

SOUTH NATION  
CONSERVATION  
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# 2018 Summary Report: Regional Biodiversity Funding Program

Ontario Power Generation

SOW # 2017-JW-01-02





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## Executive Summary

South Nation Conservation received funds from the OPG Regional Biodiversity Funding Program to partner with the United Counties of Prescott-Russell (UCPR) for a combined lakes/rivers and wetlands restoration project in Larose Forest for the 2017-2019 period. Larose Forest is owned and managed by the United Counties of Prescott-Russell who operate the forest for recreation, timber production and wildlife. All activities occurred within Lots 26-27, Concession 5, of Clarence Township. This section of Larose Forest is partially Red Pine plantation, with areas of natural re-growth.

SNC is working with UCPR to restore an area that was planted as a Red Pine plantation that experienced localized die-off due to wet conditions. A 0.5-hectare salvage cut completed five years ago created an opportunity for SNC to develop a project that consists of wetland restoration, channel naturalization, and an increase to native plant biodiversity. Activities outlined by year include:

Year 1: Establish baseline conditions of the site, site preparation, design and restore approx. 1,500 meters of channel re-configuration.

Year 2: Site preparation of salvage cut, design and excavation of vernal pools and design of planting scheme.

Year 3: Site stabilization of excavated area with native plantings/seeding, communications and outreach, and effectiveness monitoring.

Activities completed in Year-1 included an inventory of plants at the site, design of the restored channels, brushing, and clearing along the channels for access, and restoring the channels following the prepared design.

Year-2 began with monitoring in Spring of 2018 and continued throughout the year. Frogs and salamanders were observed to be using the newly excavated drains. Egg masses of several species were documented. Changes in vegetation along the drains also occurred. Dormant species emerged within the newly excavated site which allowed sun to penetrate down to the soil layer. Pink Ladyslipper Orchids bloomed on the shoreline where the excavation disturbed the soils and canopy vegetation was removed.

Year-2 also saw the excavation of the Pit & Mound Micro-topography. More than 100 Red Pine stumps in the salvage-cut zone were excavated. The Operator pulled the stumps toward him using the shovel blade, effectively up-rooting them, and flipped them over so that the stump was either resting on its side (90° angle from original position) or cut-side down. Typically, a bit more soil was excavated from the pit and the soils were

placed on top of the stumps or right beside it. The soils consisted mainly of sand, with clay and organics interspersed or mixed. Potted stock was brought in to the project site and planted within the salvage cut area. Shade tolerant species were planted where vegetation was left untouched by excavation. Part sun and full-sun species were planted in the excavated areas where the canopy opening was suitable. Native grasses were seeded in November onto any remnant exposed soils.

Year-3 will consist of survival assessments of all planted materials, documenting the Pit & Mound Micro-topography for wildlife observations and plant emergence and survival. Replacement vegetation will be purchased to fill-in any that didn't survive the 2018 drought. Measures to control invasive Phragmites (*Phragmites australis*) and Buckthorn (*Rhamnus* spp.) will also take place in 2019.

## 1.0 Introduction

### South Nation Conservation

South Nation Conservation (SNC) has a strong history in watershed management and leadership in applying sustainable practices. As an agency established under the Conservation Authorities Act of Ontario in 1947, SNC has decades of practical experience in protecting our environment and engaging communities. Today, SNC employs more than 40 staff while leading hundreds of stewardship projects to success, throughout a 4,384 km<sup>2</sup> jurisdiction in Eastern Ontario.

#### *Vision*

'Improved Water Quality for a Healthy Ecosystem: Our vision encompasses water levels which satisfy the needs of humans and the environment, healthy rivers and natural shorelines, and safe wastewater management practices.'

#### *Expertise*

Conservation is our core competency. SNC offers natural resource management expertise and experience to help our partners contribute to a healthy region. These contributions include forest, wetland, wildlife, fisheries, urban trees, floodplain, natural hazards and water management. Community education and awareness initiatives are also an important component of our conservation efforts.

#### *Working Together*

As one of Ontario's 36 Conservation Authorities, SNC protects and restores regional ecosystems. We do this in partnership with 16 Municipalities, comprising portions of: United Counties of Prescott and Russell; United Counties of Stormont, Dundas and Glengarry; United Counties of Leeds and Grenville; and the City of Ottawa. The member municipalities appoint a 12-member, plus past chair, Board of Directors to govern all of SNC's work.

SNC's mandate to manage the natural resources in its jurisdiction includes the following primary roles:

*Water Resources Management* – SNC manages water resources using integrated, ecologically sound environmental practices to maintain secure supplies of clean water, to protect communities from flooding and to ensure that environmental planning is an integral part of community development.

*Forest Resources Management* – SNC manages a large forest resource using sound sustainable forest management practices involving agriculture and wildlife habitat improvements which contribute to the health of the watershed's natural environment.

*Lifelong Education and Recreation* – SNC creates educational and recreational experiences in natural environments that enrich the lives of people of all ages by instilling awareness and appreciation of the watershed's natural heritage.



### Current Drainage Scheme

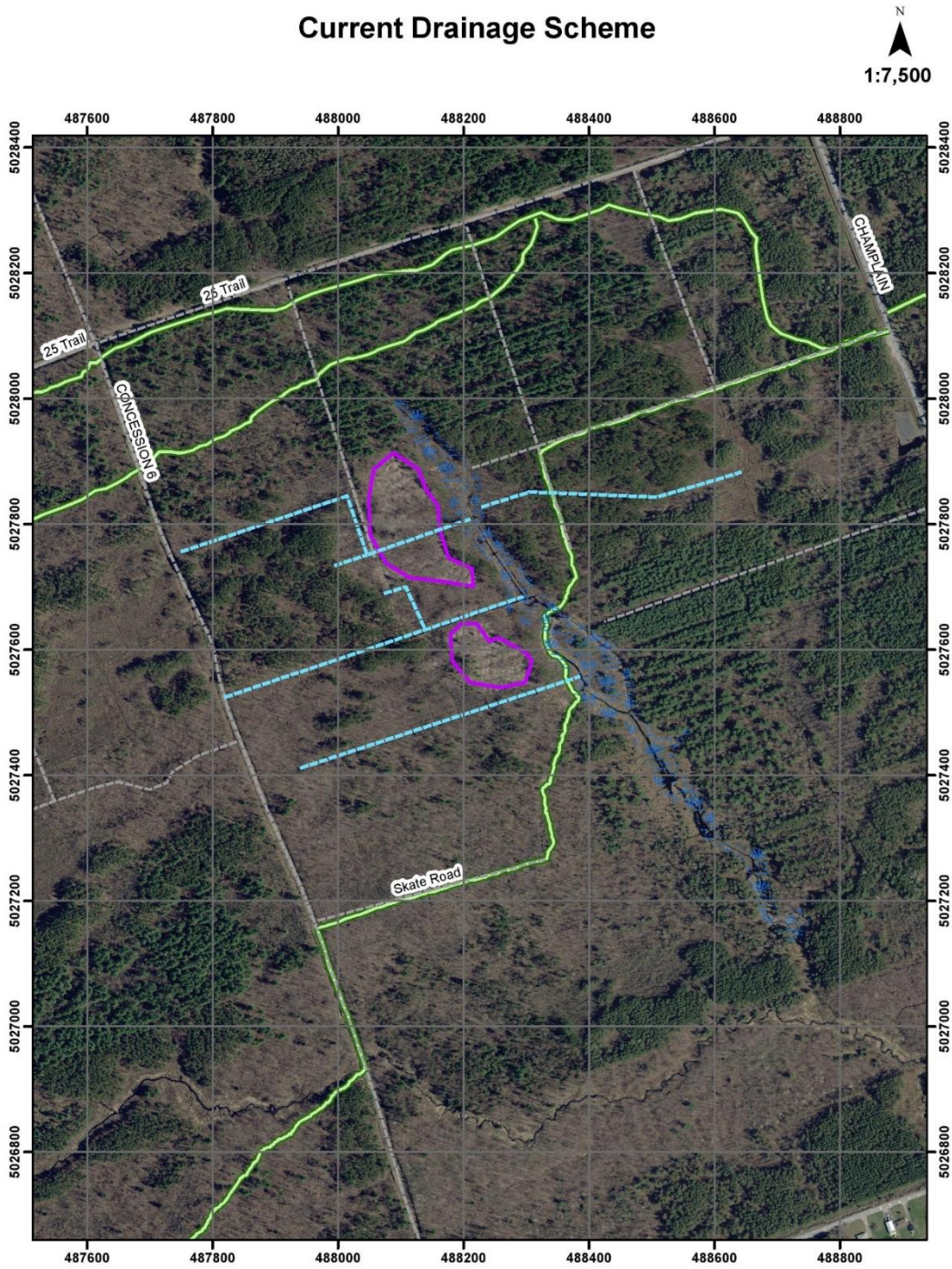


Figure 1 Salvage cut areas outlined in pink line show their relative position east of Concession 6 Road, south of trails (green line) and drainage ditches (dashed blue line) that were excavated in 2017.

## 2.0 2018 Deliverables

Year-2 activities focused on the salvage cut area, see Figure 1. The 0.5-hectare area was formerly part of a Red Pine plantation that succumbed to flooding over 5 years ago. The trees were cut to salvage what could be sold. Many were left standing as the rot was too far gone to salvage any lumber. The regrowth is predominantly Red Maple, with White Meadowsweet, Steeplebush, White Pine, and Nannyberry common throughout.



*Figure 2 Stump from salvaged Red Pine shows approximate size, prior to Pit & Mound construction.*

Pit & mound topography describes the forest floor where strong winds have caused several trees to be blown-over. The resulting landscape has pits from where the tree's root-ball was ripped out of the ground, and the mound is made-up of the tree's root ball and bole that lay and rot on the ground. There is a mixing of organic soil and mineral layers that takes place as the tree roots are ripped out of the ground. This effect has an important influence on the plant establishment and survival. As the disturbance progresses over time, vegetative succession and the establishment of a natural plant community unfold.

The construction of pit & mound topography was undertaken using a small excavator. Construction began on July 25<sup>th</sup> and was completed on July 26<sup>th</sup>. More than 120 Red Pine stumps, as in Figure 2, were inverted for the purpose of creating pit & mound topography. The methodology was outlined in the Request for Quote that was circulated to the contractors, see Appendix A. The Excavation Operator cleared each stump of overgrowth using the shovel to scrape and push-away small shrubs, trees, and vegetation. The blade of the shovel was pushed into the earth around the base of the stump, in approximately a 3-metre radius to cut the roots. Then a bucket or two of soil was removed in the spot where the stump would be tipped into to stabilize the stump in the inverted position. The Operator grabbed the far side of the stump and pulled it towards the tractor, into the ready hole. Then another one or two buckets of soil were pulled from the hole left by the stump to provide extra planting medium for the planting phase of the project and to deepen the pit, as in Figure 3. The pit depths vary from 70 cm to 150 cm.



*Figure 3 Completed Pit & Mound: red pine stump is pulled from ground and flipped onto its side. Soil is excavated from the pit to further deepen it.*

## 2.1 Biodiversity Specifics

A Bio-blitz is an event where naturalist and scientist volunteers concentrate in a defined area to find and identify as many species as possible, within a set amount of time. Typically, it is a 24-hour period. Members of the Ottawa Field Naturalists Club (OFNC) have undertaken four Bio-blitzes at Larose Forest and these have contributed significantly to the species inventory of four different compartments within Larose Forest. In addition to the UCPR Larose Forest Inventory lists, the bio-blitz inventories were helpful for selecting species that are native but not known to occur in Larose forest.

Consultation with Christine Hanrahan, the principal organizer of the Larose Forest Bio-blitzes regarding native species introductions proved to be invaluable. Mrs. Hanrahan has extensive knowledge and insight about plants and provided her opinion about species that might or might not do well in Larose Forest. Peggy Pike-Thompson and Henry Lickers from the Mohawk Council of Akwesasne – Department of the Environment, as well as Larry and Francis McDermott from Plenty Canada (Indigenous Resource Centre) also received my list of suggested species. These contacts felt that the species would be beneficial with medicinal value.

Tables 1 and 2 list the species that were planted in the salvage cut area once the Pit & Mound Topography construction was completed. Species in Table 1 are the species selected for suitability based on the Salvage Cut area. Plants listed in Table 2 are mainly the desired species but also include the remainder of Peter Fuller's (tree nursery owner) propagated stock which are comprised of a few already-present species, such as Red & White Pine, plus a few that may not suit the site, (e.g. the Spreading Juniper and the American Bladdernut.) In total, 1,016 potted stock were planted in the project site.

In terms of biodiversity, at the site level, 30 of the 38 planted species were not previously accounted for within the salvage cut area prior to plantings. Of these 38 species, 20 are new to Larose Forest, in that they have not been documented in either the UCPR Forest Inventory Data, or the OFNC bio-blitz inventories.

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Table 1 Native tree, shrub and plant orders by nursery with size, numbers and cost.

Species Name	Pot Size	Source	Numbers available	Cost/unit	TOTAL Cost
Blue Beech	2 gallon pot	Natural Themes	6	\$ 8.85	\$ 53.10
Buttonbush	2 gallon pot	Natural Themes	25	\$ 8.85	\$ 221.25
Highbush Cranberry	2 gallon pot	Natural Themes	20	\$ 8.85	\$ 88.50
Nodding Wild Onion	3 or 4 inch pot	Natural Themes	30	\$ 2.65	\$ 79.50
Round-headed Bush-clover	3 or 4 inch pot	Natural Themes	9	\$ 2.65	\$ 79.50
Spicebush	2 gallon pot	Natural Themes	10	\$ 8.85	\$ 88.50
Tamarack	2 gallon pot	Natural Themes	50	\$ 8.85	\$ 442.50
Wild Blue Phlox	3 or 4 inch pot	Natural Themes	5	\$ 2.65	\$ 13.25
			<b>Natural Themes</b>	<b>Total</b>	<b>\$ 1,066.10</b>
Hackberry	3 gallon	Ferguson	3	\$ 19.00	\$ 57.00
Hackberry	5 gallon	Ferguson	9	\$ 35.00	\$ 315.00
Sweet Gale	2 gallon pot	Ferguson	2	\$ 10.50	\$ 21.00
Sweet Gale	1 gallon pot	Ferguson	98	\$ 9.00	\$ 882.00
			<b>Ferguson</b>	<b>Total</b>	<b>\$ 1,275.00</b>
Blue Flag Iris	10 cm	Grow Wild	50	\$ 2.00	\$ 100.00
Canada wild Rye	10 cm	Grow Wild	50	\$ 2.00	\$ 100.00
Cardinal Flower	10 cm	Grow Wild	50	\$ 2.00	\$ 100.00
Great Blue Lobelia	10 cm	Grow Wild	50	\$ 2.00	\$ 100.00
Hackberry	2 gallon pot	Grow Wild	50	\$ 8.00	\$ 400.00
Large Flowered Trillium	10 cm	Grow Wild	50	\$ 5.00	\$ 250.00
Oswego Tea	10 cm	Grow Wild	30	\$ 2.00	\$ 60.00
Spicebush	1 gallon pot	Grow Wild	50	\$ 6.00	\$ 300.00
Sweet Flag	10 cm	Grow Wild	50	\$ 2.00	\$ 100.00
			<b>Grow Wild</b>	<b>Total</b>	<b>\$ 1,510.00</b>
Blue Beech	5 gallon pot	Verbinnen	2	\$ 29.50	\$ 59.00
Witch Hazel	2 gallon pot	Verbinnen	5	\$ 10.91	\$ 54.55
Witch Hazel	7 gallon pot	Verbinnen	5	\$ 62.53	\$ 312.65
Tamarack	2 gallon pot	Verbinnen	1	\$ 10.62	\$ 10.62
Tamarack	7 gallon pot	Verbinnen	1	\$ 34.80	\$ 34.80
Bayberry	1 gallon pot	Verbinnen	20	\$ 7.03	\$ 140.60
American Hophornbeam	3 gallon pot	Verbinnen	16	\$ 21.23	\$ 339.68
Swamp White oak	5 gallon pot	Verbinnen	19	\$ 22.12	\$ 420.28
Eastern Hemlock	3 gallon pot	Verbinnen	25	\$ 21.23	\$ 530.75
Downy Arrowwood	1 gallon pot	Verbinnen	9	\$ 5.88	\$ 52.92
Nodding Wild Onion	2X5 in plug	Verbinnen	100	\$ 2.18	\$ 218.00
			<b>Verbinnen Total</b>		<b>\$ 2,173.85</b>

Table 2 Peter Fuller Nursery was down-sizing and provided a variety of native plant material at bargain-rates.

Name	Species	Amount/size	Cost
black chokeberry	Aronia melanocarpa	tray of 15/ 10 cm	\$ 45.00
American bladdernut	Staphylea trifolia	tray of 15/ 10cm	\$ 45.00
American hophornbeam	Ostrya virginiana	7 X 2gal	\$ 70.00
Ninebark	Physocarpus opulifolius	8 clumps	\$ 80.00
Ninebark	Physocarpus opulifolius	6 X 1 gal	\$ 30.00
Tamarack	Larix laricina	2 X 1 gal	\$ 10.00
Spreading Juniper	Juniperus communis v dep	7 X 10cm	\$ 21.00
Grey Dogwood	Cornus racemosa	6 X 15cm	\$ 18.00
Northern bush honeysuckle	Diervilla lonicera	4 X 1 gal	\$ 20.00
Chokecherry	Prunus virginiana	3 X 1 gal	\$ 12.00
Sandbar Willow	Salix exigua	3 X 1 gal	\$ 12.00
Sand Cherry	Prunus pumila	3 X 1 gal	\$ 12.00
American Bittersweet	Celastrus scandens	1 x 1 gal	\$ 4.00
American Mountain Ash	Sorbus americana	9 X 10 cm	\$ 18.00
Bebb's Willow	Salix bebbiana	pot of 10 rooted cuttings	\$ 5.00
Northern Wild Raisin	Viburnum cassinoides	3 x 1 gal	\$ 18.00
Red Pine	Pinus resinosa	7 X 3-4'	\$ 40.00
White Spruce	Picea glauca	5 X 3'	\$ 40.00
Swamp Rose	Rosa palustris	2 X 1 gal	\$ 6.00
			\$ 506.00

### 3.0 Planting Scheme

The potted stock arrived in batches as each nursery delivered to the remote Concession 6 roadside in Larose. The first delivery arrived on August 14<sup>th</sup> and the last on August 29<sup>th</sup>. Each delivery had to be manually unloaded, pot-by-pot, inspected and carefully loaded into a small trailer that was hauled by ATV to the project site. A drought during this period exacerbated the process of moving and storing the potted stock. Air temperatures were in excess of 30 degrees Celsius, with humidex factors pushing it into the low 40's. Daily watering of the potted stock was undertaken using backpack fire pumps and 20 litre jugs with watering cans, see Figure 4.



*Figure 4 A summer student is helping with the daily watering of potted stock using a backpack fire pump to keep the plants hydrated.*



Site planting instructions were provided to the Contract Planter to provide guidance on the site requirements for each plant species. See Appendix A for the Planting Instructions. Plantings were undertaken throughout the salvage cut plantation and in adjacent stands within the remaining Red Pine. Plants suitable for the excavated, small pools include Blue Flag Iris, as in Figure 5, with Swamp White Oak placed in adjacent, low-lying areas, as an example. Planting of the potted stock began on September 4<sup>th</sup> and continued up to September 14<sup>th</sup>, 2018.

Construction of the pit & mound topography adds habitat diversity. To encourage more amphibians to lay eggs in the newly created ponds of the pit & mound topography, fallen tree branches and other woody material are added to the pond. See Figure 5, the pool is approximately 2 metres wide and 70 cm deep. In 2018, amphibians were found to be using the excavated channels. It was noted that the amphibians were mainly using the twigs and fallen branches within the water course on which to adhere their eggs, see Figure 6.

In November, two students from Tagwi Secondary School, (Avonmore, ON) helped distribute 25 kg of native grass seeds. SNC took part in Take Our Kids to Work Day and hosted both students, see Figure 7. We also had four students from St Lawrence College, Cornwall Campus, volunteer at SNC, as part of their required placement. The students helped conduct amphibian, plant and bird monitoring in the spring of 2018. The 2018 monitoring data is compiled in Appendix C.



*Figure 5 A Blue Flag Iris is planted in the slope of the excavated pit. Small woody branches are added to the pool to encourage amphibians to lay eggs in the pool.*



*Figure 6 Spring 2018 observations: amphibian egg masses cling to a twig that fell into the excavated water course.*



*Figure 7 Hallie Cutler (left) and Corinne Anderson (right) help sow grass seed in Larose, November 2018.*

## 4.0 2018 Budget Summary

Table 3 presents the revised 2018 budget showing the carry-over of unspent funds from 2017.

YEAR 2	Total	OPG	SNC		Other Partners	
		Cash	Cash	In-kind	Cash	In-kind
<b>Materials, Supplies, Contracted Services</b>	<b>\$58,000</b>	<b>\$58,000</b>				
<b>Outreach and Education</b>	<b>\$6,953</b>	<b>\$6,953</b>				
<b>Other (monitoring, transportation, volunteer planting, office equipment, financial and senior management support).</b>	<b>\$56,329</b>	<b>\$35,079</b>	<b>\$11,000</b>			<b>\$10,250</b>
<b>Contingency</b>	<b>\$7,000</b>		<b>\$7,000</b>			
<b>TOTAL</b>	<b>\$128,282</b>	<b>*\$100,032</b>	<b>\$18,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$10,250</b>

Table 3 \*The \$100,032 includes carry-over of unspent funds in 2017.

Item	Proposed	Actual
<b>Materials, Supplies, Contracted Services</b>	<b>\$58,000</b>	<b>\$21,872.78</b>
<b>Outreach &amp; Education</b>	<b>\$6,953</b>	<b>\$0</b>
<b>Other (monitoring, transportation, etc.)</b>	<b>\$56,329</b>	<b>\$42,954.5</b>
<b>Contingency</b>	<b>\$7,000</b>	<b>\$0</b>
<b>Total</b>	<b>\$128,282</b>	<b>\$64827.28</b>

Table 4 Actual expenditures were much lower than proposed, due in part to the excavation of the pit & mound topography costing much less than anticipated.

## 5.0 2019 Project Deliverables

Year-3, the final year of the OPG Larose Biodiversity Project concludes with monitoring as the primary activity. The following activities are scheduled, beginning in Spring of 2019:

- Amphibian monitoring in the excavated drains;
- Amphibian monitoring in the constructed pit & mound topography;
- Plant survival assessments of planted stock;
- Replacement plantings of dead plant stock;
- Targeted invasive alien management: Buckthorn and Phragmites; and
- Education & Outreach: video, website content, student activities.

## Appendix A – Pit & Mound Topography

### Constructed Pit & Mound Topography

Construction Design Objectives: To re-create a naturally occurring forest disturbance, that of a wind-throw. In a natural wind-throw, high winds can knock-over trees; the tree pulls free from the ground which causes the roots to pull up a layer of soil.



*Figure 8 High winds can cause a tree to become up-rooted. The result is a pit where the root ball left a hole and then a mound is created by the root ball and tree bole. Over time, the tree decomposes leaving what is termed "pit & mound micro topography".*

In Lots 26-27, Concession 5 of the former Clarence Township, within Larose Forest, see Figure 2, there are two salvage cut areas in the red pine plantation approximately 0.5-hectare total that provide an opportunity to create pit & mound topography. In the constructed pit & mound topography, excavation of the remaining tree stumps and burying of woody slag will simulate an area of wind-throws.

Five Pit & Mound sites are to be created in each salvage cut area with a total of 10. Site prep that will take place prior to the excavation include site assessments, design, slag cutting and tree stump site marking. Site marking will identify the areas where the tree stump excavations will take place. The mounds will consist of the Red Pine stumps that will be pulled out (up-rooted) and mounded with soil excavated from the hole where the stump is removed. This hole then creates the pit.

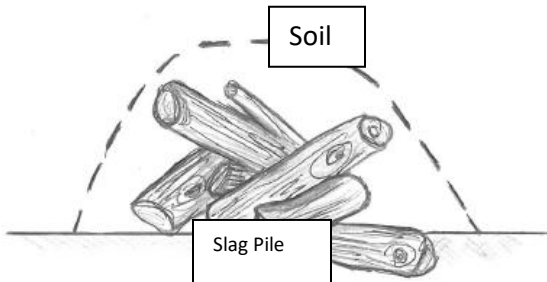
Figure 2 shows the placement of the pits and mounds relative to the salvage cut areas, slag piles, streams and project boundary. To minimize the damage to streams and local vegetation, a site progression route is indicated. The Excavation Operator is expected to follow this route and progress on the path as indicated, from the north heading in a southerly direction. The Project Site will be entered from the north end of Concession 6 Road, near trail 25, and exit at Concession 6 Road.



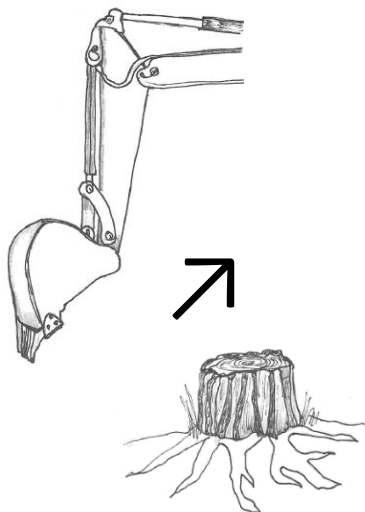


**Pit & Mound Construction Instructions:**

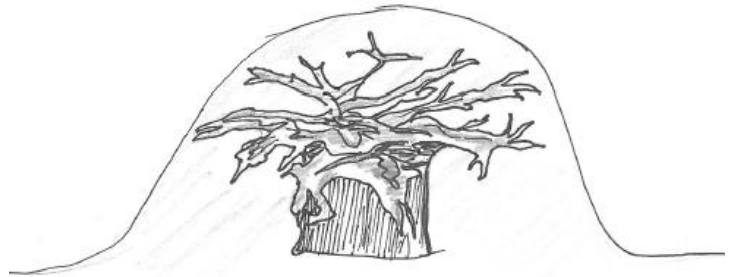
The mound is constructed by covering slag piles and inverted stumps with soil excavated adjacent to the pile. The excavated materials from the pit are piled onto the woody materials.



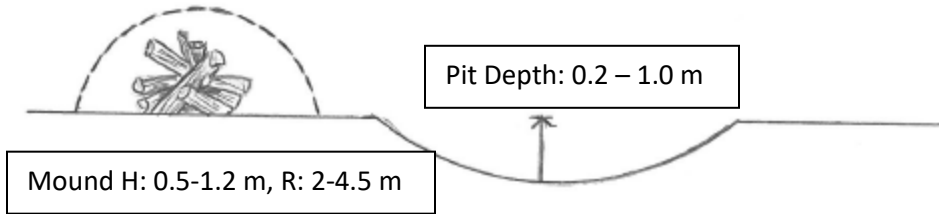
Inverted stump is covered with approximately 30 cm of soil and compacted.



Use bucket to flip over stump.



The mounds should range in height from 0.5 to 1.2 metres, with a maximum height of 1.5 metres. The radius of the pile should range from 2 to 4.5 metres. The mounds do not have to be circular. The soil should be well compacted to limit air pockets within the mound. The pit depth should range from 0.2 to 1.0 metres and should not exceed 1.5 metres in depth. The size of the pit can range from 2 to 15 metres in radius. The side slopes should be 2:1 or more to limit erosion or soil movement.



Tree Stumps and Slag Piles: Construction of the pits and mounds on the Larose project Site will be located as indicated by the flagging tape. The tree stumps and slag piles to be covered with soil will be flagged. A project site review for the construction workers will be mandatory prior to the construction date.

Tree Damage: Upon completion, plantation trees damaged by the Excavation Operator will be assessed and valued by a certified Forester. The total value will be deducted from the owing amount to the Contractor/Company responsible for the work.

## Appendix B – Site Requirements by Plant Species

### Potted Stock Planting Project in Larose Forest

#### Planting Specs and Details

Dated: August 13, 2018

Background: A Biodiversity project that involves planting native trees, shrubs and plants in a red pine plantation in Larose Forest where a salvage cut occurred approximately 7 years ago. In July 2018, the remnant red pine stumps were dug up and flipped over to simulate a wind-throw (trees knocked over by strong winds). The forest floor was excavated to create pits and mounds, where the stumps and holes create a diverse topography for different kinds of vegetation. Planting and seeding will take place in the excavated areas, as per the Planting Instructions.

#### Planting Portion:

The native stock purchased for this project includes\*:

Hackberry	Witch hazel	Wild Leek
Buttonbush	Canada Wild Rye	Black Walnut
Sweet Gale	Tamarack	Spicebush
Blue Flag Iris	Northern Bayberry	Tamarack
Cardinal Flower	A. Hophornbeam	Wild Blue Phlox
Blue Beech	Swamp White Oak	Great Blue Lobelia
Black Chokeberry	Eastern Hemlock	Large-flowered trillium
Highbush Cranberry	Downy Arrowwood	Oswego Tea
Nodding Wild Onion	Sweet Flag	Round-headed Bush-clover

\*some additional species may be added, if available at the time of purchase.

Planting Instructions: Plant pot sizes range from 10 cm pots up to 5 gallons. Approximately 1,520 plants are included in this planting project, with the majority being in 2 and 3-gallon pots. Plantings are based on the habitat suitability for each species, as outlined. The site requirements for each species is briefly described herein and is to be applied at planting. The project site is a composition of shade, semi-shade and open areas. There are standing, dead Red Pine, up to 20 metres in height throughout, which are remnants from the salvage cut that were deemed unsalvageable at the time of cutting. Please use caution while working around the dead trees as they may fall during high winds or if pushed upon. The project site soil is moist to fresh, with wet areas from remnant agricultural ditches and the pits created during excavation. There is a combination of sand and clay under the relatively shallow organic litter layer. There are higher-ground areas that are drier, mainly towards Concession 6 Road, with wetlands at

the most easterly extent of the project site. The project site soil analysis results are also provided for your reference.

Nodding Onion *Allium cernuum*: It grows in dry woods, rock outcroppings, and prairies, also occurs in rocky soils on glades, bluff edges, open woods and slopes. Grows in average, dry to medium, well-drained soil in full sun to light shade. Best in full sun but appreciates some light afternoon shade in hot summer climates. Best in sandy loams.

Blue Flag Iris (*Iris versicolor*): It is common in sedge meadows, marshes, and along streambanks and shores.

Round Headed Bushclover *Lespedeza capitata*: In the wild this plant grows in wooded areas, on prairies, and in disturbed habitat such as roadsides.

Cardinal Flower *Lobelia cardinalis*: requires rich, deep soil which remains reliably moist year-round.

Great Blue Lobelia *Lobelia siphilitica*: Growing up to three feet tall, it lives in zones 4 to 9 in moist to wet soils.

Large White Trillium *Trillium grandiflorum*: found in rich, mixed upland forests, notably deciduous woodland which it favours. Favours well-drained, neutral to slightly acid soils, usually in second- or young-growth forests. In the Northern parts of its range it shows an affinity for maple or beech forests but has also been known to spread into nearby open areas.

Highbush-cranberry, *Viburnum trilobum*: Native to moist woods, lake margins, thickets and moist low places, Highbush Cranberry is easily grown in average, moist, well-drained soils in full sun to part shade. It prefers consistent moisture but tolerates a wide range of soils.

Swamp White Oak, *Quercus bicolor*: The swamp white oak generally occurs singly in four different forest types: black ash-American elm-red maple, silver maple-American elm, bur oak, and pin oak-sweetgum. The swamp white oak typically grows on hydromorphic soils. It is not found where flooding is permanent, although it is usually found in broad stream valleys, low-lying fields, and the margins of lakes, ponds, or sloughs.

Blue Beech, *Carpinus caroliniana*: It is a shade-loving tree, which prefers moderate soil fertility and moisture. It has a shallow, wide-spreading root system.

American Hophornbeam, *Ostrya virginiana*: Easily grown in average, medium, well-drained soil in full sun to part shade. Often occurs in dry soils on rocky slopes, upland woods and bluffs throughout its range.

Hackberry, *Celtis occidentalis*: Best grown in moist, organically rich, well-drained soils in full sun. Tolerates part shade. Also tolerates wind, many urban pollutants and a wide range of soil conditions, including both wet, dry and poor soils.

Buttonbush (*Cephalanthus accidentalis*): Buttonbush is a common shrub of many wetland habitats in its range, including swamps, floodplains, riparian zones, and moist forest understory.

American Witch Hazel (*Hamamelis virginiana*): Easily grown in average, medium moisture, well-drained soils in full sun to part shade. Best flowering in full sun. Prefers moist, acidic, organically rich soils. Tolerates heavy clay soils.

Downy Arrowwood (*Viburnum rafinesquianum*): Downy Arrow-wood is found in forest understories and along woodland margins. In heavier shade it is somewhat sparse but in the open can form dense, shrubby thickets. Downy arrowwood grows best in full sun to partial shade. It will grow in a range of soil types.

Northern Bayberry (*Myrica pensylvanica*): Easily grown in average, dry to medium, well-drained soils in full sun to part shade. Prefers moist, peaty or sandy, acidic soils, but tolerates a wide range of soils and growing conditions, including poor soils, wet soils, drought, high winds and salt spray (seashore or road salt conditions). Groupings of plants need a least one male plant to facilitate pollination of the female plants and subsequent fruit set.

Black Walnut (*Juglans nigra*): Walnut grows best on sandy loam, loam, or silt loam type soils but will also grow well on silty clay loam soils. It prefers these soils since these soils hold large quantities of water, which the tree draws from during dry periods.

Tamarack (*Larix laricina*): Tamarack can tolerate a wide range of soil conditions but grow most commonly in swamps, bogs, or muskeg in wet to moist organic soils such as sphagnum peat and woody peat. They are also found on mineral soils that range from heavy clay to coarse sand; thus, texture does not seem to be limiting.

Sweet Flag (*Acorus calamus*): Habitats include edges of small lakes, ponds and rivers, marshes, swamps, and wetlands.

Wild Leek (*Allium tricoccum*): Wild Leek prefers typical woodland conditions: medium wet to medium dry soil and full to partial shade.

Oswego Tea (*Monarda didyma*): It grows best in full sun, but tolerates light shade and thrives in any moist, but well-drained soil.

Spicebush (*Lindera benzoin*): Within its native range it is a relatively common plant where it grows in the understory in moist, rich woods, especially those with exposed limestone.

Sweet Gale (*Myrica gale*): It typically grows in acidic peat bogs, and to cope with these difficult nitrogen-poor growing conditions, the roots have nitrogen-fixing actinobacteria which enable the plants to grow.

The project site is mainly dominated by red maple and the understory has a mixture of forbs and flowering shrubs, including steplebush, meadowsweet, sensitive ferns, starflower, three-leaf Solomon's-seal and bearded short-husk (grass).

Mycorrhizal powder is supplied for adding to the root balls upon planting. A site meeting can be scheduled before submitting a quote so that site conditions are known before quoting. A site map is included that shows the basic project site layout. Planting can take place anywhere within the salvage cut/ project site, as per the plant requirement. Although, all the plants selected are relatively well-suited to the project site. The Project Coordinator will be on-site daily during the planting work to provide direction, if needed.

## Appendix C – 2018 Monitoring Data



Figure 9 Monitoring photos from April 13, 2018: From top to bottom, left to right: Turkeytail moss, middle drainage ditch looking east, slime mold, Mirica Gale, invasive *Phragmites australis* patch, lichen, *Gammarus* spp., Gold thread, acarina, moose teeth scrapings on red maple, *Gammarus*, mouth of ditch looking east, middle ditch looking east, and *Pyrrharctia Isabella* woollybear caterpillar.





Figure 10 Monitoring observations from April 26 2018: Top to bottom left to right: moose dung found on project site, DOR Eastern Newt, moose tracks, amphibian egg masses, DOR spring peeper, Slime Flux on Red Maple, several egg masses in constructed ditches, adult Blue-spotted salamander caught in constructed ditches, Wintergreen (*Gaultheria procumbens*), St Lawrence College students Tavish MacLeod and Emily Vanveen, Springtails (*Collembola*), and north drain looking east.