

Invasive Species Management Strategy



Round Goby



Dog Strangling Vine



Emerald Ash Borer

CLOCA INVASIVE SPECIES WORKING GROUP
NOVEMBER 2010

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INTRODUCTION

The spread of invasive species has become a major concern for ecologists, naturalists and land and water managers across the province of Ontario. It is now estimated that the spread of invasive species is second only to habitat loss, as the major cause of declining biodiversity (Wilcove, *et al.*, 1998). In response to the threat of invasive species, much research, monitoring and publication of findings has resulted in a very high level of information products available to address this issue. All levels of government are collaborating with grassroots organizations to create a coordinated approach to public awareness and management action. The Central Lake Ontario Conservation Authority (CLOCA) has been working in this realm since 1995 when purple loosestrife (*Lythrum salicaria*) became a threat to local wetlands, and CLOCA became engaged in multiple strategies to manage its invasion. We continue now 15 years later to work in partnership with Federal, Provincial and Municipal governments, NGOs, and many other organizations to promote awareness and implement policy changes to help fight biodiversity loss resulting from a variety of invading species in our watersheds.

Invasive species are organisms that out compete native species when introduced outside of their native range, and have the ability to transform entire ecosystems. They can be plants, animals, aquatic-life, insects and micro-organisms; and they reproduce at prolific rates making them a threat to native organisms and habitats. (Government of Canada, 2009)

While the momentum behind addressing invasive species was kick-started by purple loosestrife, it was not until 2000 that a broader strategy for invasive species was established for Southern Ontario. In 2000 a collection of organizations consisting of the City of Toronto, The Society for Ecological Restoration Ontario and Ecological Outlook published a document entitled Sustaining Biodiversity: a Strategic Plan for Managing Invasive Plants in Southern Ontario. In 2004 the federal government published a strategic plan entitled An Invasive Alien Species Strategy for Canada. The federal document focuses on national and international endeavors, to thwart the introduction and spread of invasive species through major gateways (international trade and transportation of goods, etc), quarantine programs and the like. While the provincial strategic plan addresses actions for execution at local, regional and provincial levels. Due to the scope, focus and comprehensiveness of the provincial Strategic Plan and its relevance today to watershed concerns in CLOCA's jurisdiction, CLOCA has found this document to be an excellent foundation for its work in addressing invasive species over the past 10 years. It is important to note that CLOCA staff have adapted the provincial document to reflect CLOCA's needs and authoritative ability, and this present document (Invasive Species Management Strategy, CLOCA) represents the adaptation. One major revision CLOCA has made is the inclusiveness of all invasive organisms including invasive plants (terrestrial and aquatic vascular plants, trees and shrubs), aquatic organisms (fishes, invertebrates, diseases), pests (insects and diseases) and wildlife (birds, reptiles and amphibians); throughout this document the term invasive species is used to encompass and describe all of the above mentioned organisms. CLOCA has created a list of the most invasive species within our jurisdiction, (Appendix A), which includes the aquatic, terrestrial and pest species.

GOALS AND OBJECTIVES

Jurisdiction Wide Goal: To employ a hands-on strategy with respect to the management of invasive species that aims to maintain and increase overall biodiversity within the CLOCA jurisdiction by providing our constituents with a variety of awareness and prevention information products related to invasive species.

Jurisdiction Wide Objectives:

- To educate the public in a strategic manner that allows for evaluation
- To create tools for advocacy and communication about invasive species
- To prevent the spread of invasive species through communication and outreach
- To develop action programs for invasive species management to engage the public
- To contribute to improved land and water management and recreational practices through the control of invasive species

Conservation Area Goals: To employ a hands-on strategy with respect to the management of invasive species that aims to maintain and increase overall biodiversity within the CLOCA Conservation Areas by means of management, communication, outreach and prevention.

Conservation Area Objectives:

- To create an invasive species management plan for each of our conservation areas that engages the public in prevention, identification and a suite of volunteer activities directed to the control/management of invasive species.
- To manage ecologically sensitive Conservation Area lands where the ecological integrity of the area is threatened, but not yet infested by invasive species
- To develop guidelines for managing priority invasive species
- To identify priority geographic areas for management of invasive species
- To manage priority invasive species cost effectively
- To provide the resources necessary to manage priority invasive species in Conservation Areas over the long term
- To create awareness and encourage the prevention of the spread of invasive species through communication, outreach and leading by example
- To develop action programs for invasive species management to engage the public

STRATEGY

Dealing with invasive species can be a very difficult and daunting task. While management is feasible in some respects, there can be many challenges associated with managing invasive species such as funding, resources, expertise and experience. Management strategies directed at invasive species should be long-term, however securing funding for such lengthy endeavors can be challenging. While CLOCA will engage in management strategies for priority species where possible, our focus will be primarily on the prevention of the introduction and spread of invasive species.

Due to the varying methods of dispersal of invasive species, different strategies must be used to manage their impacts. For instance, control based management may be feasible for invasive plants, if funding and resources can be secured for the appropriate length of time; however, aquatic organisms are not as easy to isolate due to their mobility. For this reason, dealing with aquatic organisms and pest species will require actions focused on monitoring, communication, public outreach and best management practices. Invasive plant actions will have a similar focus to that of the aquatic organisms; yet will go farther by including management activities when feasible. Actions and recommendations that fall under the jurisdiction wide subcategory for aquatic organisms will be amended within the CLOCA Fisheries Management Plan (FMP, CLOCA, 2007) during its revision process to ensure implementation.

There are eight underlying strategies that are relevant in achieving our major goals and objectives. Several actions have been identified under each strategy, and as mentioned above, are geared towards specific types of invasive species. The eight strategies are:

1. Prevention
2. Communication
3. Best Management Practices
4. Prioritization
5. Implementation
6. Collaboration
7. Policy
8. Research & Monitoring

The core of this document is organized in table format, with these eight strategies followed by a list of actions. The strategies are categorized between Jurisdiction Wide initiatives and Conservation Area (CA) specific initiatives. Due to CLOCA's scope of responsibility, jurisdiction wide actions will focus on creating partnerships and promoting communication and prevention, while Conservation Area actions will involve more hands on management. Actions relevant to both Jurisdiction Wide and Conservation Area Specific categories will only be listed in the larger scale Jurisdiction Wide section and highlighted with an asterisk to denote they apply to both categories.

To account for the different management methods required for the varying types of invasive species, the actions are sub-categorized as invasive species (encompassing all organisms); invasive plants; and aquatic organisms. This will allow for clarity as to which actions are most achievable and appropriate for each group of organisms. All the actions listed are accomplishable, assuming appropriate resources are available. To combat the problem of invasive species, raise awareness and engage in appropriate management methods, a long-term commitment is necessary to ensure the longevity of these programs and successful management of invasive species.

This document is a working strategic action plan, and will be updated as necessary to reflect current research, best management practices and will incorporate and evaluate new and existing actions.

*All actions marked with an asterisk apply to both Jurisdiction Wide and Conservation Area Specific categories

1. Prevention

Prevention is always the preferred method of dealing with a problem such as invasive species. Presently, there are new initiatives the federal and provincial governments and other NGOs are embarking on related to prevention. Many of these initiatives encompass invasive species vectors and entrance gateways, such as Early Detection Rapid Response systems (OIPC, 2009), stricter legislation and quarantined invasive species lists (Environment Canada, 2004; Havinga, *et al.*, 2000). Historically, invasive organisms were brought in through the ballast waters of ships and as food staples. Many invasive organisms now are introduced as horticultural species, accidental transport or purposely released in the wild as a humane method of disposal (Havinga, *et al.* 2000). Within the CLOCA jurisdiction the main methods of dispersal of invasive species appears to be through garden escapees, spread through recreational activities (hiking, boating etc.), dumping bait and the humane disposal of pets; therefore our action plan for prevention will focus on the following activities:

Table 1: Prevention Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Work in partnership with Federal, Provincial and Municipal governments and NGO organizations to support an early warning system that identifies new potentially invasive species ❖ Once the early detection rapid response system is created, liaise and share with local municipality's ❖ Create website link for all municipal and regional partners and the general public with online resources regarding invasive species, prevention and management ❖ Generate a contact hierarchy for reporting newly discovered invasive species within CLOCA's jurisdiction. Also utilize existing reporting infrastructure like the invading species hotline. ❖ Review current operational procedures used by CLOCA field staff in the Conservation Areas and private properties, and update accordingly having regard for invasive species introduction and control* ❖ Train staff and volunteers to correctly identify and report on invasive species, and what actions/BMP should be taken* 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Place educational posters at kiosks (i.e. spread of species, animals on leashes, clean your boats, fish bait etc.) ❖ Provide education days for CA users on importance of staying on trails, vectors of spread, etc. ❖ Incorporate Best Management Practices (BMP) for day to day CA management/operation activities ❖ Create website link and online resources for conservation area users in the Conservation Area section of the CLOCA website <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Install cleaning facilities at CA entrances for boots and bikes for seed removal <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Conduct cost benefit analysis to discern whether to install internal washing stations for summer monitoring staff working in or near water ❖ Incorporate BMP's for day to day CA management/monitoring activities for Aquatics Monitoring Program and Durham Region Coastal Wetland Monitoring Program
Plant Species	

<ul style="list-style-type: none"> ❖ Develop a suggested native plantings list for CLOCA's jurisdiction and distribute to regional and municipal partners (Appendix C) ❖ Compile information on potential future plant invaders to the CLOCA jurisdiction ❖ Host workshops geared towards the nursery industry, horticultural groups, educational institutions with horticultural programs, etc. <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Develop a list of fishes <u>not</u> suitable for stocking within CLOCA's jurisdiction and refer further queries to the MNR ❖ Compile information on potential future aquatic invaders to the CLOCA jurisdiction ❖ Host workshops geared towards aquaculture industry, pet industry, angler community, etc. 	
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2. Communication

Communication and awareness is key to achieving our goals and objectives. This is necessary as control can be expensive, arduous and ineffective for certain species, particularly aquatic organisms. By educating the general public and organizations on the introduction, spread and threat of invasive species, we can provide our audience with alternatives to reduce the mechanisms by which they spread. In collaboration with Federal, Provincial and Municipal governments and NGO organizations, CLOCA has researched and created a list of its top invasive species (Appendix A).

Table 2: Communication Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Update and manage Invasive Species section on CLOCA website and create evaluation tools to measure receptiveness and change in attitudes ❖ Develop a communication strategy to deploy to private landowners (rural & urban) ❖ Design training session and host workshop for local industries that inadvertently endorse invasive species, i.e. nursery industry, pet industry, aquaculture industry, horticultural groups, angler community and educational institutions with horticultural programs <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Develop resources for landowners 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Design training session for staff, volunteers and students regarding invasive species. ❖ Post signage at CA's informing patrons of invasive species and ways to avoid spreading them <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Create demonstration sites and host management tours for interested landowners ❖ Post signage within CA lands to identify tracked invasive plant species <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Post signage within CA lands to identify tracked invasive aquatic organisms

<p>regarding invasive species, alternative native plantings, etc.</p> <ul style="list-style-type: none"> ❖ Research which invasive species are being sold at local nurseries and educate landowners and nursery owners on species <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Develop resources for landowners regarding where and how to properly dispose of aquatic pets and fish bait, proper care during aquatic recreational activities, etc. 	
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3. Best Management Practices (BMP's)

There have been many studies done trying to determine the best control methods for specific invasive species; however results always vary and are dependent on the size of a population, location, resources and many other factors. There is a considerable amount of literature available on control methods for invasive species; by prioritizing sites and species, CLOCA will be better equipped to manage their lands. While proven control methods are important, it is also necessary to incorporate best management practices for daily operations and recreational activities to help reduce the spread and avoid introduction of invasive species.

Table 3: Best Management Practices (BMP's) Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Create BMP's for daily activities and recreational activities and make available to private land owners ❖ Identify invasive species of top concern for CLOCA's jurisdiction* <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Provide management and control methods to landowners through online resources (i.e. The Landowner's Guide to Controlling Invasive Woodland Plants) ❖ Create working binder/database with up to date strategies and management methods for top invasive plant species and update as new science emerges* <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Create BMP's for recreational activities near and on the water ❖ Create working binder/database with up to date strategies and management methods for top invasive aquatic organisms and update as new science emerges* 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Review current operational procedures used by CLOCA field staff in the Conservation Areas, and update accordingly having regard for invasive species introduction and control <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Create species specific demonstration sites for active management, and use as an educational tool for the public and for strengthening CLOCA's control methods ❖ Where species specific management occurs, consider replacing invasive species with a native alternative (if population small enough, and time and budget allow) <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ create BMP's for field staff to reduce spread of invasive species during daily monitoring tasks

4. Prioritization

CLOCA’s watersheds and Conservation Areas are already subject to the impacts of infestations. Prioritizing areas for management is important, due to the aggressiveness and competitive nature of invasive species. Through CLOCA’s Natural Heritage Evaluation System (NHES), the distribution and abundance of invasive plant species have been mapped and evaluated for many of the Conservation Areas. Invasive aquatic organisms and aquatic plants are also mapped and monitored through the Aquatic Monitoring Program and the Durham Region Coastal Wetland Monitoring Program, respectively.

Appendix B provides two examples of the invasive plant mapping conducted within Enniskillen Conservation Area and Long Sault Conservation Area. Within each of the CAs there are varying levels of intensity, distribution, abundance and number of species present. This type of information will allow CLOCA staff to prioritize the sites for short and long-term management actions. Informative and educational resources regarding prioritization will be made available to other landowners who wish to conduct invasive species management on their own lands.

Direct management is not always feasible for aquatic organisms, therefore efforts will be focused on mapping, monitoring and small scale management initiatives such as the Enniskillen Pond Goldfish removal project. This information can be used towards the prioritizing of communication and outreach programs for invasive aquatic organisms.

Table 4: Prioritization Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Partner with Federal, Provincial and Non-Government organizations to obtain findings of reported invasive species within CLOCA’s jurisdiction ❖ Create criteria to prioritize invasive species* <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Provide landowners with resources to assist them in prioritizing their own lands ❖ Continue to map and monitor invasive plant species* <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Utilize the data gathered through the Aquatic Monitoring Program to prioritize watersheds for communication and outreach programs 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Create criteria to prioritize CA lands for Invasive Species management ❖ To continue listing and mapping invasive species for each CA. ❖ Apply prioritization criteria to all CA lands, and determine which lands are most conducive to management ❖ Apply prioritization criteria to each invasive species within CA lands ❖ Use Conservation Areas Management Plans (where available) to help inform the decision process used to prioritize CA lands targeted for invasive species management ❖ Newly acquired land parcels will continue to be inventoried and mapped for invasive species in the context of prioritizing CA lands for Invasive Species Management <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Utilize the data gathered through the NHES and the Terrestrial Watershed Monitoring Program to prioritize Conservation Areas for communication and outreach programs

	<p>Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Continue to map and monitor invasive aquatic organisms ❖ Utilize the data gathered through the Aquatic Monitoring Program and the Durham Region Coastal Wetland Monitoring Program to prioritize Conservation Areas for communication and outreach programs
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5. Implementation

There has been some hands-on invasive species management conducted by CLOCA field staff and volunteers at designated sites. By creating Invasive Species Management Plans for each CA with explicit work plans, CLOCA will be able to better utilize volunteers to assist in invasive species management and removal projects. Some actions will require the use of herbicides and will be conducted by a licensed individual under the supervision of CLOCA staff.

Implementation of active management techniques and all other activities addressed throughout this document is subject to long-term commitment and available resources. Funding will continue to be actively sought for the implementation of this strategy.

Table 5: Implementation Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Implement partnerships with local organizations and other landowners to promote invasive species management outside of CA's ❖ Develop an up to date list of invasive species removal activities done and attach as an Appendix to the Invasive Species Management Strategy (CLOCA), update as necessary* <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Host demonstration days with landowners and other interested volunteers to engage them in active management techniques* <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Utilize the data gathered through the Aquatic Monitoring Program to implement communication and outreach programs throughout CLOCA's watersheds 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Develop and implement a youth volunteer program to work at prioritized CA sites ❖ Create and implement Invasive Species Management Plans for each CA. ❖ Implement identified BMPs at each CA. ❖ Obtain funding from outside sources for projects as required <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Implement management techniques identified for priority areas and priority species. ❖ Implement CA specific plant communication and outreach programs. <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Implement CA specific aquatic communication and outreach programs.

6. Collaborations

CLOCA has developed partnerships with a number of Federal, Provincial, and Municipal governments, NGOs and many other organizations who are all heavily involved with invasive species control and education. Combining the knowledge and efforts of such organizations allows us to share and learn from each other and better advocate our message to the public.

Table 6: Collaboration Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Work closely with municipalities and Durham region to better control introduction of invasive species through planning processes ❖ Continue working with Federal, Provincial, NGOs and local organizations to better disseminate information and to share experiential knowledge ❖ Contribute to broader invasive species reporting initiatives ❖ Work with new and existing partners to learn from each other’s experiences, successes and failures in prevention and management strategies to ensure an adaptive management approach* 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Report on our projects and their successes and failures so that the information is available to other land and aquatics managers.

7. Policy

Federal, Provincial and local policies and legislation can facilitate the prevention of invading species and help direct management actions. Through various tools such as Official Plans, the permitting process, municipal by-laws, and Watershed Management planning, CLOCA will work with all levels of government and key stakeholders to create policies and guidelines to assist in the control of invasive species.

Table 7: Policy Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Provide education, clarity and direction for newly introduced and existing legislation (e.g. the Provincial Cosmetic Pesticide Ban) ❖ Develop CA permit conditions and recommendations to address the introduction/management/prevention of invasive species ❖ Recommend municipal by-law permit conditions to address the introduction/management/prevention of invasive species – exotic species removal, accepted plant list, fill by-laws, etc <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Create working binder/database with up to date strategies and management methods for top invasive plant species and update as new science emerges* 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Review current operational procedures used by CLOCA field staff in the Conservation Areas, and update accordingly having regard for invasive species introduction and control

<ul style="list-style-type: none"> ❖ Recommend the introduction/enhancement of official plan and watershed plan policies to account for the management/prevention of invasive species such as encouraging the use of native plantings appropriate to the locality, and posting standard signage with consistent messaging ❖ Work with all levels of government to consider placing certain invasive plants on noxious weed lists as bylaw ❖ Develop Landscaping BMP Guidelines to address development/site alteration proposals <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Create working binder/database with up to date strategies and management methods for top invasive aquatic organisms and update as new science emerges* ❖ Suggest additions during OP review and Watershed Planning, requiring signage posted at appropriate sites (CLOCA FMP, 2009) ❖ Develop a list of fish not suitable for stocking within CLOCA's jurisdiction and refer further queries to the MNR ❖ Develop BMP management and maintenance guidelines for Storm Water Management Ponds 	
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8. Research and Monitoring

CLOCA will stay up to date on research and control methods and update this document (Invasive Species Management Strategy) and related control method documents (to be produced) accordingly. While CLOCA will conduct limited on the ground research, there will be opportunity to collect data and provide analysis on monitoring initiatives conducted on invasive species management actions.

Table 8: Research and Monitoring Strategies

Jurisdiction Wide	Conservation Area Specific
<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Perform annual review of invasive species list and make necessary amendments ❖ Create web link on invasive species as a resource for all landowners and stakeholders ❖ Compile information on potential future invaders to the CLOCA jurisdiction <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Create working binder/database with up to date strategies and management methods 	<p style="text-align: center;">Invasive Species</p> <ul style="list-style-type: none"> ❖ Where appropriate, CLOCA will conduct monitoring in Conservation Areas to observe ecology of newly discovered species ❖ Attempt to fill data gaps where control methods for specific species are lacking or not well understood ❖ Report on specific species successes and failures, what happened, how methods can be or need to be improved, limitations, etc

<p>for top invasive plant species and update as new science emerges</p> <ul style="list-style-type: none"> ❖ Create a comparison of management methods on private and public lands ❖ Research which invasive species are being sold at local nurseries and educate landowners and nursery owners on alternative species <p style="text-align: center;">Aquatic Organisms</p> <ul style="list-style-type: none"> ❖ Continue to map and monitor invasive aquatic organisms * ❖ Investigate measures to control the introduction and spread of invasive species (CLOCA FMP, 2009)* 	<ul style="list-style-type: none"> ❖ Create website link and online resources for conservation area users in the Conservation Area section of the CLOCA website. ❖ Update lists and maps of invasive species for each CA as data becomes available. <p style="text-align: center;">Plant Species</p> <ul style="list-style-type: none"> ❖ Conduct monitoring between different management methods within CA lands
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GLOSSARY

Invasive Species - A species of plant, animal, aquatic life or micro-organisms that out competes native species when introduced outside of its natural environment and threatens ecosystems, economy and society. (Government of Canada, 2009)

Native – A native [organism] is one that historically occurs (or occurred) naturally somewhere within the boundaries of a given jurisdiction. (Daigle, J.M, & Havinga, D., 1996)

Indigenous – is commonly used as a refinement on native. It refers to the specific local or bioregional distribution of a species. (Daigle, J.M, & Havinga, D., 1996)

Non-native Species – Any animal or plant found outside its normal range is said to be a non-native species. When a non-native (or nonindigenous) species is able to reproduce and maintain a population in an introduced environment, it is said to be “naturalized”. (Environment Canada, 2007)

Biodiversity - variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (Environment Canada, 2004).

APPENDIX A: Invasive Species List

CLOCA's Top Terrestrial Plant Species

Common Name	Latin Name
Manitoba Maple	<i>Acer negundo</i>
Norway maple	<i>Acer platanoides</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Pale Swallow-wort	<i>Cynanchum rossicum</i>
Russian/Autumn Olive	<i>Elaeagnus Spp</i>
Day Lilly	<i>Heemerocallis Spp</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>
Dames Rocket	<i>Hesperis matronalis</i>
Himalayan balsam	<i>Impatiens glandulifera</i>
Exotic Honeysuckle's	<i>Lonicera spp</i>
Wild Parsnip	<i>Pastinaca sativa</i>
Japanese Knotweed	<i>Polygonum cuspidatum</i>
Common Buckthorn	<i>Rhamnus cathartica</i>
Black Locust	<i>Robinia pseudo-acacia</i>

CLOCA's Top Aquatic Plant Species

Common Name	Latin Name	Comments
Flowering rush	<i>Butomus umbellatus</i>	
Fanwort	<i>Cabomba caroliniana</i>	potentially invasive - not yet found in CLOCA jurisdiction - but nearby - Peterborough
Waterweed	<i>Egeria densa</i>	potentially invasive - not yet found in CLOCA jurisdiction
Water Hyacinth	<i>Eichhornia crassipes</i>	
Hydrilla	<i>Hydrilla verticillata</i>	potentially invasive - not yet found in Ontario
European frog-bit	<i>Hydrocharis morus-ranae</i>	
Yellow Iris	<i>Iris pseudacorus</i>	
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	
Minor naiad	<i>Najas minor</i>	potentially invasive - not yet found in Ontario
Floating Heart	<i>Nymphoides peltata</i>	potentially invasive - not yet found in CLOCA jurisdiction
Water Lettuce	<i>Pistia stratiotes</i>	
Curly Pondweed	<i>Potamogeton crispus</i>	
Marsh Cress	<i>Rorippa amphibia</i>	potentially invasive - not yet found in Ontario
True Watercress	<i>Rorippa nasturtium-aquaticum</i>	potentially invasive - not yet found in CLOCA jurisdiction
Water Soldier	<i>Stratiotes aloides</i>	potentially invasive - not yet found in CLOCA jurisdiction
Water chestnut	<i>Trapa natans</i>	potentially invasive - not yet found in CLOCA jurisdiction

APPENDIX A: Invasive Species List (cont'd)

Terrestrial Invasive Species Categorization (Urban Forest Associates Inc., 2002)

Terrestrial Invasive Categorization
Category 1
This category contains aggressive invasive exotic species that can alter and dominate sites and exclude native species. These organisms are a threat to natural areas, as they disperse widely, through transport by animals and natural means (water, wind, etc). These species are top priority, however control may be difficult.
Category 2
Species that are highly invasive but tend to only dominate certain niches or do not spread rapidly from major concentrations. They spread by vegetative means or by seeds that drop close to the parent. They may persist in dense populations for long periods. Control where necessary and limit their spread to other areas.
Category 3
Moderately invasive species, but can become locally dominant when the proper conditions exist. Control where necessary and limit their spread to other areas.
Category 4
Species that do not pose a serious threat to natural areas unless they are competing directly with more desirable vegetation. These plants are sometimes substituted for native plants, but may not reproduce aggressively once established.
Category 5
Some of these species have the potential to become invasive exotics in Ontario. They can reproduce aggressively on occasion but have not been shown to be a serious threat to natural areas in Ontario. Some are very similar to indigenous species and could simply have been overlooked.

Adapted from Urban Forest Associates Inc., 2002.

APPENDIX A: Invasive Species List (cont'd)

Categorized Terrestrial Invasive Species List
(Adapted from Urban Forest Associates Inc. 2002)

Latin	Common Name	Durham Region Status*	Weediness Index	Invasiveness Category
Category 1				
<i>Acer negundo</i>	Manitoba Maple			
<i>Aegopodium podagraria</i>	Goutweed			
<i>Alliaria petiolata</i>	Garlic Mustard	C	-3	1
<i>Betula pendula</i>	European Birch	U	-3	1
<i>Cirsium arvense</i>	Canada Thistle	+	-1	1
<i>Coronilla varia</i>	Crown Vetch	C	-2	1
<i>Cynanchum nigrum</i>	Black Swallow-wort	c	-2	1
<i>Cynanchum rossicum</i>	Pale Swallow-wort	c	-3	1
<i>Elaeagnus angustifolia</i>	Russian Olive	c	-1	3
<i>Elaeagnus umbellata</i>	Autumn Olive	c	-3	1
<i>Geum urbanum</i>	Yellow Avens			
<i>Glyceria maxima</i>	Rough Manna Grass	r?	-1	1
<i>Heracleum mantegazzianum</i>	Giant Hogweed	n/a		1
<i>Hesperis matronalis</i>	Dames Rocket	c	-3	1
<i>Impatiens glandulifera</i>	Himalayan balsam	u	-2	1
<i>Lonicera japonica</i>	Japanses Honeysuckle	n/a	-2	1
<i>Lonicera maackii</i>	Amur Honeysuckle	n/a	-2	1
<i>Lonicera morrowii</i>	Morrow's Honeysuckle	u	-1	1
<i>Lonicera Tatarica</i>	Tartarian Honeysuckle	c	-3	1
<i>Lonicera x bella</i>	Hydrbid Honeysuckle	u	-3	1
<i>Lonicera xylosteum</i>	European Fly Honeysuckle	u	-2	1
<i>Lythrum salicaria</i>	Purple Loosestrife	c	-3	1
<i>Morus alba</i>	White Mulberry	u	-3	1

<i>Phragmites australis</i>	Common Reed	c		1
<i>Populus alba</i>	White poplar	+	-3	1
<i>Rhamnus cathartica</i>	Common Buckthorn	c	-3	1

Category 2

<i>Acer platanoides</i>	Norway maple	c	-3	2
<i>Ailanthus altissima</i>	Tree-of-Heaven	u	-1	2
<i>Centaurea maculosa</i>	Spotted Knapweed	+	-3	3
<i>Convolvulus arvensis</i>	Field Bindweed	c	-1	3
<i>Galium mollugo</i>	White Bedstraw	c	-2	2
<i>Lotus corniculatus</i>	Bird-Foot Trefoil	c	-2	2
<i>Lysimachia nummularia</i>	Moneywort	c	-3	2
<i>Melilotus alba</i>	White Sweet Clover	c	-3	2
<i>Melilotus officinalis</i>	Yellow Sweet Clover	c	-1	2
<i>Pinus sylvestris</i>	Scots Pine	c	-3	2
<i>Poa pratensis</i>	Kentucky Bluegrass	c		2
<i>Polygonum cuspidatum</i>	Japanese Knotweed	c	-1	2
<i>Robinia pseudo-acacia</i>	Black Locust	c	-3	2
<i>Rosa multiflora</i>	Multiflora rose	c	-3	2
<i>Salix fragilis</i>	Crack Willow	r	-3	3
<i>Salix x rubens</i>	Hybrid Willow	c	-3	3
<i>Scilla sibirica</i>	Scilla	u	-1	2
<i>Ulmus pumila</i>	Siberian Elm	r	-1	2
<i>Vicia cracca</i>	Cow Vetch	c	-1	2
<i>Vinca minor</i>	Periwinkle	+	-2	2

Category 3

<i>Abutilon theophrasti</i>	Velvet-leaf	+	-1	3
<i>Acinos arvensis</i>	Mother-of-Thyme	u	-1	3

<i>Aesculus hippocastanum</i>	Horse-Chestnut	c	-1	3
<i>Alnus glutinosa</i>	Black Alder	u	-3	1
<i>Artemisia absinthium</i>	Absinth Sage	+	-1	3
<i>Barbarea vulgaris</i>	Yellow Rocket	c	-1	3
<i>Berberis thunbergii</i>	Japanese Barberry	c	-3	3
<i>Berberis vulgaris</i>	Common Barberry	c	-2	3
<i>Berteroa incana</i>	Hoary-alyssum	u	-3	3
<i>Carduus nutans</i>	Nodding Thistle	+	-1	3
<i>Celastrus orbiculatus</i>	Oriental Bittersweet	r	-1	2
<i>Convallaria majalis</i>	Lily-of-the-Valley	u	-2	3
<i>Crataegus monogyna</i>	Singleseed Hawthorn	c	-1	3
<i>Dactylis glomerata</i>	Orchard Grass	c	-1	3
<i>Dipsacus fullonum spp sylvestris</i>	Teasel	c	-1	3
<i>Elymus repens</i>	Quack grass	c	-3	3
<i>Euonymus alata</i>	Winged Euonymus	n/a	-1	3
<i>Euonymus europaea</i>	Spindle-Tree	r	-1	3
<i>Euphorbia cyparissias</i>	Cypress Spurge	u	-2	3
<i>Festuca arundinacea</i>	Tall Fescue	c	-1	3
<i>Gallium verum</i>	Yellow Bedstraw	c	-1	3
<i>Hedera helix</i>	English Ivy			3
<i>Hemerocallis fulva</i>	Day Lilly	+	-3	4
<i>Hemerocallis lilioasphodelus</i>	Day Lilly	+	-1	4
<i>Hieracium aurantiacum</i>	Orange Hawkweed	+	-2	3
<i>Hieracium caespitosum</i>	Yellow Hawkweed	+	-2	3
<i>Hieracium x floribundum</i>	Pale Hawkweed	u		3
<i>Humulus japonicus</i>	Japanese Hop	n/a	-1	3
<i>Kochia scoparia</i>	Summer Cypress	r	-1	3
<i>Ligustrum vulgare</i>	Privet	u	-2	4
<i>Lycopus europeaus</i>	Bugleweed	c	-2	3
<i>Miscanthus sinensis</i>	Eulalia	n/a	-1	3

<i>Pastinaca sativa</i>	Wild Parsnip	c	-3	3
<i>Ranunculus repens</i>	Creeping Buttercup	c	-1	3
<i>Rhamnus frangula</i>	Glossy Buckthorn	n/a	-3	1
<i>Salix alba</i>	White Willow	c	-2	3
<i>Saponaria officinalis</i>	Bouncing-Bet	c	-3	3
<i>Solanum dulcamara</i>	Bittersweet Nightshade	c	-2	3
<i>Sorbaria sorbifolia</i>	False Spiraea	u	-1	3
<i>Tanacetum vulgare</i>	Tansy	c	-1	3
<i>Thymus praecox</i>	Creeping Thyme	r		3
<i>Urtica dioica ssp. Dioica</i>	European Stinging-nettle	c	-1	3
<i>Vicia sativa ssp. Nigra</i>	Common vetch	r	-1	3
<i>Vicia tetrasperma</i>	Slender Vetch	u	-1	3

Category 4				
<i>Acer ginnala</i>	Amur Maple	u	-2	4
<i>Ajuga reptans</i>	Creeping Bugleweed	u	-1	4
<i>Bromus inermis</i>	Smooth Brome	c	-3	4
<i>Campanula rapunculoides</i>	Creeping Bellflower	c	-2	4
<i>Euphorbia esula</i>	Leafy Spurge	u	-1	4
<i>Glechoma hederacea</i>	Ground Ivy		-2	4
<i>Hypericum perforatum</i>	St. John's-wort	c	-3	4
<i>Inula helenium</i>	Elecampane	c	-2	4
<i>Iris pseudoacorus</i>	Yellow Flag	c	-2	4
<i>Linaria vulgaris</i>	Butter-and-Eggs	c	-1	4
<i>Lolium perenne</i>	Perennial Rye Grass	u	-1	4
<i>Malva moschata</i>	Musk Mallow	+	-1	4
<i>Medicago lupulina</i>	Black Medick	c	-1	4
<i>Medicago sativa</i>	Alfalfa	c	-1	4
<i>Mentha x piperita</i>	Peppermint	u	-1	4
<i>Myosotis scrpioides</i>	True Forget-me-not	c	-1	4

<i>Nepeta cataria</i>	Catnip	c	-2	4
<i>Origanum vulgare</i>	Wild marjoram	n/a	-2	4
<i>Pachysandra terminalis</i>	Japanese Spurge	n/a		4
<i>Polygonum persicaria</i>	Ladys' thumb			
<i>Populus x canadensis</i>	Carolina poplar	c		4
<i>Rumex acetosella</i>	Sheep Sorrel	c	-2	4
<i>Salix caprea</i>	Goat Willow	u		4
<i>Salix purpurea</i>	Purple Willow	r	-2	4
<i>Senecio jacobaea</i>	Tansy	u	-1	4
<i>Setaria spp.</i>	Foxtail	U	-1	4
<i>Sorbus aucuparia</i>	European Mountain Ash	c	-2	4
<i>Symphoricarpus albus var. laevigatus</i>	Western Snowberry	u??	-1	4
<i>Trifolium arvense</i>	Rabbit-Foot	n/a	-1	4
<i>Trifolium pratense</i>	Red Clover	c	-2	4
<i>Trifolium repens</i>	White Clover	c	-1	4
<i>Tussilago farfara</i>	Sweet Coltsfoot	c	-2	4
<i>Ulmus glabra</i>	Scotch Elm	n/a		4
<i>Viburnum opulus sp. Opulus</i>	Guelder Rose	r	-1	4

Category 5				
<i>Alnus incana spp. Incana</i>	European White Alder	n/a		5
<i>Ampelopsis brevipedunculata</i>	Porcelain-berry	n/a		5
<i>Artemisia vulgaris</i>	Common Mugwort	+	-1	5
<i>Cornus alba</i>	Tatarian dogwood	n/a		5
<i>Daphne mezereum</i>	Mezer's Daphne	r		5
<i>Fraxinus excelsior</i>	European Ash	+		5
<i>Humulus lupulus</i>	Common Hop	r	-1	5
<i>Isatis tinctoria</i>	Dyer's Woad	n/a		5
<i>Lapsana communis</i>	Nipplewort	u	-2	5

<i>Phalaris arundinacea</i>	Reed Canary Grass	c		5
<i>Populus tremula</i>	European Aspen	n/a		5
<i>Prunus avium</i>	Bird Cherry	r	-2	5
<i>Prunus mahaleb</i>	Perfumed Cherry	n/a	-1	5
<i>Sambucus racemosa ssp. Racemosa</i>	European Red Elder	n/a		5
<i>Tilia cordata</i>	European Linden	r		5
<i>Trapa natans</i>	Water-chestnut	n/a		5
<i>Typha angustifolia</i>	Narrow-leaved cattail	c		5
<i>Typhaxglauca</i>	Hybrid Cattail	c		5
<i>Viola odorata</i>	Sweet Violet	n/a	-1	5
<i>Chelidonium majus</i>	Celandine Poppy			

C = Common

U = Uncommon

R = Rare

+ = introduced

APPENDIX A: Invasive Species List (cont'd)

Forest Pests

Common Name	Scientific Name
Asian Long-Horned Beetle	<i>Anoplophora glabripennis</i>
Emerald Ash Borer	<i>Agrilus planipennis</i>
Tent Caterpillar	<i>Malacosoma disstria</i>
Butternut Canker	<i>Sirococcus clavignenti-juglandacearum</i>
Dutch Elm Disease	<i>Ophiostoma ulmi</i>

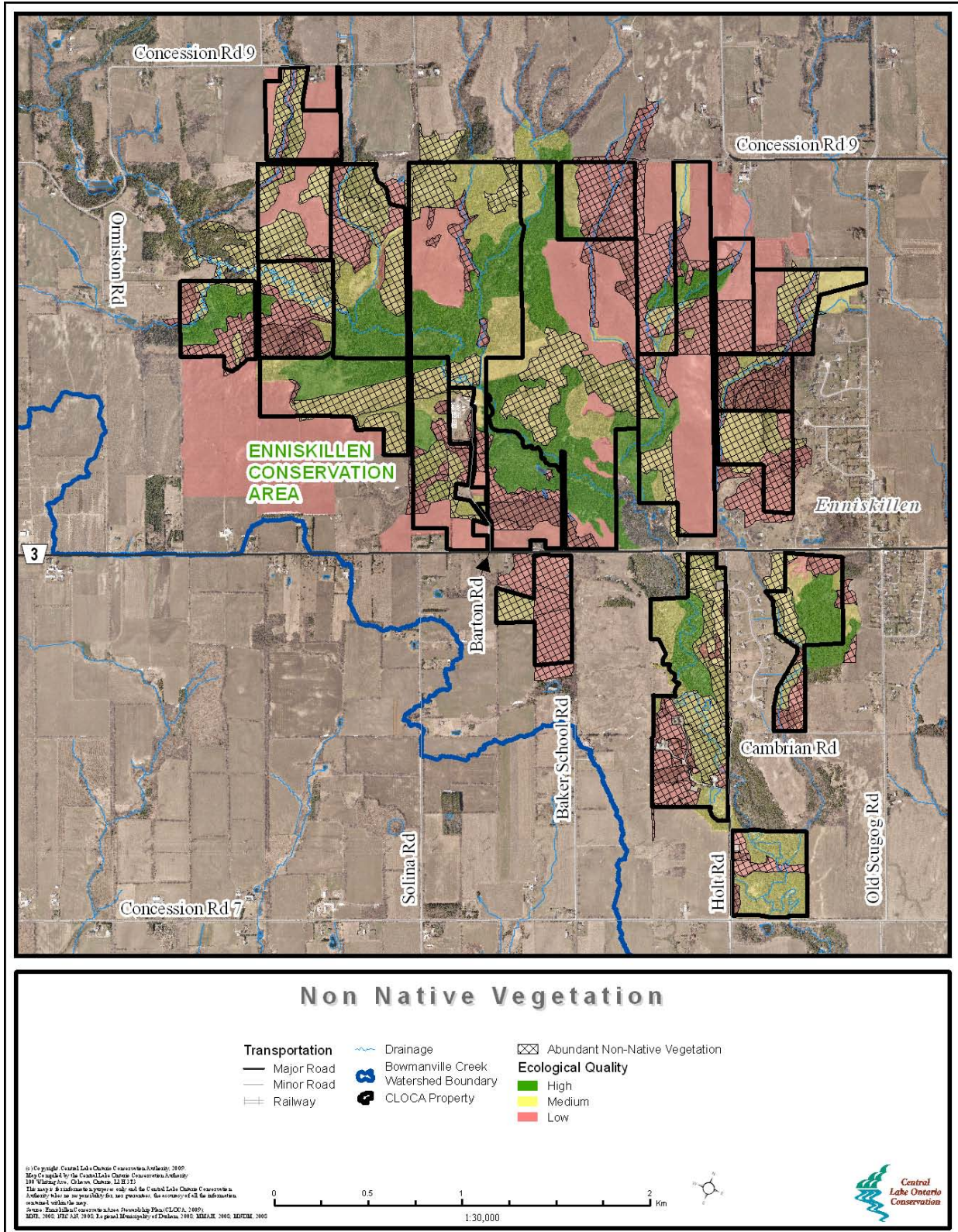
Aquatics organisms present within the Great Lakes

Common Name	Latin Name
Fish	
Goldfish	<i>Carassius auratus</i>
Snakehead	<i>Channa Spp. / Parachanna Spp.</i>
Common Carp	<i>Cyprinus carpio</i>
Ruffe	<i>Gymnocephalus cernuus</i>
Round Goby	<i>Neogobius melanostomus</i>
Lamprey	<i>Petromyzon marinus</i>
Rudd	<i>Scardinius erythrophthalmus</i>
Invertebrate	
Spiny waterflea	<i>Bythotrephes longimanus</i>
Fish Hook Waterflea	<i>Cercopagis pengoi</i>
Zebra Mussel	<i>Dreissena polymorpha</i>
Rusty Crayfish	<i>Orconectes rusticus</i>
Mystery/apple snails	<i>Pomacea spp</i>
Other	
Columnaris	<i>Flavobacterium columnare</i>
VHS	<i>Viral Hemorrhagic Septicaemia</i>

APPENDIX B: Invasive Plant Species Mapping

Excerpt from Enniskillen Conservation Area Stewardship Plan, 2009.

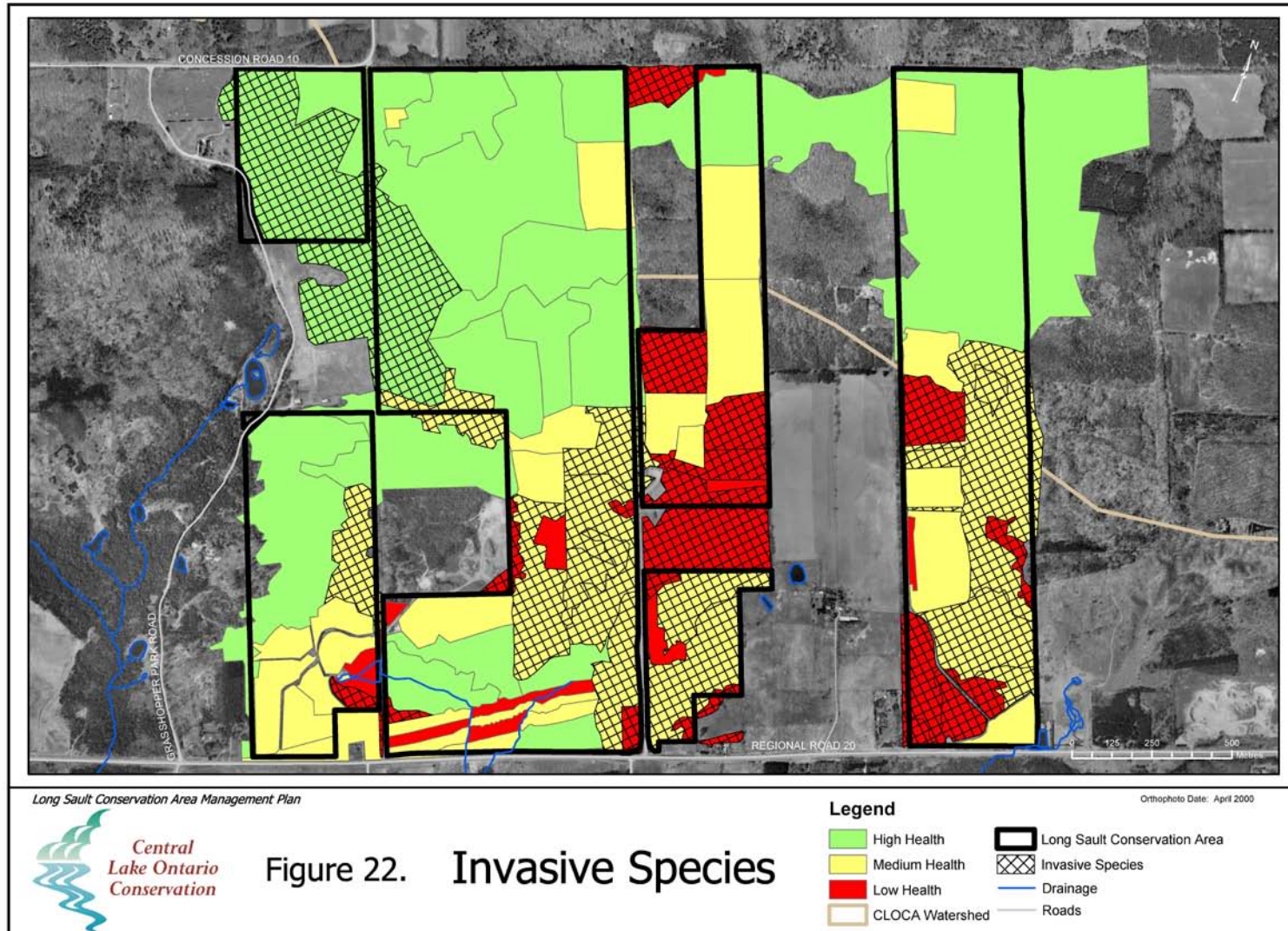
Note: This map does not include recently acquired land parcels secured by CLOCA to enhance property holdings associated with this Conservation Area. Invasive species mapping is continuously updated to assist with our land management activities, however may not be shown in this example for newly acquired parcels.



APPENDIX B: Invasive Plant Species Mapping (cont'd)

Excerpt from Long Sault Conservation Area Management Plan, 2004.

Note: This map does not include recently acquired land parcels secured by CLOCA to enhance property holdings associated with this Conservation Area. Invasive species mapping is continuously updated to assist with our land management activities, however may not be shown in this example for newly acquired parcels.



APPENDIX C: Suggested Native Species Planting List

Native Tree Species List

Common Name	Latin Name	Common Name	Latin Name
Balsam Fir	Abies balsamifera	Bebb's Willow	Salix bebbiana
Red Maple	Acer rubrum	Pussy Willow	Salix discolor
Silver Maple	Acer saccharinum	White Cedar	Thuja occidentalis
Sugar Maple	Acer saccharum	Basswood	Tilia americana
Alleghany Serviceberry	Amelanchier laevis	Eastern Hemlock	Tsuga canadensis
Bearberry	Arctostaphylos uva-ursi	American White Elm	Ulmus americana
Yellow Birch	Betula alleghaniensis	Nannyberry	Viburnum lentago
White Birch	Betula papyrifera		
Bitternut Hickory	Caraya cordiformis		
Blue Beech	Carpinus carolina		
Common Hackberry	Celtis occidentalis		
Alternate-Leaved Dogwood	Cornus alternifolia		
Flowering Dogwood	Cornus florida		
Red Oiser Dogwood	Cornus stolonifera		
American Beech	Fagus grandifolia		
White Ash	Fraxinus americana		
Black Ash	Fraxinus nigra		
Green or Red Ash	Fraxinus pennsylvanica		
Wintergreen	Gaultheria procumbens		
Maidenhair Tree	Ginko biloba		
Common Thornless Honeylocust	Gleditsia triacanthos		
Kentucky Coffee Tree	Gymnocladus dioicus		
Butternut	Juglans Cinera		
Black Walnut	Juglans nigra		
Eastern Red Cedar	Juniperus virginiana		
American Larch	Larix Larcinia		
Tulip Tree	Liriodendron tulipifera		
Ironwood/Hop Hornbeam	Ostrya virginiana		
White Spruce	Picea glauca		
Black Spruce	Picea mariana		
Red Pine	Pinus resinosa		
Eastern White Pine	Pinus strobus		
Balsam Poplar	Populus balsamifera		
Big-Toothed Aspen/Canadian Aspen	Populus grandidentata		
Trembling Aspen	Populus tremuloides		
Black Cherry	Prunus serotina		
White Oak	Quercus alba		
Swamp White Oak	Quercus bicolor		
Burr Oak	Quercus macrocarpa		
Pin Oak	Quercus palustris		
Red Oak	Quercus rubra		

APPENDIX C: Suggested Native Species Planting List (cont'd)

Native Wetland Plant Table
(adapted from Habitat Works!, 2002)

Latin Name	Common Name
<i>Acorus calamus</i>	Sweet flag
<i>Alisma plantago-aquatica</i>	Broadleaf water plantain
<i>Asclepias incarnata</i>	Swamp milkweed
<i>Asclepias tuberosa</i>	Butterfly milkweed
<i>Aster novae-angliae</i>	New England aster
<i>Aster puniceus</i>	Swamp/Purple aster
<i>Aster umbellatus</i>	Flat topped aster
<i>Bidens cernua</i>	Nodding burr-marigold
<i>Calamagrostis Canadensis</i>	Canada bluejoint
<i>Calla palustris</i>	Marsh marigold
<i>Carex bebbi</i>	Bebb's sedge
<i>Carex crinita</i>	Fringed sedge
<i>Carex hystericina</i>	Porcupine sedge
<i>Carex pseudo-cyperus</i>	Cyperus-like sedge
<i>Carex retrosa</i>	Beaked sedge
<i>Carex stipata</i>	Awl fruited sedge
<i>Carex stricta</i>	Tussock sedge
<i>Carex vulpinoidea</i>	Fox sedge
<i>Ceratophyllum demersum</i>	Coontail
<i>Epilobium glandulosum</i>	Northern willow herb
<i>Eupatorium maculatum</i>	Joe-pye weed
<i>Eupatorium perfoliatum</i>	Boneset
<i>Glyceria striata</i>	Fowl manna grass
<i>Impatiens capensis</i>	Spotted jewelweed
<i>Iris versicolor</i>	Blue-flag iris
<i>Juncus Canadensis</i>	Canada rush
<i>Juncus effuses</i>	Soft rush
<i>Juncus tenuis</i>	Path rush
<i>Juncus torreyi</i>	Torrey's rush
<i>Leersia oryzoides</i>	Rice cut-grass
<i>Lobelia cardinalis</i>	Cardinal flower
<i>Lobelia siphilitica</i>	Great blue lobelia
<i>Lycopus americanus</i>	Water horehound
<i>Mimulus ringens</i>	Monkey flower

Latin Name	Common Name
<i>Monarda fistulosa</i>	Wild bergamot
<i>Nuphar variegatum</i>	Yellow water-lily
<i>Oenothera biennis</i>	Evening primrose
<i>Panicum virgatum</i>	Switch grass
<i>Phalaris anrundinacea</i>	Reed canary grass
<i>Pontederia cordata</i>	Pickereel weed
<i>Potamogeton natans</i>	Floating leaved pondweed
<i>Potamogeton pectinatus</i>	Sago pondweed
<i>Potamogeton richardsonii</i>	Curly pondweed
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Rumex verticillatus</i>	Swamp dock
<i>Sagittaria latifolia</i>	Arrowhead
<i>Scirpus acutus</i>	Hardstem bulrush
<i>Scirpus atrovirens</i>	Green bulrush
<i>Scirpus cyperinus</i>	Wool grass bulrush
<i>Scirpus fluviatilis</i>	River bulrush
<i>Scirpus pungens</i>	Common three square
<i>Scirpus validus</i>	Softstem bulrush
<i>Scutellaria galericulata</i>	Marsh skullcap
<i>Sorghastrum nutans</i>	Indian grass
<i>Spartina pectinata</i>	Prairie cordgrass
<i>Typha angustifolia</i>	Narrow leaf cattail
<i>Typha latifolia</i>	Broadleaf cattail
<i>Utricularia vulgaris</i>	Bladderwort
<i>Vallisneria americana</i>	Wild celery
<i>Verbena hastate</i>	Blue vervain
<i>Acer saccharum</i>	Sugar maple
<i>Cphalanthus occidentalis</i>	Buttonbush
<i>Quercus rubra</i>	Red Oak
<i>Sambucus canadensis</i>	American elderberry
<i>Spirea alba</i>	Narrow-leaved meadowseet