

# **Ecological Risk Management Framework for Greater Sudbury:** *Toward a Community- based Biodiversity Action Plan*

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## **Follow Up to the Sudbury Soils Study Ecological Risk Assessment**

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Prepared by the City of Greater Sudbury, Vale Inco and  
Xstrata Nickel

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# **Ecological Risk Management Framework For Greater Sudbury**

## **PREFACE**

This Ecological Risk Management Framework Report was prepared by the City of Greater Sudbury, Vale Inco and Xstrata Nickel as part of each organization's commitment to address the findings of the Sudbury Soils Study Ecological Risk Assessment.

For an understanding of the background that led to the development of the Sudbury Soils Study and this framework, readers should consult the following reports:

### **SUDBURY SOILS STUDY DETAILED REPORTS**

*Volume I: Background, Study Organization and 2001 Soils Survey (SARA Group, 2008a)*

*Volume II: Human Health Risk Assessment (SARA Group, 2008b)*

*Volume III: Ecological Risk Assessment (SARA Group, 2009)*

### **SUDBURY SOILS STUDY SUMMARY REPORTS**

*Summary of Volume II: Human Health Risk Assessment (SARA Group, 2008c)*

*Summary of Volume III: Ecological Risk Assessment (SARA Group, 2008d).*

These reports are available for viewing at the Sudbury office of the Ontario Ministry of the Environment on Larch Street and at all municipal libraries in Greater Sudbury. Electronic copies of the entire technical reports and other information regarding the Sudbury Soils Study are available on the Sudbury Soils Study website at [www.sudburysoilsstudy.com](http://www.sudburysoilsstudy.com).

This Ecological Risk Management Framework Report is a follow up specifically to the Ecological Risk Assessment. To find out about risk management associated with human health, please refer to the report *Risk Management – Follow Up to the Sudbury Soils Study Human Health Risk Assessment* (Vale Inco & Xstrata Nickel, 2008).

# Ecological Risk Management Framework For Greater Sudbury

## 1.0 SUMMARY

This Ecological Risk Management Framework Report for Greater Sudbury has been prepared by the City of Greater Sudbury, Vale Inco and Xstrata Nickel as a follow up to the Sudbury Soils Study Ecological Risk Assessment (ERA). The SARA Group, who authored the Ecological Risk Assessment, concluded that:

- *“Terrestrial plant communities in the Greater Sudbury area have been and continue to be impacted by the Chemicals of Concern [COC]. Terrestrial plant communities in the Greater Sudbury area are also impacted by other factors such as soil erosion, low nutrient levels, lack of soil organic matter, and/or low pH.”*
- *“It is unlikely that COC originating from smelter emissions are exerting a significant direct toxic effect on wildlife populations in the Greater Sudbury area. However, historic impacts of smelter emissions on plant communities may currently be affecting habitat quality and, therefore, may be having a continued influence on birds and mammals in the study area.”*

The purpose of this Ecological Risk Management Framework Report is to address these findings related to ongoing and historic impacts from smelter emissions on terrestrial plant communities. The framework is intended to establish the processes that will support the recovery of regionally representative, self-sustaining terrestrial plant communities throughout Greater Sudbury. This framework report includes both an historical view of what has been achieved to date, as well as a look ahead at what might be achieved in years to come.

Although past regreening efforts have achieved significant improvements and recovery of lands affected by historical mining and smelting emissions, the Sudbury Soils Study Ecological Risk Assessment report confirmed that there is much more work to be done. The authors of this Risk Management Framework Report acknowledge and accept these results. The companies are committed to building on past regreening successes and to developing risk management mechanisms to define the path forward in support of Greater Sudbury's ecological recovery.

Over the past thirty years, more than 3,300 hectares of land have been regreened by adding lime, fertilizer and seeds and more than 9 million trees and shrubs planted. Stands of trees of varying ages have now been established in key areas throughout Greater Sudbury. But self-sustaining forests are more than just stands of trees; they are diverse, living systems that capture solar energy and carbon dioxide to make organic matter, cycle nutrients and minerals, decompose organic matter that improves soil, capture and filter rainwater, provide wildlife habitat and shelter a rich plant community.

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Building on past achievements in greening, Vale Inco, Xstrata Nickel and the City of Greater Sudbury will work together with community stakeholders in efforts to address biodiversity recovery. This long-term commitment will begin with the preparation in 2009 of a *Biodiversity Action Plan for Greater Sudbury* that defines the vision and prioritized goals for biodiversity recovery. This will be an inclusive initiative based on the following suggested guiding principles, covering ecological, sociological and educational considerations:

- Build on what has already been accomplished in the greening of Greater Sudbury.
- Ensure that the needs and aspirations of the Greater Sudbury community are considered in biodiversity recovery efforts.
- Develop and promote educational opportunities associated with recovery actions.
- Create stable soil conditions that will minimize soil erosion, dusting and the bioavailability of metals.
- Restore plant and animal species, communities and habitats in Greater Sudbury into effectively functioning ecosystems.
- Develop resilience within ecosystems so that they can adapt to climate change or other environmental stresses.
- Include monitoring and reporting processes that ensure continuous improvement.
- Ensure that the *Biodiversity Action Plan* remains a “living document” and one that adapts to changing community values, interests and priorities and incorporates evolving knowledge about local biodiversity recovery.
- Ensure Greater Sudbury remains a world leader in land reclamation and biodiversity recovery.

The *Biodiversity Action Plan* will be developed in a cooperative and collaborative effort under the leadership of the City of Greater Sudbury's Environmental Planning Initiatives Section. Oversight will be provided by VETAC, the City's greening advisory panel. Both VETAC and the City's Greening Program have over 30 years experience in community-based environmental action. Development of the Plan will involve members of the community, university researchers, biodiversity stakeholder groups and funding partners.

There will be ample opportunity throughout 2009 for community participation and involvement in developing the *Biodiversity Action Plan*. Stakeholder Involvement Sessions will be held to gain direct input from a broad spectrum of community members. These facilitated sessions will help identify our community's biodiversity priorities and future actions. They will ensure the *Biodiversity Action Plan* is aligned with community needs. As a ‘living document’, the *Biodiversity Action Plan* will likely be modified beyond 2009 in response to ecological change, monitoring results, and evolving community needs.

## **Ecological Risk Management Framework For Greater Sudbury**

'Have Your Say Workshops', telephone surveys and other dialogue meetings will provide opportunity for input from interested organizations and community groups. In addition, there is already a great deal of knowledge and action occurring in Greater Sudbury regarding biodiversity through the efforts of groups and agencies in the community. The City of Greater Sudbury proposes to bring these groups together to create the Greater Sudbury Biodiversity Partnership. Although not directly linked to the *Biodiversity Action Plan* process, the Biodiversity Partnership will be complementary to it.

The first key deliverable will be the *Biodiversity Action Plan for Greater Sudbury*. It will be developed with community involvement over the course of 2009 as follows:

### **April-June:**

- Initiate Biodiversity Stakeholder Involvement Sessions
- Hold 'Have Your Say Workshop(s)'
- Establish Greater Sudbury Biodiversity Partnership
- Conduct telephone survey

### **July-September:**

- Issue report summarizing input from Biodiversity Stakeholder Involvement Sessions
- Issue report summarizing input from telephone survey
- Continue receiving input from Greater Sudbury Biodiversity Partnership members

### **October-December:**

- Prepare and issue a draft of the *Biodiversity Action Plan for Greater Sudbury*
- Hold 'Have Your Say Workshop(s)' to receive input on draft strategy
- Finalize the *Biodiversity Action Plan for Greater Sudbury*

Both Vale Inco and Xstrata Nickel have issued letters outlining their commitments to support the City in preparing the *Greater Sudbury Biodiversity Action Plan*. The companies have also committed to providing ongoing financial and technical support for biodiversity intervention activities, monitoring and research.

Public education has been a key strength associated with past land reclamation efforts conducted by the City of Greater Sudbury. These efforts will continue, with additional opportunities initiated to ensure Sudbury remains a world leader in land reclamation and biodiversity recovery.

## Ecological Risk Management Framework For Greater Sudbury

Although this Ecological Risk Management Framework Report is focused on the terrestrial environment, reclamation work near shorelines of lakes and streams will at times involve collaboration with the Vale Inco Living with Lakes Centre and numerous lake stewardship groups in Greater Sudbury.

### **2.0 BACKGROUND AND CONTEXT FOR THE ECOLOGICAL RISK MANAGEMENT FRAMEWORK**

#### **2.1. The Sudbury Soils Study Ecological Risk Assessment**

In 2001, following recommendations by the Ontario Ministry of the Environment, Vale Inco and Xstrata Nickel voluntarily agreed to conduct one of the largest human health and ecological risk assessments ever conducted in North America. The study became known as the Sudbury Soils Study and was lead by a group of scientists known as the Sudbury Area Risk Assessment Group (SARA). Up to March 2009, the study has taken eight years to complete at a cost of approximately \$15 million.

The ERA is a comprehensive scientific study conducted to evaluate ecological risks and provide information to support the recovery of local ecosystems in areas known to have been affected by historic local mining, smelting and refining operations.

The first two years of the study were devoted to developing and carrying out an extensive soil sampling and analysis program. The next stage involved three years of intensive field and laboratory studies and report writing, followed by two years of technical review.

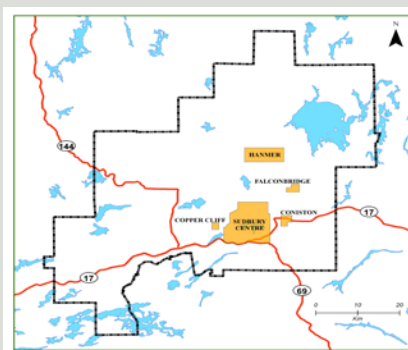
There are two main conclusions from the ERA's objectives that require follow-up actions:



Summary of Volume III:  
Ecological Risk Assessment  
December 2008

Prepared by  
**SARA**  
GROUP

**SARA GROUP**  
Sudbury Soils Study  
Ecological Risk Assessment  
Summary Report



Sudbury Soils Study  
(40,000 square kilometre  
study area).



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- **Objective 1: “To evaluate the extent to which the chemicals of concern (metals from emissions) are preventing the recovery of regionally representative, self-sustaining terrestrial plant communities”.**

The study found that *“Terrestrial plant communities in the Greater Sudbury area have been and continue to be impacted by the Chemicals of Concern. Terrestrial plant communities in the Greater Sudbury area are also impacted by other factors such as soil erosion, low nutrient levels, lack of soil organic matter, and/or low pH.”*

- **Objective 2: “To evaluate risks to terrestrial wildlife populations and communities due to chemicals of concern”.**

The study found that *“It is unlikely that COC originating from smelter emissions are exerting a significant direct toxic effect on wildlife populations in the Greater Sudbury area. However, historic impacts of smelter emissions on plant communities may currently be affecting habitat quality and, therefore, may be having a continued influence on birds and mammals in the study area.”*

COCs in this Study included arsenic, cobalt, selenium, lead, copper and nickel, with the latter two found to be most implicated in ecological risks.

This Ecological Risk Management Framework Report describes actions needed to address the Objective 1 findings (recovery of regionally representative, self-sustaining terrestrial plant communities) as well as the Objective 2 findings (terrestrial wildlife populations via habitat creation and management). The scope of the framework is focussed on the terrestrial environment and does not directly address or monitor recovery of the aquatic environment.

The SARA Group established numerous test sites and three reference sites at increasing distances from the three smelting communities of Copper Cliff, Falconbridge and Coniston. Various samples and investigations of soil and vegetation across these ‘transects’ formed the basis of the assessment for Objective 1.

The ERA found that the ecosystems at the Sudbury Soils Study test sites are inhibited and different from those at the reference sites where the COC concentrations are at background levels. Higher metal levels were found at sites closer to the smelters and lower levels at sites farther away. There was a clear association between elevated metal concentrations in soil and

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the degree of site impact. Other factors that contribute to impact at sites along the smelter transects are low pH, low nutrient levels, erosion, and lack of organic matter in the soil.

### **2.2. SARA Group Risk Management Recommendations**

The SARA Group is confident that *“the ERA did not underestimate risks to plants and animals in the Greater Sudbury area. The results and conclusions from this risk assessment will be used as the basis for future risk management decisions in the Greater Sudbury area and to support activities related to the re-greening of the Greater Sudbury areas landscape”* (SARA Group, 2008d).

In terms of risk management, the SARA Group recommends the following:

- Risk management objectives should be defined spatially using ecological parameters, not concentrations of COC in soil. The ecological parameters include species richness and diversity, presence of shade tolerant species, abundance of metal and acid tolerant species, tree height, and density/cover. These indicators together with an assessment of soil condition lead to an understanding of the condition of the forest community.
- Risk management should be considered in the regions identified by the ground cover map produced by extrapolation of the field and laboratory studies conducted as part of the ERA.
- Risk management to address impacts on the plant community should also address wildlife habitat suitability.
- Community stakeholders should be consulted during the risk management process, so that human use needs and priorities (e.g., recreation, hunting, etc.) can also be considered.
- The 22 sites established during the Objective 1 studies, or a representative portion of these, should be considered either for long-term monitoring studies to determine recovery over time, or used for remediation trials to evaluate amendment strategies.

These recommendations were used in the development of this Ecological Risk Management Framework.

## **3.0 REGREENING - WHAT'S BEEN ACHIEVED SO FAR?**

Following the discovery of mineral resources in the Sudbury area in the late 1800's, Sudbury became known as the Nickel Capital of the world. During the early and mid 1900's, extraction of minerals resulted in severe impacts on the terrestrial environment, largely due to atmospheric releases of sulphur dioxide and metal particulates. Sudbury became known for its barren treeless landscape. So drastic was the environmental damage that a widespread negative image of Sudbury developed. Almost 84,000 hectares of land were either barren or semi-barren and in need of ecological recovery.

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Environmental impairment has been experienced since the late 1800's by at least five generations of Sudburians. Early generations saw the transition from old-growth white and red pine forests to a blackened, lifeless landscape. This landscape has become home for thousands of families living and working in the Greater Sudbury area and has formed part of the community's collective frame of reference and experience.

Regreening of the barren landscape and developing a more positive image for Sudbury became one of the most critical challenges faced by Sudburians during the 1970's. Three decades of regreening of Greater Sudbury's more visible areas has given a sense of renewed hope and pride to the community. Yet thousands of hectares are yet to be regreened. Future regreening efforts must continue to consider the intrinsic relationship between the Greater Sudbury community and its environment.

In 2008, the City of Greater Sudbury celebrated its Land Reclamation Program 30<sup>th</sup> Anniversary. The following table lists some of the key program components and accomplishments achieved (City 2008):



LANDSAT 7 satellite photo of Greater Sudbury in 2000 showing industrially impacted lands near Copper Cliff, Coniston and Falconbridge.



Helicopter and ATV vehicles being used to transport lime and fertilizer to remote locations.



Awards received for the City of Greater Sudbury's Regreening Program.

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REGREENING COMPONENT	TOTAL (1978 to 2008)
Trees planted	8,978,074
Shrubs planted	44,246
Area Limed	3,406 hectares
Area Fertilized	3,204 hectares
Area Seeded	3,131 hectares
Program Costs	\$ 24,572,232
Temporary Employment Opportunities	4,490
Awards	14
Number of School Yards Regreened	13
Volunteer Tree Planters	8,949
Trees Planted by Volunteers	302,083
Trees Provided to Residents	419,213

The City's land reclamation achievements have not gone unnoticed. Since its inception, the program has received 14 national and international awards. The City has been recognized along with only a handful of municipalities world-wide as a **“Regional Centre of Expertise”** (RCE) for education in sustainability by the United Nations University. This designation provides an ideal framework for continuing with the efforts to engage the community in forest creation, watershed protection and biodiversity recovery.

Greater Sudbury's Regreening Program carefully considers site conditions in deciding the intervention(s) to apply on a given site. Over 30 years of trial and error and experimentation has allowed the development of an initial woody vegetation cover that will persist and develop a closed canopy.



Workers loading lime, fertilizer and seed into an aircraft in preparation for aerial spreading.



Aircraft spreading lime, fertilizer and seed over barren lands.



Grass growing on lands near Coniston, following aerial spreading of lime, fertilizer and seeds.

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The 25 and 30 year-old plantings have now matured sufficiently to be under-planted with additional native, shade-tolerant woody and herbaceous species representative of the Greater Sudbury area. In recent years, the Regreening Program has attempted to diversify plantings by including a variety of hardwood tree and shrub seedlings. In addition, the Program has moved forest floor mats, dug up from areas to be cleared for mining exploration. The intent is to diversify the understory of older planted stands (i.e., 15 to 20 year-old) using plants from the Greater Sudbury area that are not readily available in the nursery trade. After two years, some of the herbaceous plants from these forest floor mats have begun to spread beyond the mat itself. In time, the various species within the mats should colonize the site, thereby increasing plant diversity in the local area.

Over the past 30 years, both Vale Inco and Xstrata Nickel have been active participants and supporters of the successful regreening efforts by the City of Greater Sudbury. Over an even longer timeframe, the companies have engaged in reclamation efforts on their own properties with a focus on those areas most visible to the community.

Vale Inco has raised tree seedlings in their own greenhouses since the 1940's and continues to do so. The company currently operates a greenhouse in Copper Cliff and another at the 4600 foot level of its Creighton Mine. Nearly three million seedlings raised in these greenhouses have been planted on company owned properties.

In an effort to reach more area and create efficiencies in regreening efforts, Vale Inco used All Terrain Vehicles (ATV's) in the 1980's to spread lime, fertilizer and seed until the late 1980's when the company experimented with aerial applications. This aerial seeding program has been very successful and continues



Workers spreading lime and fertilizer on barren lands in Copper Cliff area.



Grass growing on barren land near Copper Cliff few months following spread of lime, fertilizer and seeds.



Aerial View of Copper Cliff.



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as a yearly program with over 5300 acres treated to date at a cost of over \$6 million.

Xstrata Nickel has been actively reclaiming 50 hectares per year on its Smelter site and surrounding lands. Lime, fertilizer, and soil addition has been the foundation for an aggressive re-vegetation program. Initial planting involves a series of grasses and legumes. Planting is followed using six species of coniferous and deciduous trees at a rate of 60,000 to 100,000 trees per year, with the annual total based on tree/seedling availability.

Since the program was accelerated in the last decade, bio-remediated soils have been included as a soil amendment at a rate of over 120,000 tonnes per year. This has allowed for larger trees to be planted sooner (Year 3), resulting in a higher rate of tree growth.

In 2008, Xstrata Nickel completed a biodiversity plan for the Smelter and Nickel Rim site and surrounding lands owned by both Vale Inco and the Wahnapiatae First Nations.

### **4.0 LOOKING AHEAD – DEVELOPING A BIODIVERSITY ACTION PLAN**

#### **4.1 What is Biodiversity?**

Biological diversity (or biodiversity) refers to the variety of life on Earth. It encompasses the wide array of ecosystems, ecological processes and species that are essential to human existence.

Increasing attention toward biodiversity is rooted in one of the key agreements of the 1992 Earth Summit in Rio de Janeiro - the United Nations Convention on Biological Diversity. Canada is one of 187 nations to have ratified the Convention. The Convention on Biological Diversity has three main goals:

1. The conservation of biological diversity;
2. Sustainable use of the components of biological diversity, and;



Tree seedling growing underground at Creighton Mine. Seedling are used for Sudbury areas greening work.



Aerial View of Falconbridge.



Recovering ecosystem near Falconbridge Smelter (Flyover 2008)

## Ecological Risk Management Framework For Greater Sudbury

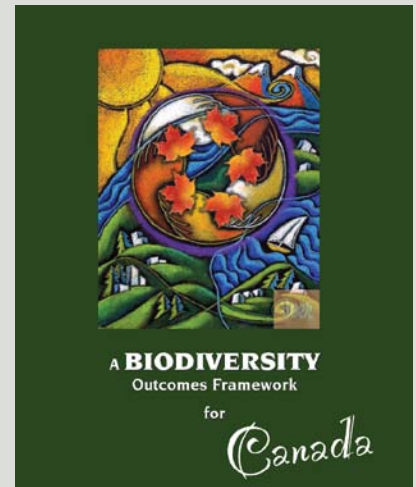
3. Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

Each of the 187 nations that ratified the Convention on Biological Diversity has prepared a biodiversity strategy. Canada and Ontario's biodiversity strategies identify the scope of biodiversity-related issues as well as the challenges on a national and provincial scale. In the context of Greater Sudbury, biodiversity recovery will involve working toward the recovery of species, communities, habitats and ecosystems previously impacted by historical mining activities and atmospheric emissions of sulphur dioxide and metals.

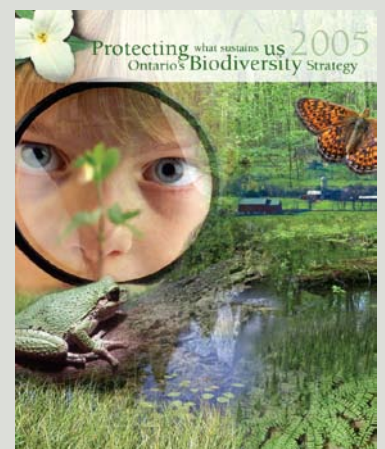
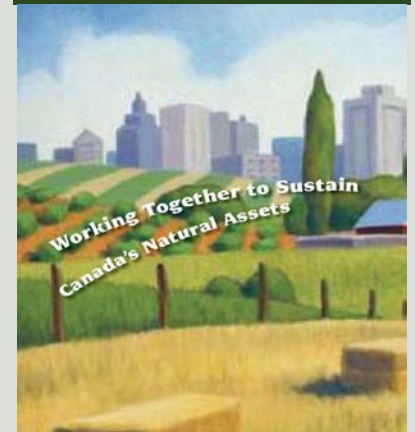
### 4.2 Why Develop a *Biodiversity Action Plan for Greater Sudbury*?

Although past greening efforts have achieved significant improvements and recovery of lands affected by historical mining and smelting emissions, the Sudbury Soils Study Ecological Risk Assessment report confirmed that there is much more work to be done. This Ecological Risk Management Framework Report and the eventual *Biodiversity Action Plan for Greater Sudbury* will build on past greening successes and define the path forward for future work needed to support Greater Sudbury's ecological recovery.

Conservation efforts focused on biodiversity represent a growing scientific discipline. Jurisdictions throughout Canada and the world are moving toward using biodiversity management as a way to protect, conserve or restore the environment, while considering our environment as our natural wealth. For more than 10 years, federal, provincial and municipal governments have been working together, using the term biodiversity as a blueprint for conservation and sustainable use of land and natural resources. Focusing Sudbury's greening efforts on biodiversity recovery and conservation will ensure that Sudbury's efforts are aligned with national and international trends.



Canada's Biodiversity Outcomes Framework.



Ontario's Biodiversity Strategy.

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Restoring biodiversity in damaged areas of Greater Sudbury improves habitat for plants, animals, birds and insects and creates healthier forests and wetlands. Biodiversity improvements in watersheds result in improved quality of fish habitat within lakes and streams.

Biodiversity supports a number of natural ecosystem processes that benefit society such as prevention of soil erosion, improved air quality, water purification, moderation of climate change and control of pest and disease organisms. Biodiversity has social and cultural benefits including aesthetic value, leisure and recreation and contributes to economic resilience.

### 4.3 Developing the *Biodiversity Action Plan*

The *Biodiversity Action Plan* will be developed in a cooperative and collaborative effort under the leadership of the City of Greater Sudbury's Environmental Planning Initiatives Section. This Plan will include a renewed vision and mission for the City's Regreening Program as well as key strategic goals. The Plan will define what actions are required for biodiversity recovery now and into the future.

Guidance in preparing the *Biodiversity Action Plan* will be provided by VETAC, with considerable opportunities planned for public involvement. Community input will help in defining environmental values and priorities that will be translated into a **clear direction** and **actions** within the *Biodiversity Action Plan* and the Annual Operations and Research Plans that will follow. A Greater Sudbury Biodiversity Partnership is envisioned to facilitate information sharing between the numerous community groups and agencies working on biodiversity-related projects. The process for community involvement, public education and the Greater Sudbury Biodiversity Partnership is discussed in more detail in Section 5.



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The *Biodiversity Action Plan for Greater Sudbury* will establish the “**big picture**” issues. It will define the overall intentions for biodiversity recovery that makes the most effective use of financial and human resources. It will define various “zones of intervention” and the recommended approach to be taken for each zone. Various forms of intervention may be applied including liming, fertilizing, seeding, organic matter supplementation, tree planting and under-planting. The use of defined zones will allow appropriate interventions to be applied, considering various factors of significance (e.g., levels of pH, metal contamination and organic content of the soil, topographical and microclimatic characteristics, water retention factors / drought exposure, and other factors at both the site and landscape level). The *Biodiversity Action Plan* will also include a list of completion criteria with the aim of measuring the success of restoration efforts.

### 4.4 Guiding Values and Principles

The following guiding principles will assist in developing the *Biodiversity Action Plan for Greater Sudbury*. These guiding principles cover ecological, sociological and educational considerations.

- Build on what has already been accomplished in the greening of Greater Sudbury.
- Ensure that the needs and aspirations of the Greater Sudbury community are considered in biodiversity recovery efforts.
- Develop and promote educational opportunities associated with recovery actions.
- Create stable soil conditions that will minimize soil erosion, dusting and the bioavailability of metals.
- Restore plant and animal species, communities and habitats in Greater Sudbury into effectively functioning ecosystems.
- Develop resilience within ecosystems so that they can adapt to climate change or other environmental stresses.
- Include monitoring and reporting processes that ensure continuous improvement.
- Ensure that the *Biodiversity Action Plan* remains a “living document” and one that adapts to changing community values, interests and priorities and incorporates evolving knowledge about local biodiversity recovery.



Exposed bedrock located outside of the industrially impacted zone. Photo shows a diverse lichen and moss community along with several species of vascular plants.



Exposed bedrock within the industrially impacted zone near Coniston.



View of Silver Lake near Sudbury illustrating importance of watershed improvements for contributing to restoration of aquatic environment.

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- Ensure Greater Sudbury remains a world leader in land reclamation and biodiversity recovery.

### 4.5 Ecological Considerations

This section outlines a number of ecological considerations that should be incorporated into the development of the *Biodiversity Action Plan for Greater Sudbury* and subsequent Annual Operations Plans.

#### 4.5.1. Habitat Types

Site conditions play an important role in determining the plant species that will occur at a particular site. Terrestrial habitat types within Sudbury's impacted areas fall into four general categories:

- Rock outcrops with shallow soil pockets,
- Inter-ridge valleys,
- Barren land with deep soils, and
- Wetlands.

Each habitat type may require a different form of ecological intervention. For example, drought tolerant plants may be needed for re-colonizing barren hill tops, whereas water tolerant species may be necessary for planting in wetlands.

Bare rock outcrops are common in Sudbury's industrially impacts zones, primarily within a few kilometers of each of the three smelters. These rock outcrops have lost most of their soils through erosion and present a particular challenge to establishing a vegetative cover. Bare rock in certain areas is currently being colonized by lichens and mosses. Grasses and a few herbaceous species have become established in the pockets of soil on top of the rocky outcrops. Establishing a vegetative cover on barren rock outcrops generally requires the placement of lime, fertilizer and grass seeds, followed some months or years later by the planting of trees.

In reclaimed areas, where there are older trees forming a closed canopy, shade tolerant plants can be under-planted to diversify the overall plant community.

#### 4.5.2. Seed Dispersal

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Different plant species colonize areas at different speeds, depending on the physical characteristics of its seeds and the mode of seed dispersal (primarily via wind, birds, animals or insects).



Transplanting of forest floor vegetation from natural areas to recovering forests on industrially impacted lands.



Fringed Polygala is a typical forest herb of north-eastern Ontario that does not occur in Greater Sudbury's industrially impacted zone. Its seeds are dispersed by ants.

Seeds that are dispersed by wind (e.g., trembling aspen, white birch, spruces, pines, ashes and maples) or birds (e.g., pin cherry) generally result in rapid recolonization of nearby areas. Some seeds like red oak are dispersed by gravity or animals and are much more limited in their dispersal and colonization rates. Fortunately, many red oak stands survived past industrial sulphur dioxide emissions and now serve as dispersal nodes throughout much of the impacted area.

Some seeds (e.g., many ground layer plant species) are dispersed by ants and recolonization rates are very slow. These plant species are also typically very exacting in their habitat requirements for moisture, shade, soil depth and nutrients.

Since distances of several kilometres exist between barren, semi-barren and natural areas, human intervention can have a dramatic effect in speeding up the recolonization process. Some regionally representative plant species would likely take several centuries to recolonize the industrially impacted areas if left to natural processes.

### 4.5.3. Climate Change

Climate change is predicted to substantially alter the composition of forests in Ontario. This may influence how we think about and respond to biodiversity recovery.

Modelling by the Canadian Forest Service shows that forest tree species will likely migrate farther north as

## **Ecological Risk Management Framework For Greater Sudbury**

climatic conditions change (Canadian Forestry Service, 2009). According to some climate change models, local conditions in a few decades may no longer be suitable for certain species like jack pine and lowbush blueberry. New plant associations are expected to occur as individual species are favoured over others and as rates of migration differ between plant species.

Insect outbreaks and diseases as well as fires may also become more prevalent due to extended droughts in certain areas.

Within the Greater Sudbury study area, intervention strategies will need to consider climate change factors along with the other factors that have traditionally been addressed in past greening efforts.

### **4.6 Corporate Commitments**

Vale Inco and Xstrata Nickel are committed to working with the City of Greater Sudbury and the community for the purpose of preparing a *Biodiversity Action Plan* and conducting ongoing field operations and research. Efforts will aim at improving biodiversity within the natural environment.

Letters of commitment for Vale Inco and Xstrata Nickel are included in Appendix 1 and 2 of this report.

## **5.0 COMMUNITY INVOLVEMENT**

### **5.1 Community Involvement – Past and Present**

Community involvement continues to be the hallmark of the City's Regreening Program. For more than 30 years, the Program has involved thousands of Sudburians in liming and tree planting on ecologically impaired areas. Dozens of school groups, community groups and businesses have been involved as well as agencies at all levels of government.

Regreening and VETAC have achieved brand recognition in Greater Sudbury. Public and political support for regreening in Greater Sudbury has been consistently strong, as evidenced by the following examples:

1. Residential survey results for the Greater Sudbury 2003 State of the Community Report conducted by Oraclepoll Research Ltd. show that 78% of people polled indicated that regreening the community is an important service provided by the City.

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2. In 2003, the Greater Sudbury Development Corporation released the Economic Development Strategic Plan for Greater Sudbury 2015 following broad community consultation. Survey results undertaken for the development of this plan reveals that “continuing with regreening efforts” is identified as the top priority (67%) to achieve strategies listed under one of five engines for growth: “A model for eco-industry and renewable energy”.
3. In 2003, the EarthCare Sudbury Community Partnership, which consists of 104 community agencies, groups and companies, released the EarthCare Sudbury Local Action Plan. This Plan identifies Regreening as an important component for achieving environmental health in Greater Sudbury.
4. Most recently, by resolution 2008-49, City of Greater Sudbury Council adopted the minutes of the Priorities Committee that included the following recommendation: “THAT the Council of the City of Greater Sudbury recognize the achievements of the Regreening Program and the value of the Program to the quality of life in the City and support the ongoing initiatives of the Program and VETAC.”

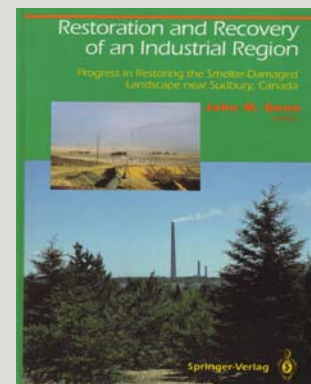
Multiple, coordinated opportunities for community involvement will be provided during the preparation and implementation of the *Biodiversity Action Plan for Greater Sudbury*. These opportunities include: 1) involvement on VETAC and other advisory panels and community committees; 2) participation in biodiversity-oriented Stakeholder Involvement Sessions; 3) coordination of community interest groups on biodiversity; 4) ‘Have Your Say Workshops’ in the community; and 5) telephone surveys. These opportunities are described in more detail in the following sections.

### 5.2 VETAC and Other Committees

Building on over 35 years of regreening successes in Greater Sudbury, VETAC will continue its advisory role associated with regreening efforts and will help coordinate the *Biodiversity Action Plan for Greater Sudbury*. VETAC is an advisory panel



Book first published by VETAC in 2001 called “Healing the Landscape”.



Book of Greater Sudbury area restoration work produced as community collaborative effort in 1995.



VETAC Members – 2007



## Ecological Risk Management Framework For Greater Sudbury

to Council composed of concerned citizens, industry and government representatives, and professors from Laurentian University. Over the years, VETAC has represented the community regarding greening issues and concerns. Both the Regreening Program and VETAC have gained an appreciable network of community contacts allowing the community's aspirations for a green environment to be considered in regreening planning and operations.



Queen Elizabeth Public School, Sudbury – Winner of the 2008 “Ugliest Schoolyard Contest”. Students planting trees in school yard.



Twenty three temporary employees hired to conduct regreening work in Greater Sudbury in 2008.  
A total of 4,490 positions were created from 1978 to 2008.

There are other complementary planning processes conducted by the City of Greater Sudbury that will involve opportunities for dialogue about regreening work and biodiversity (e.g., green space planning, land-use planning, watershed planning, and recreation planning). Results from these planning groups will be interwoven into biodiversity recovery planning at both the strategic and operational levels. There are a number of members of VETAC and the City's Regreening Program that also sit on the other planning oversight committees, allowing for effective communications among the various groups.

In addition to City committees and advisory panels, committees and other groups exist in Greater Sudbury that conduct biodiversity-related work. Examples include the Junction Creek Stewardship Committee, the numerous lake stewardship groups, fishing and hunting associations, Sudbury Field Naturalists, and Sudbury Ornithological Society among many others.

### 5.3 Stakeholder Involvement Sessions

During 2009, a group of approximately 40 to 50 members of the community will be assembled to provide input into development of the *Biodiversity Action Plan for Greater Sudbury*. Participation in the Stakeholder Involvement

## Ecological Risk Management Framework For Greater Sudbury

Sessions will be requested from a large cross section of the community, including different age groups, cultural backgrounds, and interests in the environment.

Advertisements to solicit public participation will be published in local media. VETAC will select participants to attend the sessions and will develop a set of ground rules to ensure that the sessions are productive and that valued input and recommendations are received. VETAC may also develop some ecosystem scenarios that will help in the discussions about biodiversity.

It is anticipated that the group would meet on three occasions during the second quarter of 2009, with each session expected to be about three hours in length. Participants would be expected to make a commitment to attend all three meetings. A facilitator will be appointed to oversee the main group discussions, with co-facilitators available to oversee several breakout groups if necessary.

To ensure all participants begin dialogue in the breakout groups with a common awareness, the initial meeting will involve a review of past regreening efforts and results of the Sudbury Soils Study Ecological Risk Assessment. Participants will then be presented with some key questions to stimulate dialogue in the breakout group discussions that will occur during the second and third sessions. Example questions include:

- **ENVIRONMENTAL VALUES** - What do we value most with respect to natural ecosystems in the Greater Sudbury area?
- **ENVIRONMENTAL VISION** - What kind of sustainable ecosystems are we striving for (i.e., what are we looking to achieve / what does success look like)?
- **PRIORITIES** - What are our most important priorities (goals) short-term and long-term? How do we continue to re-evaluate and re-establish our priorities as we move into the future?
- **ENGAGEMENT and COMMUNICATION** - What can we do to maintain strong engagement of the community toward improving the environmental health of Greater Sudbury? How do we better engage our youth? How do we keep everyone informed? How do we better engage those in the community that are currently disengaged?
- **MONITORING AND MEASUREMENT** – How do we measure our success?
- **PUBLIC EDUCATION** – How do we improve the learning experience of all elements of our local community? What hands-on learning opportunities can we develop?

The exact questions will be established by the City's Environmental Planning Section with input from VETAC. Discussions will be documented and recommendations used in developing the *Biodiversity Action Plan*. Results of the sessions will be available to all participants and posted for public access on the City of Greater Sudbury website.

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### **5.4 Greater Sudbury Biodiversity Partnership - Special Interest Group Participation**

Numerous agencies and groups with a focus on one or more aspects of biodiversity (e.g., habitat for plants, wildlife and fish) currently exist in Greater Sudbury. These agencies and groups are very active within their own areas of interest, but often work in isolation. Opportunities for intergroup communication and collaboration are few. A Greater Sudbury Biodiversity Partnership is envisioned to bridge the communication gap allowing a coordinated input to and implementation of the *Biodiversity Action Plan for Greater Sudbury*. The Partnership will allow information sharing, wider participation on group activities, and heightened public awareness and education on biodiversity issues. Facilitation and coordination will be undertaken by the City's Environmental Planning Section.

### **5.5 Have Your Say Workshops**

A series of "Have Your Say Workshops" are planned for 2009. These workshops will be an opportunity for dialogue with interested citizens about the results of the Sudbury Soils Study Ecological Risk Assessment and proposed plans for the *Biodiversity Action Plan for Greater Sudbury*. The workshops will provide one-on-one opportunities for dialogue. Community participation will help in determining priorities, such as what geographic areas need attention, what research projects are needed or what habitat types are most valued. Input will help establish the community's vision for the future of the Sudbury environment.

### **5.6 Telephone Survey**

A telephone survey will be conducted in 2009 to better gauge Sudburians' priorities for greening and environmental health. Ultimately, the City's greening and biodiversity efforts must reflect community aspirations and desires and deliver results that the community will understand and value. For example, the community has already indicated that they value picking blueberries and they appreciate seeing recovery of wildlife habitat.

### **5.7 Timeline**

The following diagram provides a timeline for developing the *Biodiversity Action Plan for Greater Sudbury*.



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### Timeline for Developing the Community-based Biodiversity Action Plan For Greater Sudbury

#### First Quarter 2009

- Issue Ecological Risk Management Framework Report.

#### Second Quarter 2009

- Initiate Biodiversity Stakeholder Involvement Sessions.
- Hold 'Have Your Say' Workshop(s).
- Establish the Sudbury Biodiversity Partnership.
- Conduct telephone survey.

#### Third Quarter 2009

- Issue report summarizing input from Stakeholder Involvement Sessions.
- Issue report summarizing input from the telephone survey.
- Continue receiving input from Sudbury Biodiversity Partnership members.

#### Fourth Quarter 2009

- Prepare and issue draft of the Biodiversity Action Plan for Greater Sudbury.
- Hold 'Have Your Say' Workshop(s) to receive input on the draft Plan.
- Finalize Biodiversity Action Plan for Greater Sudbury by end of 2009.

As a 'living document', the *Biodiversity Action Plan* will likely be modified beyond 2009 in response to ecological change, monitoring results, and evolving community needs.

### 5.8 How Can You Get Involved?

Whether you are a school group, club, organization or resident, there will be opportunities to get involved in establishing an environmental vision of the future for Greater Sudbury. To learn more about how to become involved and what is planned in terms of Stakeholder Involvement Sessions, committee meetings, workshops and surveys, you are encouraged to contact the City as follows:

Phone: (705) 674-4455 ext. 4605 (Regreening Program)  
(705) 674-4455 ext. 4297 (Environmental Planning Initiatives)  
Fax: (705) 673-2200  
Website: [www.greatersudbury.ca](http://www.greatersudbury.ca)  
Email: [regreening@greatersudbury.ca](mailto:regreening@greatersudbury.ca)  
Address: City of Greater Sudbury, Regreening Program, 200 Brady Street, P.O. Box 5000, Station 'A', Sudbury, Ontario, Canada, P3A 5P3.

### **6.0 PUBLIC EDUCATION**

#### **6.1 Regreening - Outreach and Education**

Outreach and education have been key strengths and founding elements of past regreening efforts conducted within Greater Sudbury (see Sections 3.0 & 5.0). Education is understood here in its broadest sense, both formally through schools, but also through more informal means aimed at 'life-long learning' experienced by all individuals. It is important that opportunities be created for broader learning by the community. In this way, the community will understand the environment in which they live and work and the actions that are being undertaken to improve environmental conditions.

Over the years, the Regreening Program and VETAC have been involved in numerous educational projects related to Sudbury's regreening. Presentations are frequently given to students, either directly in the classroom or through other venues such as the annual Roots and Shoots events hosted by Science North, Sudbury Regional Historical Fair and even international events like World Youth Day in 2002. Nearly 1500 students have been hired through the Regreening Program since 1978 and several more have been provided co-op placements to allow them to gain relevant experience prior to graduation. The close collaboration that the Regreening Program enjoys with Laurentian University has allowed a two-way flow of information for fourth year and graduate students to complete their theses. Student academic work continues to contribute to the local knowledge-base of Greater Sudbury's Regreening experience. Greater Sudbury's regreening has also been profiled at local, national and international scientific conferences and has been the subject of numerous scientific articles and chapters in academic books.

#### **6.2 Expanding Learning Opportunities**

The public engagement process that will be conducted in 2009 and future years will need to identify ways that learning can be enhanced for all age groups including our youth. Building on its solid reputation and educational experience, the City's Regreening Program will continue to provide leadership and support toward identifying, planning and coordinating educational opportunities in collaboration with the various participating organizations. The Regreening Program will continue conducting field trips, facilitating tree planting events, giving talks in classrooms, and providing information to the public at important community events like Earth Day. In collaboration with the Greater Sudbury Biodiversity Partnership, the Regreening Program will explore the possibility of hosting an annual biodiversity forum, developing an

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electronic newsletter and electronic journal, developing local biodiversity curriculum, and a biodiversity website.

Community organizations and educational institutions will be encouraged to continue conducting conferences, workshops and field trips to stimulate both intellectual and experiential learning.

### **7.0 OPERATIONAL AND ADMINISTRATIVE CONSIDERATIONS**

#### **7.1 Roles, Responsibilities and Authority**

Vale Inco and Xstrata Nickel have committed to address the risks found in the Sudbury Soils Study Ecological Risk Assessment. Both companies believe that the administration, processes and expertise for ecological risk management currently exist in the community. For this reason, the companies will continue to support the City's Regreening Program and will take an active role in biodiversity recovery. The companies are committed to the principles outlined in this document, including active community dialogue and participation, focussed research and actions aimed at increasing biodiversity. Both companies will provide appropriate, long-term financial contributions that will support biodiversity recovery.

Building on past successes, the City of Greater Sudbury intends to continue its Regreening Program and related administrative structure. The Regreening Program is ultimately accountable to City Council. At the operating level, the Program is administered by a Manager of Environment Planning Initiatives who is accountable through a reporting line that includes the Director of Planning Services, the General Manager of Growth and Development and the Chief Administrative Officer.

The City has appointed a Regreening Program Supervisor who is responsible for the day-to-day operations and research activities. Many part-time employees are hired to conduct field operations and research, the numbers depending on the funding available from year to year.

VETAC serves in an advisory role to the City's Regreening Program and reports directly to Council's Planning Committee. VETAC adheres to a Terms of Reference which defines the Committee's mission, strategic goals, committee structure, membership, meeting details and assignment of subcommittees (VETAC 2008).

VETAC is committed to enhancing and sustaining a healthy environment for residents of the City of Greater Sudbury through the restoration and protection of land and water. In 2005,

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VETAC also launched its highly successful 'Ugliest Schoolyard Contest' aimed at regreening and beautifying schoolyard environments throughout Greater Sudbury.

### **7.2 City of Greater Sudbury - Annual Operations Plan**

Effective ecological intervention requires specific targeted actions. These actions are identified in Annual Operations Plans prepared by the City. These define intended actions for the coming field season, including specifics about objectives and targets it aims to achieve. Each annual plan will be aligned with achieving the broader vision and goals defined in the *Biodiversity Action Plan for Greater Sudbury*.

The following is an example of sections that could be included in each Annual Operations Plan:

- Setting of Objectives and Targets for Regreening, Biodiversity Management and Research.
- Description of Community Involvement and Public Education Initiatives.
- Description of Funding Sources and Allocation of Financial Resources.
- Description of Human Resources Needs.
- Outline of Equipment, Materials and Other Resource Needs.
- Identification of Project Synergies and Linkages.
- Work Details, Land Access, Legal Requirements and Safety.
- Plans for Monitoring, Reporting and Project Review.

### **7.3 Regreening and Biodiversity Work Planned for 2009**

The City of Greater Sudbury Regreening Program for 2009 will focus on restoring lands within a 100 metre zone located along selected lakes. A number of activities will be conducted toward developing the *Biodiversity Action Plan for Greater Sudbury* by year end which will provide the foundation for future biodiversity work (See Sections 4, 5 and 6).

During 2009, Vale Inco will proceed with the operation of its greenhouses for the production of seedlings for regreening purposes. A portion of these seedlings will be donated to the City's restoration efforts, with the remainder to be used on company-owned properties across the Sudbury basin. The company will also continue its aerial seeding program. Areas receiving aerial applications of lime and fertilizer will be determined in discussion with the City's VETAC Committee.

During 2009, Xstrata Nickel will continue to implement baseline studies to support its biodiversity planning efforts, including:

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- Conducting a terrestrial assessment of birds (least bittern), insects (moth species) and amphibians and reptiles (Blanding's turtle). These species were identified as surrogates for species/population evaluation of special concern with respect to habitat management.
- Providing support for the elk restoration project (species/population review of larger upland mammals).
- Conducting research including conifer DNA and other complex genetic evaluations as studies to assess longer term needs at reaching sustainable forest ecosystems. Projects involve industrial partnerships with Vale Inco and Laurentian University.

In an effort to continually improve, Xstrata Nickel has set measurable targets for 2009 which include:

- Rehabilitation of at least 50 hectares of barren land and planting of 60, 000 trees.
- Development of a basin-wide land-use management plan for Xstrata Nickel's mining and exploration lands.
- Contribution of resources to support various community groups, social development functions and ecological restoration research activities (e.g., Laurentian University Co-operative Unit, Clean Air Sudbury activities and VETAC, including its "Ugliest Schoolyard Contest").

### 7.4 Documents, Records, Archives and Access to Information

The following is a list of some of the key organizations that maintain records, data and/or reports related to Greater Sudbury area regreening and biodiversity:

- **City of Greater Sudbury** (Regreening Records/Data, Annual Reports and Website).
- **Laurentian University** (Research Reports, J. N. Desmarais Library, Regional Archives, Mining and the Environment Database and Vale Inco Living Lakes Centre - Cooperative Freshwater Ecology Unit).
- **Sudbury Public Libraries** (Sudbury Soils Study Human Health and Ecological Risk Assessment Reports and records of Sudbury's environmental and social history).
- **SARA Group** (Sudbury Soils Study Reports and Website).



View of McKim Street Hill in 1978 before regreening and in 2008.



Before view (1991) and after view (2008) along the Coniston Hydro Road showing forest recovery.

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- **Vale Inco** (Records of rehabilitation conducted on company lands).
- **Xstrata Nickel** (Records of rehabilitation conducted on company lands).
- **Ministry of the Environment** (Ministry monitoring and research reports).

### **8.0 MONITORING AND RESEARCH**

#### **8.1 Measuring Success**

Measuring success requires clearly defined targets and assessment methods. Completion criteria that specifically identify end targets for regreening interventions and biodiversity recovery efforts will be developed to ensure that there is an acceptable and defined point of “closure” for regreening interventions. Once recovery has met the expected completion criteria and or defined milestones, further intervention would not be required.

Completion criteria will be used to gauge the relative completeness of recovery for a site within a specific zone of intervention. Completeness is understood here not in terms of a relative end state, such as a mature White Pine-Largetooth Aspen-Red Oak forest, but in terms of a site having the required ecological components to allow natural vegetation development to proceed unassisted. The completion criteria would define the required ecological components.

Completion criteria detail how the general goal of establishing a regionally-representative, self-sustaining terrestrial plant communities will be met. The criteria may for example define the number of species of trees, grasses, shrubs, birds and mammals that are desired in a particular habitat type. Completion criteria could include species richness and diversity, presence of shade tolerant tree and herb species, relative tree health, abundance of metal and acid tolerant species, tree height, and density/cover.

#### **8.2 Ongoing Assessments of Biodiversity Trends and Achievements**

Ongoing monitoring by qualified staff will be required to track completion criteria on the many sites that receive ecological interventions. Effective monitoring programs are required to maintain accountability to the community and to funding partners.

Monitoring has always been an integral part of the Greater Sudbury's regreening experience both at an operational and research level. Early in its inception, the City's Land Reclamation Program ran various experimental trials and assessed success of the intervention efforts. Adjustments and improvements were made as necessary. Most recently in 2006 and 2007, the Regreening Program undertook an extensive assessment of planting sites to determine the extent of ecological recovery.

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Ongoing monitoring provides a feedback mechanism to help refine the type and degree of greening intervention necessary for a particular area.

Biodiversity monitoring programs need to be realistic, balancing information needs with available resources. Monitoring can also be inclusive and community-based. For example, monitoring breeding birds can be done by qualified volunteer naturalists in the community. The Greater Sudbury Biodiversity Partnership would help link monitoring opportunities with the right community groups and individuals. As may be required, training opportunities in techniques for conducting breeding bird surveys could be made available to interested community members or students. Monitoring results would then be given back to the larger community through websites, electronic newsletters, or the annual biodiversity forum.

### **8.3 Research**

The Greater Sudbury area has been and will continue to be a large, outdoor, living laboratory for research on biodiversity recovery. Ongoing research projects by Laurentian University or other universities or by Greater Sudbury Biodiversity Partners will continue to be undertaken. The City's Regreening Program has worked collaboratively in sharing information with numerous professors, and undergraduate and graduate students from Laurentian University.

## **9.0 REPORTING, REVIEW AND IMPROVEMENT**

### **9.1 Reports**

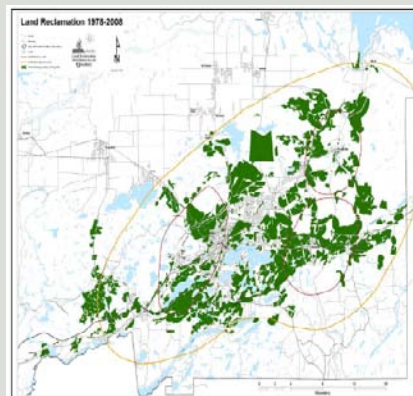
The primary avenue for reporting on greening efforts and biodiversity accomplishments will be through Annual Reports. It will be important that each Annual Report include an evaluation of achievement in terms of meeting the objectives and targets established for the year.

Technical reports will be prepared as necessary to document technical results obtained from greening or biodiversity research projects.

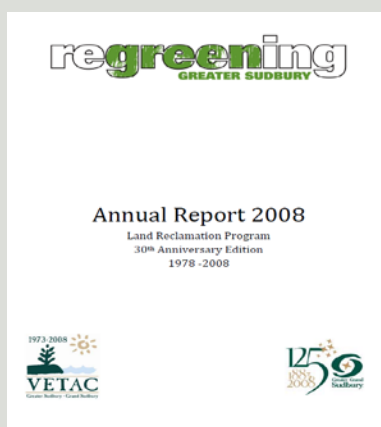
Research reports and annual reports associated with the City's greening and biodiversity work will be accessible to the public.

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### 9.2 Reviews and Continual Improvement



Tree planting and/or liming areas of Greater Sudbury covered between 1978 and 2008.



Latest City of Greater Sudbury Regreening Report.

Continual improvement will remain an ongoing priority for all regreening and biodiversity work conducted by the City. At the end of each field season, the City (with the support of VETAC) will conduct a review to determine what achievements have been made. It will determine the extent to which the objectives and targets set for the year were achieved and will identify any weaknesses that can be improved during subsequent field seasons.

The review will also identify any research and monitoring work that is needed to build on the “lessons learned”.

### 10.0 CONCLUSION

The Greater Sudbury community has reason to be proud of its regreening accomplishments considering its past ‘moonscape’ image. Yet, despite the immense improvements in Greater Sudbury’s environment, results of the Sudbury Soils Study ERA reveal that much work remains to be done before regionally representative, self-sustaining vegetation communities become reality over much of the area.

This Ecological Risk Management Framework outlines an approach for moving toward ecological recovery that builds on regreening successes and engages community participation in the development of a comprehensive ***Biodiversity Action Plan for Greater Sudbury***. This phase of Greater Sudbury’s regreening legacy will help renew the commitments of community members, including Vale Inco and Xstrata Nickel, at bringing lasting environmental improvements for current and future generations.



## Ecological Risk Management Framework For Greater Sudbury

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## **Ecological Risk Management Framework For Greater Sudbury**

### **Appendix 1 – Commitment Letter – Vale Inco**

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### **Appendix 2 – Commitment Letter – Xstrata Nickel**