

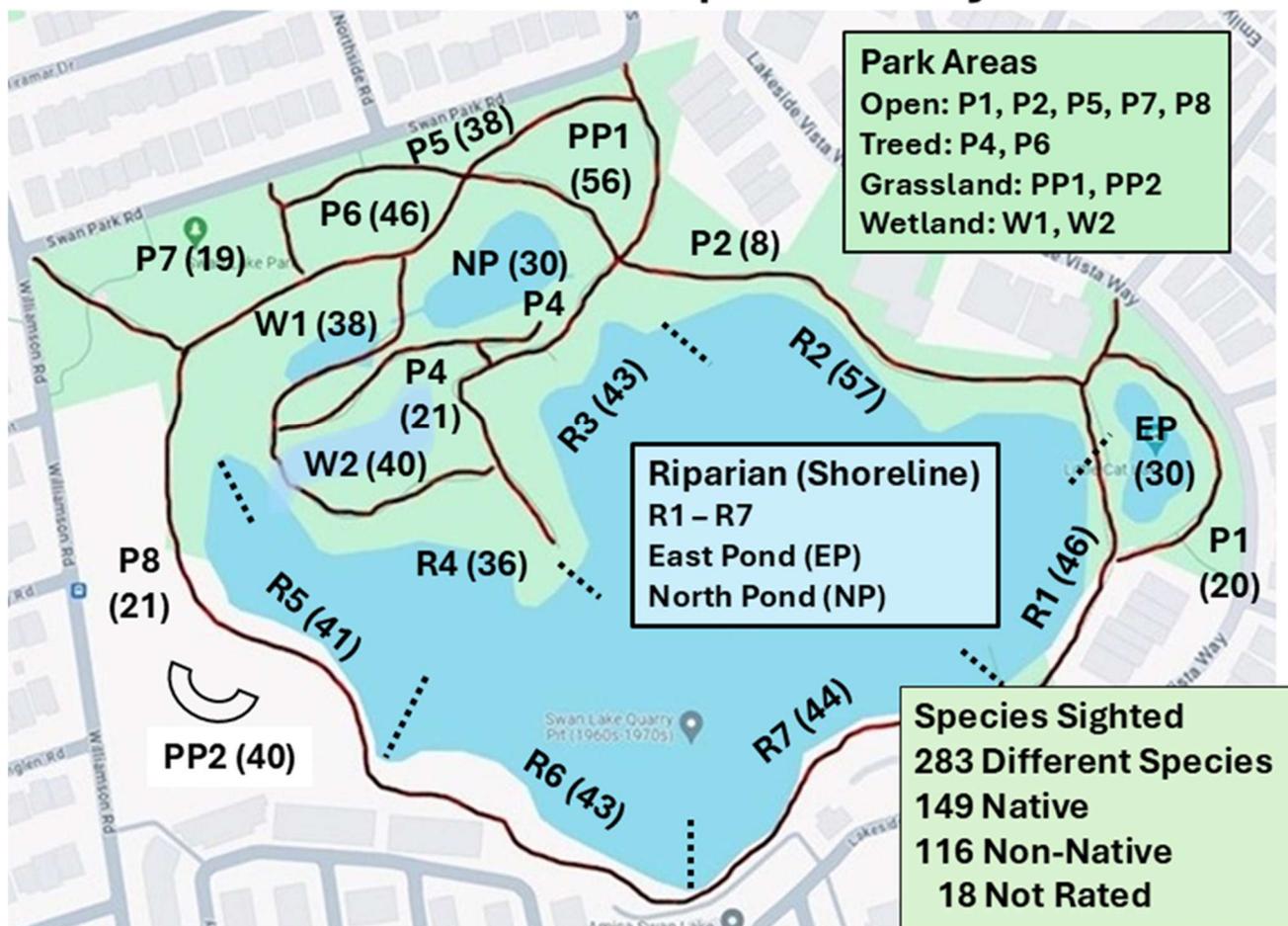
APPENDIX E: Terrestrial Diversity of Swan Lake Park

In August 2024, a group of 20 volunteers undertook a field inventory of the plants in Swan Lake Park, using cell phones linked to the PlantNet app which identifies plants based on leaves, bark or flowers. The volunteers recorded plants distributed across 20 different segments of the park. The different segments were categorized as Treed, Wetland, Shoreline, Grassland or Open Parkland.

In April 2021, North-South Environmental submitted to Markham Council the Markham Natural Heritage Inventory and Assessment Study⁶ which included the ranking of the various species found in Markham by organizations such as the Ontario government and the Toronto and Region Conservation Authority (the “TRCA”). The Swan Lake Park results incorporated the categorization structures set by the TRCA, Markham and York Region in the Heritage Inventory and Assessment Report and various other resources listed in the references section.

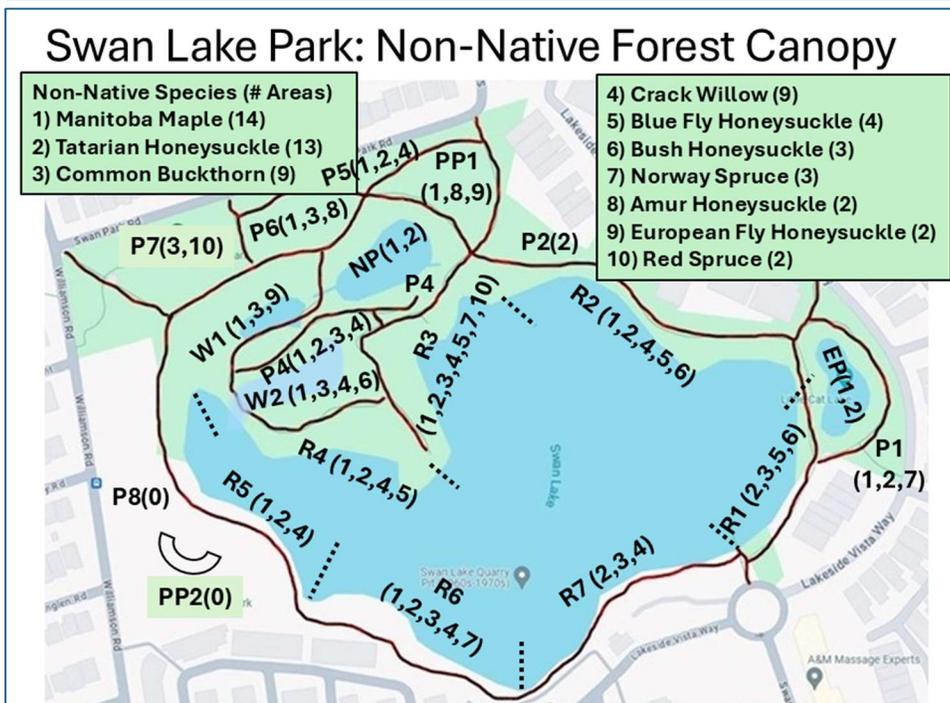
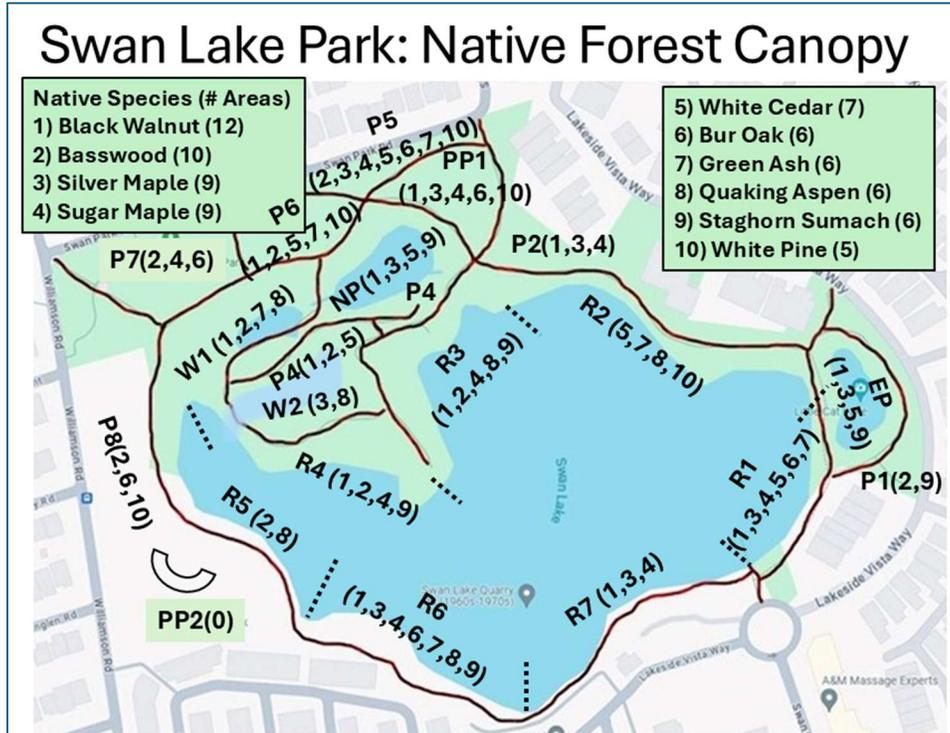
The volunteers identified 283 different species of which 149 are considered native to the area and 18 that were not rated. They also identified a significant number of non-native species (116) in the park.

Number of Plant Species By Area



A) Primary Tree Canopy

In March 2023, the Toronto and Region Conservation Authority released a study⁹ on the composition of forests throughout Markham. FOSLP documented 25 of the Native Species listed in the TRCA survey and 19 Non-Native species in Swan Lake Park. The following charts identify the location of the top 10 native and non-native species that dominate the canopy in Swan Lake Park and indicate how many areas they were found.

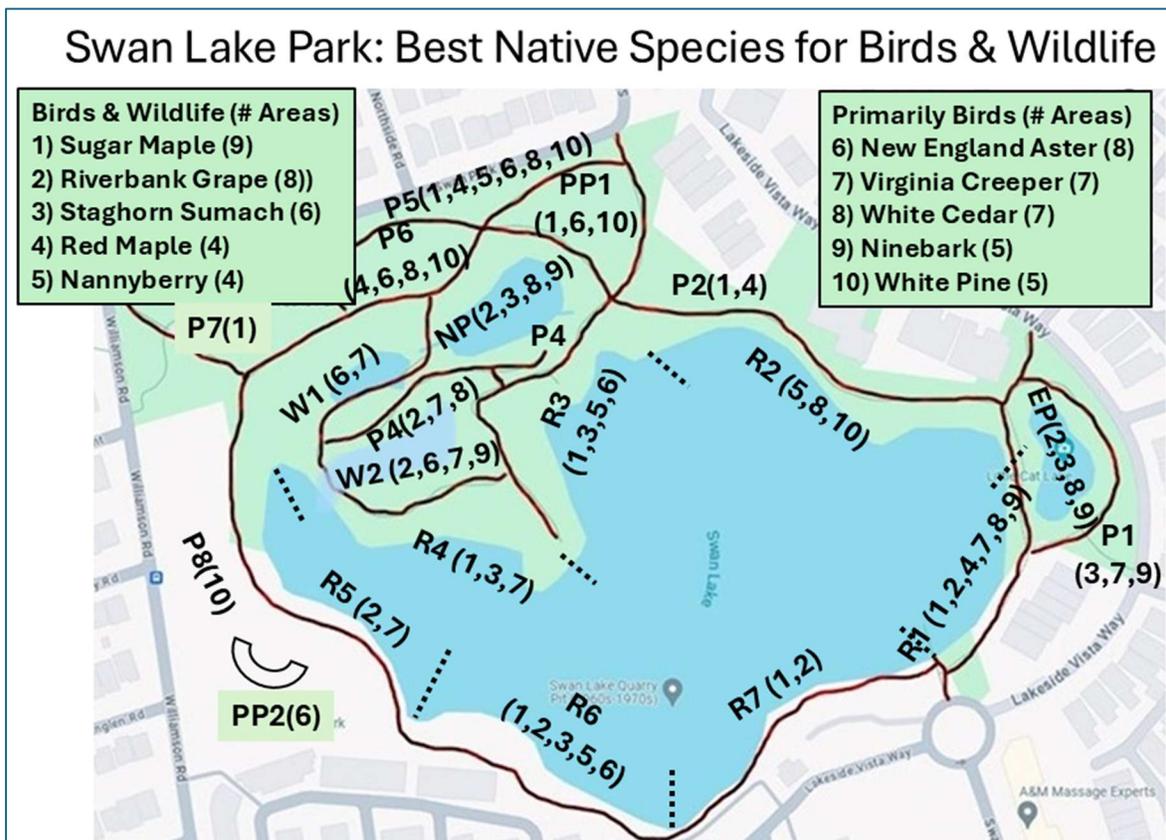


B) Species Most Beneficial to Birds and Wildlife

The Selection Guide for Water Efficient Plants²³ on the York Region website includes a summary of plants considered beneficial to birds or other wildlife. The following tables indicate how many areas they have been found within Swan Lake Park.

Species Beneficial for Birds & Wildlife	
Native Species	# Areas
Sugar Maple	9
Riverbank Grape	8
Staghorn Sumach	6
Red Maple	4
Nannyberry	4
Wild Black Raspberry	3
Wild Strawberry	2
Smooth Wild Rose	1
Ironwood	3
Wrinkled Rose	1

Species Beneficial for Birds	
Native Species	# Areas
New England Aster	8
Virginia Creeper	7
White Cedar	7
Ninebark	5
White Pine	5
White Spruce	3
Indian Grass	1
Non-native Species	
Honeysuckle Specie:	2
Scouler's Willow	2
Pear	1

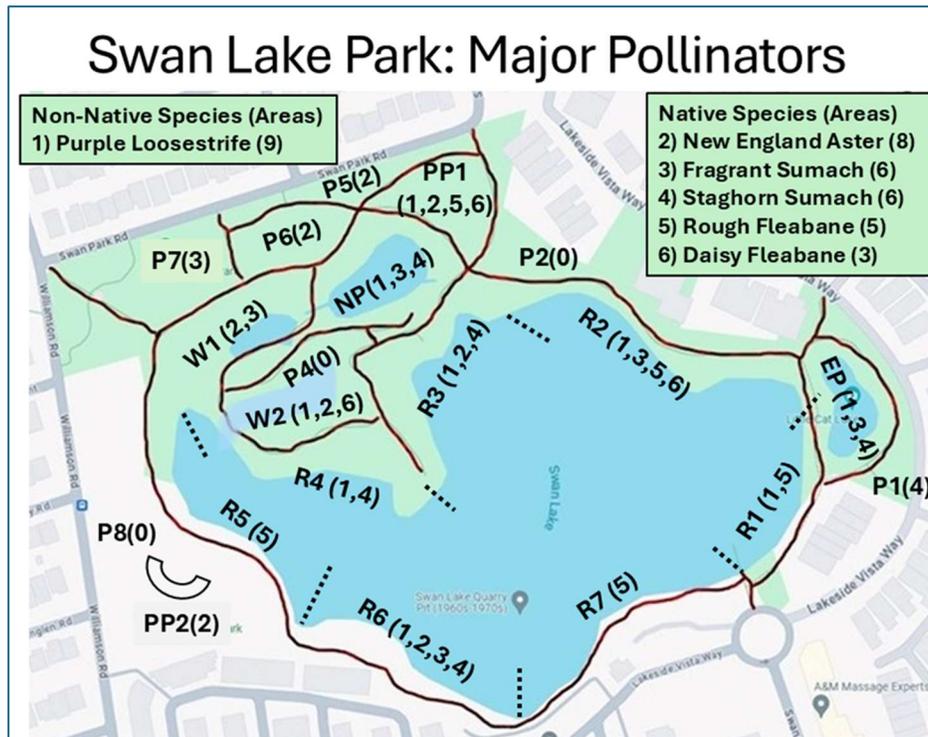


C) Species Most Beneficial for Pollinators

The York Region Selection Guide for Water Efficient Plants²⁴ also indicates which plants are considered beneficial to pollinators. The following table summarizes the major pollinator supportive plants in Swan Lake Park and whether they appeal to butterflies, bees or both. Two plants were identified as appealing to hummingbirds.

Pollinator Supportive Plants In Swan Lake Park (August 2023)			
Name	# Areas	Name	# Areas
Butterflies Only		Bees Only	
Native		NN Purple Loosestrife 9 NN Honeysuckle Species 2 NN Scouler's Willow 2 NN Black Locust 1	
N New England Aster	8	Bees and Butterflies	
N Fragrant Sumach	6	N Rough Fleabane	5
N Staghorn Sumach	6	N Daisy Fleabane	3
N Black Oak	2	N Foxglove Beard-tongue	2
N Early Goldenrod	2	N Hoary Vervain	2
N Eastern Snowberry	2	N Wild Bergamot	2
N Black Cherry	1	N Tall Fleabane	1
N Black-eyed Susan	1	Hummingbirds	
N Butterfly Milkweed	1	N Wild Bergamot	2
N Indian Grass	1	NN Wayfaring Tree	1
N Stiff Goldenrod	1		
N Wrinkled Rose	1		
Non Native			
NN Claspig Mullein	1		
NN Dense-flowered Mullein	1		
NN Pear	1		

The shoreline and wetland areas supported most of the pollinator plants as indicated in the following map.



D) Supporting Monarch Butterflies

The Monarch Butterfly is rated as a Species at Risk under the Federal Species at Risk Act and organizations such as the David Suzuki Foundation have encouraged efforts to support the Monarch. Several years ago some area residents, in association with the David Suzuki Foundation, planted a variety of pollinator plants in a canoe near the dock area in Swan Lake Park.



Markham, added pollinator plants to the grassland area in the northeastern section of the park in 2021 (PP1) and, supported by the Markham Lions and Friends of Swan Lake Park, created a pollinator garden 2022 in the new parkland area along Williamson Road (PP2).

Monarchs are threatened by a number of factors such as pesticides and the deforestation of their winter resting places in Mexico. Locally, there is a significant threat in the rise of the dog-strangling vine, an aggressive invasive plant in the same family as milkweed, the primary plant that sustains monarchs. Monarchs lay their eggs on both milkweed and dog-strangling vine; however, since the larva can eat only from milkweed plants, the eggs laid on the dog-strangling vine do not survive.

In a blog dated September 27, 2024, Erica Browne Grivas outlined the “Top 10 Types of Milkweed to Support Monarch Butterflies”. Fortunately the four species in Swan Lake Park are on that list.

Swan Lake Park is also home to both species of dog-strangling vine. Some efforts have been made to curtail dog-strangling vine along the pathways but it remains one of the most pervasive plants in the park. The Markham Invasive Management Plan categorizes Dog-strangling vine as a Tier 1 species, one of its top priorities.

The following extract from the Ontario Invasive Species Awareness website provides greater detail on the species:

The name “Dog-strangling Vine” refers to two invasive plants native to Eurasia– black swallowwort and pale swallowwort. These look-alike members of the milkweed family were introduced to the northeastern United States in the mid-1800s for use in gardens. In recent years these perennial vines have spread rapidly throughout central and southern Ontario. Because they are so similar, both species have the same common name.

Dog-strangling Vine prefers open sunny areas but can grow well in light shade. It grows aggressively up to two metres high by wrapping itself around trees and other plants or trailing along the ground. Dense patches of the vine can “strangle” plants and small trees.

The plant can produce up to 28,000 seeds per square metre. The seeds are easily spread by the wind, and new plants can grow from root fragments, making it difficult to destroy. The vine has invaded ravines, hillsides, fence lines, stream banks, roadsides and utility corridors.

Impacts of Dog-Strangling Vine

- *Dog-strangling Vine forms dense stands that overwhelm and crowd out native plants and young trees, preventing forest regeneration.*
- *Colonies form mats of interwoven vines that are difficult to walk through and interfere with forest management and recreational activities.*
- *Leaves and roots may be toxic to livestock. Deer and other browsing animals also avoid dog-strangling vine, which can increase grazing pressure on more palatable native plants.*
- *The vine threatens the monarch butterfly, a species at risk in Ontario. The butterflies lay their eggs on the plant, but the larvae are unable to complete their life cycle and do not survive.*

Milkweed & Dog-strangling Vine in Swan Lake Park

Common Name	Scientific Name	Class	# Areas
Milkweed Species			
Common Milkweed	<i>Asclepias syriaca</i>	Apocynaceae	8
Swamp Milkweed	<i>Asclepias incarnata</i>	Apocynaceae	4
Purple Milkweed	<i>Asclepias purpurascens</i>	Apocynaceae	2
Butterfly Milkweed	<i>Asclepias tuberosa interior</i>	Apocynaceae	1
Dog-strangling Vine			
Pale Swallow-Wort	<i>Vincetoxicum rossicum</i>	Apocynaceae	7
Black Swallow-Wort	<i>Vincetoxicum nigrum</i>	Apocynaceae	4

The following section provides more information on the management of Dog-Strangling Vine.



E) Invasive Species

The Government of Canada defines invasive species as plants, animals, and micro-organisms that are found outside of their natural range, and whose presence poses a threat to environmental health, the economy, or society.

The following section is extracted from the Invasive Plant Species Management Plan, Natural Heritage Management Study, Markham, May 2024¹⁷

The City of Markham (the City) retained CBCL Limited (CBCL) in July of 2022 to undertake a natural heritage management study to support stewardship and enhancement of City owned natural areas in the Greenway System. The City of Markham's 2014 Official Plan designates approximately 7,000 ha. of lands as the City's Greenway System and establishes policies to maintain and enhance this interconnected network of natural areas. More than half of the Greenway System is owned and managed by public agencies: approximately 1,000 ha. are owned by the city and another 3,200 ha. by Parks Canada (i.e., Rouge National Urban Park).

During field work carried out by CBCL in 2022, invasive plant species were the most frequently observed type of management concern in City-owned natural areas. Invasive species are a major threat to ecosystems and introductions of invasive species to Ontario are predicted to become more frequent in an increasingly globalized world (Nienhuis and Wilson 2018). Invasive species

have a variety of impacts on ecosystems and are one of the leading threats to biodiversity worldwide (McNeely et al. 2001). Invasive plant species may compete with native species for water, light, nutrients, and physical space (Duenas et al. 2018; Reaser et al. 2020). In the worst cases, invasive species can cause extirpation of native species and completely dominate habitats where they occur.

This report provides an invasive Plant Species Management Plan (IPSMP) with information on key invasive plants in Markham, past and ongoing management efforts, and direction on the prioritization and implementation of invasive species management projects in City-owned natural areas. The scope of the IPSMP is limited to plants and does not include other invasive pests such as insects.

Invasive plant species are common in Markham's natural areas. A least 41 invasive species are considered to pose a risk to natural areas in Markham.

Invasive species pose the second greatest threat to biodiversity after habitat loss (Erllich, 1998; Wilson, 1992). Invasive plant species can displace native species in a community, negatively impacting ecosystem function and services, and are a growing threat to human health and the economy. Many invasive plants have the ability to spread rapidly and aggressively, leading to a decline in ecological health and recreational enjoyment. The following are some of the significant impacts on natural ecosystems in urbanized environments:

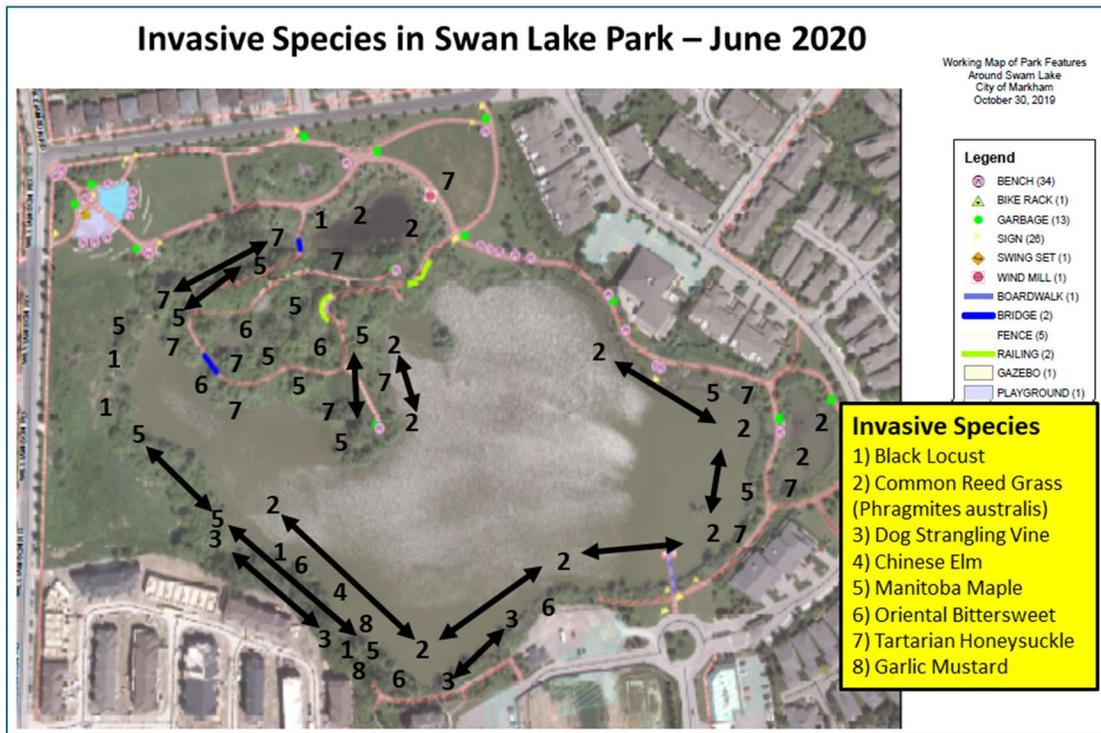
Biodiversity loss, habitat degradation, and disruption of ecological and hydrological processes – *Invasive plants can outcompete native plants for resources such as water, light and nutrients, leading to a decline in native plant populations. As native plants decline, the habitat structure and composition of ecosystems are altered. The degradation of ecosystems can impact native animals by reducing nesting sites and foraging opportunities or disrupt natural ecological and hydrological processes such as dispersal, pollination, water quality and nutrient cycling.*

Human health, safety, and recreational enjoyment – *Some invasive plant species pose risks to human health causing severe skin irritations or injuries, impacting the enjoyment of outdoor activities. Certain invasive plant species can limit visibility in rights-of-way increasing the risk of vehicle accidents or they can intensify fire risk by increasing fuel loads or altering fire regimes. Other invasive plants can reduce the aesthetic value or accessibility of recreational land and waterbodies.*

Economic impacts – *Invasive plant species can have significant economic consequences including the costs of control and management, such as surveys, eradication programs, and public awareness campaigns. In addition, costs can be incurred due to damaged infrastructures, reduction in property values, and negative effects on agriculture and landscaping industries.*

In June 2020, volunteers with the Friends of Swan Lake Park undertook a field survey to identify invasive plant species in Swan Lake Park. Markham staff have used this summary to address certain areas,

specifically Dog-strangling Vine along the southern pathways and in 2023 TRCA was engaged to remove Phragmites along the eastern shoreline and the North Pond.



In May 2024, Markham Council approved the Invasive Species Management Guide which identified 41 invasive species of concern in Markham. From a management perspective, the 6 species that were currently being addressed by Markham’s park staff were rated as Tier 1 while the 14 species that the report recommend as the next highest priority were rated Tier 2. It was recommended that the other 21 species rated as Tier 3 should be addressed when resources permit.

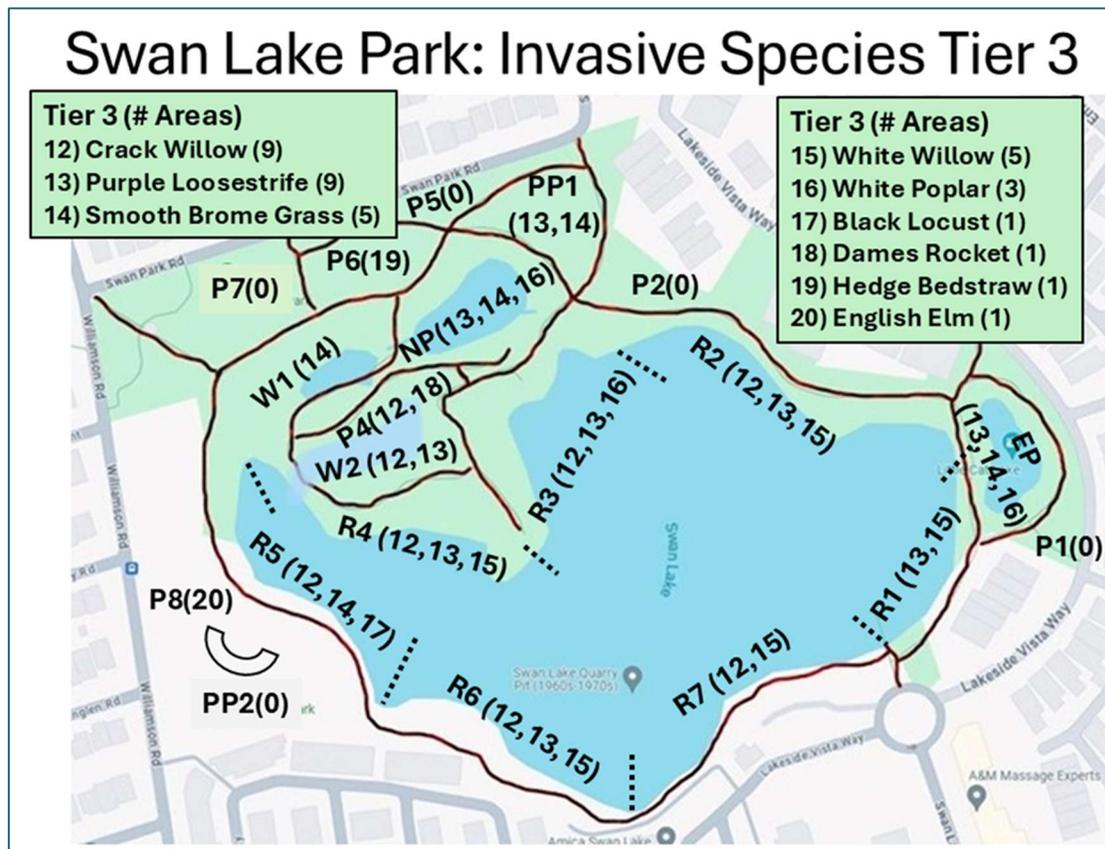
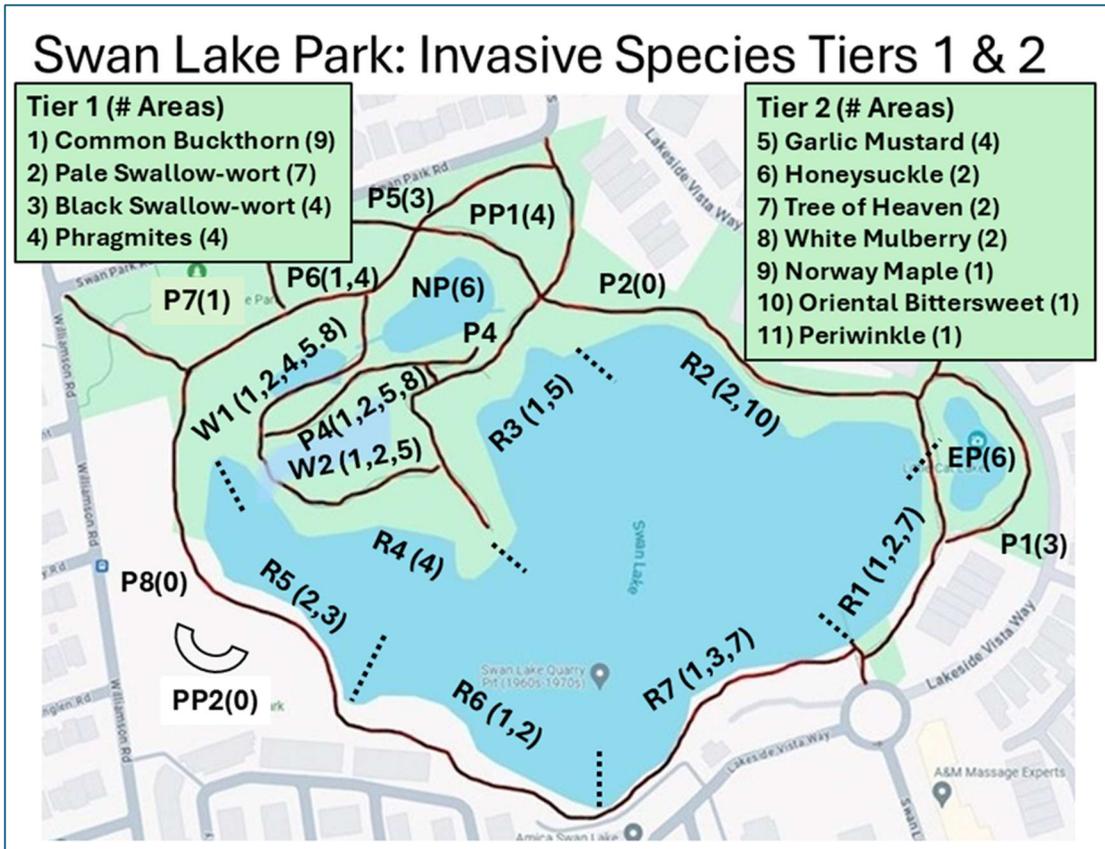
In March 2025, the Friends of Swan Lake Park and leading researchers from York University launched the Swan Lake Citizen Science Lab. The Citizen Science Lab is a pilot program that will involve environmental monitoring of both water quality and invasive plant species using four advanced technologies, Drone Monitoring, Artificial Intelligence, Virtual Reality and Simulation.

The advanced drone measurements will provide key metrics for a comprehensive assessment of the water quality in Swan Lake throughout the year.

Drone imagery will try to map the 19 invasive plant species found in Swan Lake Park that Markham identified to be of concern in its 2024 Invasive Species Management Plan.

The Citizen Science Lab incorporates four of the strategies outlined in Section 2.3 of Markham’s Invasive Species Management Plan:

- i. Encouragement and use of community data
- ii. Collaboration with local experts
- iii. Use of remote sensing imagery
- iv. Fostering partnerships with educational institutions and others



F) Management of TIER 1 Invasive Plant Species

The Invasive Species Management Plan¹⁷ included the following summary on the issues and treatment for the three Tier 1 Invasive species found in Swan Lake Park.

Common Buckthorn (Found in 9 areas in Swan Lake Park)

Most prevalent in woodlands and early successional communities in the Markham Greenway System, Common Buckthorn is a deciduous shrub or small tree that can form dense thickets that rapidly outcompete native vegetation. Common Buckthorn reproduces through both seed and vegetative propagation and can disperse widely as the berries are consumed and dispersed by birds.

By forming dense thickets that shade out and suppress native plant species, Common Buckthorn reduces biodiversity and alters native plant communities by suppressing understory plant growth, changing soil nutrient composition, and interrupting successional processes. Buckthorn thickets provide poor habitat for native wildlife and negatively affect the availability of food and nesting sites for birds. Buckthorn can also have negative impacts on recreational values where it is established.

A typical treatment option for Common Buckthorn is through mechanical control measures. Mechanical management is achieved by pulling or cutting the shrubs (with efforts focused on removing female plants). It is recommended to pull plants in the fall when they are readily identifiable and when disturbance to the dormant native vegetation is minimized, but care must be taken to contain branches containing berries.

Resprouting can be a problem after mechanical treatments and control measures are often combined with controlled burns and chemical control. Chemical control may be an effective option for treating larger infestations, especially those that threaten forestry or agriculture. Repeated burning may be effective where feasible. Flooding and re-establishment of water levels is another method that may help to control buckthorn. Federal, provincial, or conservation authority permits or approvals may be required to use this control method.

Regular follow-up monitoring is suggested to identify and address any new growth or seedlings. New sprouts and seedlings should be promptly removed to prevent further spread and re-infestation. Mowing can be used to reduce vigour of smaller stems and kill seedlings. A typical timeline for treatment of buckthorn is two to six years or more; however, a recent study found that treatment of buckthorn may be needed for only one to two years (Schuster, et. al, 2023). Re-planting with native vegetation following treatment is recommended once buckthorn is eradicated or under control.

Dog-strangling Vine - 2 species (Found in 11 areas in Swan Lake Park)

*A common invasive plant of early successional communities in the City, Dog-strangling Vine is a perennial, herbaceous vine that forms extensive stands with the ability to exclude all other species from a site. It is especially problematic for wildlife (particularly grassland birds) due to its habitat-altering capability which reduces capacity to provide food resources for native insects, including the Monarch butterfly (*Danaus plexippus*). Dog-strangling Vine can also severely inhibit recreational*

activities where it is established, due to the difficulty of travel through the dense tangled mats that it forms.

Infestations of Dog-Strangling Vine can be managed by digging out the plants, ensuring that all root fragments are removed to prevent re-sprouting. This method is most effective when applied before seed production. Other mechanical methods of control include clipping and tarping when eradication may not be possible. Seed pod removal can be used in the case of a late season discovery to reduce seed dispersal when other control methods are not an option.

Chemical control of Dog-Strangling Vine by licensed exterminators using herbicides is typically applied during the plant's active growth phase. Reapplication of herbicides is needed for several years to target seedling growth.

In Ontario, there has been notable progress in the biological control of this weed by introducing *Hypena opulenta*, a leaf-feeding caterpillar (Anderson, 2012). This type of control is best suited to large sites with a high density of plant cover; however, the most effective approach often involves integrated strategies that combine control methods.

Prioritization of efforts should be made where the population of plants is small or newly detected and eradication is possible. Site restoration is needed during and after control activities to reduce the risk of re-invasion.

Phragmites/ European Reed (Found in 4 areas in Swan Lake Park)

A common invasive plant, Phragmites/European Reed is a tall, perennial grass species that is widespread in Ontario. It has a fibrous root system and can spread through underground rhizomes outcompeting native plants and forming dense monocultures. Phragmites typically grow in dense stands that can reach heights of more than 5 metres, blocking shoreline views and access. Major highways and secondary roads are commonly a vector of spread of this species. A native species of Phragmites is also found in Ontario and does not have the same negative impacts on habitat and biodiversity. Native Phragmites should be distinguished from invasive Phragmites before considering management actions. Native Phragmites grow in sparser stands mixed with other plants, in contrast to the near monoculture stands of invasive Phragmites. Morphologically, native Phragmites can be distinguished from invasive Phragmites by the ligule width, stem colour, leaf retention and smaller, sparser seedheads.

Monotypic stands of Phragmites can significantly alter wetland habitats and have several negative ecological impacts such as reduced biodiversity (including significant impacts hydrology and nutrient cycling). In addition, Phragmites can create human health or safety hazards such as increased fire hazard due to dead stems and reduced visibility along roadways (Nichols, 2020).

Managing Phragmites infestations requires a combination of control methods, and the choice of treatment depends on the extent of the invasion and the specific site conditions. Treatment options typically include mechanical and chemical control methods. Cutting stems can help reduce their density and prevent seed production.

This method is best employed repeatedly during the growing season and performed for several years to weaken the plant. However, TRCA does not recommend cutting as a treatment option for Phragmites as it can invigorate growth and increased density. Herbicides can be used to target stands during their active growth phase. Herbicides are typically applied by licensed professionals and should follow environmental regulations to minimize non-target impacts. Other control techniques include mulching and prescribed burning and, where possible on wet sites, flooding can be an effective management tool.

Re-vegetation with native plant species, including grasses and forbs, is being used to resist the invasion of Phragmites in Ontario (Nichols, 2020). Research has identified competitive native plants, and initiatives are successfully converting landscapes, such as highway verges, into tall prairie grasslands, effectively inhibiting the plant's spread. Re-vegetation not only prevents its return but also protects soil and complements restoration efforts.

G) Other Invasive Species

Natural areas such as Swan Lake Park provide shelter and food for wildlife, remove pollutants from air and water, produce oxygen through photosynthesis and provide valuable recreational and educational opportunities. Invasive species can threaten these important services.

Invasive species generally are non-native plant, animal or pest species that outcompete native species for resources and dominate space.

The following invasive species have been reported in Swan Lake Park by local residents. The invasive fish species are listed as invasive under either the Ontario Invading Species Awareness Program ("OISAP") or by the Toronto and Region Conservation Authority ("TRCA"). Information on invasive insects is from the Ministry of Agriculture.

Invasive Fish		
<ul style="list-style-type: none"> • Goldfish (<i>Carassius auratus</i>) 	OISAP	Goldfish are quite tolerant of poor water quality, including water with low levels of dissolved oxygen and may threaten some native species in degraded ecosystems. Goldfish eat snails, small insects and young fish, making this species a competitor with, and predator of, native fish. They stir up mud and other matter when they feed, which increases the cloudiness of the water and affects the growth of aquatic plants.
Invasive Insects		
<ul style="list-style-type: none"> • Japanese Beetles (<i>Popillia japonica</i>) 		Adult beetles skeletonize foliage. While adults do not damage turf, they do feed on foliage and fruit of about 300 species of plants. Larval feeding on the fibrous roots of grasses makes this stage a destructive pest for turf. Injured turf initially wilts and yellows during August and September. Eventually, dead patches of turf can be observed.

<ul style="list-style-type: none"> • Yellow-headed Spruce Sawfly (<i>Pikonema alaskensis</i> (Rohwer)) 	<p>Larvae emerge in early spring and begin feeding on the succulent needles. Larvae initially feed on the new needles, leaving only short brown stubs. Once the new growth is devoured, the larvae move back on the branch and feed on the older needles. By July, infested trees appear ragged and yellowish-brown especially near the tops. Heavily infested trees may be completely stripped of foliage. Three to four consecutive years of moderate to heavy attacks can kill the tree.</p>
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H) Noxious Weeds

In Ontario, a noxious weed is a plant that has been listed in the Schedule of Noxious Weeds found in [Regulation 1096](#) made under the *Weed Control Act*. This list is commonly referred to as the "noxious weed list."¹⁹

In general, a species designated as a noxious weed under the *Weed Control Act* is one that:

- is difficult to manage on agricultural land once established and will reduce the yield and quality of the crop being grown
- negatively affects the health and well-being of livestock
- poses a risk to the health and well-being of agricultural workers

The intent of the [Weed Control Act](#) is to reduce:

- the infestation of noxious weeds that negatively impact agriculture and horticulture lands
- plant diseases by eliminating plant disease hosts such as common barberry and European buckthorn
- health hazards to livestock and agricultural workers caused by poisonous plants

Of the 25 weeds designated as noxious under the Weed Control Act, 11 species were found in Swan Lake Park.

