

Sam Slick Park

Shoreline Restoration Plan

2015

Final Draft Report



Prepared for:



Coalition of Haliburton Property Owners Association

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OVERVIEW

The Coalition of Haliburton Property Owners Association (COHOA) is seeking to provide their members with a shoreline restoration demonstration site to better inform the membership about Best Management Practices (BMPs). To this end COHOA approached the Municipality of Dysart et al and proposed utilizing an area, near the Village of Haliburton and along the shoreline of Head Lake, as a demonstration site. The selected site, known as Sam Slick Park, is currently owned by the Municipality and the Municipality agreed to the proposal.

Sam Slick Park is located on the southern shore of Head Lake. The Park is accessed via County Road 21 and is identified as the following:

Part Lot 14, Concession 8
Geographic Township of Dysart
Municipality of Dysart et al
County of Haliburton

Glenside Ecological Services Limited was retained to develop a Shoreline Restoration Plan for Sam Slick Park with the following tasks and deliverables:

- ⇒ Background review and consultation with the Ontario Ministry of Natural Resources and Forestry;
- ⇒ Site assessment including floral inventory, shoreline compartmentalization and mitigation analysis;
- ⇒ Recommended mitigation techniques;
- ⇒ Identification of educational opportunities;
- ⇒ Costing and permitting recommendations; and
- ⇒ Final report with maps

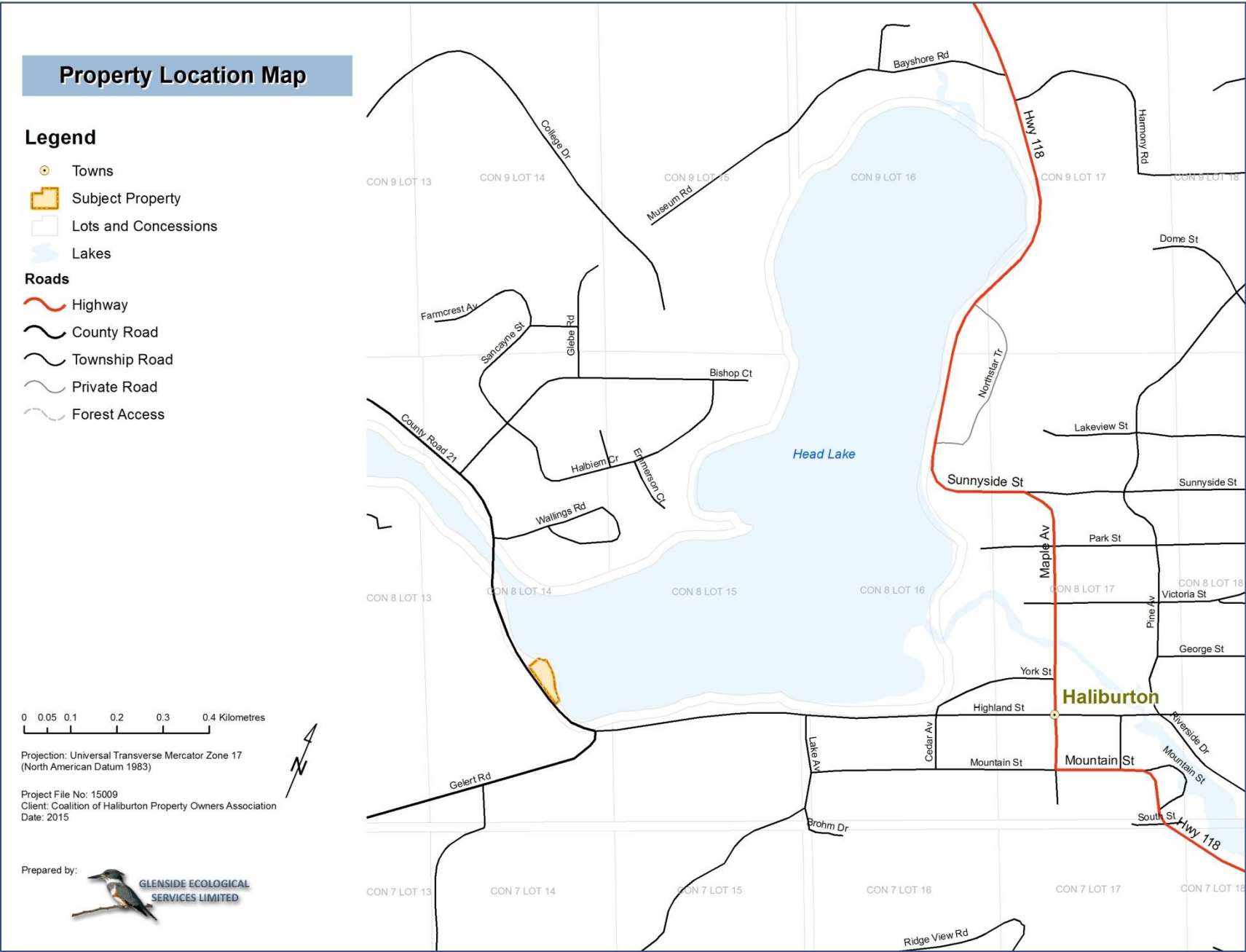
Although it is the intent of Glenside Ecological Services Limited to provide accurate and relevant information, the success of the recommended shoreline restoration activities cannot be guaranteed. Any and all restoration activities are done at the risk of the landowner and require consent/approval from the proper authorities prior to any undertaking.

ACKNOWLEDGEMENTS

Paul C. Heaven was the principal investigator and author of the final report. Glenside Associate Peter McElwain, assisted in site investigations, mitigation design, and costing.



Figure 1: Property location map



SAM SLICK PARK

Sam Slick Park is a 0.27 ha park fronting onto Head Lake with approximately 110m of shoreline. The property is maintained as an open area for public use through regular lawn maintenance (See Photograph 1 and Photograph 2). Originating from south of County Road 21, a stream bisects the property and flows northerly into Head Lake. A walking bridge has been constructed over the stream to facilitate access from one side of the park to the other (See Photograph 3). The community and municipality have expressed interest in replacing the bridge. However, the bridge appears to be utilized by pedestrians and sleds and how this use is to be balanced requires a comprehensive review of the historical trends, objectives and implications of change. For example, tailoring the bridge to pedestrians only may increase the risk of collisions with traffic on County Road 21, yet it seems reasonable to assume that a dual purpose bridge also has associated risks. Bridge design, strength and safety are beyond the scope of this project.

Other features consist of a monument (See Photograph 4) on the east side of the stream and a metal sitting bench on the west side.

Photograph 1: Park west of stream



Photograph 2: Park east of stream



Photograph 3: Wooden walking bridge over the stream



Photograph 4: Sam Slick Park monument on east side of stream



Figure 2: Detailed property map



HEAD LAKE AND FISH HABITAT

Head Lake is a relatively small and shallow lake with a surface area of 0.62km², a mean depth of 2.56m and maximum depth of 5.64m (See Figure 3). With these characteristics Head Lake is considered a warm water lake with no thermal stratification and a maximum temperature of 25°C recorded in early June (Ministry of the Environment, 1984).

Head Lake has three inflows consisting of the Drag River and two unnamed creeks. The Drag River exits the lake immediately to the west of Sam Slick Park (Ministry of the Environment, 1984).

The fish community is typical of that for a warm water lake and is defined in Table 1 (Flowers, 2015). Some colder water species such as Lake Herring and White Fish have been known to migrate up from Kashagawigamog Lake but are not considered to be part of the local fish community.

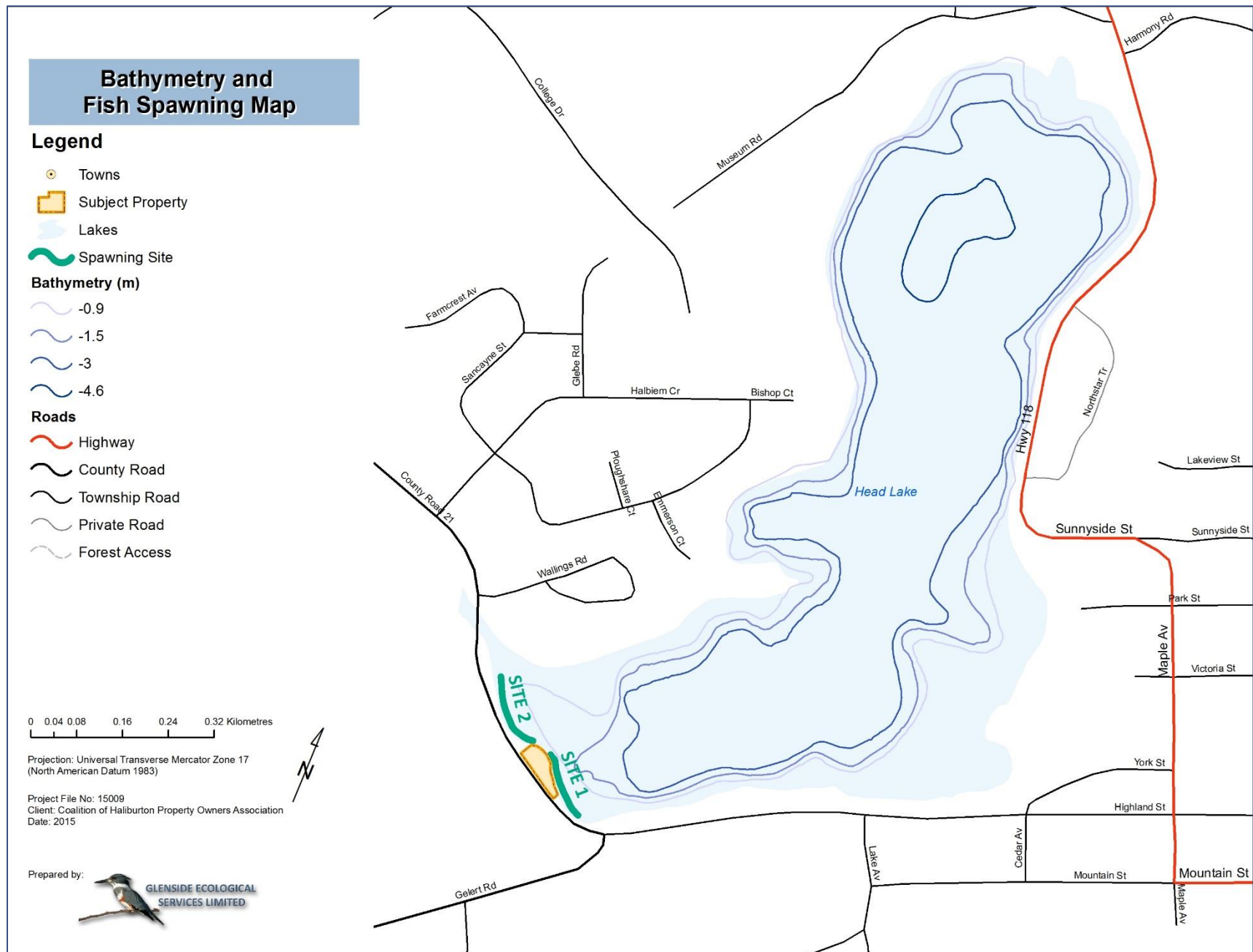
Table 1: Fish community in Head Lake

Scientific Name	Common Name	MNR Status	S_RANK
<i>Ambloplites rupestris</i>	Rock Bass		S5
<i>Ameiurus nebulosus</i>	Brown Bullhead		S5
<i>Catostomus commersoni</i>	White Sucker		S5
<i>Couesius plumbeus</i>	Lake Chub		S5
<i>Esox masquinongy</i>	Muskellunge		S4
<i>Lepomis gibbosus</i>	Pumpkinseed		S5
<i>Micropterus dolomieu</i>	Smallmouth Bass		S5
<i>Micropterus salmoides</i>	Largemouth Bass		S5
<i>Notropis hudsonius</i>	Spottail Shiner		S5
<i>Perca flavescens</i>	Yellow Perch		S5
<i>Pimephales notatus</i>	Bluntnose Minnow	NAR	S5
<i>Pomoxis nigromaculatus</i>	Black Crappie		S4
<i>Sander vitreus vitreus</i>	Walleye		S5
<i>Percidae</i>	Darter sp.		
<i>Centrarchidae</i>	Sunfish sp.		
<i>Gasterosteidae</i>	Stickleback sp.		

Two confirmed Largemouth Bass spawning sites have been identified immediately fronting the subject property and are delineated in Figure 3. Due to the extensive submerged, floating and emergent vegetation, this area is also considered to be a critical feeding and refuge area for juvenile fishes (Flowers, 2015).



Figure 3: Bathymetry and fish spawning map



SAM SLICK PARK SITE GENERAL INVENTORY

VEGETATION

UPLAND VEGETATION

A vegetated buffer has been retained adjacent to the stream (See Photograph 5) and along the shoreline of Head Lake (See Photograph 6). The buffer is of varying widths and structure consisting of a compilation of the following components:

TREES AND SHRUBS

A variety of trees can be found scattered along the shoreline of Sam Slick Park and consist of red maple (*Acer rubrum*), white elm (*Ulmus americana*), white birch (*Betula papyrifera*), green ash (*Fraxinus pensylvanica*), larch (*Larix decidua*) and white spruce (*Picea glauca*). The single white spruce is in a state of decline and there is evidence of two other trees that were recently removed west of the stream.

A wide diversity of shrub species can be found on site and include speckled alder (*Alnus incana*), highbush cranberry, virginia creeper (*Parthenocissus quinquefolia*), small bristleberry (*Rubus setosus*), willow (*Salix sp.*) and sweet bayberry (*Myrica gale*).

HERBACEOUS PLANTS, GRASSES AND SEDGES

The herbaceous plant, grass and sedge community along the shoreline and streambanks is also very rich. Common upland species include common yarrow (*Achillea millefolium*), common milkweed (*Asclepias syriaca*), goldenrod (*Solidago sp.*), wild strawberry (*Frageria virginiana*), Canada St. John's-wort (*Hypericum canadense*) and plantain (*Plantago sp.*). Lower on the banks are more hydrophilic plants such as spotted jewelweed (*Impatiens capensis*), spotted joe-pye weed (*Eutrochium maculatum*), northern water-horehound (*Lycopus uniflorus*), hooded skullcap (*Scutellaria galericulata*), Fraser's St. John's-wort (*Triadenum fraseri*), sensitive fern (*Onoclea sensibilis*) and sedges (*Carex sp.*)



Photograph 5: Stream with vegetated buffer



Photograph 6: Vegetated buffer along shoreline



AQUATIC VEGETATION

Aquatic vegetation provides valuable fish habitat and can help protect the shoreline from erosion caused by wave action. Emergent plant species, particularly robust emergents, provide the greatest protection whereas submergents and floating plants have less of an effect. Glenside Ecological Services Limited assessed the presence of aquatic plants in 10m intervals beginning at the northwest edge of the Park (See Table 2 and Photograph 7).

The aquatic vegetation fronting the Park was assessed out to the limit of the floating vegetation, estimated at 30m. Within this area, floating vegetation was quite prominent in the north-west with up to 70% coverage but decreased dramatically to the southeast. Common species consisted of variegated pond lily (*Nuphar variegata*), fragrant water lily (*Nymphaea odorata*), watershield (*Brasenia schreberi*) and pondweed (*Potamogeton sp.*).

Emergent vegetation was limited to small patches or thin bands along the shoreline and never exceeded 5% coverage. Broad-leaved and narrow-leaved cattail (*Typha latifolia* and *Typha angustifolia*), broad-fruited burreed (*Sparganium eurycarpum*), pickerelweed (*Pontederia cordata*) and sedges were all noted in this component.

Submergent vegetation was common throughout the area and consisted primarily of broad waterweed (*Elodea canadensis*), greater bladderwort (*Utricularia vulgaris*) and pondweed (*Potamogeton sp.*).



Table 2: Aquatic vegetation coverage

Sample Point	Floating Plants	Emergent Plants	Submergent Plants
0 - 10m	30%	<5%	100%
10 - 20m	10%	0%	80%
20 - 30m	25%	0%	100%
30 - 40m	50%	5%	100%
40 - 50m	70%	5%	100%
50 - 60m	10%	<5%	50%
60 - 70m	10%	<5%	100%
70 - 80m	5%	0%	80%
80 - 90m	0%	0%	100%
90 - 100m	0%	0%	100%
100 - 110m	5%	0%	80%

Photograph 7: Floating and emergent aquatic plants in Head Lake



SUBSTRATE

The substrate was sampled throughout the littoral zone of the park. The substrate consisted primarily of a 20 cm deep gravelly sand substrate over a silt deposit. On the north side of the stream outflow (approximately 40 m from the north-western edge of the Park) a 10-15cm deep organic component was found on top of the gravelly sand.

STRUCTURAL FISH HABITAT

Structural fish habitat in the form of logs, stumps and boulders in the littoral zone fronting Sam Slick Park, are limited to a few scattered occurrences (See Photograph 8)



Photograph 8: Partially submerged log



NEAR SHORE SLOPE

When assessing shoreline restoration, near shore slopes help determine the feasibility of shoreline restoration techniques. Shoreline stabilization through planting and/or hard and soft armour on steeper slopes with soft substrates can be more challenging than those with gentler slopes.

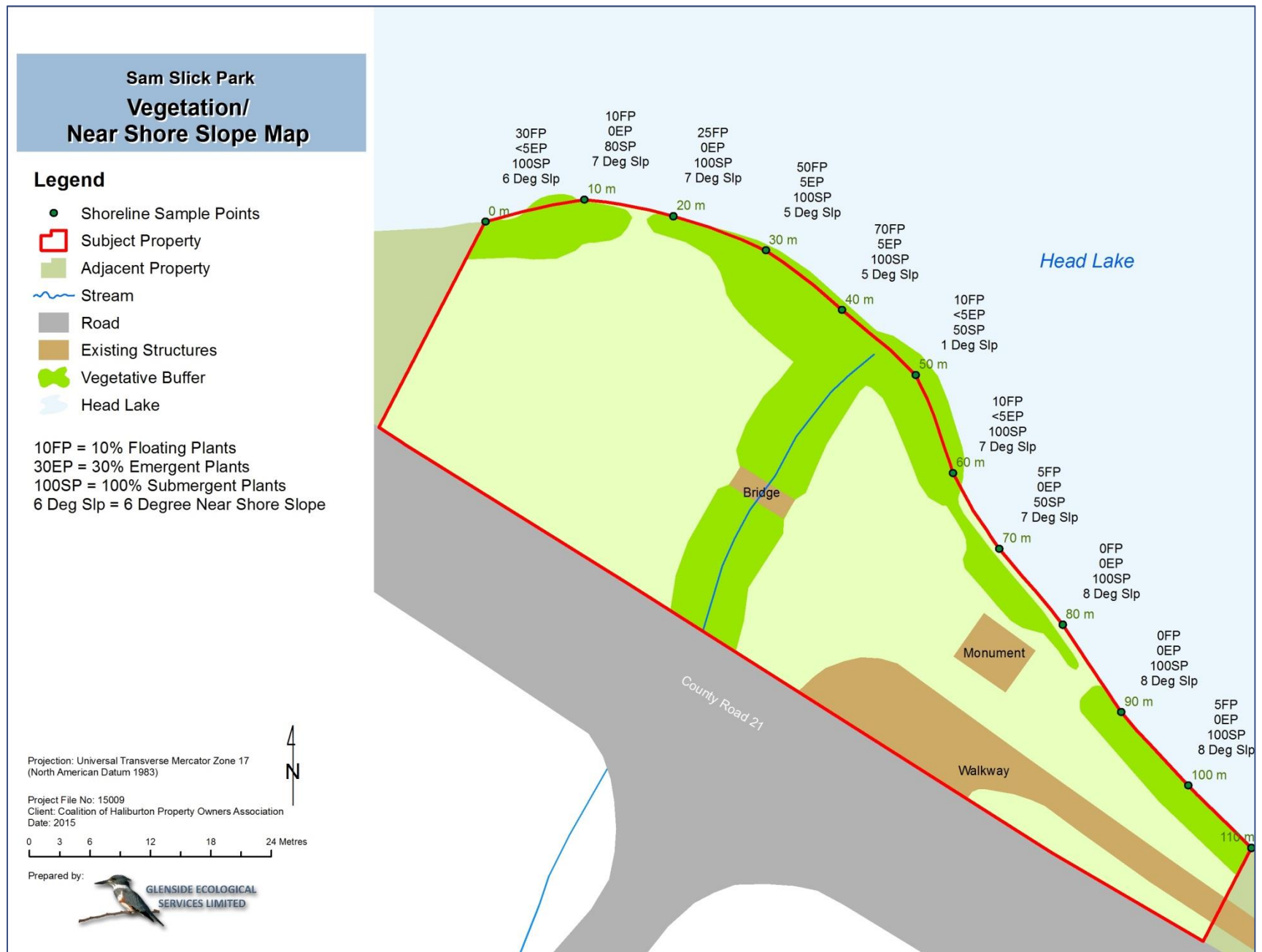
Beginning at the north-western edge Glenside Ecological Services Limited calculated the slope at 10 m intervals across the water frontage of Sam Slick Park. Overall the nearshore slopes would be considered gentle, ranging from 1° to 8° with an average slope of 6° (See Table 3). The gentlest nearshore slope was located at the 50m mark which is found immediately adjacent to the outflow of the stream and therefore likely attributed to deposition of sediment originating from the stream itself.

Table 3: Nearshore slopes

Sample Point (m)	Dist. to shore (m)	Depth (m)	Slope (Degrees)
0	3	0.34	6
10	3	0.37	7
20	3	0.37	7
30	3	0.26	5
40	3	0.26	5
50	3	0.06	1
60	3	0.35	7
70	3	0.36	7
80	3	0.43	8
90	3	0.44	8
100	3	0.42	8
110	3	0.43	8
Average			6



Figure 4: Vegetation and near shore slope map



SAM SLICK PARK SHORELINE MITIGATION ASSESSMENT

Although the shoreline of Sam Slick Park has a relatively natural vegetative buffer consisting of both upland and aquatic species, the health of this buffer has been compromised in some areas through a reduction in width, introduction of invasive plant species and/or shoreline erosion through high use or wave action. As a result of these impacts geese activity is high in some areas, further resulting in excessive geese excrement throughout the park, and traffic concerns. For the purposes of assessing shoreline health and recommending mitigation, the shoreline of Sam Slick Park was compartmentalized into zones based on similar features or proposed use. This process identified 13 zones along the shoreline of the Park as well as a stream buffer zone and an open area zone (See Figure 8).

For the purposes of mitigation and cost estimates the zones were grouped based on similar profiles. The following provides group profiles as well as recommended mitigation techniques, educational opportunities and cost estimates.

ZONES 1, 3, 7 AND 8

PROFILE

Zones 1, 3, 7 and 8 represent the healthier zones along the shoreline of Sam Slick Park. In these zones the upland vegetation buffer widths range from 2.30 m to 6.20 m with additional overhanging shrubbery ranging from 0.55 m to 2.80 m (See Table 4, Photograph 9 and Photograph 10). Submerged, floating and emergent aquatic vegetation can be found throughout much of the shallow waters fronting these zones. Bank profiles are moderate with a maximum height of 0.70 m and maximum slope of 35° (See Table 5) The combined length of Zones 1, 3, 7 and 8 is 41.2 m.

Table 4: Zone 1, 3, 7 and 8 descriptions

Zone	Location (m)	Upland Veg. Buff. (m)	Veg. Overhang (m)	Length (m)
1	0-1.2	3.80	0.55	1.2
3	4.0-9.0	4.10	2.20	5.0
7	27.0-45.5	6.20	1.70	18.5
8	45.5-62.0	2.30	2.80	16.5
Total length (m)				41.2

Table 5: Zone 1, 3, 7 and 8 profiles

Zone	Rise (A)	Run (B)	Degrees
1	0.55	1.20	25
3	0.35	0.50	35
7	0.55	1.00	29
8	0.70	1.80	21



Photograph 9: Floral structure of shoreline in Zone 3



Photograph 10: Floral structure of shoreline in Zone 8



RECOMMENDED MITIGATION

INVASIVE PLANT MANAGEMENT

A single shrub of an exotic honeysuckle (*Lonicera sp.*) is located on the northwest end of Zone 7 (See Figure 8, Table 6 and Photograph 11). Exotic honeysuckles can rapidly invade areas, thereby outcompeting native plant species. This in turn can affect the light and nutrient availability to neighbouring plants. Further their flowers attract more pollinators thereby reducing the amount of seeds produced by native species; and the exotic honeysuckles produce toxic chemicals that prevent other plants from growing in the area. In regard to the wildlife impact of these species, the fruit of exotic honeysuckles offer fewer nutrients than native species. This deficiency can be detrimental to birds that rely on this food source during migration (Ontario Federation of Anglers and Hunters/ Ontario Ministry of Natural Resources and Forestry, n.d.).

Currently the distribution of the exotic honeysuckle is extremely limited, consisting of one shrub in one location and therefore Glenside Ecological Services Limited recommends hand removing the shrub prior to seed dispersal in late summer/early autumn. The area should be inspected yearly to ensure that new shrubs are not emerging. Any newly established exotic honeysuckle shrubs should be removed immediately.

It is imperative that any invasive plant material removed is disposed of in a proper manner as negligence can result in the proliferation of exotic honeysuckles in new areas. It is recommended that exotic honeysuckles are not composted but rather discarded with the regular garbage (Ontario Federation of Anglers and Hunters/ Ontario Ministry of Natural Resources and Forestry, n.d.).

Table 6: Exotic Honeysuckle location in Zone 7

Scientific Name	Common Name	Zone	Easting	Northing
<i>Lonicera tatarica</i>	Tartarian Honeysuckle	17T	695141	4990802

Photograph 11: Exotic honeysuckles located at northwest end of Zone 7



VEGETATION BUFFER ENHANCEMENT AND EXPANSION

Although Zones 1, 3, 7 and 8 represent the healthier zones along the shoreline of Sam Slick Park, the existing vegetative buffer still requires some enhancement in the upland area. The existing upland buffer ranges from 2.30 to 6.20 m in width. Typically, recommended buffer widths for bank stability, nutrient reduction, and wildlife habitat are at a minimum of 20-30 m (Muskoka Watershed Council, 2013). As the width of Sam Slick Park at its widest point is only 30 m from the high water line, the development of a 30 m buffer would compromise the function of the Park. That said, any expansion of the existing buffer would be considered an improvement to meeting those functions. Therefore, Glenside Ecological Services Limited recommends expanding the existing vegetation buffer to a consistent 6.0 m in width. A 6.0m buffer width is of sufficient size to support floral structure and deter random access to the lake, while still providing a park area and not encroaching on the park features (i.e. monument).

As well as expanding the width of the vegetative buffer, Glenside Ecological Services Limited also recommends enhancing the floral structure of the buffer to create a multi-layered buffer consisting of trees, shrubs and herbaceous plants. These zones typically have sufficient aquatic vegetation and bank shrubbery but the upland floral structure is lacking. Planting of upland shrubbery is recommended.

Generally for a more natural looking buffer, trees and shrubs should be planted close together (0.5-1m apart) in groupings of 3-5, however Glenside recognizes that the microhabitat and competition will dictate most planting locations. Exposed soil should be stabilized with a mulch to prevent any loss of soil into the lake.

Table 7 details the existing buffer widths, and enhancement and expansion areas, associated with each zone.

Table 7: Buffer enhancement and expansion area estimates

Zone	Length (m)	Upland Veg. Buff. (m)	Enhancement (m ²)	Expansion (m ²)
1	1.2	3.80	4.56	2.64
3	5.0	4.10	20.50	9.50
7	18.5	6.20	114.70	0.00
8	16.5	2.30	37.95	61.05
	41.2		177.71	73.19

EDUCATIONAL OPPORTUNITY

Three educational opportunities are identified in this group of zones.

FISH HABITAT

This group of zones has the best representation of aquatic vegetation on site. The abundant submerged, floating and emergent vegetation in this group of zones provides fish habitat in the form of spawning sites



for largemouth bass, and feeding and refuge areas for juvenile fishes. The COHOA can use this group of zones to highlight the critical link between aquatic vegetation and fish habitat

Key Messages:

- ✓ Aquatic vegetation provides fish habitat

EROSION CONTROL

Emergent vegetation such as cattails, pickerelweed and sedges have the ability to dissipate wave action and stabilize the substrate through the associated root network. Pockets of aquatic vegetation in this group of zones are already providing this function. The COHOA can use this group of zones to highlight the critical link between aquatic vegetation and erosion control.

Key Messages:

- ✓ Emergent aquatic vegetation protects shorelines

HEALTHY VEGETATION BUFFER

Although the width of the shoreline vegetation buffer at Sam Slick Park is limited to approximately 6m, and therefore less than optimal, this group of zones represents the zones with the healthiest buffers. Features typically associated with healthy shoreline vegetation buffers such as a multi-layered floral structure and a broad diversity of native plants can be found in this area. The COHOA can use this group of zones to demonstrate the features of a healthy shoreline vegetation buffer as well as highlight the critical link between healthy vegetation buffers and protection of fish habitat, shoreline stabilization and geese deterrence.

Key Messages:

- ✓ Healthy shoreline vegetation buffers protect water quality
- ✓ Healthy shoreline vegetation buffers provide wildlife and fish habitat
- ✓ Healthy shoreline vegetation buffers stabilize shorelines
- ✓ Healthy shoreline vegetation buffers should be multi-structural, with a diverse array of floral plants
- ✓ Healthy shoreline vegetation buffers deter geese

COST ESTIMATE

Table 8 provides cost estimates for the recommended mitigation in Zones 1, 3, 7 and 8.



Table 8: Planting stock cost estimate for Zones 1, 3, 7 and 8

Objective/ Zone	# of Shrubs	# of Trees	Plant Height (m)	Species Composition	Total Cost
Overhang					
3	3	0	0.5	2 Speckled Alder, 1 Red Osier Dogwood	\$5.00
7	2	0	1.0	1 Sweet Gale, 1 Red Osier Dogwood	\$8.00
Vegetation Buffer Enhancement					
1	4	0	0.5	2 Pussy Willow, 1 Bush Honeysuckle, 1 Highbush Cranberry	\$11.90
3	3	0	1.0	2 Highbush Cranberry, 1 American Elderberry	\$6.70
7	0	5	1.0	1 White Pine, 2 Red maple, 1 White Birch, 1 White Spruce	\$9.95
Vegetation Buffer Expansion					
1	2	2	0.3	2 White Pine, 2 Speckled Alder, 2 Highbush Cranberry	\$9.40
3	0	3	0.3	1 Eastern Hemlock, 1 Larch, 1 Red maple	\$5.40
8	0	6	0.3	2 Eastern Hemlock, 1 White Pine, 1 Yellow Birch, 2 Eastern White Cedar	\$11.95
Total Plant Estimate					\$68.30

ZONE 6

PROFILE

Zone 6 is similar to the previous zones, however has a narrower upland vegetative buffer, and is lacking any emergent vegetation (See Table 9). With a bank height of only 0.45 m and a slope of 29°, Zone 6 has a gentle profile (See Table 10). The length of Zone 6 is 9.5m

Table 9: Zone 6 description

Zone	Location (m)	Upland Veg. Buff. (m)	Veg. Overhang (m)	Length (m)
6	17.5-27.0	1.40	0.70	9.5
Total length (m)				9.5

Table 10: Zone 6 profile

Zone	Rise (A)	Run (B)	Degrees
6	0.45	0.80	29



Photograph 12: Shoreline structure in Zone 6



RECOMMENDED MITIGATION

VEGETATION BUFFER ENHANCEMENT AND EXPANSION

Glenside Ecological Services Limited recommends expanding the width of the shoreline vegetation buffer to 6m, and enhancing the floral structure of the buffer to create a multi-layered buffer consisting of trees, shrubs and herbaceous plants. Specifically Zone 6 requires planting of upland shrubbery and tree species.

Generally for a more natural looking buffer, trees and shrubs should be planted close together (0.5-1m apart) in groupings of 3-5, however Glenside recognizes that the microhabitat and competition will dictate most planting locations. Exposed soil should be stabilized with a mulch to prevent any loss of soil into the lake.

Table 11 details the existing buffer width, and enhancement and expansion areas, associated with Zone 6.

Table 11: Zone 6 buffer enhancement and expansion area estimates

Zone	Length (m)	Upland Veg. Buff. (m)	Enhancement (m ²)	Expansion (m ²)
6	9.5	1.40	13.30	43.70
	9.5		13.30	43.70



EDUCATIONAL OPPORTUNITY

CREATING A HEALTHY SHORELINE VEGETATION BUFFER

The COHOA can use this zone to demonstrate how shoreline vegetation buffers can be enhanced, specifically highlighting the establishment of floral structure and the expansion of the buffer to 6m.

Key Messages:

- ✓ Wider shoreline vegetation buffers create healthier shorelines
- ✓ Multi-layered shoreline vegetation buffers create healthier shorelines

COST ESTIMATE

Table 12 provides a cost estimate for the recommended mitigation in Zone 6.

Table 12: Planting stock cost estimate for Zone 6

Objective/ Zone	# of Shrubs	# of Trees	Plant Height (m)	Species Composition	Total Cost
Overhang					
6	2	0	0.3	1 Sweet Gale, 1 Red Osier Dogwood	\$8.00
Vegetation Buffer Enhancement					
6	5	1	0.3	1 Mountain Ash, 2 Highbush Cranberry, 2 American Elderberry, 1 Nannyberry	\$14.10
Vegetation Buffer Expansion					
6	0	5	0.3	1 White Pine, 1 White Spruce, 1 White Birch, 2 Yellow Birch	\$9.95
Total Plant Estimate					\$32.05

ZONES 2, 4, 5, 9, 10, 11 AND 13

PROFILE

Zones 2, 4, 5, 9, 10, 11 and 13 represent the areas of the shoreline fronting Sam Slick Park requiring significant mitigation. In these zones the upland vegetative buffer is narrow or non-existent and there is no vegetative overhang providing structure to the bank (See Table 13). As a result mild undercutting of the bank has begun and geese frequently use these zones as passage points to open grassy areas associated with the park and neighbouring school (See Photograph 13).

The total length of these zones is 57.3 m. Although the upland slope ranges from 22 to 90°, there is a maximum rise of only 1m and therefore these zones are considered to have a moderate profile (See Table 14).



Table 13: Zone 2, 4, 5, 9, 10, 11 and 13 descriptions

Zone	Location (m)	Upland Veg. Buff. (m)	Veg. Overhang (m)	Length (m)
2	1.2-4.0	2.80	0.00	2.8
4	9.0-14.5	2.60	0.00	5.5
5	14.5-17.5	0.00	0.00	3.0
9	62.0-67.0	1.00	0.00	5.0
10	67.0-79.0	3.00	0.00	12.0
11	79.0-84.5	1.00	0.00	5.5
13	86.5-110.0	3.20	0.00	23.5
Total length (m)				57.3

Table 14: Zone 2, 4, 5, 9, 10, 11 and 13 profiles

Zone	Rise (A)	Run (B)	Degrees
2	0.40	0.00	90
4	0.50	0.70	36
5	0.50	0.45	48
9	0.78	1.20	33
10	0.70	1.70	22
11	0.63	1.30	26
13	0.97	2.20	24

Photograph 13: Shoreline structure in Zone 10



RECOMMENDED MITIGATION

VEGETATION BUFFER ENHANCEMENT AND EXPANSION

Glenside Ecological Services Limited recommends expanding the width of the vegetative buffer to 6m, and enhancing the floral structure of the buffer to create a multi-layered buffer consisting of trees, shrubs and herbaceous plants. Specifically Zone 2, 4, 5, 9, 10, 11 and 13 require the planting of bank shrubbery, upland shrubbery and tree species.

Generally for a more natural looking buffer, trees and shrubs should be planted close together (0.5-1m apart) in groupings of 3-5, however Glenside recognizes that the microhabitat and competition will dictate most planting locations. Exposed soil should be stabilized with a mulch to prevent any loss of soil into the lake.

Viewsapces are an important component of a park adjacent to a lake and can be maintained through trimming the lower branches of the trees. When first establishing a buffer viewsapces may be temporarily blocked until the trees reach a sufficient height for trimming. If this is of concern, an option would be to plant the trees in phases, to maintain existing viewsapces in some areas while allowing trees to become established in others. Once the planted trees reach a height where viewsapces can be established through the trees, than trees can be planted in the remaining areas.

Table 15 details the existing buffer widths, and enhancement and expansion areas, associated with each zone.

Table 15: Buffer enhancement and expansion area estimates

Zone	Length (m)	Upland Veg. Buff. (m)	Enhancement (m ²)	Expansion (m ²)
2	2.8	2.80	7.84	8.96
4	5.5	2.60	14.3	18.70
5	3.0	0.00	0.00	18.00
9	5.0	1.00	5.00	25.00
10	12.0	3.00	36.00	36.00
11	5.5	1.00	5.50	27.50
13	23.5	3.20	75.2	65.80
	57.3		143.84	199.96

GEESE MANAGEMENT

Zones 5 and 11 represent two of the primary access points for geese to migrate between the lake and upland grassy areas associated with Sam Slick Park and the neighbouring schools. As a result goose excrement is abundant in these areas, both in the water and the maintained grassy area of the Park (See Photograph 14, Photograph 15 and Photograph 16). Further the migration to and from these points to the grassy areas of the neighbouring school results in the migration of geese across County Road 21 (See



Photograph 17). This activity has become a traffic concern as evidenced by two near accidents witnessed by Glenside during the field investigation. A dead goose was also noted on County Road 21 as well as two others along the shoreline. Whether the latter two are a result of trauma from a motorized vehicle is unknown.

Changing the landscape is the best non-lethal solution to many human-geese conflicts. Canada Geese prefer large open areas that allow them to take off and land, and with clear lines of sight so that they can see predators coming and make their escape. The establishment of dense tall grass, shrubs, trees, and aquatic plants impede access to grazing areas and block their view of predators and escape routes to water. Plants should be tall enough to prevent geese from seeing over them and wider vegetative buffers are more effective than narrow ones (Canadian Wildlife Service, Environment Canada, 2010).

The mitigation as recommended to enhance the vegetation buffer will meet these criteria.

Photograph 14: Goose access point at Zone 5



Photograph 15: Goose access point at Zone 11



Photograph 16: Goose excrement at Zone 5



Photograph 17: Geese crossing County Road 21 towards Zone 11



INVASIVE PLANT MANAGEMENT

Purple Loosestrife

Three to five stems of purple loosestrife (*Lythrum salicaria*) can be found approximately 5 m from the northwestern end of Zone 13 (See Table 16, Photograph 18 and Figure 8). Purple loosestrife forms dense stands with thick root mats that can spread over large areas, degrading habitat for many native birds, insects and other species. By crowding out native plants purple loosestrife reduces the biodiversity along riparian buffers.

Currently the distribution of purple loosestrife at Sam Slick Park is limited to three sites, consisting of less than 50 stems and therefore Glenside Ecological Services Limited recommends hand removing the plant before it goes to seed in late June, July and early August. If removing after plants with seeds, gently bend stalks over a plastic bag and cut them off to ensure seeds do not drop onto the ground during removal. Remove as much of the root system as possible as broken roots may sprout new plants. The area should be inspected yearly to ensure that the new plants are not emerging. Any newly established purple loosestrife should be removed immediately.

It is imperative that any plant material removed is disposed of in a proper manner as negligence can result in the proliferation of purple loosestrife in new areas. It is recommended that purple loosestrife is not composted but rather discarded with the regular garbage (Ontario Federation of Anglers and Hunters).

Table 16: Location coordinates of purple loosestrife in Zone 13

Scientific Name	Common Name	Zone	Easting	Northing
<i>Lythrum salicaria</i>	Purple Loosestrife	17T	695180	4990754

Photograph 18: Purple loosestrife (*Lythrum salicaria*)



Narrow-leaved Cattail

Narrow-leaved cattail (*Typha angustifolia*) is distributed along the shoreline and streambanks of Sam Slick Park and is considered to be an exotic plant in Ontario (See Photograph 19). Hybridizing with common cattail to form *Typha glauca*, this hybrid is extremely aggressive and will often outcompete either parent. Cattails in general can out-compete other native plants in disturbed areas, often forming monotypic stands of dense cattails (United States Department of Agriculture, Natural Resources Conservation Service, 2015).

Although narrow-leaved cattail is considered an exotic plant, it is well established along the shoreline and streambanks and plays a critical role in stabilizing the banks, filtering sediments and deterring geese. Further the invasive tendency of cattails is in disturbed areas where the light fluffy seeds can become quickly distributed over bare soils. It is therefore the opinion of Glenside Ecological Services Limited that the removal of narrow-leaved cattail will be more damaging to the site then retaining the plants. No action is recommended.

Photograph 19: Narrow-leaved cattail (*Typha angustifolia*)



SHORELINE STABILIZATION

At Zones 5, 9, 10 and 11 there is evidence of mild undercutting resulting from a combination of wave action, and a lack of shoreline structural integrity due to a scarcity of shoreline vegetation. As the undercutting is mild it is anticipated that the establishment of a healthy shoreline vegetation buffer will likely suffice as a mitigation technique. However the objective of the COHPOA in remediating the shoreline of Sam Slick Park is to demonstrate a variety of effective mitigation techniques and the existing undercutting provides the opportunity to showcase the use of soft armour as a component of the solution. Specifically the placement of coir logs are an effective mitigation technique for undercutting on low profile banks as they absorb wave energy and allow vegetation to become established (Ontario Ministry of Natural Resources,



Cataraqui Region Conservation Authority, Mississippi Valley Conservation, Quinte Conservation, Raisin Region Conservation Authority, Rideau Valley Conservation Authority, South Nation Conservation, 2011) (Ontario Ministry of Natural Resources, Dufferin Simcoe Lake Stewardship Network, 2014) (Klymko, 2015).

Coir logs are manufactured from 100% biodegradable coconut fibres and provide immediate and temporary toe of slope protection while plants and root networks become established. At 2.28 m in length, 30 cm in diameter, and a weight of approximately 25 kg, they are relatively easy to manage and install. Coir logs have a functional longevity of 3 to 4 years.

Photograph 20: Coir Logs



Zones 9, 10 and 11 offer the best opportunity to demonstrate the use of coir logs as a soft armour mitigation technique to stabilize the toe of the bank while establishing shrubbery.

The recommended installation technique is based on the guidelines provided in the Professional's Guide to Healthy Shoreline Management for Lake Simcoe (Ontario Ministry of Natural Resources, Dufferin Simcoe Lake Stewardship Network, 2014), consultation with Rideau Valley Conservation Authority (Klymko, 2015) and recommendations provided by the manufacturer (Terrafix Geosynthetics Inc., 2013).

To provide temporary toe of slope protection while bank plants and root networks become established, Glenside recommends placing one coir log directly into the undercut, fronted by a second coir log embedded in the substrate (See Figure 5). As the undercut is approximately 20-25 cm high, 30 cm (12") diameter coir logs will suffice. The coir logs should be staked into place using 8 stakes per log, with five stakes on the outside and 3 on the inside (Terrafix Geosynthetics Inc., 2013). Wooden stakes, 2" in diameter work well in substrates with low stone content (Klymko, 2015). The coir logs should be held down with twine attached to the stakes to ensure they are not lifted by wave and/or ice action, and the ends should be tied into the bank or other features to reduce wash-out potential. Adjacent logs should be tied together and further secured with river stone (Klymko, 2015). The river stone will not only help secure the ends of the coir logs but will also provide structure for fish habitat.

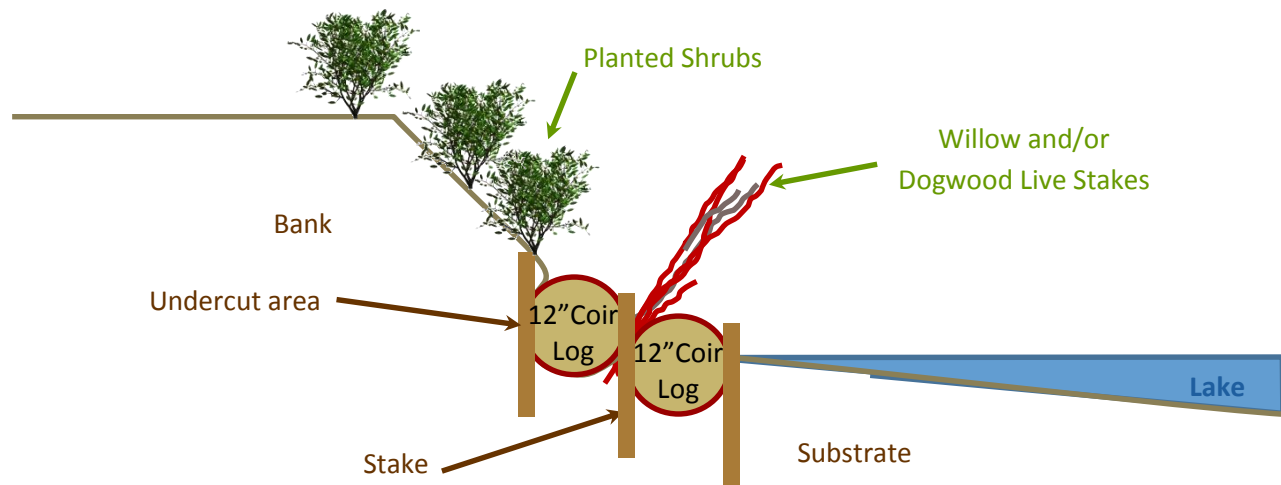
Bank shrubbery should be planted behind and between the coir logs to provide vegetative structure and stabilize the existing bank. Bunches of large live stakes work well in between the coir logs as space is limited and the use of potted or bare root plants difficult (See Photograph 21) (Klymko, 2015).

Zones 9, 10 and 11 have an overall length of 22.5 m and therefore 20 – 30cm diameter coir logs will be required.



As the coir logs will be placed below the high water line a permit from the Ontario Ministry of Natural Resources and Forestry will be required and timing restrictions in accordance with fish activity will need to be adhered to.

Figure 5: Mitigation with coir logs at Zones 9, 10 and 11



Photograph 21: Installation of coir logs by Rideau Valley Conservation Authority (Klymko, 2015)



Zone 5 represents an opportunity to demonstrate a small scale stone revetment, which is a mitigation technique required for more severe erosion control. This technique would involve placing 30cm river stones at the toe of the bank to assist in stabilizing the bank. As the height of the bank is minimal in this area a stone revetment of 2-3 stones will be sufficient with the lower stone embedded into the substrate to deter undercutting. A medium sized rounded stone and embedded log currently can be found at this site (See Photograph 22). Glenside recommends incorporating these existing natural materials and allowing vegetation to grow up in between the rocks to provide a more natural setting. As some of the stones will be placed below the high water line, a permit will be required from Ontario Ministry of Natural Resources and Forestry.

Photograph 22: Shoreline erosion in Zone 5



ACCESS POINT DEVELOPMENT

Access points are an important component of a shoreline, particularly those associated with public parks, as they allow the public to view the lake and enjoy recreational opportunities such as fishing and swimming. Two existing access points were identified in Zones 5 and 9. At these sites the vegetative buffer was non-existent and there appeared to be a clear standing area by the water. Glenside Ecological Services Limited recommends retaining these access points as they have a history of use and therefore further use is likely, whether provided or not.

All of Zone 5 is defined as an access point representing an area approximately 3m wide. The vegetative buffer is gone, the maintained lawn extends to the high water line and goose activity is prolific. Although swimming activity is unlikely given the amount of goose excrement, the area is likely used for fishing.

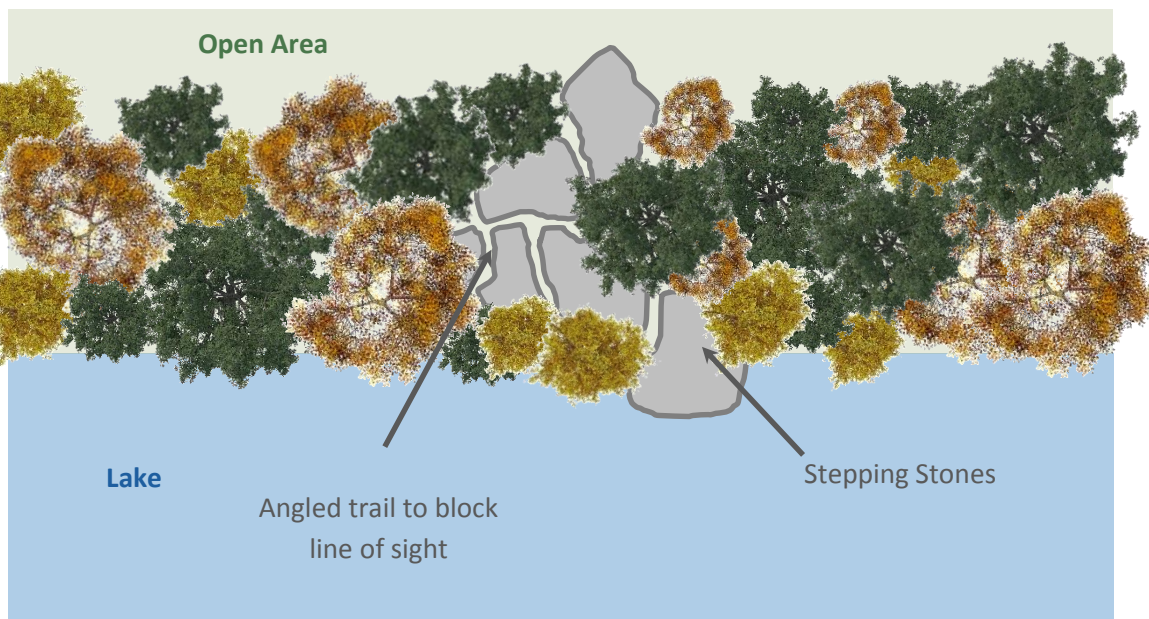
To retain the access at Zone 5, while at the same time naturalizing and stabilizing the shoreline and limiting geese access, Glenside Ecological Services Limited recommends providing a narrow and angled path



through the 6m enhanced vegetative buffer (See Figure 6). The angle of the path should be sufficient enough to ensure that there is no direct line of site from the lake to the open uplands, and the width of the path limited to that required for a single person to pass through. This design will deter Canada Geese from travelling along the path as there is no visible attraction (i.e. grazing area) or escape route, and predators may be hidden. Stepping stones should be provided along the path as a means of directing users and minimizing the potential for the trail to become widened or redirected over time.

To protect the bank from traffic and resulting erosion, Glenside Ecological Services Limited recommends providing two to three standing stones extending out into the water. The imported standing stones should be approximately 60cm in diameter, 15-20cm in depth and naturally rounded. The stones should be stepped down to the water to account for the 50cm rise of the bank.

Figure 6: Trail layout for access to lake



The second access point is located at the northwest end of Zone 9 (See Photograph 23). This access point consists of a vegetated clump that has been used as a standing spot, possibly for fishing or viewing the lake. To access this point Glenside recommends adopting the same trail and stepping stone layout as that proposed for Zone 5, with the exception of the water's edge where a larger stone (75cm x 45cm) is recommended as the bank is higher. As the larger stone will be placed below the high water line, a permit will be required from the Ontario Ministry of Natural Resources and Forestry.



Photograph 23: Access point in Zone 9



Access Point

EDUCATIONAL OPPORTUNITY

GEESE MANAGEMENT

Geese excrement is a common concern for waterfront landowners and indicative of unhealthy shorelines. The COHOA can use this group of zones to highlight the critical link between healthy shoreline vegetation buffers and geese management.

Key Messages:

- ✓ Geese excrement is a product of an unhealthy shoreline vegetation buffer
- ✓ Healthy shoreline vegetation buffers should be tall enough to prevent a direct line of sight to potential grazing areas
- ✓ Access points through the shoreline vegetation buffers should be angled to prevent a direct line of sight to potential grazing areas

SHORELINE RESTORATION

A variety of shoreline restoration techniques will be applied to address common issues such as mild erosion, access points and shoreline naturalization. The COHOA can use this group of zones to showcase best management practices, specifically mitigation techniques involving the application of soft armour and stone revetments, trail and access point design, maintaining viewscapes, and planting of terrestrial flora.



Key Messages:

- ✓ Soft armour mitigation techniques provide more natural settings with greater wildlife benefits
- ✓ Coir logs are an effective means of temporarily stabilizing the shoreline for the purposes of establishing bank vegetation and associated root networks
- ✓ In areas where hard armour is required, stone revetments in combination with planting, can assist with erosion control and create habitat for fish and wildlife species
- ✓ Access points can be incorporated into a natural shoreline
- ✓ Viewsapes can be incorporated into a natural shoreline

INVASIVE PLANTS

Two species of invasive plants can be found in these zones and for each a different strategy proposed.

Key Messages:

- ✓ Invasive plants can be detrimental to the biodiversity of a shoreline vegetation buffer
- ✓ Hand removal is an option for Purple Loosestrife management
- ✓ Detrimental impacts resulting from the removal of invasive plants may outweigh the benefits, depending on the species.

COST ESTIMATE

Table 17 and Table 18 provide cost estimates for the recommended mitigation in Zones 2, 4, 5, 9, 10, 11 and 12

Table 17: Planting stock cost estimate for Zones 2, 4, 5, 9, 10, 11 and 13

Objective/ Zone	# of Shrubs	# of Trees	Plant Height (m)	Species Composition	Total Cost
Overhang					
2	3	0	0.3	2 Sweet Gale, 1 Red Osier Dogwood	\$16.00
4	3	0	0.3	1 Sweet Gale, 2 Red Osier Dogwood	\$10.00
5	6	0	0.3	2 Sweet Gale, 2 Red Osier Dogwood, 2 Pussy Willow	\$21.40
9	6	0	0.6	2 Sweet Gale, 2 Red Osier Dogwood, 2 Pussy Willow	\$21.40
	33		0.6-1.0	33 Red Osier Dogwood whips	\$66.00
10	5	0	0.6	2 Sweet Gale, 2 Red Osier Dogwood, 1 Pussy Willow	\$18.70
	80		0.6-1.0	80 Red Osier Dogwood whips	\$160.00
11	6	0	0.5	2 Sweet Gale, 2 Red Osier Dogwood, 2 Pussy Willow	\$21.40
	36		0.6-1.0	36 Red Osier Dogwood whips	\$72.00



Objective/ Zone	# of Shrubs	# of Trees	Plant Height (m)	Species Composition	Total Cost
Vegetation Buffer Enhancement					
2	4	0	0.3	2 Alternate-leaved Dogwood, 1 Bush Honeysuckle, 1 Red Osier Dogwood	\$10.50
4	3	0	1.0	2 Pussy Willow, 1 Bush Honeysuckle	\$9.90
5	6	0	0.3	2 Alternate-leaved Dogwood, 2 Highbush Cranberry, 2 Bush Honeysuckle	\$10.90
9	3	0	0.6	1 Highbush Cranberry, Alternate-leaved Dogwood, 1 Bush Honeysuckle	\$8.50
10	3	0	0.6	1 Alternate-leaved Dogwood, 1 Bush Honeysuckle, 1 Nannyberry	\$10.00
11	3	2	0.5	2 Mountain Ash, 2 Highbush Cranberry, 1 American Elderberry	\$9.10
13	4		1.0	2 Red Osier Dogwood, 2 Sweet Gale	\$16.00
Vegetation Buffer Expansion					
2	4	0	0.3	2 American Elderberry, 2 Nannyberry	\$12.40
4	0	3	0.3	2 Silver Maple, 1 Eastern Hemlock	\$6.25
5	0	6	0.3	2 Yellow Birch, 2 White Birch, 2 White Pine	\$10.90
9	0	1	0.3	1 Eastern Hemlock	\$1.75
10	0	8	0.3	2 Red Maple, 2 Yellow Birch, 2 White Birch, 2 Eastern Hemlock	\$14.50
11	0	3	1-1.5	1 White Pine, 1 White Spruce, 1 Red Maple	\$77.00
13	0	20	0.3	3 Silver Maple, 3 Red Maple, 3 White Pine, 3 Eastern Hemlock, 3 White Spruce, 5 White Birch	\$35.85
13	0	3	1-1.5	1 White Pine, 1 White Spruce, 1 Red Maple	\$77.00
Total Plant Estimate					\$717.45

Table 18: Other material cost estimates for Zones 2, 4, 5, 9, 10, 11 and 13

Action/Zone	Description	Units	Cost/Unit	Total Cost
Shoreline Stabilization				
Coir Logs	30cm x 2.28m (TerraFix)	20	\$50.00	\$1000.00
Coir Log Freight	(TerraFix)			\$220.00
Wooden Stakes	2" x 2" x 3' (Home Hardware)	130	\$0.80	\$104.00
Clean River Rock	30cm diameter (Fowlers)			\$1633.80
Access Point Development				
Stepping Stones	1x1x0.3 (Fowlers)	12 m ²	218.88	\$2626.56
Total				\$5584.36

ZONE 12

As evidenced by the tracks on the road, Zone 12 represents a 2m wide, highly used skidoo access point between Head Lake and the Haliburton Highlands High School (See Photograph 24). The bank has been eroded by this traffic and as a result the water's edge cuts into the shoreline. During the summer time this zone appears to be the third primary access point for geese migrating between the lake and the open grassy areas associated with the Park and neighbouring school.



There is no vegetation buffer associated with this zone and the bank slope is 17° (See Table 19 and Table 20)

Table 19: Zone 12 description

Zone	Location (m)	Bank Veg. Buff. (m)	Veg. Overhang (m)	Length (m)
12	84.5-86.5	0.00	0.00	2.0
				2.0

Table 20: Zone 12 profile

Zone	Rise (A)	Run (B)	Degrees
12	0.63	2.00	17

Photograph 24: Skidoo access point at Zone 12



RECOMMENDED MITIGATION

ACCESS POINT

As Zone 12 represents a highly used access point for skidoo traffic the naturalization of this zone is not appropriate and hardening of the shoreline is required. However the hardening should be kept to a minimum; that which is required for the passage of a single skidoo.

Glenside Ecological Services Limited recommends the placement of large flat stones (roughly 1 m wide by 30 cm deep) to create a 6 m long ramp extending 3 m above and below the high water mark. Below the water line spaces between the stones should be filled with pea gravel to deter erosion and undercutting, however above the high water line the establishment of herbaceous plants and grasses between the stones



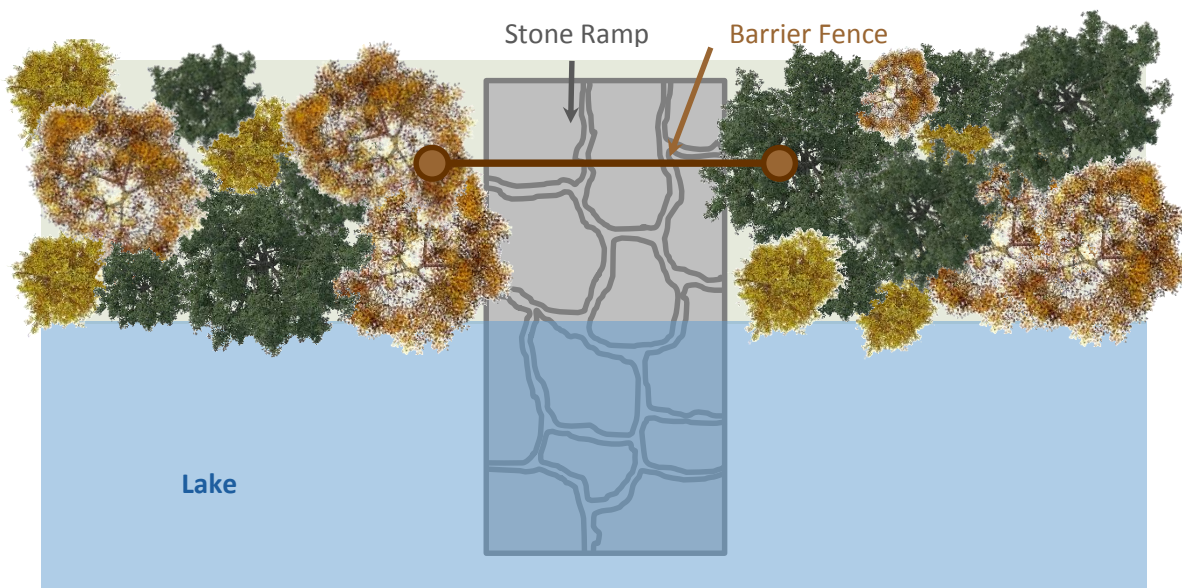
should be promoted. Native herbaceous plants and grasses between the stones would naturalize the ramp during the summer months and assist in blocking geese sight lines.

As some stone will be placed below the high water line, a permit will be required from the Ontario Ministry of Natural Resources and Forestry.

During the off winter months Glenside recommends installing and maintaining a barrier fence across the 2m zone to deter geese from using the zone as an access point. The fence should exceed adult/gosling height and be constructed in a manner that would prohibit geese from walking or seeing around, under or through it. As Canada geese can exceed 1m in height a 1.2m high fence is recommended. The fence posts should be placed at a safe distance from the ramp to reduce risk of snowmobiles colliding with the posts. Taller coniferous trees should also be planted around the fence ends to deter geese and people from circumventing the fence. These taller coniferous trees have been budgeted into the cost estimates for Zones 11 and 13.

The installation of a fence during the off winter months will also deter the unauthorized use of the ramp as a boat launch.

Figure 7: Skidoo access point sketch



COST ESTIMATE

Table 21 and Table 22 provide a cost estimate for the recommended mitigation in Zone 12

Table 21: Planting stock cost estimate for Zone 12

Objective/Zone	# of Grasses	Species Composition	Total Cost
Stone Ramp			
12	15	Big Bluestem	\$37.50
Total Plant Estimate			\$37.50

Table 22: Other material cost estimate for Zone 12

Action/Zone	Description	Units	Cost/Unit	Total Cost
Access Point Development				
Stone Ramp	1m x1m x0.3 (Fowlers)	12m ²	218.88	\$2626.56
Fence	(Fowlers)			\$921.59
Total				\$3548.15



ZONE 14 (STREAM BUFFER)

The banks of the stream buffer represented by Zone 14 appear to be stable and well vegetated (See Table 23). In a few areas evidence of hard armour in the form of a stone revetment can be found but much of the revetment has now grown over with a variety of floral species. The vegetative buffer on either side is now approximately 4m in width and consists of aquatic plants, herbaceous plants, shrubbery and a few young trees near the bridge.

Table 23: Zone 14 description

Zone	Northwest Bank Veg. Buff. (m)	Southeast Bank Veg. Buff. (m)	Length
14	4.00	4.15	30.95
			30.95

RECOMMENDED MITIGATION

VEGETATION BUFFER ENHANCEMENT AND EXPANSION

Glenside Ecological Services Limited recommends expanding the width of the vegetative buffer to 5m, and enhancing the floral structure of the buffer to create a multi-layered buffer consisting of trees, shrubs and herbaceous plants. Specifically Zone 14 requires planting of bank shrubbery, upland shrubbery and trees species.

Generally for a more natural looking buffer, trees and shrubs should be planted close together (0.5-1m apart) in groupings of 3-5, however Glenside recognizes that the microhabitat and competition will dictate most planting locations. Exposed soil should be stabilized with a mulch to prevent any loss of soil into the lake.

Table 24 details the existing buffer widths, and enhancement and expansion areas, associated with Zone 14.

Table 24: Buffer enhancement and expansion area estimates for Zone 14

Zone	Length (m)	Upland Veg. Buff. (m)	Enhancement (m ²)	Expansion (m ²)
14 (NW Bank)	30.95	4.00	123.80	30.95
14 (SE Bank)	30.95	4.15	128.44	26.31
	57.3		252.24	57.26

INVASIVE PLANTS

Purple loosestrife (*Lythrum salicaria*) can be found in two places in Zone 14 (See Table 25). The first location is approximately 4-5 m from County Road 21 and is a pocket of purple loosestrife consisting of 15-20 plants. The second location is found on the northern end of the zone and on the eastern side of the stream and is a smaller pocket of only 3-5 plants. As the distribution is limited and number of plants



minimal Glenside Ecological Services Limited recommends hand removing the purple loosestrife in these areas.

Table 25: Purple Loosestrife locations in Zone 14

<i>Scientific Name</i>	<i>Common Name</i>	<i>Zone</i>	<i>Easting</i>	<i>Northing</i>
<i>Lythrum salicaria</i>	Purple Loosestrife	17T	695139	4990768
<i>Lythrum salicaria</i>	Purple Loosestrife	17T	695153	4990787

COST ESTIMATE

Table 26 and Table 27 provides a cost estimate for the recommended mitigation in Zone 14

Table 26: Planting stock cost estimate for Zone 14

<i>Objective/ Zone</i>	<i># of Shrubs</i>	<i># of Trees</i>	<i>Plant Height (m)</i>	<i>Species Composition</i>	<i>Total Cost</i>
<i>Vegetation Buffer Enhancement</i>					
14	16	4	1.0	4 Mountain Ash, 4 Alternate-leaved Dogwood, 5 American Elderberry, 4 Nannyberry, 3 Bush Honeysuckle	\$53.80
<i>Vegetation Buffer Expansion</i>					
14	0	14	0.5	5 White Spruce, 3 Silver Maple, 3 Red Maple, 3 White Birch	\$30.00
<i>Total Plant Estimate</i>					<i>\$83.80</i>

Table 27: Other cost estimates for Zone 14

<i>Action/Zone</i>	<i>Description</i>	<i>Units</i>	<i>Cost/Unit</i>	<i>Total Cost</i>
<i>Invasive Plant Management</i>				
Removal	Purple Loosestrife	20 - 25 plants		Not costed



ZONE 15 (OPEN PARK AREA)

PROFILE

Zone 15 represents the upland open area of Sam Slick Park (See Photograph 25). This area is predominantly a managed grass area with a few scattered trees near the edges

Photograph 25: Open Area in Zone 5



RECOMMENDED MITIGATION

Although the open park area associated with Zone 15 is beyond the scope of this shoreline restoration plan, it should be noted that efforts in Zone 15 can help assist with addressing issues related to the shoreline. Specifically, the open park area is a major attraction to the geese population, as geese prefer such areas for grazing purposes. The planting of trees throughout Zone 15 would create flight path barriers for the geese thereby making Zone 15 less desirable for grazing purposes.



COST ESTIMATE

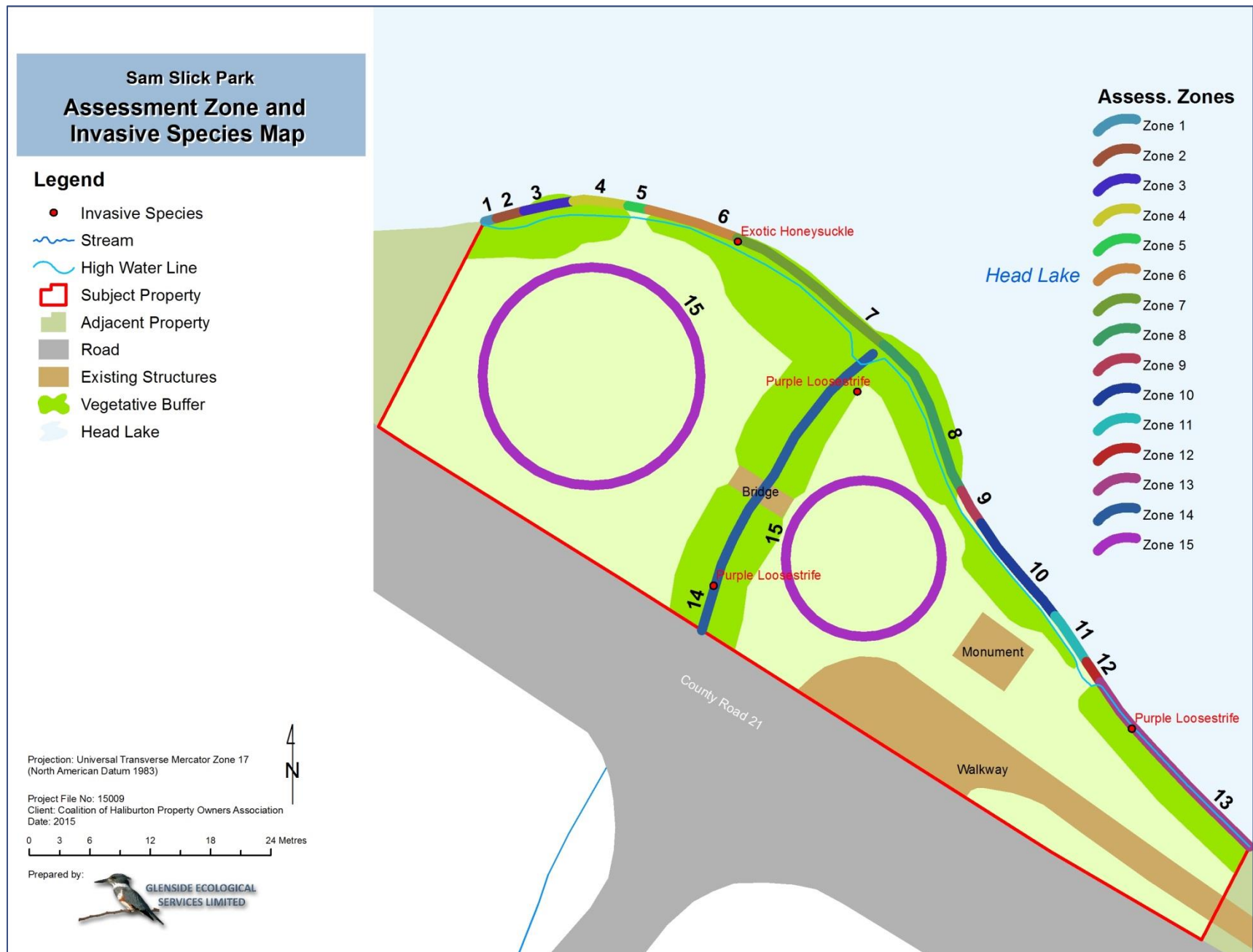
Table 28 provides a cost estimate for the recommended mitigation in Zone 15

Table 28: Plant stocking cost estimate for Zone 15

Objective/ Zone	# of Shrubs	# of Trees	Plant Height (m)	Species Composition	Total Cost
<i>Tree Cover Enhancement</i>					
15	0	15	2.0	5 White Pine, 3 Silver Maple, 4 Red Maple, 3 White Birch (potted 3 gallon)	\$200.00
<i>Total Plant Estimate</i>					<i>\$200.00</i>



Figure 8: Assessment zone and invasive species map



RECOMMENDED PLANT SPECIES AND COSTING

The recommended plant species list was compiled based on the following criteria:

- ✓ Site suitability
- ✓ Effectiveness in stabilizing shorelines
- ✓ Attractiveness; and
- ✓ Wildlife value

All plants are native to Ontario and readily available from the following Ontario nurseries/sources:

Grow Wild Native Plant Nursery
3784 Highway #7
Omemee, Ontario
K0L 2W0
www.grow-wild.com

Haliburton Highlands Land Trust
739 Mountain St
Haliburton, ON
K0M 1S0
www.haliburtonlandtrust.ca

Native Plant Nurseries
12965 Regional Road 39, Box 169
Zephyr, ON
www.nativeplantnurseries.ca

Bark Ecological Gardens and Nursery
barknursery@hotmail.com
705-489-1541

Pineneedle Farms
423 Highway #35, Box 220
Pontypool, ON
LOA 1K0
www.pineneedlefarms.ca

TREES AND SHRUBS

The number and spacing of recommended trees and shrubs is based on a site assessment of each zone that examined light conditions, competition and moisture regimes. Table 29 and Table 30 detail the general site conditions and buffer locations of the recommended tree and shrub species. Although from a budget perspective it is preferable to use bare rooted trees and shrubs, in order to provide some immediate structure to the planted areas, and thereby reduce the probability of trampling, some potted plants are required. For Zone 15 where trees will be planted individually and subject to high traffic, 2-2.5m high trees are recommended.



Table 29: Recommended tree species

Common Name	Scientific Name	Conditions	Proposed Location
Red Maple	<i>Acer rubrum</i>	Full sun to partial shade, moist to wet soil	Bank and upland terrace
Silver Maple	<i>Acer saccharinum</i>	Full sun to partial shade, moist to average soil	Bank and upland terrace
Sugar Maple	<i>Acer saccharum</i>	Full sun to partial shade, average soil	Upland terrace
White Birch	<i>Betula papyrifera</i>	Full sun to partial shade, moist to dry soil	Upland terrace
Yellow Birch	<i>Betula alleghaniensis</i>	Full sun to partial shade, moist to average soil	Bank and upland terrace
American Mountain Ash	<i>Sorbus americana</i>	Full sun to partial shade, moist to dry soil	Upland terrace
White Pine	<i>Pinus strobus</i>	Full sun to partial shade, moist to dry soil	Upland terrace
Eastern Hemlock	<i>Tsuga canadensis</i>	Partial shade to shade, moist to average soil	Upland terrace
Eastern White Cedar	<i>Thuja occidentalis</i>	Full sun to partial shade, moist to dry soil	Upland terrace
White Spruce	<i>Picea glauca</i>	Full sun to partial shade, moist to average soil	Upland terrace

Table 30: Recommended shrub species

Common Name	Scientific Name	Conditions	Proposed Location
Alternate-leaved Dogwood	<i>Cornus alternifolia</i>	Partial shade, moist to average soil	Upland terrace
Red Osier Dogwood	<i>Cornus stolonifera</i>	Full sun to partial shade, wet to average soil	Bank and upland terrace
American Elderberry	<i>Sambucus canadensis</i>	Full sun to partial shade, wet to moist soil	Bank
Nannyberry	<i>Viburnum lentago</i>	Full sun to partial shade, wet to moist soil	Bank
American High-bush Cranberry	<i>Viburnum trilobum</i>	Full sun to shade, wet to average soil	Bank and upland terrace
Bush Honeysuckle	<i>Diervilla lonicera</i>	Full sun to shade, average to dry soil	Upland terrace
Sweetgale	<i>Myrica gale</i>	Full sun, wet to average soil	Bank
Pussy Willow	<i>Salix discolor</i>	Full sun to partial shade, moist soil	Bank
Speckled Alder	<i>Alnus incana</i>	Full sun to partial shade, moist soil	Bank

GRASSES AND HERBACEOUS PLANTS

The existing grasses and herbaceous plants are diverse and suitable for the site, and are expected to naturally colonize the vegetation buffer expansion areas. Therefore with the exception of Zone 12 planting of grasses and herbaceous plants is not required.

In Zone 12, to assist in naturalizing the stone ramp and blocking geese site lines, the establishment of native grasses between the stones is recommended. Table 31 lists a native grass suitable to the site conditions in Zone 12.

Table 31: Recommended grass species

Common Name	Scientific Name	Conditions	Proposed Location
Big Bluestem	<i>Andropogon gerardii</i>	Partial shade, moist to average soil	Stone ramp



SCHEDULING

For most trees and shrubs the optimal time for planting is after the last frost in spring, however timing restrictions will apply to any planting below the high water line (i.e. between coir logs).

All in-water work (including planting) should be conducted in accordance with the required permit and restriction windows based on the fish species present. For Head Lake and the associated fish community all in-water work will be limited to July 15th – March 15th (Ontario Ministry of Natural Resources, 2013).

COST ESTIMATE SUMMARY

The shoreline restoration with enhanced access points, and the establishment of tree cover throughout Sam Slick Park has an estimated cost of approximately \$20,000 (See Table 32 and Table 33) with the labour estimates for planting and coir log installation outstanding. It should be noted that a significant component (approx. 50%) of this cost is labour and cost savings may be realized through conducting tasks in-house or through the utilization of community volunteers.

Table 32: Material Cost estimate summary

Action	Quote Provider	Total Cost
Plants and Shrubs	Pineneedle Farms	\$1136.10
Stone Ramp	Fowlers Construction	\$2626.56
Fence and Posts	Fowlers Construction	\$921.59
Access Stones	Fowlers Construction	\$2626.56
Shoreline Coir Logs	Terrafox	\$1220.00
Shoreline River Stone	Fowlers Construction	\$1633.80
Total		\$10164.61

Table 33: Labour Cost estimate summary

Action	Quote Provider	Total Cost
Planting	Pineneedle Farms	outstanding
Coir Log Installation	Fowlers Construction	outstanding
Stone Ramp and Fence	Fowlers Construction	\$3416.27
Angled Access	Fowlers Construction	\$3416.27
Permit Application with site visit	Glenside Ecological Services Limited	\$600.00
Supervision and Tender	Forest Design	\$2100.00
Total (incomplete)		\$9532.54



SUMMARY

The Sam Slick Park Shoreline Restoration Plan provides a detailed analysis of the natural and physical features of the park and proposes a variety of mitigation techniques to common shoreline issues. The mitigation techniques promote soft approaches thereby enhancing native biodiversity, ecological and hydrological functions, and lakeshore aesthetics.

The Sam Slick Park Shoreline Restoration Plan also identifies educational opportunities related to shoreline restoration. Topics include, but are not limited to, fish habitat, erosion control, vegetation buffers, geese management, access point development and invasive species.

It is the opinion of Glenside Ecological Services Limited that through the adoption and implementation of the Sam Slick Park Shoreline Restoration Plan, not only will the shorelines of Sam Slick Park will be healthier, but the shorelines throughout the County will benefit, through the application of knowledge acquired by visitors of Sam Slick Park.



BIBLIOGRAPHY

- Canadian Wildlife Service, Environment Canada. (2010). *Handbook Canada and Cackling Geese: Management and Population Control in Southern Canada*. Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment,.
- Fisheries and Oceans Canada, Canadian Heritage Parks Canada, Ontario Ministry of Natural Resources, Conservation Ontario. (2000). *Working Around Water: What you should know about Fish Habitat and Shoreline Stabilization. Fact Sheet Version 2.0*.
- Flowers, D. (2015, 08 07). Management Biologist, Minden Field Office, Ontario Ministry of Natural Resources and Forestry. (G. E. Paul Heaven, Interviewer)
- Heydon, P. (2015, 10 21). Owner, Grow Wild Native Plant Nursery. (G. E. Paul Heaven, Interviewer)
- Klymko, A. (2015, 10 28). Lake Planning/Shoreline Stewardship Program Manager, Rideau Valley Conservation Authority. (W. B. Paul Heaven, Interviewer)
- Ministry of the Environment. (1984). *Head Lake*. unpublished.
- Muskoka Watershed Council. (2013). *Shoreline Vegetative Buffers*. Bracebridge: Muskoka Watershed Council.
- Ontario Federation of Anglers and Hunters. (n.d.). *Purple Loosestrife: What you should know, what you can do*. Retrieved 08 14, 2015, from Ontario's Invading Species Awareness Program: <http://www.invadingspecies.com/resources/publications/>
- Ontario Federation of Anglers and Hunters/ Ontario Ministry of Natural Resources and Forestry. (n.d.). *Invasive Honeysuckles*. Retrieved 08 14, 2015, from Ontario's Invading Species Awareness Program: <http://www.invadingspecies.com/invaders/plants-terrestrial/invasive-honeysuckles/>
- Ontario Ministry of Natural Resources. (2013, 03 11). *In-water Work Timing Window Guidelines*. Retrieved from ontario.ca/fishing
- Ontario Ministry of Natural Resources, Cataraqui Region Conservation Authority, Mississippi Valley Conservation, Quinte Conservation, Raisin Region Conservation Authority, Rideau Valley Conservation Authority, South Nation Conservation. (2011). *Solutions for Shoreline Erosion: A Basic Guide to Bioengineering. Version 1.0*. Rideau Valley Conservation Authority.
- Ontario Ministry of Natural Resources, Dufferin Simcoe Lake Stewardship Network. (2014). *Working Along the Shore: A Professional's Guide to Healthy Shoreline Management for Lake Simcoe*. Ontario Ministry of Natural Resources.
- Terrafix Geosynthetics Inc. (2013, 10). *Coir Mats and Logs*. Toronto, Ontario, Canada: Terrafix Geosynthetics Inc.



United States Department of Agriculture, Natural Resources Conservation Service. (2015, 09). *Plant Guide: Narrowleaf Cattail (Typha angustifolia)*. Retrieved from National Plant Data Center: <http://plant-materials.nrcs.usda.gov/intranet/pfs.html>



APPENDIX 1: SPECIES LIST

CLASS	SCIENTIFIC NAME	COMMON NAME	FAMILY	MNR	S_RANK
Actinopterygii					
	Ambloplites rupestris	Rock Bass	Centrarchidae		S5
	Ameiurus nebulosus	Brown Bullhead	Ictaluridae		S5
	Catostomus commersoni	White Sucker	Catostomidae		S5
	Couesius plumbeus	Lake Chub	Cyprinidae		S5
	Esox masquinongy	Muskellunge	Esocidae		S4
	Lepomis gibbosus	Pumpkinseed	Centrarchidae		S5
	Micropterus dolomieu	Smallmouth Bass	Centrarchidae		S5
	Micropterus salmoides	Largemouth Bass	Centrarchidae		S5
	Notropis hudsonius	Spottail Shiner	Cyprinidae		S5
	Perca flavescens	Yellow Perch	Percidae		S5
	Pimephales notatus	Bluntnose Minnow	Cyprinidae	NAR	S5
	Pomoxis nigromaculatus	Black Crappie	Centrarchidae		S4
	Sander vitreus vitreus	Walleye	Percidae		S5
Dicotyledoneae					
	Acer rubrum	Red Maple	Aceraceae		S5
	Acer x freemanii	(Acer rubrum X Acer saccharinum)	Aceraceae		SNA
	Achillea millefolium	Common Yarrow	Asteraceae		SNA
	Alnus incana	Speckled Alder	Betulaceae		S5
	Asclepias syriaca	Common Milkweed	Asclepiadaceae		S5
	Betula papyrifera	Paper Birch	Betulaceae		S5
	Brasenia schreberi	Watershield	Cabombaceae		S5
	Cichorium intybus	Chicory	Asteraceae		SNA
	Comarum palustre	Marsh Cinquefoil	Rosaceae		S5
	Cornus stolonifera	Red-osier Dogwood	Cornaceae		S5
	Euphrasia nemorosa	Common Eyebright	Scrophulariaceae		SU
	Euthamia graminifolia	Grass-leaved Goldenrod	Asteraceae		S5
	Eutrochium maculatum var. maculatum	Spotted Joe Pye Weed	Asteraceae		S5
	Fragaria virginiana	Wild Strawberry	Rosaceae		S5
	Fraxinus pennsylvanica	Green Ash	Oleaceae		S4
	Galium trifidum	Three-petalled Bedstraw	Rubiaceae		S5
	Hypericum canadense	Canadian St. John's-wort	Clusiaceae		S4?
	Impatiens capensis	Spotted Jewelweed	Balsaminaceae		S5
	Leucanthemum vulgare	Oxeye Daisy	Asteraceae		SNA
	Lonicera tatarica	Tartarian Honeysuckle	Caprifoliaceae		SNA
	Lycopus uniflorus	Northern Water-horehound	Lamiaceae		S5
	Lythrum salicaria	Purple Loosestrife	Lythraceae		SNA
	Mentha arvensis	Field Mint	Lamiaceae		S5
	Myrica gale	Sweet Bayberry	Myricaceae		S5



CLASS	SCIENTIFIC NAME	COMMON NAME	FAMILY	MNR	S_RANK
	<i>Nuphar variegata</i>	Variegated Pond-lily	Nymphaeaceae		S5
	<i>Nymphaea odorata</i> ssp. <i>odorata</i>	Fragrant Water-lily	Nymphaeaceae		S5?
	<i>Oenothera biennis</i>	Common Evening Primrose	Onagraceae		S5
	<i>Parthenocissus quinquefolia</i>	Virginia Creeper	Vitaceae		S4?
	<i>Persicaria amphibia</i> var. <i>stipulacea</i>	Flanged Smartweed	Polygonaceae		S5?
	<i>Pilosella aurantiaca</i>	Orange Hawkweed	Asteraceae		SNA
	<i>Plantago lanceolata</i>	English Plantain	Plantaginaceae		SNA
	<i>Plantago major</i>	Common Plantain	Plantaginaceae		S5
	<i>Rubus idaeus</i> ssp. <i>idaeus</i>	Common Red Raspberry	Rosaceae		SNA
	<i>Rubus setosus</i>	Small Bristleberry	Rosaceae		S4?
	<i>Salix bebbiana</i>	Bebb's Willow	Salicaceae		S5
	<i>Salix petiolaris</i>	Meadow Willow	Salicaceae		S5
	<i>Scutellaria galericulata</i>	Hooded Skullcap	Lamiaceae		S5
	<i>Solanum dulcamara</i>	Climbing Nightshade	Solanaceae		SNA
	<i>Solidago canadensis</i> var. <i>canadensis</i>	Canada Goldenrod	Asteraceae		S5
	<i>Solidago rugosa</i> var. <i>rugosa</i>	Northern Rough-leaved Goldenrod	Asteraceae		S5
	<i>Symphotrichum puniceum</i>	Swamp Aster	Asteraceae		S5
	<i>Thalictrum pubescens</i>	Tall Meadow-rue	Ranunculaceae		S5
	<i>Triadenum fraseri</i>	Fraser's St. John's-wort	Clusiaceae		S5
	<i>Tussilago farfara</i>	Colt's-foot	Asteraceae		SNA
	<i>Ulmus americana</i>	American Elm	Ulmaceae		S5
	<i>Utricularia vulgaris</i>	Greater Bladderwort	Lentibulariaceae		S5
	<i>Viburnum opulus</i> ssp. <i>trilobum</i>	Highbush Cranberry	Caprifoliaceae		S5
	<i>Vitis riparia</i>	Riverbank Grape	Vitaceae		S5
Monocotyledoneae					
	<i>Calla palustris</i>	Wild Calla	Araceae		S5
	<i>Carex aquatilis</i> var. <i>aquatilis</i>	Water Sedge	Cyperaceae		S5
	<i>Carex crinita</i>	Fringed Sedge	Cyperaceae		S5
	<i>Carex viridula</i>	Greenish Sedge	Cyperaceae		S5
	<i>Dulichium arundinaceum</i>	Three-way Sedge	Cyperaceae		S5
	<i>Elodea canadensis</i>	Broad Waterweed	Hydrocharitaceae		S5
	<i>Iris versicolor</i>	Harlequin Blue Flag	Iridaceae		S5
	<i>Phalaris arundinacea</i>	Reed Canary Grass	Poaceae		S5
	<i>Pontederia cordata</i>	Pickereel Weed	Pontederiaceae		S5
	<i>Potamogeton natans</i>	Floating Pondweed	Potamogetonaceae		S5
	<i>Potamogeton robbinsii</i>	Robbins' Pondweed	Potamogetonaceae		S4S5
	<i>Sagittaria latifolia</i>	Broad-leaved Arrowhead	Alismataceae		S5
	<i>Scirpus cyperinus</i>	Cottongrass Bulrush	Cyperaceae		S5
	<i>Sparganium eurycarpum</i>	Broad-fruited Burreed	Sparganiaceae		S5
	<i>Typha angustifolia</i>	Narrow-leaved Cattail	Typhaceae		SNA
	<i>Typha latifolia</i>	Broad-leaved Cattail	Typhaceae		S5
Pinopsida					
	<i>Larix decidua</i>	European Larch	Pinaceae		SNA



CLASS	SCIENTIFIC NAME	COMMON NAME	FAMILY	MNR	S_RANK
	<i>Picea glauca</i>	White Spruce	Pinaceae		S5
Filicopsida					
	<i>Onoclea sensibilis</i>	Sensitive Fern	Dryopteridaceae		S5
Equisetopsida					
	<i>Equisetum arvense</i>	Field Horsetail	Equisetaceae		S5
	<i>Equisetum variegatum</i>	Variegated Horsetail	Equisetaceae		S5

