

**Ecological Restoration Plan  
for  
Westminster Ponds/Pond Mills ESA  
Saunders Cabin Area Ecological Restoration Plan**



Prepared by:  
**St. Williams Nursery & Ecology Centre**  
**885 Hwy 24 West**  
**St. Williams Ontario**  
**NOE 1P0**

Prepared for:  
**Linda McDougall**  
**Ecologist**  
**Environmental & Parks**  
**Planning Services**  
**519-661-2500 x 6494**

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## 1.0 Introduction

The City of London and its conservation partners are currently undertaking a project to protect and enhance Westminster Ponds/Pond Mills Environmentally Significant Area (ESA) consistent with the Conservation Master Plan (CMP), including the installation of an accessible trail, accessible boardwalk and ecological restoration in the vicinity of the Saunders Cabin site, adjacent to Saunders Pond located near the City of London's Tourism Building. The ESA is the largest natural area in the City of London, covering approximately 250 hectares and is significant for its size, variety of natural habitats, and unique "kettle" ponds, all within an urban setting. The ESA is also identified by the Province as an Area of Natural and Scientific Interest and the ponds form a Provincially Significant Wetland complex. The ESA is located within the Mount Elgin Ridges physiographic region consisting of clay till, within the hummocky topography of the Ingersoll Moraine.

The proposed location of the accessible trail and boardwalk and the approximate extent of the associated ecological restoration works are illustrated in Figure 1. The ecological restoration project area includes approximately 3.5 hectares within the ESA, east of Wellington Road and south of Saunders Pond. The historic cabin site of the naturalist W. E. Saunders is located within the limits of this ecological restoration area. The existing habitat and conditions within the project area have been described in the Westminster Ponds/Pond Mills ESA: Ecological Inventory & Management Zone Report Volume 1 by North South Environmental (City of London, 2015) which included comprehensive field inventories examining natural communities, wildlife, and invasive species. Volume 2 of the report includes the Hydrological Investigation; Water Quality Monitoring and Paleolimnology Study.

The project area is a mix of deciduous swamp forest, upland deciduous forest, shrub thicket and open meadow that has been severely degraded with the invasion of alien species, especially common buckthorn (*Rhamnus chathartica*) and glossy buckthorn (*Frangula alnus*). In addition, there are many dead, and potentially hazardous ash trees (*Fraxinus*), which have succumbed in recent years due to the emerald ash borer epidemic that has killed much of the ash population in southwestern Ontario. The loss of the ash has also allowed the rapid proliferation of the buckthorn in the ESA creating dense thickets of the thorny small trees. Buckthorn invasions out-compete native plants, reduce biodiversity, and degrade the quality of wildlife habitat. Common buckthorn is listed as a noxious weed in Ontario's Weed Control Act. London's Urban Forest Effects Model (UFORE), 2012 report identified that 19% of the trees in London are buckthorn and about 10% are (or were) white and green ash.

## 2.0 Saunders' Cabin Area Ecological Restoration Plan

Ecological restoration is a process that occurs over a period of time and each site will change as it proceeds through its own unique restoration trajectory. The time period required to achieve the desired ecological outcomes depends on many factors such as how degraded the site is and what the ultimate restoration goals and objectives are. For example, restoration of a mature old growth forest starting from a degraded abandoned agricultural field site may take well over a century to achieve such an ecological state.

## 2.1 Objectives

The focus of the ecological restoration works for the Westminster Ponds ESA Saunders' cabin site, at this time, will be to:

- identify and retain or seed salvage, to an extent that is both possible and practical, existing native elements representative of the sites natural history and biodiversity;
- eradicate invasive species, notably common and glossy buckthorn from the area;
- fell dead trees that pose a hazard to ecological restoration workers, trail and boardwalk installers, consultants, local volunteers, the public, the new boardwalk, or interfere with the restoration process, and/or unnecessarily impact viewing opportunities;
- open up the thick shrub layer created by the existing dense stands of buckthorn, to allow for ecological restoration to proceed, and,
- set appropriate ecological restoration targets and objectives and initiate an ecological restoration program to establish self-sustaining native plant communities within the project area, with improved natural biodiversity consistent with the natural history of the area.

The City will be coordinating the accessible trail re-alignment and accessible trail and boardwalk installation along with some trail closures in 2017 consistent with the CMP and consensus reached by the City's Trails Advisory Group (TAG) as identified in Figure 1. TAG will re-visit the area in 2017 to micro-site TAG's trail alignments after the restoration process has begun. Another objective identified by TAG is to explore possibilities for ecologically appropriate restoration models that would allow for good opportunities for viewing Saunders Pond from some of the trail location(s) and from the W. E. Saunders cabin site consistent with historical photos and cultural history of the area.

St Williams Nursery and Ecology Centre has prepared this ecological restoration plan for the project site in order to achieve these objectives.





Figure 1. Project Site.

## 2.2 Existing Site Conditions

In preparation for the ecological restoration works the comprehensive field inventories examining natural communities, wildlife, and invasive species in the 2015 Volume 1 and 2 reports by North South Environmental (NSE) were reviewed and St. Williams Nursery and Ecology Centre ecologists conducted a detailed field survey in late August 2016. The purpose of the detailed site survey was to:

- develop a detailed description and understanding of existing plant communities within the specific project area limits;
- identify and flag specific features including plant groups or specimens that should be retained or identified as seed sources as part of the ecological restoration strategy;
- identify any site sensitivities in terms of rare, threatened or endangered species or other environmental and habitat sensitivities that need to be given special consideration and/or protection when developing restoration plans and implementing restoration interventions; and,
- delineate and assess existing environmental conditions including micro-topography.

The majority of the site is forested with a closed canopy. There are two small open meadow areas located in the northwest and southeast portions of the site. There are also some smaller openings within the forested portions and some are associated with the existing trails. In general, the natural character and native biodiversity of the site is highly degraded due to the prevalence of non-native invasive species within the project area. The project area was used historically as farmland, most likely as pastureland based on aerial photos of the site taken in the 1940/50's (see aerial photos AP1 and AP2 in Appendix A). Currently, common buckthorn and glossy buckthorn are estimated to comprise more than 80% of the living stems within large portions of the project area and occupy a significant amount of the forest canopy layer. This has been exacerbated recently by the epidemic die-off of native ash trees due to the impact of the emerald ash borer (*Agrilus plaipennis*). Dead standing ash are present throughout the project area, in the ESA, and throughout southwestern Ontario.

The site is relatively flat with minor grade elevation changes across most of the site. The only significant sloping area in the project site is associated with Saunders Pond. This sloped area extends as a band approximately 25 to 30 metres wide sloping down at about a 4 to 1 slope toward the south shoreline of the pond. Most of the site is moderately to poorly drained with fine grained silty-clay soil. The small upland section in the northwest corner of the project area appears to have better drainage. Also a small ephemeral drainage channel cuts through the site to Saunders Pond.

Four remnant native plant habitat types were identified during SWNEC site surveys conducted in 2016. These habitat types identified within the project area are:

1. an upland fresh meadow/deciduous forest;
2. moist forest/swamp;
3. mixed cultural/regeneration meadow and thicket; and,

#### 4. wetland edge.

More details on the characteristics of these habitats are provided below. Site photographs taken during the field survey are provided in Appendix A to this report. The habitat types identified are consistent with ELC habitat mapping completed by North South Environmental (2015) within the project area.

#### **Upland Fresh Meadow/Forest**

The fresh meadow/forest community zone is currently a mix of meadow, shrub thicket and buckthorn dominated mesic forest habitat. Some of the remnant community native species characteristic of the site include grass-leaved goldenrod (*Euthamia graminifolia*), brown-eyed Susan (*Rhudebeckia hirta*), heath aster (*Symphyotrichum ericoides*), arrow-leaved aster (*Symphyotrichum urophillum*), white vervain (*Verbena urticifolia*), grey dogwood, (*Cornus foemina*), hawthorn (*Crateagus spp.*), red cedar (*Juniperus virginiana*), black walnut (*Juglans nigra*), trembling aspen (*Populus tremuloides*), balsam poplar (*P. balsamifera*), and, a large cottonwood (*P. deltoides*). Limited regeneration of maple, hickory and ash is occurring in some areas of the zone.

#### **Moist Forest/Swamp**

The moist forest/swamp habitat is currently buckthorn-infested woodland with relatively little vegetative diversity in the herbaceous layer. Remnant native species found in this zone include tree species: trembling aspen, balsam poplar, swamp or silver maple (*Acer freemanii* or *A. saccharinum*), bitternut hickory (*Carya cordiformis*), white ash (*Fraxinus americana*), green ash (*F. pennsylvanica*), American elm (*Ulmus americana*), hawthorn, black walnut, and white pine (*Pinus strobus*).

Native shrubs found in this zone include grey dogwood and silky dogwood (*C. amomum*). A relatively large and healthy population of native black currant (*Ribes americanum*) in the shrub layer is a significant natural feature found in this zone and should be retained as part of the restoration plan.

Native species found in the openings and representative of natural mesic to swamp forest openings in the herbaceous layer include white vervain, dark green bulrush (*Scirpus atrovirens*), soft stem bulrush (*Schoenoplectus tabernaemontani*), fowl mannagrass (*Glyceria striata*), Indian tobacco (*Lobelia inflata*), lance-leaved aster (*Symphyotrichum lanceolatum*), and, grass leaved goldenrod. Sensitive fern (*Onoclea sensibilis*) was noted in small patches in association with these species in several locations. *C. arctata*, an understory sedge in the southern half of the restoration zone, is of note and worth protecting.

Other common exotic and invasive species, in addition to buckthorn in this zone include *Phragmites australis*, *Miscanthus* spp and lilac (*Syringa vulgaris*), noting the *Phragmites* was treated in September of 2016 and will be monitored.



### **Mixed Cultural/Regeneration Meadow and Thicket**

The mixed regeneration meadow and thicket occurring in the southwest portion of the site has a much more open character, though it has been invaded by buckthorn as well. There are few mature trees: native hickories, maple, ash, and poplar within this zone. An American plum was found along the forest edge in this zone. Shrubs include grey and silky dogwood. Poverty oat grass (*Danthonia spicata*) and foxglove beardtongue (*Penstemon digitalis*) are examples of native survivors of the remnant meadows at this site.

### **Wetland Edge**

The wetland edge within the project area, is the low lying area, a band running 3 to 5 metres in width, along the south shoreline of Saunders Pond. Trees line the edge of the pond in this area. A detailed survey of the wetland edge was not completed, however a few species noted include horse gentian (*Triosteum aurantiacum*), blue skullcap (*Scutellaria laterifloral*), and rice cutgrass (*Leersia oryzoides*). Buckthorn has encroached to within a few metres of the shoreline in this zone.

## **2.3 Restoration Models**

A first step in any ecological restoration project is to define what the restored ecosystem or landscape should become. Restoration models are conceptualizations of the ecological state that the restoration plan is intended to achieve. Restoration models may be theoretical constructs such as ecological land classification (ELC) vegetation types or they can be based on specific examples of other existing natural habitat areas which can be used as reference sites. Based on our review of site data and considering the stated restoration objectives, we recommend basing ecological restoration on the following ELC vegetation community types.

In the Upland Fresh Meadow/Forest and Mixed Regeneration Meadow and Thicket habitat areas we recommend using Fresh-Moist Oak Maple Hickory Deciduous Forest (ELC FODM9), as the reference model. In the Moist Forest/Swamp Habitat areas we recommend using Swamp Maple Mineral Deciduous Swamp Type (ELC SWDM3), as the reference model.

In addition, to strictly ecological considerations for the restoration plan, TAG is interested in ecologically appropriate restoration models that would allow for good opportunities for views to Saunders Pond from the re-aligned trail. This could be accomplished by restoring a more open woodland or savanna like habitat with native moist wet meadow species (grasses, sedges and wildflowers) between the realigned trail section and the wetland edge zone. This would be accomplished by seeding with a wet meadow mix and planting appropriate trees such as bur oak to create a savanna habitat structure as part of the restoration plan where open views are desired.

These Restoration Models are used to develop Conceptual Planting Plans which are provided in Appendix B. Biological metrics can be developed based on these models to assess the success of restoration outcomes. The approach to application of restoration models in restoration process is described further in the implementation plan.



## **2.4 Implementation Plan**

The key elements of the ecological restoration strategy for this project site are:

1. Eradication of invasive species, especially common and glossy buckthorn is the first critical step to restoring the site. These invasive species have established and currently dominate the site and without removal of the buckthorn population it will not be possible to establish appropriate native species and natural biodiversity cannot be restored to the site.
2. Retaining native species where possible and practical and further enhanced by seeding and planting to establish native plant communities appropriate for the site environmental conditions. The planting and seeding plans will be developed to achieve outcomes consistent with the ecological restoration models selected as appropriate for the site.
3. Ongoing monitoring and adaptive management will be required to ensure that desired restoration outcomes are achieved.

Ecological restoration is probabilistic process in that the final outcomes cannot be predicted with absolute certainty due to the many uncontrollable factors that will act on a site through time. The Restoration Models were used to develop Conceptual Planting Plans in Appendix B that will allow for a range of acceptable restoration outcomes for each of the restoration zones. The species and relative planting densities are specified in the Planting Plans to achieve objectives consistent with the reference models. Final detailed planting plans will be developed in consultation with the native plant supplier(s) and must consider stock species and format availability, and must be implemented adaptively with consideration of natural regeneration following treatments to remove invasive species from the site.

## **2.5 Conservation of Existing Natural Biodiversity**

Although the project site is dominated by invasive species, there are a number of native species plants and plant associations present that are representative of some of the natural native biodiversity of the site before it was overrun by exotic invasive species. These plants have been identified during our detailed site surveys and where feasible and practical will be retained.

It is not always practical to retain all native species features when undertaking a site restoration where invasive and exotic species need to be managed. There will inevitably be some collateral damage, especially in the understory and herbaceous layer, as part of the effort to eradicate buckthorn. Measures will be implemented to retain ecologically significant plants, larger quality trees and plant associations during invasive species and standing dead ash tree mitigation and mulching operations. This is seasonal work best carried out in late fall or winter when most species are dormant. Plant and plant associations that are to be retained have generally been inventoried and flagged in the field by SWNEC ecologists. Additional screening for native species will be conducted by SWNEC ecologists prior to mulching and dead ash mitigation work. Temporary protective fencing will be erected where possible and practical to protect retainable native vegetation and careful

supervision of the mitigation and mulching operations by project ecologists will limit collateral damage to native plants to the extent possible.

Following the management of exotic invasive species, some natural regeneration is expected from the natural seed bank in the soil as well as from seed rain from native species, especially from wind borne seeds and also from seeds produced by retained vegetation. It was noted that at least one mature white pine within the project areas was producing a good crop of pine cones that will be mature in 2017. Monitoring of the site will be required to determine the degree of natural regeneration that occurs. Planting using appropriate source identified local wild type genetic stock is an important criteria to ensure the restoration of natural biodiversity to the site.

Planting Plans developed to achieve Restoration Model vegetation communities will be used to direct planting operations to help restore appropriate natural biodiversity at the site. Conceptual Planting Plans are developed at this time, however, all Planting Plans should be reviewed and updated prior to implementation, as adjustments may be warranted based on natural regeneration or other unforeseen circumstances. This is part of the adaptive management approach important for ecological restoration projects since not all outcomes can be predicted at the outset.

## **2.6 Eradication of Invasive Species**

Invasive plants must be eradicated in order to permit restoration of a healthy native vegetation community. Based on site conditions, two different methods are recommended for efficient and environmentally appropriate eradication of invasive buckthorn.

1. Basal bark treatment using Garlon RTU® (active ingredient triclopyr)
2. Mechanical clearing/mulching followed by foliar application with Garlon Ultra® and glyphosate formulation on buckthorn regrowth.

Due to the extensive coverage by buckthorn that currently forms pure stands over much of the site, we recommend using the second option. With this option, all target woody stems will be removed by mulching with heavy duty mulchers attached to tracked excavators and/or skidsteers. The wood mulch as well some un-mulched larger diameter logs will be spread over the site. Larger diameter logs can be mulched but some will be selectively retained and left lying on the ground to add habitat value and site heterogeneity.

As noted above, method 2 requires the use of heaving equipment and will be restricted to areas of low habitat sensitivity to potential impacts such as erosion. In areas where ecological sensitive features are present (e.g., in close proximity to Saunders Pond or around retainable native plants or plant communities) we will use basal bark treatment and manual removal with chainsaws or by other less intrusive methods (e.g., weed wrench).

Invasive species like buckthorn in particular, once established on a site, have a nasty habit of re-sprouting from below ground parts that have not been killed by the treatment, and from the typically abundant seed bank that develops in the soils where they have thrived for a number of years. The Best Management Practices (BMP) in Ontario for Buckthorn document developed by the Ontario Invasive Plant Council (OIPC), and its partners and the Ontario Ministry of Natural Resources (OMNR) identifies that common buckthorn seeds can remain viable in the soil for up to 5 years. Therefore, expect that one or more follow-up treatments for a period of up to five years may be required before effective control of buckthorn is achieved.

With adequate herbicide control, cutting and mulching will open up the site to help promote the growth of native species versus exotics and invasives. This process is facilitated by incorporation of woody mulch as well as felled logs into the ground layer which will increase soil carbon and promote soil denitrification.

Due to the use of heavy equipment and mulching heads that can throw debris, the site will be posted and access by the public will be restricted during invasive species and standing dead ash tree mitigation and mulching operations. The City of London will coordinate public notification of these closures and the restoration process through public engagement, mail outs, educational signage and other communications.

Long term monitoring and management to prevent re-invasion will be required as buckthorn can be re-introduced by birds and small mammals which eat the buckthorn berries that are prevalent throughout the City. The laxative properties of the berries helps to spread them widely.

It is worth noting that The Upper Thames River Conservation Authority (UTRCA) ESA team have managed buckthorn primarily through basal bark application of Garlon RTU as part of operational and capital projects, funded by the City, in the ESA since 2008 including the buckthorn in the Rotary/UTRCA restoration area noted on Figure 1. In 2014 - 2016 woody invasives including buckthorn were managed in the landfill meadow to protect habitat for Meadowlarks a Threatened Species at Risk. In 2014 - 2016 buckthorn around Spettigue Pond were treated to protect many rare species and their habitats. Buckthorn was managed on the northeast shore of Saunders Pond in 2015. This approach is generally consistent with the North South Environmental 2015 report that prioritizes protection of SAR and rare species from buckthorn infestation, then to treat the areas of least infestation to protect them, moving to then manage the remainder of the denser stands of buckthorn in the ESA as funds and opportunities such as this ecological restoration project arise.

Treatment of invasive species in the ground layer (e.g., garlic mustard) will also be undertaken adaptively as required to facilitate the restoration of the site. Purple loosestrife is becoming more prevalent on the shoreline of Saunders Pond (and across Ontario) and will be treated in spring of 2017 through the release of *Neogalerucella spp.* beetles in consultation with Donna MacKenzie M.Sc. of Ontario Beetles (pers comm: Linda McDougall). Biological control of purple loosestrife can reduce populations by up to 90 per cent and allow native plants to re-establish.

## **2.7 Establishment of healthy native vegetation community**

The restored plant communities will be established through a combination of retained vegetation elements, natural regeneration and supplemented by planting following the Planting Plans for each restoration zone as provided in Appendix B.

As noted the Planting Plans should only be implemented when the aggressive invasive species have been adequately eradicated from the restoration zones. Otherwise restoration can become an expensive mess to manage if invasive species like buckthorn sprout up in large numbers in and around newly planted native species. In such a scenario, it becomes very difficult to utilize practical and efficient techniques such as foliar herbicide application without causing significant losses of the newly established native plants. Adequate control of invasive species must be managed adaptively, monitoring to determine when additional treatments are required and when adequate control has been achieved to allow successful planting for restoration.

Restoration seed mixes can be used effectively to restore early successional native biodiversity to the site, to help prevent the reinvasion by invasive species, mitigate erosion issues, and provide a good environment for establishing native vegetation communities. Unlike planting of trees and shrubs, seeding of the area with appropriate restoration seed mixes is possible in advance of foliar spraying to control buckthorn. We recommend seeding in advance of mitigation and mulching to ensure good seed soil contact. The mulch layer will act as a mulch to prevent erosion, help to denitrify the site and allow herbaceous species to establish through the mulch layer. Seeding will be done with restoration mixes by restoration zone as provided in Appendix B.

The majority of the restoration area south of the sloped area along the shore of Saunders Pond is relatively flat with fine grained clayey silt soil. Pits and mounds mimicking natural forest microtopography will be created during the mitigation and mulching operations to create microhabitats with varying moisture levels. Pits and mounds would naturally form over centuries as large trees topple over leaving pits and mounds in forests. Trees in these areas typically grow more rapidly as the pits capture water and allow it to percolate more slowly through the soil.

As noted previously, Restoration Planting Plans may need to be modified prior to planting based on the amount of natural regeneration that occurs on these sites. However, it should be noted that regeneration by some species is not likely to occur sufficiently due to the lack of proximity of a viable local seed source. Such species will need to be restored to the site via seeding or planting.

Sourcing appropriate local native plant material for larger ecological restoration projects can present a significant challenge. It is strongly recommended that the City works with its project partners such as St. Williams Nursery and Ecology Centre to coordinate the supply of source-identified wild-type plant materials well in advance of the anticipated planting schedule in order to ensure the availability of appropriate quality stock.

Opportunities for local volunteers and school groups to participate in restoration planting events will be provided to enhance local stewardship.



## 2.8 Creating/maintaining conditions for safe access

In addition to buckthorn removals, dead ash trees and other potentially hazardous trees will be selectively mitigated where they may present a hazard to ecological restoration workers, trail and boardwalk installers, consultants, local volunteers, the public, the proposed boardwalk, or interfere with the restoration process. It is important to remember however, that wildlife trees can provide important wildlife habitat and care will be taken to maintain wildlife trees where these have significant ecological value without representing a risk to ecological restoration workers, trail and boardwalk installers, consultants, local volunteers, the public or the new boardwalk. Also, large stems will be selectively felled and left on the ground to create large woody debris as a natural element and to create additional habitat value and natural complexity to the site. This will be completed under the direction of a project restoration ecologist.

## 2.9 Improved viewing opportunities of Saunders Pond

Clearing of the thick shrub layer of buckthorn will help to open up of views of Saunders Pond from the portions of the proposed accessible trail and boardwalk and from the W.E. Saunders cabin area consistent with TAG's recommendations. The restoration plan provides for establishment of ecologically appropriate species assemblages that provide a diversity of habitats while maintaining these historical views.

## 3.0 Sequence and Schedule of Restoration Works

The ecological restoration works need to be implemented in a manner and over a timeframe consistent with the ecological restoration trajectory to achieve the desired ecological outcome(s). The sequence of restoration works and anticipated time frame for these works is summarized in Table 1.

**Table 1. Proposed Sequence and Schedule of Restoration Works**

Restoration Work Element	Timeframe
Survey site and flag native plants to be retained	Summer/fall 2016
Finalize Restoration Plan	Fall 2016
Seeding with initial restoration seed mixes	Fall 2016
Clearing and mulching	Fall/Winter 2016
Basal bark treatment of woody invasive and selective clearing	Fall/Winter 2016
Monitoring	Starts in fall 2016; ongoing
Foliar Spraying	Anticipated in Summer 2017; timing subject to adaptive management; repeat treatments for up to 5 years may be required until adequate control is achieved

Planting according to Planting Plans	Timing is subject to adaptive management; dependent on time required to achieve adequate control of buckthorn/invasives
Ongoing Monitoring and Site Management	Ongoing, adaptive

### 3.1 Adaptive Management Strategy

Adaptive management is an approach to making ecological restoration decisions throughout the restoration trajectory to best achieve the intended outcomes per the Restoration Objectives and Restoration Models. Adaptive management is a process for continually improving management practices by learning from the outcomes of operational interventions. Adaptive management is an appropriate strategy for ecological restoration since it is impossible to predict all eventual outcomes of the restoration process in a deterministic manner.

Adaptive management involves:

- setting clearly defined objectives;
- planning and implementing works/practices to meet the objectives;
- monitoring and assessing outcomes in relation to the objectives; and,
- modifying works/practices, as appropriate to attain objectives.

Future management decisions, required, if any, that are beyond the scope of this plan will need to be led by the City.

## 4.0 Potential Risks and Constraints

### Migratory Birds

Disturbance of nesting birds and/or destruction of nests during the breeding season is prohibited under the Migratory Birds Convention Act. It is probable that migratory birds do use the area for nesting as identified in the NSE 2015 study, therefore the necessary tree mitigation, and mulching, will be completed in the late fall or winter outside of the Migratory Bird breeding season window from March 30 to August 31.

### Bats

Bat species are divided into two groups: non-migratory bats, which hibernate from September or October through April in mines, caves, underground foundations and Karsts, and, migratory bats, which spend the winter further south and return in the summer. Bat hibernacula is not present in the restoration area or within the ESA therefore bats will not be present in the late fall and winter.

The majority of the larger, mature, live, native trees will be retained in the restoration area where possible and practical including species such as cottonwood, trembling aspen, hickories, maple, white pine and poplars providing potential bat habitat in the restoration area itself and throughout the 250 ha ESA. In the unlikely event that a large tree would need to be proactively managed for risk to public safety outside of bat hibernation/migration season (April to September) when bats could be present, a cavity search would be completed in advance by qualified personnel to avoid impacts to the species. As bats do not generally exhibit site fidelity to a specific tree for use as a bat maternity colony for example, the restoration project and associated late fall and winter tree mitigation and mulching activities would not impact bats or bat habitat.

### Amphibians

The 2015 NSE study identified aquatic frogs including leopard frog, American bullfrog and green frog present near the project area. These species hibernate underwater, likely in Saunders Pond near the bottom and they will not be impacted by the late fall and winter tree mitigation and mulching activities. Although they were not noted by NSE in 2015 near the project area American toads are commonly present in the ESA. It is unlikely that any American toads if present in the restoration area could be impacted by late fall and winter terrestrial tree removals, clearing and mulching activities that would generally not disturb the soil below the frost line, as they burrow deep beneath the frost line. The longterm benefit for the amphibian habitat achieved by buckthorn removal through the restoration project is substantial as buckthorn emits a chemical called emodin that affects frog embryos, causing defects in unborn frogs and inhibits the hatching of amphibian eggs.

### Salamanders, Snakes, Turtles

The 2015 NSE study did not identify salamanders, snakes or turtles as being present in the restoration area. Although they were not noted by NSE in 2015 in the project area, eastern gartersnakes are commonly present in the ESA. Snake hibernacula features that go below frost line such as rock piles or slopes, old stone fences, and abandoned crumbling foundations were not noted by NSE in 2015 and have not been observed within the restoration area. In the unlikely event that eastern gartersnakes were hibernating inside the restoration area, they hibernate deep beneath the frost line and are very unlikely to be impacted by late fall and winter tree mitigation and mulching activities that would generally not disturb the soil below the frost line.

### Herbicide Use

Herbicides are an important and useful tool commonly employed in ecological restoration and landscape management. They are particularly useful in the battle to control and eradicate invasive species and their proper application will minimize the use of herbicides to amounts necessary to effect control and mitigate potential impacts on non-target species.

Herbicide will be applied only by licensed exterminators trained in ecological restoration applications to ensure safe, efficient use of herbicides on this project. Use of herbicides will be

implemented in a manner to ensure safety to the public and to the environment noting these herbicides are approved for use by Health Canada. Areas will be posted prior to herbicide application at the Westminster Pond ESA restoration site.

#### Clean Equipment Protocol

To avoid importing invasives to the site the inspection and cleaning of all machinery and equipment will be performed in accordance with the procedures, checklists and diagrams provided in the Clean Equipment Protocol prepared for the Canada-Ontario Invasive Species Centre and the Ontario Ministry of Natural Resources by the Peterborough Stewardship Council and the Ontario Invasive Plant Council.

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## 5.0 References

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## Appendix A.

### Site Photographs and Field Survey Results



Photo 1. View of entrance to site and trail off Wellington Road. Note dead standing ash which previously formed a significant component of the forest canopy.



Photo 2. The canopy and understory through much of site is dominated by a thick tangle of almost solid exotic buckthorn.





Photo 3. Limited regeneration of seedlings dominated by buckthorn beneath buckthorn canopy of much of the site. Note ephemeral drainage channel cutting through site toward Saunders Pond.



Photo 4. Example of American black current flagged during site visit in August.





Photo 5. View of canopy in location of a pair of white pines in mesic forest habitat.



Photo 6. Saunders' Cabin site plaque. Note dense buckthorn thicket forming on site behind rail fence.





Photo 7. Mature trembling aspen in mesic moist forest near Saunders' cabin site.





Photo 8. Wetland edge along south shore of Saunders Pond.



Photo 9. View looking north across Saunders Pond from south shore.





AP1: Aerial Photo (1942). Note Saunders Pond in bottom right-hand corner of photo.





AP2. Aerial Photo (1950). Saunders Pond located in approximate centre of photo.

## SWNEC Salvage and Control Flags for Invasive and Non-native Plant Data - WMP ESA Restoration Project

#	Coordinate	Flag Type	Notes
1	42.947630, -81.226017	Control (Yellow)	Western edge, spot spray invasive shrubs, remove
2	42.947768, -81.225792	Salvage (Orange)	Scattered Grey Dogwood
3	42.947813, -81.225676	Salvage (Orange)	Hawthorn patch, mixed dogwood, raspberry and White Vervain
4	42.947826, -81.225868	Control (Yellow)	Scattered Siberian Elm of all ages, remove
5	42.947909, -81.225999	Control (Yellow)	Clear Meadow, spot spray / rototill with care noting native Grass-leaved Goldenrod also present
6	42.947985, -81.225633	Salvage (Orange)	Scattered Walnut
7	42.948003, -81.225964	Salvage (Orange)	Meadow fragment, Heath Aster, Red Cedar
8	42.948007, -81.226015	Salvage (Orange)	Meadow fragment, Brown-eyed Susan
9	42.948108, -81.226097	Salvage (Orange)	Arrow Leaved Aster, remnant meadow communities
10	42.948215, -81.226009	Salvage (Orange)	Cottonwood, Trembling Aspen and Balsam Poplar
11	42.948266, -81.226142	Control (Yellow)	North Western Edge, forbs like Purple Loosestrife and Spotted Knapweed
12	42.947125, -81.224589	Salvage (Orange)	Understory sedges, <i>Ovales</i> , <i>C. arctata</i> ;
13	42.947283, -81.222881	Salvage (Orange)	Black Currant
14	42.947393, -81.222493	Salvage (Orange)	American Plum, beyond ERA
15	42.947400, -81.223430	Salvage (Orange)	Black Currants
16	42.947468, -81.223156	Salvage (Orange)	Stone Crop, Bullrush, white vervain etc.
17	42.947542, -81.223929	Salvage (Orange)	Agrimony and Bullrush remnants, scattered
18	42.947583, -81.223890	Salvage (Orange)	Wet meadow remnant with Soft Stemmed Rush, <i>Glyceria</i> and Black Currant
19	42.947692, -81.225236	Control (Yellow)	<i>Phragmites</i>
20	42.947692, -81.225236	Salvage (Orange)	Lance-leaved Aster, Grass-leaved goldenrod
21	42.947702, -81.224452	Salvage (Orange)	Wet meadow remnant with Juncus effuses
22	42.947717, -81.225155	Salvage (Orange)	Many scattered young ash
23	42.947725, -81.224485	Salvage (Orange)	Large Black Currant patch
24	42.947741, -81.224075	Salvage (Orange)	Silky Dogwood, with scattered Grey Dogwood
25	42.947753, -81.224000	Salvage (Orange)	Black Currant
26	42.947755, -81.223314	Salvage (Orange)	Herbaceous remnant, Bullrush, White Vervain
27	42.947756, -81.223961	Salvage (Orange)	Hawthorn patch with Black Currant
28	42.947772, -81.224586	Salvage (Orange)	Remnant White Vervain and Dark Bullrush
29	42.947796, -81.223946	Control (Yellow)	Garden remnant, <i>Miscanthus</i> , Lilac sp., control
30	42.947800, -81.223834	Salvage (Orange)	<i>Lobelia inflata</i>

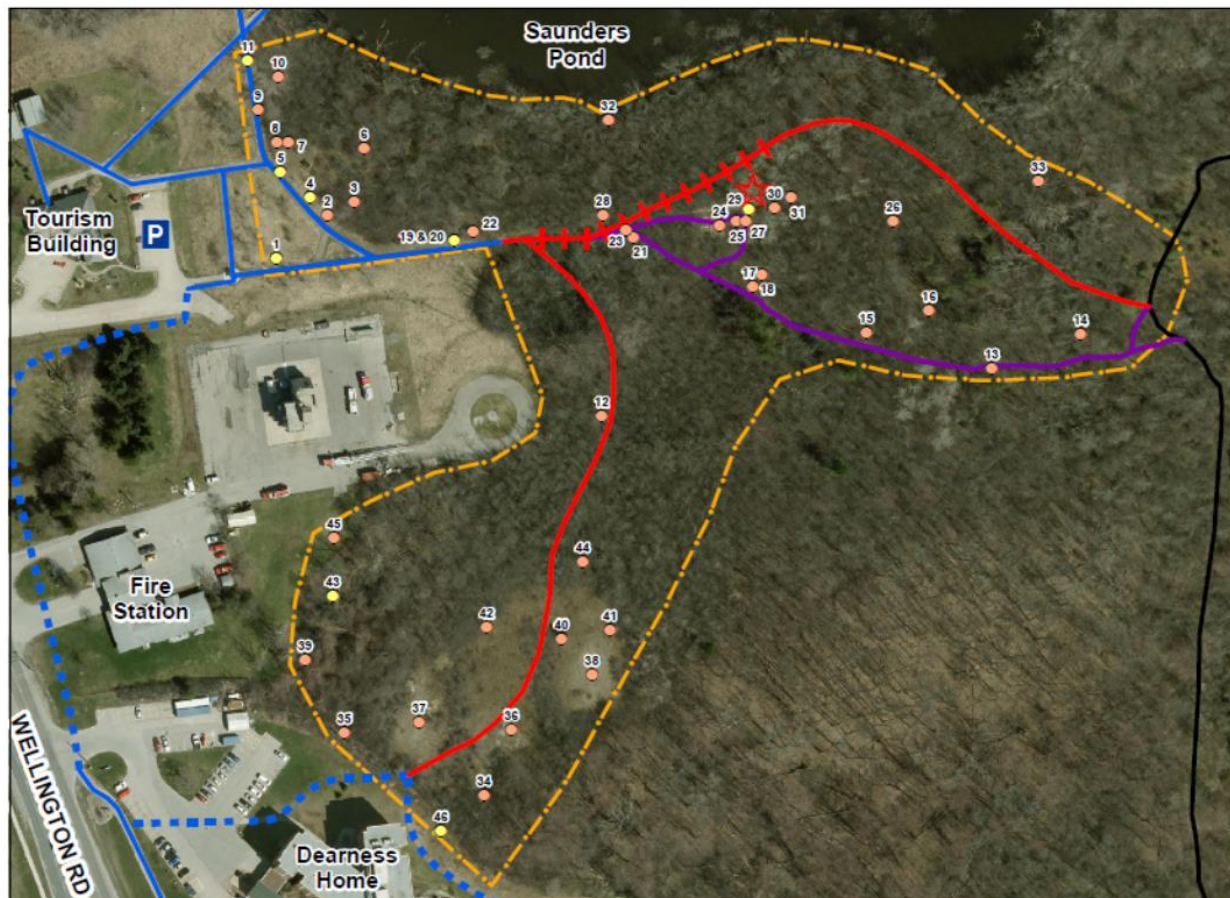
31	42.947830, -81.223763	Salvage (Orange)	Herbaceous remnant, Bullrush, White Vervain, <i>Carex arctata</i> etc
32	42.948078, -81.224564	Salvage (Orange)	Significant wetland edge fragment with <i>Triosteum</i> , <i>Scutellaria</i> and Rice Cutgrass
33	42.947886, -81.222678	Salvage (Orange)	North eastern edge, scattered Grey Dogwood
34	42.945907, -81.22510	Salvage (Orange)	mature native trees: Hickories, Ash, Maple, Poplars, remove Buckthorns and Elm
35	42.946105, -81.225712	Salvage (Orange)	Silky dogwood, grey dogwood, trembling aspen, balsam poplar
36	42.946119, -81.224981	Salvage (Orange)	Meadow remnant, <i>Danthonia spicata</i>
37	42.946141, -81.225385	Salvage (Orange)	Meadow remnant with <i>Penstemon digitalis</i> and Grey Dogwood
38	42.946293, -81.224628	Salvage (Orange)	Meadow remnant, <i>Danthonia</i> , <i>Penstemon</i> etc.
39	42.946338, -81.225885	Salvage (Orange)	Silver/Freemans Maple, trembling aspen
40	42.946411, -81.224762	Salvage (Orange)	Balsam poplars
41	42.946440, -81.224551	Salvage (Orange)	Meadow edge Grey Dogwood, Grass-leaved Goldenrod throughout
42	42.946446, -81.225089	Salvage (Orange)	meadow remnant continued, scattered dogwood and <i>Penstemon digitalis</i> ,
43	42.946545, -81.225764	Control (Yellow)	Remove mature exotic willows
44	42.946658, -81.224670	Salvage (Orange)	Very large patch of Ditch Stone Crop, <i>Penthorum sedoides</i>
45	42.946731, -81.225761	Salvage (Orange)	American Plum, forest edge, seed collected
46	42.945792, -81.225289	Control (Yellow)	Southern limit, spot spray meadow/meadow edge, remove exotic woody

Note: Stiff Marsh Bedstraw and Sweetflag were noted by NSE in 2015 on the shore of Saunders Pond. These and all other sensitive shoreline and wetland edge species are assumed to be present, and will be retained and protected.



# Westminster Ponds/Pond Mills ESA - Saunders Cabin Area Ecological Restoration

St. Williams Nursery and Ecology Centre (SWNEC) Invasive Non-Native and Native Plant Data



## Legend

- Proposed Accessible Granular Trail (Trails Advisory Group)
- + + Proposed Accessible Boardwalk (Trails Advisory Group)
- Existing Trail to be Removed (Trails Advisory Group)
- Existing Trail to Remain (Trails Advisory Group)
- Control Flag (Invasive Species) St. Williams Nursery and Ecology Centre (SWNEC) Data
- Salvage Flag (Native Species) St. Williams Nursery and Ecology Centre (SWNEC) Data
- ■ Accessible Connections on Dearness Home Grounds/Fire Station Grounds (Proposed)
- Existing Accessible Connections
- - - Ecological Restoration Area (approximate)
- ★ W.E. Saunders Cabin Site

Not to Scale



\* Note buckthorn are estimated to comprise 80% of the living stems inside majority of restoration area. (SWNEC)



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## **Appendix B**

### **Restoration Models with Conceptual Planting Plans and Restoration Meadow Habitat Seed Mixes**

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REF MODEL:	Fresh Moist Oak Maple Hickory Deciduous Forest (WP/PM ESA)				
Planting Plan			Estimated Total Area (ha):		1
BOTANICAL NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	Estimated Quantity to be planted
<i>Dryopteris</i>	<i>carthusiana</i>	Spinulose Wood Fern	5	-2	10
<i>Matteuccia</i>	<i>struthiopteris</i> var. <i>pensylvanica</i>	Ostrich Fern	5	-3	10
<i>Onoclea</i>	<i>sensibilis</i>	Sensitive Fern	4	-3	10
<i>Polystichum</i>	<i>acrostichoides</i>	Christmas Fern	5	5	10
<i>Thelypteris</i>	<i>noveboracensis</i>	New York Fern	7	-1	10
<i>Thuja</i>	<i>occidentalis</i>	Eastern White Cedar	4	-3	10
<i>Larix</i>	<i>laricina</i>	Tamarack	7	-3	10
<i>Pinus</i>	<i>strobus</i>	Eastern White Pine	4	3	50
<i>Acer</i>	<i>rubrum</i>	Red Maple	4	0	50
<i>Acer</i>	<i>saccharum</i> ssp. <i>saccharum</i>	Sugar Maple	4	3	100
<i>Apocynum</i>	<i>cannabinum</i> var. <i>hypericifolium</i>	Clasping-leaved Indian Hemp	3	0	10
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5	10
<i>Symphyotrichum</i>	<i>cordifolius</i>	Heart-leaved Aster	5	5	20
<i>Symphyotrichum</i>	<i>ericoides</i> ssp. <i>ericoides</i>	White Heath Aster	4	4	20
<i>Symphyotrichum</i>	<i>lateriflorus</i> var. <i>lateriflorus</i>	Calico Aster	3	-2	10
<i>Eurybia</i>	<i>marophyllus</i>	Large-leaved Aster	5	5	20
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3	20
<i>Solidago</i>	<i>caesia</i>	Blue-stem Goldenrod	5	3	10
<i>Caulophyllum</i>	<i>thalictroides</i>	Blue Cohosh	6	5	10
<i>Podophyllum</i>	<i>peltatum</i>	May-apple	5	3	10
<i>Carpinus</i>	<i>caroliniana</i> ssp. <i>virginiana</i>	Blue Beech	6	0	50
<i>Ostrya</i>	<i>virginiana</i>	Hop Hornbeam	4	4	50
<i>Lobelia</i>	<i>inflata</i>	Indian Tobacco	3	4	50
<i>Lonicera</i>	<i>dioica</i>	Glaucous Honeysuckle	5	3	10
<i>Lonicera</i>	<i>hirsuta</i>	Hairy Honeysuckle	7	0	10
<i>Sambucus</i>	<i>canadensis</i>	Common Elderberry	5	-2	50
<i>Symphoricarpos</i>	<i>albus</i>	Snowberry	7	4	10
<i>Viburnum</i>	<i>acerifolium</i>	Maple-leaved Viburnum	6	5	10
<i>Viburnum</i>	<i>rafinesquianum</i>	Downy Arrow-wood	7	5	10
<i>Viburnum</i>	<i>trilobum</i>	High Bush Cranberry	5	-3	10
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5	10
<i>Cornus</i>	<i>alternifolia</i>	Alternate-leaved Dogwood	6	5	20
<i>Cornus</i>	<i>florida</i>	Eastern Flowering Dogwood	7	4	2
<i>Cornus</i>	<i>foemina</i> ssp. <i>racemosa</i>	Red Panicle Dogwood	2	-2	50
<i>Cornus</i>	<i>stolonifera</i>	Red-osier Dogwood	2	-3	100
<i>Fagus</i>	<i>grandifolia</i>	American Beech	6	3	10
<i>Quercus</i>	<i>alba</i>	White Oak	6	3	100
<i>Quercus</i>	<i>macrocarpa</i>	Bur Oak	5	1	100
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3	50
<i>Geranium</i>	<i>maculatum</i>	Spotted Crane's-bill	6	3	10
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3	10
<i>Ribes</i>	<i>cynosbati</i>	Prickly Gooseberry	4	5	10
<i>Hamamelis</i>	<i>virginiana</i>	Witch-hazel	6	3	20
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	6	0	100
<i>Carya</i>	<i>ovata</i> var. <i>ovata</i>	Shagbark Hickory	6	3	100
<i>Juglans</i>	<i>cinerea</i>	Butternut	6	2	10
<i>Juglans</i>	<i>nigra</i>	Black Walnut	5	3	50

<i>Lindera</i>	<i>benzoin</i>	Spicebush	6	-2	10
<i>Fraxinus</i>	<i>americana</i>	White Ash	4	3	10
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3	10
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3	10
<i>Sanguinaria</i>	<i>canadensis</i>	Bloodroot	5	4	10
<i>Actaea</i>	<i>pachypoda</i>	White Baneberry	6	5	10
<i>Actaea</i>	<i>rubra</i>	Red Baneberry	5	5	10
<i>Anemone</i>	<i>acutiloba</i>	Sharp-lobed Hepatica	6	5	10
<i>Thalictrum</i>	<i>dioicum</i>	Early Meadow-rue	5	2	10
<i>Thalictrum</i>	<i>pubescens</i>	Tall Meadow-rue	5	-2	10
<i>Crataegus</i>	<i>pruinosa</i>	Waxy-fruited Thorn	4	5	10
<i>Crataegus</i>	<i>punctata</i>	Large-fruited Thorn	4	5	10
<i>Fragaria</i>	<i>vesca</i> ssp. <i>americana</i>	Woodland Strawberry	4	4	50
<i>Fragaria</i>	<i>virginiana</i> ssp. <i>virginiana</i>	Scarlet Strawberry	2	1	50
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1	10
<i>Geum</i>	<i>canadense</i>	White Avens	3	0	10
<i>Physocarpus</i>	<i>opulifolius</i>	Ninebark	5	-2	50
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3	50
<i>Prunus</i>	<i>virginiana</i> ssp. <i>virginiana</i>	Choke Cherry	2	1	100
<i>Rubus</i>	<i>occidentalis</i>	Thimble-berry	2	5	10
<i>Smilax</i>	<i>hispida</i>	Bristly Greenbrier	6	0	10
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5	10
<i>Mitchella</i>	<i>repens</i>	Creeping Partridge-berry	6	2	10
<i>Populus</i>	<i>balsamifera</i> ssp. <i>balsamifera</i>	Balsam Poplar	4	-3	10
<i>Populus</i>	<i>deltoides</i> ssp. <i>deltoides</i>	Eastern Cottonwood	4	-1	50
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0	100
<i>Penthorum</i>	<i>sedoides</i>	Ditch Stonecrop	4	-5	20
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3	50
<i>Celtis</i>	<i>occidentalis</i>	Common Hackberry	8	1	20
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2	50
<i>Viola</i>	<i>canadensis</i>	Canada Violet	6	5	10
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1	10
<i>Carex</i>	<i>arctata</i>	Drooping Wood Sedge	5	5	10
<i>Carex</i>	<i>gracillima</i>	Graceful Sedge	4	3	10
<i>Carex</i>	<i>pennsylvanica</i>	Pennsylvania Sedge	5	5	10
<i>Carex</i>	<i>stipata</i>	Awl-fruited Sedge	3	-5	10
<i>Juncus</i>	<i>tenuis</i>	Path Rush	0	0	10
<i>Arisaema</i>	<i>triphyllum</i> ssp. <i>triphyllum</i>	Small Jack-in-the-pulpit	5	-2	10
<i>Maianthemum</i>	<i>racemosum</i> ssp. <i>racemosum</i>	False Solomon's Seal	4	3	10
<i>Trillium</i>	<i>erectum</i>	Purple Trillium	6	1	10
<i>Trillium</i>	<i>grandiflorum</i>	White Trillium	5	5	10
<i>Elymus</i>	<i>canadensis</i>	Nodding Wild Rye	8	1	10
<i>Elymus</i>	<i>virginicus</i> var. <i>virginicus</i>	Virginia Wild Rye	5	-2	10

2,331

#### PLANTING PLAN SUMMARY METRICS

total tree species stocking rate (plants/ha)	1160
total small tree and shrub species stocking rate/ha	581
total forb species stocking rate/ha	480
total grass species stocking rate/ha	20
total sedge species stocking rate/ha	40
total vine species stocking rate/ha	0
total fern species stocking rate/ha	50



# Tree Species	25
# Small Tree and Shrub Species	23
# Forb Species	31
# Grass Species	2
# Sedge Species	4
# Vine Species	0
# Fern and Fern ally Species	5
All Species Total	90

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REF MODEL:		Swamp Maple Mineral Deciduous Forest (WP/PM ESA)			
Planting Plan				Estimated Total Area (ha):	
BOTANICAL NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	Estimated Quantity to be planted
<i>Athyrium</i>	<i>filix-femina</i> var. <i>angustum</i>	Northern Lady Fern	4	0	15
<i>Dryopteris</i>	<i>marginalis</i>	Marginal Wood Fern	5	3	15
<i>Matteuccia</i>	<i>struthiopteris</i> var. <i>pensylvanica</i>	Ostrich Fern	5	-3	15
<i>Onoclea</i>	<i>sensibilis</i>	Sensitive Fern	4	-3	15
<i>Osmunda</i>	<i>cinnamomea</i>	Cinnamon Fern	7	-3	15
<i>Osmunda</i>	<i>regalis</i> var. <i>spectabilis</i>	Royal Fern	7	-5	15
<i>Thelypteris</i>	<i>palustris</i> var. <i>pubescens</i>	Marsh Fern	5	-4	15
<i>Larix</i>	<i>laricina</i>	Tamarack	7	-3	15
<i>Acer</i>	<i>rubrum</i>	Red Maple	4	0	75
<i>Acer</i>	<i>saccharum</i> ssp. <i>saccharum</i>	Sugar Maple	4	3	15
<i>Acer</i> X	<i>freemanii</i>	Freeman's Maple			150
<i>Ilex</i>	<i>verticillata</i>	Winterberry	5	-4	15
<i>Asclepias</i>	<i>incarnata</i> ssp. <i>incarnata</i>	Swamp Milkweed	6	-5	15
<i>Symphytotrichum</i>	<i>lateriflorus</i> var. <i>lateriflorus</i>	Calico Aster	3	-2	15
<i>Symphytotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3	30
<i>Betula</i>	<i>alleghaniensis</i>	Yellow Birch	6	0	150
<i>Betula</i>	<i>papyrifera</i>	White Birch		2	75
<i>Ostrya</i>	<i>virginiana</i>	Hop Hornbeam	4	4	75
<i>Lobelia</i>	<i>cardinalis</i>	Cardinal-flower	7	-5	15
<i>Lobelia</i>	<i>siphilitica</i>	Great Lobelia	6	-4	15
<i>Lonicera</i>	<i>dioica</i>	Glaucous Honeysuckle	5	3	15
<i>Sambucus</i>	<i>canadensis</i>	Common Elderberry	5	-2	75
<i>Symphoricarpos</i>	<i>albus</i>	Snowberry	7	4	15
<i>Viburnum</i>	<i>trilobum</i>	High Bush Cranberry	5	-3	15
<i>Cornus</i>	<i>foemina</i> ssp. <i>racemosa</i>	Red Panicked Dogwood	2	-2	75
<i>Cornus</i>	<i>stolonifera</i>	Red-osier Dogwood	2	-3	150
<i>Vaccinium</i>	<i>corymbosum</i>	Highbush Blueberry	8	-3	15
<i>Quercus</i>	<i>macrocarpa</i>	Bur Oak	5	1	150
<i>Quercus</i>	<i>muhlenbergii</i>	Chinquapin Oak	9	5	30
<i>Geranium</i>	<i>maculatum</i>	Spotted Crane's-bill	6	3	15
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3	15
<i>Ribes</i>	<i>cynosbati</i>	Prickly Gooseberry	4	5	15
<i>Juglans</i>	<i>nigra</i>	Black Walnut	5	3	75
<i>Lindera</i>	<i>benzoin</i>	Spicebush	6	-2	15
<i>Fraxinus</i>	<i>nigra</i>	Black Ash	7	-4	15
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3	15
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3	15
<i>Thalictrum</i>	<i>dioicum</i>	Early Meadow-rue	5	2	15
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1	15
<i>Geum</i>	<i>canadense</i>	White Avens	3	0	15
<i>Physocarpus</i>	<i>opulifolius</i>	Ninebark	5	-2	75
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3	75
<i>Prunus</i>	<i>virginiana</i> ssp. <i>virginiana</i>	Choke Cherry	2	1	150
<i>Rosa</i>	<i>palustris</i>	Marsh Rose	7	-5	15
<i>Rubus</i>	<i>pubescens</i>	Dwarf Raspberry	4	-4	15
<i>Spiraea</i>	<i>alba</i>	Narrow-leaved Meadow-sweet	3	-4	150
<i>Smilax</i>	<i>hispida</i>	Bristly Greenbrier	6	0	15

<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5	15
<i>Mitchella</i>	<i>repens</i>	Creeping Partridge-berry	6	2	15
<i>Zanthoxylum</i>	<i>americanum</i>	American Prickly-ash	3	5	15
<i>Populus</i>	<i>balsamifera</i> ssp. <i>balsamifera</i>	Balsam Poplar	4	-3	15
<i>Populus</i>	<i>deltoides</i> ssp. <i>deltoides</i>	Eastern Cottonwood	4	-1	75
<i>Salix</i>	<i>bebbiana</i>	Long-beaked Willow	4	-4	75
<i>Salix</i>	<i>discolor</i>	Pussy Willow	3	-3	150
<i>Salix</i>	<i>petiolaris</i>	Slender Willow	3	-4	75
<i>Penthorum</i>	<i>sedoides</i>	Ditch Stonecrop	4	-5	30
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3	75
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2	75
<i>Verbena</i>	<i>urticifolia</i>	White Vervain	4	-1	30
<i>Carex</i>	<i>granularis</i>	Meadow Sedge	3	-4	15
<i>Carex</i>	<i>stipata</i>	Awl-fruited Sedge	3	-5	15
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5	15
<i>Juncus</i>	<i>effusus</i> ssp. <i>solutus</i>	Soft Rush	4	-5	15
<i>Arisaema</i>	<i>triphyllum</i> ssp. <i>triphyllum</i>	Small Jack-in-the-pulpit	5	-2	15
<i>Maianthemum</i>	<i>racemosum</i> ssp. <i>racemosum</i>	False Solomon's Seal	4	3	15
<i>Elymus</i>	<i>virginicus</i> var. <i>virginicus</i>	Virginia Wild Rye	5	-2	15
<i>Glyceria</i>	<i>striata</i>	Fowl Meadow Grass	3	-5	15

2,790

#### PLANTING PLAN SUMMARY METRICS

total tree species stocking rate (plants/ha)	770
total small tree and shrub species stocking rate/ha	790
total forb species stocking rate/ha	180
total grass species stocking rate/ha	20
total sedge species stocking rate/ha	30
total vine species stocking rate/ha	0
total fern species stocking rate/ha	70
# Tree Species	17
# Small Tree and Shrub Species	23
# Forb Species	15
# Grass Species	2
# Sedge Species	3
# Vine Species	0
# Fern and Fern ally Species	7
All Species Total	67

**Custom Restoration Meadow Seed Mix 1 for mesic and drier site areas**

<b>Species</b>	<b>Common Name</b>	<b>% by weight</b>
<i>Elymus trachycaulis</i>	Slender Wheat Grass	15
<i>Elymus canadensis</i>	Canada Wild Rye	10
<i>Elymus hystrix</i>	Bottle Brush Grass	15
<i>Penstemon hirsutus</i>	Hairy Beard Tongue	5
<i>Panicum virgatum</i>	Switch Grass	2
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint	5
<i>Penstemon digitalis</i>	Foxglove Beardtongue	7
<i>Rudbeckia hirta</i>	Brown Eyed Susan	5
<i>Oenothera biennis</i>	Evening Primrose	5
<i>Verbena hastata</i>	Blue Vervain	5
<i>Desmodium canadense</i>	Showy Trefoil	5
<i>Asclepias syriaca</i>	Common Milkweed	5
<i>Symphiotrichum novae-angliae</i>	New England Aster	2
<i>Monarda fistulosa</i>	Wild Bergamot	5
<i>Agastache nepetoides</i>	Yellow Hyssop	5
<i>Solidago juncea</i>	Early Goldenrod	2
<i>Hypericum ascyron</i>	Great St. John's Wort	2

(to be applied at rate of 5 to 10 kg/hectare as per direction of restoration ecologist)



**Custom Restoration Meadow Seed Mix 2 for wetter (swamp restoration) site areas**

<b>Species</b>	<b>Common Name</b>	<b>% by weight</b>
<i>Bromus ciliatus</i>	Fringed Brome	10
<i>Elymus virginicus</i>	Virginia Rye	20
<i>Elymus riparius</i>	Riverbank Rye	20
<i>Carex retrorsa</i>	Retorse Sedge	5
<i>Carex granularis</i>	Grain Sedge	3
<i>Carex crinita</i>	Fringed Sedge	5
<i>Carex lupulina</i>	Hop Sedge	3
<i>Carex hystericena</i>	Porcupine Sedge	3
<i>Pycnanthemum tenuifolia</i>	Slender Mountain Mint	2
<i>Doellingeria umbellata</i>	Flat Topped Aster	1
<i>Symphiotrichum puniceus</i>	Purple Stemmed Aster	1
<i>Scrophularia marilandica</i>	Carpenters Square	5
<i>Chelone glabra</i>	Turtle Head	1
<i>Lobelia siphilitica</i>	Blue Lobelia	2
<i>Penstemon digitalis</i>	Foxglove Beardtongue	5
<i>Eupatorium perfoliatum</i>	Boneset	2
<i>Rudbeckia laciniata</i>	Green Headed Coneflower	2
<i>Verbena hastata</i>	Blue Vervain	5
<i>Glyceria striata</i>	Fowl Mana Grass	5


(to be applied at rate of 5 to 10 kg/hectare as per direction of restoration ecologist)

# Westminster Ponds/Pond Mills ESA - Saunders Cabin Area Conceptual Ecological Restoration Plan/ Vegetation Community Targets

St. Williams Nursery and Ecology Centre (SWNEC)



## Legend

Not to Scale 

- Proposed Accessible Granular Trail (Trails Advisory Group)
- + + Proposed Accessible Boardwalk (Trails Advisory Group)
- Existing Trail to be Removed (Trails Advisory Group)
- Existing Trail to Remain (Trails Advisory Group)
- Control Flag (Invasive Species) St. Williams Nursery and Ecology Centre (SWNEC) Data
- Salvage Flag (Native Species) St. Williams Nursery and Ecology Centre (SWNEC) Data
- ■ Accessible Connections on Dearness Home Grounds/Fire Station Grounds (Proposed)
- Existing Accessible Connections
- - - Ecological Restoration Area (approximate)
- ★ W.E. Saunders Cabin Site

FODM9 - Fresh - Moist Oak - Maple Hickory Deciduous Forest  
SWDM3 - Maple Mineral Deciduous Swamp Ecosite  
MEMM4 - Fresh - Moist Mixed Meadow Ecosite

\* Note buckthorn are estimated to comprise 80% of the living stems inside majority of restoration area. (SWNEC)

\*\* Appropriate trees such as Bur Oak planted to create savanna-like habitat structure.