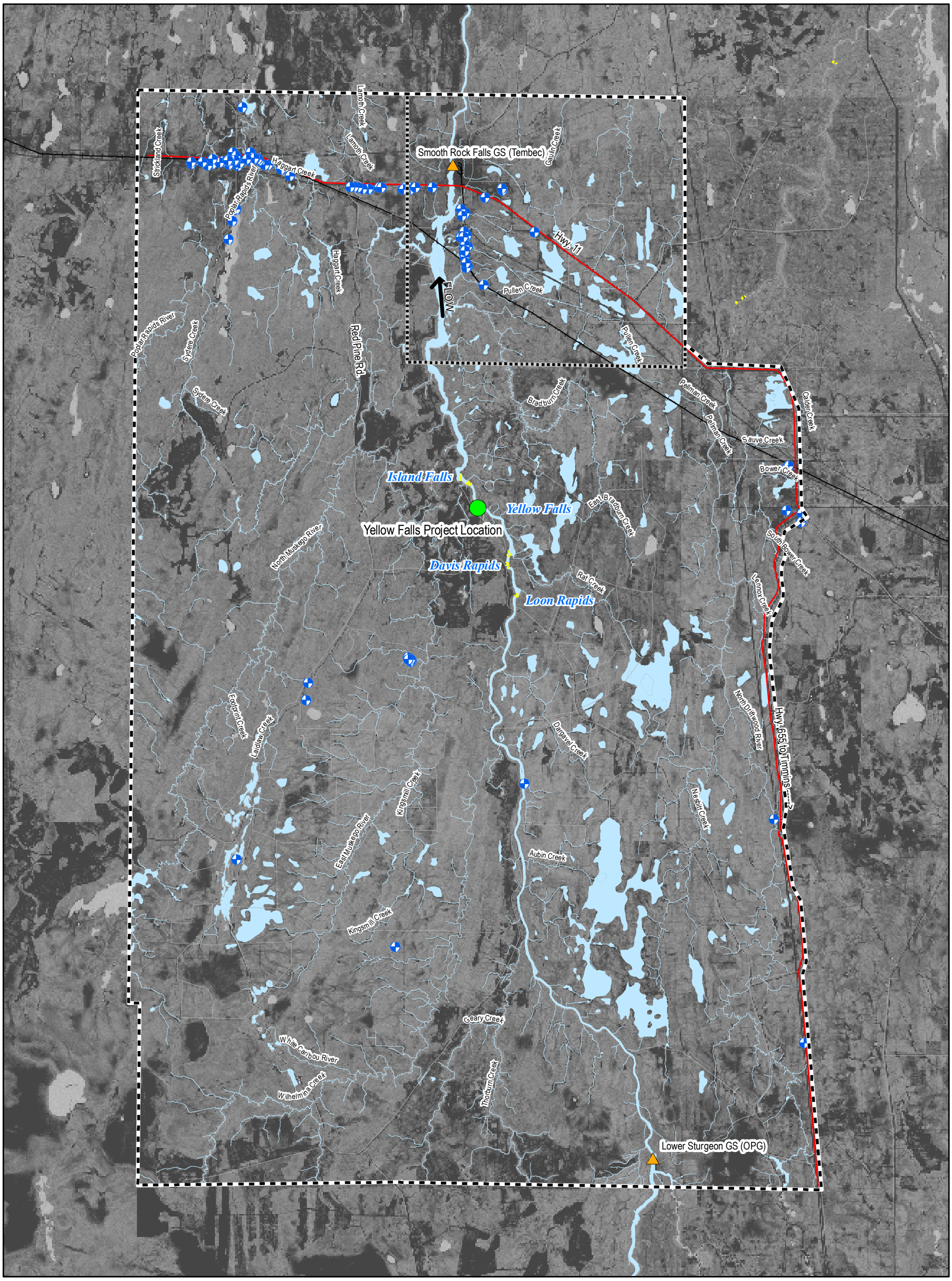
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-3

SOILS

Initiated: June, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Water Features: LIDS, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Main Road
- Secondary Road
- Railroads
- Water
- Falls or Rapids
- Waterwells

N W E S

Stantec

0 1 2 3 4 Kilometers

1:200,000

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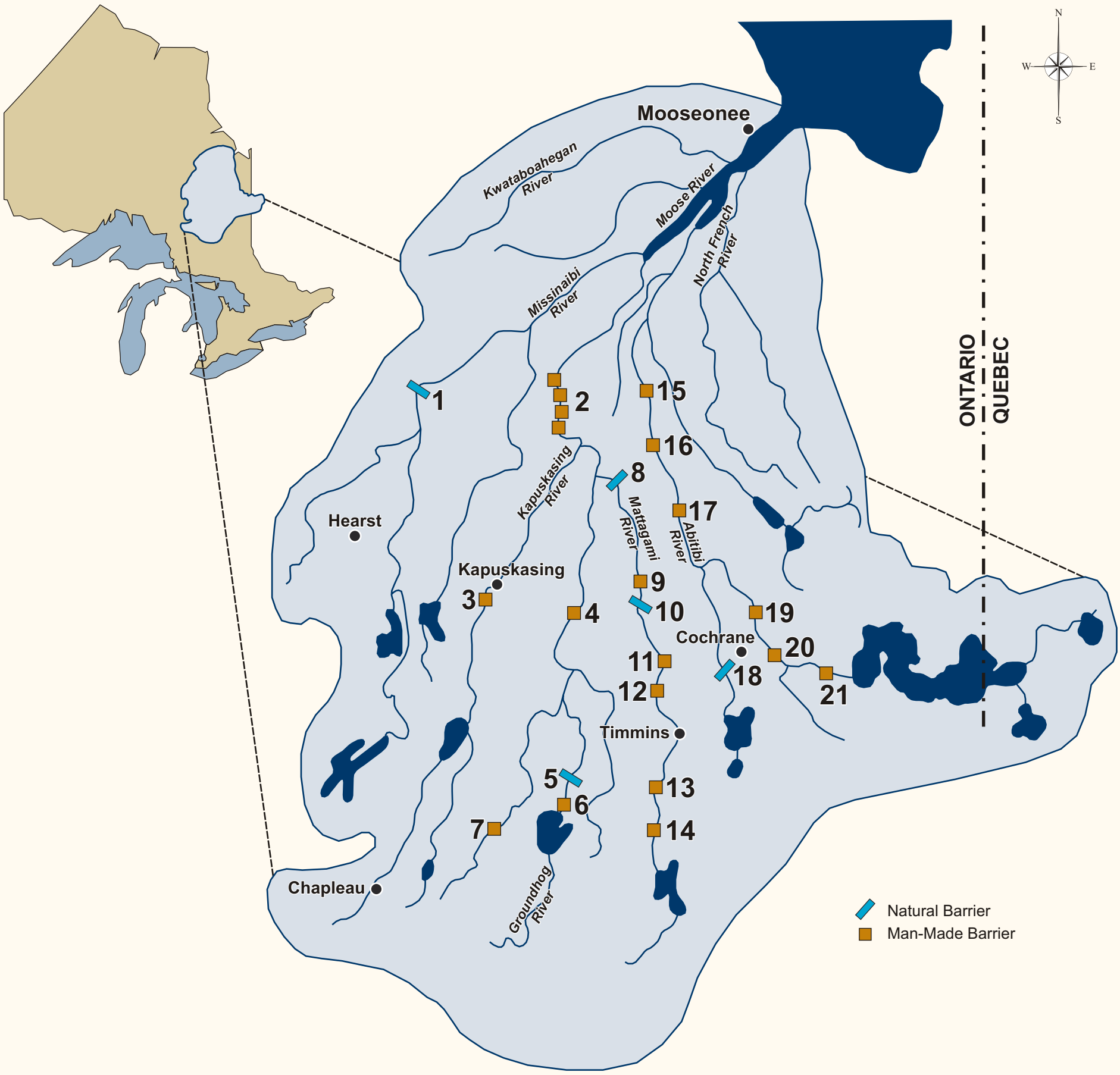
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-4

SURFACE AND GROUNDWATER FEATURES

Initiated: October, 2007
Revised: October, 2008



1	Thunderhouse Falls	12	Sandy Falls G.S.
2	Mattagami G.S. Complex	13	Wawatin G.S.
3	Kapuskasing G.S.	14	Kenogamissi Falls Dam
4	Camichael Falls G.S.	15	Otter Rapids G.S.
5	Upper Falls	16	Abitibi Canyon G.S.
6	Harwood Lake Dam	17	Island Falls G.S.
7	Ivanhoe Lake Dam	18	High Falls
8	Cypress Falls	19	Long Sault G.S.
9	Smooth Rock Falls G.S.	20	Iroquois Falls G.S.
10	Yellow Falls	21	Twin Falls G.S.
11	Lower Sturgeon G.S.		

Source: from Stokes et. al, 1999.

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Yellow Falls Power LP

PREPARED FOR:

ISLAND FALLS HYDROELECTRIC PROJECT
NATURAL AND SOCIO-ECONOMIC PROFILE

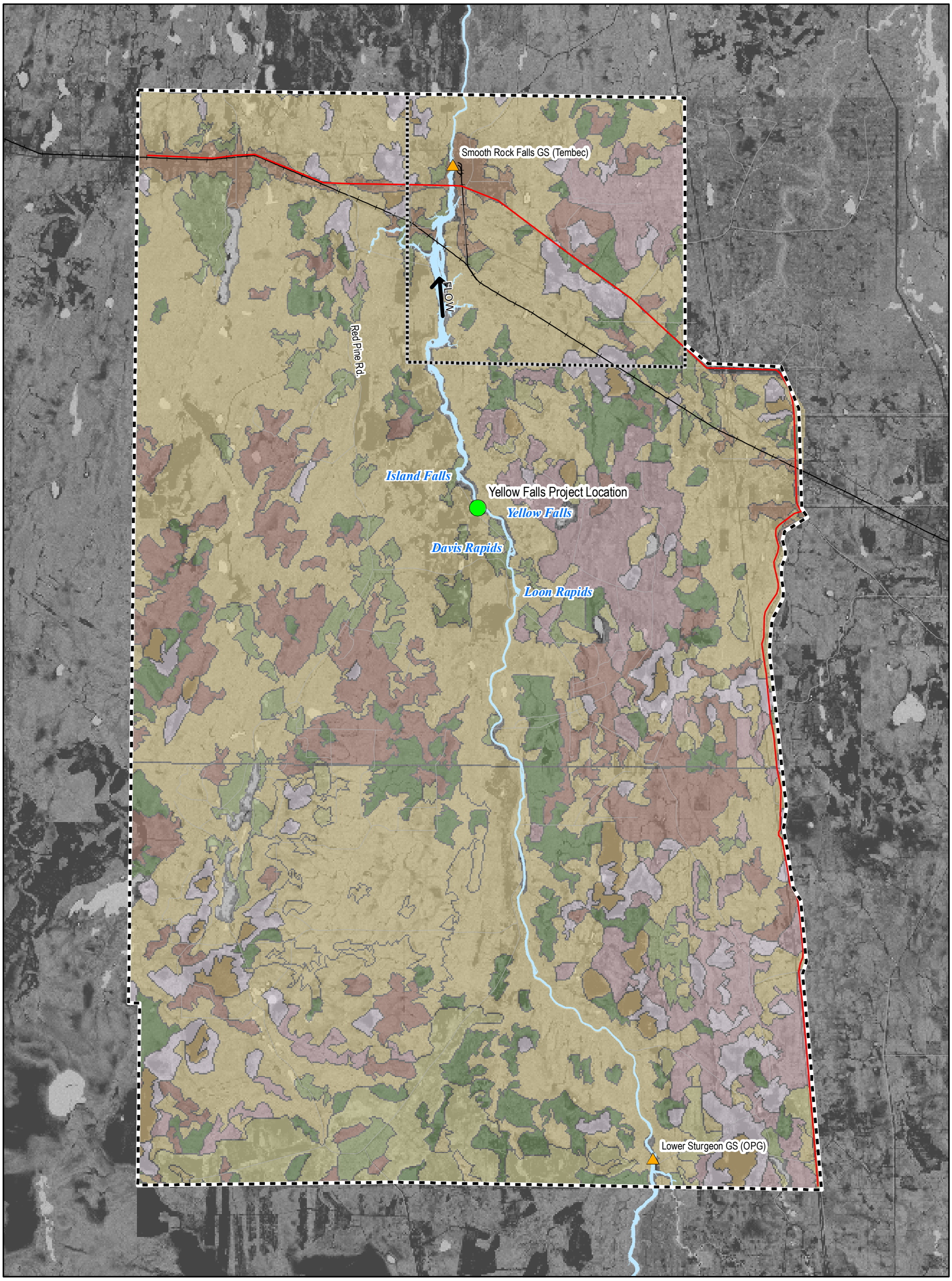
FIGURE NO.

F2-5

TITLE

NATURAL AND MAN-MADE BARRIERS IMPEDING UPSTREAM FISH MIGRATION, MOOSE RIVER BASIN

Initiated: June, 2007
Revised: October, 2007



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Land Cover: MNR, 2002.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Main Road
- Secondary Road
- Railroads
- Mattagami River

Ontario Land Cover

- Dense Coniferous Forest
- Dense Deciduous Forest
- Early Successional Forest
- Mixed Forest
- Open Wetlands
- Settlement and Developed Land
- Sparse Forest
- Successional Forest
- Treed Wetlands

N W E S

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0 1 2 3 4 Kilometers

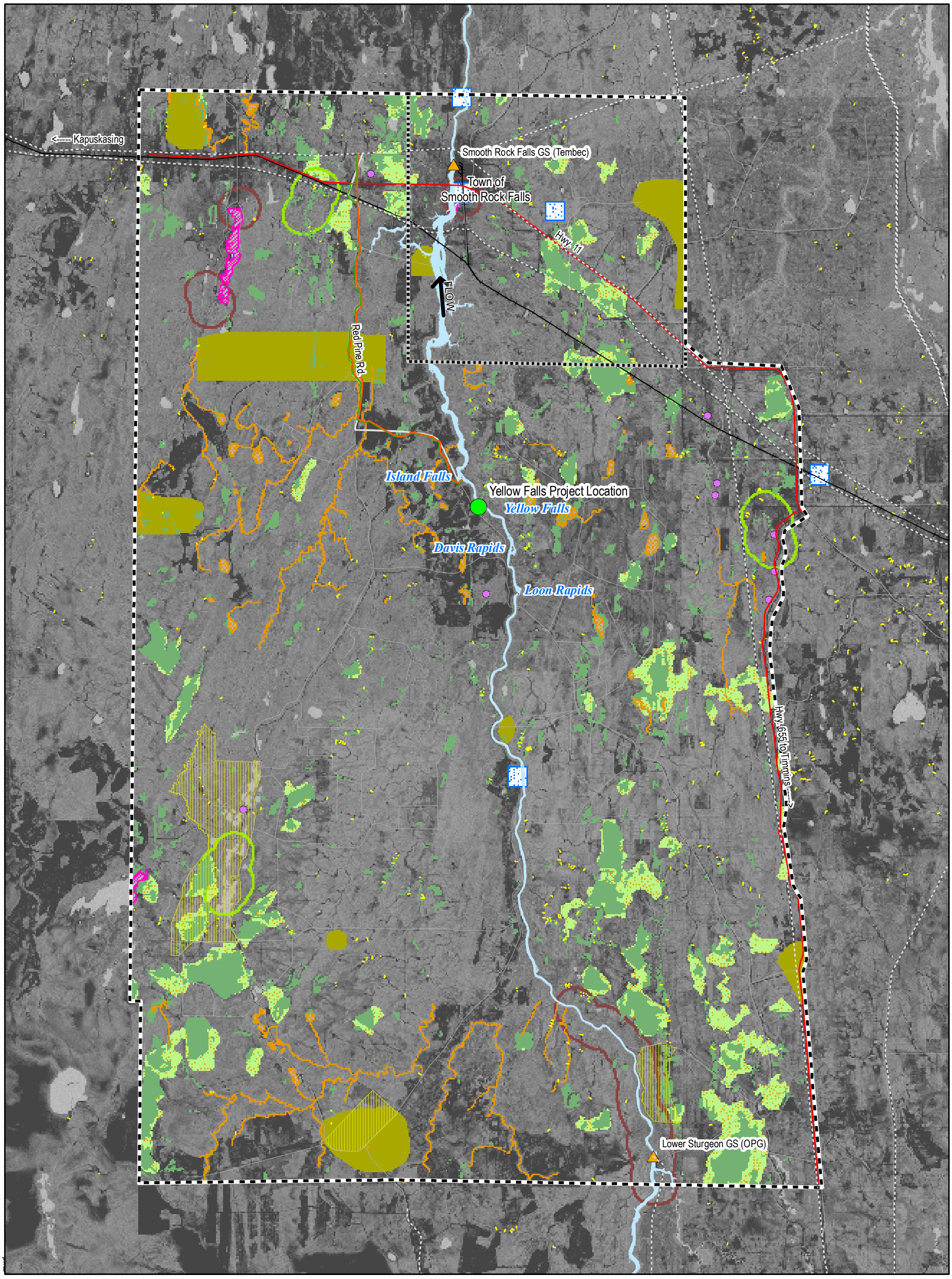
1:200,000

PREPARED FOR:
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-6

ONTARIO LAND COVER

Initiated: October, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Natural Environment: LIDS, 2006, MNR NHIC Database, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Proposed Transmission Line
- Proposed Access Road
- Existing 115 kV Power Line
- Access Road and Transmission Line Corridor
- Main Road
- Secondary Road
- Railroads
- Mattagami River
- Nesting Sites
- Beaver Dams
- Conservation Reserves
- Vulnerable, Threatened and Endangered Species
- Moose Feeding Areas
- Waterfowl Staging Area
- Muskeg
- Moose Wintering Areas
- 1km Buffer of Old Growth Forest
- 1km Buffer of Walleye Spawning
- Wetlands

N W E S

0 1 2 3 4 Kilometers

1:200,000

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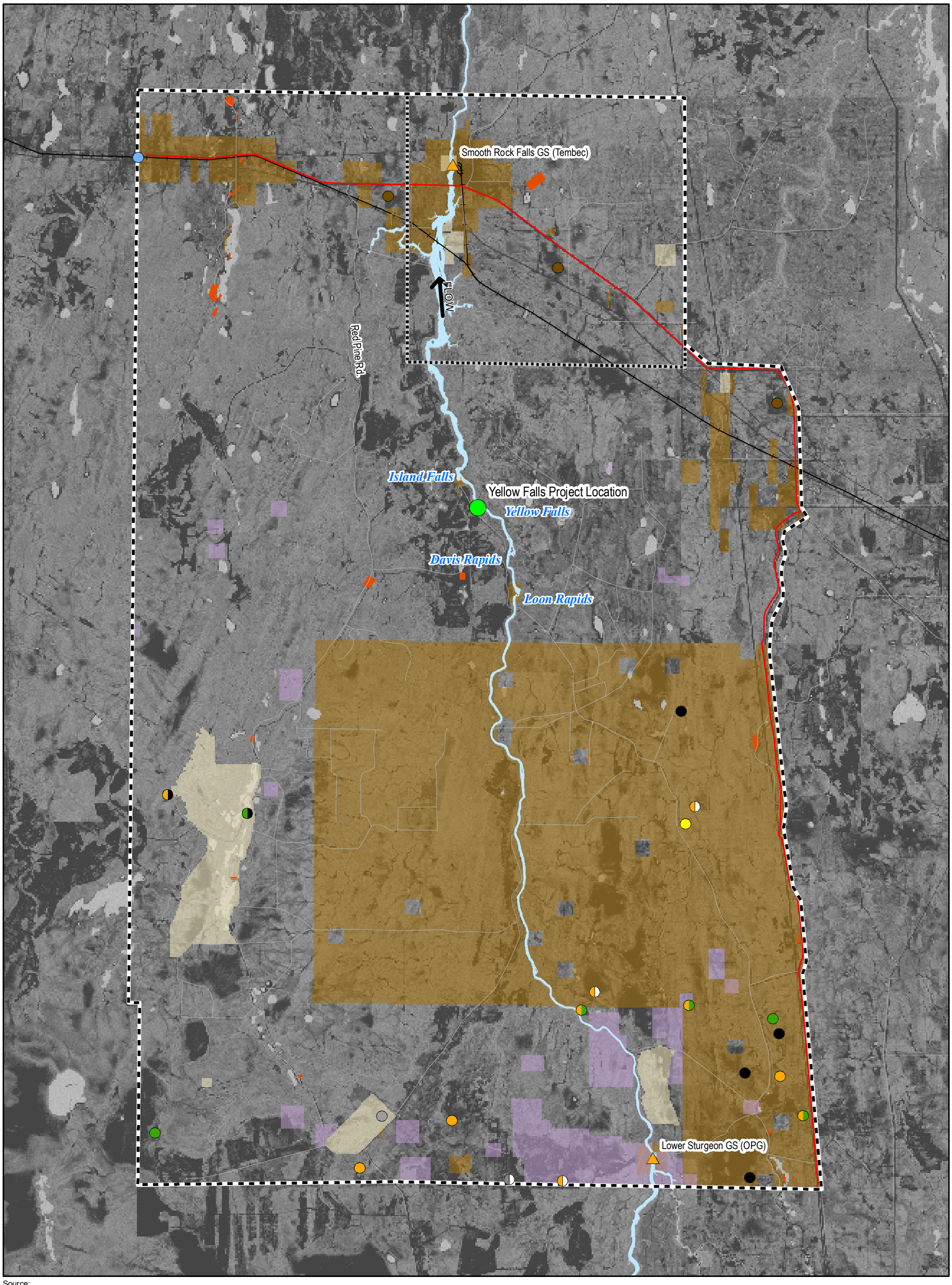
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-7

NATURAL ENVIRONMENT

Initiated: October, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Occurrences: MNDM, 2004.
Other Features: LIDS, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Main Road
- Secondary Road
- Railroads
- Mattagami River

- Active Mining Claims
- Active Mining Leases and Patents (Private Land)

Mineral Occurrences

- Apatite, Rare Earth Elements
- Copper
- Copper, Nickel
- Copper, Nickel, Zinc
- Copper, Zinc
- Gold

- Land Withdrawals and Notifications
- Pits and Quarries

Mineral Occurrences

- Iron
- Iron, Magnetite
- Nickel
- Nickel, Zinc
- Peat
- Zinc

0 1 2 3 4 Kilometers

1:200,000

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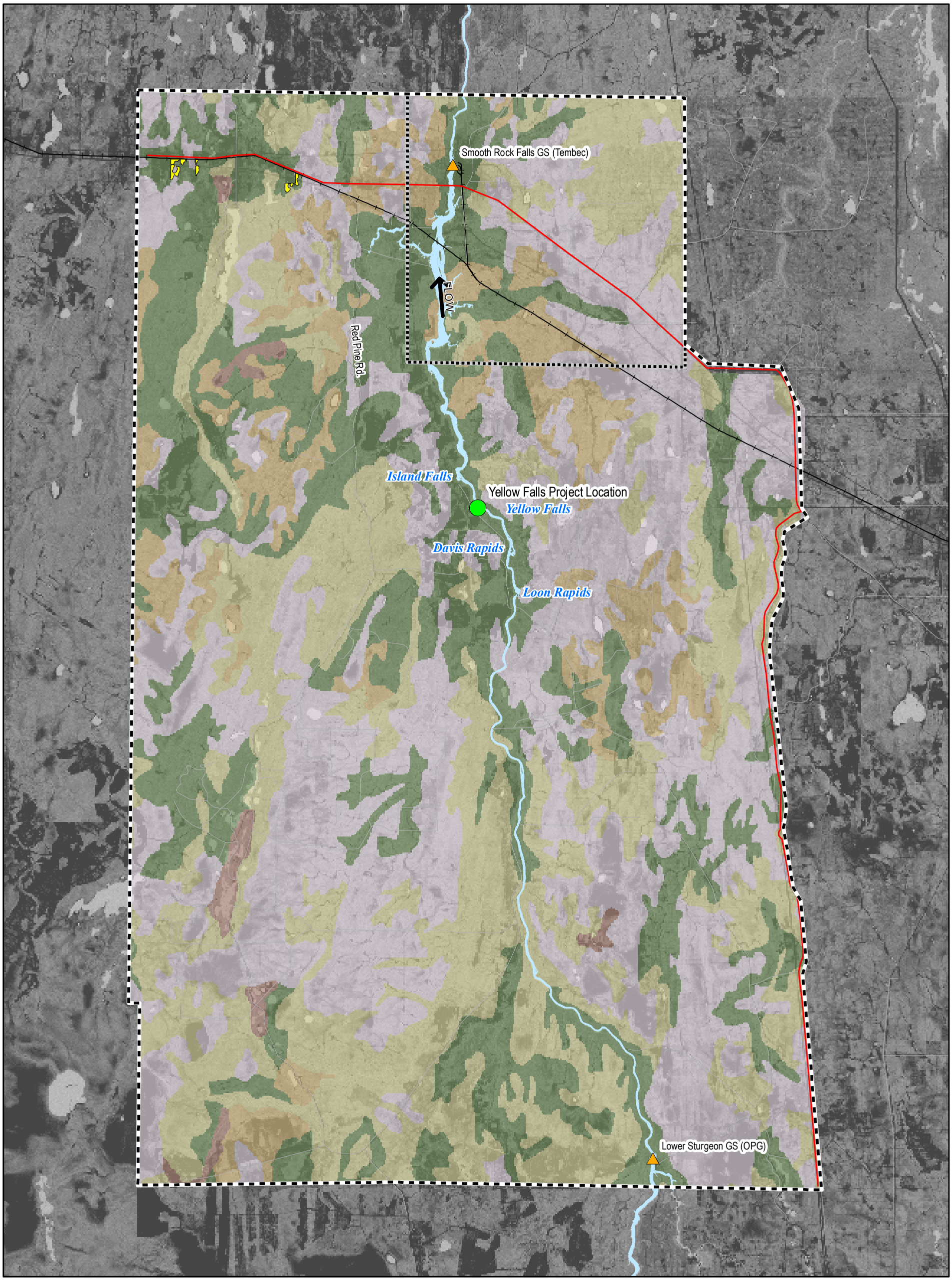
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-8

MINERAL, AND AGGREGATE RESOURCES

Initiated: January 28, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
CLI: Agriculture and Agri-Food Canada, 1998.

Study Area
Smooth Rock Falls Town Limits
Generating Stations
Yellow Falls Project Location
Main Road
Secondary Road
Railroads
Mattagami River

Canada Land Inventory for Agriculture
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Agricultural Land

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Stantec

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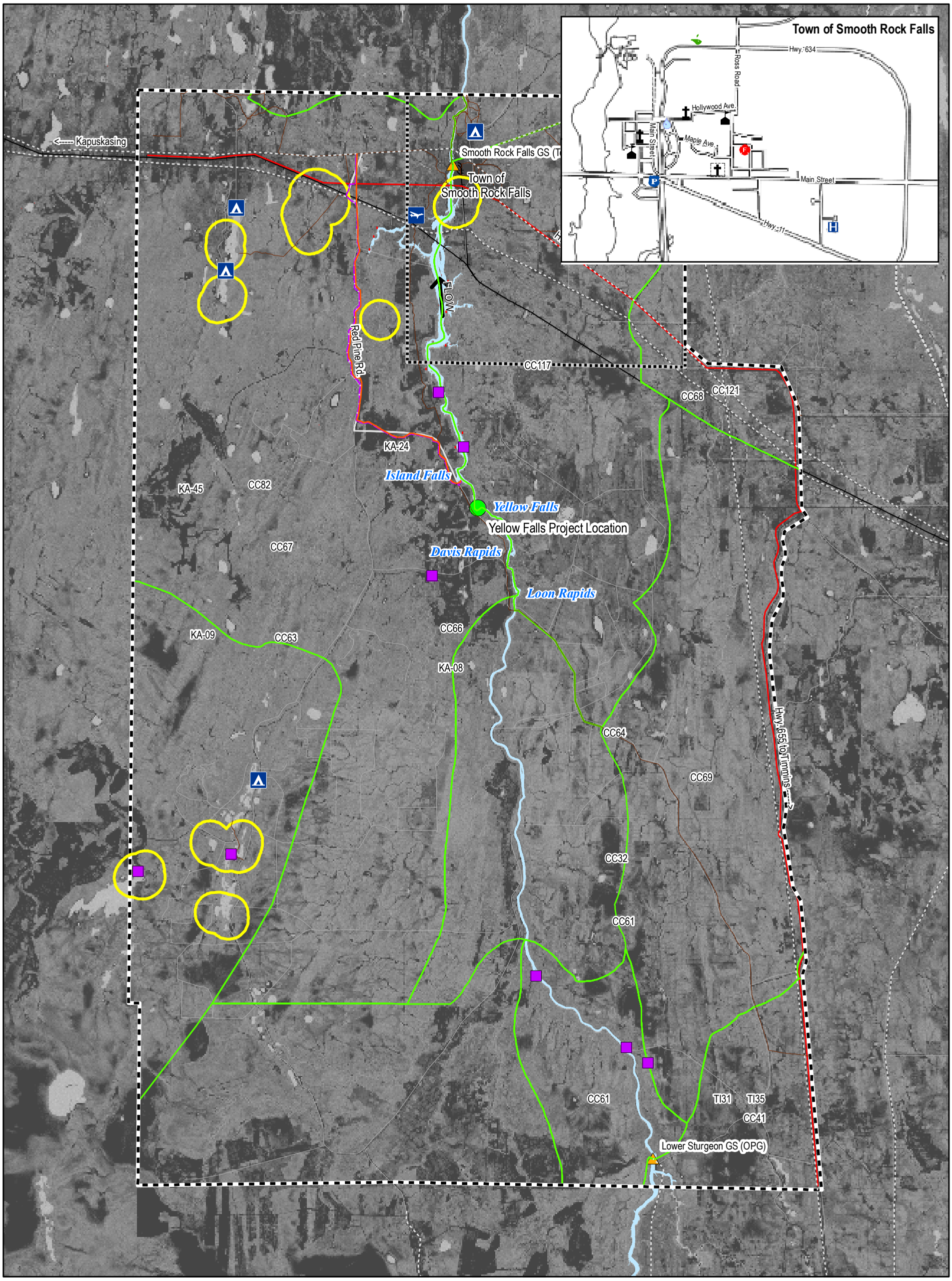
Kilometers
1:200,000

PREPARED FOR:
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-9

AGRICULTURAL RESOURCES

Initiated: June, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Proposed Transmission Line
- Proposed Access Road
- Main Road
- Secondary Road
- Railroads
- Existing 115 kV Power Line
- Mattagami River
- Access, Clubhouse, Designated Camping
- Trapping Cabins
- Traplines
- Cottage / Residential
- Snowmobile, Ski or Hiking Trail
- Wild Rice Stand
- Access Road and Transmission Line Corridor

0 1 2 3 4 Kilometers
1:200,000

Socio-Economic Features

- Airport
- Cemetery
- Church
- Fire Hall
- Golf Course
- Hospital
- Police Station
- Pool
- School

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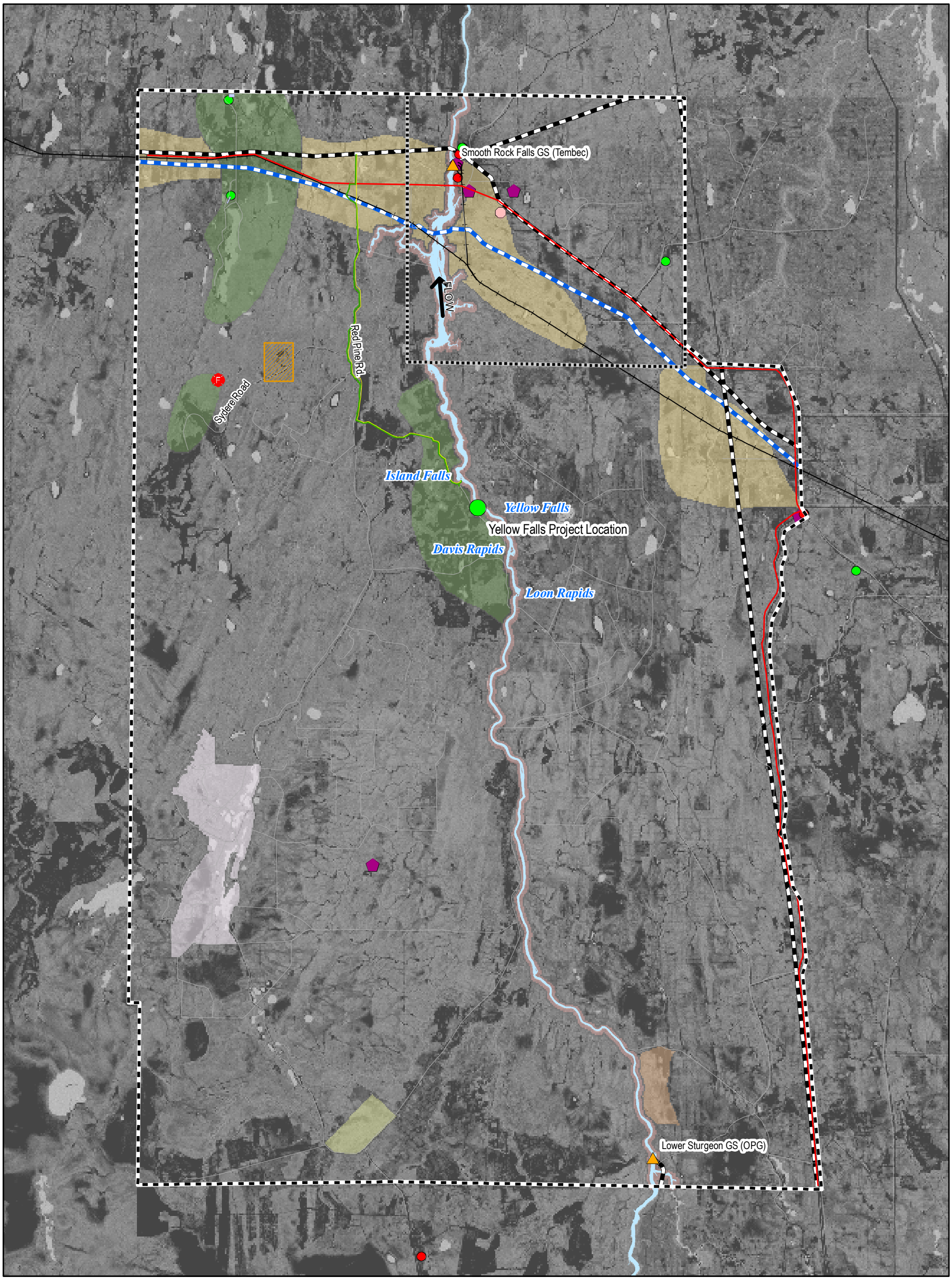
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-10

SOCIO-ECONOMIC, NATURAL, AND RECREATIONAL FEATURES

Initiated: October, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.

- Study Area
- Smooth Rock Falls Town Limits
- Generating Stations
- Yellow Falls Project Location
- Proposed Access Road
- Rock Quarry

- Main Road
- Secondary Road
- Railroads
- Transmission Station
- Waste Disposal

Landfills
- Closed
- Open

Communication and Fire Towers
- Communication Tower
- Fire Tower

Utility Lines
- Hydro Line
- Natural Gas Pipeline
- Mattagami River

Southern Resource Area
- Critical Aggregate Area
- Geary Township Shoreline Bluff
- Great Claybelt Agricultural Area
- Mahaffy Township Ground Moraine
- Mattagami River Land Use Area
- North Muskego Mixed Forest

N W E S

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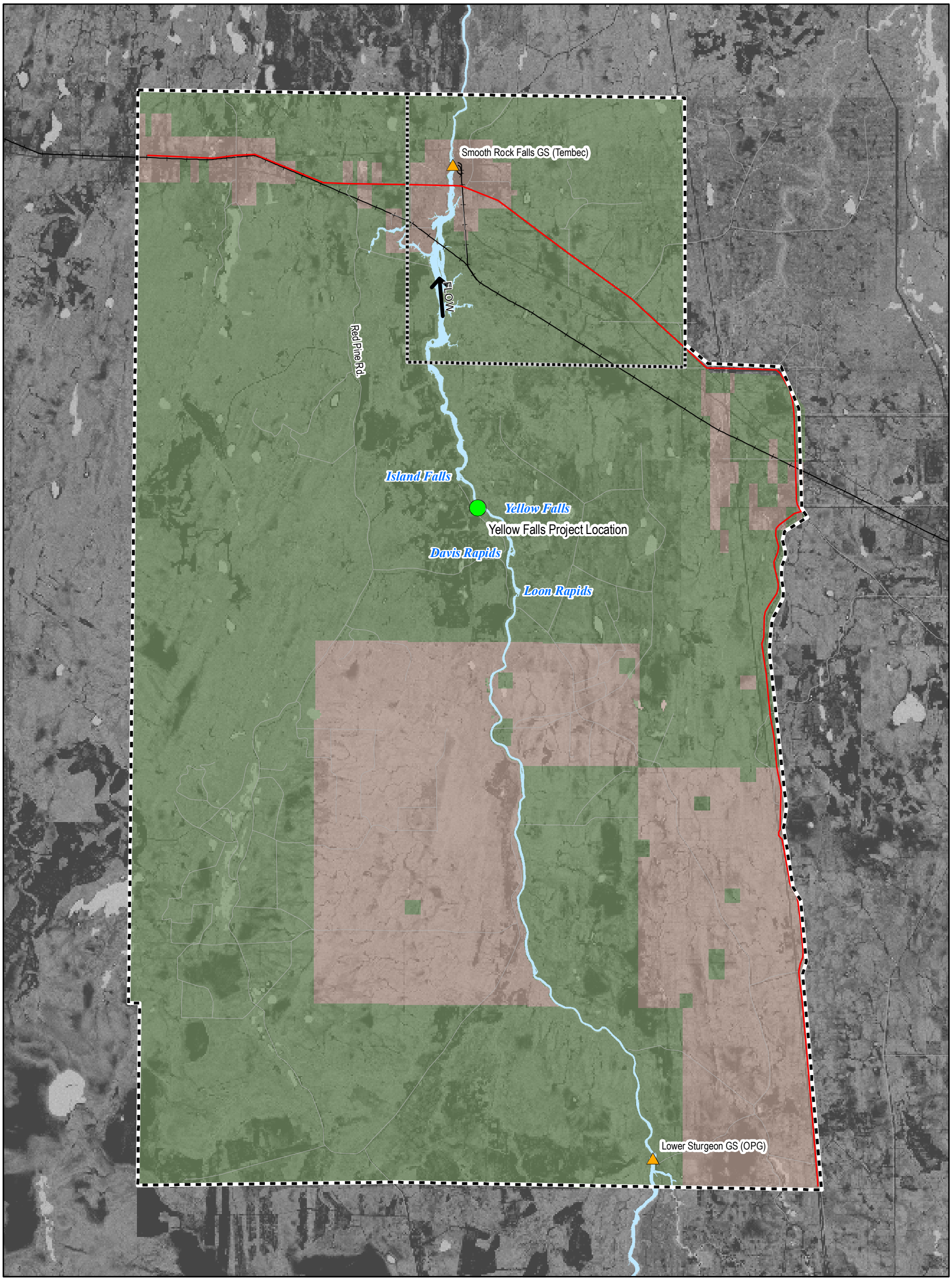
PREPARED FOR:
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-11

LAND USE PLANNING AND INFRASTRUCTURE

Initiated: October, 2007
Revised: October, 2008



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Source:
Airphoto: LANDSAT 7, 2002.
Base Map: LIDS, 2006.
Land Ownership: MNR Crown Land Use Atlas, 2006.

Study Area
Smooth Rock Falls Town Limits
Generating Stations
Yellow Falls Project Location
Main Road
Secondary Road
Railroads
Mattagami River

Land Ownership
Crown Land
Private Land

N
W
E
S

Stantec

0 1 2 3 4
Kilometers
1:200,000

PREPARED FOR:
YELLOW FALLS POWER LP
ENVIRONMENTAL AND SOCIO-ECONOMIC FEATURES REPORT

FIGURE NO. F2-12

LAND OWNERSHIP

Initiated: October, 2007
Revised: October, 2008