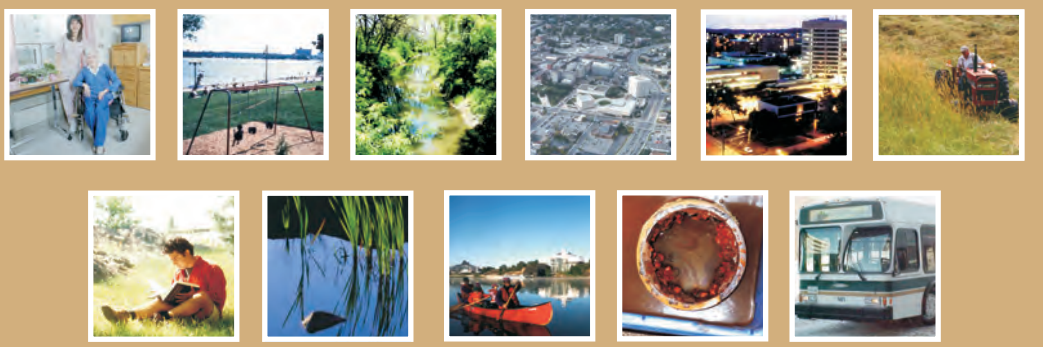

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Natural Heritage Background Study

February 2005

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Natural Heritage Background Study

February 2005

Stephen Monet, Ph.D.
Nikki Boucher

Cartography
Angèle Francoeur
David Grieve
Krista Carré

Environmental Initiatives Group
Community and Strategic Planning Section
Planning Services Division
City of Greater Sudbury

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Ontario Ministry of Natural Resources
Edward Morris
Mike Hall
Phil Kor
Jenny Martindale
Joanna Samson
John Thompson
Scott Dingwall
Bruce Richard

Ontario Geological Survey
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Kathy McDonald

Science North
Franco Mariotti
Dan Chaput

Laurentian University
Peter Beckett
Gerard Courtin
David Pearson
Ann Gallie
Jean-Francois Robitaille
Regie Alam

Vegetation Enhancement Technical Advisory Committee
Peter Beckett

Sudbury Ornithological Society
Charles Whitelaw
Chris Blomme

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Linda Hugli

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Dieter Schoenefeld

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Pascal Samson
Karl Aubry
Andre Ferron

Cambrian College
Ivan Filion
Kim Goodman
Josef Hamr

Nickel District Conservation Authority
Paul Sajatovic

Junction Creek Stewardship Committee
Carrie Regenstreif

Hands for Nature
Clement Farmer

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Ken McCausland
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Table of Contents

List of Tables

List of Figures

1. INTRODUCTION

The City of Greater Sudbury (henceforth referred to as the 'City') was formed on January 1, 2001 and today consists of the towns and cities which comprised the former Regional Municipality of Sudbury (Sudbury, Capreol, Nickel Centre, Onaping Falls, Rayside-Balfour, Valley East and Walden), as well as several unincorporated townships (Fraleck, Parkin, Aylmer, Mackelcan, Rathbun, Scadding, Dryden, Cleland and Dill).

A requirement of the amalgamation was that an Official Plan be developed for the City. Several background studies have been prepared as part of the development of an Official Plan. One of these studies is the Natural Heritage Background Study, henceforth referred to as the 'Study'.

1.1 Study Purpose

The principal objective of this Study is to conduct an inventory and assessment of significant natural heritage features and areas within the City and to provide recommendations for policies on matters of natural heritage in the Official Plan.

The Sudbury Natural Heritage Study should also fulfill a number of other purposes, including:

- heighten awareness of natural heritage as the foundation of Sudbury's past, present and future;
- serve as an educational tool for the Sudbury community; and,
- serve as a "spring-board" for future studies and/or initiatives involving natural heritage features and areas within the City.

1.2 Study Approach

This Study integrates disparate information available on Sudbury's natural heritage and provides recommendations for natural heritage policy direction to be considered in developing the City's Official Plan. Guidance for establishing the scope of the Study is provided mainly by the Provincial Policy Statement (PPS) and associated interpretive documents prepared by the Ontario Ministry of Natural Resources (OMNR). Proposed policy changes to the Natural Heritage section of the PPS (MMAH, 2004) are reflected in this Study's recommended policy directions.

The PPS defines natural heritage features and areas as:

> *"features and areas, such as significant wetlands, fish habitat, significant woodlands south and east of the Canadian Shield, significant valleylands south and east of the Canadian Shield, significant portions of the habitat of endangered and threatened species, significant wildlife habitat, and significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area".*

This definition establishes that, as matters of provincial interest, only certain natural heritage features and areas are applicable to the City due to it being located on the Canadian Shield. The list of relevant natural heritage features and areas remains unchanged by proposed planning reform initiatives affecting the PPS (Ministry of Municipal Affairs and Housing, 2004). The applicable natural heritage features and areas listed in the definition will be discussed individually in this report.

Other natural heritage features, areas, and ecological functions not present in the definition are also considered in this Study due to their importance to the Sudbury situation specifically as will be discussed later. These features and areas include the following:

- Watersheds and subwatersheds to serve as integrative frameworks for environmental planning;
- Sites of Geological Interest that reflect the importance of geology to the Sudbury area; and,
- Ecological recovery of thousands of hectares of land that were severely impacted by past mining activities in the Sudbury area.

This Study relies heavily on existing information to identify natural heritage features and areas (see Section 2).

1.3 Study Considerations

Natural heritage studies have been conducted in many southern Ontario municipalities for land-use planning purposes, many using the framework described in Riley and Mohr (1994) and the OMNR's Natural Heritage Reference Manual. There are several differences, however, that make a direct transfer of the southern Ontario natural heritage 'model' to the City problematic.

First, the ecological matrix (or dominant ecological system) of the City is principally forest and wetlands with patches of agricultural and urban land cover. The context in southern Ontario is the opposite: an agricultural and/or urban matrix with patches of remnant forest and wetlands. As such, concepts of wildlife corridors and core areas, while still relevant to Sudbury's wildlife, are less evident and likely less critical as will be discussed in Section 4.7.

Second, approximately 82,000 hectares of land have been affected by mine-related smelting in Sudbury. This land is undergoing some degree of recovery now that sulphur dioxide levels have been substantially reduced. Much of the area is still ecologically limited, however, due to two factors. First, the large distances between seed sources of native plants and the central portions of the impacted zone limits speed of natural plant colonization in these latter areas. Second, elevated levels of metals in the soil, especially nickel and copper, effectively prevent growth of many plant species. The extent of the impacted area, which is without parallel in Ontario, has profound implications for Sudbury's natural heritage. For over 25 years, the City (and formerly the regional municipality) has been committed to reclaiming industrially affected land offering little more than black rock devoid of vegetation. Although thousands of hectares have been reclaimed, thousands more are in need of reclamation. Moreover, even those lands that have been reclaimed are very low in plant diversity and are far from being self-sustaining

and functional forest ecosystems (see Section 4.10).

Third, about 42% of the City is Crown Land. Use for much of this land is determined under a forest management plan for the Sudbury Forest and is not within the purview of the City's Official Plan. Figure 1 shows the Crown Land in the City along with Ontario Living Legacy sites and Conservation Areas.

Fourth, the City is a geologically important area containing numerous geological features that have yet to become 'of provincial interest' through formal ANSI designation. These features still require some degree of consideration during land-use planning so as to ensure their continued local presence for future generations and for possible economic development opportunities through ecotourism (see Section 4.9).

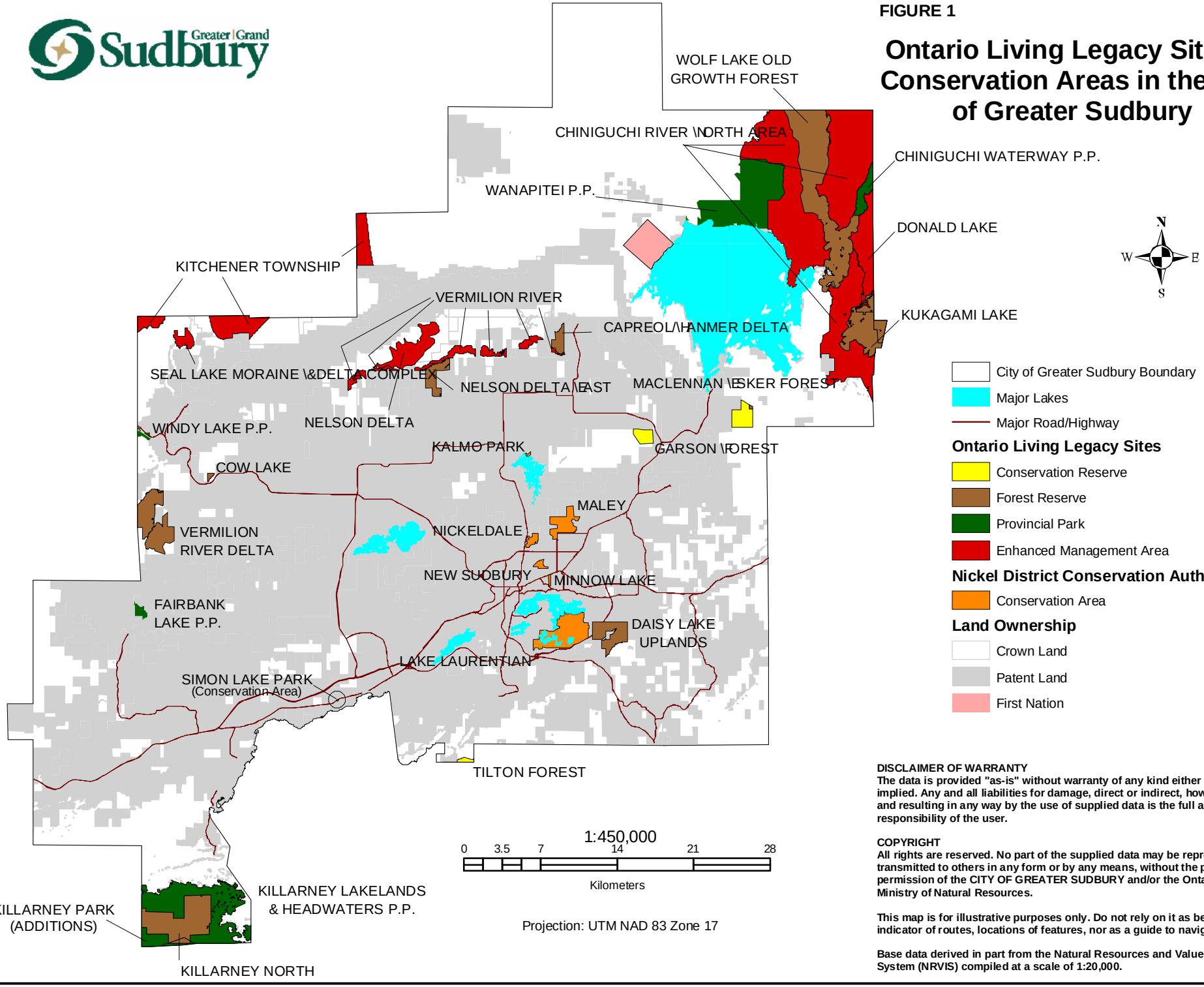
Finally, the City contains hundreds of lakes, many of which have cottages and/or permanent residences along the shoreline. These lakes and their associated watersheds represent important natural heritage features. Many of the lake watersheds are independent of one another and thus require individual assessment of environmental features and functions. In contrast, southern Ontario watersheds are linked to one of the Great Lakes and not to relatively small and hydrologically independent lakes. This Study considers watersheds as the principal spatial unit for integrating, to some extent, environmental and land-use planning in Sudbury (see Section 4.8).

While guidance is provided mainly by the PPS, this Study has regard to the Sudbury context in addressing matters of natural heritage.

In this Study, the following terms are defined as in the PPS: 'adjacent lands', 'development', 'ecological functions', 'fish habitat', 'negative impacts', 'natural heritage features and areas', 'significant', and 'site alteration'.

FIGURE 1

Ontario Living Legacy Sites & Conservation Areas in the City of Greater Sudbury



This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation.

Base data derived in part from the Natural Resources and Values Inventory System (NRVIS) compiled at a scale of 1:20,000.

2. METHODS

Existing information on natural heritage features and areas was gathered from various sources. A major source of information was OMNR's Natural Resources and Values Information System (NRVIS), which shows various natural heritage features and areas that are of interest to the OMNR. A variety of agencies and groups with interest in natural heritage were contacted for input into the Study and as sources of information. These agencies and groups include: OMNR Sudbury District, Ontario Parks (Northeast Zone), Natural Heritage Information Centre, Cooperative Freshwater Ecology Unit, Nickel District Conservation Authority, Sudbury Naturalists, Sudbury Ornithological Society, Laurentian University, Collège Boréal, Cambrian College, the City's Lake Water Quality Program, the City's Vegetation Enhancement Technical Advisory Committee, Junction Creek Stewardship Committee, and the Sudbury Horticultural Society.

Open Houses were held on March 29, 30, and 31 and on June 1 and 2, 2004, at various locations inthe City to obtain public input into the Study.

All information gathered was then evaluated in order to determine whether it was relevant, current and comprehensive in terms of spatial coverage. Gaps in the information were identified and filled through aerial photo interpretation and a very limited amount of field work.

Maps showing natural heritage features and areas of interest in the Sudbury area were created by direct import of digital data from NRVIS or by digitization from 2003 ortho-rectified digital air photos commissioned by the City. Additional details on source information related matters are discussed for each section of natural heritage features.

3. AN OVERVIEW OF SUDBURY'S NATURAL HERITAGE

3.1 Aquatic Natural Heritage Features

Approximately 13 % of the City is covered by water. Aquatic natural heritage features in the City include 330 lakes over 10 ha in size, hundreds of smaller lakes, major river systems (e.g., Vermilion River and Wanapitei River), and numerous other watercourses. Many lakes and the major rivers are used as drinking water sources as well as for water-based recreation. From a natural heritage standpoint, an important value of the aquatic features is in the fish habitat that they provide. This aspect is discussed in section 4.2.

3.2 Vegetation

A vegetation cover map of the City was developed for this Study using data from the OMNR's Forest Resource Inventory (FRI) based on 1989 and 1990 aerial photography interpretation (Figure 2 - back pocket). Stands were reclassified based on FRI data in an attempt to approximate as much as possible the ecosites defined by the Forest Ecosystem Classification (Chambers et al, 1997). Where the latter was not possible or desirable, an ecologically meaningful category was used (see Appendix E).

Figure 2 clearly shows that forests cover most of the City of Greater Sudbury, but that a diversity of other vegetation types are present as well. Table 1 lists the various vegetation cover types by total area and percent. Roughly 60 % of the City is covered by forests, including forested wetlands. Forests range from pine-dominated stands in the northern part of the City to mixed and deciduous stands in the south to early stage forests in the central portion reflecting some recovery from impacts by past mining activities. Wetlands cover 9 % of the City representing several wetland types from conifer and deciduous swamps to marshes. The 'Valley' offers relatively large expanses of fields associated with the current and past agricultural activities occurring there. Exposed bedrock covers about 8 % of the City but this amount is expected to be less now since additional forest recovery has occurred on previously damaged land since 1989/1990, the years in which the data were gathered.

Table 1. Vegetation cover types by total area and percent of the City.

Vegetation Cover Type	Total Area (hectares)	Percent of City Area
FOREST (Total)	**209077**	**57.6**
Red Pine/White Pine	9537	2.6
Jack Pine and/or Black Spruce (upland)	25760	7.1
Shade Tolerant Mixed	277	0.08
Shade Tolerant Deciduous	5280	1.5
Shade Tolerant Coniferous	75	0.02

Shade Intolerant Coniferous	20130	5.5
Shade Intolerant Mixed	46255	12.7
Shade Intolerant Deciduous	101763	28
WETLAND (Total)	**33144**	**9.1**
Lowland Coniferous[1]	4991	1.4
Lowland Deciduous[1]	540	0.15
Swamp[2]	4820	1.3
Open Wetland[3]	15087	4.2
Thicket Swamp	7706	2.1
Rock	30546	8.4
Developed Agricultural Land	7280	2
Field	5547	1.55
Developed Land[4]	30408	8.4
Water	47044	13
TOTAL	**363046**	**100**

[1] Including lowland types as wetlands is assumed to be reasonable in most cases given the species listed in the stand information of the Forest Resources Inventory (FRI).
[2] Swamp is an FRI class termed 'Treed Muskeg' that is likely conifer swamps in most cases.
[3] Open Wetland is an FRI class termed 'Open Muskeg' that includes various marsh types.
[4] Developed Land includes urban areas, mine and mine waste areas, and rights-of-way for electrical power distribution.

3.3 Wildlife

Wildlife species that are listed as 'Endangered' or 'Threatened' by the OMNR and for which location data were available are not included in any of the species lists or species totals in the paragraphs below.

3.3.1 Amphibians and Reptiles

According to the Ontario Herpetological Summary Atlas (Oldham and Weller, 2000), 12 species of amphibians and 10 species of reptiles have been recorded in the City (Appendix A). Of

these species, the Wood Turtle is listed as 'Vulnerable' by the OMNR.

3.3.2 Birds

The Sudbury Ornithological Society reports that 300 species of birds have been recorded thus far in the Sudbury area (Whitelaw, 2004), including birds breeding in the area, those simply passing through during migration, and 'accidental' birds far from their normal range.

Breeding birds are especially representative of the quality and quantity of available habitat in an area. Information on Sudbury's breeding birds was obtained from the Ontario Breeding Bird Atlas website (http://www.birdsontario.org/atlas/atlasmain.html) in July 2004. The Breeding Bird Atlas is based on breeding evidence codes assigned to bird sightings in individual 10 x 10 km squares of the National Topographic System (NTS). The Ontario Breeding Bird Atlas is divided into two periods: 1) 1st Atlas period - 1981 to 1985 and 2) 2nd Atlas period - 2001 to 2005.

Lists of birds associated with the forty-five (45) 10 x 10 km squares that roughly cover the City of Greater Sudbury were downloaded from the above website and arranged in a spreadsheet. Bird species were arranged in a list for both Atlas periods based on decreasing number of squares in which they have been recorded and assigned the breeding codes of 'Possible', 'Probable', or 'Confirmed' (all considered as 'breeding' in this Study). The Atlas data for a given area represents a measure of frequency of occurrence of the species across that area, but does not reflect how abundant the species is. For this Study, the greater the number of squares that a species is recorded as breeding, the more widely distributed the species is assumed to be within the City.

Based on the Ontario Breeding Bird Atlas, 183 species of birds have been recorded as breeding in the City (Appendix B). Of these, 12 species were recorded as breeding in the 1st Atlas period only.

Given the large extent of forest cover in the City, forest birds are expected to be frequent breeders. The ten most widespread breeding species across the City, recorded in over 90% of the 45 squares, include several forest bird species like the Red-eyed Vireo, Chestnut-sided Warbler, White-throated Sparrow, Veery, Hermit Thrush and Yellow-rumped Warbler. Several area-sensitive forest bird species (i.e., those birds requiring relatively large and undisturbed forest stands) occur in over fifty percent of the 45 squares that cover the City. These area-sensitive species include the Ovenbird, Broad-winged Hawk, Veery, Hermit Thrush, Canada Warbler, Black-throated Blue Warbler and several others. Based on draft relative abundance maps prepared for a few species by the Ontario Breeding Bird Atlas, a large portion of the City occurs in one of the zones of greatest relative abundance in Ontario for the Red-eyed Vireo, a moderately area-sensitive forest bird species (http://www.birdsontario.org/atlas/pointcountmaps.html#Red-eyed%20Vireo) (September 14, 2004). Clearly, the City's forests are large enough to support a diverse and representative bird community.

The relatively large cover of wetlands and lakes in the City are reflected by the widespread breeding records (i.e., > 60% of squares) for wetland birds such as the Common Yellowthroat, Swamp Sparrow, Red-winged Blackbird, Eastern Phoebe and American Bittern and lake

specialists like the Common Loon.

Grassland bird species are also well-represented in the City due to the agricultural land in the 'Valley'. Of particular interest is the presence of area-sensitive grassland species, such as Upland Sandpiper and Bobolink, that require relatively large patches of suitable field habitats (Dechant et al, 1999a,b).

Four species that have been recorded as breeding in the City are listed as 'Vulnerable' by the OMNR: Red-shouldered Hawk, Great Gray Owl, Black Tern and Red-headed Woodpecker.

3.3.3 Mammals

According to the Atlas of the Mammals of Ontario (Dobbyn, 1994), 46 mammals have been recorded in the City (Appendix C). All of these species are broadly distributed over Ontario and other parts of Canada. The occurrences of Hairy-tailed Mole, Gray Squirrel and Long-tailed Weasel in the City appear to be at the northern extent of their range in Ontario.

While none of the species occurring in the City are listed as 'Vulnerable' by the OMNR, several are important commercial species for hunting and trapping. Wapiti or 'Elk', which were reintroduced to the Burwash/French River area during the first half of the previous century and again in the 1990s and 2000s, have been sighted in the southern portion of the City. Elk restoration in Ontario is an OMNR initiative that is overseen by the Provincial Elk Restoration Advisory Committee.

4. SPECIFIC NATURAL HERITAGE FEATURES AND AREAS

The following sections discuss the specific natural heritage features and areas identified in the City through this Study. Features include those mentioned in the existing PPS (i.e., sections 4.1 through 4.7), those that are mentioned in the proposed changes to the PPS (section 4.8) and those that are not mentioned in the PPS but that are still important to the City (section 4.9 and 4.10).

4.1 Significant Portions of the Habitat of Endangered and Threatened Species

4.1.1 Background

The PPS defines an endangered species and threatened species as follows:

> *Endangered species means any native species, as listed in the Regulations under the Endangered Species Act, that is at risk of extinction throughout all or a significant portion of its Ontario range if the limiting factors are not reversed.*
>
> *Threatened species means any native species that is at risk of becoming endangered through all or a portion of its Ontario range if the limiting factors are not reversed.*

The City is inhabited by one endangered species and one threatened species. Due to the sensitive nature of the records, the endangered and threatened species cannot be identified in this report. The rough locations of the records, however, are shown on Figure 3 (back pocket).

A third species, the Bald Eagle, is also listed as 'Endangered' by the OMNR. The Ontario Breeding Bird Atlas efforts to date have resulted in two Bald Eagles observed in the breeding season in suitable nesting habitat (assigned the breeding evidence code of 'Possible' only). However, no Bald Eagle nests are known to exist in the City.

4.1.2 Planning and Regulatory Context

Policy 2.3.1 a) of the PPS states:

> *Natural heritage features and areas will be protected from incompatible development.*
> *a) Development and site alteration will not be permitted in:*
> *...*
> - *significant portions of the habitat of endangered and threatened species.*

In addition, the PPS includes section 2.3.2, which addresses 'adjacent lands':

> *2.3.2. Development and site alteration may be permitted on adjacent lands to a) and b) if it has been determined that there will be no negative impacts on the natural features or on the ecological function for which the area is identified.*

Proposed changes to the PPS uphold the above statement with minor modification:

> *2.1.2.1 Development and site alteration will not be permitted in:*
> *a) significant habitat of endangered and threatened species;...*

2.1.2.5 Development and site alteration will not be permitted on adjacent lands to 2.1.2.2, 2.1.2.3, and 2.1.2.4 unless the ecological function of the adjacent lands have been evaluated, and it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified.

The PPS policy relating to endangered and threatened species reflects a broader concern internationally, nationally and provincially over the increasing loss of species due to human activity. The federal Species at Risk Act and the provincial Endangered Species Act were enacted to afford protection to species faced with the possibility of extinction or extirpation. The policies and legislation all hinge on a clear and effective process for assigning categories of extinction risk to species.

In Canada, there are five categories of risk that are assigned to species by the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Committee on the Status of Species at Risk in Ontario (COSSARO) reviews status reports and assesses the level of risk for each species in Ontario and recommends designations to the OMNR. The work of COSSARO integrates with and complements the work of COSEWIC. In addition to being responsible for assigning the categories of 'Extinct', 'Extirpated', Endangered', 'Threatened' and 'Vulnerable' to 'Species at Risk', the OMNR also manages the records of occurrence of these species in the province through the Natural Heritage Information Centre (NHIC).

The NHIC has expressed concern over the potential misuse of species occurrence records and discourages the identity and precise location of sensitive records being made broadly available to the public. Given the sensitivities associated with the data, the Official Plan should identify the known locations of 'Endangered' and 'Threatened' species only in a broad way (e.g., a one-kilometre circle placed off-centre of a sensitive occurrence record). The species associated with these records should not be revealed within the Official Plan document.

Documentation of Endangered and Threatened species records in the Official Plan would serve only to alert planners when reviewing development applications in the general vicinity of 'sensitive records' as shown in the Official Plan. Detailed maps of the actual 'sensitive records' would be available at the City Planning Services Division to planning staff to determine the proximity of the proposed development to a 'sensitive record'. If the two are judged to be sufficiently proximate, the OMNR should be contacted for their input in determining the nature and extent of the habitat, or portion thereof, of the endangered or threatened species and the extent of 'adjacent lands'. Discussions with the OMNR would also establish the need for and scope of an Environmental Impact Study (EIS) to demonstrate that the proposed development would create no negative impacts on the natural features or on the ecological functions of the habitat of the endangered or threatened species or to the adjacent lands. The EIS, which would be undertaken by the development proponent, would outline all potential impacts and measures to be integrated into the development to prevent or mitigate the impacts.

4.1.3 Recommended Policy Direction

Based on the above discussion, the following points should be considered in the development of the Official Plan:

1. A statement should be included in the general principles or goals that affirms Council's

support for the protection of endangered and threatened species. The Official Plan should include a section addressing endangered and threatened species.
2. The general location of an endangered or threatened species should be shown on an environmental features overlay. The species should not be identified.
3. Provisions should be included for the identification of more precise location of the record associated with the endangered or threatened species by the City or the OMNR during review of new development.
4. A specific policy should be included for undertaking an EIS when new development is proposed near the location of an endangered or threatened species.
5. A specific policy should be included for consulting the OMNR to determine the significant portions of the habitat of endangered and threatened species during the EIS. Delineation of the significant portions of the habitat of endangered and threatened species and the 'adjacent lands' (i.e., 50 m from the delineated habitat boundary) would also be conducted during the EIS.
6. Development and site alteration should not be permitted in significant portions of the habitat or endangered and threatened species.
7. Development and site alteration may be permitted on the adjacent lands (50 m) if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified.

4.2 Fish Habitat

4.2.1 Background

Fish habitat information was obtained from OMNR's NRVIS and from the Cooperative Freshwater Ecology Unit. Included in this information are locations of spawning areas for various species and locations of cold water and warm water streams and lakes where known.

With about 13% water cover and 330 lakes over 10ha in size within its boundaries (Pearson et al, 2002), the City of Greater Sudbury is host to considerable fish habitat. Thousands of lakes in northeastern Ontario have been affected by over a century of atmospheric depositions from the metal smelting operations in Sudbury. The general trend indicates recovery of these lakes but many closest to the smelters are still impaired due to relatively high acidity and concentrations of certain metals (Keller et al, 2004). Urbanization and shoreline development for cottages and recreation also continue to impact fish habitat on lakes and major watercourses.

Of the approximately 30 species of fish present in the City (Keller et al, 2004), several provide sports fishing opportunities, walleye likely being the most prized. Other sport fish include warm water species, such as Largemouth Bass and Smallmouth Bass and cold water species, such as Lake Trout and Brook Trout. Spawning habitat for the two latter species and Walleye is particularly sensitive to human disturbance and is generally not particularly abundant at any given lake. For these reasons, the spawning habitat for these three species is considered 'sensitive spawning habitat' for the purposes of this Study and specific policies are recommended.

All known sensitive fish spawning areas (i.e., for brook trout, lake trout, and walleye) are shown

on Figure 3 along with known cold water and warm water features. A close-up of Lake Ramsey's aquatic features is shown on Figure 4.

4.2.2 Planning and Regulatory Context

Under the federal Fisheries Act, "fish habitats" are defined as those parts of the environment "on which fish depend, directly or indirectly, in order to carry out their life processes". The Act also defines "fish" to include all the life stages of "fish, shellfish, crustaceans, marine animals and marine plants". Pursuant to the Act, the Department of Fisheries and Oceans developed a "Policy for the Management of Fish Habitat". The Policy applies to all projects and activities, large and small, in or near the water, that could "*alter, disrupt or destroy*" fish habitats, by chemical, physical or biological means. The Policy is guided by the principle of "no net loss" such that unavoidable habitat losses are balanced with habitat replacement on a project-by-project basis so that further reductions to Canada's fisheries resources due to habitat loss or damage may be prevented. The harmful alteration, disruption or destruction of fish habitat is prohibited unless authorized by the DFO pursuant to Section 35(2) of the Fisheries Act. In keeping with DFO's Policy for the Management of Fish Habitat, no such authorizations are issued unless acceptable measures for the habitat loss are developed and implemented by the proponent. In Ontario, the Policy for the Management of Fish Habitat is generally implemented with the cooperation of Conservation Authorities.

Based on the above, the PPS broadly defines 'fish habitat' as "*the spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes*". The PPS states that development and alteration may be permitted in fish habitat if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified. Again, the EIS is the means usually used to demonstrate the absence of impacts.

The proposed changes to the PPS recognize the federal and provincial jurisdiction on matters of fish habitat by stating:

> *2.1.2.4 Development and site alteration will not be permitted in fish habitat, except in accordance with provincial and federal requirements.*

The municipality, however, still has the ability to establish measures to protect fish habitat through shoreline policies. One common measure is through the use of vegetated buffers.

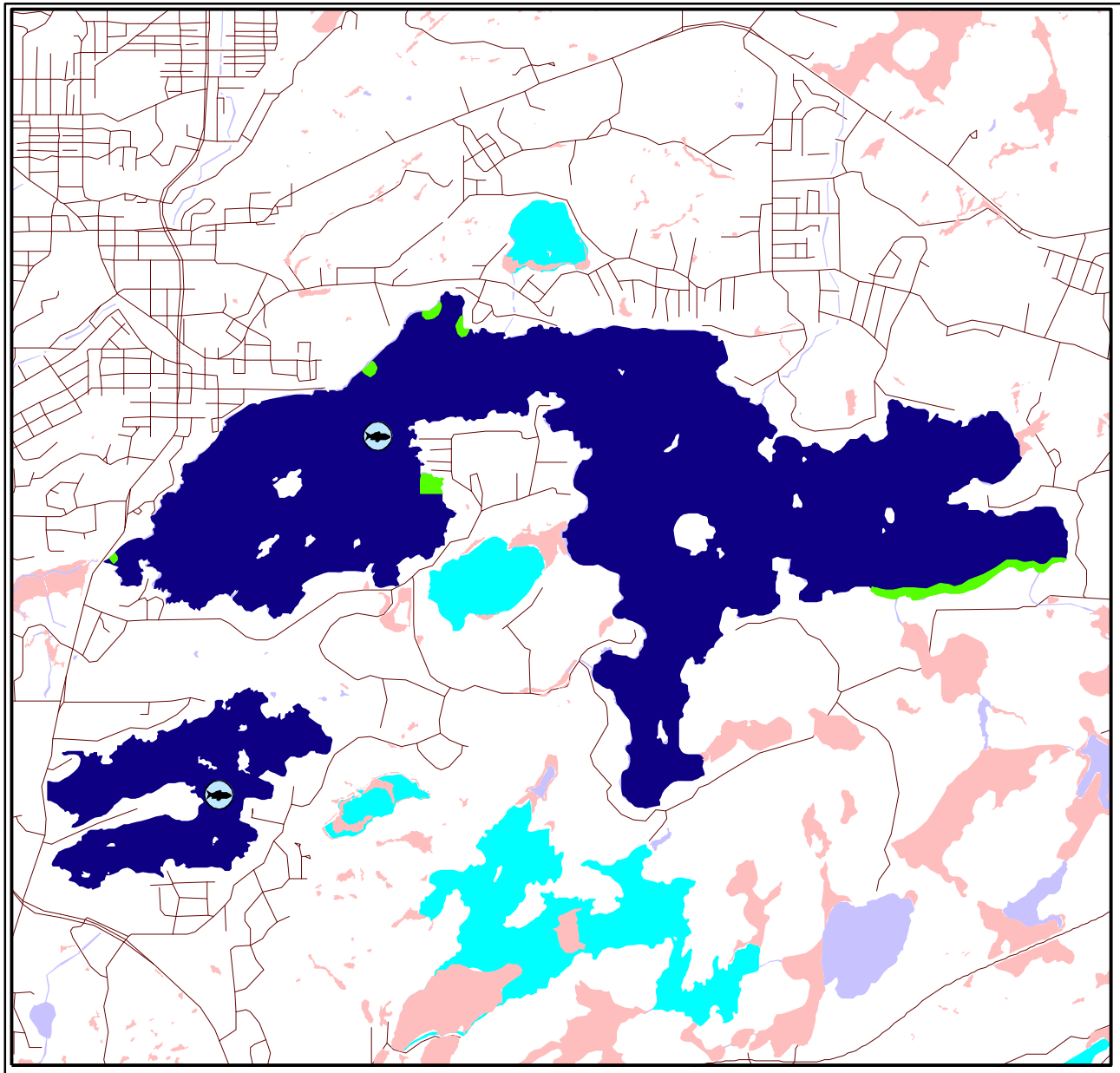
4.2.3 Riparian, Shoreline and Wetland Buffers

Strips of natural vegetation separating streams (or rivers), lakes and wetlands from adjacent land-uses that could act as non-point pollution sources or sources of other ecological disturbances are known respectively as riparian, shoreline and wetland buffers. These buffers serve a number of important functions, including the following (from Wenger and Fowler, 2000):

- Maintaining habitat for fish and other aquatic organisms;
- Trapping and removing sediment from runoff;
- Stabilizing stream banks and reducing channel erosion;
- Trapping and removing nutrients and contaminants;
- Storing floodwaters, thereby reducing property damage;

FIGURE 4

Aquatic & Wetland Features (Ramsey Lake)



Road

Lake Trout Lake

Surfacewater

Cold Water River

Warm Water River

Cold Water Lake

Warm Water Lake

Unknown Thermal Regime (Lake)

Wetland

Critical Fish Spawning Area

Walleye Spawning Area

Greater Sudbury

1:45,000

0 0.25 0.5 1 1.5 2

Kilometers

Projection: UTM NAD 83 Zone 17

N

W E

S

This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation.

Base data derived in part from the Natural Resources and Values Inventory System (NRVIS) compiled at a scale of 1:20,000.

- Providing terrestrial habitat;
- Maintaining good water quality;
- Improving aesthetics, thereby increasing property values;
- Offering educational and recreational opportunities.

Ideally, buffers are composed of multilayered vegetation, from groundcover to tree canopy. Complex vegetation layering increases the benefits offered by the buffer by increasing its pollution filtering capabilities, habitat types, and visual screening abilities. The width of the buffer is also a critical factor in determining its effectiveness. While the literature on this topic is extensive, there are no clearly established standard buffer widths (Castelle et al, 1992; Fischer and Fischenich, 2000; Palone and Todd, 1998; Wenger, 1999; Wenger and Fowler, 2000). What is clear from the literature is that the wider the buffer, the greater the types and degree of ecological and environmental benefits derived from the buffer. Also, the greater the slope of the shoreline or streambank, the greater the width of buffer required to achieve benefits. Relatively narrow buffers (5 to 15 m) provide some sediment and phosphorus control along with limited wildlife habitat (Wenger, 1999). Greater buffer widths (15 to 30 m) remove additional levels of pollutants and create wildlife habitat for an increasing number of species. Protecting diverse terrestrial riparian wildlife communities requires forested buffers of at least 100 m (Fischer, 2000).

Buffer guidelines and by-laws have been developed for numerous jurisdictions in North America (Fischer, 2000; Fischer and Fischenich, 2000; US EPA, 2001a; Wenger and Fowler, 2000). Two approaches are typically proposed: 1) a standard buffer width applied to all situations and 2) a flexible buffer width that is determined based on site-specific conditions such as slope. The standard buffer width approach is easier to implement but, since it does not respect site-specific conditions, can result in varying degrees of environmental and ecological benefits. Conversely, the flexible buffer width approach is more site-specific but much more difficult to implement since it requires site data collection and technical expertise.

Regardless of the buffer width approach that is adopted, Wenger (1999) recommends eliminating all major sources of contamination from buffers such as construction activities resulting in major land disturbances, impervious surfaces, mining activities, septic tank drain fields, clear cutting of forests, waste disposal sites, etc. As well, application of pesticides and fertilizers should be prohibited, except as may be needed for buffer restoration.

4.2.4 Recommended Policy Direction

Based on the above discussion, the following points should be considered in the development of the Official Plan:

1. A general policy to protect fish habitat from harmful alteration, disruption or destruction should be included.
2. A general policy to prohibit development and site alteration in fish habitat, except in accordance with provincial and federal requirements, should be included.
3. A general policy to encourage restoration, enhancement or creation of fish habitat should be included.
4. Natural vegetated buffers should be maintained adjacent to the shoreline and banks of

all lakes, rivers, and streams. Coldwater streams may require greater buffer widths than warmwater streams. Appropriate buffer widths also depend on the characteristics of the buffer, terrain conditions, and the desired buffer function(s).

5. Setbacks between all buildings, except boathouses and floatplane hangars, and the shoreline of all lakes should be applied.
6. All construction activities should be mitigated for potential impacts to surface water runoff.
7. All known 'sensitive' fish spawning areas (i.e., for brook trout, lake trout, and walleye) should be identified on an environmental overlay map appended to the Official Plan and impacts to these areas should be addressed when considering new development.
8. New development proposed within 120 metres of 'sensitive' fish spawning areas should not negatively impact these areas.
9. New lots should be discouraged where the entire shoreline abuts 'sensitive' spawning habitat.
10. Boathouses or float plane hangars should discouraged in 'sensitive' spawning habitat (although permission to build would be established through the DFO permitting process).
11. The Official Plan should allow for minor adjustments to be made to the boundaries of 'sensitive' fish spawning areas as shown on the schedule without an Official Plan amendment.

4.3 Wetlands

4.3.1 Background

The PPS defines a wetland as:

> *"lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens. Periodically soaked or wet lands being used for agricultural purposes which no longer exhibit wetland characteristics are not considered to be wetlands for the purposes of this definition."*

Wetlands of various types cover approximately 9 % of the City (Figure 3). Slightly less than half of these wetlands are categorized as "open wetlands", which include marshes, fens and treeless bogs. The rest include thicket swamps and various forested wetlands (i.e., swamps).

One wetland in the City, the Vermilion River Wetland Complex, is considered provincially significant (Figure 3). The boundary of the Vermilion River Wetland Complex was obtained from OMNR's NRVIS. Information for other wetlands was obtained from OMNR FRI data (as per Table 1) except for the area around the Sudbury urban area (outlined by the box on Figure 3) in which wetlands were digitized from the 2003 aerial photos by City staff.

4.3.2 Planning and Regulatory Context

Policy 2.3.1 states:

> *Natural heritage features and areas will be protected from incompatible development. ...*
> *b) Development and site alteration may be permitted in: ...*
> - *significant wetlands in the Canadian Shield; ...*

> *if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified.*

Proposed changes to the PPS would not allow development and site alteration in significant wetlands in Site Regions 5E, 6E and 7E (i.e., roughly the southern two-thirds of the City). Additional proposed changes would not permit development and site alteration in significant wetlands in the Canadian Shield north of Site Regions 5E, 6E, and 7E, unless it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified.

Wetlands provide a number of important ecological functions, including:

1. nutrient removal and transformation;
2. sediment and toxicant retention;
3. shoreline stabilization;
4. floodflow alteration;
5. ground water recharge;
6. organic matter production and export;
7. aquatic diversity and abundance; and,
8. habitat for wildlife (Marble, 1991).

Every wetland provides several of the functions listed above. Wetland loss can have serious environmental consequences including rapid degradation of stream and lake water quality in hydrologically connected systems. The relative significance and/or sensitivity of wetland features and functions provided by individual wetlands should be evaluated based on the watershed or catchment within which they are located. Significant and/or sensitive wetland features and functions should be protected from incompatible development. Buffers should be considered for the protection of wetland features and functions (see Section 4.2).

4.3.3 Recommended Policy Direction

The following points should be considered in the development of the Official Plan. Policy direction is dependent to some extent on the final adopted version of the PPS.

Provincially Significant Wetlands

Two policy direction options are offered for provincially significant wetlands. Policy direction is dependent on the final adopted version of the PPS:

1. Development or site alteration, including peat extraction, should not be permitted in a provincially significant wetland.

OR

2. Development and site alteration should not be permitted in a provincially significant wetland unless it has been demonstrated, through the completion of an EIS, that there will be no negative impacts on wetland features or functions.
3. Peat extraction should not be permitted in a provincially significant wetland.

All Wetlands (i.e., except provincially significant wetlands)

1. All wetlands should be identified on an environmental overlay map appended to the O.P. (i.e., wetlands shown on Figure 3).
2. Every wetland can provide several environmental functions, some more critical than others. Ideally, development and site alteration should be directed away from wetlands. Wetland loss can have serious environmental consequences including rapid degradation of stream and lake water quality in hydrologically connected systems. The relative significance and/or sensitivity of wetland features and functions provided by individual wetlands should be evaluated based on the watershed or catchment within which they are located. Significant and/or sensitive wetland features and functions should be protected from incompatible development or site alteration, including peat extraction.

   Consider the following two options to protect wetlands from incompatible development:

   2a). Development and site alteration should not be permitted in a wetland unless it has been demonstrated that there will be no negative impacts to significant and/or sensitive wetland features and functions. Proponents are encouraged to discuss their development plans with planning staff early in the approval process. Planning staff shall determine the need for an EIS during these early discussions with the proponents or at the time of development or site alteration application.

   OR

   2b). The significance and/or sensitivity of individual wetland features and functions shall be determined through the development of watershed plans. Development and site alteration should not be permitted in a wetland unless it has been demonstrated that there will be no negative impacts to significant and/or sensitive wetland features and functions.

3. Wetlands should be delineated through field investigations undertaken by a qualified person during the site planning stage, or during an EIS, if such a study is determined to be necessary. The O.P. should allow for the minor modification of wetland boundaries as depicted on the environmental overlay map without an O.P. amendment.
4. The O.P. should allow for the identification of additional wetlands to those on the environmental overlay map appended to the O.P.

5. Natural vegetated buffers should be maintained adjacent to the edges of wetlands to protect and enhance the ecological functions provided by the wetlands. Appropriate buffer widths depend on the characteristics of the buffer, terrain conditions, wetland functions, and the desired buffer function(s).

4.4 Significant Wildlife Habitat

4.4.1 Background

Significant wildlife habitat information was obtained from OMNR's NRVIS and from the OMNR's FRI data.

Section 2.3 of the Provincial Policy Statement identifies *significant wildlife habitat* as a natural heritage feature, and thus it "should be protected from incompatible development". For the purpose of this report, the term *wildlife* refers to "*all wild mammals, birds, reptiles, amphibians, fishes, invertebrates, plants, fungi, algae, bacteria and other wild organisms*" (Ontario Wildlife Working Group, 1991). Furthermore, the Provincial Policy Statement identifies *wildlife habitat* as:

> *areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter, and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual life cycle; and areas which are important to migratory or non-migratory species.*

Therefore, wildlife habitat is considered *significant* where it is

> *ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System. Criteria for determining significance may be recommended by the Province, but municipal approaches that achieve the same objective may also be used.* (OMNR 2000)

Areas of significant wildlife habitat differ from other natural heritage features/areas in that it falls upon the Municipality to recognize and identify them. Although the OMNR offers considerable technical guidance on the identification, description and prioritisation of significant wildlife habitat, it is the responsibility of municipalities to determine how they shall "have regard to" this feature.

Based on guidance provided by the Signficant Wildlife Habitat Technicial Guide (OMNR, 2000), the following significant wildlife habitat types have been retained for this Study:

- moose late wintering areas;
- colonial bird nesting sites;
- old-growth forest stands; and
- habitats of Species of Conservation Concern.

Information was obtained from OMNR's NRVIS, but is limited since comprehensive inventories have not been undertaken by the OMNR in the City.

Late winter is often a critical period for moose in the north when the habitat is responsible for carrying these animals through the final stages of winter. Figure 3 shows the known moose late winter habitat in the City. Other late winter habitat may also exist in the City in areas not surveyed by the OMNR.

Nesting colonies of great blue herons (colonial bird nesting sites) and osprey nesting sites (specialized raptor nesting habitat) represent important wildlife features that require protection. Heronries and osprey nests require considerable effort to establish on the part of the birds and are generally used for several years. General locations of known heronries and osprey nests in the City are identified on Figure 3.

Old-growth forest stands occur at various locations in the City. The most extensive occurs on Crown Land in the Wolf Lake Old Growth Forest Reserve in the northeastern corner of the City. The Wolf Lake site represents the largest contiguous area of red pine working group stands older than 140 years in Site Region 4E (Southern Boreal Site Region) of Ontario (Arbex Forest Dev. Co. Ltd.,1991).

Five species designated as 'Vulnerable' (therefore considered Species of Conservation Concern) by the OMNR occur in the City. The following table identifies the situation of these 'Vulnerable' species.

Table 2. List of 'Vulnerable' species in the City

Species Name	Current Status
Wood Turtle	Known locations all occur within the boundaries of the Vermilion River Wetland Complex and therefore would not be prone to disturbances by development if the policies recommended for wetlands in this report are applied.
Red-shouldered Hawk	Two 'Possible' breeding records and one confirmed breeding record in the 2nd Breeding Bird Atlas period.
Great Gray Owl	One confirmed breeding record in the 2nd Breeding Bird Atlas period.
Black Tern	One confirmed breeding record in the 2nd Breeding Bird Atlas period.
Red-headed Woodpecker	One breeding record in the 1st Breeding Bird Atlas period only. No current evidence of breeding.

Only 'Confirmed' breeding records can be addressed in this Study since they are most assured of being associated with a nest. Exact locations of the breeding bird records were not identified in any of the background information reviewed.

4.4.2 Recommend Policy Direction

The following points should be considered in the development of the Official Plan:

1. Development and site alteration in moose late wintering areas should be sensitive to the critical habitat functions provided by these areas for sustaining local moose populations.
2. New development or site alteration proposed adjacent to heronries and osprey nesting sites should not result in negative impacts to the nesting efforts of these birds.
3. New development or site alteration proposed within 120 metres of the nests of great gray owls, red-shouldered hawks and black terns should not result in negative impacts to the nesting efforts of these birds.

4.5 Areas of Natural and Scientific Interest (ANSIs)

4.5.1 Background

The PPS describes *areas of natural and scientific interest (ANSIs)* as "*areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study, or education*".

A *significant area of natural and scientific interest* is defined within the same policy as "*an area identified as provincially significant by the Ministry of Natural Resources using evaluation procedures established by the province, as amended from time to time*".

There are two types of ANSIs (OMNR 1999):

1. Life science ANSIs–significant representative segments of Ontario's biodiversity and natural landscapes including specific types of forests, valleys, prairies and wetlands, their native plants and animals, and their supporting environments. They contain relatively undisturbed vegetation and landforms, and their associated species and communities. Provincially significant life science ANSIs include the most significant and best examples of the natural heritage features in the province and many will correspond with other significant features and areas such as wetlands, valleylands and woodlands.
2. Earth science ANSIs–consist of some of the most significant representative examples of the bedrock, fossil and landforms in Ontario, and include examples of ongoing geological processes.

There are five (5) factors used by the Province to evaluate potential ANSIs:

1. Representation of geological themes or of the landform-vegetation features of an ecological site district;
2. Condition, which considers existing and past land uses as a means of assessing the degree of human-induced disturbance;
3. Diversity, which assesses the number of high quality, representative features that exist within a site;
4. Other ecological considerations, particularly those related to hydrological function and connectivity (linkages with other natural areas), size, shape, proximity to other important areas, etc; and

5. Special features, which includes populations of vulnerable, threatened or endangered species, special habitats, unusual geological features, and educational or scientific value.

Sites which do not occur within provincial parks or other protected areas and which are considered to be the best representatives are considered provincially significant ANSIs. Other sites that still provide good representation (i.e. still meet all 5 of the criteria), may be identified as regionally significant ANSIs.

According to Phil Kor (personal communication, 2004a) and Scott Dingwall (personal communication, 2004) of the OMNR there is only one provincially significant ANSI in the City - the Vermilion River and Delta (Life Science ANSI). This ANSI is also considered a part of the Vermilion River Wetland Complex, a provincially significant wetland, and its protection is addressed by the recommended policy direction outlined in Section 4.3.

4.5.2 Planning and Regulatory Context

Policy 2.3.1 b) of the PPS states that "*development and site alteration may be permitted in .... significant areas of natural and scientific interest if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified*".

OMNR (1999) recommend that land 50 metres from an ANSI boundary be considered as 'adjacent lands'. As per Policy 2.3.2 of the PPS, "(d)*evelopment and site alteration may be permitted on adjacent lands (to significant ANSIs) if it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified*".

The proposed changes to the PPS to do not modify the existing PPS's policies relating to ANSIs.

4.5.3 Recommended Policy Direction

As stated previously, there is only one provincially significant ANSI in the City, and this ANSI is contained within the Vermilion River Wetland Complex, a provincially significant wetland, thereby affording it the necessary protection through the recommended wetland policies outlined in Section 4.3.

Candidate Earth Science ANSIs are included as Geological Sites of Interest as discussed in Section 4.9.

4.6 Environmental Impact Studies

4.6.1 Background

Environmental Impact Studies (EIS), also known as Environmental Assessments, are the most common means of assessing the impacts of proposed developments on natural features and ecological functions. The environmental impact assessment process is used world-wide at all levels of government and for the full range of development projects. Due to the expertise

required, EISs are generally undertaken by qualified environmental professionals on behalf of development proponents. The Natural Heritage Reference Manual (OMNR, 1999) describes the environmental impact assessment process suggested to demonstrate that there will be no negative impacts on the natural features or ecological functions for which an area is identified.

The EIS process generally begins with an initial assessment based on consultation with the planning authority. The proponent initially outlines the proposed development project and activities to the municipal staff involved in the development application review. Municipal staff examine project scope, site conditions, background information, policy direction, and applicable regulations and determine the best approach to assess whether or not negative environmental impacts would result from the project. The proposed development may, for example, be subject to environmental impact assessment processes under other legislation, including the *Environmental Assessment Act,* the *Ontario Energy Board Act,* and the *Ontario Water Resources Act*. In this case, satisfying the impact assessment requirements under these Acts should also satisfy any municipal requirements for EISs, thus avoiding duplication of effort. Assessing development impacts may also be incorporated into other approval requirements such as permits under the *Public Lands Act, Lakes and Rivers Improvement Act, Conservation Authorities Act*, etc. Again duplication should be avoided by having one EIS satisfy all requirements for impact assessment.

Importantly, municipal staff also determine if an EIS is required, and if so, if the EIS will be a scoped-site EIS or a full-site EIS.

The scoped-site EIS addresses the EIS requirements in an abbreviated report form or checklist prepared by the development proponent or an environmental professional. The scoped-site EIS is applied to minor developments, such as applications for single-lot severances, or in situations where mitigation measures are well-established or where negative impacts are known to be minor based on experience with local conditions. The scoped-site EIS would include some of the same elements as the full-site EIS depending on the development proposal, but in brief form (e.g., yes-no checkboxes, brief descriptions, schematic drawing of proposal, etc.). The exact requirements of the scoped-site EIS would be established in consultation with municipal staff.

The full-site EIS addresses the EIS requirements at a level of detail appropriate to the scope of the proposed development. A qualified professional is typically retained by the proponent to prepare the full-site EIS.

Environmental Impact Studies typically include the following:

a) A map showing the location of the Study Area, including the location and extent of the natural heritage features of interest and the location of the proposed development.
b) A description of the natural heritage features and ecological functions in the Study Area that could be affected by the proposed development and their sensitivity to development.
c) A description of the proposed development.

d) A description of the proposed development's potential impacts to the natural heritage features and ecological functions, if any. Impact evaluation should consider all phases of the proposed development, including post-construction.
e) A description of the actions that may be reasonably required to prevent, change, minimize or mitigate impacts on the natural heritage features and functions as a result of the proposed development. Identification, where appropriate, of opportunities for ecological restoration and enhancement of the natural features and functions.
f) An evaluation of cumulative effects that the proposed development, in light of existing development and activities in the area, may have after mitigation on natural heritage features and ecological functions.
g) A professional opinion as to whether or not the proposed developments will have negative impacts on natural heritage features and ecological functions.
h) A description of monitoring activities to be undertaken to ensure that the mitigative measures are having the desired effect. Identification of the parties responsible for assessing the monitoring needs and conducting the monitoring activities.

4.6.2 Recommended Policy Direction

The following points should be considered in the development of the Official Plan:

1. The typical EIS as outlined above should be the means by which to demonstrate that there will be no negative impacts from the proposed development on the natural features or ecological functions for which an area is identified (see previous sections).
2. Proponents should be strongly encouraged to discuss development proposals early in the process with municipal staff to ensure that the appropriate level of environmental assessment is applied to the development.
3. The scoped-site EIS should be used in some situations (e.g., minor developments, well-established mitigation measures, etc.).
4. The full-site EIS should be used for development proposals where the scoped-site EIS is insufficient to address potential impacts.

4.7 Natural Heritage Features - Diversity and Connectivity

4.7.1 Background

Along with the specific natural heritage features, the PPS includes a policy addressing broader ecosystem components such as diversity and connectivity. Policy 2.3.3 states that "(t)*he diversity of natural features in an area, and the natural connections between them should be maintained, and improved where possible*". This policy is carried forward with modifications in the proposed changes to the PPS:

> "*2.1.1 The diversity and connectivity of natural features in an area, and the long-term ecological function of natural heritage systems, should be maintained, restored or improved where possible, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features*".

A natural heritage system is defined in the proposed changes to the PPS as: "*a system made up of natural heritage features and areas, linked by natural corridors necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems*".

4.7.2 Diversity

In the context of Policy 2.3.3, 'diversity' is apparently intended to apply to the *natural heritage features and areas* as defined in Section 1.2 of this report. As outlined in this report, the City contains a considerable number of natural heritage features and areas, the most significant features of which are shown on Figure 3.

Maintenance and improvement of the diversity of natural features should be achieved through the Ontario Lands for Life program for Crown Lands and through the adoption in the Official Plan of the policy directions recommended in this report.

4.7.3 Connectivity

Connectivity (connections) between natural features is also mentioned as an important ecological property of an area. Perhaps the most well-known expression of connectivity, and certainly the one intended by the PPS (as per the definition of *natural heritage system* above), is the wildlife or conservation corridor. In a recent review of corridors, Beier and Noss (1998) define a corridor as "*a linear habitat in a dissimilar matrix, that connects two or more larger blocks of habitat and that is proposed for conservation on the grounds that it will enhance or maintain viability of specific wildlife populations in the habitat blocks*". The matrix is defined as the dominant patch type in a landscape and is characterized by extensive cover, high connectivity, and/or major control over dynamics.

Connectivity and corridors are not synonymous (Lindenmeyer and Franklin, 2002). Moreover, corridors are not universally agreed on as being beneficial to conservation or on whether they function in ways in which they were intended (Groves, 2003). Lindenmeyer and Franklin (2002) emphasize that "*wildlife corridors should not automatically be assumed to be an essential component of all conservation strategies... the best general strategy to facilitate connectivity for some biota may be to improve structural conditions throughout the matrix*". Even if applied in conservation plans, most agree that functional corridors must be designed with specific species, landscapes, and ecological processes in mind, and that the goals of any corridor must be explicitly stated and analyzed (Groves, 2003). Also, the concept of wildlife corridors is inseparable from the notion of ecological scale; some corridors might operate at regional or continental scales while others, such as fencerows in an agricultural landscape, are functional only locally (Noss, 1991).

Most studies of wildlife corridors have been conducted in agricultural landscapes where corridors create a stark and often permanent contrast with the surrounding fields (Lindenmeyer and Franklin, 2002). Likewise, application of the corridor concept as a conservation planning strategy has often been in agricultural, urban or urbanizing settings (e.g., Riley and Mohr, 1994; Arnold, 1995). Lindenmeyer and Franklin (2002), however, point out that extrapolation from agricultural to managed forest landscapes is problematic because potential corridors are less evident as distinct physical features and can be dynamic due to forest regeneration and

development.

4.7.4 Recommended Policy Direction

As stated previously, the City is located within a vast forest matrix and is itself composed mainly of forest cover, much of it managed through a provincially approved forest management plan. This study considers both diversity of natural heritage features and high connectivity between natural heritage features as inherent properties of the forest matrix that dominates the City land cover and within which the City itself is embedded. These properties will be maintained overall since the forest matrix in and around the City is not about to be converted to another land cover. Furthermore, on Crown land, the forest management plan for the Sudbury Forest provides landscape-level management to maintain a shifting mosaic of forest stands of various ages and compositions.

At a finer scale, diversity and connectivity will be enhanced through ecosystem recovery occurring throughout much of the City's industrially damaged landscape as a result of continued land reclamation efforts (see Section 4.9). Overall, these efforts initiate and enhance the recovery of the forest matrix in damaged areas. At these scales, diversity and connectivity will also be addressed through the application of the policy direction proposed for using watersheds as the basic unit of planning in the City (see Section 4.8).

At a finer scale still, connectivity is afforded in the agricultural and urban area through 1) the numerous residual woodlots and second-growth on abandoned fields, 2) the forested riparian corridors along stream corridors, such as along the Whitson River, and 3) the relatively close proximity of the surrounding forest matrix. Recommended policy direction for protecting vegetated buffers around lakes, rivers and streams, if applied, will have the effect of maintaining connectivity, to some extent, at this scale.

4.8 Watersheds and Watershed-based Planning

4.8.1 Background

A watershed is the land area that drains to a single body of water such as a lake, a stream or a wetland. The concept of watersheds is not new. In Ontario, for example, the Conservation Authorities Act was legislated in 1946 in response to earlier land, water and forestry practices that resulted in environmental problems, such as loss of topsoil and floods. The Conservation Authorities Act provided the means by which the province and the municipalities of Ontario could join together to form a Conservation Authority within a specified watershed to undertake programs for natural resource management. The watershed concept is now recognized as one of the most appropriate ecosystem units on which to manage resources (Revenga et al, 1998 and US EPA, 2001b).

In Ontario, the notion of watersheds as appropriate resource planning units came to the fore following Justice O'Connor's Report of the Walkerton Inquiry in which he stated that protecting and enhancing natural systems is one of the most effective and efficient means of protecting the safety of Ontario's drinking water. The Report's 22 recommendations have lead to Ontario's watershed-based source protection planning framework under the Ontario Ministry of the

Environment (MOE, 2004).

The increase in attention to watershed planning is reflected by the proposed changes to the PPS. Whereas the term watershed is used minimally in the existing PPS (Section 1.1.1 e 1) and water quality and quantity are covered by one general policy, the revised changes would greatly expand the requirements for water protection. Section 2.2 (Water) of the proposed PPS reads as follows:

> *2.2.1 All planning authorities will provide for a comprehensive, integrated and long-term approach for the protection, improvement or restoration of the quality and quantity of water by:*
>
> *a) utilizing the watershed as the ecologically meaningful scale for planning;*
> *b) addressing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;*
> *c) identifying surface and ground water features, hydrologic functions and natural heritage features and areas necessary for the ecological and hydrological integrity of the watershed;*
> *d) identifying restrictions on development and site alteration:*
> *1) to protect all municipal drinking water supplies;*
> *2) to protect, improve or restore sensitive surface and ground water features and their hydrologic functions;*
> *e) maintaining linkages and related functions among surface and ground water features, hydrologic functions and natural heritage features and areas;*
> *f) promoting efficient and sustainable use of water resources, including practices for water conservation and sustaining water quality; and*
> *g) ensuring stormwater management practices which minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.*
>
> *2.2.2 Development and site alteration will be restricted in or near sensitive surface and groundwater features such that these features and their related hydrological functions will be protected, improved or restored.*
>
> *Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface and groundwater features, and their hydrologic functions.*

While these policies are still only proposed changes to the PPS, they reflect a clear and dramatic increase in the awareness of using watersheds as relevant planning units. Although the above policies may be modified in the final version of the revised PPS, watershed-based planning will become reality due to the depth and firmness with which this idea has taken root in Ontario and elsewhere.

As stated previously, watersheds are especially relevant in the City with its large percentage of water cover and its numerous, hydrologically independent and socially important lakes. The City's watersheds are important natural heritage features that should provide the integrative

framework for planning in Sudbury.

4.8.2 Recommended Policy Direction

Given the above discussion, the following points should be considered in the development of the Official Plan:

1. The Official Plan should recognize watersheds as a basic unit of planning in the City. As such, watershed plans should be developed using individual lakes as the appropriate spatial watershed level. Watercourses should be divided, if required, into smaller segments for the purposes of developing watershed-based plans.
2. Based on the issues to be addressed and level of detail, the Official Plan should allow for two tiers: watershed plans and subwatershed plans (nested into the former).
3. Watershed plans identify sensitive ecological features, ecological connectivity, and stressors on natural systems and propose measures to mitigate environmental stresses and enhance natural systems. Watershed plans provide recommendations on strategies for management, implementation, and monitoring to address the preservation and enhancement of the ecological features, and identify the boundaries and priorities of subwatersheds.
4. Subwatershed plans provide details on such matters as setbacks from watercourses and waterbodies, percent impervious surface cover, stormwater management, protection and/or enhancement of natural features, and rehabilitation of degraded areas. Terms for the subwatershed plans should be defined in the watershed plan. Subwatershed plan recommendations could be implemented through a variety of means, including infrastructure upgrade, development approval conditions, stormwater site management plans, property stewardship, tree planting, etc.

4.9 Sites of Geological Interest

4.9.1 Background

The City is a geologically important area whose bedrock is one of the most intensely studied on Earth (Rousell et al, 2002). Along with having the world's largest nickel-copper-platinum group elements mineral deposit (Rousell et al, 2002), the City contains a number of other important geological and geomorphological features (e.g., in Bajc and Barnett, 1999). The City has the most physically varied and economically important urban geology of any locality in Canada (Saarinen and Tanos, 2002). Although the PPS does not address geological features, except if these features are designated as provincially significant ANSIs (see Section 4.5), the important role of geology in the City warrants special consideration in the development of the Official Plan.

This study identifies Sites of Geological Interest (Figure 3) that are representative of the rich geological heritage of the Sudbury area and should be protected for future generations. These features could also contribute to the development of the ecotourism and geotourism industry in the City.

Sites of Geological Interest identified in this Study include candidate Earth Sciences ANSIs as

defined by the Ministry of Natural Resources (Kor, 2004b), sites recommended for ANSI designation by Gallie et al (1995), sites identified in the OMNR's Natural Resources Values Information System (OMNR, 1997), and sites identified in Northeastern Region Sensitive Area Report (OMNR, 1975). While these sources capture the breadth of the significant geological and geomorphological features in the City, the list is not necessarily exhaustive. To ensure comprehensive representation of geological features in the City, a plan that addresses the mapping, protection, and popularization of these features should be developed.

4.9.2 Recommended Policy Direction

The following points should be considered in the development of the Official Plan:

1. Sites of Geological Interest should be identified on an environmental overlay map appended to the Official Plan.
2. Sites of Geological Interest should be protected from incompatible development, including planning and construction associated with infrastructure (e.g., new road construction and road widening).
3. Whenever possible, public access to the geological feature should be integrated into the site plan for the development.
4. Future additions to the list of Sites of Geological Interest should be facilitated.

4.10 Ecosystem Recovery

4.10.1 Background

Sudbury's mining legacy has had profound environmental impacts. After a century of mining in the area, over 80,000 hectares of land were left either completely devoid of vegetation or in semi-barren state, with only a few stunted birches and a few grasses. Numerous lakes were rendered too acidic and too high in certain metals to support any life except a few tolerant organisms. Large reductions in local air pollution due to smelting have allowed some of these areas to begin to recover somewhat through natural plant colonization. Water quality in lakes also improved with the resultant enhancement of ecosystem function. The City's Land Reclamation Program has succeeded in liming thousands of hectares to reduce metal toxicity to plants thereby allowing millions of trees to be planted on formerly barren hillsides. Thousands more hectares, however, remain to be limed and planted to initiate ecosystem recovery and plant diversity remains low even in areas that have been treated and planted.

Similarly, numerous urban areas within the City are deficient in tree canopy cover and subsequently could be improved from an aesthetic, environmental and livability standpoint by planting additional trees and shrubs.

4.10.2 Recommended Policy Direction

The following points should be considered in the development of the Official Plan:

1. A statement should be included in the general principles or goals that affirms Council's support for the continued recovery of indigenous, self-sustaining terrestrial, aquatic and wetland ecosystems in areas of the City impaired by past smelting.

2. A statement should be included in the general principles or goals that affirms Council's support for the increase in tree canopy cover, specifically in the City's urban areas, so as to enhance the City's appearance, enhance local watersheds to help protect water quality of streams and lakes, enhance air quality, and enhance the amount of shade to protect against certain sun-related diseases and to help reduce energy use in buildings.

5. CONCLUSIONS

The principal objective of this Study is to conduct an inventory and assessment of significant natural heritage features and areas within the City and to provide recommendations for policies on matters of natural heritage in the Official Plan.

This Study integrates disparate information available on Sudbury's natural heritage and provides recommendations for natural heritage policy direction to be considered in developing the City's Official Plan. Guidance for establishing the scope of the Study is provided mainly by the Provincial Policy Statement (PPS) and associated interpretive documents prepared by the OMNR. Proposed policy changes to the Natural Heritage section of the PPS (MMAH, 2004) are reflected in this Study's recommended policy directions.

The recommended policy directions developed through this Study are outlined in Table 3 for each natural heritage feature.

Table 3. Recommended policy direction for natural heritage features

SIGNIFICANT PORTIONS OF THE HABITAT OF ENDANGERED AND THREATENED SPECIES 1. A statement should be included in the general principles or goals that affirms Council's support for the protection of endangered and threatened species. The Official Plan should include a section addressing endangered and threatened species. 2. The general location of an endangered or threatened species should be included on an environmental features overlay, but do not identify the species. 3. Provisions should be included for the identification of more precise location of the record associated with the endangered or threatened species by the City or the OMNR during review of new development. 4. A specific policy should be included for undertaking an EIS when new development is proposed near the location of an endangered or threatened species. 5. A specific policy should be included for consulting the OMNR to determine the significant portions of the habitat of endangered and threatened species during the EIS. Delineation of the significant portions of the habitat of endangered and threatened species and the 'adjacent lands' (i.e., 50 m from the delineated habitat boundary) would also be conducted during the EIS. 6. Development and site alteration should not be permitted in significant portions of the habitat or endangered and threatened species. 7. Development and site alteration may be permitted on the adjacent lands (50 m) if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified.

FISH HABITAT

1. A general policy to protect fish habitat from harmful alteration, disruption or destruction should be included.
2. A general policy to prohibit development and site alteration in fish habitat, except in accordance with provincial and federal requirements, should be included.
3. A general policy to encourage restoration, enhancement or creation of fish habitat should be included.
4. Natural vegetated buffers should be maintained adjacent to the shoreline and banks of all lakes, rivers, and streams. Coldwater streams may require greater buffer widths than warmwater streams. Appropriate buffer widths also depend on the characteristics of the buffer, terrain conditions, and the desired buffer function(s).
5. Setbacks between all buildings, except boathouses and floatplane hangars, and the shoreline of all lakes should be applied.
6. All construction activities should be mitigated for potential impacts to surface water runoff.
7. All known 'sensitive' fish spawning areas (i.e., for brook trout, lake trout, and walleye) should be identified on an environmental overlay map appended to the Official Plan and impacts to these areas should be addressed when considering new development.
8. New development proposed within 120 metres of 'sensitive' fish spawning areas should not negatively impact these areas.
9. New lots should be discouraged where the entire shoreline abuts 'sensitive' spawning habitat.
10. Boathouses or float plane hangars should discouraged in 'sensitive' spawning habitat (although permission to build would be established through the DFO permitting process).
11. The Official Plan should allow for minor adjustments to be made to the boundaries of 'sensitive' fish spawning areas as shown on the schedule without an Official Plan amendment.

WETLANDS

Provincially Significant Wetlands

Two policy direction options are offered for provincially significant wetlands:

1. Development or site alteration, including peat extraction, should not be permitted in a provincially significant wetland.
   OR

2. Development and site alteration should not be permitted in a provincially significant wetland unless it has been demonstrated, through the completion of an EIS, that there will be no negative impacts on wetland features or functions.

3. Peat extraction should not be permitted in a provincially significant wetland.

All Wetlands (i.e., except provincially significant wetlands)

1. All wetlands should be identified on an environmental overlay map appended to the O.P. (i.e., wetlands shown on Figure 3).
2. Every wetland can provide several environmental functions, some more critical than others. Ideally, development and site alteration should be directed away from wetlands. Wetland loss can have serious environmental consequences including rapid degradation of stream and lake water quality in hydrologically connected systems. The relative significance and/or sensitivity of wetland features and functions provided by individual wetlands should be evaluated based on the watershed or catchment within which they are located. Significant and/or sensitive wetland features and functions should be protected from incompatible development or site alteration, including peat extraction.

   Consider the following two options to protect wetlands from incompatible development:

   2a). Development and site alteration should not be permitted in a wetland unless it has been demonstrated that there will be no negative impacts to significant and/or sensitive wetland features and functions. Proponents are encouraged to discuss their development plans with planning staff early in the approval process. Planning staff shall assess the need for an EIS during these early discussions with the proponents or at the time of development or site alteration application.

   OR

   2b). The significance and/or sensitivity of individual wetland features and functions shall be determined through the development of watershed plans. Development and site alteration should not be permitted in a wetland unless it has been demonstrated that there will be no negative impacts to significant and/or sensitive wetland features and functions.

3. Wetlands should be delineated through field investigations undertaken by a qualified person during the site planning stage, or during an EIS, if such a study is determined to be necessary. The O.P. should allow for the minor modification of wetland boundaries as depicted on the environmental overlay map without an O.P. amendment.
4. The O.P. should allow for the identification of additional wetlands to those on the environmental overlay map appended to the O.P.
5. Natural vegetated buffers should be maintained adjacent to the edges of wetlands to protect and enhance the ecological functions provided by the wetlands. Appropriate buffer widths depend on the characteristics of the buffer, terrain conditions, wetland functions, and the desired buffer function(s).

Significant Wildlife Habitat

1. Development and site alteration in moose late wintering areas should be sensitive to the critical habitat functions provided by these areas for sustaining local moose populations.
2. New development or site alteration proposed adjacent to heronries and osprey nesting sites should not result in negative impacts to the nesting efforts of these birds.
3. New development or site alteration proposed within 120 metres of the nests of great gray owls, red-shouldered hawks and black terns should not result in negative impacts to the nesting efforts of these birds.

Areas of Natural and Scientific Interest (ANSIs)

There is only one provincially significant ANSI in the City, and this ANSI is contained within the Vermilion River Wetland Complex, a provincially significant wetland, thereby affording it the necessary protection through the recommended wetland policies outlined in Section 4.3.

Candidate Earth Science ANSIs are included as Geological Sites of Interest as discussed in Section 4.9.

Environmental Impact Studies

1. The typical EIS as outlined in Section 4.6 should be the means by which to demonstrate that there will be no negative impacts from the proposed development on the natural features or ecological functions for which an area is identified.
2. Proponents should be strongly encouraged to discuss development proposals early in the process with municipal staff to ensure that the appropriate level of environmental assessment is applied to the development.
3. The scoped-site EIS should be used in some situations (e.g., minor developments, well-established mitigation measures, etc.).
4. The full-site EIS should be used for development proposals where the scoped-site EIS is insufficient to address potential impacts.

Natural Heritage Features - Diversity and Connectivity

Addressed through other recommended policies and by the nature of the City's landscapes.

Watersheds and Watershed-based Planning

1. The Official Plan should recognize watersheds as a basic unit of planning in the City. As such, watershed plans should be developed using individual lakes as the appropriate spatial watershed level. Watercourses should be divided, if required, into smaller segments for the purposes of developing watershed-based plans.

2. Based on the issues to be addressed and level of detail, the Official Plan should allow for two tiers: watershed plans and subwatershed plans (nested into the former).
3. Watershed plans identify sensitive ecological features, ecological connectivity, and stressors on natural systems and propose measures to mitigate environmental stresses and enhance natural systems. Watershed plans provide recommendations on strategies for management, implementation, and monitoring to address the preservation and enhancement of the ecological features, and identify the boundaries and priorities of subwatersheds.
4. Subwatershed plans provide details on such matters as setbacks from watercourses and waterbodies, percent impervious surface cover, stormwater management, protection and/or enhancement of natural features, and rehabilitation of degraded areas. Terms for the subwatershed plans should be defined in the watershed plan. Subwatershed plan recommendations could be implemented through a variety of means, including infrastructure upgrade, development approval conditions, stormwater site management plans, property stewardship, tree planting, etc.

Sites of Geological Interest

1. Sites of Geological Interest should be identified on an environmental overlay map appended to the Official Plan.
2. Sites of Geological Interest should be protected from incompatible development, including planning and construction associated with infrastructure (e.g., new road construction and road widening).
3. Whenever possible, public access to the geological feature should be integrated into the site plan for the development.
4. Future additions to the list of Sites of Geological Interest should be facilitated.

Ecosystem Recovery

1. A statement should be included in the general principles or goals that affirms Council's support for the continued recovery of indigenous, self-sustaining terrestrial, aquatic and wetland ecosystems in areas of the City impaired by past smelting.

2. A statement should be included in the general principles or goals that affirms Council's support for the increase in tree canopy cover, specifically in the City's urban areas, so as to enhance the City's appearance, enhance local watersheds to help protect water quality of streams and lakes, enhance air quality, and enhance the amount of shade to protect against certain sun-related diseases and to help reduce energy use in buildings.

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APPENDIX A

Amphibians and Reptiles of the City of Greater Sudbury

Amphibians and reptiles of the City of Greater Sudbury. This list is based on records from the Ontario Herpetological Summary Atlas (Oldham and Weller, 2000). Species that are considered either ‘Endangered’ or ‘Threatened’ are not included in the list.

Salamanders

Blue-spotted Salamander
Jefferson - Blue Spotted Salamander Complex
Spotted Salamander
Northern Redback Salamander

Frogs and Toads

Eastern American Toad
Spring Peeper
Gray Treefrog
Wood Frog
Northern Leopard Frog
Green Frog
Mink Frog
Bullfrog

Turtles

Common Snapping Turtle
Midland Painted Turtle
Blanding’s Turtle
Wood Turtle

Snakes

Eastern Garter Snake
Northern Water Snake
Northern Redbelly Snake
Smooth Green Snake
Northern Ringneck Snake
Eastern Milk Snake

APPENDIX B

Birds of the City of Greater Sudbury

Breeding Birds of the City of Greater Sudbury

Breeding evidence data obtained from the Ontario Breeding Bird Atlas as of July 2004. A total of 45 squares each measuring 10 x 10 km are contained within the City of Greater Sudbury. Species are shown in decreasing occurrence of breeding evidence in 2nd atlas period.

	2nd Atlas Period 2000 - 2005		1st Atlas Period 1980 - 1985	
Bird Species	Number of squares with breeding evidence	Percent	Number of squares with breeding evidence	Percent
Red-eyed Vireo	43	95.6	45	100.0
Chestnut-sided Warbler	43	95.6	44	97.8
White-throated Sparrow	43	95.6	45	100.0
Northern Flicker	42	93.3	45	100.0
Common Raven	42	93.3	44	97.8
Veery	42	93.3	45	100.0
American Crow	41	91.1	45	100.0
Hermit Thrush	41	91.1	45	100.0
Yellow-rumped Warbler	41	91.1	44	97.8
Common Yellowthroat	41	91.1	45	100.0
Blue Jay	40	88.9	41	91.1
Black-capped Chickadee	40	88.9	45	100.0
American Robin	40	88.9	45	100.0
American Redstart	40	88.9	45	100.0
Ovenbird	40	88.9	45	100.0
Chipping Sparrow	40	88.9	45	100.0
Cedar Waxwing	39	86.7	45	100.0
Song Sparrow	39	86.7	45	100.0
Belted Kingfisher	38	84.4	44	97.8
Hairy Woodpecker	38	84.4	39	86.7
Alder Flycatcher	38	84.4	43	95.6
Nashville Warbler	38	84.4	45	100.0
Mallard	36	80.0	39	86.7
Broad-winged Hawk	36	80.0	40	88.9
Mourning Warbler	36	80.0	41	91.1
Swamp Sparrow	36	80.0	45	100.0
Common Grackle	36	80.0	44	97.8
American Goldfinch	36	80.0	41	91.1
Common Loon	35	77.8	37	82.2
Least Flycatcher	34	75.6	45	100.0
Yellow Warbler	34	75.6	43	95.6
Red-winged Blackbird	34	75.6	44	97.8
Tree Swallow	33	73.3	45	100.0
Ruffed Grouse	32	71.1	41	91.1
Black-billed Cuckoo	32	71.1	26	57.8
Magnolia Warbler	32	71.1	39	86.7
Ring-necked Duck	31	68.9	28	62.2

	2nd Atlas Period 2000 - 2005		1st Atlas Period 1980 - 1985	
Bird Species	Number of squares with breeding evidence	Percent	Number of squares with breeding evidence	Percent
Yellow-bellied Sapsucker	31	68.9	37	82.2
Ruby-throated Hummingbird	30	66.7	37	82.2
Red-breasted Nuthatch	30	66.7	37	82.2
Winter Wren	30	66.7	34	75.6
Black-throated Green Warbler	30	66.7	34	75.6
Purple Finch	29	64.4	45	100.0
American Bittern	28	62.2	18	40.0
Spotted Sandpiper	28	62.2	44	97.8
Downy Woodpecker	28	62.2	35	77.8
Pileated Woodpecker	28	62.2	25	55.6
Eastern Phoebe	28	62.2	25	55.6
European Starling	28	62.2	32	71.1
Dark-eyed Junco	28	62.2	39	86.7
Wood Duck	27	60.0	23	51.1
Black-throated Blue Warbler	27	60.0	29	64.4
American Kestrel	26	57.8	35	77.8
Black-and-White Warbler	26	57.8	42	93.3
Sandhill Crane	25	55.6	5	11.1
Mourning Dove	25	55.6	22	48.9
Blackburnian Warbler	25	55.6	24	53.3
Canada Warbler	25	55.6	42	93.3
Indigo Bunting	25	55.6	29	64.4
Evening Grosbeak	25	55.6	41	91.1
Canada Goose	24	53.3	2	4.4
Merlin	24	53.3	5	11.1
Eastern Kingbird	24	53.3	45	100.0
Philadelphia Vireo	24	53.3	19	42.2
Hooded Merganser	23	51.1	28	62.2
Blue-headed Vireo	23	51.1	16	35.6
Gray Catbird	23	51.1	33	73.3
Brown Thrasher	23	51.1	25	55.6
Savannah Sparrow	23	51.1	32	71.1
Common Merganser	22	48.9	33	73.3
Northern Harrier	22	48.9	32	71.1
Red-tailed Hawk	22	48.9	15	33.3
Common Snipe	22	48.9	33	73.3
American Woodcock	22	48.9	38	84.4
Ruby-crowned Kinglet	22	48.9	36	80.0
Swainson's Thrush	22	48.9	32	71.1
Barn Swallow	21	46.7	41	91.1
Killdeer	20	44.4	40	88.9

	2nd Atlas Period 2000 - 2005		1st Atlas Period 1980 - 1985	
Bird Species	Number of squares with breeding evidence	Percent	Number of squares with breeding evidence	Percent
Great Crested Flycatcher	20	44.4	33	73.3
Gray Jay	20	44.4	14	31.1
Golden-crowned Kinglet	20	44.4	14	31.1
Wilson's Warbler	20	44.4	17	37.8
Vesper Sparrow	19	42.2	26	57.8
Rose-breasted Grosbeak	19	42.2	42	93.3
Pied-billed Grebe	18	40.0	16	35.6
Virginia Rail	18	40.0	13	28.9
Whip-poor-will	18	40.0	40	88.9
Green-winged Teal	17	37.8	0	0.0
Sharp-shinned Hawk	17	37.8	16	35.6
Common Nighthawk	17	37.8	44	97.8
Scarlet Tanager	17	37.8	23	51.1
Pine Siskin	17	37.8	22	48.9
Great Blue Heron	16	35.6	33	73.3
American Black Duck	16	35.6	37	82.2
Sora	16	35.6	15	33.3
Rock Dove	16	35.6	15	33.3
Eastern Bluebird	16	35.6	10	22.2
Tennessee Warbler	16	35.6	23	51.1
Baltimore Oriole	16	35.6	25	55.6
Blue-winged Teal	15	33.3	32	71.1
Herring Gull	15	33.3	22	48.9
Warbling Vireo	14	31.1	16	35.6
Pine Warbler	14	31.1	9	20.0
Bobolink	14	31.1	28	62.2
Common Goldeneye	13	28.9	16	35.6
Brown-headed Cowbird	13	28.9	37	82.2
Turkey Vulture	12	26.7	4	8.9
Olive-sided Flycatcher	11	24.4	31	68.9
Northern Waterthrush	11	24.4	21	46.7
Osprey	10	22.2	8	17.8
Barred Owl	10	22.2	14	31.1
Lincoln's Sparrow	10	22.2	8	17.8
Eastern Meadowlark	10	22.2	21	46.7
Eastern Wood-Pewee	9	20.0	16	35.6
White-breasted Nuthatch	9	20.0	9	20.0
Double-crested Cormorant	8	17.8	1	2.2
Solitary Sandpiper	8	17.8	11	24.4
Black-backed Woodpecker	8	17.8	8	17.8
Yellow-bellied Flycatcher	8	17.8	10	22.2
Bank Swallow	8	17.8	19	42.2
Brown Creeper	8	17.8	9	20.0

	2nd Atlas Period 2000 - 2005		1st Atlas Period 1980 - 1985	
Bird Species	Number of squares with breeding evidence	Percent	Number of squares with breeding evidence	Percent
Great Horned Owl	7	15.6	14	31.1
Golden-winged Warbler	7	15.6	9	20.0
American Wigeon	6	13.3	5	11.1
American Coot	6	13.3	2	4.4
Northern Saw-whet Owl	6	13.3	8	17.8
Cliff Swallow	6	13.3	30	66.7
Northern Shoveler	5	11.1	7	15.6
Black/Yellow-billed Cuckoo	5	11.1	0	0.0
Chimney Swift	5	11.1	10	22.2
Ring-billed Gull	4	8.9	1	2.2
Willow Flycatcher	4	8.9	3	6.7
House Wren	4	8.9	5	11.1
Northern Mockingbird	4	8.9	4	8.9
Clay-colored Sparrow	4	8.9	6	13.3
Trumpeter Swan	3	6.7	0	0.0
Gadwall	3	6.7	0	0.0
Northern Pintail	3	6.7	8	17.8
Red-shouldered Hawk	3	6.7	0	0.0
Peregrine Falcon	3	6.7	0	0.0
Upland Sandpiper	3	6.7	11	24.4
Yellow-billed Cuckoo	3	6.7	3	6.7
Short-eared Owl	3	6.7	2	4.4
Sedge Wren	3	6.7	11	24.4
Wood Thrush	3	6.7	9	20.0
Northern Parula	3	6.7	1	2.2
Cape May Warbler	3	6.7	16	35.6
Le Conte's Sparrow	3	6.7	1	2.2
Northern Cardinal	3	6.7	2	4.4
Lesser Scaup	2	4.4	3	6.7
Bald Eagle	2	4.4	0	0.0
Northern Goshawk	2	4.4	3	6.7
Long-eared Owl	2	4.4	2	4.4
Marsh Wren	2	4.4	2	4.4
Connecticut Warbler	2	4.4	0	0.0
Rusty Blackbird	2	4.4	6	13.3
White-winged Crossbill	2	4.4	3	6.7
Red-necked Grebe	1	2.2	1	2.2
Redhead	1	2.2	1	2.2
Red-breasted Merganser	1	2.2	0	0.0
Cooper's Hawk	1	2.2	5	11.1
Spruce Grouse	1	2.2	3	6.7
Caspian Tern	1	2.2	0	0.0
Great Gray Owl	1	2.2	0	0.0

	2nd Atlas Period 2000 - 2005		1st Atlas Period 1980 - 1985	
Bird Species	Number of squares with breeding evidence	Percent	Number of squares with breeding evidence	Percent
Northern Rough-winged Swallow	1	2.2	6	13.3
Bay-breasted Warbler	1	2.2	8	17.8
Western Meadowlark	1	2.2	1	2.2
Brewer's Blackbird	1	2.2	18	40.0
House Finch	1	2.2	0	0.0
Red Crossbill	1	2.2	5	11.1
House Sparrow	1	2.2	20	44.4
Great Egret	0	0.0	1	2.2
Ruddy Duck	0	0.0	2	4.4
Wilson's Phalarope	0	0.0	3	6.7
Black Tern	0	0.0	1	2.2
Boreal Owl	0	0.0	1	2.2
Red-headed Woodpecker	0	0.0	1	2.2
Horned Lark	0	0.0	1	2.2
Purple Martin	0	0.0	9	20.0
Boreal Chickadee	0	0.0	8	17.8
Eastern Towhee	0	0.0	1	2.2
Field Sparrow	0	0.0	1	2.2
Grasshopper Sparrow	0	0.0	2	4.4

APPENDIX C

Mammals of the City of Greater Sudbury

Mammals of the City of Greater Sudbury. This list is based on records from the Atlas of the Mammals of Ontario (Dobbyn, 1994). Species that are considered either ‘Endangered’ or ‘Threatened’ are not included in the list.

Common Shrew
Smoky Shrew
Pygmy Shrew
Water Shrew
Northern Short-tailed Shrew
Hairy-tailed Mole
Star-nosed Mole
Little Brown Bat
Northern Long-eared Bat
Big Brown Bat
Snowshoe Hare
Least Chipmunk
Eastern Chipmunk
Woodchuck
Gray Squirrel
Red Squirrel
Northern Flying Squirrel
Beaver
Deer Mouse
Southern Red-backed Vole
Rock Vole
Meadow Vole
Muskrat
Southern Bog Lemming
Norway Rat
House Mouse
Meadow Jumping Mouse
Woodland Jumping Mouse
Porcupine
Coyote
Gray Wolf
Red Fox
Black Bear
Raccoon
Marten
Fisher
Ermine
Long-tailed Weasel
Mink
Striped Skunk
River Otter
Canada Lynx
Bobcat
Wapiti
White-tailed Deer
Moose

APPENDIX D

Sites of Geological Interest of the City of Greater Sudbury

Geological Sites of Interest

Name	Candidate PS ANSI*	Candidate R&L ANSI†	Information Source	Brief Description
Anthraxolite Vein			3,4	A small vein of anthraxolite, a rare form of anthracitic carbon. Only occurrence known in Ontario and may be the only anthraxolite occurrence in Canada.
Bailey Corners Glacial Striae			3,4	Glacial striae with some over 45 cm deep.
Capreol Delta			1,4	May be one of the best-developed perched deltas in the province. Gallie et al (1995) consider as provincially significant.
Chelmsford - Chelmsford Formation		√	2	Good example of turbidite bedding.
Denison - Aphebian Formations		√		No description information available.
Dowling - Onwatin Formation	√		2,4	A 12 m long by 2 m high, weathered outcrop exhibits the thin-bedded black, carbonaceous, pyritic siltstone of the Onwatin Formation. Provincially significant representation of this Formation.
Drury Bedrock Formations		√		No description information available.
Elsie Mountain Formation		√	2	The type locality for the Elsie Mountain Formation. Thick metabasalt flows with well-preserved amygdules and pillows.
Graham - Copper Cliff Formation	√		2,4	Regionally significant representation of the Copper Cliff Formation.
Graham - Stobie Formation		√		No description information available.
Hanmer Ice Contact Delta			1,4	Vermilion River cuts through Cartier I Moraine ridge and down to bedrock and upper portions of a kettled delta surface on which terraces are preserved. Fronted by extensive outwash fans. Gallie et al (1995) include with Capreol Delta, which they consider provincially significant.

Kelly Lake Shatter Cones	√		2,3,4	Provincially significant for their exceptional size, form and distribution. Features remain a key element in the study of the origins of the Sudbury Basin.
Larchwood - Chelmsford Formation	√		2,3	Provincially significant representation of Chelmsford Formation due to its size and excellent interpretive features.
Laurentian University - Sudbury Breccia		√	2	Good exposure of Sudbury Breccia.
Levack Astrobleme		√		No description information available from sources. Astrobleme is the remains of an ancient meteorite-impact structure, generally in the form of circular scar of crushed and deformed bedrock.
Lively - Elsie Mountain Formation	√		2,4	Regionally significant representation of the Elsie Mountain Formation due to good access and use by geologists.
Louise - Aphebian Formations		√		No description information available from sources.
McCrea Heights - South Range Norite	√		2,4	Provincially significant representation of the upper zone South Range Norite, Sudbury Nickel Irruptive; and an example of the youngest rock type in the Sudbury Basin, an olivine diabase dike.
Murray Mine Discovery Site		√	2,3,4	Relocation of Highway 144 and expansion of the Murray Mine open pit operation has removed the original discovery site. What remains is an outcrop of a rusty, weathered portion of the sub-layer, the heterogenous marginal phase of the Sudbury Irruptive.
Naughton A - Pecors Formation	√		2,4	Provincially significant representation of a section through the Pecors Formation.
Naughton B- Ramsey Lake Formation	√		2,4	Provincially significant representation of the Ramsay Lake Formation. A large outcrop area exposes most of the Ramsay Lake Formation, Hough Lake Group, a polymictic paraconglomerate and pebbly sandstone, and the upper part of the McKim Formation, Elliot Lake Group, a greywacke and argillite.

Nelson River Delta			1,4	Nelson River delta may have the most complete record of postglacial lake levels in glacial Lake Algonquin along the north shore of the Huron basin. Gallie et al (1995) consider the feature to be provincially significant.
Onaping River Delta			1	Gallie et al (1995) consider this glacially formed delta feature to be regionally significant.
Onaping Formation			2,4	Provincially significant representation of the Onaping Formation, Whitewater Group, as it is the type locality and the discovery site of shock metamorphic microfeatures related to the genesis of the Sudbury Basin.
Onaping - Sudbury Nickel Irruptive	√		2,4	Provincially significant representation of the outer portion of the Sudbury Irruptive event. As a single outcrop, the rock types have low significance, but in context with history of the Irruptive, provincial status is achieved.
Ramsey Lake Shatter Cones		√	2,4	Although shatter cones are not particularly rare in the Sudbury area, the significance of the Ramsay Lake site is its accessibility, its high interpretive value, the abundance of the features, and its scientific value.
Robinson Lake - Ramsey Lake Pecors Formation		√	2,4	Regionally significant representation of the Sudbury Breccia.
Sandcherry Creek Delta			1	Gallie et al (1995) consider this glacially formed delta feature to be regionally significant.
Seal Lake Moraine/Delta Complex			4	Considered a provincially significant moraine/delta complex related to the Cartier I Moraine (OMNR, 1997). Not mentioned in Kor (2004b).
Serpent Gowganda Formation		√		No description information available from sources. Contained within the Wanapitei Provincial Park.
Sudbury Airport Glacial Lake & Sand Delta			1,2,3,4	Kor is quoted in Gallie et al (1995): “The airport meltwater channel is an extraordinary landform with some of the largest and best developed kettles (ice block depressions) in Ontario”. Kor (2004b) confirmed that this statement still holds true.

Sudbury Airport Kettles	√ proposed		1,2,3,4	Kor is quoted in Gallie et al (1995): "The airport meltwater channel is an extraordinary landform with some of the largest and best developed kettles (ice block depressions) in Ontario". Kor (2004b) confirmed that this statement still holds true.
Sudbury A - Norite	√		2,4	Provincially significant exposure of South Range Norite, Sudbury Nickel Irruptive
Sudbury B - Norite	√		2,4	Provincially significant representation of the quartz-rich norite of the South Range Norite, Sudbury Nickel Irruptive.
Sudbury Treeless Area			4	
Vermilion River - Chelmsford Formation		√		

* Candidate provincially significant ANSI. From Kor, P. 2004b.

† Candidate Regional or Local ANSI. From Kor, 2004b.

1. Gallie, E.A., A. Lampinen, and K. Rukholm. 1995. A Study of Selected Glacial Landforms of the Sudbury Basin. Report for the Ontario Ministry of Natural Resources, Parks Ontario, Central Region, Sudbury, Ontario. Centre in Mining and Mineral Exploration Research, Laurentian University, Sudbury, Ontario. 44 p. + maps.

2. Kor, P. 2004b. Personal Communication. Senior Conservation Geologist. Ontario Parks. Peterborough, Ontario. From an email with attached maps received December 8, 2003 and from an email with attached information sheets received April 15, 2004. Information sheets included selections from Ontario Nature Reserve Program Environmental Data Cards, Earth Science Inventory Checklist and Natural Area Database.

3. OMNR (Ontario Ministry of Natural Resources). 1975. Northeastern Region - Sensitive Area Report.

4. OMNR (Ontario Ministry of Natural Resources). 1997. Natural Resources Values Maps and Accompanying Information for Determining Application of the Provincial Policy Statement under the Planning Act. Sudbury District OMNR. Unpublished.

APPENDIX E

Vegetation Classification Model Used to Generate Figure 2

Vegetation Classification Model

Outlined below are the details of the vegetation classification model used to generate Figure 2 (City of Greater Sudbury Vegetation Cover Types). The model used Microsoft Excel formulas to classify over 85,000 polygons based on forest stand information and other land cover information provided in the Forest Resources Inventory database. The model proceeds in a stepwise manner across spreadsheet columns following the order shown below for each spreadsheet row.

The formulas were developed by City of Greater Sudbury staff. As with all vegetation classification, this is only one interpretation.

Red Pine and/or White Pine

=IF(OR((AND(Pj+Pr+Pw>=50%,Pr>=20%,Pw<20%)),(AND(Pj+Pr+Pw>=50%,Pw>=20%,Pj<20%)),(Pw>=40%),(Pr>=40%)),"Red Pine and/or White Pine","")

Lowland Deciduous

=IF((Ab+Pb+E)>=50%, "Lowland Deciduous","")

Lowland Coniferous

=IF(AND((OR(L<>0,Ce<>0,Sb>=60%)),(Bw<30%),(Po<30%),(Mh=0),(Pr<=10%),(By<=10%),(He<=20%),(Pj=0),(Pw<20%),(L+Ce+Sb)>50%),("Lowland Coniferous"),"")

Jack Pine and/or Black Spruce (upland)

=IF(AND(Pj>Pw,Pj>Pr,Pj>Sb,Pj>Bw+Po,Pj>40%),"Pj+Sb",IF(AND((OR(Pj<>0,Sb<>0,Pr<>0,Pw>10%)),(Sb<100%),(Sb>10%),(EE=""),(L<1),(Sb>=Pw),(Sb>Pr),(Sb>=B),(Ce<=20%),Sb>=40%),(Pj+B+Ce+Sb+Pr+Sw+Pw)>50%),("Pj+Sb"),IF(Pj+Sb>=70%,"Jack Pine and/or Black Spruce (upland)","")))

Shade Intolerant Deciduous and Shade Intolerant Mixed

=IF(AND((Ab+Bw+Mr+By+Mh+Or+Po>=70%),(Ab<=10%),(Mh<=20%),(By<=20%),(Or<=30%),(Mr<=60%),(EI6="")),"Shade Intolerant Deciduous",
IF(AND((Ab+Mh+Bw+By+Mr+Po>=40%),(Mh<=20%),(By<=30%),(Bw+Mr+Po<=60%),(Mr<40%),(Pj+Pr+Pw+He+Sw+B+Ce+Sb>=40%),(Pj+Pr+Pw+Sw+B+Ce+Sb<=60%),(Pr<30%),(Ab<=10%),(Pw<40%),(Sw<=40%),(B<50%),(Ce<=40%),(He<=20%),(Sb<40%),(Pj<50%),(EF="")),"Shade Intolerant Mixed",
IF(AND((Bw+Mr+Or>=40%),(Bw+Mr+Or<=60%),(He+Pj+Pr+Pw+Sw+B+Ce+Sb>=40%),(EF=""),(He<=10%),(Pj+Pr+Pw+Sw+B+Ce+Sb<=60%)),"Shade Intolerant Mixed","")))

Shade Intolerant Coniferous

=IF(AND((Ce+He+B+Ps+Pr+Pw+Sw+Pj+Sb>60%),(He<=10%),(Pr<=30%),(Pw<=30%),(Pj<50%),(Sb<=30%),(EE=""),(EC=""),(EF=""),(Pw<40%)),"Shade Intolerant Coniferous","")

Shade Tolerant Deciduous , Shade Tolerant Mixed, and Shade Tolerant Coniferous

=IF(AND((OR(Bw+H+Mh+By+Iw+Be+Bd+Or+Mr>=70%,Or>=40%,Mh>20%)),(Bw<=30%),(Mr<40%)),"Shade Tolerant Deciduous",

IF(AND(Pr+Pw+Sw+B+He+Ce<=60%,Pr+Pw+Sw+B+He+Ce>=40%,Pw<50%,EC="",

EE="",EF="",EH="",He>10%), "Shade Tolerant Mixed",

IF(AND((OR(Pr+Pw+Sw+B+He+Sb+Ce>=70%,He>=50%)), EC="",EE="",EF="",EH=""),"Shade Tolerant Coniferous","")))

Category Codes in Formulas

EC = Red Pine and/or White Pine

ED = Lowland Deciduous

EE = Lowland Coniferous

EF = Jack Pine and/or Black Spruce (upland)

EG = Shade Intolerant Hardwood and Shade Intolerant Mixed

EH = Shade Intolerant Coniferous

EI = Shade Tolerant Deciduous and Shade Tolerant Mixed

Tree Species Codes

Ab = Black Ash

Aw = White Ash

Bw = White Birch

H = Hardwood

Mr = Red Maple

Pb = Balsam Poplar

Po = Poplar (upland)

By = Yellow Birch

E = American Elm

Or = Red Oak

Ow = White Oak

Bd = Basswood

Be = American Beech

Iw = Ironwood

Mh = Sugar Maple

L = Tamarack

Pj = Jack Pine

Pr = Red Pine

Pw = White Pine

Sw = White Spruce

B = Balsam Fir

He = Hemlock

Ce = Eastern White Cedar

Sb = Black Spruce

FIGURE 2

City of Greater Sudbury Vegetation Cover Types

1:100,000

0 2 4 8 12 16

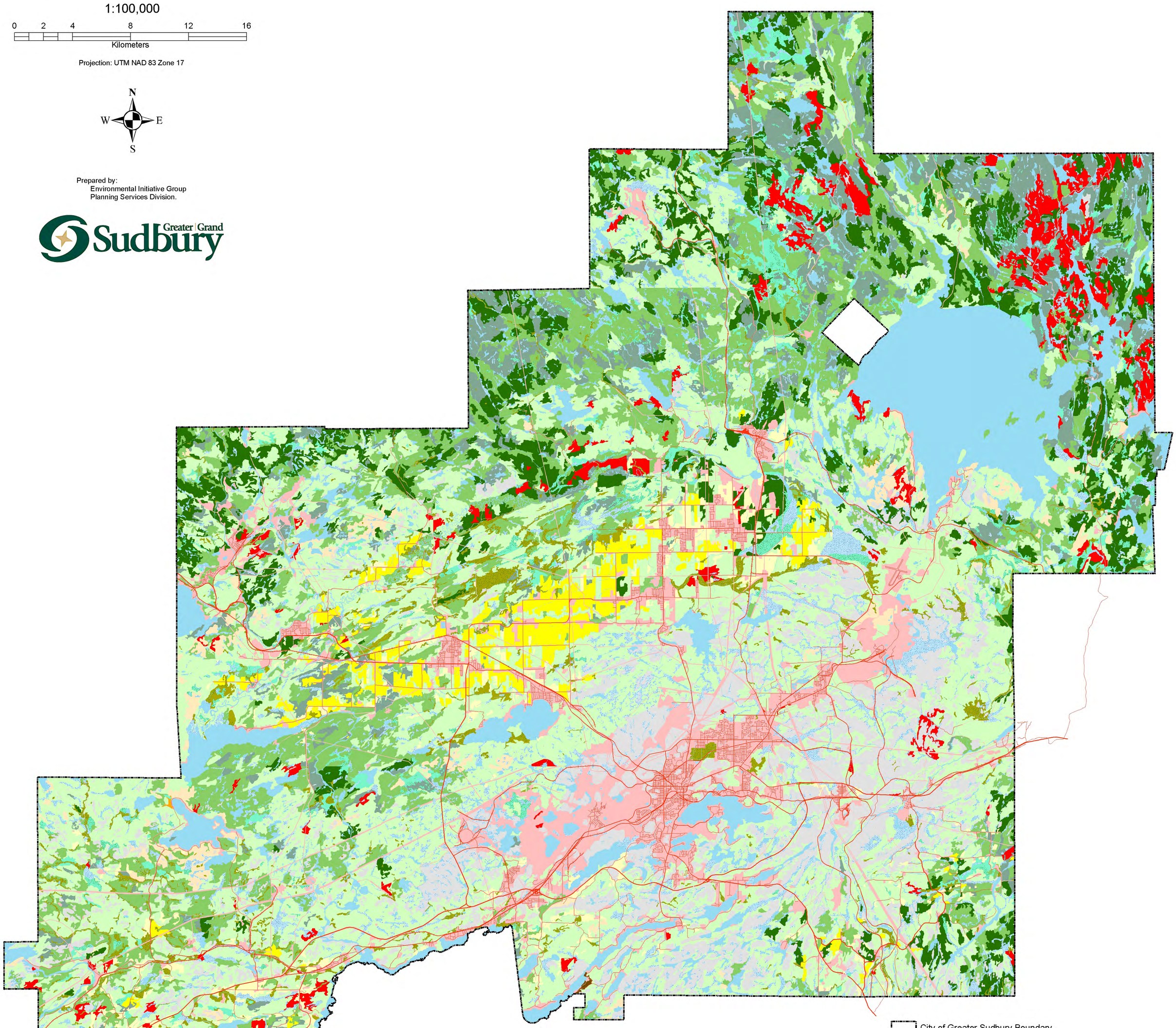
Kilometers

Projection: UTM NAD 83 Zone 17

N W E S

Prepared by:
Environmental Initiative Group
Planning Services Division.

Greater Grand Sudbury



City of Greater Sudbury Boundary
Highway
Major Road
Local Road
Railway
Airport

Forest Stand Type

Jack Pine and/or Black Spruce (upland)
Red Pine and/or White Pine
Shade Intolerant Deciduous
Shade Intolerant Mixed
Shade Intolerant Coniferous
Shade Tolerant Deciduous
Shade Tolerant Mixed
Shade Tolerant Coniferous
Lowland Coniferous
Lowland Deciduous

Non-Forested Land Cover

Developed Land
Field
Developed Agricultural Land
Rock
Swamp
Thicket Swamp
Open Wetland
Water

Vegetation cover types by total area and percent of the City of Greater Sudbury (CGS).

Vegetation Cover Type	Total Area (hectares)	Percent of CGS Area
FOREST (Total)	**209077**	**57.6**
Red Pine/White Pine	9537	2.6
Jack Pine and/or Black Spruce (upland)	25760	7.1
Shade Tolerant Mixed	277	0.08
Shade Tolerant Deciduous	5280	1.5
Shade Tolerant Coniferous	75	0.02
Shade Intolerant Coniferous	20130	5.5
Shade Intolerant Mixed	46255	12.7
Shade Intolerant Deciduous	101763	28
WETLAND (Total)	**33144**	**9.1**
Lowland Coniferous[1]	4991	1.4
Lowland Deciduous[1]	540	0.15
Swamp[2]	4820	1.3
Open Wetland[3]	15087	4.2
Thicket Swamp	7706	2.1
Rock	30546	8.4
Developed Agricultural Land	7280	2
Field	5547	1.55
Developed Land[4]	30408	8.4
Water	47044	13
TOTAL	**363046**	**100**

[1] Including lowland types as wetlands is assumed to be reasonable in most cases given the species listed in the stand information of the Forest Resources Inventory (FRI).
[2] Swamp is a FRI class termed 'Treed Muskeg' that is likely conifer swamps in most cases.
[3] Open Wetland is a FRI class termed 'Open Muskeg' that includes various marsh types.
[4] Developed Land includes urban areas, mine and mine waste areas, and rights-of-way for electrical power distribution.

This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation.

Base data derived from the Forest Resources Inventory (FRI) compiled at a scale of 1:20,000.

FIGURE 3

Aquatic & Wetland Features, Significant Wildlife Habitat, and Sites of Geological Interest

1:100,000

0 2 4 8 12 16

Kilometers

Projection: UTM NAD 83 Zone 17

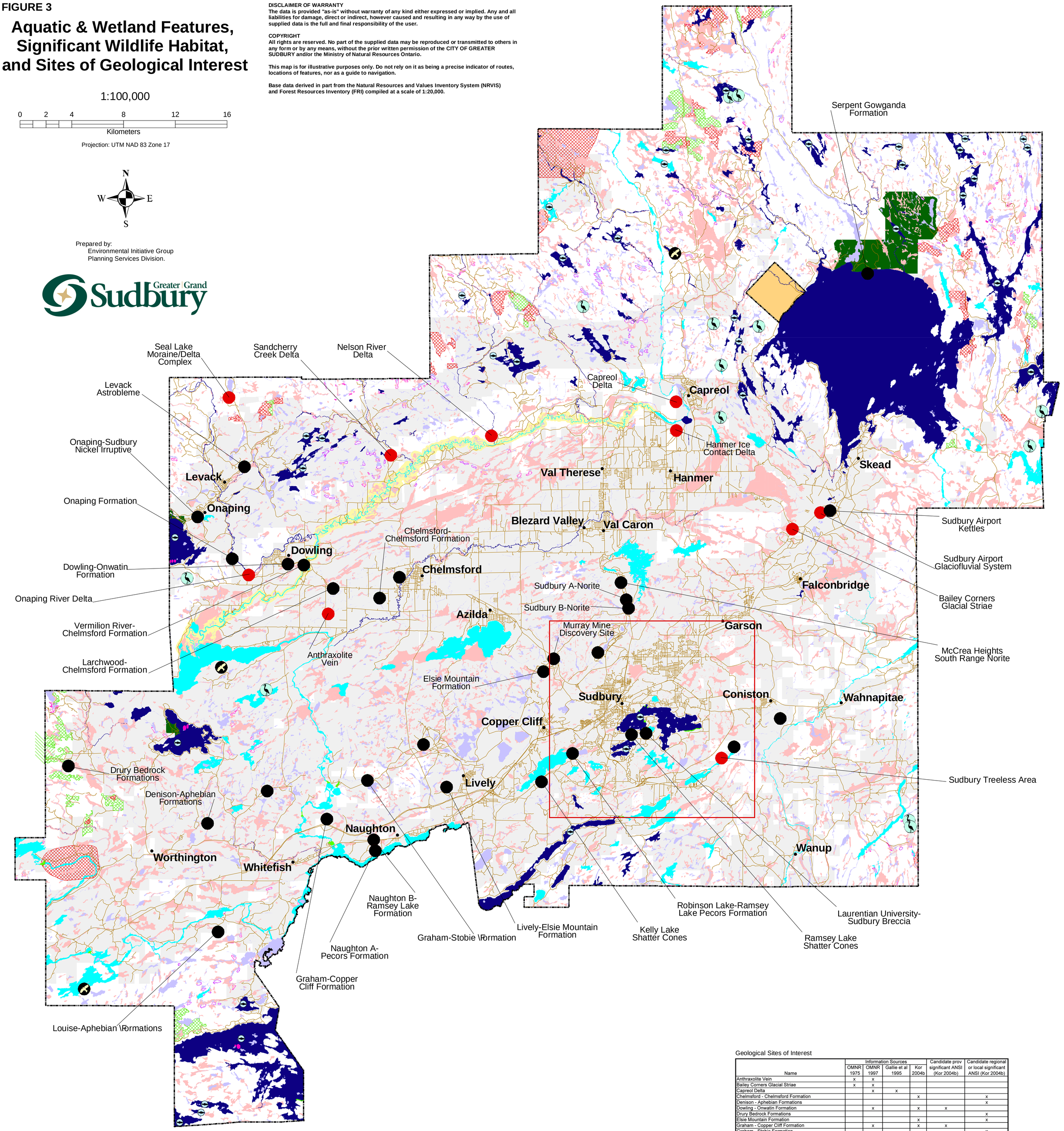
N W E S

Prepared by:
Environmental Initiative Group
Planning Services Division.

Greater Sudbury

This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation.

Base data derived in part from the Natural Resources and Values Inventory System (NRVIS) and Forest Resources Inventory (FRI) compiled at a scale of 1:20,000.



Legend

- City of Greater Sudbury Boundary
- Town Centre
- Road
- Surfacewater and wetlands within this area were digitized from 2003 ortho-rectified aerial photographs by City Staff

Land Ownership

- Crown Land
- Patent Land
- Provincial Park
- First Nation

Sites of Geological Interest

- Area of Natural and Scientific Interest (ANSI)
- Candidate Regional or Local ANSI
- Other Site of Geological Interest

Aquatic and Wetland Features

- Lake Trout Lake

Critical Fish Spawning Area

- Brook Trout Spawning Area
- Lake Trout Spawning Area
- Walleye Spawning Area

Surface Water

- Cold Water River
- Warm Water River
- Cold Water Lake
- Warm Water Lake
- Unknown Thermal Regime (Lake)
- Wetland
- Provincially Significant Wetland (PSW) (Includes 120 meter Adjacent Lands to PSW)

Significant Wildlife Habitat

- Endangered or Threatened Species
- Great Blue Heron Nesting Site/Colony
- Osprey Nesting Site

Moose Wintering Areas

- Early Wintering Area
- Late Wintering Area

Moose Aquatic Feeding Areas

- Very High to High
- Moderate to Low

Geological Sites of Interest

Name	Information Sources: OMNR 1975	OMNR 1997	Gallie et al 1995	Kor 2004b	Candidate prov significant ANSI (Kor 2004b)	Candidate regional or local significant ANSI (Kor 2004b)
Anthraxolite Vein	x	x				
Bailey Corners Glacial Striae	x	x				
Capreol Delta		x	x			
Chelmsford - Chelmsford Formation				x		x
Denison - Aphebian Formations						x
Dowling - Onwatin Formation		x		x	x	
Drury Bedrock Formations						x
Elsie Mountain Formation				x		x
Graham - Copper Cliff Formation		x		x	x	
Graham - Stobie Formation						x
Hanmer Ice Contact Delta		x	x(Capreol)			
Kelly Lake Shatter Cones	x	x		x	x	
Larchwood - Chelmsford Formation		x		x	x	
Laurentian University - Sudbury Breccia				x		x
Levack Astrobleme						x
Lively - Elsie Mountain Formation		x		x	x	
Louise - Aphebian Formations						x
McCrea Heights - South Range Norite		x		x	x	
Murray Mine Discovery Site	x	x				x
Naughton A - Pecors Formation		x		x	x	
Naughton B- Ramsey Lake Formation		x		x	x	
Nelson River Delta		x	x			
Onaping River Delta			x			
Onaping Formation		x		x	x	
Onaping - Sudbury Nickel Irruptive		x		x	x	
Ramsey Lake Shatter Cones		x		x		x
Robinson Lake - Ramsey Lake Pecors Formation		x		x		x
Sandcherry Creek Delta			x			
Seal Lake Moraine/Delta Complex		x				
Serpent Gowganda Formation						x
Sudbury Airport Glacial Lake & Sand Delta	x	x	x	x		
Sudbury Airport Kettles	x	x		x	x (proposed)	
Sudbury A - Norite		x		x	x	
Sudbury B - Norite		x		x	x	
Sudbury Treeless Area		x				
Vermillion River - Chelmsford Formation				x		x

Gallie, E.A., A. Lampinen, and K. Rukholm. 1995. A Study of Selected Glacial Landforms of the Sudbury Basin. Report for the Ontario Ministry of Natural Resources, Parks Ontario, Central Region, Sudbury, Ontario. Centre in Mining and Mineral Exploration Research, Laurentian University, Sudbury, Ontario. 44 p. + maps.

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OMNR (Ontario Ministry of Natural Resources). 1997. Natural Resources Values Maps and Accompanying Information for Determining Application of the Provincial Policy Statement under the Planning Act. Sudbury District OMNR. Unpublished.