Organic Landscape Maintenance Guidelines

Corktown Common & Lawren Harris Square

Waterfront Toronto | City of Toronto - Parks, Forestry & Recreation Division

9 September 2014

PREPARED BY
Michael Van Valkenburgh Associates, Inc
Landscape Architects
231 Concord Avenue
Cambridge, MA 02138
617.864.2076
www.mvvainc.com

Contents

Appendices

I. Introduction

Introduction

THE COMMITMENT

The park's design firm, landscape architects Michael Van Valkenburgh Associates, Inc. (MVVA), with the support of WaterfronTORONTO (WT), has produced these *Organic Landscape Maintenance Guidelines* as a site-specific resource tool to assist the City of Toronto's Parks, Forestry and Recreation Division (PFR) staff in maintaining Corktown Common (CTC) and Lawren Harris Square (LHS).

Closely developed with input from PFR staff, these guidelines are designed to complement the Parks, Forestry, Technical and Facilities Management Services Information Guide and the Parks Branch Field Guide.

These guidelines are not intended to be prescriptive; rather, they are MVVA's recommendations to organically manage the growth and sustainment of this young landscape into healthy, diverse, and functional ecological systems that offer the public a unique and high-quality experience in the city.

MVVA believes that the ultimate purposes of any landscape are to enrich the daily lives of people, to make comfortable places for one or many, and to be vital and central in their communities.

This manual is a working document and the guidelines respond to the evolving site conditions and developing organic maintenance methods. As the PFR staff come to know and understand the park well, they should add to and change the guidelines to specifically fit Corktown Common and Lauren Harris Square.

PFR is committed to maintaining Corktown Common organically and sees this as a potential model to introduce additional organic maintenance means and methods into PFR's current resources and larger parkland network.

THE VISION

Establish an ecologically diverse landscape for this previously de-natured urban site.

Nurture the growth of this new urban landscape through organic means and methods.

Use as many organic maintenance means and methods as possible to produce a healthy, sustainable urban ecosystem.

Progress towards full organic maintenance but recognize that this is an evolving program. If, say, 70% compliance is achieved in the early days, this is still significant progress over conventional maintenance methods.

ORGANIC MAINTENANCE PRINCIPLES

Organic Land Care

- Focus on long-term performance instead of short-term sustainability.
- Promote and enhance biodiversity, biological cycles, and soil biological activity.
- Promote the health of all living things.
- Emulate and sustain ecological systems.
- Practice precautionary and protective care.
- Build on relationships that ensure fairness with regard to common environments and life opportunities for current and future generations.

Water Use and Quality

Municipal water, site watersheds, rain water, and gray water.

- Conserve water supply.
- Maintain water quality.
- "Do no harm" means avoid procedures or inputs that would alter water flow, groundwater, and bodies of water.

Energy Use and Climate

- Minimize the amount of energy used in operations.
- Minimize fossil fuel use in equipment.
- Minimize fossil fuel use in offices or workshops.
- Reduce the amount of energy needed to cool and heat occupiable spaces.

Planting Soil

- Nourish soil life instead of plants directly.
- Encourage the cycling of nutrient systems through replenishment of organic matter and sustaining soil biology.
- Balance nutrients through management of pH.
- Sustain soil biological life through the use of biologically active materials such as compost and compost teas.
- Compost on-site materials such as grass clippings and leaves, and use minimal supplements from off-site sources.
- Prevent and avoid contaminating soil or water.

Fertilizers and Soil Amendments

- Feed the soil to benefit plant health, not to artificially stimulate plant growth.
- Prohibit any unnecessary application of fertilizers or soil amendments, including acceptable organic products.
- Do not allow excessive nutrients to build up in soil. Nitrogen and phosphorus, for instance, would harm water supplies or bodies of water (nitrification).
- Test soil seasonally to determine soil needs before any applications are made. *See Chapter III: Planting Soil and the Maintenance Calendars in Chapter IV: Planting.*
- Use renewable materials (such as compost, compost teas) that are locally and sustainably produced.
- Use plants that can fix nitrogen.

- Avoid broad spectrum fertilizers (including organic products) by applying individual nutrients or blends made up of only needed nutrients.

Lawns

- Reduce the need for irrigation, fertilizers, and pesticides by encouraging healthy soil and plants.
- Minimize the use of energy-using machinery.
- Keep grass at 6 cm height or longer to encourage deeper root growth and weed suppression.
- Leave grass clippings on lawn to release nutrients back into the soil.
- Spread 6-7 mm of compost in the fall to create an available nutrient source in the spring.
- Use nitrogen-fixing plants to help encourage nitrogen cycling and reduce the need for fertility inputs.
- Hand pull weeds or suppress them through mowing.
- Instead of fertilizers, use thin layers of compost to feed lawns.
- Water sparingly but deeply, managing irrigation by zones that are adjusted for aspect, sun/shade, wind, and slope.

Native, Exotic, and Invasive Plants

- *See Appendix C: Invasive Plants for species-specific tips.*
- Sustain the existing native plant palette by using natives for plant replacements or additions.
- Learn to identify locally threatening invasive plants so they can be brought under control quickly.
- Regularly monitor and remove invasive plants through hand pulling, repeated cutting down, or disturbance to their preferred habitat and ecology.

Plant Maintenance

- Sustain plants through their roots by managing plant bed health.
- Use a soil amendments program recommended for soil health. *See Appendix A: Planting Soil Primer for details.*
- Put the right plant in the right place.
- Prepare the soil before planting.
- Keep the natural branching habit of plants. Prune only for broken or dead branches, crossing branches, and structural safety.
- Compost pruned materials and leaf litter.
- Mulch beds with organic matter such as shredded leaves or compost.

Weeds, Diseases, and Pests

- *See Appendix C: Invasive Plants and Appendix D: Diseases and Pests for more details.*
- Make scouting for weeds, diseases, and pests part of a regular routine of inspection.
- Avoid conditions favored by weeds such as compaction, over-watering, and ill-timed nitrogen feeding.
- Mulch to suppress weeds.
- Tolerate weeds (they are part of the ecology too), but limit quantity by proper management.
- Limit weed control in individual areas by using products that are non-selective herbicides containing ethanonic and acetic acids, or potassium salts of fatty acids.
- Prevent disease with healthy soil.
- Use natural means of disease control including hand removal, soaps, plant-based oils, etc.
- Avoid the use of pesticides by identifying the pests, learning about their soil biology, determining their tolerance levels, and modifying pest habitat accordingly.
- Use natural control of pests through predators or antagonist insect species.
- Use natural means of pest control such as milky spores or horticultural sprays.

PROHIBITED TREATMENTS AND PRACTICES

In General

- Do not use synthetic or inorganic products of any kind.
- Do not dump synthetic or inorganic material into the drainage structures because this will contaminate every water system on site. All water leads to the marsh and irrigation system or to the city storm water system.
- Do not irrigate excessively to avoid water runoff, soil compaction, anaerobic soil, plant over-watering stress, or water-induced disease and pests.
- Do not weed whack plant beds as this can damage and stress plants, reduce nutrient flow, and open up routes for disease and pests to enter. Only hand weed in these areas.
- Do not mow lawn to a height of less than 6 cm, except for sports turf, as short blades reduce surface area for photosynthesis, nutrient uptake, and shading that helps keep weeds in check.

Soil Amendments

- Do not amend soil without the guidance of a soil test or field diagnostics. Never set up an "automatic" soil improvement plan. Instead, treat every area on its own based on its particular physical conditions and plant palette.
- Do not use synthetic fertilizers or amendments. These have salts and other ingredients that will disturb soil biology.
- Do not use blended fertilizers that contain a mixture of organic and synthetic materials.
- Do not apply nitrogen organic fertilizer to lawns when grass is not actively growing. Only apply nitrogen when the lawn is able to use it rapidly during the growing season.
- Do not exceed soil test recommendations for nitrogen, phosphorus, and potassium. Give plants only the nutrient amounts that they need.
- Do not over-apply compost, as this may result in an excess of nitrogen and phosphorus.
- Do not use anaerobic compost, bio-solids, or sewage sludge because it can contain pathogens, antibiotics, and salts.
- Do not use synthetically-derived nitrates, urea, or ammonia (e.g., ammonium sulfate).
- Do not use mono-ammonium and di-ammonium phosphate, single and triple superphosphate, or synthetically derived phosphates as these will run off into and pollute water systems.
- Do not apply muriate of potash (potassium chloride) or synthetically derived potassium. These are highly soluble and their high salt index may disrupt soil biology, especially in the rhizosphere where there are critical exchanges between roots and microorganisms.
- Do not use burned, quick lime (magnesium oxide), hydrated lime, or slaked lime. These can have a cementious reaction with soil that will harden it. It can also easily enter the watershed and raise the pH of the marsh to unacceptable levels.
- Do not use synthetically derived calcium, sulfates or magnesium. Claims that these help with soil compaction or detoxification are not proven. Almost every soil already contains enough calcium and this is true for Corktown Common.
- Do not use copper sulfide, iron chloride, iron sulfate, chelated iron or aluminum sulfate. These trace elements are needed in very small quantities and if they are deficient it is usually because of another issue within the soil, such as high pH or poor drainage. Additionally, an imbalance of one of these trace elements can lead to blocking plant uptake of other elements. For example, high iron levels can block plant uptake of copper and cobalt.
- Do not use synthetically derived micronutrients or microbial inoculants like genetically modified organisms (GMOs). Synthetic micronutrients often come with other undesirable products used in their making.

Weed Control

- Do not use synthetic herbicides because they affect soil biology, can enter the water system through run-off, and are toxic to people and animals.
- Do not use synthetic growth regulators, caustic acid, or salts as they can imbalance soil biology.
- Do not use diesel products or petroleum distillates because they are harmful to soil and are regulated contaminants.

Pest and Disease Management

- Do not use any synthetic insecticide, including neonicotinoids, synthetic insect growth regulators, pyrethroids, carbamates, organophosphates, and piperonyl butoxide (used as an insecticide synergist).
- Do not use nicotine, nicotine sulfate, or tobacco dust.
- Do not use sodium fluoaluminate.
- Do not use mothballs.
- Do not use any persistent poisons, such as arsenic.
- Do not use genetically engineered organisms or materials derived from them.
- Do not use any synthetic fungicides.
- Do not use petrochemical-based anti-desiccants.

II. Park Overview

Park Overview

MVVA DESIGN PRINCIPLES

The park was founded on the idea of the "common" as a democratic, inclusive open space that anchors adjacent neighborhoods and becomes wired into the daily lives of the people it serves. Equally important was the promotion of ecological, programmatic, experiential, and social diversity that makes living in the city enticing and enjoyable. Corktown Common's design goals are:

Create a place to be immersed in nature within the city of Toronto. The park's plants bring nature to the city and they are its most vulnerable asset. Change is inevitable but the feel of the landscape requires vigilant adherence to design concepts. Guiding principles are to replace natives with natives, keep natural plant forms, and always match plants with place.

Establish visual connections that draw people from the developing West Don Lands community into the park. Entrances and views of the park from surrounding streets were carefully planned to be inviting and enticing, using nature as the draw for people instead of the more typical (and visually cluttering) devices of signage or site furniture.

Provide a variety of spaces to support the broad range of activities that the Corktown community desires. This is both an active and passive park. The park pavilion, play areas, splash pad, community picnic table, and recreation field form a cluster for activity. The paths that meander through the park, marsh, and prairie offer a respite from activity. The open lawn, sited between the marsh and pavilion, is a flexible space that supports intensive public use or, when empty, adds visual expansiveness. The Don River Bike Trail connects the park to downtown Toronto and the Don River Valley, making the park an easily reachable destination for those near and far.

Introduce ecological diversity to this denatured, post-industrial site. Marshes, prairies, and woodlands have been established to create experiential range for park users and a diverse habitat to shelter and feed the Don River's wildlife and migratory birds.

Build a resilient urban landscape founded on regional natural system principles and processes. The park's planting soil system, topography, and plant communities are redolent of Ontario's intrinsic ecologies, but they have been engineered to withstand the intensity of modern human use.

Make a showcase for native southern Ontario plant communities. Native and Toronto-adapted species make up 95% of the plant palette, a first for Toronto's public parks. Diversity of species leads to horticultural vigor, expanded habitats, and varied seasonal interest.

Minimize inputs to Toronto's stormwater system and maximize reuse of potable water. All potable water (except pavilion wastewater) and stormwater are collected and reused both for flushing stagnant water through the marsh and for filling the irrigation cistern for watering plants. This closed system overflows to the city only in extreme storm events.

Make Corktown Common the model for organic maintenance. Design decisions about the park have always been in service to sustainability, which enables organic maintenance. Maxims such as right plant/right place, healthy soil/healthy plants, waste not/want not, and think globally/buy locally have netted a landscape that can be more resilient to its urban setting, less troubled by diseases and pests, resistant to invasive plants, water efficient, and better able to bounce back quickly from any problems encountered.

Encourage community stewardship and ownership at Corktown Common through outreach programs. If the park becomes a valuable part of the city and neighborhood, through either programming or presence, it will attract advocates who will look out for its well-being and come forward to help when needed. Volunteer programs, such as the "green greeters" and "weed squad" should be encouraged.

– – Flood Protection Landform (FPL)

0 5 10 25 N

Park Overview

CPU AND FPL SITE PARAMETERS

Jurisdiction: The park is under jurisdiction of Infrastructure Ontario (IO) and the Toronto Region Conservation Authority (TRCA). The City of Toronto maintains the park, and its practices must comply with the agreements made with these agencies at the time the park was built.

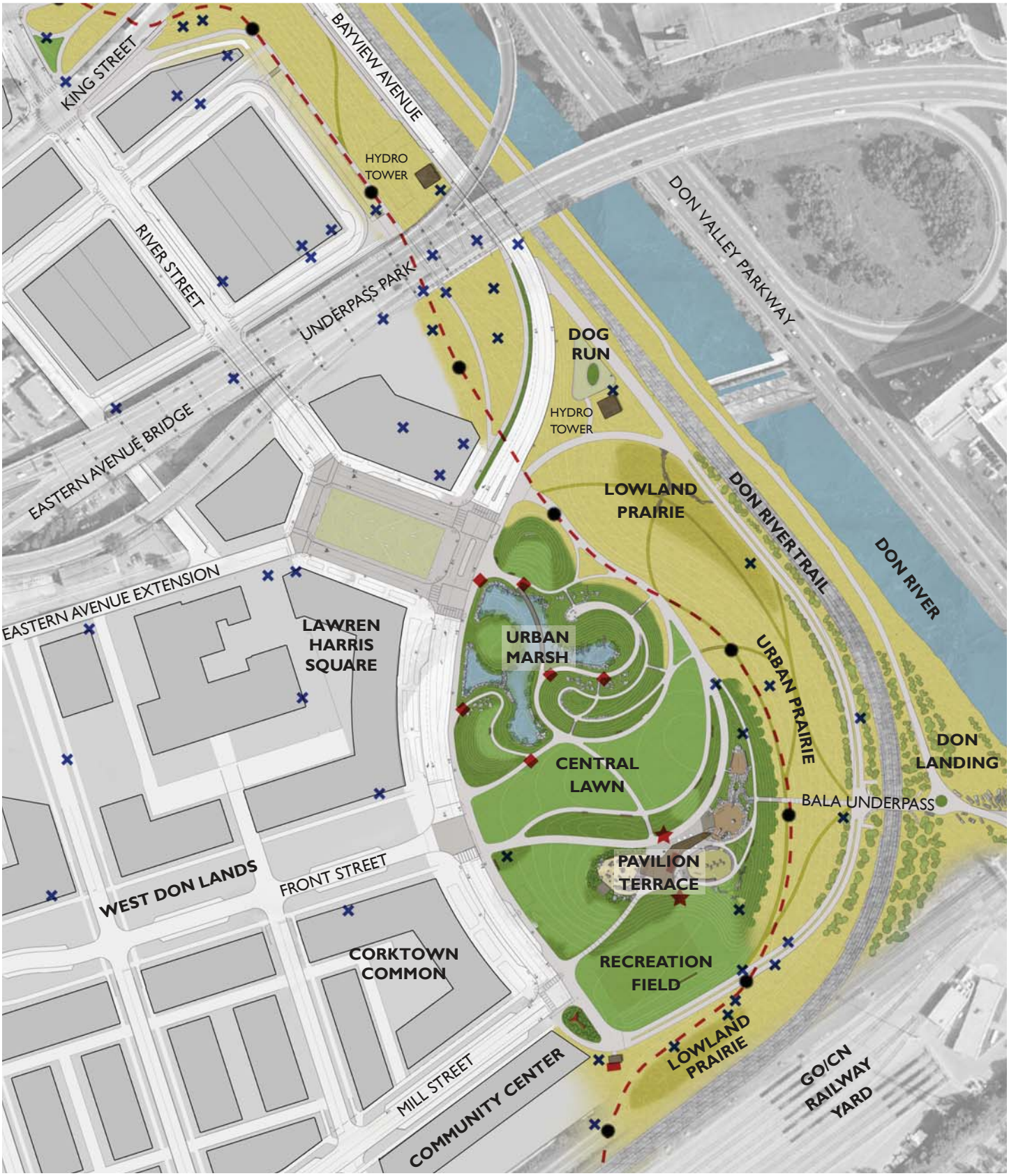
MOE Certificate of Property Use (CPU): Prior to being developed as a park, the site was a brown field. As part of the park development, the site has been capped as per the Ministry of the Environment (MOE) and city requirements for the CPU. Refer to the CPU #5857-8JWJJC for any maintenance requirements for the park as required by the Ministry of the Environment.

- All park panting soil is imported and meets the Soil Cap Standards specified in the CPU.
- All future soil and soil components (e.g. compost, sand, and base loam) imported to this site must meet the Soil Cap Standards specified in the CPU.

Flood Protection Landform (FPL): The park sits on top of a Flood Protection Landform (FPL), which was constructed to protect the West Donlands from the Don River floods. It is constructed of compacted fill primarily composed of clay and silt. Armoring stone (rip rap) is integrated into the fill east of the FPL crest between the Bala Underpass steps northward to the King and Queen Streets Triangle. Refer to TRCA's FPL maintenance requirements for the park as required by the Environmental Assessment (EA).

- FPL Footprint
  - East of the FPL crest: the FPL is concurrent with the park finish grade.
  - West of the FPL Crest: the FPL is not concurrent with the park finish grade and the depth to the FPL below varies.
- FPL Settlement Monuments: there are ten settlement monuments that must be accessible for TRCA's forces to monitor possible settlement of the FPL. These are located along the FPL crest.
- Marsh Pond Liner Monitoring Wells: There are six wells connected to a sand layer under the Marsh pond liner. These wells allow monitoring of potential water seepage due to pond liner failure. PFR staff shall monitor these wells once a season and report any inconsistencies to TRCA.

CPU AND FPL SITE PARAMETERS PLAN



- Flood Protection Landform (FPL)
- Settlement Monuments
- MOE Monitoring Wells
- TRCA Pond Liner Monitoring Wells
- MOE Pavilion Basement Vents

0 5 10 25 N

III. Planting Soil

Planting Soil

OVERVIEW

Fast Facts

All planting soil has been imported and designed to specifically support the park's new plant communities.

All imported soil has been environmentally tested and approved prior to importation as per the Ministry of the Environment's (MOE) Certificate of Property Use (CPU) for this site. *See Chapter II: Park Overview for details.*

The planting soil program for the park is different on the east and west of the Flood Protection Landform (FPL) crest. The soil in the main part of the park (west of the FPL crest) is carefully segregated by use, plant type, topography, and water needs. There are many soil profiles in this most active part of Corktown Common. East of the crest is dominated by the urban prairie, which has a single type of soil profile. Due to restrictions aimed at protecting the integrity of the FPL, no woody plants are allowed on this side of the crest so the soil profile is shallow and mostly contiguous.

The planting soil mixes have been created by blending the following soil components, at varying ratios, to create soil layers.

- Base Loam (a naturally-occurring soil).
- Sand: granitic (west of FPL) and calcareous (east of FPL).
- Compost (yard waste).

The planting soil is installed in multi-layered "profiles" to emulate the arrangement and function of natural soil horizons:

- Top: nutrients (sandy loam).
- Middle: root structure (loamy sand).
- Bottom: drainage (sand).

Eleven soil profiles were used. They vary by number of layers, gradation, and organic content, and are arranged from finish grade and below. *Also see Soil Profile Details in this chapter.* The layering systems used are:

3-layer profiles (all plant beds and trees)

- sandy loam (nutrients)
- loamy sand (root development)
- sand (drainage)

2-layer profiles (lawns and prairie west of the FPL)

- sandy loam (nutrients and root development)
- coarse sand (drainage)

1-layer profiles (marsh and urban prairie east of the FPL)

- loam (nutrients and root development).

All planting profiles sit on a subgrade consisting of an impermeable compacted clay/silt fill. Instead, water infiltrates through the soil profile layers into the sand drainage layer above the subgrade (except at the marsh basin and at the urban prairie east of the FPL crest). An extensive piped underdrainage system is located in the continuous sand layer to collect infiltrated storm and irrigation water and direct it to the irrigation cistern. *See Chapter V: Water Collection and Re-Use.* The underdrainage system is composed of:

- Round underdrainage polyvinylchloride (PVC) pipes at planting beds (mid-slope and at the toe of slope) and Lawren Harris Square on either side of the trees.
- PVC flat panel underdrainage pipes at lawns.

To help with stability and compaction, some of the planting soil layers are mixed with polystyrene fiber reinforcement (geofibers). It will be harder to dig in these areas. Specifically, geofibers are in the following locations:

- All slopes 3:1 or steeper, to prevent erosion.
- The Youth Athletic Field, to resist compaction.

Bottom Line Design

Plants are the backbone of the design and the site's ecological communities.

Planting soil is the primary determinant of plant health.

Planting soil profiles are designed for optimum performance, which includes:

- Self-sustaining nutrient cycling systems.
- Healthy soil biology.
- Water holding capacity and infiltration.
- Resistance to compaction.

Specific soil profiles are designed to sustain and nurture each plant community. In addition, the design encourages the following general soil maintenance practices:

- Replace soil layers in kind after disturbances or remedial work.
- Supplement organics in top soil layer to maintain optimal content.
- Monitor and rebalance soil biology and compaction with compost tea applications.
- Aerate and compost planting soil if over-compaction occurs.

Making it Organic

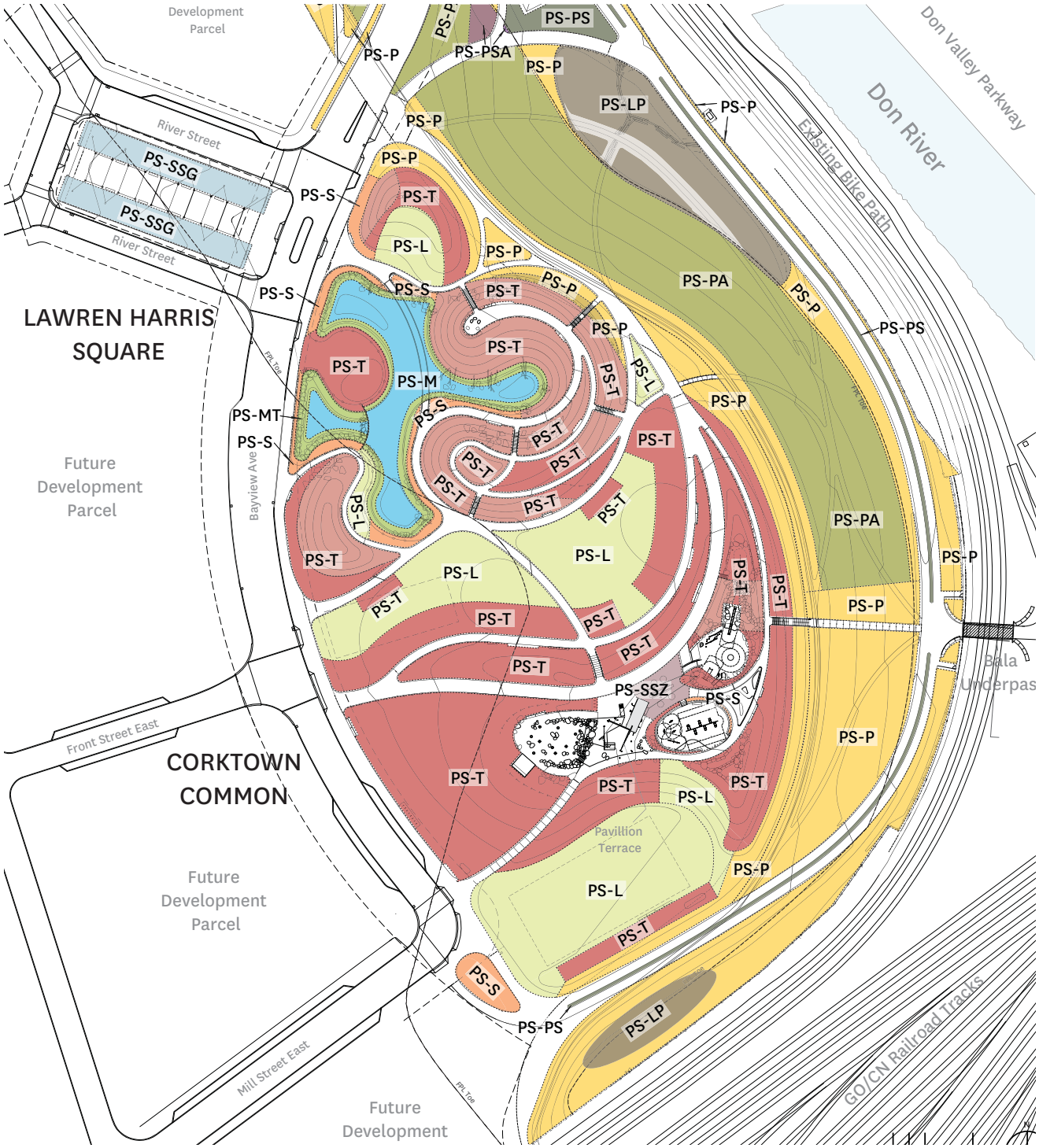
Soil evolves with plants through the soil-root interface called the rhizosphere, which is a thin layer of soil that is not a region of particular size or shape but rather a three-dimensional gradient of chemical, physical, and biological processes that occur on a root. Simply put, critical exchanges happen in the rhizosphere, and without this interface both soil biology and plant roots suffer.

Soil Maintenance requires the following:

- Nourish soil life instead of plants directly.
- Prevent nutrient overloading. Limit use of organic fertilizers. Apply individual nutrients as needed, not fertilizer blends.
- Sustain soil biology through using biologically active materials such as compost and liquid biological amendments (LBA) or "compost tea". Brew specific LBAs for specific needs.
- Compost on-site yard-waste materials such as post-mowing grass-clippings, twigs, and leaf litter.
- Perform seasonal testing to determine soil needs.
- Mulch with organic matter such as on-site shredded leaves or yard-waste compost.
- Keep soil at optimum moisture content, around 15%, for all but the marsh soil. Prevent over watering since over-saturated soil becomes anaerobic.
- Use organic methods for controlling pests and diseases. Prohibit or greatly limit use of herbicides, pesticides, or fungicides because they alter soil biology. If they must be used, follow up with biological testing to gain a basis for LBA treatments, which are likely needed to rebalance the microbial communities.

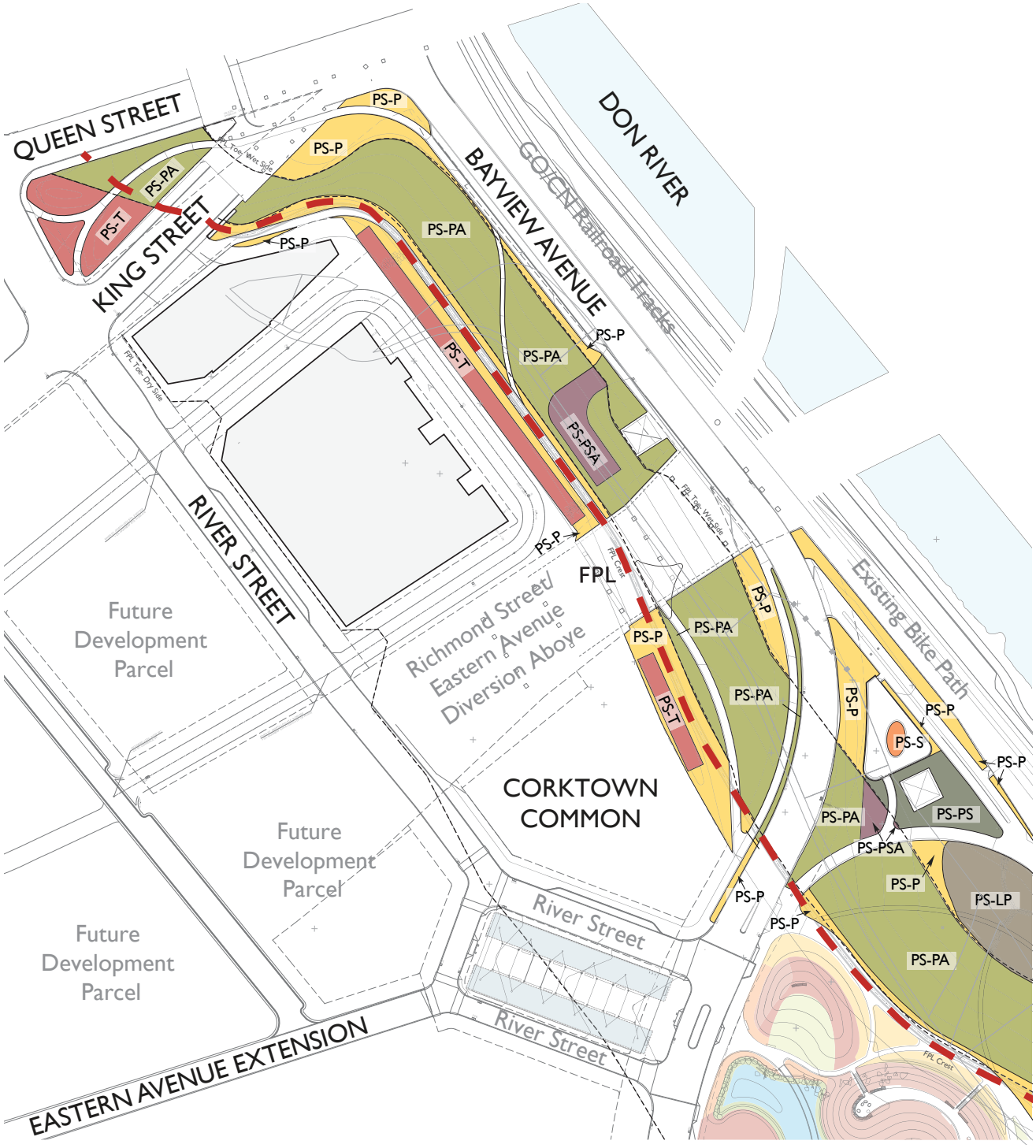
Planting Soil

PLAN SOUTH



- PS - L : LAWN
- PS - S : SHRUB
- PS - T : TREE SOIL
- PS - T : TREE SOIL GEOFIBERS
- PS - P : PRAIRIE
- PS - M : MARSH
- PS - MT : MARSH TRANSITION
- PS - PA : ARMORED SLOPE
- PS - LP : LOWLAND PRAIRIE
- PS - PS : PRAIRIE STABILIZED
- PS - SSG : STRUCTURAL SOIL AT RIVER SQUARE
- PS - SSZ : STRUCTURAL SOIL AT PAVILION TERRACE

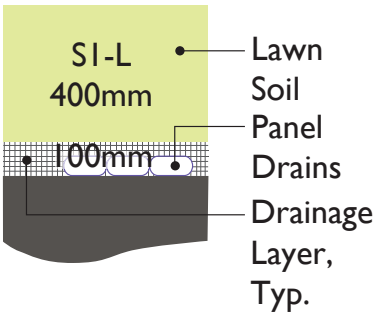
PLAN NORTH



PS - L : LAWN
PS - S : SHRUB
PS - T : TREE SOIL
PS - T : TREE SOIL GEOFIBERS
PS - P : PRAIRIE
PS - M : MARSH
PS - MT : MARSH TRANSITION
PS - PA : ARMORED SLOPE
PS - LP : LOWLAND PRAIRIE
PS - PS : PRAIRIE STABILIZED
PS - SSG : STRUCTURAL SOIL AT RIVER SQUARE
PS - SSZ : STRUCTURAL SOIL AT PAVILION TERRACE

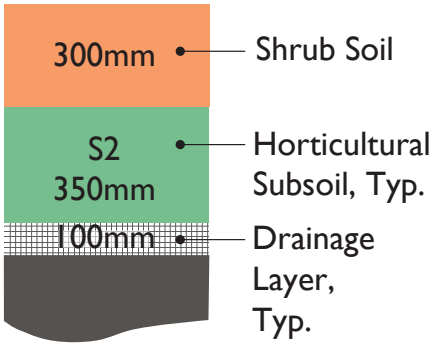
0 5 10 25 N

Planting Soil



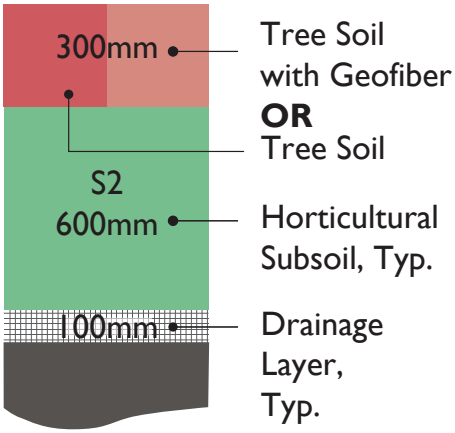
LAWN

PS - L



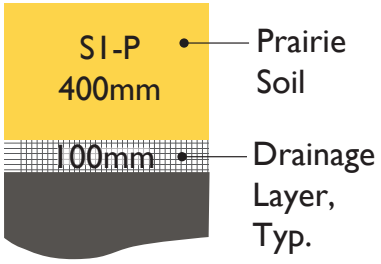
SHRUB

PS - S



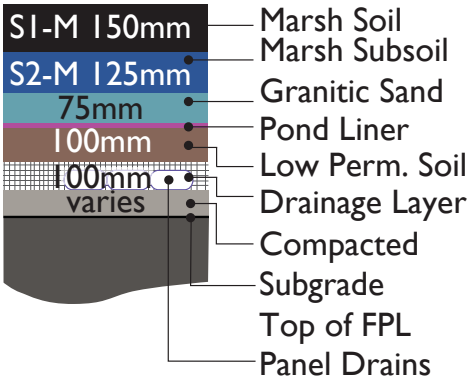
TREE SOIL and
TREE SOIL GEOFIBERS

PS - T PS - T



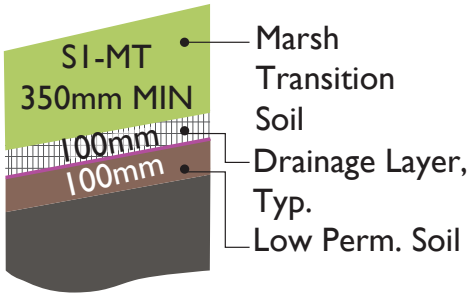
PRAIRIE

PS - P



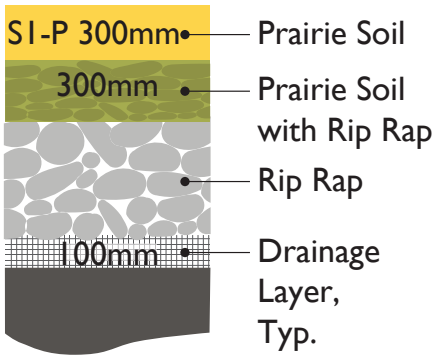
MARSH

PS - M

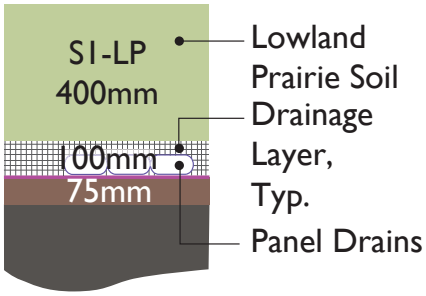


MARSH TRANSITION

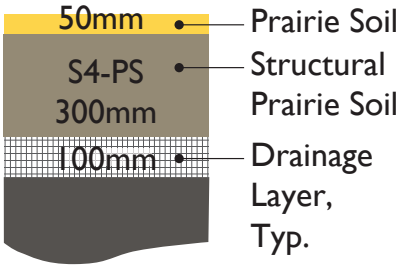
PS - MT



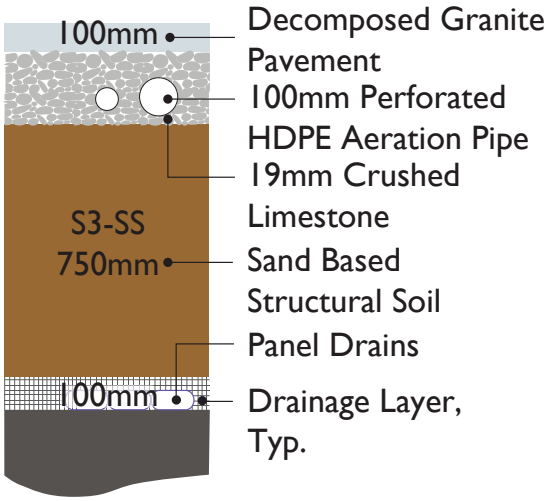
PRAIRIE
PS - PA



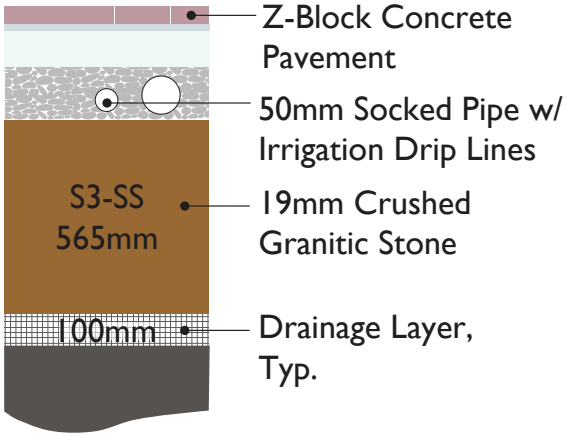
LOWLAND PRAIRIE
PS - LP



PRAIRIE STABILIZED
PS - PS



STRUCTURAL SOIL at Lawren Harris Square
PS - SSG



STRUCTURAL SOIL at Pavilion Terrace
PS - SSZ

Planting Soil

ALL ZONES				***West of the FPL: 2.5 Hectares, 6.2 Acres East of the FPL: 2.9 Hectares, 7.2 Acres***
Month	**Week**	**Location**	**Task**	**Notes**
December to February	Every week	Lawn	Don't drive or park on lawn.	• Freeze-thaw cycles trap water in soils and makes compaction a real threat.
			Limit walking on lawns and in plant beds.	• If winter events require heavy use of lawn, allow lawn to rest for two weeks after by cordoning off lawn areas. • When moist or wet, plant beds are susceptible to compaction.
March	3rd week	All Areas	Inspect for animal borrowings and repair in April.	• Repair in April when soil moisture is at field capacity.
				• Refer to Appendix A. • Water-logged soil is in danger of becoming anaerobic although lower temperatures will usually inhibit this greatly. If freeze-thaw cycle has been high then anaerobic conditions could develop.
April	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone. Check for any areas that may have become waterlogged due to low spots, burrowing, or compaction.	• Refer to Appendix A. • Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).
	1st week	Woodlands	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
			Test for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
	2nd week	Lawn	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods.
			Test for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods.
			Take lawn cores to determine if de-thatch is needed and perform work.	• If organic practices are used, de-thatching should rarely need to be done. De-thatch only if the thatch mat reaches 1.25 cm (0.5") or more. • De-thatch before any amendments are put down except for corn gluten.
		Prairie	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
May	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone. Check for any areas that may have become waterlogged due to low spots, burrowing, or compaction.	• Refer to Appendix A. • Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).
June	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone.	• Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).

Month	Week	Location	Task	Notes
July	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone. Check for any areas that may have become waterlogged due to low spots, burrowing, or compaction.	• Refer to Appendix A. • Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).
August	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone. Check for any areas that may have become waterlogged due to low spots, burrowing, or compaction.	• Refer to Appendix A. • Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally but will be slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions ("sewage" odor).
September	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone.	• Do not disturb wet soil as it can become compacted or lose its structure if moved while moist. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).
	1st week	Woodlands	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods.
			Test for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods.
		Lawn	Test soil for nutrients, salts, NO3, NO4, and pH. (Use test results for September amendments.)	• See Appendix A for soil testing methods. • Use as a check for soil needs going into winter.
	2nd week	Lawn	Test for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods.
October	Every week	All Areas	Inspect irrigation areas for any leaks. If discovered, allow soil to dry out in that zone. Check for any areas that may have become waterlogged due to low spots, burrowing, or compaction.	• Refer to Appendix A. • Do not disturb or move wet soil as it can become compacted or lose its structure. • Soil profiles should be sandy enough to allow the soil to drain naturally, although water drains slower in lower temperatures. • Once water is drained, dig a 300 mm deep hole and inspect for anaerobic conditions (Note if there is a "sewage" odor).
November	2nd week	All Areas	Last check for problem areas of disturbance or ponding.	• If soil is wet, mark the area and work again in the spring. • Do not disturb frozen soil.

IV. Planting

Planting

OVERVIEW

Fast Facts

Approximately 95% of the plant palette is native or Toronto-adapted.

There are 17 distinct planting "zones" within the park design. The *Guidelines* have grouped them into the following maintenance types. Also see *Planting Plans* within this chapter).

- Woodland
- Trees in Pavement
- Marsh
- Lawn
- Urban Prairie

Corktown Common's planting structure is divided into two halves by the Flood Protection Landform (FPL). Woody plants are only allowed west of the FPL crest and herbaceous plants are installed east of the FPL crest.

Bottom Line Design

The planting design balances fast-growing plants for immediate effect with slow-growing plants that provide a long-term spatial structure. Most of the plants are placed in protected woodland plant beds with selected plants in the Central Lawn.

Planting is never formally arranged, which means that plant removal will not "ruin" the design.

While removing a limited number of plants is okay, introduction of plant species that are different than the overall palette or that are visually incompatible with adjacent plants is strongly discouraged.

The introduction of new plant communities re-establishes this site as a diverse ecosystem.

- The overall plant palette provides food and shelter for migratory birds and the local riparian edge wildlife of the Don River.
- The fresh-water marsh is a unique environment that supports a vast array of wildlife and plant communities. It is also a critical component of the overall stormwater collection strategy; water that would otherwise be wasted is directed to the marsh. *See Chapter V: Water Collection and Reuse for details.*
- The prairie brings a new type of plant ecosystem to the area, giving home to a wider diversity of animals, birds, and insects.

The lawns are the most "traditional" part of the park and they were purposefully limited and placed to provide a range of uses and experiences. The central lawn has spectacular views of Toronto and is large enough for community events. The recreation field supports more intensive uses but it too is sized for gatherings. Smaller patches of sloped lawns edge the marsh and provide a place of prospect. Limiting their area also helps to reduce more intensive maintenance.

Species were selected for micro-climate fit (e.g., dry-tolerant species at tops of slopes, moisture-tolerant at bottom of slopes). However, if a plant is not performing well in its location, replace it with a better native fit. *Consult MVVA for ideas on replacement species.*

Making it Organic

Plant Maintenance:

- Soil is the basis for plant health.
- Stop nutrient overloading by prohibiting inorganic fertilizers and limiting organic fertilizers.
- Sustain plants through their roots by managing soil in the plant beds.
- Right plant, right place.
- Keep the natural habit and character of plant branches. Prune only for broken or dead branches, crossing branches, structural safety.
- Compost pruned materials and leaf litter.
- Mulch beds with mature organic matter such as shredded leaves or compost. Maintain a consistent layer of 4-5 cm of mulch maximum.
- Conserve water and encourage deep root development by deep watering at longer intervals. After establishment (3–5 years), only water when needed

Weeds, Diseases, and Pests:

- Scout for weeds, diseases, and pests during regular maintenance.
- Avoid favorable conditions for weeds by managing compaction, over-watering, and application of ill-timed nitrogen.
- Mulch to suppress weeds.
- Hand-weed in plant beds (do not use weed whackers).
- Use natural means of disease control including hand removal, soaps, plant-based oils, etc.
- For pest control use predators, antagonistic species, milky spores, beneficial insects, or horticultural oils.
- Use no herbicides, pesticides, or fungicides.


Queen Street East Bridge Abutment
King Street East Bridge Abutment
Block 3
Block 4
Block 1 Future Development Parcel
Future Development Parcel
Future Development Parcel
Richmond Street/ Eastern Avenue Diversion Above
Bayview Ave
GO/CN Railroad Tracks
Don River
Don Valley Parkway
Existing Bike Path
Block 6 Future Development Parcel
River Street
River Street
Eastern Avenue Extension
LAWREN HARRIS SQUARE
Block 6 Future Development Parcel
Bayview Ave
CORKTOWN COMMON
Front Street East
Block 6 Future Development Parcel
Mill Street East
Block 6 Future Development Parcel
GO/CN Railroad Tracks
Bala Underpass
ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL
0 5 10 25
N

ZONE 1: WOODLAND
ZONE 2: FAST GROWING FRAME
ZONE 3: PLAY WOODLAND
ZONE 4: ASPEN GROVE

Fast Facts

Size: 1.5 Hectares (3.7 Acres)

Planting soil on steep slopes (3:1) contains geofiber reinforcement to prevent erosion.

All woodland beds have underdrains at the mid and bottom of slopes, which helps to prevent over-saturation of soil.

Bottom Line Design

The woodlands contain the majority of plants in the park and are protected in several ways.

Slopes discourage people from walking in plant beds. A low range fence signals "stay out (please!)". Paths and steps are carefully sited to guide pedestrian movement and eliminate the desire to take a shortcut.

Woodland structure is multi-layered and includes:

- Canopy trees for spatiality and cover.
- Understory trees for scale and colour.
- Evergreen trees for spatial animation during winter.
- Shrubs for massing are planted in groups of three. These groups are widely spaced except at the Fast-Growing Frame and the Play Woodland where a continuous shrub layer is encouraged.
- Perennials for detail and seasonal interest, where their colonization/division/transplant is encouraged.

When needed, tree species should be replaced in kind, especially at:

- Marsh slopes (larch, red maple, and birch).
- Park stairs (tulip poplar).
- Grove plantations (shagbark hickory, American beech, and yellowwood).

A close spacing of trees intentionally emulates natural woodland density.

Making it Organic

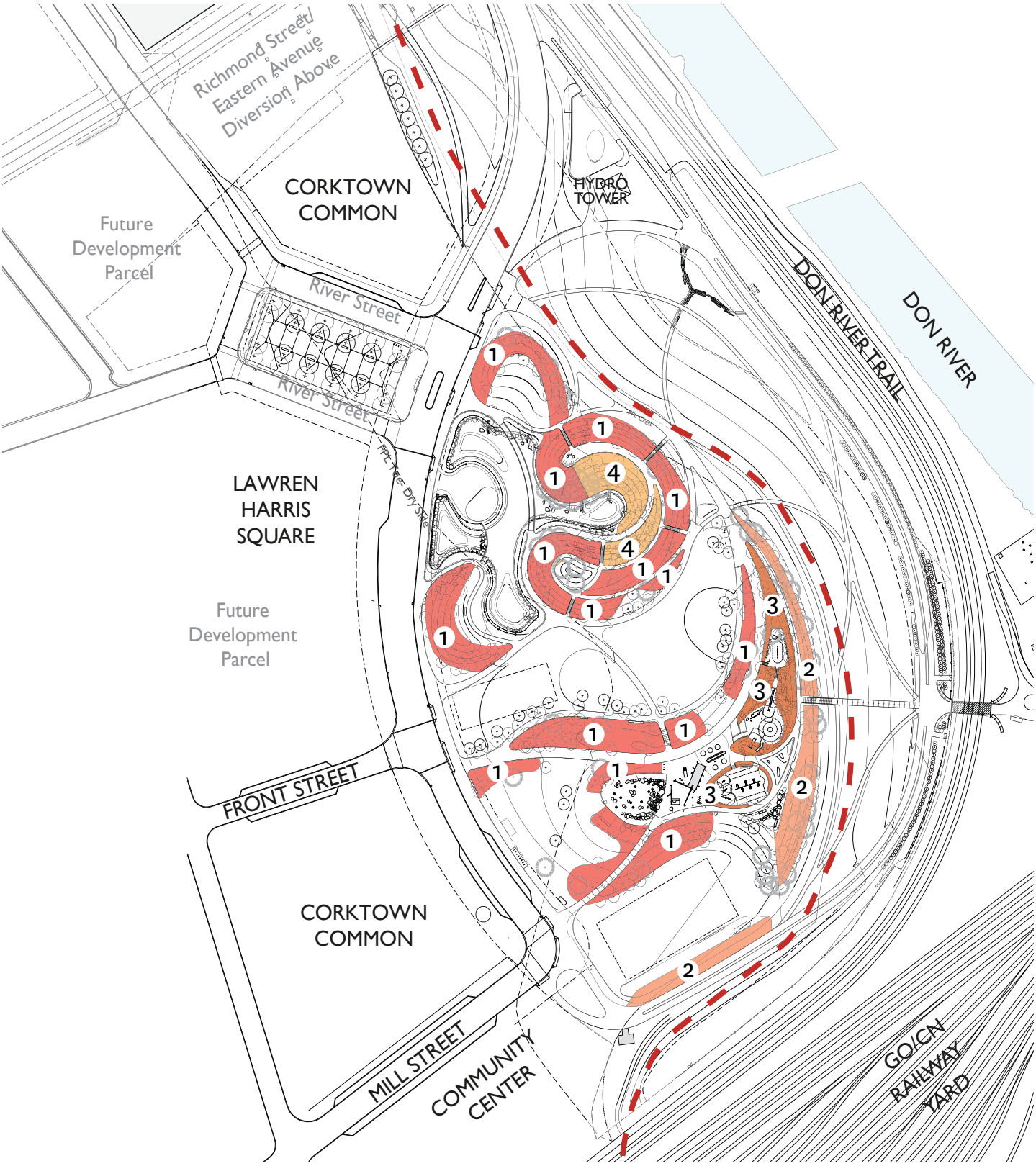
The woodlands are planted in a rich sandy loam that encourages root development, nutrient cycling, water retention and movement, and supports soil biology. The health of the soil will be telegraphed into the health of the plants so protecting this resource is of utmost importance. *Refer to Soil Maintenance and Appendix A.*

Plant Maintenance:

- Do not remove groundcover debris (leaves primarily) until late winter or early spring to encourage re-seeding, soil protection and habitat nesting. Ideally, the debris would be collected in late fall, shredded by a mulching mower, and then placed back on the beds. This practice will add nutrients to the soil, ready and available in the early warm days of late winter and early spring.
- Retain the natural plant form—no shaping or shearing. Remove all suckers or advantageous sprouts.
- Allow shrubs to grow into each other to create larger massings.
- Encourage complete coverage of ground plane through dividing, transplanting, colonization, or supplemental planting.
- Irrigate deeply and less often. The planting soil is formulated to infiltrate at a high rate so longer watering will not harm the soil and it will encourage roots to seek water at a deeper depth. As plants grow, say beyond the first five years, reduce watering. Mature trees only need watering in a drought.

Weeds, Diseases, and Pests:

- Remove poplar seedlings, even in the Aspen Grove area.



ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL

0 5 10 25 N

Planting: *Woodland*

ZONES 1, 3, 15, 16			***1.5 Hectares, 3.7 Acres,***
Month	**Week**	**Task**	**Notes**
December to February	Every week	Limit walking on plant beds.	• Freeze-thaw cycles trap water in soils and makes compaction a real threat.
	February	Inspect plant bud set for death or poor health.	• Note location or tag. • Contact MVVA to discuss plant replacements or removals. • Contact nurseries to locate plant replacements. Use fresh-dug plants. • Determine if plants will be replaced in kind, species changed, or not replaced.
	As possible	Prune trees: December and late February are best due to more moderate winter temperatures.	• Prune only to remove rubbing or damaged branches. Limb up trees near paths, remove damaged limbs, and remove crossing limbs. • Keep natural form of trees. • Limb up shade trees to 5 metres. Depending on growth rate, should be done within the first 5 years of growth.
		Prune all but flowering shrubs.	• Prune only to remove rubbing or damaged branches. • Never shear shrubs. Leave natural shape. •Grouped plants should be pruned together, never as individuals.
March	2nd week	Clean up debris from beds.	• Add organic matter to compost piles.
		Check for winter damage.	• Includes ice and snow removal damage, desiccation, and animal damage. • Fix all but damage from walkway de-icing. Address as part of irrigation start-up.
	4th week	If weather permits and it wasn't done in November, clean out plant beds of debris and leaves. If weather is bad, move this task to the first week of April.	• Use a mulching mower to shred leaves and re-spread on plant beds. Add excess to the compost pile.
April	1st week	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
		If it wasn't done in November, clean out plant beds of debris and leaves.	• Use a mulching mower to shred leaves and re-spread on plant beds. Add excess to the compost pile.
		Test soil biology.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
	1st or 2nd week	Commission irrigation.	• ONLY run for deep watering of winter damage from walkway de-icing operations. • Perform deep watering before application of compost, mulch, and LBA.

Month	Week	Task	Notes
April cont.	2nd week	Apply 1.3 cm of compost/organics to the plant bed.	• Work into surface of bed.
		Add 2.5 cm of shredded leaf mulch.	• Apply before LBA is applied but after compost is incorporated.
	2nd and 4th week	Note weak to emerge trees for on-going monitoring.	• Note location of or tag weak trees. • Contact MVVA to discuss plant replacements or removals.
		Inspect for weed emergence and remove.	• See Appendix C for identification and treatment of weeds.
	3rd week	Apply liquid biological amendments.	• Formulate LBA from soil biology tests (likely bacterial tea).
	4th week	Begin normal irrigation schedule.	• Set for deep watering (no more than twice weekly).
	Begin after final frost	Replace or add new plants.	• Contact MVVA to discuss plant replacements or removals.
May	Every week	Continue irrigation.	• Set for deep watering, no more than twice weekly.
	1st week	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.
	1st and 3rd weeks	Check for pests and diseases.	• See Appendix D for identification and treatment of pests or diseases.
	2nd and 4th week	Inspect for and remove weeds.	• See Appendix C for identification and treatment of weeds.
		Note weak to emerge trees for on-going monitoring.	• Note location of or tag weak trees. • Contact MVVA to discuss plant replacements or removals.
	3rd week	Apply liquid biological amendments.	• Formulate LBA from soil biology tests (likely bacterial tea).
	By 4th week	Replace or add new plants.	• Contact MVVA to discuss plant replacements or removals.
June	Every week	Continue irrigation.	• Set for deep watering (no more than twice weekly). • Inspect zones and adjust for solar aspect, wind, drainage, and slope.
	2nd and 4th week	Inspect for and remove weeds.	• See Appendix C for identification and treatment of weeds.
July	Every week	Continue irrigation.	• Set for deep watering (no more than twice weekly). • Adjust individual zones.
	1st week	Test for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods. • Use this soil test as the basis for any amendments.

Planting: *Woodland*

Month	Week	Task	Notes
July cont.	1st and 3rd weeks	Check for pests and diseases.	• See Appendix D for identification and treatment of pests or diseases.
	2nd and 4th week	Inspect for and remove weeds.	• See Appendix C for identification and treatment of weeds.
	3rd week	Apply liquid biological amendments.	• Formulate LBA from soil biology tests (likely protozoa with food).
August	1st and 3rd weeks	Check for pests and diseases.	• See Appendix D for identification and treatment of pests or diseases.
	2nd and 4th week	Inspect for and remove weeds.	• See Appendix C for identification and treatment of weeds.
September	1st week	Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods.
		Tests for soil biology, active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods.
	1st and 3rd weeks	Check for pests and diseases.	• See Appendix D for identification and treatment of pests or diseases.
	3rd week	Apply liquid biological amendments.	• Formulate LBA from soil biology tests (likely fungal tea).
October	1st and 3rd weeks	Check for pests and diseases.	• See Appendix D for identification and treatment of pests or diseases.
	2nd and 4th week	Inspect for and remove weeds.	• See Appendix C for identification and treatment of weeds.
November	3rd or 4th week	Weather dependent, collect fallen leaves in plant beds and mulch for re-use.	• Use a mulching mower to shred leaves and re-spread on plant beds. Add excess to the compost pile.
	4th week	Inspect plants for any potential problems that might develop over the winter.	• Check for broken limbs, cracks, and desiccated younger stems. Take action or note for further inspection over the winter and early spring.

ZONE 5: HONEYLOCUST ALLÉE
ZONE 6: RIVER BIRCH GROVE

Fast Facts

Size: 0.12 Hectares (0.30 Acres)

The honeylocusts are "manufactured" multi-stemmed plants. Three separate rootballs were planted together to give the appearance of being multi-stemmed.

A specially formulated, sand-based structural soil extends underneath the pavement in both zones to encourage extensive root growth. The honeylocust trees have decomposed granite paving and the river birch are below concrete unit pavers.

There is a PVC aeration system under the pavement that serves two functions. It provides air to roots and it acts as a sleeve for the drip irrigation system.

Bottom Line Design

Trees planted in pavement offer an urbane moment, where plants and people can come in close contact. The use of this type of planting is saved for special moments in the park.

At the pavilion, the hub of activity in the landscape, river birch trees surround the community picnic area. Their peeling bark is an exquisite detail in all seasons and their downward swooping branches give light shade and bend easily in the wind.

Lawren Harris Square was designed as a true city plaza. Surrounded by streets and buildings, a nexus for the neighborhood. The Square is large enough to hold many people but also offers quite places to rest, Because this plaza would often be empty (though a weekend farmer's market is expected in warmer months) it is lined with multi-stemmed honeylocust trees that always have a strong presence. Clump honeylocusts are rarely seen, but here they are powerful enough to be shade trees for the street and a form an intimate canopy in the Square. Their small compound leaves are light and airy, cast dappled light, and in the fall they are dispersed by the wind.

Honeylocust Allée:

- Original spacing of the multi-stem trees plans for attrition for approximately 1/3 of the trunks within the first 15 years.
- Encourage the canopies to knit together over the central axis.
- Branches at sidewalks should be pruned up to at least 2.25 m to prevent obstructions to pedestrians.

River Birch Grove:

- Branches are to remain low except where they are in conflict with circulation or seating.
- Branches are intended to provide a sense of shelter when using the community table.

Prune all trees to retain an airy character and dappled light.

Maintain decomposed granite pavement up to tree bases.

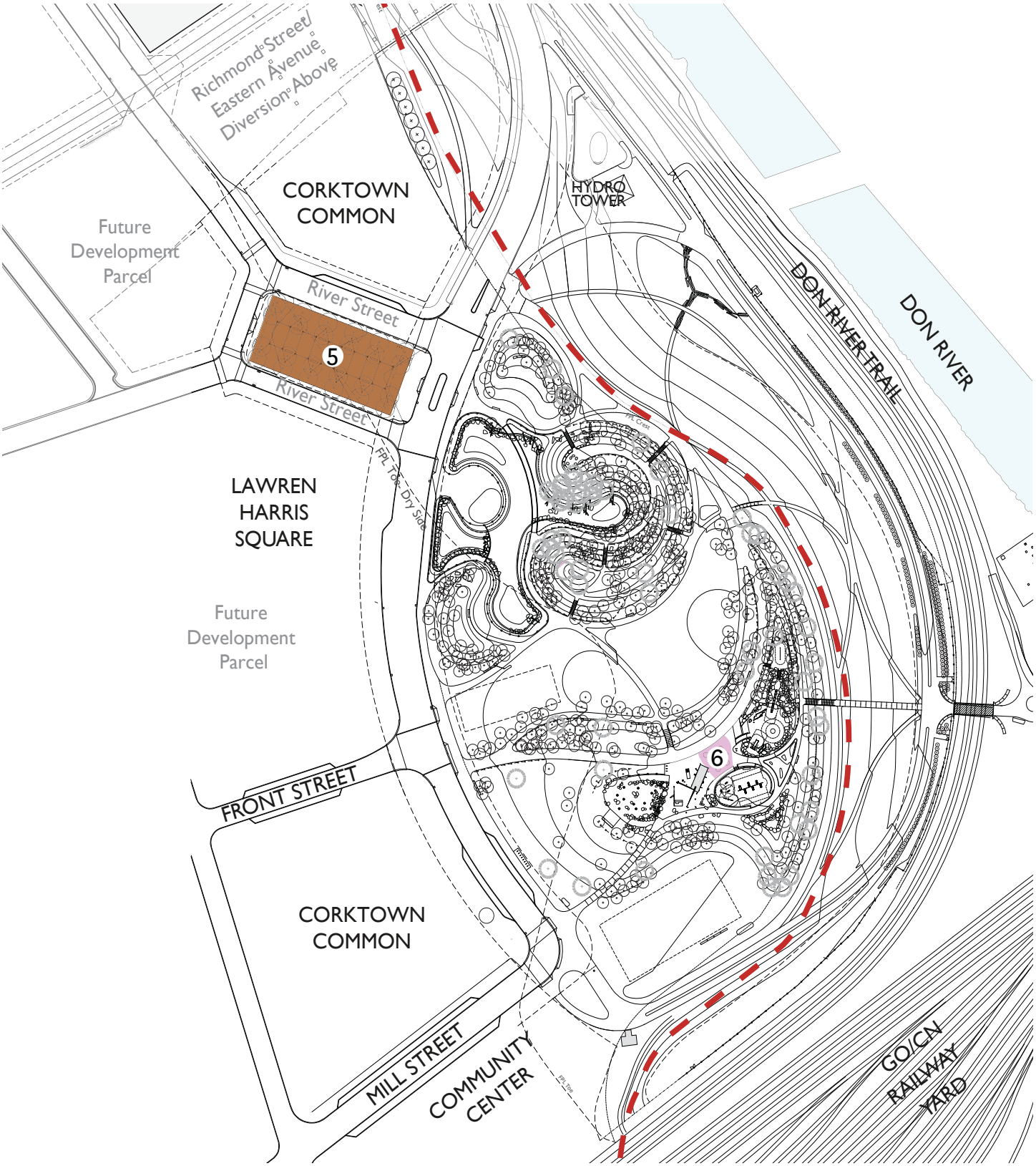
Making it Organic

Plant Maintenance:

- Monitor soil moisture levels at a higher frequency for trees in pavement.
- Trees in pavement require deep fertilization in their rootballs.
- Monitor and remove all advantageous sprouts especially at honey locusts.

Weeds, Diseases, and Pests:

- Foot traffic should suppress many weeds in decomposed granite pavement.
- Weed suckers that may sprout through pavement. should be removed at an early stage since large weeds have large root systems that will tear away at the decomposed granite. If this happens, shake out all of the trapped pavement particles, remove soil clods, and re-pat in place.
- In the pavilion area, weeds should not be a problem.



ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL

0 5 10 25 N

ZONES 5, 6			***Lawren Harris Square and Park Pavilion 0.12 Hectares, 0.30 Acres***
Month	**Week**	**Task**	**Notes**
December to February	Every week	Inspect plaza for washout of stabilized pavement.	• Repair work is weather dependent. Wait until ambient temperature is 5 deg C (40 deg F) and rising. Focus repairs on preventing problems.
	2nd and 4th weeks	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	• Do not pile snow on caps.
	December every 3rd year	Prune honeylocust trees. Prune river birch trees.	• Judiciously remove lower branches that interfere with pedestrian traffic. Maintain natural habit and form. Continue process until trees have a 4.5 m high canopy.
	As needed	Remove snow.	• Do not disturb surface of stabilized pavement. Use rubber blade on equipment.
March	3rd week	Remove winter detritus.	• Take organic matter to compost pile.
		Inspect for winter damage to trees.	• Prune only as needed.
April	2nd week	Repair stabilized pavement.	• Apply stabilizer spray as needed to reconsolidate surface.
		Inspect for weeds and start to remove them.	• See Appendix C for identification and control of weeds. • Catch weeds early to minimize disturbance to stabilized paving.
	2nd and 4th weeks	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	
	3rd week	Commission irrigation.	• Allow irrigation to run to flush out winter chemicals from stabilized pavement. • Do not regularly operate irrigation until the middle of May.
	4th week	Apply liquid biological amendments (LBA).	• Formulate for trees. Soil testing is not possible in these areas. Use aeration system as distribution system.
May	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	
	1st and 3rd weeks	Inspect for pests and diseases.	• River Birch risks include Leaf Blight and Chlorosis with high pH soil.
	2nd week	Begin irrigation.	• Use care not to overwater trees.
June	1st and 3rd weeks	Inspect for pests and diseases.	• River Birch risks include Leaf Blight and Chlorosis with high pH soil. • Honeylocust risks include cankers, spider mites, and leaf hoppers. • See Appendix D for identification and treatment of pests or diseases.
	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	
	3rd week	Monitor and adjust irrigation as needed.	• Use care not to overwater.

Month	Week	Task	Notes
July	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	
	1st and 3rd weeks	Inspect for pests and diseases.	• River Birch risks include Leaf Blight and Chlorosis with high pH soil. • Honeylocust risks include cankers, spider mites, and leaf hoppers. • See Appendix D for identification and treatment of pests or diseases.
	2nd and 3rd weeks	Monitor and adjust irrigation as needed.	• Watch for drought symptoms but do not over water.
August	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	
	3rd week	Monitor and adjust irrigation as needed.	• Use care not to overwater.
September	Every week	Inspect aeration system clean out grates (located at surface of pavement) and if necessary clean.	
	2nd week	Reduce irrigation by 1/3.	• Use care not to overwater.
October	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	• Falling leaves may clog grates quickly.
	1st week	Apply liquid biological amendments (LBA).	• Formulate for trees. Soil testing is not possible in these areas. Use aeration system as distribution system.
	3rd week	Stop irrigation and winterize system.	• Plants in paved areas should be watered longer into the season.
November	Every week	Inspect aeration system (grates located at surface of pavement) and clean if necessary.	• Falling leaves may clog grates quickly.
	4th week	Final fall clean up.	• Remove leaves and debris.
SPECIAL NOTE	At all times	The soil for the trees in pavement is a "sand-based structural soil" (SBSS), a specially formulated and manufactured soil that can support pavement and also meet the performance criteria for healthy tree growth. Essentially, this is a coarse sand mixed with compost.	• Utilities have been routed away from the trees (save for electrical) so digging in these areas should be minimal but if it occurs, the SBSS must be replaced in kind.

ZONE 7: MARSH BASIN
ZONE 8: FOREBAY AQUATICS
ZONE 9: MARSH TRANSITION

Fast Facts

Size: 0.16 Hectare (0.40 Acres)

The marsh is a constructed wetland that is NOT connected to the site's groundwater.

A self-healing pond liner under the planting soil seals off the marsh water.

- Do not puncture liner.
- Check underdrainage system under pond liner to monitor liner performance as per TRCA.
- Track water level and report significant water volume fluctuations to TRCA.

Hydrology is the single most important factor for the marsh design and plant health.

- The park's water reuse system provides constant fresh water input from filtered water at the splash pad, waste water, and storm water/irrigation water run-off. Two yard hydrants allow for potable water feed, when necessary.
- Marsh planting soil profiles transition from free-draining to saturated hydric planting soil to emulate natural marsh conditions.
- Water levels in the Upper Marsh are allowed to fluctuate between 2-10 cm, and 5 cm average.

The majority of the original marsh plants were field-collected in southern Ontario and propagated for this project.

Woody debris and boulders provide shelter for wetland wildlife.

Bottom Line Design

The marsh is the central focusing element on the north side of the park. Rather than a refuge from the city, MVVA imagined it as an opportunity to experience intensive nature within the city. It is the only standing body of water and the bridge gives an opportunity to be at its center. From this vantage point it's obvious that the marsh is brimming with life, offering a unique set of circumstances that attracts migratory birds, water-loving mammals, herbivores, insects, and reptiles. To house, shelter, and feed this diverse wildlife, there is a fresh-water variety of submerged, aquatic, floating, water edge emergent, sedge-grass plants and upland shrubs. The slopes provide enclosure, protection, and surface runoff that directs water toward the marsh.

Marsh systems are dynamic, and it is the designers' expectations that plants will migrate to respond to microclimate conditions. The marsh should always have submergent and floating aquatic layers.

Marsh Planting Structure:

- Shrubs are dense at marsh edge to prevent nuisance water fowl (e.g. geese and ducks) from nesting in water and feeding on broadleaf plants, as well as and animals from creating disturbance that will allow invasive plants to establish.
- Emergents for edge protection and subemergents for ecological diversity are also dense to shade out algae.
- Floating aquatics prevent algae blooms in open water.

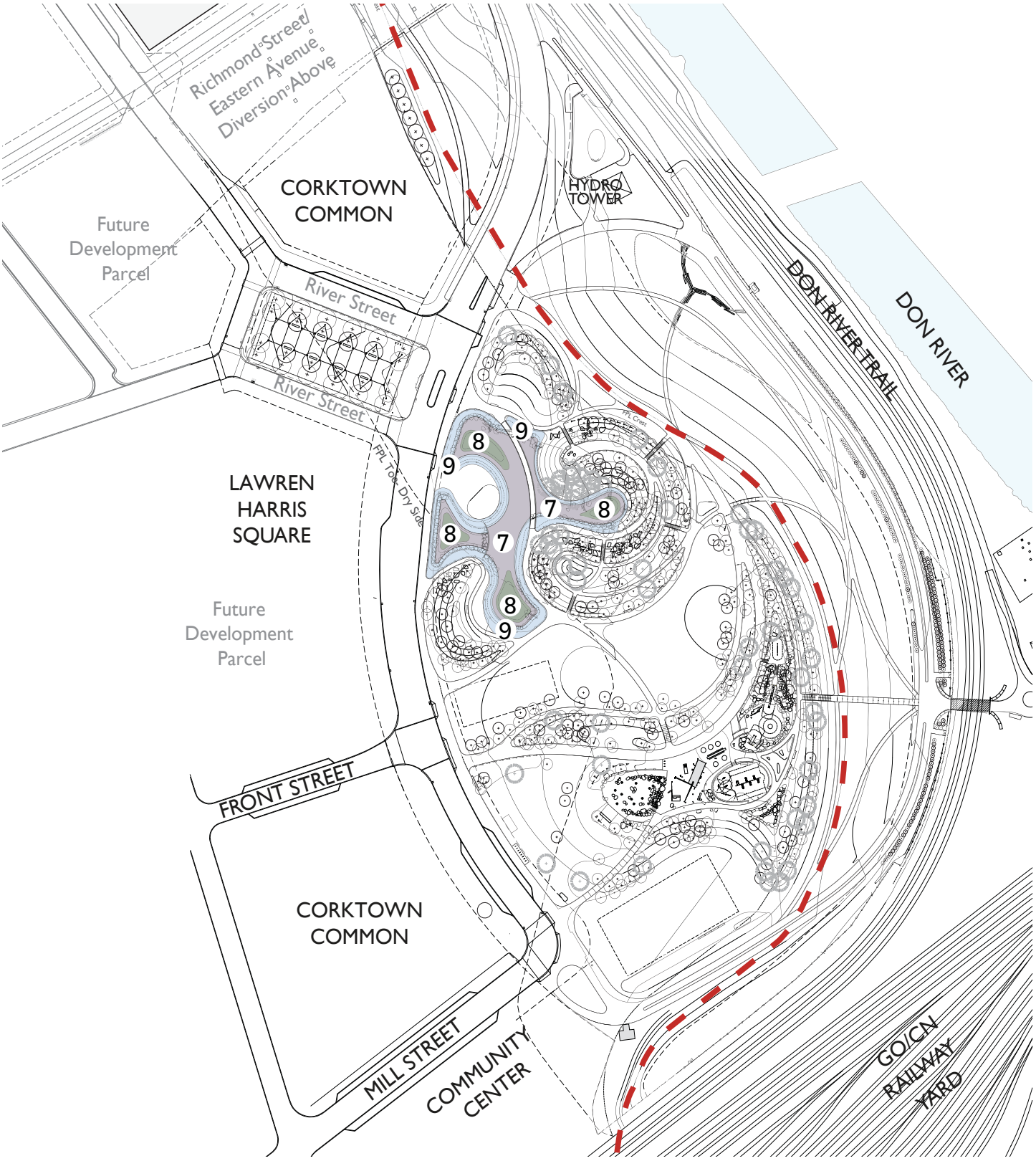
Making it Organic

Plant Maintenance: Monitor water quality.

- For replacement planting, employ a "pulsing" regime while establishing plants, allowing the water to fluctuate. For established plants, bring up water level to a consistent 200 mm during the summer and 150 mm minimum during the winter to avoid frost damage to roots.
- Monitor sedimentation: Inspect marsh bank for erosion after storm events and repair as needed.
- Remove sedimentation at forebays every 3–5 years.
- Periodically inspect animal screens at inlet pipes and remove debris that could clog the pipes.

Weeds, Diseases, and Pests: Monitor edge disturbance and repair/replant immediately to prevent aggressive invasives to get a foothold.

- Control herbivory in an integrated approach:
  - Schedule PFR's sheep dog visits to deter nuisance water fowl (ducks and geese) as needed.
  - Use herbivory fencing in early spring.
- A certain amount of algae is normal and expected, as it is an essential component in the aquatic food web, but algae blooms and dense mats that shade out desired plants should be removed.
  - Physically remove algae from the water surface, especially large contiguous mats.
  - Add barley straw bags or logs to shallow areas of marsh basin floor. If used, maintain and replace every 6 months.
  - Add cooler potable water as input to lower temperatures and raise water level to maximum height.
  - Manage nutrient input with beneficial bacteria to reduce ammonia, nitrate, nitrite, and phosphorus levels.
  - Promote growth of broad leaf plants and aquatics to shade out algae.



ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL

0 5 10 25 N

Planting: *Marsh*

ZONES 7, 8, 9			*0.16 Hectare, 0.40 Acres,*
Month	**Week**	**Task**	**Notes**
December to February	Every week	Check weir, overflows, and outfalls for obstructions and sedimentation.	• Remove obstructions and sedimentation.
		Remove inorganic debris.	• Marsh is sensitive to disturbance.
March	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
	1st and 2nd weeks	Clean up surface debris	• Take organic matter to the compost center.
	3rd and 4th weeks	Inspect for winter damage to plants.	• Determine lawn repair program and gather materials.
April	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
	2nd week	Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
		Inspect Pond Liner monitoring wells.	• Track water levels. Report significant fluctuation to TRCA.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.
		Inspect for aquatic and bank weeds and remove.	• See Appendix C for identification and control of weeds.
	2nd through 4th week	Check aquatics.	• Maintain diversity and use plugs during establishment. Draw down water and employ pulsing regime.
	3rd week	Inspect the state of habitat "homes" in the marsh (woodland debris and rocks that were placed at the edges) and supplement if needed.	• Use felled trees and twigs from other park sites (or CTC if available). Do not use suckering tree stock, such as poplars.
	4th week	Planting of more aquatics, if needed.	• Consult with MVVA on species selection.
		Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
May	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
	2nd week	Remove sediment deposits from all forebays.	• Vacuum debris if needed and use caution not to disturb stone and plants.
		Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.

Month	Week	Task	Notes
May cont.	3rd week	Commission irrigation, if needed.	• ONLY needed if May rains have been insufficient for seed germination.
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
June	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
		Inspect for weeds and remove.	• See Appendix C for identification and control of weeds.
		Monitor and adjust irrigation.	• Adjust zones based on exposure, temperature, and wind. • Check for leaks or repairs.
	1st week	Commission irrigation.	• Establish deep watering and set irrigation to water only once a week.
	2nd week	Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
July	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
	2nd week	Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
August	Every week	Check weir and overflows for obstructions and sedimentation.	• Remove obstructions and sedimentation.
	1st week	Inspect for weeds and remove.	• See Appendix C for identification and control of weeds.
	2nd week	Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.

Planting: *Marsh*

Month	Week	Task	Notes
August cont.		Apply organic amendments as suggested by early August soil tests.	
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
September	2nd week	Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.
		Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
		Planting of more aquatics, if needed.	• Plant plugs.
October	1st week	Test water quality.	• Test for temperature, pH, turbidity, dissolved oxygen, total dissolved solids, and salinity, and control N and phosphorous.
	2nd week	Remove sediment deposits from all forebays.	• Vacuum debris if needed and use caution not to disturb stone and plants.
		Maintain water fluctuation and overturning of water.	•Allow water to fluctuate between 200mm and 400mm. • Inspect and clean drainage pipes feeding the marsh if needed.
		Inspect Pond Liner monitoring wells.	• Track water levels. Report significant fluctuation to TRCA.
	4th week	Inspect and control algae.	• Draw down water, remove algae, and control nutrient loading.
November	2nd week	Apply liquid biological amendment.	
	2nd and 3rd weeks	Complete fall clean-up.	• Remove leaves and debris. • Take leaves to composting center.
SPECIAL NOTE	At all times	Part of the marsh is on the dry side of the Flood Protection Landform (FPL) that is regulated by the Toronto and Region Conservation Authority for the Living City (TRCA) and should not be disturbed.	• For any issues, consult TRCA before making subsurface repairs or digging.

ZONE 10: OPEN LAWN
ZONE 11: SHADE LAWN
ZONE 12: RECREATION FIELD

Fast Facts

Size: 1.5 hectares (2.8 acres)

Sun Lawn Mix: 45% Bluegrass (98/95), 25% Creeping Red Fescue, 5% Perennial Ryegrass, 15% Kentucky Bluegrass (Park or Merit), and 10% Boreal or Perennial Red Fescue.

Shade Lawn Mix: 20% Kentucky Bluegrass (Nu Glade), 30% Creeping Red Fescue, 10% Chewings Fescue, 20% Tri Rye Blend (40% Secretariate Perennial Ryegrass, 30% Affirmed Perennial Ryegrass, 30% Exacta Perennial Ryegrass), and 20% Boreal of Jamestown II Red Fescue.

Lawn planting soil is designed to be free-draining and compaction-resistant, which means they have a higher sand content.

Recreational lawn contains fiber reinforcement mixed to full depth of the lawn planting soil.

The lawns have a flat polyvinyl-chloride panel (PVC) underdrainage system that collects infiltrated water and directs it to the irrigation cistern.

Bottom Line Design

A perfect lawn - one free of any plants except perennial grasses - is not part of the vision for the park. As much as 10% of the lawn area can be comprised of other beneficial plants such as white clover that can convert atmospheric nitrogen into a usable form for uptake by roots (aka, nitrogen fixing).

However, this is not a call for tolerating invasive weeds, but rather a shift towards promoting conditions for healthy growth of favorable plants that will discourage weed development by shading out weed seed germination or crowding them out.

An overly weedy lawn is also not part of the design vision either. If weeds exceed 10% coverage then it it's time to take organic maintenance action. Unrestrained outbreaks can quickly become serious and eventually necessitate full lawn renovation.

Mulch rings at trees in lawns should be maintained until 2017. Afterwards, allow grass to grow up to the base of the trunks.

Prune canopy trees to be high limbed in lawn areas to allow for sun exposure on lawns.

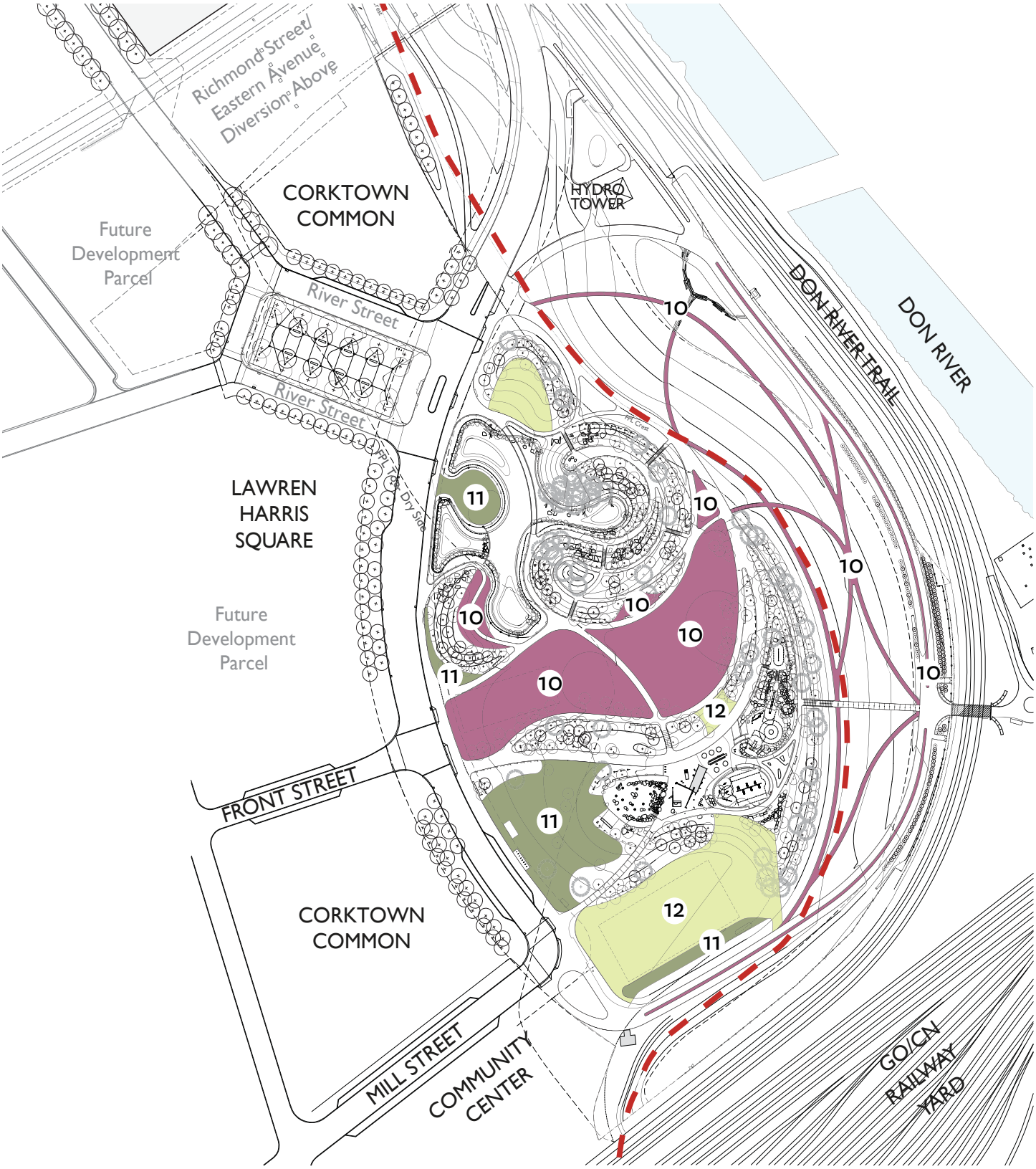
Making it Organic

Plant Maintenance: Maintain the lawn area by area. Never resort to wholesale prescribed programs of "one-size-fits- all for feed-weed-feed" with synthetic or organic products, as this will disturb soil biology and areas that are functioning properly. For instance, compared to the central lawn, the recreation lawn is always going to need some help with compaction even with the "best practices" that were aimed at preventing it.

- Provide inputs for the soil and lawn roots, not the grass blades.
- Water longer and less frequently to encourage roots to go deeper into the soil to find moisture. Watering every other day for 15 minutes will keep moisture in the upper region of the soil and roots will stay there waiting for the next drink. By doing this the lawn ends up being "hydroponically" sustained, needing more fertilization because shallow roots have less surface area to absorb nutrients. Use a moisture meter to test moisture levels.
- Use soil tests to find out what the soil needs in the way of nutrients, pH, and soil biology.
- Make nitrogen fixing the cornerstone of soil health as this will support the natural nutrient cycling system, which is the ability to make and uptake nitrogen in soil.
- Keep on top of weed removal. Weeds are opportunistic and will rob the soil of moisture and nutrients.
- Liquid biological amendments (LBA) and organic products like feather meal are the basis of lawn soil health. *Refer to the Maintenance Calendar in this chapter for details.*
- Recognize where there are differences in moisture, sun, compaction, etc., then treat those areas based on their individual needs.
- Leave grass clippings on the lawn so they can return nitrogen to the soil.
- Use mature compost to feed the lawn instead of synthetic fertilizers.
- Monitor nutrient levels and grass uptake.
- Several times a season, take soil cores to inspect root development. White roots should be plentiful and deep. If not, test soil biology and apply LBA/compost formulated for the deficiency. Watch timing as LBAs should not be applied in July.
- Prevent over-compaction by rotating usage and aerating lawn every fall.

Weeds, Diseases, and Pests:

- Schedule PFR's sheep dog visits to discourage nuisance water fowl (geese).
- Regularly inspect for weeds and disease.



ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL

0 5 10 25 N

Planting: *Lawn*

Zones 10, 11, 12			***1.5 Hectares, 2.8 Acres***
Month	**Week**	**Task**	**Notes**
December to February	Every week	Don't drive or park on lawns.	• Freeze-thaw cycles trap water in soils and makes compaction a real threat.
		Limit walking on lawns.	• If winter events require heavy use of lawn, allow lawn to rest for two weeks after by cordoning off lawn areas.
	February	Prepare lawn care equipment.	
March	1st and 2nd weeks	Rake up leaves and debris.	• Take leaves to compost center.
	3rd week	Apply liquid biological amendment (LBA).	• Apply bacterial tea to stimulate bacterial growth. No need for soil tests yet.
	3rd and 4th weeks	Inspect for winter damage to lawns.	• Determine lawn repair program and gather or order materials.
April	1st week	Apply corn gluten for weed seed control.	• Apply just before forsythia bloom.
	2nd week	Inspect for weeds and start to remove.	• See Appendix C for identification and control of weeds.
		Test soil for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods.
		Test soil biology for active and dormant bacteria, active and dormant fungi, predators, nematodes, active:dormant ratios, and available nitrogen.	• See Appendix A for soil testing methods.
		Take lawn cores to determine if de-thatch is needed and perform work.	• If organic practices are used, de-thatching should rarely need to be done. Dethatch only if thatch mat reaches 1.25 cm or more. • De-thatch before any amendments are put down except for corn gluten.
	3rd week	Apply granular feather meal.	• Apply at rate of 10#/1,000 SF.
	4th week	First mowing. Leave grass clippings in place.	• Set mower blade low at 5-6 cm height.
May	1st or 2nd week	Repair lawn. Use methods as if it's new lawn.	• Make sure that seeding occurs at least 3 weeks after corn gluten application.
		Overseed lawn, slice seeding recommended	• Temperature should reach 10 deg C (50 deg F) minimum for 3 days straight before seeding begins. Make sure that seeding occurs at least 3 weeks after corn gluten application.
	2nd week	Apply organic amendments as suggested by April soil tests.	• Combine amendments before application.
		Apply liquid biological amendment (LBA).	• Use April soil tests but make sure there is a good active fungal supply in the LBA.
	3rd week	Top dress lawn with compost.	• Apply only 0.3-0.6 cm layer and distribute evenly. Use mature, finely shredded leaf mulch. If aerating, apply directly after aerating.
		Commission irrigation, if needed.	• ONLY needed if May rains have been insufficient for seed germination.
		Apply beneficial nematodes for grub control.	

Month	Week	Task	Notes
May cont.	4th week	Apply liquid biological amendment ONLY if lawn is diseased. This should be rare.	• Apply same LBA used during 2nd week.
	As needed	Mow and leave grass clippings in place.	• Set mower blade at 7.5-9 cm height.
June	Every week	Inspect for insects and disease.	• See Appendix D for organic pest and disease control.
		Inspect for weeds and remove.	• See Appendix C.
		Monitor and adjust irrigation.	• Adjust zones based on exposure, temperature, and wind. • Check for leaks or repairs.
	1st week	Commission irrigation.	• Establish deep watering and set irrigation to water only once a week.
	3rd week	Apply granular feather meal.	• Apply at rate of 5#/1,000 SF.
	As needed	Mow and leave grass clippings in place.	• Set mower blade at 7.5-9 cm height.
July	Every week	Monitor and adjust irrigation.	• Adjust zones based on exposure, temperature, and wind. • Check for leaks or repairs.
		Inspect for weeds and remove.	• See Appendix C.
	2nd week	Apply liquid biological amendment (LBA).	• No soil tests required. Use a LBA with good protozoa populations.
	As needed	Mow and leave grass clippings in place.	• Set mower blade at 7.5-9 cm height.
August	Every week	Inspect for weeds and remove.	• See Appendix C.
	3rd week	Apply soil amendments.	• Apply humic acid and sea kelp.
	4th week	Reduce irrigation.	• Reduce watering time by 1/3. • Check for leaks or repairs.
	As needed	Mow and leave grass clippings in place.	• Set mower blade at 7.5-9 cm height.
September	1st week	Test soil biology for nutrients, salts, NO3, NO4, and pH. Use results for September amendments.	• See Appendix A for soil testing methods. • Use as a check for soil needs going into winter.
	2nd week	Aerate if needed.	• Apply compost directly after aerating.
	2nd thru 3rd week	Overseed if needed.	• Adjust irrigation in these areas if needed.
	3rd week	Reduce irrigation.	• Cut irrigation back by 1/3. • Adjust zones based on exposure, temperature, and wind. • Check for leaks or repairs.
	As needed	Mow.	• Lower mower blade to 6-7cm height.
October	1st week	Fall clean-up.	• Remove leaves and debris.
	2nd week	Apply liquid biological amendment (LBA).	• Apply heavy fungal LBA with endospores.
	2nd or 3rd week	Decommission irrigation.	
	As needed	Mow.	• Keep blade at 6-7 cm height. The last mow in October should occur 10 days before the first week in November.
November	1st week	Last mow.	• Lower mower blade to 5 cm. Don't scalp.
	2nd and 3rd weeks	Complete fall clean-up.	• Remove leaves and debris. • Take leaves to composting center.

ZONE 13: UPLAND PRAIRIE
ZONE 14: LOWLAND PRAIRIE
ZONE 15 : PRAIRIE TREES

Fast Facts

Size: West of FPL Crest: 0.19 Hectares (0.47 Acres);
East of FPL Crest: 2.9 Hectares (7.1 Acres)

Soil sand component varies:

- East of the FPL crest: sandy loam with calcareous (high pH) sand.
- West of the FPL crest: sandy loam with granitic (pH neutral) sand.

Soil depth varies:

- 500 mm over FPL or park fill.
- 300 mm over armored stone (rip rap) along the FPL, north of the Bala steps.

Geofiber reinforcement was mixed into soil at:

- Slopes 3:1 or steeper
- Stabilized soil at Hydro towers

There is no irrigation at prairie east of the FPL crest due to TRCA requirements. Prairie west of the crest is subject to irrigation runoff from planting beds above slope.

There are no woody plants east of FPL crest except sumacs, which sit at the base of the elevated railroad flood shadow. This is due to TRCA requirements for keeping woody plants off the FPL.

There is a self-healing pond liner under Lowland Prairie due to TRCA requirements. No underdrainage monitoring system is present as it is in the marsh. Weed holes have been added to the catch basin risers to allow for sub-draining.

Bottom Line Design

The prairie is a special and unique component of Corktown Common; it is rich in diversity and changing scenery. More than any other part of the park, the prairie marks the seasons with its fast-growing grasses, billowy seed heads, fall foliage, and knobby winter stems. Over half of the park area is dedicated to the prairie. While it brings a unique experience to the city it also expands the ecological diversity of the park. Prairies are home to a wide range of animals, insects, and birds that are infrequently seen in more groomed park settings. Prairies produce some of the richest soil in the world, with deep complex roots that sustain soil biology and improve soil structure. Located on the Flood Protection Landform (FPL), the prairie grasses provide slope stabilization against wind and water erosion.

The prairie plant palette has been limited to a narrow mix of grasses, rushes, and sedges (e.g., no forbes) for ease of establishment, weed identification, and maintenance.

Prairies are dynamic systems that adjust to microclimatic conditions. Species movement is expected and encouraged.

Once the prairie is established (years 3 to 5), other prairie plants such as forbes can be slowly introduced. The key is to go slow, only add what can be easily controlled and identified by staff.

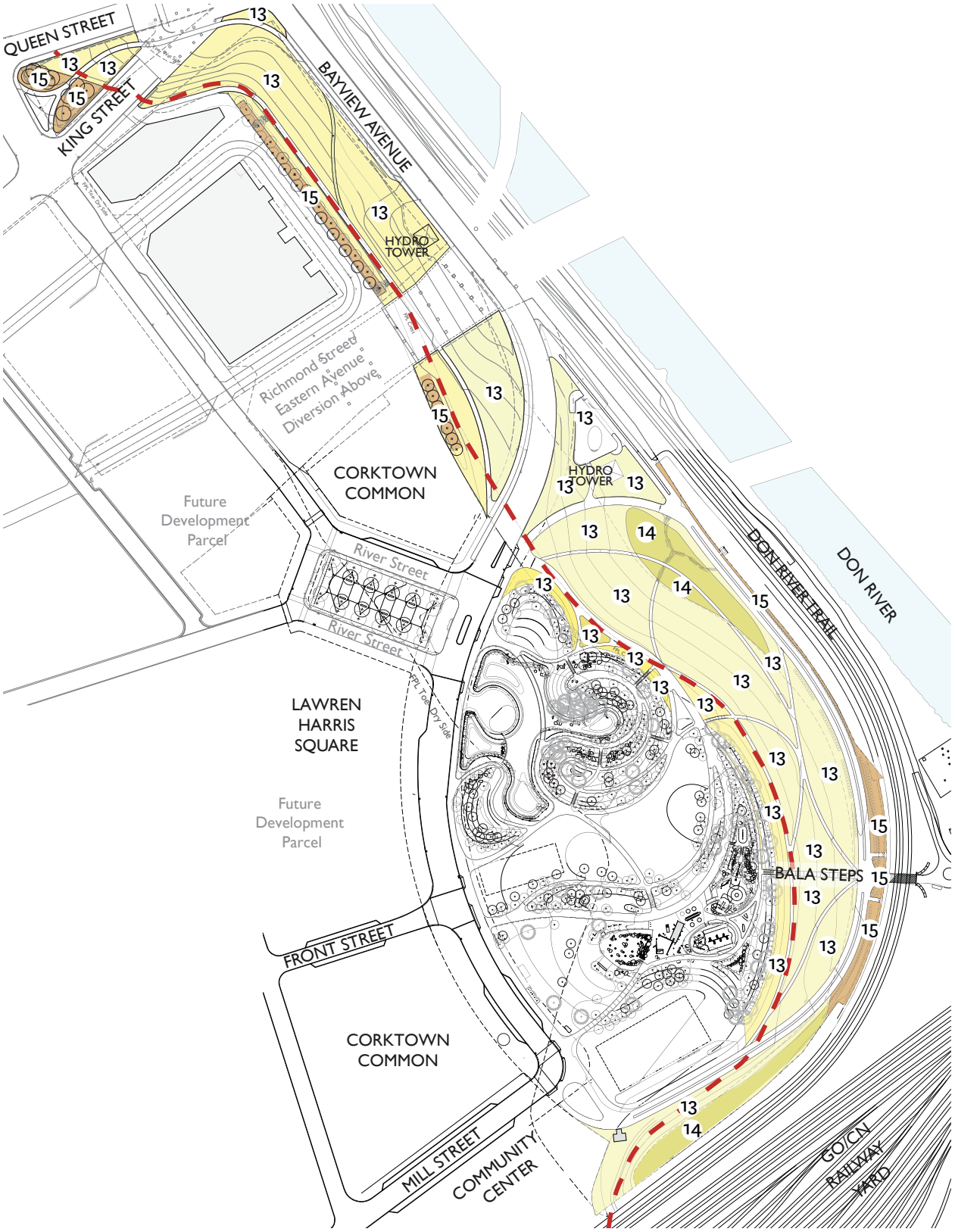
Making it Organic

Plant Maintenance:

- Cut prairie and harvest cutting in late winter/early spring. Do not leave cuttings—decomposing organics will turn the prairie into a meadow system.
- Mow lawn paths weekly and maintain edge definition.
- Monitor salinity build up in Lowland Prairie area.
- Replace prairie plants and lawn grasses in kind, following recommended establishment procedures:
  - Deep-spade soil, if compacted.
  - Seed in spring or early fall.
  - Broadcast seed at a rate of 80#/acre.
  - Cut warm grasses in early fall to encourage cooler grasses to establish for the first two years.

Weeds, Diseases, and Pests:

- Set up a regular schedule for walking on the mown grass paths and through the prairies to scout for weeds, especially invasive plants. Until forbes are introduced by PFR staff, broad-leaf species are not part of the plant palette and should be removed.
- Prairies are susceptible to being overtaken by invasive plants because the lands they reside on rarely disturbed, Removing invasive plants takes knowledge, hard work, and persistence. Download the handbook entitled *Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas* prepared by the Nature Conservancy at http://www.invasive.org/gist/handbook.html. Refer to Chapters 1-4.
- Diseases, and pests are unlikely but keep an eye out for them. Use natural means of disease control including hand removal, soaps, plant-based oils, etc.
- For pest control use predators, antagonistic species, milky spores, beneficial insects, or horticultural oils.
- Use no herbicides, pesticides, or fungicides.
- Never fertilize prairies. Use biological supplements like liquid biological amendments to sustain the fungal populations required by prairie plants.


QUEEN STREET
KING STREET
BAYVIEW AVENUE
HYDRO TOWER
Richmond Street
Eastern Avenue
Diversion Above
CORKTOWN COMMON
Future Development Parcel
River Street
River Street
LAWREN HARRIS SQUARE
Future Development Parcel
FRONT STREET
CORKTOWN COMMON
MILL STREET
COMMUNITY CENTER
HYDRO TOWER
DON RIVER TRAIL
DON RIVER
BALA STEPS
GO/CN RAILWAY YARD
ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL
0 5 10 25
N

Planting: *Prairie*

ZONES 13, 14, 15			***West of FPL Crest: 0.19 Hectares, 0.47 Acres; East of FPL Crest: 2.9 Hectares, 7.1 Acres***
Month	**Week**	**Task**	**Notes**
December to February	At all times	Don't drive or park on the prairie. Restrict x-country skiing to lawn paths. Inspect for tire tracks and record their location/s on a map for monitoring and repair during the growing season.	• The prairies have heavier soil (silt-clay loam) than other areas of the park and they are susceptible to freeze-thaw cycles that trap water in soil and make it susceptible to compaction.
	After storms/floods	Inspect for damage, particularly slope stability, washouts, and damage to log path.	• The Flood Protection Landform (FPL) on which the prairies are planted is a regulated protection berm. Contact TRCA to report extent of damage and work with them to repair.
March	2nd week	Clean up winter and surface debris.	• Take organic matter to compost center.
	3rd and 4th weeks	Inspect for winter damage to prairie.	• Damage might include erosion, flood damage, bald/burn spots, compaction, and animal disturbance/burrowing. Map the extent or mark out with flags.
April	Info only	There is no irrigation system in the prairie.	• Hand water newly planted seeds, otherwise no irrigation is needed.
	Every week	Inspect for weed emergence.	• See Appendix C for identification and organic control of weeds.
		Inspect woody plant growth and remove.	• TRCA requires that all woody plants be removed from the FPL. To determine if woody plants are invasive, see Appendix C.
	1st- 4th weeks	Overseed, repair, and introduce new species.	• Use slice seeding if area is large. • Hand seed if area is small. • Introduce warm season grasses and forbs. Select seed for localized conditions.
	2nd week	Aerate at winter damage/compaction areas.	• Use deep tines and low pressure tires. • Spread 0.6 cm compost while aerating.
		Test soil biology for nutrients, salts, NO3, NH4, pH, organic content, and CEC.	• See Appendix A for soil testing methods. • Use test as the basis for any amendments.
		Test soil for gradation ONLY if there are growth problems.	• Only test affected areas. • See Appendix A for soil testing methods.
	3rd week	Perform first mow of prairie paths.	• Set mower blade low to 5 cm.
	4th week	Apply liquid biological amendment (LBA).	• Bases formula on soil biology tests. LBA should be fungal-dominant.
May	1st and 3rd weeks	Mow prairie paths.	
	2nd week	Inspect for weeds and remove.	• See Appendix C.
June	1st and 3rd weeks	Inspect for weeds and remove.	• See Appendix C.
	As needed	Hand water or set up temporary irrigation for newly planted areas only.	• Only for newly planted prairie • Establish deep watering and set irrigation to occur only once a week.
July	Every week	Inspect for weeds and remove	• See Appendix C.

Month	Week	Task	Notes
August	Every week	Inspect for weeds and remove	• See Appendix C.
	2nd week	Apply amendments per August soil tests.	
September	1st and 3rd weeks	Inspect for weeds and remove.	• See Appendix C.
October	1st and 3rd weeks	Inspect for seed drop.	
November	3rd or 4th week	Mow after seed has dropped from dormant plants.	• Cut to 15-20 cm height. • Remove foliage and add to compost.
	After final mowing	Overseed, repair, and introduce new species.	• Use slice seeding if area is large. • Hand seed if area is small. • Introduce warm season grasses and forbs. Select seed for localized conditions.
SPECIAL NOTE	At all times	The prairies are planted on top of a Flood Protection Landform (FPL) that is regulated by the Toronto and Region Conservation Authority for the Living City (TRCA). The performance of the FPL is dependent on the stability of its surface. Prairie plants were selected for their ability to form wide spreading roots to provide the maximum protection from erosion and turbidity. Digging on the prairie surface is prohibited. Woody plants are prohibited.	• Inspect the prairie regularly for woody plants or breaches in the soil surface. • For any issues related to the FPL, contact the TRCA.

V. Water Collection & Re-Use

Water Collection and Re-Use

Relevant Appendices: B

OVERVIEW

Fast Facts

Size: 2.5 Hectares (6.2 Acres)

One hundred percent of the site's water, in the form of potable, irrigation, and stormwater is collected on site and re-used in the marsh and irrigation system. Water from the pavilion and Lauren Harris Square are not connected to this system.

Major components

- *See Stormwater Collection and Underdrainage Plans.*
- The system starts at the splash pad where runoff is collected in drains, piped to a water play storage tank south of the pavilion and then pumped through a UV filter in the pavilion basement.
- Once filtered, the splash pad runoff leaves the pavilion, enters DMH-02, and is then distributed to the marsh at two locations (Forebays B and C) so that it can flush and aerate the marsh water.
- The marsh is kept at a consistent water level, controlled by a weir at elevation 81.00. Marsh water overflows into outlet control structures (OCS) at two locations in the marsh (OCS-1 and OCS-2).
- Water that flows though the OCS is filtered (DMH-8A and Stormcepter DMH-8B) and flows to the irrigation tank.
- In addition to marsh water, overland flow is collected in catch basins and underdrains and then sent to the irrigation cistern.
- The irrigation tank water is pumped (Irrigation Pump) to the irrigation manifold in the pavilion basement and then used for irrigation.
- Excess water in the irrigation tank overflows to the city stormwater system on Bayview Avenue.

The irrigation cistern holds approximately 568,000 liters (150,000 gallons) of water - enough to irrigate the park for a week.

All controls for the park's water collection/irrigation systems are in the pavilion basement.

Sumps for the water play storage tank (DMH-03) and irrigation tank (DMH-08A/B) are in individual manholes located in the Central Lawn and must be regularly cleaned.

The marsh has two potable water sources at yard hydrants (YH-01 and YH-02) and one irrigation quick coupler.

If the water play is off or inoperable, there is a water override in the pavilion basement that can run the irrigation system on potable water (though stormwater will always contribute).

Pavilion trees in pavement have drip irrigation in 100 mm PVC aeration pipes. This is part of the park's overall irrigation system.

Lawren Harris Square has an independent drip irrigation system located within 100 mm-round aeration pipes. The pipes run east to west on the north and south sides of both honeylocust allees. The controller for the system is on the southwest corner of the square.

Bottom Line Design

Water is everywhere in Corktown Common. It is revealed for enjoyment (at the splash pad and marsh) or put to service in the ecological functioning of the park (such as stormwater collection and marsh flushing). Just like all natural systems, if one part is neglected all other parts are affected.

Along with planting soil, the water collection system is the most important system to be kept operational at all times. The marsh's appearance is dependant on its own health.

Marsh health is dependent on water quality which is particularly susceptible to leachable inputs such as excess nitrogen and phosphorous from plant beds and lawns as well as salt from winter de-icing practices.

Making it Organic

Principles for sustaining water quality:

- Never introduce additives, conditioners, or chemicals into any parts of the system.
- Prohibit inorganic fertilizers and limit organic fertilizers throughout the park.
- Test water at all components seasonally and as needed. *See Maintenance Calendar in this chapter.*

Monitor water play area and drains daily to prevent solids from entering the system.

- Collect debris and solids.
- Never use inorganic cleaners.

In early spring, use irrigation water to flush out harmful leachates such as salts.

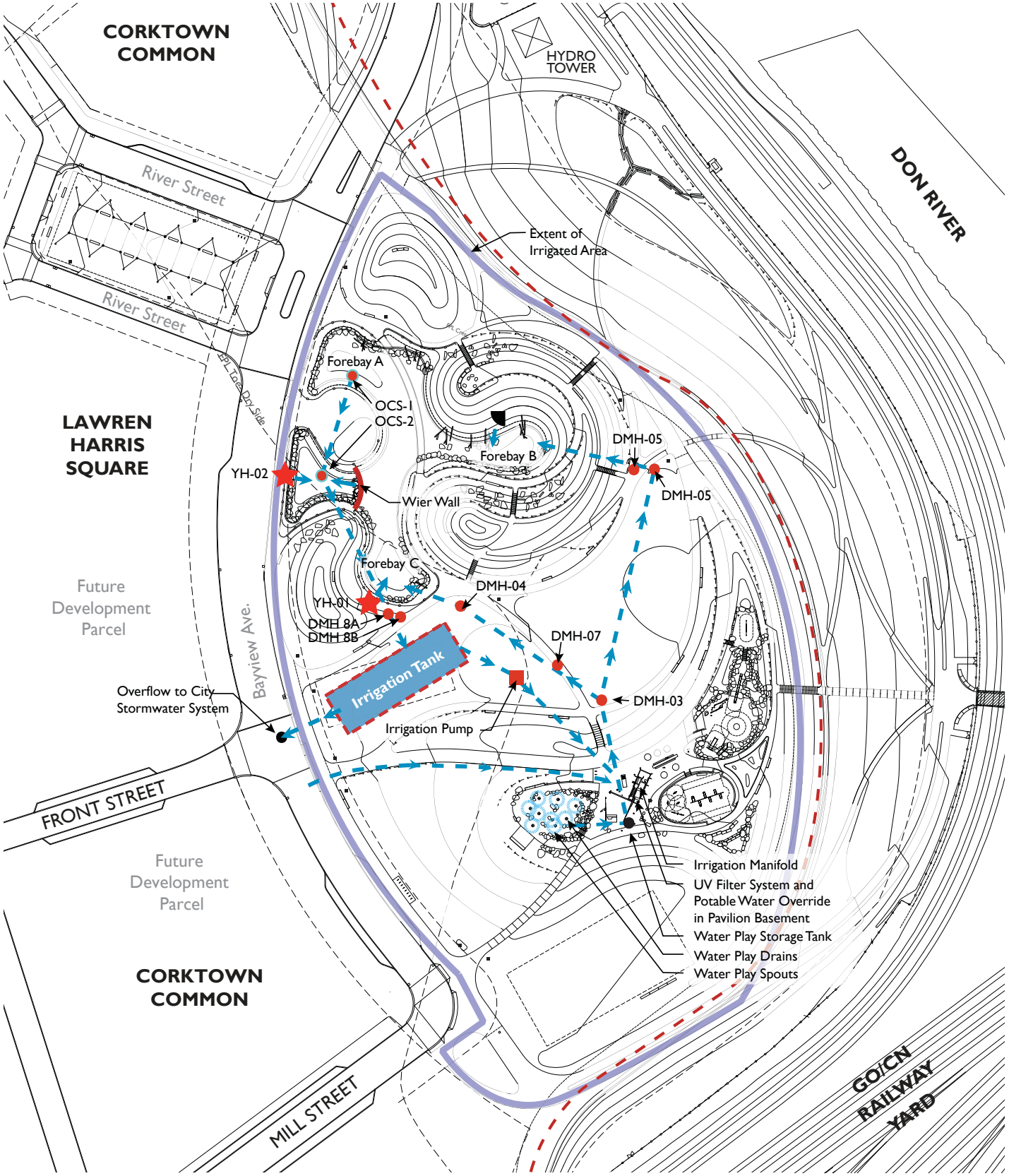
Replace UV filters annually at the beginning of each water play season.

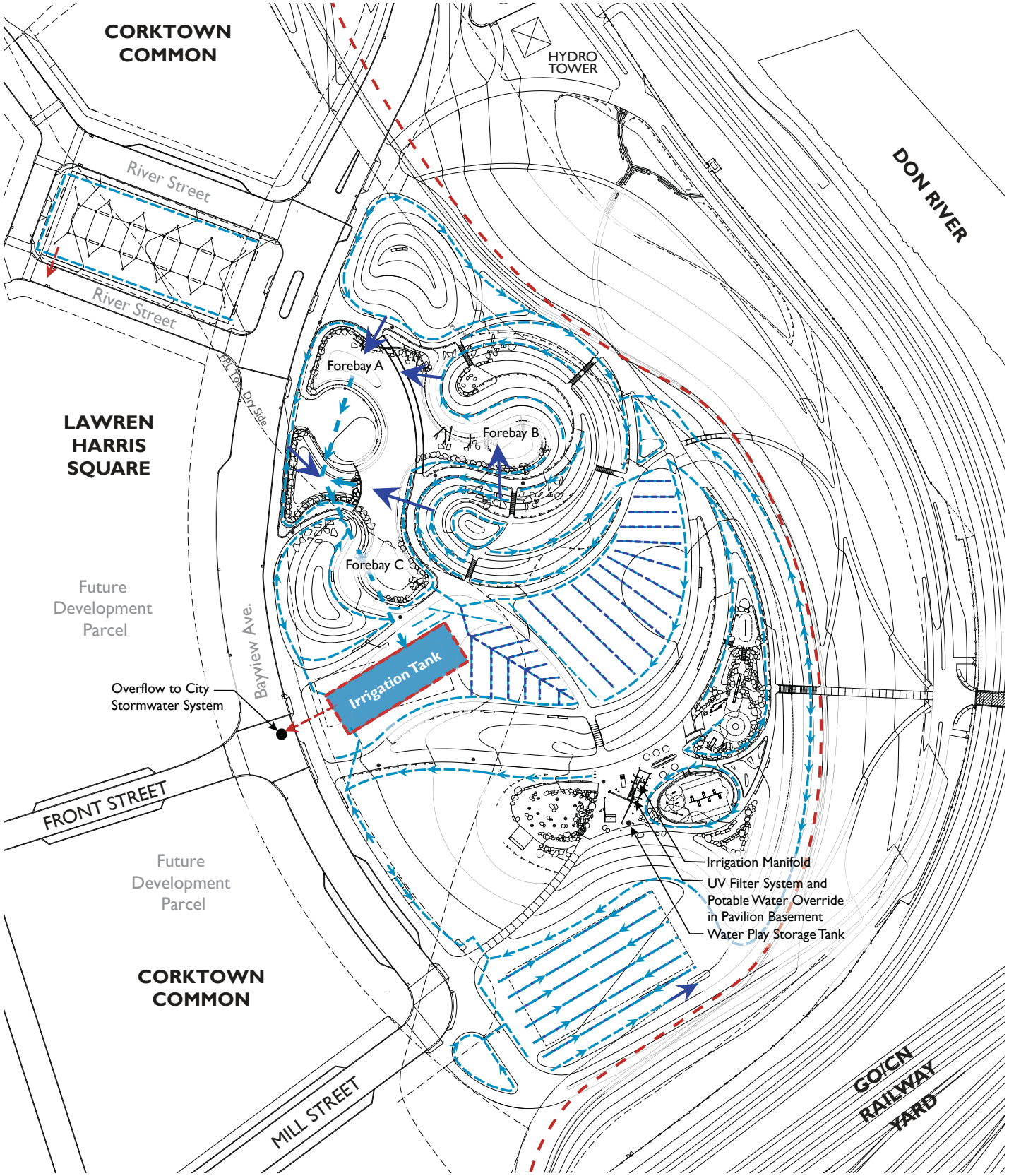
Monitor and remove debris and sediment from DMH and CB sumps as needed.

Monitor salt inputs into system. Use no or low-salt ice-removing products and use mature compost.

Water Collection and Re-Use

STORMWATER COLLECTION PLAN




CORKTOWN COMMON
HYDRO TOWER
DON RIVER
River Street
River Street
FPL 120 Dry Side
LAWREN HARRIS SQUARE
Forebay A
Forebay B
Forebay C
Future Development Parcel
Bayview Ave.
Irrigation Tank
Overflow to City Stormwater System
FRONT STREET
Future Development Parcel
CORKTOWN COMMON
MILL STREET
GO/CN RAILWAY YARD
Irrigation Manifold
UV Filter System and Potable Water Override in Pavilion Basement
Water Play Storage Tank
100 MM Ø UNDERDRAINAGE PIPE
FLAT PANEL DRAINAGE PIPE
UNDERDRAINAGE DAYLIGHT
OVERFLOW TO CITY STORM WATER SYSTEM
FPL
0 5 10 25
N

Water Collection and Re-Use

ALL ZONES WEST OF THE FPL			***All areas west of the FPL 2.5 Hectares, 6.2 Acres***
Month	**Week**	**Task**	**Notes**
December to February	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms.
March	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms.
April	1st week	Inspect Forebays A, B, and C to determine if cleaning is needed.	• If needed, vacuum debris. Use caution not to disturb stone and plants.
	1st and 2nd weeks	Before the splash pad and irrigation are commissioned, inspect every component of the water collection system.	• Look at manholes, filters, pumps, outfall pipes, irrigation cistern, drain inlets, catch basins, marsh overflow, marsh weir, and equipment in the pavilion basement.
	2nd week	Commission irrigation system. Refer to separate maintenance manual.	• Install new UV Filters.
	3rd week	Commission splash pad to determine if there are any operational issues before it's opened to the public. Refer to separate operational manual.	• Check nozzles, activation button, inlets, pipes, equipment and manifold in pavilion basement.
		Commission fountain in sand play area.	
May	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms.
		Inspect marsh and remove algal blooms.	• Algae begins to show up in May as the water warms. Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days, remove algae at marsh floor and refill.
June	Every week	Inspect marsh and remove algal blooms.	• Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days, remove algae at marsh floor and refill.
July	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms
	3rd week	Inspect marsh and remove algal blooms.	• Algae favors warm conditions. Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days and refill.
August	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms

Month	Week	Task	Notes
August cont.	Every week cont.	Inspect marsh and remove algal blooms.	• Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days, remove algae at marsh floor and refill.
September	3rd week	Inspect marsh and remove algal blooms.	• Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days, remove algae at marsh floor and refill.
	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms
October	2nd week	Clean Forebays A, B, and C.	• Vacuum debris, use caution not to disturb stone and plants
		Decommission splash pad. Refer to separate operational manual.	• Make any last adjustments and repairs.
	3rd week	Decommission fountain in sand play area.	
		Inspect marsh and remove algal blooms.	• Early upkeep will keep populations down. If situation gets out of hand, remove algae and drain down marsh to 5 cm level, leave for 2 days and refill.
	4th week	Make any last adjustments and repairs.	
November	1st and 2nd weeks	Inspect every component of the water collection system.	• Look at manholes, filters, pumps, outfall pipes, irrigation cistern, drain inlets, catch basins, marsh overflow, marsh weir, and equipment in the pavilion basement.
	Every week	Check for and clean blockages in marsh outfall pipes.	• Especially important before and after storms.
SPECIAL NOTE	All the time: May through September	Inspect splash pad for any leaks, drain obstructions, and miss-operational nozzles.	• Repair immediately. Do not shut down splash pad unless absolutely necessary; the splash pad is the initiation point for the stormwater collection system.

Appendix A
Planting Soil Primer

ORGANIC SOIL MANAGEMENT

Organic soil management shifts a maintenance program from one of discouragement (getting rid of what is unwanted) to one of encouragement (setting up conditions that support what is desired). It creates the circumstances by which soil can function consistently without drastic physical and chemical interventions. It restores and maintains the soil's natural nutrient cycling system by regularizing nutrient replenishment, sustaining water availability, encouraging deep root growth, and balancing the biological communities that are present in all healthy soil. The benefits for plants include minimizing cyclical stresses that misallocate plant energy, reducing watering requirements, suppressing attacks by pests and diseases, sustaining soil pores for air and water, and degradation of harmful pollutants.

A key aspect of organic soil management is gaining an education in soil composition, characteristics, and performance. This document is truly a primer and is meant to provide basic information while stimulating an interest in soil - one of the most complex materials on earth. For more information, see *Appendix E: Resources*. Additionally, soil education resources abound, so seek them out!

Soil testing provides a window into the physical characteristics, chemical processes, and living organisms of soil. Tests can report problems before they are visible in plants as well as provide a guide for keeping soil in check. Two types of testing are required for organic management: agronomic (structure, fertility, chemistry) and biological (the ratio of living/biotic organisms to non-living/abiotic elements). Both are discussed in this appendix.

BASIC SOIL CONSIDERATIONS

Soil is alive and it is an extremely delicate material. A single teaspoon of soil holds 50 billion microbes which are all interconnected and allow soil to interact with and support plant life. Kill the organisms and soil becomes"dead".

Soil structure is the visible and physical "crumb" that is made of soil particles and pores. Soil structure is built up over years but it can be destroyed in seconds if it is improperly handled. For example, never dig, handle, or drive over wet or frozen soil. This compacts soil by pushing particles together so intensely that all or large regions of pore spaces (needed for oxygen and water exchange) are eliminated. It's impossible to restore soil structure quickly; recovery takes years of special treatment and patient, careful addition of amendments. Due to this reality, "ruined" soil is often removed and replaced.

Soil pores are the spaces between particles that allow water to infiltrate and air to be exchanged. Both of these things are needed by soil organisms in order to survive. In productive soil, the ratio of pore space and soil is equal. When pores are crushed out of existence by compaction or become water-logged due to poor drainage, then conditions for diverse biological populations are lost. With this loss, chemical processes at plant roots are compromised, which means that some of the most important biological activity for soil and plants is blocked.

Water infiltration is the gravitational flow of water through soil. The infiltration rate or velocity of water is a measurement of how quickly water can enter and move through the soil. There is a fine balance needed between overly sandy soil that percolates too fast and fine-textured soil that percolates too slow. Healthy soil can drain well and store water moisture, making it available to roots and organisms over a long time period. Other influences for infiltration include compaction, topography, solar exposure, water volume, plant density, and temperature.

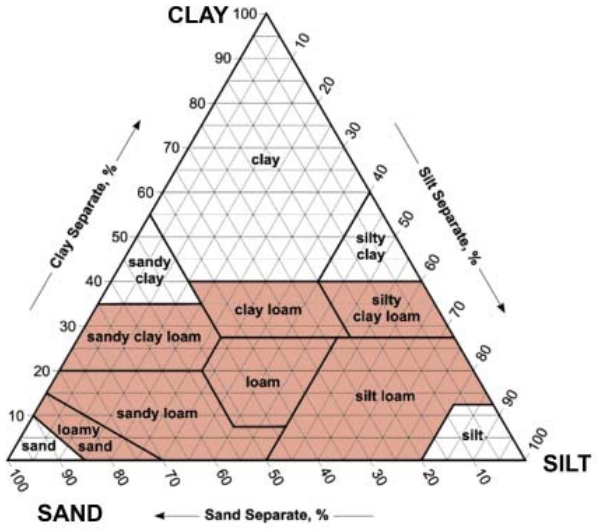
Soil texture is determined by gradation of particle sizes, which measures the ratio of sand, silt, and clay in a given soil. For landscapes, soil textures must be suitable for agronomic or horticultural use, which means it's classified as a loam (*see USDA Soil Triangle at right*). The cluster of graduated USDA sieve sizes that are used to measure all types of loam are #18, #35, #60, #140, #270. Silt and clay are too small for sieves and instead are measured through a distillation process.

Corktown Common soil is sandy loam (with varying organic content) everywhere except the marsh (where it's slit clay loam,) the prairies (where it's silt loam), and at trees in pavement (where it is sand-based structural soil).

Sand is the largest grain size in soil (USDA sieve #s 10, 18, 35, 60 through 270). An often overlooked aspect of loam texture is the gradation of sand particles, which range from very coarse to medium to very fine. Fine and very fine sands are important to gauge because they affect the infiltration rate of soil. These fine particles can easily fill in pore space, which can slow down water flow and air exchange. Conversely, too much coarse sand can allow water to infiltrate too quickly, creating a deficit in water availability for roots. Generally, soil where 70% of the total particles consist of very coarse, coarse, and medium sands (#s 18, 35 and 60 sieves), and the remaining 30% is combined fine sand, silt, and clay, should drain and retain water well. This is the ratio used at Corktown Common.

Silt is a (.005-.05 mm) slippery mineral particle that helps retain water in soil. However, if there are too many silt particles in a loam then they fill in pore spaces and slow down water too much. This can lead to water-logged soil that can easily turn anaerobic and damage plants. Silt particles are measured by water suspension since they are too small and slippery to be sieved.

Clay is a (<.002 mm) mineral particle essential for soil function and fertility. As a negatively-charged ion, it attracts and holds onto positively charged nutrients, making them available for uptake by plant roots. Soil texture and cohesion is also improved with clay since its sticky surface helps to bind non-clay particles together. Clay helps retain water, but like silt, an excess of clay particles can slow water down too much. The natural elasticity of clay allows it to swell and shrink, which means it absorbs a



lot of water. When dry, clay becomes hard and difficult to work with. Clay particles are smaller than silt and are measured by water suspension.

Anaerobic soil has very little oxygen present, an over-abundance of inactive bacteria, and is a result of water-logged conditions. Therefore, anaerobic soil smells rotten. This occurs because when soil pores are filled by water, they cannot exchange air. Wet (hydric) soil in the marsh at Corktown Common is intentional, but unintended areas of poor drainage or damaged soil can become anaerobic and release gasses that are harmful to plants (such as methane or hydrogen oxide). It is unfortunately impracticable to reverse anaerobic soil so it must be replaced. (Note: considerable research about reversing this condition is being done in agriculture but so far efficacy is inconsistent.)

BALANCED SOIL BIOLOGY

Balanced soil biology is at the core of every organic soil management program. Bacteria, fungi, nematodes, protozoa, arthropods, earthworms, and other organisms are the living engines that enable soil to function and perform. Soil microbiology is always present in loam soil, but populations vary with the infinite combinations of soil texture, food source, plant type, and environmental conditions such as moisture, air, and temperature. The key is to encourage the right microbial populations for a given plant community.

The "soil food web" is a term used to describe the entire community of organisms living all or part of their lives in the soil. It's a complex system in which every animal is dependent on another. If one of these organisms is over-represented or under-represented, the entire community is affected. While this is neither bad nor good, per se, it is known that certain plant communities require a specific balance of soil organisms to be viable. Every organism has multiple functions, benefits, and influences. The following are major players in soil food webs:

Bacteria are single celled organisms that decompose carbon compounds and convert that energy into forms that are useful to other soil organisms. In doing so they regulate water dynamics, nutrient cycling, and disease suppression. Bacteria species are abundant (only a small fraction have been identified) and vary in functions. They can decompose organic matter, form mutualistic relationships with plants (such as nitrogen fixing), be pathogenic (disease-causing), or act as chemoautotrophs (able to derive energy from sources other than carbon).

Fungi are long strands of cells called hyphae that push their way between soil particles, roots, and rocks. They have three general categories. Saprophytic fungi are decomposers that convert hard-to-digest organic matter into a form more easily digestible by other organisms. They bind and stabilize soil particles, helping to increase water filtration and water holding capacity. Pathogenic fungi cause disease to plants, but some types actually help control diseases by attacking other harmful organisms. Latly, mycorrhizal fungi are mutualistic: in exchange for carbon from plants, they make certain nutrients available to roots by converting them into a form that is easier to absorb.

Mycorrhizal fungi are unique members of the biological community and have a distinct symbiotic relationship with plants and soil. Structurally, mychorrizal fungi send out hyphae strands that extend and colonize in the soil. These strands grow intertwined with plant roots where they can gain sugars for energy in exchange for giving plants critical nutrients like phosphorus and moisture. In addition to helping plants function better, mycorrhizal fungi improve soil structure by wrapping and sticking to soil particles. Lastly, they accumulate carbon in the soil by exuding a sticky, glue-like substance called glomalin (a stable form of carbon).

Protozoa are single-celled animals that feed primarily on bacteria, but also other protozoa, soluble organic matter, and sometimes fungi. They live in the top layers of soil around the rhizosphere of roots and help to regulate bacterial and algae populations. When they eat bacteria, they release excess nitrogen in the form of NH4 that can be used by plants and other soil food web organisms. Protozoa are eaten by nematodes.

Nematodes are non-segmented worms that congregate near their food sources which include bacteria, protozoa, and fungi. Like protozoa, nematodes release excess nitrogen as NH4. They move through spaces in soil particles, distributing other smaller organisms that attach to them or live in their digestive system. There are beneficial and harmful nematodes, root feeders being the latter. Since they need bacteria and fungi to survive, the presence of beneficial nematodes is a good indicator of general soil health.

Arthropods are invertebrates that feed on fungi, worms, other arthropods, and harmful root and leaf pests. They chew and shred dead plant matter enabling other organisms to eat it, and in so doing, aerate and mix soil. Nutrients are released through their fecal matter. Their size ranges from microscopic to several

inches long. Common arthropods include ants, beetles, springtails, spiders, mites, millipedes and centipedes.

Earthworms stimulate microbial activity, mix and aggregate soil and residue, increase infiltration, and improve water-holding capacity - all by eating organisms and moving through the soil. Their waste is a rich source of nutrients. The presence of earthworms indicates higher and more active populations of bacteria and fungi, and thus, healthy soil.

INFLUENCES OF SOIL BIOLOGY

Nutrient Retention: Beneficial organisms keep valuable nutrients in the proper root zone. Bacteria and fungi also prevent leaching, a process that removes nitrogen and other nutrients from the soil.

Nutrient Availability: Protozoa feed on bacteria and fungi, excreting nitrogen in a form that is easily absorbed by plants. The symbiotic relationship between fungi and roots helps plants filter needed micronutrients from the soil.

Moisture Retention and Availability: Organic matter retains water in the root zone long enough to be absorbed by plants and therefore dramatically reduces overall water use.

Pest and Disease Control: Beneficial nematodes and fungi protect the roots of plants from potentially harmful organisms that are always present in the soil.

Aeration: Organisms add oxygen and give structure to the soil by creating air holes and drain pockets. This reduces compaction, maximizes water availability to the root zone, and prevents formation of harmful anaerobic bacteria.

CAUTION!

As important soil biology is to providing a fuller picture of what's going on in the soil, it's only one of a suite of tests and in situ diagnostics that characterizes the performance of soil. For instance, if soil gradation is poor and results in, say, water-logged conditions, then no amount of biological adjustments will improve the soil. Likewise, incorrect soil pH is not fixable through biological programs. But there are conditions such as compaction and low fertility that can benefit from biological treatments.

COMPOST

Compost is the residue of life. It is the aerobically decomposed remnants of plants and food created through the proper management of heat, moisture, and aeration. The result is a nutrient-rich environment for beneficial bacteria, fungi, protozoa, and nematodes that can be incorporated or applied directly to the soil in solid form or as liquid biological amendments (LBAs) These micro-organisms control pests (pathogenic organisms) and aerate the soil, providing the opportunity for extended plant root development. Suitable high quality compost is stable (which means "mature" or no longer degrading at a rapid rate), has a high organic content of 25 to 75%, has an active and balanced biological community, and is free from contaminants. Most importantly, the benefits gained from incorporating organic material into soil are immediate (though slower than inorganic fertilizers) and provide long-term contributions to soil health. The following are the key concepts for mature compost:

Maturity is one of the best indicators of compost quality and performance potential. Maturity is reached when all of the easily degraded molecules have been broken down, leaving complex organic material behind. Mature compost has a fine texture, dark colour, earthy smell and the parent material is unrecognizable.

Immature compost release gases and compounds that can harm plants and wreak havoc on soil biology. As it ages, compost produces a lot of heat, which can harm roots. As compost matures it has a very high microbial activity that needs air to progress and sufficient carbon and nitrogen to assist in the process. Green compost will continue to breakdown when mixed with soil, which leads to two serious issues: Maturing compost needs air and that is usually provided when compost piles are overturned. In soil, the air-hungry microbes will rob it of its oxygen, literally suffocating roots. Additionally, immature compost has a high carbon to nitrogen ratio (C:N), which means that it is short on nitrogen and will take what it needs from the surrounding soil, leaving root zones temporarily nitrogen-poor.

Stability is not the same as maturity. It refers to the level of biological activity. Slowed biology can indicate maturity but the inactivity could also be caused by low temperatures or lack of water and nitrogen. Once those conditions are corrected, the compost will continue the maturing process.

Organic content is a measure of all substances containing organic carbon. An acceptable range for organic content in compost is 25% to 75% and the higher the better (though 40% is a good goal). If organic content is low, more compost will be needed to deliver the same benefits found in more fertile compost because compost is added to soil by volume. The lower the organic content the more cubic metres are needed to reach acceptable organic matter percentages.

Soil amendment. Quality compost is an ideal soil amendment. Besides providing nutrients and sustaining biological activity, it also has a positive effect on soil structure, tilth, fertility and water/nutrient holding capacities. Compost improves soil structure and tilth by lowering bulk densities, by increasing permeability and porosity, and by introducing microorganisms that produce "cementing agents" (such as gels, gums, slimes, and other polysaccharides) helpful in binding soil particles together into aggregates. When amended with compost, clay soil is protected against compaction and sandy soil is better able to retain water and nutrients.

COMPOST TEA

Compost teas are specific liquid biological amendments (LBAs) made by encouraging reproduction of the beneficial organisms from the compost by depositing compost into an aerated water solution with various food sources. The advantage of the tea is that recipes can be developed and fine-tuned to target specific conditions and plant communities. Careful application of compost teas can speed up the process of balancing the soil biology, but achieving the proper mix requires time and testing. Good quality compost improves the effectiveness of the tea.

Compost Tea can be made through a brewing or an extraction process, using special equipment. Care should be taken to ensure the compost tea is well aerated during production. The liquid should be aerated for 24 to 48 hours at room temperatures and used immediately after brewing. This will prevent the production of harmful microorganisms within the compost tea. Three basic types of composts are used to address particular needs within landscape systems:

Bacterial Mix composts are more dominant in bacterial feedstocks such as hay, weeds, coffee grounds, and herbaceous material. Common plants that prefer bacterial soil include grasses, annuals, perennials, and vegetables.

Fungal Mix composts are dominant in fungal feedstocks including dry leaves, sawdust, wood chips, and shredded newspaper. Common plants that prefer fungal soil include trees and shrubs, and prairies.

Vermicompost is the product of specific species of earthworms as they breakdown organic matter. It is an ingredient in many compost tea recipes. This compost is typically the highest in available nutrients but it is also expensive.

To select the proper compost, identify the types of plants within the planting area. In general, turf, grasses, and perennials require higher bacterial populations, while more complex landscapes with trees and shrubs benefit from higher fungal populations. See the M*aintenance Calendars* in *Section IV: Planting* for suggested compost types. As one example, the urban prairie requires a fungal mix.

Planting Soil Testing

SOIL TESTS: BASIC CONSIDERATIONS

Soil testing provides a window into the physical characteristics, chemical processes, and living organisms of soil. Tests can report problems before they are visible in plants as well as provide a guide for keeping soil in check. Two types of testing are required for organic management: agronomic (e.g., structure, fertility, chemistry) and biological (e.g., the ratio of living organisms to non-living material). Both types are discussed in this appendix.

Physical and visual examination of soil during daily maintenance routines is the best way to stay on top of soil problems. Before calling for lab tests, which are costly and take time, bend down and get your hands dirty. It is the quickest way to determine if the park soil is in good or poor health.

There are some basic things to look for in the soil: Is the soil too moist or wet (poor drainage, overwatering); is it odorous (anaerobic or some other foreign matter); is it without odor (lifeless); does it crumble or stay in a ball when dropped from shoulder height (poor structure, compaction); does it have a sheen (oil or other chemical spill); has it changed colour (salt accumulations, anaerobic, poor mixing of organic material, disturbance to soil horizons); are soil issues localized or symptomatic of an area (the extent of the issue, where to treat); is it hard to dig in a bed (compaction); has something been digging in the soil? And so on. *See Soil Tests in Situ in this chapter for details.*

Likewise, it's important to notice when things are going well so that there is a baseline for judging health. Are there worms in the soil (an indicator of overall balanced soil biology); is soil colour darkest on top, fading to lighter shades (good horizon development); does the soil crumble easily when held (good soil aggregation and structure); does it have that rich earthy smell (good soil biology), is mycorrhizal fungi visible in the soil? And so on. *See Soil Tests in Situ in this chapter for details.*

Soil Collection/Sampling for All Tests

- Within a common landscape type and area (e.g., lawn, woodlands, etc.) collect soil at 4 locations, 10-15 cm deep and blend together. Remove visible organic or inorganic solids (e.g., twigs, rocks, etc.).
- Collect 2 cups of soil, expose it to air indoors to dry it overnight.
- Seal dried soil in a ziplock baggie, leaving air in it.
- Place plant clippings on top of soil in bag for food stock (do not incorporate).
- Store the sample in a dry cool place indoors (not a truck!).
- For agronomic tests, send the sample to the lab within 2 days. For biological tests, send it to the lab within one day.

Testing takes time. It is a necessary step so plan ahead and leave enough time. While many labs offer expedited services, this can double the cost of tests and sometimes may not be available. The timing for testing is as follows:

For agronomic testing, labs ask for at least a week to give results and if the lab is busy it can take two weeks. Besides the time to perform the tests, labs need time to analyze it and prepare reports. However if only partial tests are needed that may take less time. A sieve analysis (gradation) for sand particles can take as little as two days but if sand and silt percentages are also needed then add three days since the testing is more elaborate and requires calculations. Tests for chemical characteristics take a week or more because the processes for extracting nutrients are time intensive and cannot be rushed.

Biological tests take 10 to 14 days to perform, period. This is because microscopy is used to count specific microbes. Since fewer labs do this type of testing, timely submission is critical.

Compost testing can take one to two weeks.

LABS

There is not a single laboratory that can run all the types of testing needed for soil analysis. However, for each type of test (agronomic, biological, compost) ALWAYS use the same lab to perform the tests. Despite standardized test methods, there are still differences between labs such as calibration of equipment and skill of technician.

- **Qualified agronomic labs:** This is a reference for qualified agronomic soil laboratories in Ontario for standard soil tests:
  http://www.omafra.gov.on.ca/english/crops/resource/soillabs.htm
- **Qualified soil biology labs:** There are not many labs that measure soil biology but these are reliable and reputable:
  http://www.soilfoodwebnewyork.com/
  http://www.soilfoodweb.com/
- **Qualified compost testing labs:** This is a reference for qualified agronomic soil laboratories in Ontario for compost tests:
  http://www.omafra.gov.on.ca/english/crops/resource/soillabs.htm
- **Woods End Research Laboratories, Inc.** in Mt. Vernon, Maine, USA performs Solvita tests:
  www.woodsend.org
- **Solvita Maturity test** for on-site compost maturity evaluation:
  www.solvita.com/compost

Planting Soil Testing

AGRONOMIC SOIL TESTS

Regularized soil testing forms the basis of any successful organic maintenance program. It provides information that targets specific amendments or treatments for soil health and reduces both cost and waste. Critical ways to determine soil conditions include chemical analysis, textural analysis, and fertility tests.

Chemical Analysis is required to determine the following:

- **pH Level** measures the soil acidity or basicity that impacts nutrient availability in soil. A reading of 7.0 is neutral, below that soil is acidic, and above that soil is alkaline. At Corktown Common plant pH requirements match the soil pH, making little to no need for adjustments. If needed, acidify soil with granulated sulphur and lower acidity with dolomitic limestone or calcium carbonate. However, it is difficult to lower pH since it is likely to "rebound" to its former level.
- **Buffer pH** measures the reserve acidity in soil and is an indicator of how difficult is to change soil pH. Buffer pH is always below 8.0 and the lower the number is below 8.0 the more lime it takes to raise the pH.
- **Cation Exchange Capacity (CEC)** is used to measure soil fertility, nutrient retention capacity, and the capacity to protect groundwater from cation contamination. A desirable CEC range is 10 to 15 or more. Sandy soil has a low CEC value whereas clay soil has a high CEC value.
- **Individual Macro and Micro-Nutrients** are nitrogen, phosphorus, potassium, magnesium, manganese, zinc, iron, and copper. Lab tests will indicate whether these levels are high, medium or low. Incorporation of organic matter is usually sufficient to address concerns but extremely low levels may require the addition of specific nutrients.
- **Soluble Salts/Electrical Conductivity (EC)**measures salinity levels in units of mmhos/cm. A reading of 1.0 is acceptable but a reading of 0.60 is ideal. A reading of 1.0 means that water absorption is hindered even when water is present due to an unfavorable osmotic pressure. High salinity also injures leaf cells through transpiration. However, plants do need salt to absorb nutrients. A reading of 0.50 is fine if the soil is high in organics. Plants can't absorb nutrients below 0.15 mmhos/cm.
- **Nitrate (NO3)** is soluble nitrogen that is readily available to plants but easily dislocated or leached from soil by rain or irrigation. Nitrate threatens water bodies and ground water. It is measured in lbs/acre and 150 lbs/acre is a reasonable goal but over 350lbs/acre will cause leaching.
- **Ammonium nitrate (NH4)** is insoluble nitrogen that is long-lasting and converted to NO3 through nitrification, where bacteria convert NO4 to NO3.
-
-

Soil Textural Analysis is required to measure:

- **Sand, silt and clay particle percentages.** Also known as sieve analysis or gradation, these tests help determine the soil classification and can be predicative of characteristics such as infiltration rate, compaction, water retention capacity, erodability, and suitability for specific uses.
- **The sieve sizes** used for classifying loam soil are:

Soil Particle Type	*Sieve Size/Diameter*
Clay	< 0.002
Silt	.005 -.05
Very Fine Sand	#270 / < 0.002
Fine Sand	#140 / 0.002-0.05
Medium Sand	#60 / 0.05-0.10
Coarse Sand	#35 / 0.10-0.25
Very Coarse Sand	#18 / 0.25-0.50
Fine gravel	#10 / 0.50-1.00
Gravel	#4/1.00-2.00

- **It is not necessary** to determine the silt and clay content if these are not suspected to be problematic. A lot can be learned about a soil's performance from the percentages of sand particles since sand sizes range from very coarse to very fine.
- **Instead of evaluating overall sand-silt-clay** percentages it's more helpful to compare the proportion of fine to coarse particles, which is what affects soil performance of loam more than any one particle size. Coarse particles would be medium (#60 sieve) to very coarse (#18 sieve) sands. Fine particles are grouped from fine sand (#140 sieve) to clay (<0.002). At Corktown Common most of the plant beds have soil that is 30% fine particles to 70% coarse to balance water retention and drainage. The marsh soil is 70% fine to 30% coarse to retain water. The lawns are 20% fine to 80% coarse to resist compaction.

Fertility tests are required to measure:

- **Organic Matter** on a percent by weight basis. It's indicative of nutrient availability and water holding capacity. Preferred level is 3-5% in topsoil and less than 2% in subsoil. While this may seem low, if the nutrient cycling system is operating, these levels are adequate.

BIOLOGICAL SOIL TESTS

Biological soil testing is different than standard nutrient, chemical, and textural analyses that look at physical characteristics or chemical processes. Soil is full of life and the organisms within soil are responsible for soil function and nutrient exchange with plants. Although soil biology is constantly changing, testing for fungi and bacteria as well as beneficial predators (e.g., protozoa and nematodes) provides critical information about nutrient availability and biological production. These tests remove much of the guesswork when selecting proper compost or organic matter amendment strategies. (Again, nutrient cycling systems of different plants will require specific fungal or bacterial dominated soil to function optimally.)

Biological Soil Tests include the following:

- **Fungi Test** for total and active fungi. These microbes are decomposers break down hard-to-digest organic matter so it is available for uptake by plants. Fungi are also critical for water dynamics, nutrient cycling, and disease suppression. Active fungi ranges should be between 25-50 ug/gram of soil, with a total range between 500-3000 ug/gram of soil.
- **Bacteria Test** for active, aerobic bacteria and inactive, anaerobic bacteria. Healthy soil has an active bacteria range between 15-25 ug/gram of soil.
- **Protozoa Test** for flagellates, amoebae, and ciliates that are critical for nitrate production. Low protozoa counts indicate low bacteria levels since protozoa feed on bacteria. Ideal ranges for flagellates and amoebae are between 10,000- 50,000 ug/gram of soil. An ideal range for ciliates is between 25-50 ug/gram of soil.
- **Nematodes Test** for beneficial and non-beneficial (e.g., root-feeding) populations. Adequate beneficial populations are needed to consume, control, and convert bacterial and fungal populations into nitrate. Beneficial nematode populations should range between 10-20 ug/gram of soil.
- **Mycorrhizal fungi** for percentage of colonization for endo (inside the root) and ecto (outside the root) fungi.

COMPOST SOIL TESTS

Compost is the cornerstone of every organic maintenance program and it is the single-most used material for soil and plant health, both by direct application on soil and as the basis for LBA/Compost Tea. Unfortunately the quality of compost is widely variable in the marketplace because it requires time and specific practices to make a high-quality product. Often immature compost is sold to unsuspecting or unknowledgeable customers. The best defense for this is to have the compost tested for maturity, organic content, biology, fertility, and C:N ratios.

- **Degree of maturity** measures the stage of decomposition where microbial activity has slowed and large complex molecules are left to work on long-term soil nourishment, structure, and water holding capacity. The most accurate test is the Solvita Method, which measures the CO2 respiration and ammonia (NH3). Solvita rates maturity on an index of 1-8. A result of 6-8 is acceptable. *Solvita tests are provided by Woods End Research Laboratories, Inc., Mt. Vernon, Maine, USA. Visit www.woodsend.org for details. Accurate and easy-to-use test kits are also available at www.solvita.com/compost.*
- **Organic content** tells the percentage of the compost that is nutrient rich. It should never be less than 25% and 40% is ideal. The remaining percentage is composed of mineral matter and ash.
- **Biological testing** looks at the active to inactive ranges for bacteria and fungi as well as nematode populations needed to keep bacteria populations in check.
- **Carbon to Nitrogen Ratio (C:N)** measures the mass of carbon to the mass of nitrogen and is a measurement of stability. Carbon is the energy or food supply for organisms and affects the release of nitrogen. Nitrogen is used by organisms for proteins and reproduction. A ratio below 25:1 is acceptable but the preferred range is 11:1 to 22:1.
- **pH.** Compost may help buffer soil towards neutral reading of 7.0. An acceptable range is 6.0 to 7.5.
- **Soluble Salts (salinity, electrical conductivity)** measures salt levels. When compost is used as an amendment, a reading of 2.5 mmhos/cm is acceptable because the ratio of compost to organic matter is low enough to have a diluting effect. The lower the reading the better.

Planting Soil Testing

SOIL TESTS IN SITU

With natural systems like soil, sometimes the best approach is the simplest one. There is no doubt that laboratory tests provide critical, dependable scientific facts, diagnostics, and evidence but there is also no substitute for being able to see a problem and make a quick diagnosis. Here are ten easy "tests" for soil *(adapted from http://www.mcshanesnursery.com/articles/lawn-and-soil/10-easy-soil-tests/)*

- **Soil structure and tilth:** In soil that is not too dry or wet (at field capacity), dig a hole 150-250 mm deep and replace the soil in the hole. Remove a "soup can"-sized section of soil. The soil should hold together but crumble easily in your hand, and not be too powder, cloddy, or granular. A crumbly soil indicates good structure and adequate pore space.
- **Compaction:** Plunge a wire flag (like the kind that are used in surveying or to mark irrigation lines) or an unfurled coat hanger (clean cut) into the ground. It should be able to go in 300 mm deep with ease. If resistance is met at less depth, soil may be compacted. If encountered, do this across a bed/lawn to determine limits of compaction.
- **Workability:** Dig a hole or try to upend soil (work away from of root zones). If cloddy or platy soil is encountered, workability is low, which means other problems, such as compaction or poor soil biology levels, are present or developing.
- **Soil biology:** Dig down 150-200 mm and peer into the hole for 5 minutes. Count the number of organisms spotted, such as centipedes, beetles, and spiders. These critters might need some gentle probing to come into the light. You should spot at least ten in this time period. If not, soil biology is missing a link somewhere and further soil biology lab tests are needed.
- **Earthworms:** On soil that is not too dry or wet (at field capacity), look for earthworm castings or burrows. Once they are located, shovel out 150 mm deep soil and count the number of earthworms in shovelful. Three worms are good, five is better (if you have more than 24, you have the makings of a highly-profitable worm-casting operation ;-). The presence of earthworms is a good indicator that the soil food web is active and operational. If not, further soil biology lab tests are needed.
- **Organic Matter:** At the beginning of summer, when the soil warms to at least 10 degrees C, dig down to find decomposing plant matter. Recognizable plant parts as well as fibrous material are a good sign that the rate of decomposition is good and that soil biology is actively working.
- **Plant Vigor:** Once plants are actively growing in the season, look for healthy development. Clean leaves, good bud set, and good stem growth all indicate that a plant is getting what it needs to grow.
- **Root development:** Carefully hand trowel around a selected plant (an adjacent weed or annual works) until reaching root depth. There should be plenty of healthy white roots. Brown or mushy roots indicate a drainage problem. Stunted roots may mean disease or root-gnawing pests.
- **Water Infiltration:** In soil that is not too dry or wet (at field capacity), push a coffee can (top and bottom removed) into the soil until 7.5 cm of it is sticking above grade (Remove any soil inside the can so that the soil floor at the bottom is visible.) Fill the can and let water drain and repeat twice more. On the second and third fillings, record the rate of infiltration. Anything less than 12-25 mm per hour means that the water is draining too slowly and that soil may be compacted.
- **Sight and Smell:** Topsoil should be dark brown (i.e., rich in organics) and smell earthy as a sign of good soil biology. If it has no smell, it is lifeless. If it smells septic then it is anaerobic.

A "Soil Quality Test Kit" can provide slightly more accurate instruments and materials that will enable the Corktown Common PFR horticultural staff to always be ready to test out their theories about soil concerns. *The United States Department of Agriculture's National Resources Conservation Service for Soil has instructions for assembling such a kit and detailed instructions for assembling this kit and procedures for performing tests are available here: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2_053873.*

- Soil Respiration: soil biological activity.
- Infiltration: the rate at which water flows through soil via gravity.
- Bulk Density: soil compaction and pore space.
- Electrical Conductivity: salt concentration.
- pH: gauge alkalinity and acidity.
- Nitrate: nitrate levels.
- Aggregate Stability: water-stable aggregates.
- Earthworms: number of earthworms in a given area.
- Observations: soil structure, root patterns, topsoil depth, penetration resistance, and soil texture.
- Water quality: salinity, nitrate and nitrite levels.

Planting Soil Glossary

Carbon:Nitrogen Ratio (C:N Ratio): The C:N ratio of the soil indicates nitrogen availability for plant root uptake. For example, if the organic matter in the soil contains more nitrogen than carbon, then nitrogen is released into the soil from the decomposing organic material for root uptake. If the organic material contains less nitrogen than carbon, then microorganisms use the soil nitrogen for decomposition and it will not be available for the plant root uptake. Ideally the S1 (topsoil) layer stabilizes at a C:N ratio between 10:1 and 12:1.

Compost Tea (Liquid Biological Amendment): A brewed, aerated water extract of compost. The concentrated liquid by-product of a process that "brews" or aerates compost in water with carbohydrates (used to activate and feed micro- organisms present in the compost). This process extracts the microbes and humic matter from the compost's cellulose material. The type of compost used (fungal-based or bacterial-based) in the brewing process determines the type of extract that is produced.

Contaminants: Soil should not contain anthropic material or toxic substances such as Boron or Cyanide. *Refer to Corktown Common's Certificate of Property use (CPU) thresholds.*

Manufactured Planting Soil: A manufactured, horticulturally-viable, planting medium that is optimal for the plant community. This material is created through a process of blending naturally-occurring soil components.

Manufactured Planting Soil Components: The components (base loam, sand, compost, and pine fines) that are blended together at specific ratios. The ratios reflect the horticultural needs of the designed plant community.

- Base Loam: Naturally-occurring Horizon A soil (or topsoil). This material is used as the base material for creating manufactured soil. It contains sand, silt, clay, organic matter, and microbes to varying degrees.
- Sand: Naturally-occurring soil particles from weathered rock. Sand is used to control the water holding capacity, compatibility, and fertility of manufactured soil.
- Compost: Organic matter derived from decomposed yard waste (leaves, twigs, bark, etc.) and food sources. Compost is used in three ways: to add nutrients and microbes to manufactured soil, to help sustain the natural nutrient cycling system of in-place soil, and as the basis of liquid biological amendments (compost tea).
    - Maturity: The stage of decomposition of composted organic matter that will not inhibit plant growth.
    - Stability: Indicates the relative state of decomposition.
    - Humus: Highly decomposed residue that remains after decomposition of organic matter. Humus improves soil structure and increases water retention. Its nutritive qualities include trace elements but not nitrogen or phosphorus.

Soil Food Web: The ecosystem of organisms living in the soil that produces energy and nutrients for plants to live. There are five interconnected tropic levels within this system.

- Tropic level 1: Photosynthesizers (plants, and organic matter).
- Tropic Level 2: Decomposers, Mutualists, Pathogens, Parasites, Root-Feeders (root feeding nematodes, fungi, and bacteria).
- Tropic Level 3: Shredders, Predators, Grazers (shredder arthropods, bacterial and fungal-feeding nematodes, and protozoa).
- Tropic Level 4: Higher Level Predators (predator arthropods and predator nematodes).
- Tropic level 5: Highest Level Predators (animals and birds).

Soil Nutrient Content: Macronutrients present in the soil. Some examples of ideal quantities are:

- Nitrogen (N): 1-2%
- Phosphorus (P2O2): 0.5-1.5%
- Potassium (K2o): 0.2-1.5%

Soil Organisms Content: The amount and complexity of soil organisms present to support a healthy soil food web for plant growth. The ideal quantities are:

- Active bacteria 15-25 ug/gram of soil; total bacteria 100-3000 ug/gram of soil.
- Active fungi 25-50 ug/gram of soil; total fungi 500-3000 ug/gram of soil.
- Protozoa:
    - Flagellates: 10,000-50,000.
    - Amoebae: 10,000-50,000.
    - Ciliates: 25-50.
- Beneficial Nematodes: 10-20/sq ft.
- Arthropods: Up to 100/sq ft.
- Earthworms: 5-30/sq ft.

Soil Profile: A layered system of planting soil that is specifically designed for the intended plant community.

- S1 Layer: Topsoil, similar to Horizon A.
- S2 layer: Horticultural Subsoil, similar to Horizon B.
- S3 layer: Sand drainage layer.
- S4 layer: Sand-based structural soil layer.

Planting Soil Glossary

Soil Properties: The properties that contribute to making manufactured planting soil a viable horticultural medium for plant roots.

- Cation Exchange Capacity (CEC): A measure of the soil's ability to hold and release nutrients to the plant's roots. A range of 5-25 cmol/kg is ideal.
- Texture: The proportion of sand, silt and clay particles in soil. Sandy loam to silty clay loam is desirable.
- Structure: The aggregation of sand, silt and clay.
- Bulk Density and Porosity: The amount of voids in soil that allows water, air, and roots to penetrate. 1.13 Mg/m3 is ideal. Up to 1.4 Mg/m3 is acceptable. 1.60 Mg/m3 inhibits plant growth.
- Water Holding Capacity: The soil's capacity to store water for plant use. 15%-25% water holding capacity by volume is ideal.
- Infiltration Rate: The rate at which water moves through the soil by gravitation. The ideal infiltration rate is 2–10 cm/day for well-drained to moderately-well drained soil.
- Organic Matter Content (OM): The amount of organic matter in soil, expressed as a percentage by total volume.
- pH and buffer pH: A measure of soil acidity. A pH of 7 is neutral, below 7 is acidic, and above 7 is alkaline. Urban soil tends to have a higher pH. Buffer pH will predict how easily the pH of soil can be moved from an acid to an alkaline with the application of lime. Buffer pH will be higher than the pH and the greater the difference, the easier it is for an acidic soil to become more alkaline. There is no test to predict ease of change from alkaline to acidic soil.

Soluble Salts/Electrical Conductivity (EC): The ability of a material to conduct (transmit) an electrical current. Less than 200 ppm is ideal for horticultural viability. *Refer to Corktown Common's Certificate of Property use (CPU) thresholds.*

Subgrade Soil: The fill soil directly beneath the manufactured planting soil, which does not have any horticultural value because it is low in fertility and soil biology.

Appendix B
Plant Palette

Plant Palette List

TREES

Botanical Name	Common Name	Planting Zone(s)
Acer rubrum	Red Maple	1
Acer sachharinum	Silver Maple	1, 2 & 11
Acer saccharum	Sugar Maple	1, 3, 10 & 11
Amelanchier laevis	Serviceberry	1, 10 & 11
Betula nigra	River Birch	1 & 6
Carpinus caroliniana	American Hornbeam	1
Carya ovata	Shagbark Hickory	1
Celtis occidentalis	Common Hackberry	1, 3, 10 & 11
Cercis canadensis	Eastern Redbud	1 & 10
Cladrastris kentukea	Yellowwood	11
Cornus racemosa	Gray Dogwood	16
Cornus stolonifera	Red Osier Dogwood	16
Fagus grandifolia	American Beech	1
Gleditsia triacanthos var. inermis	Thornless Honeylocust	5
Gymnocladus dioicus	Kentucky Coffeetree	15
Juniperus virginiana	Eastern Red Cedar	1 & 2
Larix laricina	Tamarack	1
Liriodendron tulipifera	Tulip Poplar	1, 10 & 11
Ostrya virginiana	American Hophornbeam	1 & 3
Pinus strobus	White Pine	1, 2 & 11
Platanus occidentalis	Sycamore	1, 2, 3, 10 & 11
Populus deltoides	Eastern Cottonwood	2
Populus tremuloides	Quaking Aspen	4
Quercus macrocarpa	Bur Oak	1, 2, 3 & 11
Quercus muehlenbergii	Chinkapin Oak	11
Quercus rubra	Red Oak	1, 10 & 11
Quercus robur x. Q. alba	Crimson Spire Oak	15
Quercus velutina	Black Oak	1 & 2
Sassafras albidum	Sassafras	1
Tilia americana 'Redbud'	Redmond Basswood	1 & 2


Access Street
Queen Street East Bridge Abutment
King Street East Bridge Abutment
Block 3
Block 4
GO/CN Railroad Tracks
Bayview Ave
Don Valley Parkway
Don River
Existing Bike Path
Block 1 Future Development Parcel
Richmond Street/ Eastern Avenue Diversion Above
Future Development Parcel
Block 6 Future Development Parcel
River Street
Eastern Avenue Extension
LAWREN HARRIS SQUARE
CORKTOWN COMMON
Front Street East
Mill Street East
Bayview Ave
Bala Underpass
ZONE 1- WOODLAND
ZONE 2- FAST GROWING FRAME
ZONE 3- PLAY WOODLAND
ZONE 4- ASPEN GROVE
ZONE 5- RIVER SQUARE
ZONE 6- PAVILION
ZONE 7-MARSH
ZONE 8- MARSH, FLOATING AQUATICS
ZONE 9-MARSH EDGE
ZONE 10- CENTRAL LAWN
ZONE 11- SHADE LAWNS
ZONE 12- OPEN LAWN AND SPORTS FIELDS
ZONE 13- PRAIRIE
ZONE 14- LOWLAND PRAIRIE
ZONE 15- TREES IN PRAIRIE
ZONE 16- DOG RUN
ZONE 17- SCULPTURE
FPL
0 5 10 25
N

Plant Palette List

SHRUBS

Botanical Name	Common Name	Planting Zone(s)
Acer pensylvanicum	Striped Maple	1
Cephalanthus occidentalis	Button Bush	1, 2 & 9
Clethra alnifolia	Coastal Sweet Pepperbush	1 & 9
Clethra alnifolia '16 Candles'	16 Candles Sweet Pepperbush	1 & 9
Cornus sericea	Redosier Dogwood	1
Corylus americana	American Hazlenut	1 & 2
Corylus cornuta	Beaked Hazlenut	1 & 2
Hamamelis vernalis	Vernal Witchhazel	1 & 2
Hamamelis virginiana	American Witchhazel	1, 2 & 4
Ilex verticillata	Winterberry	1, 2 & 16
Ilex verticillata 'Jim Dandy'	Jim Dandy Winterberry	1 & 9
Ilex verticillata 'Red Sprite'	Red Sprite Winterberry	1 & 9
Lindera benzoin	Spicebush	1, 4 & 9
Myrica gale	Sweetgale	1
Physocarpus opulifolius	Ninebark	1 & 2
Prunus virginiana	Black Chokeberry	1, 2 & 9
Rhus aromatica	Fragrant Sumac	15
Rhus aromatica 'Grow Low'	Grow Low Fragrant Sumac	1
Rhus typhina	Staghorn Sumac	15
Ribes hirtellum	Hairystem Gooseberry	1 & 9
Rosa carolina	Pasture Rose	1
Rosa palustris	Swamp Rose	1
Rubus odoratus	Purple Flowering Raspberry	1
Sambucus canadensis	Elderberry	1, 2 & 4
Sambucus racemosa	Red Elder	1, 2 & 4
Staphylea trifolia	American Bladdernut	1 & 2
Symphoricarpos albus	Common Snowberry	1
Vaccinium corymbossum	High Bush Blueberry	1
Viburnum dentatum	Arrowwood Viburnum	1
Viburnum dentatum 'Blue Muffin'	Blue Muffin Viburnum	1 & 9
Viburnum lantanoides	Hobblebush	1 & 4
Viburnum lentago	Nannyberry	1 & 2
Xanthorihiza simplicissima	Yellowroot	1 & 3

GROUNDCOVERS

Botanical Name	Common Name	Planting Zone(s)
Actaea pachypoda	White Baneberry	1
Actaea rubra	Red Baneberry	1
Actaea racemosa	Black Cohosh	1 & 4
Adiantum pedatum	Maiden Hair Fern	1
Ageratina altissima	White Snakeroot	1
Anemone canadensis	Canadian Anemone	1
Aruncus dioicus	Goat's Beard	1
Asarum canadense	Canadian Wild Ginger	1
Asclepias incarnata	Swamp Milkweed	9
Athyrium filix-femina	Lady Fern	1
Aquilegia formosa	Red Columbine	1
Carex stipata	Awl-Fruited Sedge	1 & 9
Chelone glabra	Turtlehead	1 & 9
Clematis virginiana	Virgin's Bower	1
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	1, 4 & 9
Dryopteris filix-mas	Male Fern	1 & 4
Dryopteris marginalis	Marginal Wood Fern	1
Eupatoriadelphus fistulosus	Joe Pye Weed	4
Eupatoriadelphus maculatus	Spotted Joe Pye Weed	1 & 9
Eupatorium perfoliatum	Boneset	1 & 9
Filipendula rubra	Queen of the Prairie	1 & 4
Geranium maculatum	Wild Geranium	1
Lobelia cardinalis	Cardinal Flower	9
Lobelia berlandieri	Blue Lobelia	9
Lysimachia terrestris	Swamp Candles	9
Matteuccia struthiopteris	Ostrich Fern	3
Monarda fistulosa	Wild Bergamot	1
Oclemena acuminata	Whorled Wood Aster	1
Onoclea sensibilis	Sensitive Fern	1
Panicum virgatum	Switchgrass	4
Phlox divaricata	Wild Blue Phlox	1
Polystichum acrostichoides	Christmas Fern	1 & 3
Solidago caesia	Blue-Stemmed Goldenrod	1
Solidago puberula	Downy Goldenrod	1
Symphyotrichum cordifolium	Blue Wood Aster	1
Symphyotrichum divaricatum	White Wood Aster	1
Symphyotrichum lateriflorum	Calico Aster	1
Symphyotrichum novae-angliae	New England Aster	1
Symphyotrichum puniceum	Swamp Aster	1 & 9
Thalictrum dasycarpum	Tall Meadow-Rue	1 & 9
Zizia aurea		1

Plant Palette List

PRAIRIE PLANTS

Botanical Name	Common Name	Planting Zone(s)
Agrostis perennans	Autumn Bentgrass	13 - A, B, C & D
Bouteloua curtipendula	Side-Oats Grama	13 - A & B
Bouteloua gracilis	Blue Grama	13 - A
Calamagrostis canadensis	Canada Bluejoint	14
Carex bebbii	Bebb's Sedge	14
Carex lupulina	Hop Sedge	14
Elymus hystrix	Bottlebrush Grass	13 - C
Elymus riparius	Riverbank Wild Rye	14
Elymus trachycaulus	Slender Wheatgrass	13 - A & B
Glyceria striata	Fowl Manna Grass	14
Juncus canadensis	Canada Rush	14
Poa palustris	Fowl Blue Grass	13 - A & B
(Bluegrass, Fescue, Ryegrass)	Seeded Lawn	12

AQUATIC PLANTS

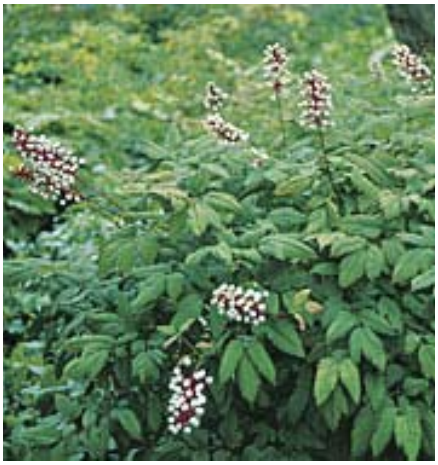
Botanical Name	Common Name	Planting Zone(s)
Caltha palustris	Yellow Marsh Marigold	9
Carex vulpinoidea	Fox Sedge	9 and 13-D
Ceratophyllum demersum	Coon's Tail	8
Carex stricta	Tussock Sedge	7
Iris versicolor	Northern Blue Flag Iris	7
Juncus effusus	Soft Rush	7 & 14
Nymphaea odorata	White Waterlily	8
Plantago cordata	Water Plantain	7
Pontederia cordata	Pickerel Weed	7
Sagittaria latifolia	Broadlead Arrowhead	7
Schoenoplectus acutus	Hardstem Bulrush	7
Schoenoplectus tabernaemontani	Softstem Bulrush	7
Stuckenia pectinata	Sago Pondweed	8

Groundcovers

Plant Palette: *Groundcovers*

White Baneberry

Actaea pachypoda



Location: Zone 1

Pest & Disease Issues: Rust and leaf-feeding insects may be a problem.

Red Baneberry

Actaea rubra






Location: Zone 1

Pest & Disease Issues: Rust and leaf-feeding insects may be a problem.

Plant Palette: *Groundcovers*

Black Cohosh

Actaea racemosa





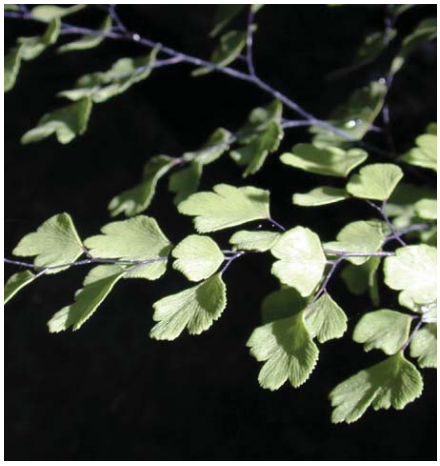

Location: Zones 1 and 4

Pest & Disease Issues: Rust and leaf spot are occasional problems. Leaf margins may brown up (scorch) and growth may slow down if soil is not kept consistently moist.

Maiden Hair Fern

Adiatum pedatum



Location: Zone 1

Pest & Disease Issues: High summer heat may cause fronds to brown by mid to late summer, particularly if good soil moisture is not maintained and/or plants are grown in too much sun.

Plant Palette: *Groundcovers*

White Snakeroot

Ageratina altissima

Location: Zone 1

Pest & Disease Issues: Leaf miners and flea beetles may attack the foliage.

Canadian Anemone

Anemone canadensis






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Goat's Beard

Aruncus dioicus






Location: Zone 1

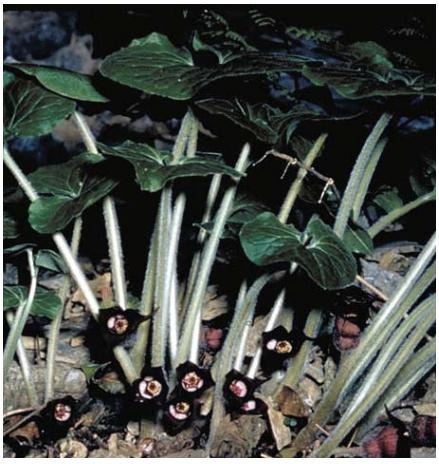
Pest & Disease Issues: Fly larvae and tarnished plant bugs may be a problem. Also, some susceptibility to leaf spot.

Canadian Wild Ginger

Asarum canadense





Location: Zone 1

Pest & Disease Issues: Slugs and snails can be occasional problems.

Plant Palette: *Groundcovers*

Swamp Milkweed

Asclepias incarnata

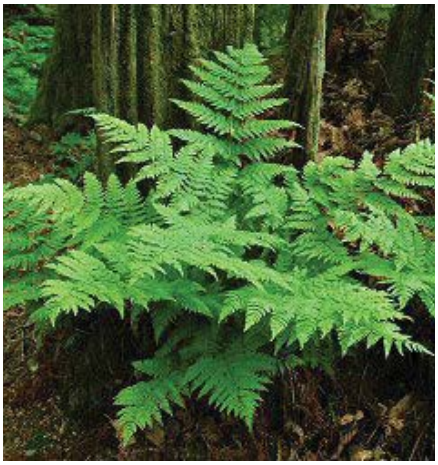





Location: Zone 9

Pest & Disease Issues: Danaus plexippus or the Monarch Butterfly, and Danaus gilippus or the Queen Butterfly both use all kinds of milkweed for their larva (caterpillars). The caterpillars may remove all or most of the leaves. Aphids, also known as green fly and black fly, are a common sap-sucking garden pest. Swamp milkweed attracts the orange milkweed aphid. If plants begin to look unhealthy, spray them with a soap solution or high-pressure blasts of water.

Lady Fern
Athyrium filix-femina






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems, even though fronds can look tattered by mid summer.

Plant Palette: *Groundcovers*

Red Columbine

Aquilegia formosa






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Awl-Fruited Sedge

Carex stipata






Location: Zone 1 and 9

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Turtlehead

Chelone glabra

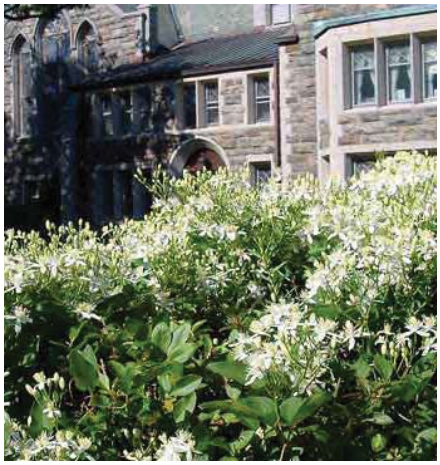





Location: Zone 1 and 9

Pest & Disease Issues: Some susceptibility to mildew, particularly if soil is kept on the dry side and/or air circulation is poor.

Virgin's Bower
Clematis virginiana





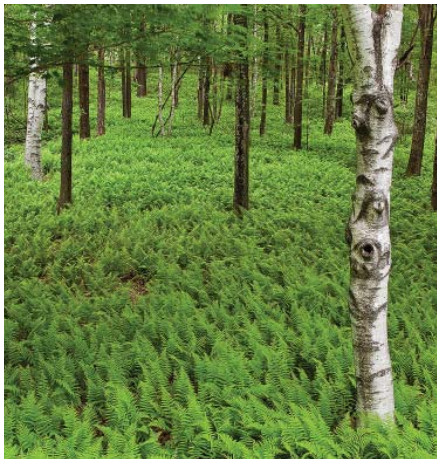

Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems

Plant Palette: *Groundcovers*

Eastern Hay-Scented Fern

Dennstaedtia punctilobula





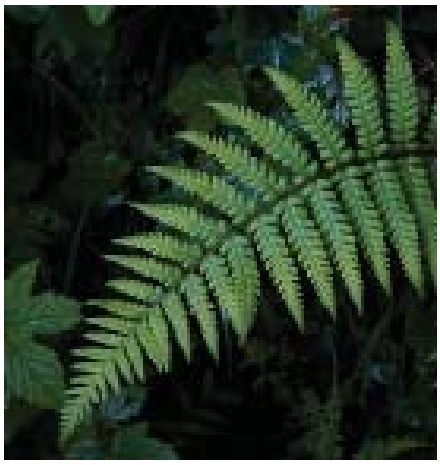
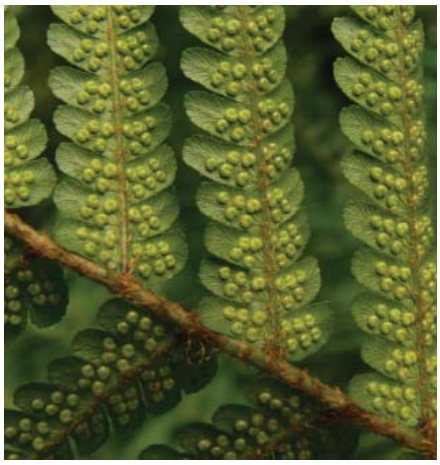
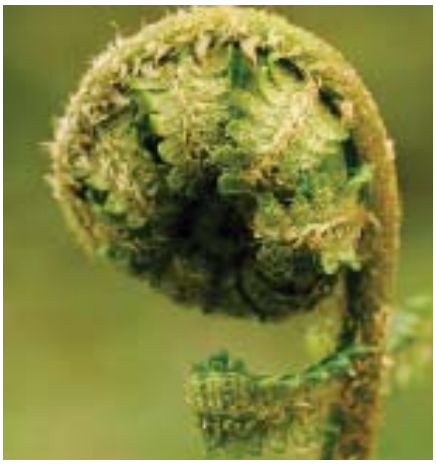

Location: Zone 1, 4, and 9

Pest & Disease Issues: No serious insect or disease problems, even though in hot summer climates, fronds tend to decline by late summer.

Male Fern

Dryopteris filix-mas



Location: Zone 1 and 4

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Marginal Wood Fern

Dryopteris marginalis






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Joe Pye Weed

Eupatoriadelphus fistulosus





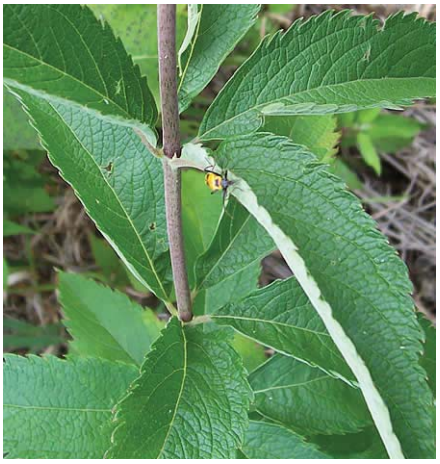

Location: Zone 4

Pest & Disease Issues: No serious insect or disease problems, but leaves may scorch if soil is allowed to dry out.

Plant Palette: *Groundcovers*

Spotted Joe Pye Weed

Eupatoriadelphus maculatus

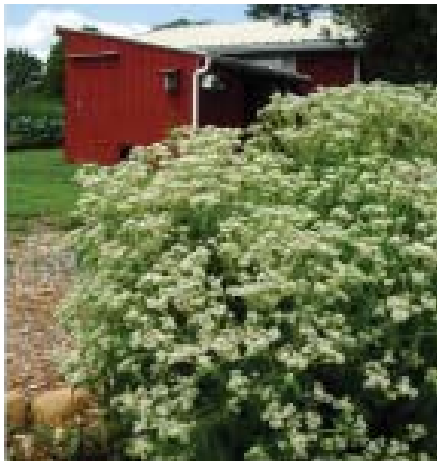


Location: Zone 1 and 9

Pest & Disease Issues: No serious insect or disease problems, but leaves may scorch if soil is allowed to dry out.

Boneset

Eupatorium perfoliatum






Location: Zone 1 and 9

Pest & Disease Issues: The leaves are favored by grasshoppers, flea beetles and saw flies, which can leave them looking bedraggled by midsummer.

Plant Palette: *Groundcovers*

Queen of the Prairie

Filipendula rubra






Location: Zone 1 and 4

Pest & Disease Issues: No serious insect or disease problems.

Wild Geranium
Geranium maculatum






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Cardinal Flower

Lobelia cardinalis






Location: Zone 9

Pest & Disease Issues: No serious insect or disease problems.

Blue Lobelia

Lobelia berlandieri






Location: Zone 9

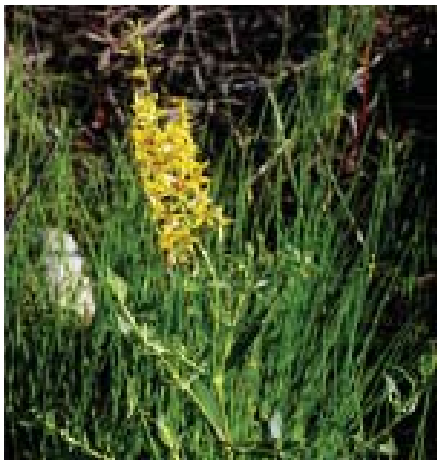
Pest & Disease Issues: No serious insect or disease problems.

Swamp Candles

Lysimachia terrestris





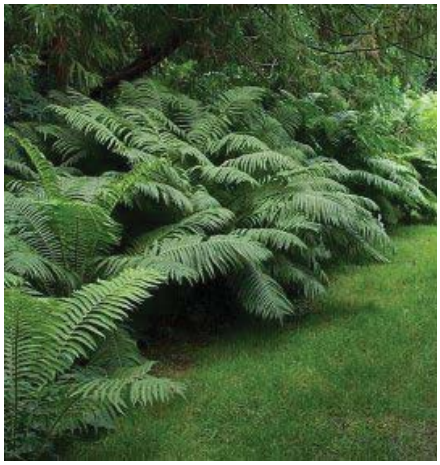



Location: Zone 9

Pest & Disease Issues: No serious insect or disease problems.

Ostrich Fern

Matteuccia struthiopteris






Location: Zone 3

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Wild Bergamot
Monarda fistulosa






Location: Zone 1

Pest & Disease Issues: Powdery mildew can be a significant problem, particularly in crowded gardens with poor air circulation. Rust can also be a problem.

Whorled Wood Aster

Oclemena acuminata






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Sensitive Fern

Onoclea sensibilis






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems. But, foliage may depreciate as summer progresses in hot climates, particularly if soil is not kept moist.

Switchgrass
Panicum virgatum






Location: Zone 4

Pest & Disease Issues: Grasshoppers, leafhoppers and armyworms can be major pests in new seedlings and established stands. Some stands are impacted by damping off and seedling blight. Leaf rust may affect forage quality. Smut can cause significant seed loss. Smut has been found on the cultivars 'Cave-in Rock', 'Blackwell', 'Pathfinder', 'Shelter', and 'Summer'. A switchgrass moth has been reported on young switchgrass tillers that could affect stands.

Plant Palette: *Groundcovers*

Wild Blue Phlox

Phlox divaricata






Location: Zone 1

Pest & Disease Issues: Powdery mildew can be a serious problem. Cutting back stems after flowering helps combat mildew. Spider mites can also be a problem, particularly in hot, dry conditions. Watch out for rabbits.

Christmas Fern

Polystichum acrostichoides






Location: Zone 1 and 3

Pest & Disease Issues: Crown rot in poorly drained soil can be a problem, particularly in winter.

Plant Palette: *Groundcovers*

Blue-Stemmed Goldenrod

Solidago caesia






Location: Zone 1

Pest & Disease Issues: Rust can be an infrequent problem.

Downy Goldenrod
Solidago puberula






Location: Zone 1

Pest & Disease Issues: Rust, powdery mildew, and leaf spot may occur.

Plant Palette: *Groundcovers*

Blue Wood Aster

Symphyotrichum cordifolium

Location: Zone 1

Pest & Disease Issues: Some susceptibility to powdery mildew. Aster wilt can also be an occasional problem, particularly if plants are grown in poorly-drained clay soil.

White Wood Aster

Symphyotrichum divaricatum






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Groundcovers*

Calico Aster

Symphyotrichum lateriflorum






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

New England Aster

Symphyotrichum novae-angliae






Location: Zone 1

Pest & Disease Issues: Susceptibility to powdery mildew and stem rot. Aster wilt can also be an occasional problem, particularly if plants are grown in poorly-drained clay soil.

Plant Palette: *Groundcovers*

Swamp Aster

Symphyotrichum puniceum



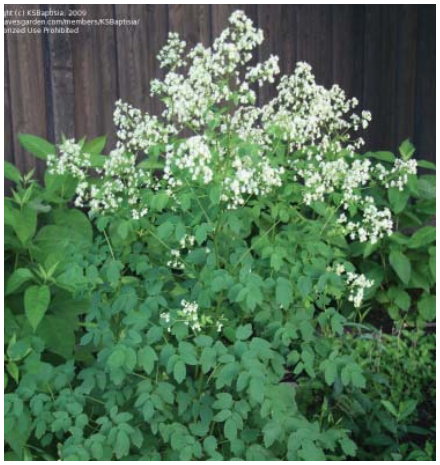


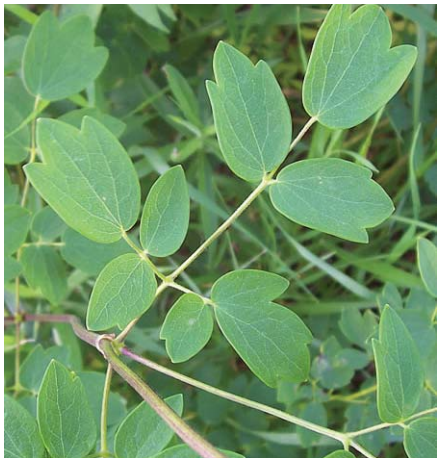

Location: Zone 1 and 9

Pest & Disease Issues: No serious insect or disease problems.

Tall Meadow-Rue

Thalictrum dasycarpum





Location: Zone 1 and 9

Pest & Disease Issues: Rust, powdery mildew, and leaf spot may occur.

Plant Palette: *Groundcovers*

Golden Alexanders

Zizia aurea






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Shrubs

Plant Palette: *Shrubs*

Striped Maple

Acer pensylvanicum

Location: Zone 1

Pest & Disease Issues: Leaves may scorch in full sun locations. Potential disease problems include verticillium wilt, leaf spots, tar spot, canker and root rots. Potential insect problems include aphids, scale, borers, mites and caterpillars.

Button Bush

Cephalanthus occidentalis






Location: Zones 1, 2, and 9

Pest & Disease Issues: No serious insect or disease problems.

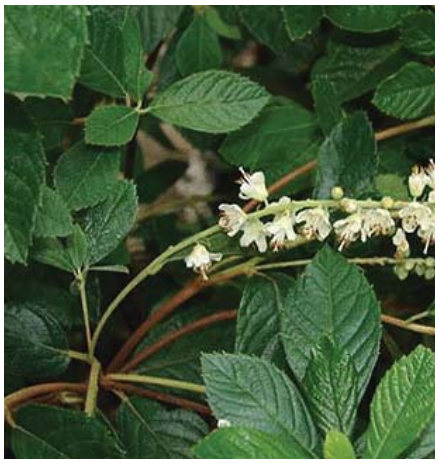
Plant Palette: *Shrubs*

Coastal Sweet Pepperbush

Clethra alnifolia








Location: Zones 1 and 9

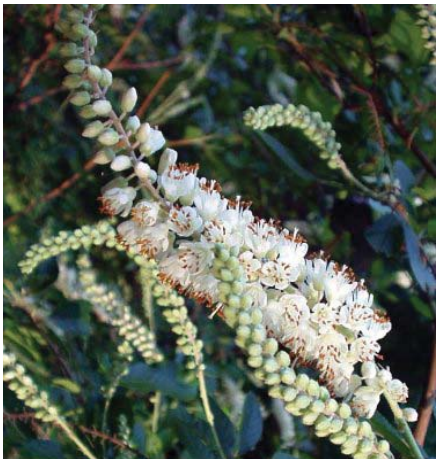
Pest & Disease Issues: No serious insect or disease problems.

16 Candles Sweet Pepperbush

Clethra alnifolia '16 Candles'





Location: Zones 1 and 9

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Shrubs*

Redosier Dogwood

Cornus sericea






Location: Zone 1

Pest & Disease Issues: Susceptible to leaf and twig blights, canker and leaf spots. Scale, leaf miners and bagworms are occasional insect pests.

American Hazelnut
Corylus americana






Location: Zones 1 and 2

Pest & Disease Issues: Some susceptibility to leaf spots, blight and crown gall. Occasional insect pests include scale, leafhoppers and various foliage-eating caterpillars.

Plant Palette: *Shrubs*

Beaked Hazelnut

Corylus cornuta

Location: Zones 1 and 2

Pest & Disease Issues: Good resistance to filbert blight. Infrequent disease problems include black knot, crown gall and leaf spots. Scale may occur.

Vernal Witch-hazel
Hamamelis vernalis






Location: Zones 1 and 2

Pest & Disease Issues: Occasional insect galls from wasps appear on foliage.

Plant Palette: *Shrubs*

American Witchhazel

Hamemalis virginiana






Location: Zones 1, 2, and 4

Pest & Disease Issues: Occasional insect galls from wasps appear on the foliage. Japanese beetles may chew on the leaves in some areas.

Winterberry
Ilex verticillata





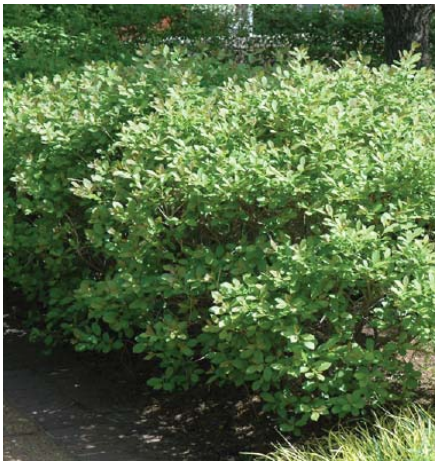

Location: Zones 1, 2, and 16

Pest & Disease Issues: Occasional disease problems include leaf spots and powdery mildew. Plants do poorly in neutral to alkaline soil where they are susceptible to chlorosis (yellowing of leaves) and often die.

Plant Palette: *Shrubs*

Jim Dandy Winterberry

Ilex verticillata 'Jim Dandy'






Location: Zones 1 and 9

Pest & Disease Issues: Occasional problems include leaf spots and powdery mildew. Susceptible to chlorosis in high pH (alkaline) soil.

Red Sprite Winterberry

Ilex verticillata 'Red Sprite'





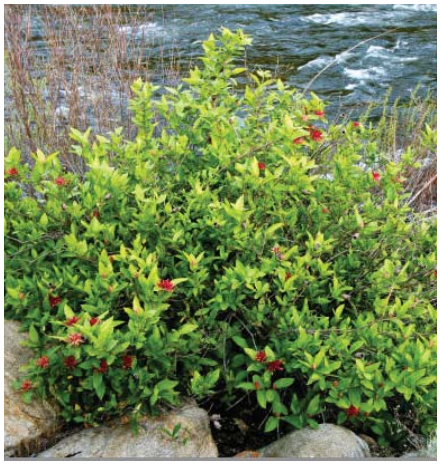

Location: Zones 1 and 9

Pest & Disease Issues: Occasional problems include leaf spots and powdery mildew. Susceptible to chlorosis in high pH (alkaline) soil.

Plant Palette: *Shrubs*

Spicebush

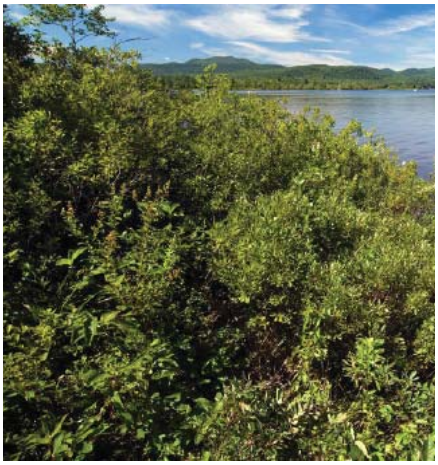
Lindera benzoin



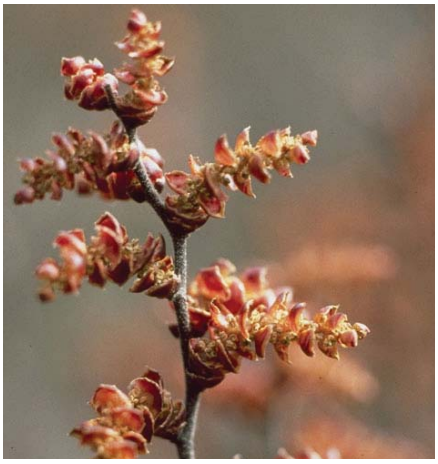
Location: Zones 1, 4, and 9

Pest & Disease Issues: No serious insect or disease problems.

Sweetgale
Myrica gale








Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

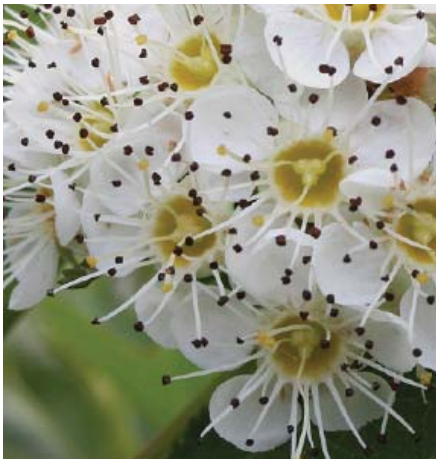
Plant Palette: *Shrubs*

Ninebark

Physocarpus opulifolius





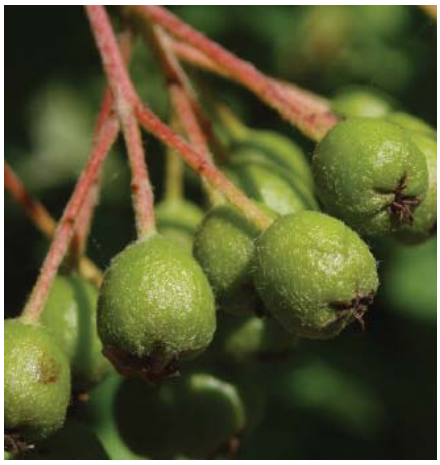
Location: Zones 1 and 2

Pest & Disease Issues: No serious insect or disease problems.

Black Chokeberry

Prunus virginiana



Location: Zones 1, 2, and 9

Pest & Disease Issues: Some susceptibility to leaf spot and blight.

Plant Palette: *Shrubs*

Fragrant Sumac

Rhus aromatica



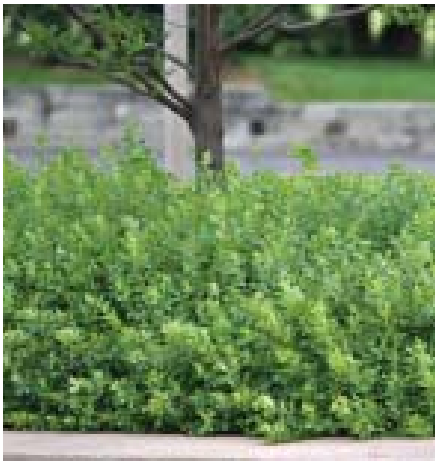



Location: Zone 15

Pest & Disease Issues: Some susceptibility to leaf spot, rust, scale, aphids and mites. Nipple galls on foliage are a somewhat common, but generally cosmetic problem.

Grow Low Fragrant Sumac

Rhus aromatica 'Grow Low'



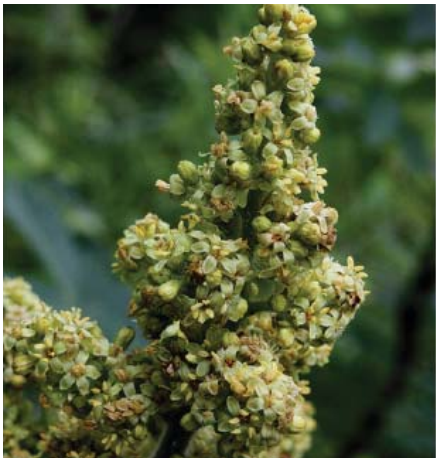
Location: Zone 1

Pest & Disease Issues: Some susceptibility to leaf spot, rust, scale, aphids and mites. Nipple galls on foliage are a somewhat common, but generally cosmetic problem.

Plant Palette: *Shrubs*

Staghorn Sumac

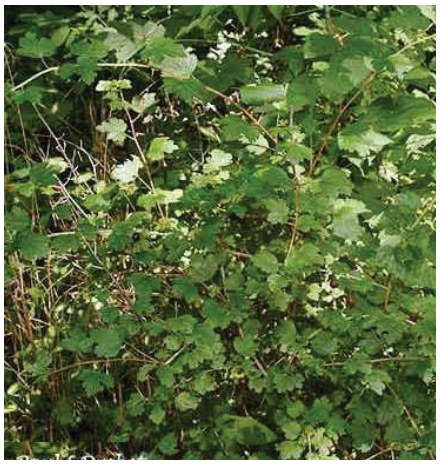
Rhus typhina



Location: Zone 15

Pest & Disease Issues: Some susceptibility to leaf spots, rusts, powdery mildew, blister and cankers. Scale, mites, aphids and caterpillars may appear.

Hairystem Gooseberry
Ribes hirtellum






Location: Zones 1 and 9

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Shrubs*

Pasture Rose

Rosa carolina






Location: Zone 1

Pest & Disease Issues: Roses are susceptible to a large number of diseases, the most common of which are black spot, powdery mildew, rust and rose rosette. Although good cultural practices are the first line of defense in disease control, regular preventative fungicide applications throughout the growing season are generally required in humid climates with regular summer rainfall such as the St. Louis area. This species rose has better natural resistance to the aforementioned diseases than most hybrid roses. Potential insect problems include aphids, beetles, borers, scale, thrips, rose midges, leafhoppers and spider mites.

Swamp Rose
Rosa palustris






Location:
Zone 1

Pest & Disease Issues:
This species rose is generally not susceptible to the disease and insect pests that attack many of the hybrid roses. For roses in general, potential disease problems include black spot, powdery mildew and rust. Potential insect pests include aphids, beetles, borers, scale, thrips, rose midges and leafhoppers. Spider mites may appear.

Plant Palette: *Shrubs*

Purple flowering Raspberry

Rubus odoratus



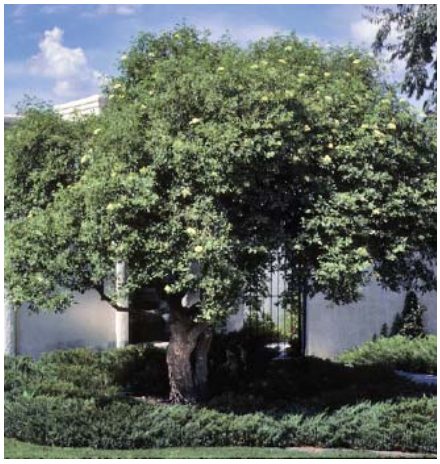



Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Elderberry
Sambucus canadensis



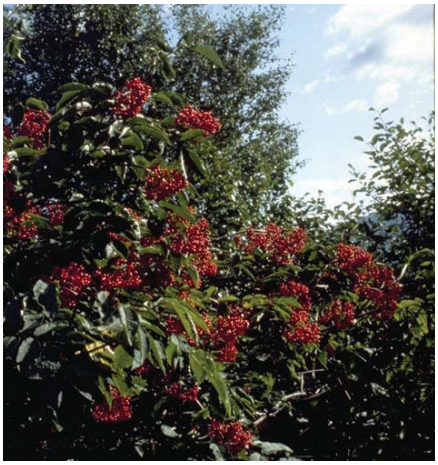
Location: Zones 1, 2, and 4

Pest & Disease Issues: Some susceptibility to canker, powdery mildew, leaf spot, borers, spider mites and aphids.

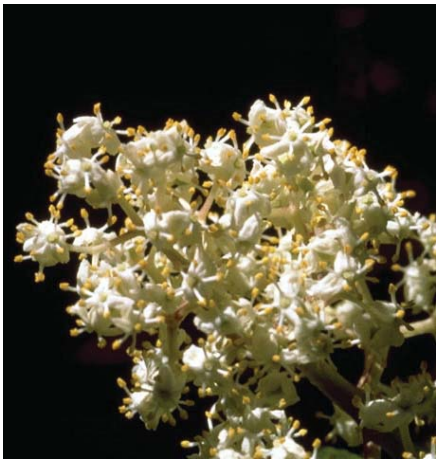
Plant Palette: *Shrubs*

Red Elder

Sambucus racemosa





Location: Zones 1, 2, and 4

Pest & Disease Issues: No serious insect or disease problems.

American Bladdernut
Staphylea trifolia






Location: Zones 1 and 2

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Shrubs*

Common Snowberry

Symphoricarpos albus






Location: Zone 1

Pest & Disease Issues: Anthracnose, leaf spot, powdery mildew, rust and berry rot may occur.

High Bush Blueberry

Vaccinium corymbosum






Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Shrubs*

Arrowwood Virburnum

Viburnum dentatum





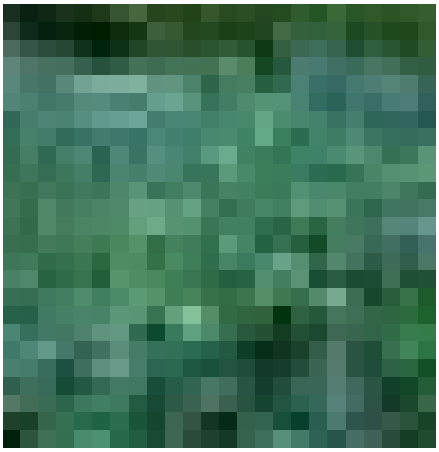

Location: Zone 1

Pest & Disease Issues: Leaves can be damaged or skeletonized by the leaf beetle adults and larvae. The beetle larvae hatch in early May, feed for about 4-5 weeks then pupate in the soil. Adults emerge by mid-July, feed, mate, and females lay over-wintering eggs in a straight line on viburnum twigs. If found, the eggs should be pruned out and destroyed before hatching. Chemical control is best applied to young larvae, which feed on both upper and lower leaf surfaces.

Blue Muffin Viburnum

Viburnum dentatum 'Blue Muffin'






Location: Zones 1 and 9

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette: *Shrubs*

Hobblebush

Viburnum lantanoides






Location: Zones 1 and 4

Pest & Disease Issues: No serious insect or disease problems.

Nannyberry
Viburnum lentago






Location: Zones 1 and 2

Pest & Disease Issues: Larval host for the spring azure butterfly (not a pest). Powdery mildew, which may affect leaves in late summer, decreases aesthetic value but will not kill the plant. Leaves can be damaged or skeletonized by the Viburnum lead beetle adults and larvae, The beetle larvae hatch in early May, feed for about 4-5 weeks then pupate in the soil. Adults emerge by mid-July, feed, mate, and lay overwintering eggs on viburnum twigs. Chemical control is best applied to young larvae. Over-wintering eggs should be pruned out and destroyed before hatching.

Plant Palette: *Shrubs*

Yellowroot

Xanthorhiza simplicissima






Location: Zones 1 and 3

Pest & Disease Issues: No serious insect or disease problems.

Trees

Plant Palette : *Trees*

Red Maple

Acer rubrum

Location: Zone 1

Pest & Disease Issues: Few pests seriously bother red maple, although the Asian long-horned beetle is a dire threat to the species if eradication efforts fail. Leaf hoppers can cause substantial damage.

Silver Maple
Acer sachharinum






Location: Zones 1, 2, and 11

Pest & Disease Issues: Like other maples, silver maple issusceptible to a wide range of insect and disease problems. Gray mold spot is a foliage disease. A host of root and trunk rots attack silver maple. It is susceptible to verticillium wilt, anthracnose and canker, as well as scale and borers. Because of its brittle wood properties, it is highly susceptible to ice damage.

Sugar Maple

Acer saccharum

Location: Zones 1, 3, 10, and 11

Pest & Disease Issues: Some susceptibility to verticillium wilt. Leaf scorch may be a problem in drought conditions.

Serviceberry
Amelanchier laevis






Location: Zones 1, 10, and 11

Pest & Disease Issues: Rust, leaf spot, blight and powdery mildew are sometime disease problems, and sawfly, leaf miner, borers and scale are occasional pests.

Plant Palette : *Trees*

River Birch

Betula nigra

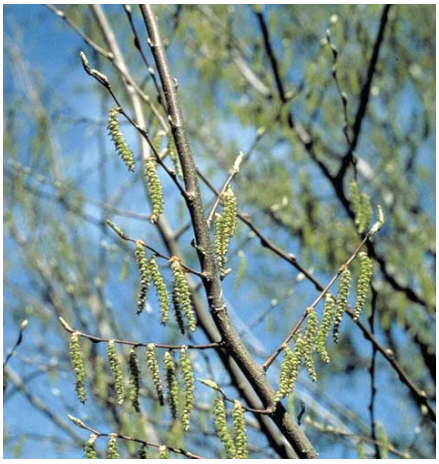
Location: Zones 1 and 6

Pest & Disease Issues: The principal leaf disease of river birch is anthracnose leaf blight caused by Gloeosporium betularum. Christmas mistletoe (Phoradendron serotinum) is a common pest in the South. Weakened birches become vulnerable to the bronze birch borer which typically infects and kills birches stressed by summer heat and humidity. They are extremely resistant to birch borer. Although river birches have some susceptibility to aphids, leaf miner and iron chlorosis in high pH soil, these problems are somewhat minor in comparison to the birch borer.

American Hornbeam
Carpinus caroliniana





Location: Zone 1

Pest & Disease Issues: Leaf spots, cankers and twig blight are occasional disease problems.

Plant Palette : *Trees*

Shagbark Hickory

Carya ovata






Location: Zone 1

Pest & Disease Issues: Hickory bark beetle, pecan weevil and twig girdler can be problems in some areas of its range. Anthracnose and leaf spot are occasional diseases.

Common Hackberry

Celtis occidentalis

Location: Zones 1, 3, 10, and 11

Pest & Disease Issues: Hackberry nipple gall is so common that it is often used as an aid in identifying the tree. Although the galls do not hurt the tree, they often significantly disfigure the leaves. Witches' broom (dwarfed, dense, contorted twig clusters at the branch ends) is also somewhat common. It also does little harm to the tree, but can be quite unsightly. Powdery mildew, leaf spot and root rot may occur. Watch for lacebugs and scale.

Plant Palette : *Trees*

Eastern Redbud

Cercis canadensis



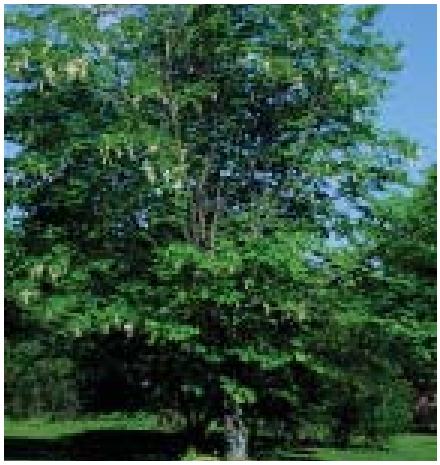



Location: Zones 1 and 10

Pest & Disease Issues: Redbuds are subject to damage by insect pests such as tree hoppers, caterpillars, scale, and leafhoppers. Diseases include Verticillium wilt, leaf spots, and the worst disease, canker. Keeping the tree vigorous by regular watering and fertilization and by pruning out dead branches will help keep the tree healthy.

Yellowwood

Cladrastis kentukea






Location: Zone 11

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Trees*

Gray Dogwood

Cornus racemosa






Location: Zone 16

Pest & Disease Issues: The dogwood bud gall occurs on this species but is usually not a significant problem.

Gray Dogwood
Cornus stolonifera






Location: Zone 16

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Trees*

American Beech

Fagus grandifolia






Location: Zone 1

Pest & Disease Issues: Beech scale is an occasional problem.

Thornless Honeylocust

Gleditsia tricanthos var. inermis





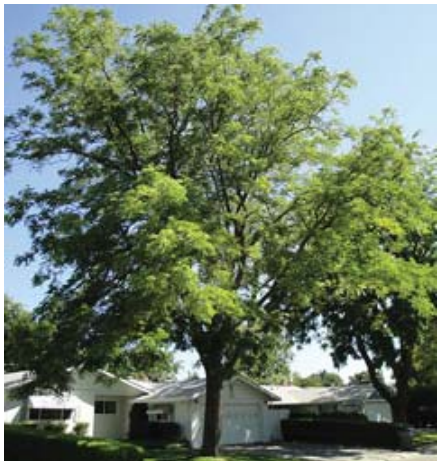

Location: Zone 5

Pest & Disease Issues: Honey locust is susceptible to a large number of potential disease problems, including leaf spot, canker, witches' broom, powdery mildew and rust. Borers and webworms are common insect problems in some areas. Bagworms, plant bug, leafhopper and leaf miner may appear. Watch for spider mites.

Plant Palette : *Trees*

Kentucky Coffeetree

Gymnocladus dioicus



Location: Zone 15

Pest & Disease Issues: No serious insect or disease problems.

Eastern Red cedar

Juniperus virginiana






Location: Zones 1 and 2

Pest & Disease Issues: It is the alternate host for the cedar-apple rust disease which does very little harm to this species. Susceptible to twig blight. Watch for bagworms.

Tamarack

Larix laricina






Location: Zone 1

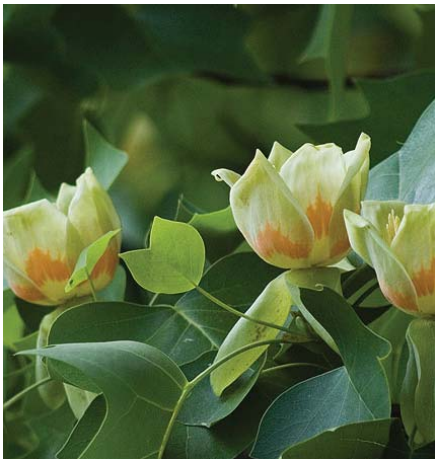
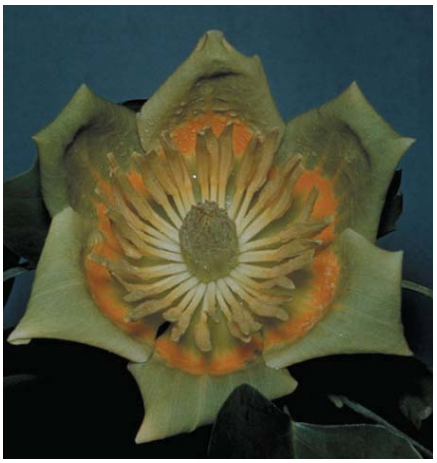
Pest & Disease Issues: Potential insect pests include larch case-bearer, larch sawfly, larch looper, tussock moth, Japanese beetle and woolly aphids. Potential disease problems include needle cast, needle rust and canker.

Tulip Poplar

Liriodendron tulipifera





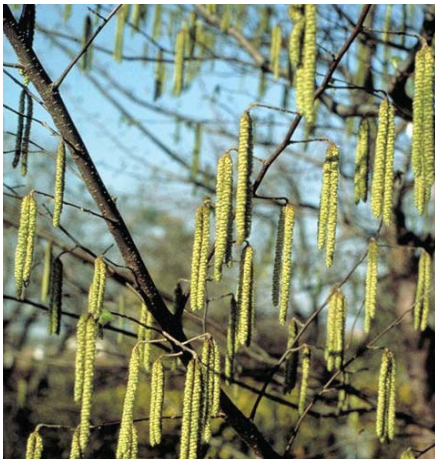
Location: Zones 1, 10, and 11

Pest & Disease Issues: Watch for aphids and scale. Potential diseases include verticillium wilt, mold, mildew and canker. Large aphid infestations result in honeydew secretions on the leaves that provide the growing medium for sooty mold.

Plant Palette : *Trees*

American Hophornbeam

Ostrya virginiana



Location: Zones 1 and 3

Pest & Disease Issues: Although not bothered by any significant insect pests, Leafcutter bees seem to prefer the tender leaves of this tree over Ash, Oak, Walnut or Apple. Leafcutter bee damage is distinctive and is visible as a semi-circular cut about 2 cm in diameter from the side of the leaf. This injury often is only a minor curiosity. However, where leafcutter bees are abundant and concentrate on cultivated plantings, the removal of leaf tissues can be damaging. Serious damage most often occurs in isolated rural plantings. Insecticides are ineffective for preventing leaf cutting. The only known control of leaf injuries is to cover susceptible plants with cheesecloth or other loose netting during periods when leafcutter bees are most active.

White Pine

Pinus strobus






Location: Zones 1, 2, and 11

Pest & Disease Issues: Some susceptibility to white pine blister rust which is a bark disease that is usually fatal. Also some susceptibility to white pine weevil which is an insect pest that attacks terminal shoots thus damaging the shape of the tree. Cone crops may be destroyed by the pine cone beetle. This insect compounds the problem of infrequent seed years and is a serious threat to white pine management. Diseases, including white pine blister rust, red ring rot, root rot, wood decay, and certain needle fungi, cause losses in white pine stands. Such natural elements as snow, ice, and wind may also cause damage to white pine.

Sycamore

Platanus occidentalis






Location: Zones 1, 2, 3, 10, and 11

Pest & Disease Issues: Sycamore anthracnose is a significant disease that can severely damage the foliage and twigs, often precipitating premature leaf drop. Canker, leaf spot and powdery mildew may also occur. Insect visitors include borers, scale, Japanese beetles, caterpillars and mites.

Eastern Cottonwood

Populus deltoides





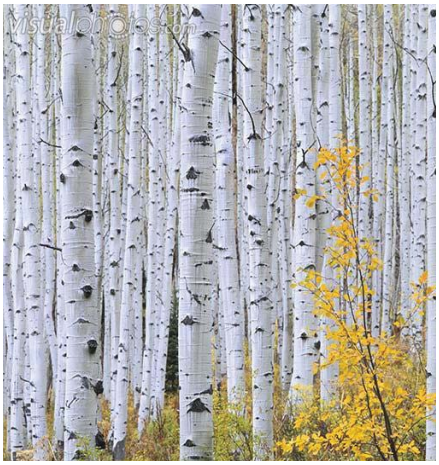

Location: Zone 2

Pest & Disease Issues: Eastern cottonwood can be seriously damaged bywood boring insects that attacks the main stem, branches and root system. Many leaf feeding insects can also reduce the growth and vigor of young trees. Susceptible to a wide range of diseases including dieback, cankers, leaf spots, rusts and powdery mildew. Insect visitors include borers, aphids, caterpillars and scale.

Plant Palette : *Trees*

Quaking Aspen

Populus tremuloides



Location: Zone 4

Pest & Disease Issues: Aspens are susceptible to a large number of disease problems, including dieback, leaf spots, rusts, powdery mildew and cankers. Diseased trees often suffer premature leaf drop as a result thereof. Common insect visitors include caterpillars, borers, aphids and scale.

Bur Oak
Quercus macrocarpa






Location: Zones 1, 2, 3, and 11

Pest & Disease Issues: Oaks are susceptible to a large number of diseases, including oak wilt, chestnut blight, shoestring root rot, anthracnose, oak leaf blister, cankers, leaf spots and powdery mildew. Potential insect pests include scale, oak skeletonizer, leaf miner, galls, oak lace bugs, borers, caterpillars and nut weevils.

Plant Palette : *Trees*

Chinkapin Oak

Quercus muehlenbergii

Location: Zone 11

Pest & Disease Issues: Oaks are susceptible to a large number of diseases, including oak wilt, chestnut blight, shoestring root rot, anthracnose, oak leaf blister, cankers, leaf spots and powdery mildew. Potential insect pests include scale, oak skeletonizer, leaf miner, galls, oak lace bugs, borers, caterpillars and nut weevils.

Red Oak

Quercus rubra





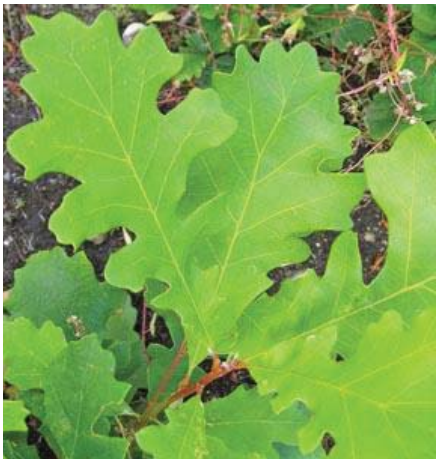

Location: Zones 1, 10, and 11

Pest & Disease Issues: Generally a durable and long-lived tree. Susceptible to oak wilt which is a systemic fungal disease that has no cure. Chlorosis (yellowing of the leaves while the veins remain green) often occurs when soil is not sufficiently acidic.

Plant Palette : *Trees*

Crimson Spire Oak

Quercus robur x. Q. alba



Location: Zone 15

Pest & Disease Issues: No serious insect or disease problems.

Black Oak

Quercus velutina

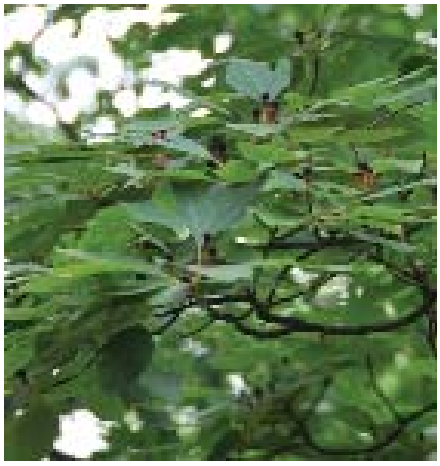
Location: Zones 1 and 2

Pest & Disease Issues: Black oak is infrequently attacked by the common diseases of oaks which include oak wilt, chestnut blight, shoestring root rot, anthracnose, oak leaf blister, cankers, leaf spots and powdery mildew. Potential insect pests include scale, oak skeletonizer, leaf miner, galls, oak lace bugs, borers, caterpillars and nut weevils.

Sassafras

Sassafras albidum



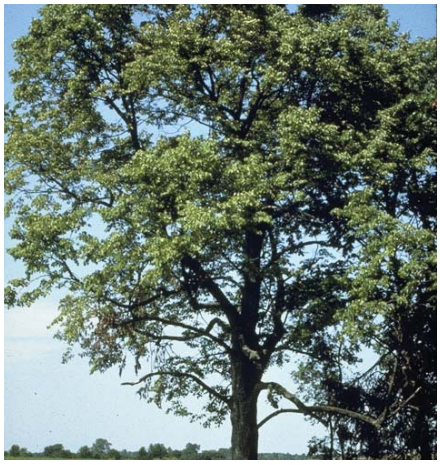



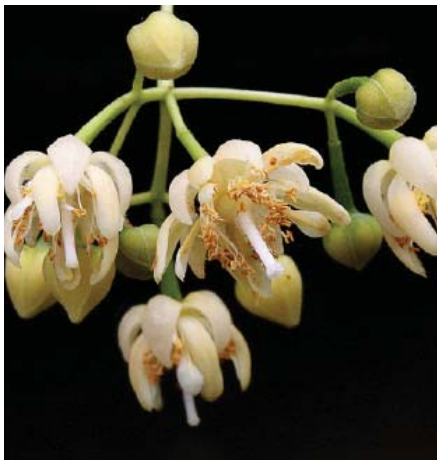
Location: Zone 1

Pest & Disease Issues: No serious insect or disease problems. Leaves may turn yellow while veins remain green (chlorosis) in alkaline soil.

Redmond Basswood

Tilia americana 'Redmond'





Location: Zones 1 and 2

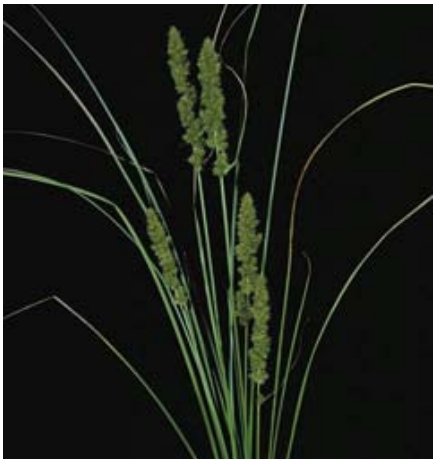
Pest & Disease Issues: Verticillium wilt is infrequent, but can be fatal. Powdery mildew, leaf spots and cankers may occur. Insect visitors include aphids, borers, beetles, lacebugs, caterpillars and scale. Spider mites can do significant damage, particularly in hot, dry periods.

Aquatic Plants

Fox Sedge

Carex vulpinoidea



Location: Zones 9 and 13-D

Pest & Disease Issues: No serious insect or disease problems.

Yellow Marsh Marigold

Caltha palustris





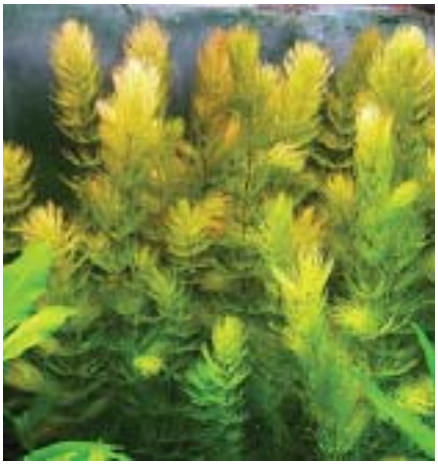

Location: Zone 9

Pest & Disease Issues: Susceptible to powdery mildew and rust.

Plant Palette : *Aquatic Plants*

Coon's Tail

Ceratophyllum demersum






Location: Zone 8

Pest & Disease Issues: No serious insect or disease problems.

Tussock Sedge
Carex stricta






Location: Zone 7

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Aquatic Plants*

Northern Blueflag

Iris versicolor






Location: Zone 7

Pest & Disease Issues: Susceptible to a number of insect pests including aphids, iris borer and iris thrips. Also susceptible to a number of diseases including various rots and viruses.

Soft Rush
Juncus effusus






Location: Zones 7 and 14

Pest & Disease Issues: Rust, leaf spot and stem rots may occur.

Plant Palette : *Aquatic Plants*

White Waterlily

Nymphaea odorata






Location: Zone 8

Pest & Disease Issues: No serious insect or disease problems.

Water Plantain

Plantago cordata






Location: Zone 7

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Aquatic Plants*

Pickerel Weed

Pontederia cordata



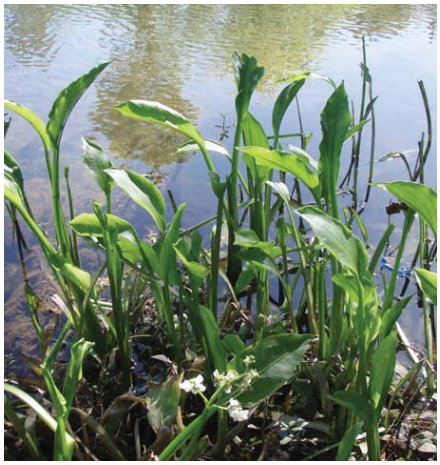



Location: Zone 7

Pest & Disease Issues: No serious insect or disease problems. Watch for spider mites.

Broadleaf Arrowhead

Sagittaria latifolia






Location: Zone 7

Pest & Disease Issues:
No serious insect or disease problems. Watch for spider mites and aphids.

Hardstem Bulrush

Schoenoplectus acutus






Location: Zone 7

Pest & Disease Issues: No serious insect or disease problems.

Softstem Bulrush

Schoenoplectus tabernaemontani






Location: Zone 7

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Aquatic Plants*

Sago Pondweed

Stuckenia pectinata






Location: Zone 8

Pest & Disease Issues: Although not conclusive, there are bacteria and fungi that may cause diseases in sago pondweed and could be responsible for a decline in sago populations or deformities of the plants.

Prairie

Plant Palette : *Prairie*

Autumn Bentgrass

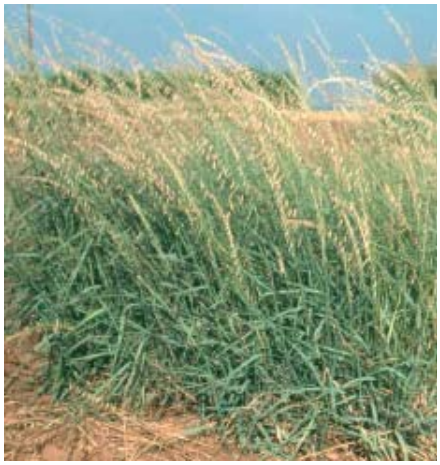
Agrostis perennans

Location: Zone 13 - A, B, C, and D

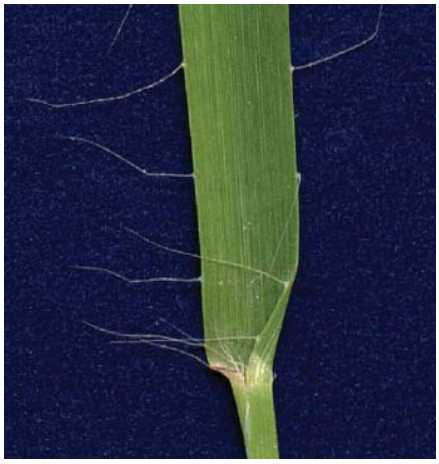
Pest & Disease Issues: No serious insect or disease problems.

Side-Oats Grama

Bouteloua curtipendula








Location: Zone 13 - A and B

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Prairie*

Blue Grama

Bouteloua gracilis






Location: Zone 13 - A

Pest & Disease Issues: No serious insect or disease problems.

Canada Bluejoint

Calamagrostis canadensis






Location: Zone 14

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Prairie*

Bebb's Sedge

Carex bebbii






Location: Zone 14

Pest & Disease Issues: No serious insect or disease problems.

Hop Sedge
Carex lupulina






Location: Zone 14

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Prairie*

Bottlebrush Grass

Elymus hystrix






Location: Zone 13 - C

Pest & Disease Issues: No serious insect or disease problems.

Riverbank Wild Rye

Elymus riparius






Location: Zone 14

Pest & Disease Issues: No serious insect or disease problems.

Plant Palette : *Prairie*

Slender Wheatgrass

Elymus trachycaulus

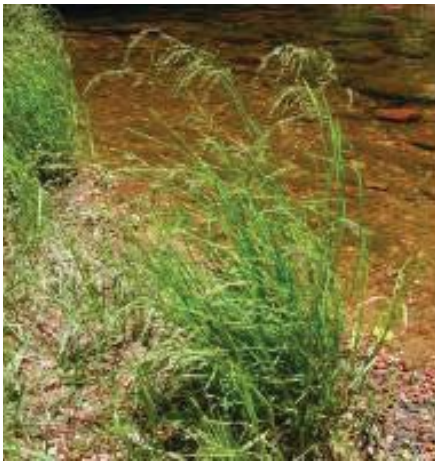


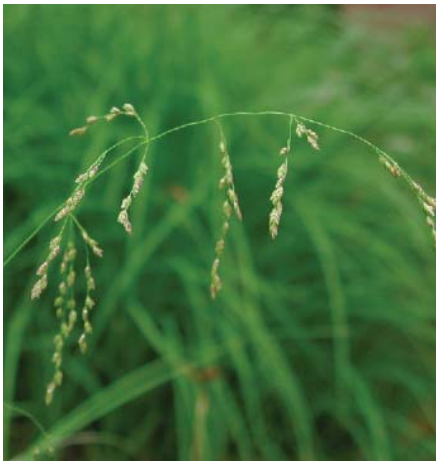



Location: Zone 13 - A and B

Pest & Disease Issues: No serious insect or disease problems.

Fowl Mannagrass
Glyceria striata






Location: Zone 14

Pest & Disease Issues: Susceptible to fungal pathogens such as Epichloe glyceriae, which causes floral castration, and Ustilago striiformis, better known as stripe smut. Fungicides may be needed for control.

Plant Palette : *Prairie*

Canada Rush

Juncus canadensis






Location: Zone 14

Pest & Disease Issues: No serious insect or disease problems.

Fowl Blue Grass

Poa palustris






Location: Zone 13 - A and B

Pest & Disease Issues: No serious insect or disease problems.

Lawn

Plant Palette : *Lawn*

Seeded Lawn

Sun Lawn Mix

45% Bluegrass (98/95), 25% Creeping Red Fescue, 5% Perennial Ryegrass, 15% Kentucky Bluegrass (Park or Merit), and 10% Boreal or Perennial Red Fescue.

Shade Lawn Mix

20% Kentucky Bluegrass (Nu Glade), 30% Creeping Red Fescue, 10% Chewings Fescue, 20% Tri Rye Blend (40% Secretariate Perennial Ryegrass, 30% Affirmed Perennial Ryegrass, 30% Exacta Perennial Ryegrass), and 20% Boreal of Jamestown II Red Fescue.

Location: Zone 12

Pest & Disease Issues: No serious insect or disease problems.

Nutrient Deficiency Symptoms of Trees

Boron
Bud die-back, distortion of meristemiatic tissue and ultimate death of the tree.

Copper
In coniferous trees: weak, drooping, wavy, pendulous shoots, corked stems, recurved branches, terminal bud death, needle drop. In deciduous trees: dark or blue-green foliage distorted by cupping or stunting. Narcosis or irregularity of leaf margins and inter-veinal chlorosis. Rosette effect at terminal buds. On poplars, large, dark brown spots.

Iron
Chlorosis of leaves and needles especially in wet or cold years. Young leaves and needles most affected. There are four general approaches to treat iron deficiency: lowering the soil's pH, soil iron treatments, foliar sprays, and tree injections. Each procedure gives variable results depending on plant species and soil conditions.

Manganese
In coniferous trees: Same symptoms as iron deficiencies. In broad-leaved trees: Marginal leaf chlorosis with bands of green along the main veins. Necrotic spots may develop in the chlorotic areas.

Magnesium
In coniferous trees: Golden or yellow tip "halo" effects in late summer to early autumn. Subsequent years extend further back on needle and tip narcosis can occur. Magnesium deficiency can be confused with potassium deficiency. In deciduous trees: irregular yellow spots between the leaf veins. In severe conditions leaves yellow and fall prematurely. Symptoms disappear slowly after magnesium amendment is added to the soil (if leaves do not fall).

Nitrogen
Small needles or leaves, general yellowish-green colour, thin crowns, poor growth, reduced chlorophyll content.

Phosphorus
In coniferous trees: gray or bluish-green needles turning to purple, brownish purple, or red. In deciduous trees: dark green or reddish, less dense foliage, poor growth.

Potassium
In coniferous trees: small needles, turning yellow-green to yellow, brown when severe deficiency. In deciduous trees: Dark-bronze leaf with bright yellow margins and necrotic spots. Leaves shrivel and die.

Sulfur
Symptoms similar to nitrogen deficiency. Soil and plant tissue tests will reveal which deficiency is present.

Zinc
In coniferous trees: General yellowing and loss of older needles. In deciduous trees: Chlorosis of younger leaves particularly in the upper crown or sunny side of the tree. Rosette effect occurs as well as extreme shortening of branches, needles, and needle spacing.

Appendix C
Invasive Plants

This Appendix catalogues the site's possible invasive species and weeds based on:

- Invasive species that City of Toronto Parks, Forestry and Recreation (PFR) has identified as common to this area.
- Southern Ontario Invasive Species list, Categories 1* and 2**.
- Weed species that are commonly found within the designed plant areas and have been observed on the site.

Each invasive plant and weed has preferred habitats and specific morphologies. Knowing this can help with identification and narrow the range of invasive plants by limiting their preferred conditions.

The following pages outline each invasive plant, their identifying characteristics, ecological threats, and suggested methods for organic management.

* Category 1 species exclude all other species and dominate sites indefinitely. They are the top priority for control but control may be difficult. Plants in this category are a threat to natural areas wherever they occur because they tend to disperse widely (for example, through transport by birds or water).

** Category 2 species are highly invasive but tend to dominate only certain niches or do not spread rapidly from major concentrations. Many spread by vegetative means or seeds that drop close to the parent plant. Most persist in dense populations for long periods. Control where necessary and limit their spread into other areas.

General Management Practices

Prevention

Instead of eradicating undesirable plants, the best defense for controlling weeds is to establish cultural practices and conditions that support desirable plants. Healthy, balanced soil is one of the most critical parts of this approach. Many invasive plants and weeds prefer highly bacterial soil with low organic matter content, whereas most desirable plants prefer soil with a higher organic content and a higher fungal to bacteria ratio. Keeping microbial populations in check is one of the most effective ways to control weeds. Biological testing will help identify weak components of the soil food web.

Despite best efforts, not every plant that was installed in the original design will thrive in the park. If plants become weak or display poor performance, then it is sensible to replace them with more compatible native plants. Consult with the park's designers, Michael Van Valkenburgh Associates, on possible substitutions if this occurs.

Disturbance of established desirable plants can be avoided by discouraging park users and pets from entering plant beds, the marsh, and the prairie. This can be done using signage or fencing. Although a "range fence" was installed around the most sensitive areas in the park, staff should continue to educate the public about minimizing plant disturbance. Wildlife such as geese should be deterred from nesting in and feeding on vegetation.

Weeds are opportunistic, so if areas become disturbed or bare where plants have been removed, immediately reestablish desired plants in these areas.

Pull weeds as they appear. Proactively managing invasive plants prevents the need for extensive removal that produces bare patches. Thoroughly clean maintenance equipment after each use to prevent the spread of invasive seeds and roots.

Monitoring

Establish an appropriate monitoring schedule based on the life cycle of invasives and weeds found on the site, such as time of emergence, growth pattern, and seed set (annual seed is abundant). Also identify ideal periods for successful removal.

Methodically map areas where invasives and weeds have occurred to help in future monitoring and upkeep. Establish baseline conditions to track where invasive plants appear and areas to focus monitoring efforts.

Physical Control

Hand pulling or digging of invasive plants is always the first choice for management. It is done best in early spring or summer when soil is moist and roots are less developed. However, hand-pulling and digging can lead to soil and site disturbance, so soil coverage after removal is vital to limit the chances of reintroduction of invasive plants and weeds. Care must be taken to replant these areas immediately with desired plants.

Use the right tools. Shovels can cut and spread plant parts. It is best to use a weed wrench or pitch fork to limit leftover plant tissue to the disturbed area.

Remove the entire plant to prevent a second infestation: which means all seeds, all above ground planting structures and all below ground rooting structures if possible.

Cutting or mowing is a quick method of removal, but it requires more effort in the long run and it can also damage non-targeted species. To be effective, the process must be monitored and repeated several times throughout several growing seasons. It is not the preferred method if total eradication of a species is the desired result. Cutting or mowing can slow down the plant's growth process by preventing self- sowing via seed. Study each plant that you are trying to manage. Some plants will form denser mats when mowed or cut down.

Cover plants. Suffocation through denial of water and sunlight will result in starvation and death of invasive plants. This is effective in areas where hand-weeding/digging or cutting/mowing is not possible. Once the cover is taken off, remove the dead plants thoroughly and replant with desired species to prevent infestation. For limited infestations use a 7 cm layer of mulch. For extreme infestations use a UV-blanket, black cloth or plastic sheets (fastened or weighed down). Some plants die fast, but others need to be covered for one to two growing seasons.

For aquatic species, habitat manipulation is an effective means of controlling weeds. Techniques such as controlled flooding, reduced water levels, and dredging can be used to deprive the plant of its vital needs. Water levels in the Upper Marsh are allowed to fluctuate within a range of 2-10 cm deep, averaging 5 cm in the warmer months. Temporarily lowering water levels are quite effective for controlling algae as long as it's combined with the removal of these plants.

Biological Control

Biological control uses living organisms to manage pests and diseases, including parasites, predation, competition, and anti-microbial production. Bio-control organisms include fungi, bacteria, nematodes, and insects. Most are natural inhabitants of the soil and the environment and are not pathogenic to birds, mammals (including humans), and fish. They are not genetically modified and generally have short lifespans. Often several mechanisms function together to make an organism effective. Related products of living organisms or dried spore preparations must be handled differently than conventional fungicides. They are sensitive to temperature extremes and must be applied immediately after mixing with water. They may also require special attention to pH levels, exposure to chlorine or UV light, and their shelf life may be limited.

The science of biological control is a young discipline and new approaches are being studied every year. Right now, agricultural crops are the area of greatest study. The most important aspect of this approach is to match the pest or disease to a known biological control. Beware of quick fixes; until more is known, disease and pest control is likely an integrated approach to achieve the best results.

Herbicides and Pesticides

Chemical applications are the last resort for controlling invasive plants, but sometimes they are necessary, such as when plants have been resistant to all other management practices or if the survival of an ecological system is severely threatened. Apply to specific invasive or weed species that PFR has received MOE approval to use pesticides and herbicides for. Spot treatment of plants is the safest and most effective way to apply chemical applications. Use of poisons and herbicides should follow all Provincial and Federal regulations.

Alternative Approaches

Boiling water will kill any plant it touches. It is especially effective for controlling annual weeds, but with repeated application, boiling water can also greatly weaken perennial weeds and ease hand removal. Cut off plant foliage to concentrate water on the root zone. It is not practical for widespread weed control but it is valuable for controlling weeds in paved areas.

Prescribed burning is currently not an approved process for this site, but if policy changes, this is the ideal way to manage invasive plants in the prairie. Prescribed burning is a simulation of the natural progression and succession of many plant communities and forest types. It require permits and is to be done by professionals under appropriate weather conditions. Controlled burns will affect soil biology; non-target species, and some target species will form denser thickets – so thorough research is always needed when applying this method to specific plants.

Invasive Plant List

PFR List of Probable Invasive Plants for the Corktown Common Site					
Botanical Name	**Common Name**	**Overall Site**	**Marsh**	**Lowland Prairie**	**Upland Prairie**
Cirsium arvense	Canada Thistle			x	x
Arctium minus	Common Burdock			x	x
Cynanchum rossicum	Dog Strangling Vine	x		x	
Phragmites australis	Common Reed		x		
Lythrum salicaria	Purple Loosestrife	x	x	x	
Melilotus alba	White Sweet Clover			x	x
Verbascum thapsus	Common Mullein			x	x
Bromus inermis	Smooth Brome			x	x
Acer negundo	Manitoba Maple	x		x	x
Ailanthis altissima	Tree of Heaven	x		x	x
Ulmus pumila	Siberian Elm	x		x	x

Invasive Species Ranking for Southern Ontario					
Category 1:					
Botanical Name	**Common Name**	**Overall Site**	**Marsh**	**Lowland Prairie**	**Upland Prairie**
Aegopodium podafraria	Goutweed			x	x
Alliaria petiolata	Garlic Mustard	x		x	x
Alnus glutinosa	Black Alder	x	x	x	x
Betula pendula	European Birch	x		x	x
Butomus umbellatus	Flowering Rush		x		
Coronilla varia	Crown Vetch			x	x
Elaeagnus umbellata	Autumn Olive	x		x	x
Glyceria maxima	Rough Manna Grass		x		
Hesperis matronalis	Dames Rocket	x		x	x
Hydricharis morsus-ranae	European Frog-bit		x		
Impatiens glandulifera	Himalayan Balsam			x	x
Lonicera japonica	Japanese Honeysuckle			x	x
Lonicera maackii	Amur Honeysuckle			x	x
Lonicera morrowi	Morrow's Honeysuckle			x	x
Lonicera tatarica	Tartarian Honeysuckle			x	x
Lonicera xylosteum	Eur. Fly Honeysuckle			x	x
Morus alba	White Mulberry	x		x	x
Myriophyllum spicatum	Eurasian Water Milfoil		x		
Nymphoides peltatum	Floating Heart		x		
Potamogeton crispus	Curly Pondweed		x		
Rhammus cathartica	Glossy Buckthorn	x		x	x
Rosa multiflora	Multiflora Rose	x		x	x

Invasive Species Ranking for Southern Ontario					
Category 2:					
Botanical Name	**Common Name**	**Overall Site**	**Marsh**	**Lowland Prairie**	**Upland Prairie**
Acer platanoides	Norway Maple			x	x
Acer pseudoplatanus	Sycamore Maple	x	x	x	x
Celastrus orbiculatus	Oriental Bittersweet			x	x
Galium mollugo	White Bedstraw			x	x
Lotus corniculatus	Bird-foot Trefoil			x	x
Lysimachia nummularia	Moneywort		x		
Melilotus officinalis	Yellow Sweet-clover			x	x
Pinus sylvestris	Scots Pine			x	
Poa pratensis	Kentucky Bluegrass			x	x
Polygonum cuspidatum	Japanese Knotweed			x	x
Populus alba	White Poplar	x		x	x
Robinia pseudoacacia	Black Locust			x	x
Scilla siberica	Scilla			x	x
Sedum acre	Mossy Stonecrop			x	x
Syrina vulgaris	Lilac			x	x
Vinca minor	Periwinkle	x			

Common Broadleaf Weeds:

From A Field Guide to Broadleaf Weeds[1]

Botanical Name	Common Name	Overall Site	Marsh	Lowland Prairie	Upland Prairie
Abutilon theophrasti	Velvetleaf			x	x
Amaranthus powelli	Green Pigweed	x		x	x
Amaranthus retroflexus	Redroot Pigweed	x	x	x	x
Amaranthus rudis	Waterhemp	x	x	x	x
Ambrosia artmisiifolia	Common Ragweed			x	x
Amrbosia trifida	Giant Ragweed			x	x
Atriplex patula	Spreading Atriplex			x	x
Chenopodium album	Lamb's Quarters			x	x
Conyza canadensis	Canade Fleabane			x	x
Daucus carota	Wild Carrot	x		x	x
Equisetum arvense	Field Horsetail	x	x	x	x
Hibiscus trionum	Flower of an Hour			x	x
Malva neglecta	Common Mallow	x		x	x
Medicago lupulina	Black Medick	x		x	
Polgonum convolvulus	Wild Buckwheat	x		x	x
Polygonum aviculare	Prostrate Knotweed	x		x	x
Silene alba	White Cockle			x	x
Solanum ptychanthum	Eastern Black Nightshade			x	x
Solanum sarachoides	Hairy Nightshade			x	x
Viccia cracca	Tufted Vetch			x	x
Viola arvensis	Field Violet			x	x

[1] by Ontario's Ministry of Agriculture, Food and Rural Affairs

Additional Invasive Species

Observed on site

Botanical Name	Common Name	Overall Site	Marsh	Lowland Prairie	Upland Prairie
Xanthium pennsylvanicum	Common Cocklebur	x			
Chenopodium album	Common Lambsquarters	x			
Portulaca oleracea	Common Purslane	x			
Digitaria sp.	Crabgrass	x			
Taraxacum officinale	Dandelion	x			
Solidago canadensis	Goldenrod			x	x
Lactuca serriola	Prickly Lettuce	x			
Amaranthus retroflexus	Redroot Pigweed	x			
Iris pseudacorus	Yellow Flag Iris		x		

Canada Thistle

Cirsium arvense






Identifying characteristics: This perennial thistle grows 0.5-1.5 m tall and is distinguished from other thistles by extensive horizontal roots and the dense growth of clones from those roots; also by having male and female flower heads on separate plants. The flower heads are small and lavender to rose-purple in colour, sometimes white. Flowering is triggered by day length, but plants in more northern latitudes bloom for longer periods of time. The leaves vary in appearance and size but are generally irregularly lobed with many spines along the edges and are arranged alternately along the stem. They can be 5 - 15 cm in length. The stem is often slightly hairy and ridged.

What it does in the ecosystem: Canada thistle competes with and displaces native vegetation, lowering plant and animal species diversity and changing species composition. Because of its economic threat to farmers and ranchers, most locations consider it a noxious weed. It reduces crop yields and pasture productivity and interferes with harvest as well as being a host for several crop-damaging insects. The flowers provide abundant nectar for insects.

Management: Canada thistle is best managed by a method that includes early fall mowing. Early fall is the preferred time to mow because most native plants will be ending their growing cycle while Canada thistles are still photosynthesizing. Other methods include annual cutting of the flower stems and buds before the plants bloom. This method will stop the dispersal of seeds, and over time, mixed with mowing and herbicide, can eradicate thistle. Additionally there is a mite (Orellia ruficudada) that feeds on thistle. This is the most efficient biological method used for thistle management. Puccinia obtengens is a rust species that used along-side other management practices can reduce thistle populations.

Common Burdock

Arctium minus






Identifying characteristics: Common burdock often looks like rhubarb with broad, heart-shaped dark green leaves up to 0.3 m and 22 cm wide. Leaves are usually woolly with whitish undersides. These leaves die back the first winter. In its second year as it forms 2 cm diameter flower heads, burdock grows 1 m tall. The tubular flowers are typical of thistles. They are tightly bunched, usually pink to violet, but enclosed in tough bracts that close over the flower head as seeds form, becoming the familiar burs. Seeds are dark grey to brown and about one cm long. Burdock is biennial, but in poor conditions a plant may live 4 years before flowering and dying.

What it does in the ecosystem: Burdock aggressively colonizes disturbed soil and newly cleared lands, sometimes forming dense colonies. Burdock is self-fertilizing. Per plant, the flower heads produce over 10,000 seeds that are enclosed in the brown bracts with Velcro-like hooks. The broad long leaves of the first year grow close to the ground and shade out almost all other plants, preparing the soil for more burdock seed. The flowers attract numerous butterflies as well as birds.

Management: Burdock is a large leafed plant that can be managed by removal of the seeds. Burdock is only spread by seed. If an annual cutting program is established before bloom, the population of mature plants can be controlled. Burdock has a large taproot, so the most effective management programs include cutting schedules.

Common Mullein

Verbascum thapsus






Identifying characteristics: Common mullein has soft green, furry leaves and 1-2 m high flower stalks. It usually lives for 2 years, and the first-year rosette has soft, downy, grey-green leaves 10 - 30 cm long and 2-12 cm wide; these leaves lie close to the ground. In the second year, if the rosette reached a diameter of at least 5 cm, a fuzzy 2-3 m flowering stalk grows, with leaves alternating along the stem getting smaller the closer they are to the flower spike. In the summer, five-petal yellow flowers, about 1 in diameter, open only a few at a time in spirals from the bottom to the top of the dense flower stalk, making for a long display. If a flower is not pollinated by a bee by the end of a day, it will self-pollinate. Dry capsules contain numerous small brown seeds, most of which fall within a metre of the parent plant.

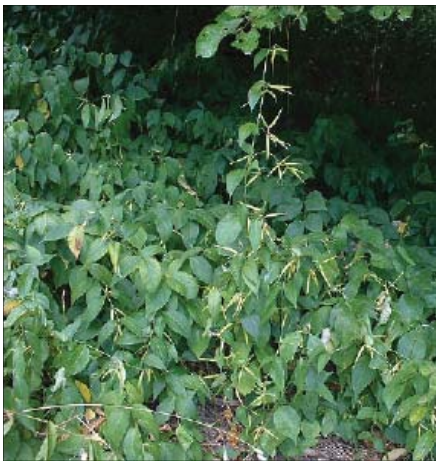
What it does in the ecosystem: Mullein is a weak competitor in most natural areas, but its seeds can remain viable for a century or more. Thus, disturbing a mullein-free area might activate very old seed. Because other plants easily displace mullein, it depends on the longevity of its seeds for survival of the species. In disturbed soil mullein can dominate until other plants are established.

Management: Common mullein is mostly a threat in bare, under-vegetated areas. If plants are already established, then mullein is not a threat. It often moves into areas after fires or other disturbances. The best management practices include weeding, cutting and root-removal, that is then followed by seeding or planting of desired plant species.

Dog Strangling Vine

Cynanchum rossicum






Identifying characteristics: Dog-strangling vine grows 1-2 m high by twining onto plants, trees, or other structures. Leaves are oval with a pointed tip, 5-10 cm long, and grow on opposite sides of the stalk. Their pink/dark purple star-shaped flowers consist of five petals. The plant produces bean-shaped seedpods from 2-5 cm long that open to release feathery white seeds in late summer.

What it does in the ecosystem: Dog-strangling vine forms dense stands that overwhelm and crowd out native plants and young trees, preventing forest regeneration. Colonies form mats of interwoven vines that are difficult to walk through and interfere with forest management and recreational activities. Leaves and roots may be toxic to livestock. Deer and other browsing animals also avoid dog-strangling vine, which can increase grazing pressure on more palatable native plants.

Management: Best management practices include early detection and removal via pulling up the vine, all rooting structures, and seedpods. Manual and or mechanical removal of the entire plant, including the root, may work to control the plant if it is done in the first year of its establishment. Cutting can spread the vine, so wash all equipment after contact. Care must be taken to remove the entire root, as the plant will re-sprout from buds on the rootstock. Removal and proper disposal of the seedpods is also crucial.

Manitoba Maple

Acer negundo






Identifying characteristics: Acer negundo goes by several common names including: boxelder, hedge maple, maple ash, elf maple, cut-leaved maple, and manitoba maple. Acer negundo is native to North America but shows signs of aggressive behavior. It has the ability to adapt to several different environments and ranges from zones 2 to 9. It is in the Sapindaceae family, which is closely related to the Aceraceae family. It carries fruits called samara and a single tree can carry thousands of samara each season. Samaras are wing-like seed casings that give Acer negundo an airborne seed dispersal mechanism allowing it to travel long distances. Acer negundo is often a multi-stem tree with a rounded form that can reach 9-15 m. It is often weak branched, and is prone to disease and insect damage. The leaves are a light green compound leaf that can come in three and five leaflets.

What it does in the ecosystem: Acer negundo is on several invasive lists around the country due to its ability to grow in disturbed areas. It prefers moist soil and grows well in riparian zones, wetlands, and disturbed forest edges. In the urban condition it can be found in old hedge rows and vacant lots. Birds and squirrels are known to have a taste for the seeds and they help spread them. Acer negundo is quick to establish and outcompetes native plants on sunny sites.

Management: Best management practices include early detection, monitoring, removal, and collection of seeds (samara) early in the season. Trees are fast growing, and seeds are spread by wind, water, and birds. All vegetative material should be taken off site and burned. The seeds can get caught in the wind and travel long distances and even a single seed can start an infestation.

Phragmites / Common Reed

Phragmites australis






Identifying characteristics: Phragmites is a tall wetland grass with leaves sticking out from the stems similar to those on a corn plant. The plant can reach a height of 6 m. In summer it produces fluffy plumes of flowers held above the stems. The non-native species will have finely ribbed and dull stems with a tan colour in spring and summer.

What it does in the ecosystem: Phragmites invasions begin in wet areas, and stands become so aggressive that they can consume shallow ponds in a few years. They clog waterways and their tall stems and dense growth shade out native aquatic or marsh plants. By invading newly constructed wetlands, Phragmites may actually decrease the extent of wetlands. Stalks often break near midpoint but don't fall to the ground. The result is both denial of light to lower-growing plants and animals and creation of a fire hazard. Stands shelter several species of small animals and are favored by red-winged blackbirds. However, this plant eliminates the favored habitat of other birds.

Management: Phragmites is an aggressive and resilient plant so any method of management used will have to be monitored closely. It can take several years to eradicate the plant. Mowing on a regular basis can be effective. Other methods include root and vegetation smothering with cloth or plastic for several growing seasons. Burning is not recommended and can make the infestation much worse due to a thicker growing mat. Hand pulling is not feasible due to the expansive and tough root and rhizome network. Root removal from the soil is not effective, since small or broken portions of rhizomes left in the soil can create new plants.

Purple Loosestrife

Lythrum salicaria






Identifying characteristics: Perennial loosestrife is abundant in damp and marshy areas where a single rootstock sends up 30 to 50 erect stems that form a plant mass up to 2.5 m high and 1.5 m wide. Flowers with 5 to 7 petals form in the summer, are deep pink to purplish (occasionally pink or white), and are arranged on long spikes. The plants continue to flower into the fall. Leaves are narrow with smooth edges and found in opposite arrangement or in whorls along an angular stem. When leaves dry in autumn, they turn bright red. No other wetland plant forms uniform stands with this colour of flower.

What it does in the ecosystem: Loosestrife's prolific seeding, its tolerance of a variety of water regimes and soil types, its ability to produce as many as 2 million seeds a season, and its reproduction from broken pieces, has allowed it to spread across the continent and outcompete many native species. When trampled by animals or humans, damaged areas produce new shoots and root buds. Leaf size will change to maximize light availability. In some places it has replaced 50% of the native species. Once established, exclusive loosestrife stands maintain themselves for over 20 years.

Management: The best time to control purple loosestrife is in the summer when it is in flower and before it goes to seed. At sites where plants have gone to seed, remove all of the flowering spikes first by bending them over a plastic bag and cutting them off into the bag. Continue to cut stems or pull roots and dispose of all equipment, including clothing, properly to avoid spreading the tiny seeds. However, purple loosestrife is best managed though biological control. There are several beetles and weevils species that have shown some success in removing purple loosestrife from infected areas. The beetle species will defoliate the entire plant by feeding on the flower and stem structures, which ultimately limits the amount of seeds that can spread annually. Successful beetle species include Galerucella calmeriensis and Calerucella pusilla. There are three species of weevil that are also commonly used: Hylobius transversovittatus, Nanophyes breves, and Nanophyes marmoratus.

Siberian Elm

Ulmus pumila






Identifying characteristics: Siberian elm is easily confused with native elms because the leaves are almost the same except for being smaller. Siberian elm leaves grow alternately on their twigs. They have broad leaves, which are heart-shaped at the base and taper to a long point, with small teeth bordering the entire margin, 0.5 - 2.5 cm wide and typically twice as long. The flowers are greenish-red to brown without petals, producing clusters of round-winged seed cases with the single seed in the center. In uncrowned conditions, the tree grows into a round shape as high as 18 m. Because of brittle branches and frequent sprouting along the trunk, the tree often has a very irregular appearance. Bark of mature trees is light grey-brown and furrowed.

What it does in the ecosystem: Siberian elm can occupy significant areas of range or pasture and grow in dense thickets where its shade stifles most native species that need sunlight. It is readily eaten by the elm leaf beetle.

Management: Siberian elm is spread by seeds during early summer. To establish a successful management program, it is crucial to manage seeds. Cutting has proven to be successful. It is important in the process to remove all dead wood and seeds from the site. Hand pulling saplings and seed collection can work if all seeds are collected and the entire rooting structure is removed. A method of girdling (bark removal) can kill mature trees in as little as two years. If this method is chosen, it is important not to damage the xylem or the tree will send up sprouts and seeds as if the tree had been cut down.

Smooth Brome

Bromus inermis






Identifying characteristics: This perennial grass has smooth stems, 0.3-1 m tall, that begin growth in very early spring. Wide-spreading rhizomes are dark coloured and jointed, with the joints covered by scaly dark brown sheaths. Flat leaf blades are 6-12 mm wide and 15-40 cm long. The leaf wraps around the stem with a v-shaped notch, and the ligule, less that one mm long, is brownish at the base. A nodding, open cluster of flowers bloom in early summer. Each cluster has 1 to 4 stiff branches per node that stick straight out or slightly up, distinguishing smooth broome from similar native broomes. Each branch has several purplish cylindrical spikelets holding 7 to 10 flowers. The bract enclosing the flower does not have a bristle, further distinguishing smooth broome from pumpelly's broome and the invasive cheatgrass.

What it does in the ecosystem: Smooth brome persists in rangelands and fields, and its dense mat of rhizomes prevents establishment of native species. Rhizomes start to form as early as 3 weeks after seeds germinate.

Management: Smooth broome grows aggressively through rhizomes and can be controlled by the use of late spring controlled burns if the setting permits. Mowing will help diminish the population. This method achieves best results if repeated until all signs of smooth broome are no longer found on site. As with any management program, monitoring and early detection are key to success.

Tree of Heaven

Ailanthus altissima






Identifying characteristics: This fast-growing tree attains a height of 24 m or more. The 11 to 41 leaflets on a straight stem are actually part of a single 0.3-2 m-long compound leaf that appears very late in spring. Each leaflet is lace shaped with a long pointed tip and has just 1 to 5 teeth at the base. Crushed foliage has an unpleasant odor often described as burnt peanut butter. The leaves are alternately arranged. The stout twigs are covered with fine hairs when young and have a core of yellowish pith. On older trees the bark is relatively smooth and either light brown or striped grey-brown. In early summer trees produce yellowish flowers held in a large cluster above the leaves at the ends of the branches. Male and female trees are separate. A single large female tree can produce more than 300,000 papery-winged, wind-dispersed, tan seeds in late summer to fall.

What it does in the ecosystem: Once established, tree of heaven sends up many root sprouts, rapidly forming a dense colony. Chemicals released from the roots and from leaf litter hinder the growth of other plants. Ailanthus sap contains quassinoids – chemicals that have caused heart problems and debilitating headaches and nausea in people who do not protect themselves from exposure when cutting and handling the trees.

Management: If ailanthus is detected when small it can be removed by weeding as long as all of the rooting structure is removed. If any of the structure is left, the infestation can get much worse. If cutting trees is the chosen option June and July are the best times of year to cut and remove. If the roots are left, sprouting and shoots can occur and make it almost impossible to remove. While the tree is growing, cutting around the tree with a machete or hatchet will expose the cambium layer and create a pocket to apply herbicide. It is crucial not to girdle the tree, or it will sprout roots. Simply keep 3 cm of intact bark and cambium in between each cut. For sprouts less than 3 cm in diameter, exposing the cambium with one scrape and then squirting herbicide in the scape works well.

White Sweet Clover

Melilotus albus





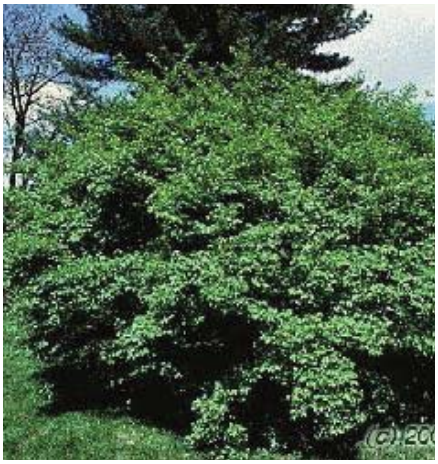

Identifying characteristics: Melilotus albus goes by several different common names that include: honey clover, tree clover, white-flowered clover and white melilot. White sweet clover is a non-native plant brought to the Canada and the United States from Europe. White sweet clover was first planted in fields for cattle forage in the 17th century. It is a member of the Fabaceace family, and as a legume, it is a natural nitrogen fixer. White sweet clover can grow up to 1.24 m tall. It grows extremely fast, and is a prolific seeder. It carries three leaves that have ribbed or toothed margins. Melilotus features a white spire flower that covers the entire plant when it blooms from July to august. It can tolerate shady areas and can grow in moist or dry soil making it an adaptable plant to a variety of site conditions.

What it does in the ecosystem: Melilotus albus is known to be prolific seeder toward the end of the growing season and can out-compete slower-growing native plants. The seeds of Melilotus albus can float, which means it is a serious threat near rivers and open water bodies. It is also known to be a plant that is liked by several insects and is pollinated by bees.

Management: Melilotus is best managed by hand weeding in the fall. If hand weeding is done in the spring it is important to weed before flowers bloom and to remove the root crown. If cutting is the chosen method, it is important to cut stems to the ground before the flowers bloom. There has been some work done on biological control methods and the use of the sweet clover weevil has had some success.

Amur Honeysuckle

Lonicera maackii






Identifying characteristics: Lonicera maaccki is in the family Caprifoliaceae and features opposite simple leaves. The leaves are 5 to 9 cm long and 2 to 4 cm broad and feature course hairs on the upper portion of the leaves. It grows as small as a large shrub to the size of a small multi-stem tree that can reach heights of 5-9 m. Lonicera was imported to Canada and the United States from Asia because of its ability to adapt to several different site conditions for containing soil erosion on steep slopes. It is endangered in parts of its home range but shows extremely invasive tendencies in the eastern North America. It features large clusters of paired white flowers, which can be used in the spring as an identifying feature.

What it does in the ecosystem: Lonicera maaccki can be found in the understory of most northeastern forests. It grows into an impassable thicket that shades out slower growing native plants, such as witch hazel. The fruits are a favourite of several bird species and this allows the seeds to be spread across long distances. If left, the thickets can take over entire understories and create a condition of monoculture. Some studies have been done in recent years that link honeysuckle to tick-borne diseases and to an increase of poor health issues in bird and tadpole populations.

Management: Honeysuckle is an extremely invasive plant. Once naturalized, the plant can be removed by cutting on a two-week cycle. This can be repeated until all nutrients and plant reserves are removed from the rooting structure. Other methods include complete excavation of rooting structure.

Autumn Olive

Elaegnus umbellata






Identifying characteristics: Autumn olive grows as a shrub to 9 m tall and is covered with silvery leaves. The leaves are arranged alternately along the stem. It has a fragrant, creamy, yellow flower in spring and produces large numbers of less than one cm fruits with one seed, eaten mainly by birds.

What it does in the ecosystem: The roots form an association with a bacterium to fix nitrogen, which may result in soil becoming more nitrogen rich, changing the composition of the plant community growing on that site. Shrubs can grow so densely that they out-compete other species. Autumn olive provides cover for wildlife but may reduce the diversity of cover types over the long term. Fruits tend to remain on the plant into winter and may be an important food source for wildlife then.

Management: Autumn olive is a resilient and aggressive seeder and it is important when creating a management program not to only look at the immediate site but also to manage adjacent sites for seed sources. Studies have shown that mowing and cutting methods can make the situation worse, and autumn olive can form denser mats that cannot easily be removed. Digging and removal of young saplings showed best result when done in early spring before seeds are produced.

Black Alder

Alnus glutinosa






Identifying characteristics: Black alder grows 12-18 m tall and can spread its branches to 12 m. It takes a generally pyramidal shape if it grows in the open but will also grow as a multi-stem tree. While native alders tend to have pointed ends, black alder has rounded leaves. Leaf edges are toothed and are arranged along the stems alternately. In the fall, clusters of 3 to 4 male catkins form, about 10 cm long. They wait for the spring emergence of female flowers that appear as green round catkins or "berries" before leaves appear. Once fertilized, the female catkins harden into 2 cm long "cones" that shelter winged seeds. The young bark can be greenish to brown, but older bark becomes dark brown to blackish.

What it does in the ecosystem: Black alder's limited appearance in natural areas of North America has not caused great problems. In the last 50 years some park and wild land managers have found colonies of black alder, usually along streams and riverbanks. They can grow in dense stands, displacing natives. Alder roots form nodes that harbor a bacterium (Frankia) that fixes nitrogen in the soil.

Management: The best time to weed or cut black alder is in early spring when the ground is soft. It is vital that all of the rooting structure be removed and disposed of off-site.

Crown Vetch

Coronilla varia






Identifying characteristics: A crown of white and pink to lavender clover-like flowers gives this plant its name. Flowers are arranged in 3 cm wide clusters on long stalks that grow from the leaf axils, flowering through the summer. Divided leaves are made up of 15 to 25 pairs of oval leaflets with 1 leaflet on the end as well. Leaves, 5-15 cm long, grow alternately along the stem. Slender, 5 cm long seedpods mature in late summer, each containing 3 to 12 brown seeds. Stems trail along the ground, growing to 2 m long. Plants tend to form mounds 15-35 cm high. Plants are perennials whose above ground stems die back in winter.

What it does in the ecosystem: The stems grow over native vegetation shading it out. Crown vetch also fixes nitrogen, thereby increasing nitrogen levels in the soil. For communities adapted to nutrient-poor soil, the increase in nitrogen may lead to a change in the composition of the community. It spreads by underground roots and by seed. Seeds can remain viable in the soil for many years. Crown vetch is toxic to horses because it contains nitroglyosides, but other livestock and wildlife eat it with impunity. It is used as a host plant by several native butterfly species and as cover by ground nesting birds and some rodents. The method of seed dispersal in crown vetch is uncertain, but crown vetch seed has germinated in deer droppings and may be dispersed by other animals as well.

Management: Crown vetch can grow if any portion of the plant structure is not removed from the site. This means that if a management program of removing the plant physically is enforced, it is vital that all portions of the plant be removed and disposed of off-site. Mowing and cutting slow the overall growth and spread but will not help remove it permanently from the site.

Curly Pondweed

Potamogeton crispus






Identifying characteristics: This popular aquarium perennial is easily recognized by the wavy edges of its flattened, dark green, 2.5-10 cm long, narrow leaves that grow on flat reddish brown stems. Leaves are bordered by very fine teeth. Curly pondweed attaches to submerged soil by shallow roots and rhizomes. In spring and summer, leaves tend to be reddish brown and more distinctly curly than in the fall when they are flatter and greener. Leaves are arranged alternately along the 4-angled stem. Only a terminal flower spike appears above water, bearing inconspicuous brownish, wind-pollinated flowers in summer or early fall. In midsummer plants begin to form vegetative buds or turions (seed-like pods), then die off until new growth begins from the buds in the fall or winter. The turions can reach 5 cm long and have 2 to 7 thick leaves pointing upwards from the stem.

What it does in the ecosystem: Curly pondweed can form dense colonies with thick vegetation just below the surface of the water. That makes fishing, boating, and swimming difficult and deprives other forms of plant life of light. As curly pondweed dies off in July (to dormant buds); summer-growing plants do not have to compete with it for light. The fact that it tends to die back in mid-summer means it contributes rotting, oxygen-absorbing organic matter to the water exactly when oxygen levels are lowest. Since new plants form in winter, even under ice, curly pondweed has a head start on most other aquatic plants. It tolerates polluted waters and is also a food for wildlife.

Management: Any leftover particle or fragment can cause an outbreak of curly pondweed so it is important to clean all tools and equipment that are used in the removal process. Curly pondweed is spread by turions that fall to the bottom of ponds and lakes for the winter months. It is crucial to remove these turions. This can be done by raking or harvesting in early spring.

Dames Rocket

Hesperis matronalis





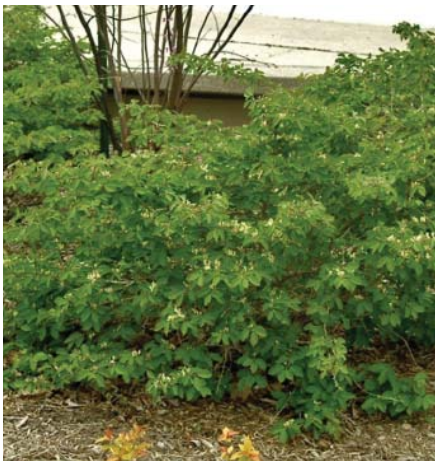

Identifying characteristics: In late spring the fragrant violet flowers of dames rocket stand out along roadsides and in forests. Each flower has four petals 1.5 cm across and held in oblong clusters on 1 m high flowering stalks. Occasionally flowers are white or pink. Plants are short-lived perennials reproducing by seed. Seeds are held in a cylindrical pod 2-10 cm long. Leaves alternate along the stems and are lance shaped with teeth along the edge, 5-15 cm long and often hairy on both sides. Plants also have a rosette of leaves at the base that overwinters.

What it does in the ecosystem: Dames rocket can locally form dense stands that may displace native species. It is primarily of concern because its widespread use in commercially sold meadow flower mixes and high seed production is introducing it to many new areas. It is also an alternate host for several crop mosaic viruses.

Management: Dames rocket has just recently been put on several invasive lists in Canada and the united states so little is known about management practices. For small areas of outbreak, hand pulling and monitoring are the most effective method for control.

European Fly Honeysuckle

Lonicera xylosteum





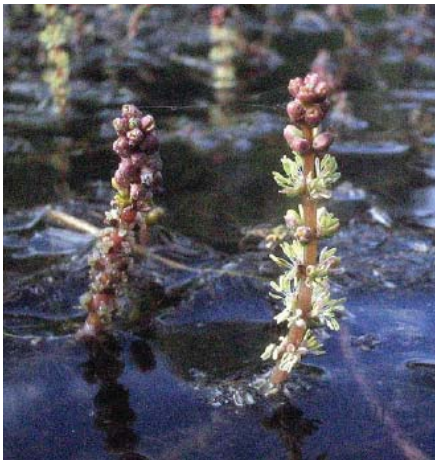

Identifying characteristics: European fly honeysuckle is a small to medium-sized shrub that can grow up to 3 m tall with a spread of up to 4 m. It is a deciduous shrub with a round shape that is often used as a hedge. It has dark, red, bead-like berries that ripen in august. The foliage is deep green and in certain light displays a bluish tint. The leaves of this plant are obovate shaped at about 2-5 cm long. The leaves are opposite, simple, and feature small rough hairs. European fly honeysuckle bears several white and yellow flowers that are born in peduncle pairs. The flowers are very small and bloom in May. The plant can grow in full sun to part shade conditions and is often found on disturbed edges of forests, roadsides, and in riparian zones. It will grow in moist to periodically dry soil.

What it does in the ecosystem: European fly honeysuckle is non-native and considered an invasive threat in several provinces. It is a prolific flowering and fruiting shrub. The berries are often eaten by birds and the seeds are spread long-distances. It is often used in urban settings because it is a hardy plant that can adapt to several different site conditions and is known for its salt tolerance.

Management: The method used most often is mechanical control or weeding. Monitor for immature saplings and remove seeds and stems early in the growing season.

Eurasian Water-milfoil

Myriophyllum spicatum



Identifying characteristics: The bright green feathery leaves of milfoil distinguish this aquatic plant. It features whorls of 3 to 5 leaves divided into 12 to 16 pairs of thin, 3 cm long leaflets that grow from stems 1 m long. Stems are pale pink to red-brown in colour. At the surface, plants spread out on top of the water in dense mats. Small, four-part, yellow flowers bloom on spikes that rise 5-10 cm above the water. The hard fruits that follow the flowers have 4 seeds in a segmented capsule. New plants grow from nodes on the stems. Plants usually die back in late fall.

What it does in the ecosystem: Like many invasive plants, Eurasian water-milfoil is an opportunist taking hold most readily in disturbed areas, especially where pollutants discourage reestablishment of natives. It can root in waters as deep as 9 m and when the stems grow near the surface they branch profusely to collect sunlight. These mats deny sunlight to submerged plants and animals. This plant spreads mainly by auto-fragmentation after flowering or by breakage. Fragments attach to equipment that carries it to new locations. Milfoil mats can increase both phosphorous and nitrogen in surrounding waters and greatly enlarge mosquito-breeding habitat. Winter kills the tops of the plants, adding to decaying, oxygen-absorbing sediments that have sometimes produced fish kills.

Management: It is important to note that cutting and harvesting can make the infestation worse if done during the growing season. Some cultural methods include covering lake ponds with an opaque cloth to block sunlight. The most efficient biological method is the North American weevil, Euhyrchiopsis lecontei, which has been shown to suppress the plant's growth and reduce its buoyancy.

European Birch

Betula pendula






Identifying characteristics: Betula pendula is a large pyramidal tree that is native to Europe and northern Asia; it can grow upwards of 80' tall. It usually exhibits a drooping or pendulous form once it reaches maturity. It is most common is higher elevations and can survive as far down as to zone 2. The leaves are arranged in an alternate pattern with simple leaves that are roughly 7 cm long and 2.5 cm wide. The overall shape of the leaves tapers from the base into a wedge shape with pronounced doubly-serrate margins. The leaf colour ranges from green to dark green and is often dotted due to birch leaf miner. The leaves turn yellow in the fall, although they are not as colourful as some of the other birch trees. In early April, Betula pendula will be covered in catkins that vary from 2.5-10 cm long. A great way to differentiate this tree from other white bark birches is the plated bark that turns from white to a greyish colour towards the basal flare of the trunk colour of older trees. Betula pendula grows best in full sun and prefers moist soil.

What it does in the ecosystem: Betula pendula is known to be one of the most sensitive birches to the bronze birch borer. The European birch is also often short-lived and sensitive to ice storms as well as drought and excessive heat. Betula pendula is not a serious offender as an invasive tree but it has been known to naturalize via seed and can compete with the native grey birch in forest openings.

Management: Mechanical control is the best approach for European birch. It is not a terrible threat like other, more aggressive invasive plants, such as Ailanthus. It is important to remove all of the stems, bark, and seeds from sites early in the spring to limit infestation during the growing season.

European Frog-bit

Hydrocharis morsus-ranae






Identifying characteristics: Hydrocharis morsus-ranae is a highly invasive plant native to Europe and Asia. It is a water-loving plant that floats on the surface of ponds, lakes, and marshes. It features kidney-shaped floating leaves and holds white, three-petal flowers that protrude from the water's surface. The leaves are connected to roots that are submerged under water and dangle in place rarely touching the bottom of its habitat. Hydrocharis morsus-ranae spreads via stolons and has a reputation for spreading like wild-fire. In the winter it sinks to the bottom of lakes and rests there for the winter as a dormant turion. The turion floats to the surface in early spring and opens up to reveal the kidney-shaped, glossy, lime green leaves.

What it does in the ecosystem: Hyrdocharis morsus-ranae is an extremely aggressive water plant that resembles the common lily pad. It creates thick impassable mats on the water surface that shades out the bottom of lakes and ponds and out-competes native plants like the common lily pad. It is a major issue in areas of eastern Canada and the United States surrounding the Great Lakes.

Management: The best control measures at this point are early detection and hand weeding. It is important that all tools and equipment used in the process be cleaned thoroughly after use. Similar to other water plants that are spread by turion, the use of an opaque screen or barrier in early spring might help with slowing down the infestation.

Floating Heart

Nymphoides peltata






Identifying characteristics: Nymphoides peltata is a perennial, non-native plant that first arrived in Washington state as an ornamental plant for backyard ponds due to its attractive yellow flowers. It is native to Eurasia, China, and India. It features a cordate, or heart-shaped leaf, that forms a thick mat covering the surface of shallow ponds. It has a showy, yellow five-petal flower that is held on a stalk about 6 cm from the surface of the water. The leaves are heart shaped and often a dark glossy green. The leaves can be found on the surface of the water, while the roots drift to the bottom of the water body. The characteristics that set this plant apart from other aquatic plants are the several yellow-petal flowers per stalk, petals in a wheel spoke formation, and a slight wave to the margins of the heart-shaped leaves.

What it does in the ecosystem: Nymphoides peltata is an extremely aggressive plant that will shade out the bottom of ponds, degrading fish habitat and creating stagnant, oxygen-deprived water. It will out-compete natives such as the common lily pad. Floating heart is most commonly found in shallow, slow moving waters and is able to reproduce by broken stems and seeds.

Management: Techniques similar to those used for fragrant water lily have been used to control large outbreaks of yellow floating heart. These methods include a mix of cutting, removal, and using a barrier on the bottom of water bodies to shade the plant out. In general, floating heart is very difficult to control through mechanical and chemical means once it has been established. If plants are harvested or cut, all plant pieces should be removed from the water.

Flowering Rush

Butomus umbellatus





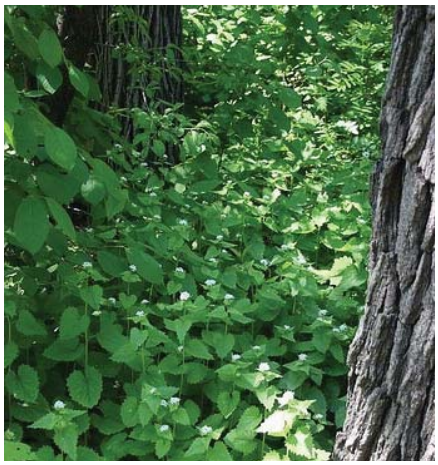

Identifying characteristics: Butomus umbellatus is a non-native plant that originates in Eurasia and is on the endangered list in its native range, due to the removal of its habitat. In the United States and Canada it grows in wetlands, marshes, and ponds in up to 3 m of water. It is named Butomus umbellatus, but is not a true rush. It features long thin straight leaves that can grow up to one metre long, and the leaves have been said to reassemble a sword with a sharp point. The plants that bear flowers can grow 2 m tall. The pink flowers grow in large clusters and bloom from June to August. The stems and leaves vary from a dark to light green. When in water depths greater than 3 m, the overall look of the plant changes: submersed leaves persist, but they become limp and more ribbon-like.

What it does in the ecosystem: Butomus umbellatus grows along slow moving water bodies such as ponds, lakes, and streams, as well as along shorelines. It grows and spreads rapidly through the use of underwater bulbs and rhizomes. It out-competes native plants due to its ability to grow quickly and spreads like wild-fire. It can spread through rhizomes in leaf tissues, so any fragment of plant tissue can start an infestation. This fact combined with its preferred habitat next to streams and rivers, allows it to spread long distances in a short time.

Management: If detected before a major outbreak, Butomus umbellatus can be removed from site by hand digging and weeding methods. If hand digging is the chosen method, it is important that all plant parts are disposed of off-site. Butomus umbellatus is more likely to establish in areas after a disturbance – if restoration efforts are made to plant native sedges and rushes, the establishment of Butomus umbellatus will be slowed down.

Garlic Mustard

Alliaria pertiolata



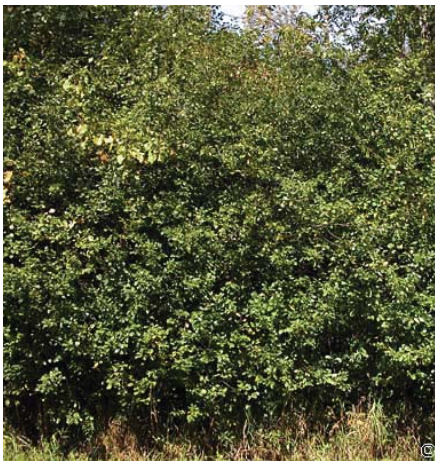
Identifying characteristics: Alliaria petiolata gets its name from the pungent odor of the crushed new leaves. Very early in spring the seeds of garlic mustard germinate and form a rosette of leaves the first year. Rosette leaves are kidney shaped with scalloped edges. Second-year plants bolt in mid spring, sending up a flowering stalk or stalks 0.3-1 m tall, with small clusters of white, 4-petaled flowers, each 0.5 cm in diameter. Leaves alternate along the flower stalk and are more triangular and toothed than in the rosette. Seedpods are skinny, 2-5 cm long; turning tan coloured by midsummer, they split along the seams to reveal small black seeds. Plants die after flowering. Seeds disperse by gravity and by the movement of water and soil. They are distinguished from native plants with rosettes of rounded leaves by the garlicky odor and in winter by the taproot, which has an 'S' curve just where it starts below the leaves. The garlic odor also distinguishes it from ground ivy.

What it does in the ecosystem: Alliaria petiolata can colonize relatively undisturbed forest understories where it competes for light and space with many spring-blooming wildflowers and tree seedlings. Alliaria petiolata may also inhibit the growth of mycorrhizal fungi. Because Alliaria petiolata becomes so abundant, butterflies lay their eggs on the plants, but the larvae fail to survive due to the different chemistry of the garlic mustard leaves.

Management: Once established, Alliaria petiolata can be labour-intensive and costly to remove. Early detection is crucial. The goal is to prevent seed development and spreading until the existing seed bank is depleted, and always make sure that the taproot is completely removed. Cutting the flowering stems at ground level and pulling plants before they set can be done in smaller areas, but may be too labor intensive for large patches. All cutting should be bagged, dried and then burned or buried deep into the ground.

Glossy Buckthorn

Rhamnus cathartica



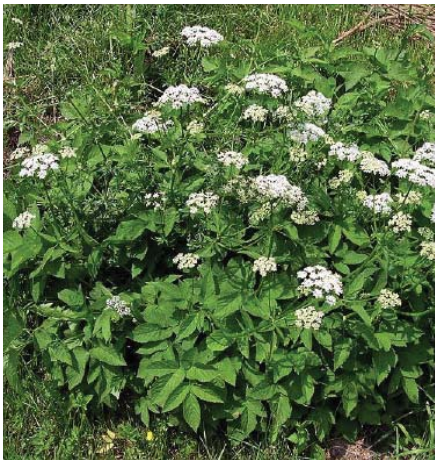
Identifying characteristics: Rhamnus grow as shrubs or small trees, and the leaves have distinctly up-curved veins. Clusters of small, 4-petaled, yellow-green flowers appear in spring with male and female flowers on separate plants. Glossy buckthorn has a shiny upper leaf surface and a hairy lower leaf surface. The leaves are not toothed and are alternate and more rounded at the tips than common buckthorn. The fruits turn from red to black. This non-native buckthorn grows 6-7 m tall.

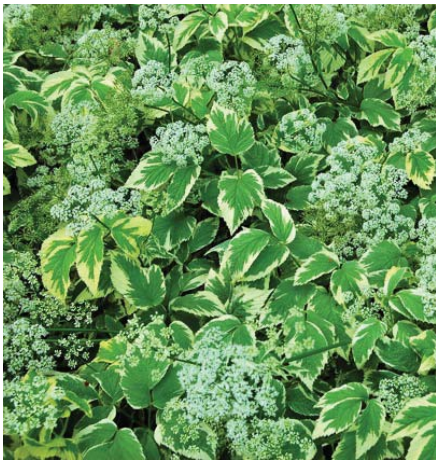
What it does in the ecosystem: Rhamnus form dense thickets under which few other plants can grow. Birds and mammals eat the fruits, but a study in Ohio showed European starlings to be a primary disperser. In prairies, the shrubs may reduce or eliminate fires. In urban areas, buckthorn leaf litter's high nitrogen content stimulates soil organisms to break down all leaf litter, changing the quantity of leaf litter on the ground and increasing levels of nitrogen in the soil. These changes may favor further establishment of buckthorn and discourage establishment of native species adapted to prior soil conditions.

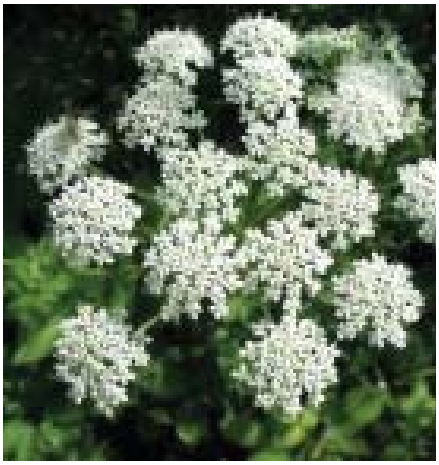
Management: For small infestations, hand digging and girdling have proven successful, as long as care is taken in removing all seeds and saplings. Larger infestations may require the use of herbicides.

Goutweed

Aegopodium podagraria





Identifying characteristics: This creeping perennial forms a dense ground cover no more than 1 m tall. The lower leaves are usually made up of 3 groups of 3 leaflets each, 2-4 cm long, with toothed edges and sometimes with irregular lobes. Leaves are alternate along the stems. The upper leaves are smaller and have fewer leaflets. Flat, 5-10 cm wide clusters of tiny white flowers, somewhat like Queen Anne's lace, bloom on stalks held above the leaves in June. The seeds are small and brown. The plant spreads via rhizomes.

What it does in the ecosystem: Goutweed can grow densely enough to prevent other species from establishing. The seedlings need light to establish, but colonies can spread by underground rooting structures in shaded areas.

Management: Goutweed spreads rapidly by underground rooting structures, so hand digging and weeding is often unsuccessful. The use of cloth or sun barriers has proven successful in small outbreaks but needs to be accompanied by hand digging and weeding so that all roots and plant parts are removed from site. Cloth should be left over these plants for no less than one year. The removal of leaves and above ground plant structures during the growing season starve the plant and stagger growth. No matter what management program is used, monitoring and repeating the weeding and removal process is crucial.

Himalayan Balsam

Impatiens glandulifera





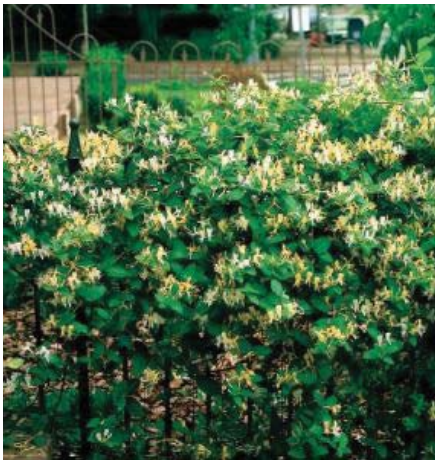

Identifying characteristics: Himalayan balsam is a non-native, tall, annual herb from the Himalayas. It is displays aggressive behaviours in Australia, Europe, and North America. It has an upright form and is roughly 1 m tall. The leaves are glabrous, ovate to oblong, and are positioned around the stem in an opposite arrangement. The flowers are on racemes and come in bunches of two to fourteen. The flowers come in several different colours, including red, white, pink, and purple. The stems are hollow, have several branches, and feature a reddish tint. The seeds cling to animals and clothes, and can be carried in the wind for long distances.

What it does in the ecosystem: Himalayan balsam can be found in a range of habitat types—agricultural areas, natural forests, riparian zones, urban areas, and wetlands. Its ability to adapt to a wide range of ecosystems gives it an advantage over native species, especially in disturbed areas and along roadsides. Himalayan balsam can reproduce at a fast rate and establish itself before native species. It will germinate and start the growing season weeks before most native plants giving it a head start. It is known to displace natives and its pollen has been shown to be more appealing to several pollinators. The fact that native pollinators prefer the nectar of Himalayan balsam is just another way it outcompetes native species.

Management: Himalayan balsam is an annual and germinates from February to March. Hand weeding is a good option early in the season. Mowing has shown promise, if done early in the growing season, followed by hand weeding and grubbing as needed mid-summer. When dealing with Himalayan balsam, it is important to remove the flower and seed capsules.

Japanese Honeysuckle

Lonicera japonica






Identifying characteristics: The sweetly scented, tubular, white to pink flowers that fade to yellow make Japanese honeysuckle most recognizable in late spring. Flowering can continue throughout the summer and into the fall. The twining vines ramble across the ground and over trees and shrubs. Most leaves are simple, oval, and opposite, 5-10 cm long. Some lowermost leaves are lobed like oak leaves. The plant spreads by seeds, underground rhizomes, and above ground runners. The black fruits mature in fall. Leaves remain on the vines year-round in the southern part of its range but fall off in midwinter in the northern part of its range. Japanese honeysuckle is easily distinguished from native vining honeysuckles by its black fruits (natives have red to orange fruits), and because the uppermost pair of leaves is distinctly separate as opposed to the fused leaves of the native honeysuckle.

What it does in the ecosystem: Japanese honeysuckle overgrows small trees and shrubs and can girdle trees as the vines thicken with age, killing hosts and eventually changing the forest structure. It forms a dense groundcover in sunny areas, outcompeting native vegetation through above- and below- ground competition. Deer and rabbits eat the leaves, which are relatively nutritious, particularly in spring. Birds feed on the fruits, and the vines provide cover for a variety of animals. Because honeysuckle tends to form a monoculture, however, the variety of food and shelter available for animals declines.

Management: Mowing has shown positive results if repeated throughout the growing season on a two-week cycle.

Multiflora Rose

Rosa multiflora





Identifying characteristics: Multiflora rose has long arching canes that can clamber into trees or root in the ground. Canes are covered with stout thorns. Canes are green when young, and brownish-grey when older. In the spring, 5-petaled, 0.5 to 2.5 cm white to pinkish fragrant flowers cover the plants. Flowers occur in clusters at the ends of small twigs and mature into small, red fruits that often stay on the plants well into winter. The flower colour and size and fruit size distinguish it from many rose species. Leaves are divided into 5 to 11 oblong leaflets, 2.5-3.5 cm long, with serrated edges. The petiole of multiflora rose looks fringed, unlike most other rose species

What it does in the ecosystem: The arching canes and thorns form impenetrable, multiflora rose thickets. Canes that climb into trees can add weight to the branches, making them vulnerable to breaking in windstorms. Many species of birds and mammals eat the fruits and disperse the seeds. A single plant can produce a million seeds a year that can survive in the soil for up to 20 years. The dense shelter of the multiflora rose is a preferred nesting place for many birds, and a haven for rodents and rabbits. Predation of nests can be higher for some birds species nesting in multiflora rose.

Management: The most effective method of removal is to mow or cut the plant to the ground and remove its root mass.

Rough Manna Grass

Glyceria maxima






Identifying characteristics: Rough manna grass is native to Europe and Japan. It is a wetland species that grows along shorelines as well as in a metre of slow moving to standing water. Rough manna grass is in the grass family Poaceae and is a perennial that spread through rhizomes. The key identifying features include red to brown bands on the leaf, shallow grooves, and a thick midrib. The overall texture of the leaf blade is rough and contains several tiny hairs. Rough manna grass can reach up to 3 m tall with large panicle clusters of flowers that bloom from June to August. The flower clusters are symmetrical and spreading and are about 0.3 m in length.

What it does in the ecosystem: Rough manna grass is a threat as an invasive species because of its ability to create thick rooting mats in wetlands. Once it is established, it is a tedious and labor-intensive process to remove the thick mat. The plant has been an issue in Canada for over 50 years and has been outcompeting native species in early spring since its arrival. Rough manna grass has a negative effect on native bird species because it is not a good food source and is a poor nesting material. It is adaptable to several growing conditions but does best in full sun locations and will often show up in areas of high flood.

Management: Most successful management practices include covering the plant with a black plastic mat during the summer. The use of a black plastic will shade out and starve rough manna grass. However, it will also kill any non-target species that are covered in the process. Hand pulling is a good option for small infestations, but it is vital to remove all rhizomes from the contaminated area.

Tartarian Honeysuckle

Lonicera tatarica






Identifying characteristics: Tartarian honeysuckle is a non-native plant that arrived in the United States and Canada from Central Asia. It is hardy to zone 3 and an aggressive large shrub to small tree that can grow in a plethora of conditions. It can reach heights of 10 to 12' with an equal spread and with age is often pendulous. The leaves are arranged around the stem in an opposite manner. The 5-7 cm-long leaves are bluish-green, ovately shaped, and 2.5-5 cm wide. Tartarian honeysuckle leafs out early to mid-spring and does not display showy fall colour. Tartarian honeysuckle is a prolific flowerier in May and features small white, pink, and red flowers that come in pairs. The fruit are small red berries (one cm) that make an appearance in July and August and are produced at high rates. The bark of the mature shrub is light grey and is often plated or peeling.

What it does in the ecosystem: Tartarian honeysuckle is a fast growing shrub that is spread by birds that eat the berries in late summer. It is adapted to grow in several landscape environments and will shade out native species that adapt and grow slower in such conditions. It has a tendency to self-sow in disturbed areas and will create dense thickets.

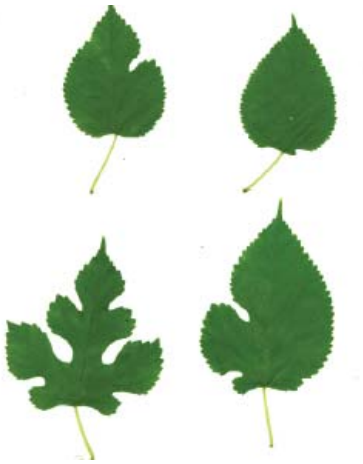
Management: If the infestation is limited, hand pulling and weeding in early spring when the soil is moist, is an effective removal solution. It is important to remove flowers and stems before berries are formed in July.

White Mulberry

Morus alba








Identifying characteristics: Mulberry trees are easily recognizable by their leaves, which have toothed edges and vary in shape from heart shaped to very lobed. White mulberry leaves are smooth on top, usually glossy, and 5-20 cm long. The bark of white mulberry is light grey with ridges or furrows. Fruits range in colour from red to purple to white. Often mature fruits are white and look a little like blackberries, maturing in early to mid-summer. White mulberry grows to about 12 m and has spreading branches. Mulberries have a milky sap that exudes from the leaf stem. They are deciduous, losing their leaves in the winter.

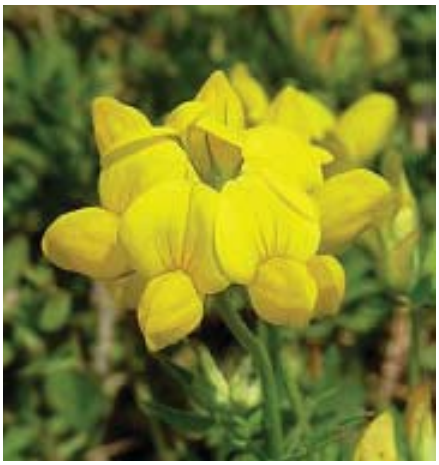
What it does in the ecosystem: White mulberry is considered a severe threat to the red mulberry, particularly in Canada where red mulberry is uncommon. White mulberry pollen appears to overwhelm that of red mulberry, causing many hybrid mulberries to form. Because white mulberry is so much more abundant, red mulberry's genes may eventually disappear. White mulberry fruits are edible but not nearly as flavorful as red.

Management: Hand pulling and weeding are appropriate when the trees are small and the soil is moist. If hand pulling is the chosen method, it is best if done before the berries have appeared (early spring).

Birds-foot Trefoil

Lotus corniculatus






Identifying characteristics: Bright yellow to orange flowers cover these low-growing plants from spring until frost. A perennial plant, its stems grow to nearly 1 m, usually sprawling on the ground. Compound leaves are made up of 3 leaflets, about one cm long and less that 3 mm wide, with 2 leaf-like stipules at the base of the leafstalk. Leaves are alternate along the stem. The flowers grow in rounded clusters of 2 to 8 flowers. Each flower is sweet pea shaped and up to 1.5 cm long. Petals sometimes have red streaks. Seeds are held in cylindrical brown to black pods, 1-2.5 cm long, forming from midsummer into fall. The name birds-foot trefoil comes from the seedpods, which fan out like bird's toes. The plant has taproots that can reach 1 m long, with branched underground roots and above-ground runners.

What it does in the ecosystem: Birds-foot trefoil forms dense mats that out-shade other plants. It is mainly of concern where prescribed burns used to maintain prairies also enhance the germination of birds-foot trefoil seeds, which in turn compete with native grasses and forbs. As a legume, it fixes nitrogen, and it is a good forage plant for deer, elk, and geese.

Management: In the case of small infestations, hand weeding and pulling of all rooting structures has proven to be successful. Mowing at a height of 5 cm, no less than every two weeks, will stunt the growth and spread of birds-foot trefoil, but has shown to have a negative effect on surrounding native grasses.

Black Locust

Robinia pseudoacacia





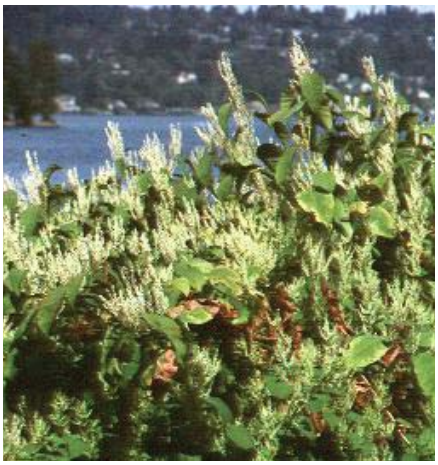

Identifying characteristics: A fast-growing tree from 12-30 m in height, black locust grows very straight in forests but has spreading, curvy branches in open areas. The bark of young trees is greenish, and in older trees the grey-brown bark is deeply furrowed with flat-topped ridges. Seedlings and young sprouts have paired 2 cm long thorns at the base of their leaves. Leaves are compound with 7 to 21 oval, smooth-edged leaflets, giving the tree a ferny appearance. Leaves turn yellow before falling off in autumn. In late spring, fragrant clusters of white flowers hang down from the branches. The uppermost petal of each flower has a yellow blotch on it. Flattened, bean-shaped, 6-8 cm-long pods are black and contain toxic seeds. Trees tend to form colonies through root suckering.

What it does in the ecosystem: Black locust roots have nitrogen-fixing nodules, so it can alter the nitrogen content of soil. It aggressively invades prairies and meadows where it shades out native plants by forming dense colonies. Its flowers attract bees and other insects.

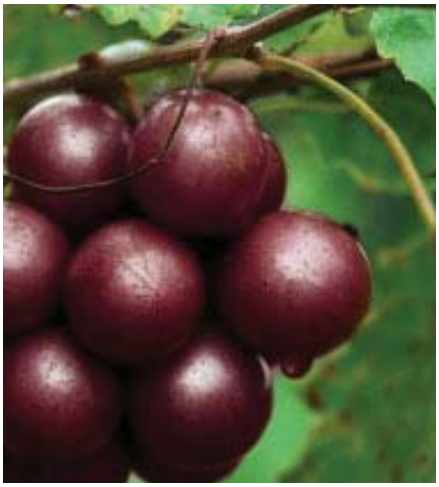
Management: Cutting and mowing have shown to be unsuccessful methods of removal because plants send out sprouts and saplings and come back more aggressively. Cutting with the use of a general herbicide has shown to be the most successful method of management. The first step is to apply the herbicide to the bark into a small cut. Wait a week or two until the tree is showing signs of weakness in the canopy or growing tips. The removal or felling of the tree is the next step. Resprouting or sapling growth should not be an issue as long as the herbicide has entered the rooting system. The most effective herbicides include: Dicamba, Fosamine, Glyphosate, and Imazapyr. Late in the growing season seems to be the most effective time for herbicide application because black locust stores reserves in rooting structures to prepare for winter dormancy.

Japanese Knotweed

Polygonum cuspidatum





Identifying characteristics: Growing 1-3.5 m tall, Japanese knotweed has smooth, stout, hollow stems, swollen at the joints where the leaf meets the stem. The young stems and leaves have a purplish colour. Characteristic of the family, a membranous sheath surrounds the stem above each joint. The leaves, typically 15 cm long and 8-10 cm wide, are broad ovals with a pointed tip. Leaves are alternate along the stems. The triangular and shiny seeds are about 2.5 mm long. An herbaceous perennial, Japanese knotweed stem grows back each year from a large underground rhizome that might stretch 12-18 m in length. The greenish white flowers occur in attractive sprays in summer, held aloft along the arching stems. The small white fruits have wings to help the seeds ride winds to new sites.

What it does in the ecosystem: Japanese knotweed spreads quickly, forming dense stands that exclude native vegetation. The thick layer of decomposing stems and leaves also mulches out competitors. In riparian areas it can survive severe floods and rapidly recolonize, usurping the role of native species. It is extremely persistent once established. Due to the change in vegetation, fish and wildlife habitat are altered. Japanese knotweed can also cause structural damage, sprouting through asphalt and foundations.

Management: For small stands of Japanese knotweed hand pulling and weeding of all shoots, roots, and runners is an option for removal. If the stand has had time to establish itself, physical removal may be labour-intensive and extremely costly. Physical removal is best for sensitive sites or where chemical removal is unadvised, such as wetlands and open water sources.

Kentucky Bluegrass

Poa pratensis






Identifying characteristics: Kentucky bluegrass is a perennial, cool season grass that blooms from May to August and spreads via rhizomes that move throughout the soil profile underground. Kentucky bluegrass forms dense mats that cover ground surfaces quickly. It can be found in front lawns, meadows, and abandoned farm fields. The blades are roughly one cm wide at a length of 15-20 cm. The leaves start their growth from the base of the plant, and the leaf has a rounded boat shape. The flowers form a tiny cluster that bares several red fruits. The seeds are a food source to rabbits, squirrel, turkey, and several other species. It is differentiated from other grasses by the dense covering mat it creates and by a shortened and box-shaped ligule. It also differs in colour from other species of Poa and is a more distinctive dark green compared to rough meadow grass, which is a much lighter green.

What it does in the ecosystem: Kentucky bluegrass acts as a food source for a wide array of species. Several bird species, ranging from goose to sparrow eat the seeds. Animal species, ranging from vole to deer, graze on the leaves. Additionally, several insects, such as worms and millipedes, eat decaying leaf, stem, and rooting structures. Powdery mildew is a common issue with bluegrass in ornamental settings such as front lawns and golf courses.

Management: Kentucky bluegrass is managed best by hand weeding and removal from the site. It can be prevented by cleaning equipment and early detection. It is a cool-season grass, so it has an advantage over warm season grasses because it has a longer growing season. Weed removal in early spring or late fall is the best time because several other ornamental grasses will have gone dormant.

Common Lilac

Syringa vulgaris






Identifying characteristics: Common lilac is a non-native large shrub to small multi-stem tree that was imported to the United States and Canada from southern Europe. It is hardy down to zone 3 and is adaptable to a variety of site conditions and climates. Common lilac is an upright deciduous shrub that can reach a height of 8' to 15', with a similar spread. The leaves are arranged in an opposite manner along the stem and hold simple oval-shaped leaves. The leaves can vary in size from 5-8 cm long, are glossy, dark green, feature an entire leaf margin, and a sub-cordate leaf base. They are best known for their showy, purple, scented panicle clusters of flowers that bloom in May. The panicles can get large depending on the variety but are usually between 10-20 cm long. The fruit is a large panicle cluster that has sharp, beak-like points. It is common cultural practice to remove clusters after they bloom to make way for the flower buds of the next growing season.

What it does in the ecosystem: Common lilac is pollinated by bees and butterflies. The seed cluster, if not removed, is a food source for several bird species. It is an annual host for powdery mildew and has been known to have issues with caterpillars and aphids. Common lilac is not known to be terribly aggressive, but its seeds can be spread by birds, and root suckering can occur if left unmanaged.

Management: Physical removal of the plant by cutting or hand pulling is a viable method for management. Remove or pruning of spent flowers will also slow down migration of the plant to different sites via seed dispersal by birds.

Common Moneywort

Lysimachia nummularia





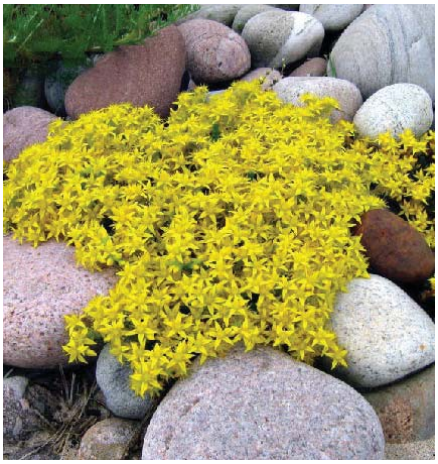

Identifying characteristics: Moneywort is a non-native plant introduced to the United States and Canada from Europe as an ornamental perennial. It is considered an invasive plant in Canada and the United States because of its aggressive behavior near ponds and wetlands. It prefers moist soil and will grow in sun to full shade. It is a ground cover that can grow to 0.3 m tall with a similar spread. The leaves are arranged in an opposite manner and are rounded with a slight wave in the margin. The leaves are said to resemble metal coins, and this is how it has received its common name. The most distinctive part of this plant is the yellow flowers that resemble little cups. The flowers are smaller than 3 cm and will show up in June and August. Common moneywort spreads by stem rooting. There are yellow-coloured varieties that are known to be less aggressive and can be managed in pots and metal-edged gardens.

What it does in the ecosystem: Moneywort is pollinated by carpenter bees, bumble bees, and butterflies in the summer months. It is not overly aggressive, but will out-compete slower growing natives in moist, shady areas.

Management: Common moneywort is a small plant with tender leaves and stems and can be managed quite thoroughly by hand pulling and weeding.

Mossy Stonecrop

Crassula tillaea






Identifying characteristics: Mossy stonecrop is a non-native, annual, succulent plant that was introduced to the United States and Canada from the Mediterranean Basin as an ornamental and green roof plant. It is a very small plant that grows to a maximum height of 8 cm, with a spread of about 15-20 cm. It has small fleshy pointed leaves that are arranged around the stem in an opposite fashion. The leaves are about 1.5 cm in length and have very small flowers. When mossy stonecrop is an immature plant, it is lime green, and over time it changes from orange to a deep crimson or red as a mature plant.

What it does in the ecosystem: Mossy stonecrop can be found on disturbed sites that feature sandy bare soil. It is spread by broken-off portions of the plant and will take root freely in low-fertility soil. It can quickly crowd out other plant species.

Management: It can be managed pretty easily by hand weeding and root pulling, as long as all portions of the plants are removed from the site.

Norway Maple

Acer platanoides






Identifying characteristics: A spreading shade tree, Norway maple generally grows to be 15 m tall. The dark green leaves, 10-18 cm long, positioned opposite each other, have 5 sharply pointed lobes. Leaves turn yellow in the fall. The trees produce copious quantities of winged seeds in a broad "V" shape with one seed per wing. Seeds mature in late summer but often remain on the tree into winter. The bark of mature trees is grey-brown, forming long narrow interlacing ridges. Norway maple can be distinguished from native maples by its leaf shape and milky sap that exudes from broken leaves or stems.

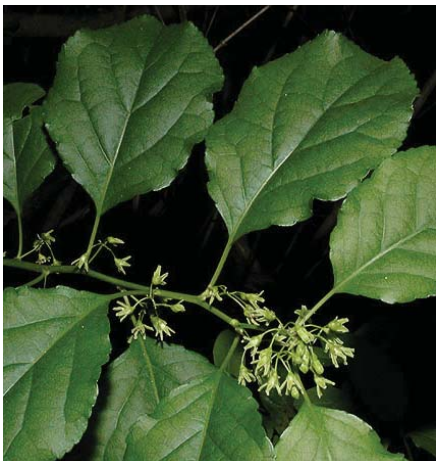
What it does in the ecosystem: Norway maple casts heavy shade, and its shallow, dense root system makes it difficult for other plants to establish. Generally, only Norway maple seedlings can grow under mature Norway maple trees. Forests with Norway maple in the canopy have much lower plant species diversity. Norway maple, because of its shallow roots, is also subject to blow-downs in strong storms. Since it tolerates poor soil and air pollution, it is often the dominant urban tree, either by choice or chance.

Management: Once a stand of Norway maple has been established, the best management program includes cutting and herbicide treatments. The large trees should be cut to about 15 cm above the ground and a herbicide that contains glyphosate should be poured directly on the cut. Young saplings can be pulled in early spring when the soil is moist. Large trees can be cut and stump ground or pulled out with an excavator, so no portions of the rooting systems are left in the soil profile. Because Norway maples are prolific seeders, it is important to cut and remove them in early spring before the seeds (samaras) have a chance to spread.

Oriental Bittersweet

Celastrus orbiculatus






Identifying characteristics: This vine can climb more than 15 m into trees, twining around trunks and branches. Twigs and branches are brown with tan lenticels, like little dashes on the twigs. Leaves, arranged alternately along the stems, are rounded, 5-13 cm long, with wavy, slightly toothed edges. Greenish yellow, 5-petaled flowers bloom in the spring in small clusters (3 to 7 flowers in the leaf axils). Male and female flowers are on separate plants. Green, round fruits turn yellow in fall. Yellow fruits split open in the fall, revealing bright red-orange-coated seeds that stand out as the leaves fall off the vines.

What it does in the ecosystem: Bittersweet seedlings can establish in dense shade and then take advantage of gaps created after storms, fire, or human disturbance to climb into the light. Sometimes called "the kudzu of the north", the vines grow rapidly , frequently overtopping trees and cutting off light to the plants below. Seeds may be an important winter food source for birds and are dispersed by birds to new areas. Oriental bittersweet can hybridize with the relatively rare American bittersweet, potentially threatening the genetic identity of American bittersweet.

Management: Oriental bittersweet can spread via seed and root suckering, so physical removal has proven to be the most successful on small plots.

Periwinkle

Vinca minor






Identifying characteristics: Common periwinkle is familiar to most gardeners as an evergreen ground cover that grows dense and low and bears violet to blue-violet flowers. It grows 15 cm tall and a single plant can spread over a 1 m wide area. Trailing stems bear elliptical, pointed, dark green, shiny leaves about 2.5 cm long, growing opposite on the thin stems. The 5 petals of the flower are widest at the outer margins. Flowers are about 2.5 cm across, first appearing in spring and continuing in lesser quantities through summer. Winter buds are very small and brown seeds are also tiny.

What it does in the ecosystem: Periwinkle spreads mainly from underground runners and from rootlets formed at leaf nodes. It seldom reproduces from seeds. Once established, it can form a carpet that entirely shades the ground, excluding other plants. Thus it has been popular as a garden ground cover. One key to its success is that as an evergreen it can make use of spring and fall sunlight when the forest canopy is bare. Leaves are toxic to most or all grazers, and seeds are too small for birds, so when it displaces native plants, it also displaces food sources for wildlife.

Management: Common periwinkle is an aggressive non-native plant that spreads via underground runners and stolons. It is a tender plant and can be hand pulled or weeded from the soil easily. It is essential that all underground portions are removed and that the site is monitored for a second or third session of removal.

Siberian Squill

Scilla siberica






Identifying characteristics: Siberian squill or wood squill is a non-native bulbous perennial that arrived in the United States from Russia and turkey. It is a small perennial that is grown from bulb and reaches a height of 10-20 cm and a spread of 5 cm. It is a spring ephemeral and only shows up for a few weeks before going dormant for the summer growing season. The leaves are strap shaped and usually come in twos and fours. The flowers are star-shaped, blue, and feature six petals. There are several ornamental varieties, and the flower colour varies from blue to white. When the flowers first show in the spring, they are hung like a bell and face down. As they mature throughout the season, they open and face toward the sun. They are one of the first plants to bloom in early April. After they flower, they produce a seed pod and shrivel up, becoming dormant until the next growing season.

What it does in the ecosystem: Siberian squill prefers moist shady woodlands and will naturalize if left unmanaged. It is a useful plant because it is deer tolerant and can grow under allelopathic conditions created by eastern black walnut, Juglans nigra. It is a double threat when it comes to dispersal mechanisms because it can sow by seed and spread by under grounding rooting structures. It is a hardy wildflower that is pollinated by bees and seems not to be bothered by voles or other rodents.

Management: Siberian squill has been monitored and studied over the last decade, and in several provinces, it is starting to be noticed to display aggressive behavior. It will naturalize if left unattended. Not many methods for management have been studied, but hand digging and mowing in early spring will help slow its growth and movement. The key to eradication is to remove the underground rooting structure.

Scots Pine

Pinus sylvestris






Identifying characteristics: This is the only pine that bears blue-green to slate-green needles in pairs from their fascicles. Needles usually twist a full 360 degrees. New buds are orange-brown and may have a resinous cover. The 6-18 cm-long cones start green and darken to greyish, maturing in November to December. Trees can grow to 30 m and live several hundred years. Trees whose leaf buds are not damaged grow straight trunks that are topped by a mass of foliage. Otherwise, Scots pines grow in a twisted, uneven shape and usually have an orange-red, scaly bark.

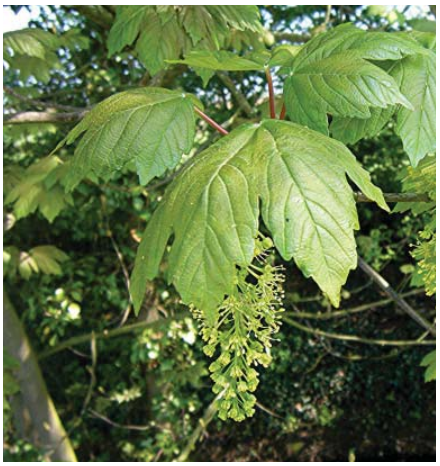
What it does in the ecosystem: Most authorities do not consider scots pine an aggressive competitor except in open areas normally dominated by herbaceous plants and shrubs that grow on poor soils. In such situations scots pine seedlings form thick mats, growing in stands that shade out the lower-growing native plants. It has colonized bogs and dunes. Due to its ability to grow in poor soil and reproduce at an early age, it has been used to reclaim mining sites and for windbreaks. Moose browse on it, but it is a low priority browse for deer. Grosbeaks eat the buds and porcupines eat the bark.

Management: Scots pine can be easily managed by hand weeding and grubbing of smaller trees or cutting of mature trees. Some biological controls include the pine root collar weevil, coneworms, and tip moths.

Sycamore Maple

Acer pseudoplatanus



Identifying characteristics: Sycamore maple is a non-native, deciduous, large tree from Europe and Central Asia that can reach 40' to 60' and features an oval to rounded canopy. It is hardy to zone 4, grows quickly, and is extremely adaptable to several different environmental conditions. It features large, 7-15 cm across, 5-lobed leaves that are arranged in an opposite manner around the stem. The leaves are dark green and have a white tint to the underside. The leaves have a leathery quality and the veins are impressed into the leaf. The margins are toothed and the autumn fall colour is yellow to brown and not showy. Sycamore maple has scaly bark that can flake off and is much less impressive then Platanus x acerfolia or Plantanus occidentails. The fruit is a samara that is 2.5-5 cm long, and they are held in large clusters. The flowers are long panicles that arrive in May and are a yellow-green. The buds are a good identifying feature, because they stay green during winter, which sets them apart from the purple buds of Norway maple.

What it does in the ecosystem: Sycamore maple tolerates a number of landscape types and is very adaptable. It can tolerate road and sea salt as well as disturbed sites in urban conditions. It is also aggressive in wetlands, can impede access, and can shade out and out-compete with native riparian species. The flowers are pollinated by bees and are known to cause an allergic reaction in people. It is spread by samaras, which are small winged seed casings that get carried in the wind and can travel long distances.

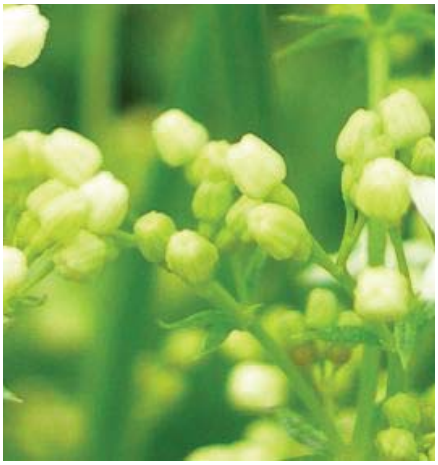
Management: In a newly installed landscape situation prevention and monitoring are the best management practice. Small saplings are easily pulled when soil is moist. It is important to remove saplings before the seeds are developed and dispersed. If a large stand is established, the best removal practice is to flush cut the tree to the ground and remove rooting structure from the soil profile.

White Bedstraw

Galium album








Identifying characteristics: White bedstraw is an herbaceous perennial plant that is native to Europe and is found in pastures, meadows, and grassy banks. It is has an aggressive sprawling tendency and is a medium-sized plant that grows upwards of 4' tall. The flower is white to yellow and is a broad wheel-shape, blooming from June to August. The flowers are arranged in a whorl and are radially symmetrical. The leaves come in a whorled arrangement around the stem, usually from 6 to 8 leaves, and are lanceolate at about 5-10 cm long. The leaves are broadest at the tip, are leathery to the touch and feature a slight re-curve. At the end of the growing season, the fruits are red-brown carpels spherical in shape. White bedstraw is a prolific seeder and will self-sow and naturalize in meadows, grassy banks, and roadsides.

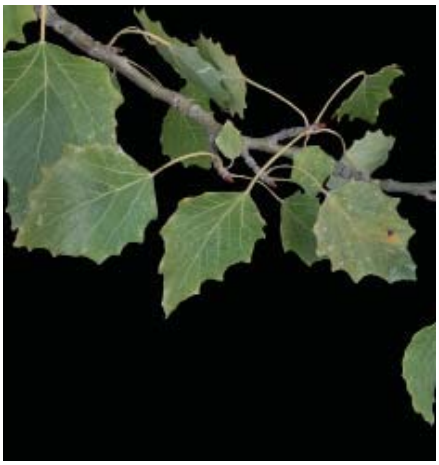
What it does in the ecosystem: White bedstraw will naturalize if left unattended and will adapt to a number of different landscape types. It is an aggressive plant that will out-compete most native herbaceous perennials. White bedstraw is a food of choice for several caterpillars. It is a pest in agricultural fields and will compete with crops for soil nutrients – reducing yields by up to 60 percent. It is also an issue for livestock. If the seeds are eaten it can inflame the animal's digestive tract. It is also a host to several diseases, pests, and non-beneficial nematodes.

Management: Monitoring, prevention and early detection are keys to keeping white bedstraw at bay. Hand pulling and grubbing small infestations work well, as long as a cover crop or mulch is applied to the disturbed area immediately after removal. Other organic control methods, such as clove oil-based herbicides, can limit infestations if applied early in the growing season.

White Poplar

Populus alba






Identifying characteristics: The silvery undersides of the leaves have given this tree a favored place in many created landscapes. The leaves are 7-15 cm long, 5-10 cm wide, have toothed margins and 3 to 7 lobes, while young leaves on shorter shoots are more oval, and the teeth along the edges are irregular. Young leaves are covered top to bottom with dense, very short hairs that give them their silvery look, but as leaves age the upper sides become green and smooth. Leaves are alternate along the stems. Yellow to tan catkins begin forming in early spring before the leaves appear and grow to 5 cm long. Trees have either male or female flowers, male catkins being longer than female. The dry fruits on female trees are dark brown, about 1 cm in diameter. The small seeds have fluffy hairs that help them ride the winds. The bark of younger trees is whitish. It darkens and becomes furrowed with age, while branches are often white barked. The tree grows to 30 m high with a trunk up to 2 m in diameter.

What it does in the ecosystem: White poplar seeds travel on the wind but few are viable. Once established, however, trees reproduce vegetatively, forming large colonies that overwhelm many natives, especially in edge areas. Cutting stimulates resprouting of multiple stems. A solution containing rooting hormones can be made from soaking white poplar root cuttings.

Management: White poplar can be hand weeded or grubbed when immature, if done in early spring when soil is moist. Cutting and girdling have also shown to be effective methods if monitored and repeated annually. Clear cutting and stump removal are the most effective way to remove all parts of the plant.

Yellow Sweet-Clover

Melilotus officinalis






Identifying characteristics: Yellow sweet clover is a non-native annual to biennial plant from Eurasia that shows invasive tendencies in north American, Africa, and Australia. It grows to about 4' to 6' tall. The grey-green leaves are arranged alternately around the stem, are trifoliate with long 2.5 cm petioles. The leaves are toothed along the margin and are oblong in shape. The flowers are yellow and have 5-15 cm-long racemes that are tubular at the base and broaden at the apex. They bloom from spring into fall. The fruit is a seedpod or legume and holds one to two seeds. It is adaptable to several different site conditions and is often found in prairies, fields, and vacant lots.

What it does in the ecosystem: Yellow sweet clover was introduced in North America as a forage crop for agriculture. It has broken free from agricultural fields and entered vacant lots and roadsides. It is pollinated and used for nectar by honeybees. The plant is winter hardy, features a deep taproot but is intolerant of prolonged flooding.

Management: Hand pulling and grubbing by identification is done with ease when the yellow flowers are in bloom. However, yellow-sweet clover is also easily located in the spring because it becomes green before native vegetation. Hand-pulling in summer can be effective if done when the ground is moist, but is labor-intensive and must be done consistently. In larger colonies, cutting stems close to the ground is effective if done after leaves on the lower stems have died (before flowers or seeds form). Yellow sweet clover usually does not re-sprout when the stems are cut close to the ground during this time.

Common Cocklebur

Xanthium pennsylvanicum





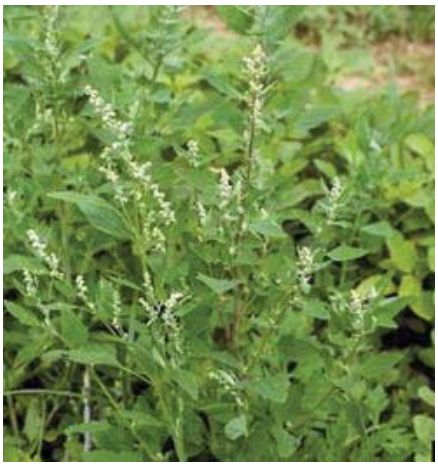

Identifying characteristics: Also known as clotbur, sheepbur, ditchbur, burweed, and hedgehog, common cocklebur is a highly branched, taprooted, broad-leaved annual that grows 0.2 to 2 m high. The stem below the leaves is stout, purple at the base, and green on the upper portion. The leaves are about 4 cm long and 6 mm wide and have lateral veins on the lower surfaces as parallel, light-green lines. Upper surfaces of the leaves are darker than lower surfaces. The first two true leaves are opposite each other, egg shaped, and slightly toothed; subsequent leaves alternate up the stem and are distinctly toothed. Newly emerging leaves are erect and flat, and both surfaces have a dense covering of hair. Flowers bloom from July through October. Clusters of small green to rusty red flower heads develop where the upper leaf stalk meets the stem.

What it does in the ecosystem: Early-season control is important because cocklebur grows rapidly and, once established, can be a long-term problem, mainly because it can out-compete other plants. Seeds can spread easily in water.

Management: Complete control of common cocklebur is often difficult because some of the seeds remain dormant in the soil for months or even years. Physical removal of the plants by hand pulling or digging is effective if done prior to flowering. After seed development, plants should be carefully removed so as not to dislodge the burs. Treating cocklebur with herbicides can work, but the plant must be shorter than 20 cm at the time of treatment.

Common Lambsquarters
Chenopodium album



Identifying characteristics: Common lambsquarters is a hardy, common weed found almost anywhere. It looks dusty from a distance due to a white coating on the leaves, and when moist, water simply beads and runs off. It produces tiny green flowers that form in clusters on top of spikes, and the leaves resemble the shape of a goosefoot or diamond. Leaves are light green on the top and whitish underneath, with some teeth along the edges, and can grow up to 10 cm long. The plant itself can reach a height of up to 2 metres. Average height is about 1 metre. Flowering occurs from early summer to fall. Pollination is achieved mainly by the wind, but various insects may also assist in pollination.

What it does in the ecosystem: New infestations of lambsquarters are patchy, but stands soon become so dense that they may smother crops.

Management: Digging or hand removal is effective because common lambsquarters cannot recover from uprooting or mechanical damage. Mowing is another way to prevent seed production. Herbicides can be used to effectively suppress lambsquarters during peak germination.

Common Purslane

Portulaca oleracea






Identifying characteristics: Common purslane, also known as verdolaga, pigweed, little hogweed, pursley, or moss rose is an annual that forms a dense mat. The plant reaches 40 cm in height and has reddish stems that originate from a central rooting point, radiating out like spokes of a wheel. Leaves are stalk-less, oval, smooth, and shiny, and vary from 1.5-5 cm in length. Tiny, five-petal, yellow flowers open only in sunshine. Seeds are borne in a small pod with a top that comes off like the lid on a cookie jar. Common purslane is a prolific seeder. In late summer, flat mats of mature purslane can be turned over to reveal thousands of seeds on the soil surface.

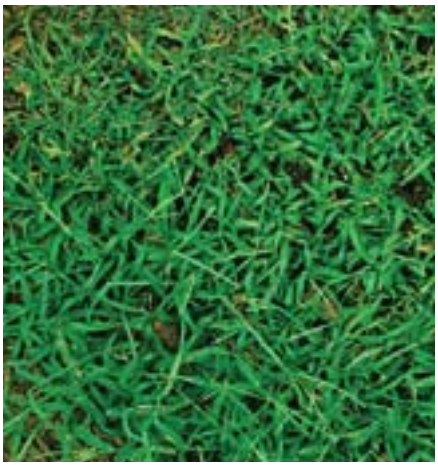
What it does in the ecosystem: Due to its ability to produce large numbers of seeds, common purslane can rapidly colonize any warm, moist site. A few scattered plants in the first year can become an almost solid carpet of purslane the following year. These vegetative mats utilize available moisture and nutrients and screen out light to the soil surface, preventing emergence of other seedlings.

Management: Maintaining a vigorous, desirable plant population that can shade the soil and weed seedlings will discourage common purslane colonization. Mulching the soil will also provide necessary shade. Frequent hand-pulling can also help control seedlings.

Crabgrass

Digitaria sp.



Identifying characteristics: Crabgrass is a common annual grass that has many other names including crowfoot grass, watergrass, and summer grass. Crabgrass seeds can germinate throughout the summer. The plant's form is branched upright with purple stems, and can grow to more than 1 m in height. The leaves are pale blue green, hairy on both sides, and with margins that may be rough. They are flat, sharply pointed, and 5-15 cm long. The flowers are borne in a raceme with 3 to 13 purplish finger-like spikes up to 15 cm long. They occur in whorls at end of stout stalks during August and September.

What it does in the ecosystem: Crabgrass can be found in most warm, moist, fertile, sunny grass areas where turf is thin or mowed too short. They will tolerate hot, dry, compacted soil after establishment, and may spread aggressively into mats that crowd out desirable grasses. The plant reproduces primarily by seeds or by long, rooting stems.

Management: Any efforts that reduce seed production will decrease occurrences of this plant. Increasing the vigor of native grasses can decrease the potential of crabgrass invasion. To control without chemicals, maintain grass density and health through proper irrigation, mowing, and summer fertilization. Crabgrass can also be hand-pulled or dug up.

Dandelion

Taraxacum officinale






Identifying characteristics: Dandelions are perennial, herbaceous plants that grow in moist, sunny. The dandelion taproot is thick, sturdy and dark brown. The buds grow from the uppermost area of the root where a tight crown is formed. The leaves are shiny and hairless, 8-30 cms long and always branch out from the center. The flowering stalk can reach lengths from 15 cm to one metre. The flower is yellow and when cut off, a bitter, milky substance leaks out from the stem. After flowering, a white, fluffy ball of seeds forms, which disperses quickly and easily by wind. The seeds are very successful at colonizing new or disturbed habitats.

What it does in the ecosystem: Dandelions are often considered an annoying weed and are found most commonly in highly disturbed ecosystems such as lawns.

Management: It is best to attempt to stop the proliferation when dandelions are still. With good crop competition, digging, and hand weeding dandelion germination can be stifled. Using herbicide application during the fall is most effective.

Goldenrod

Solidago canadensis






Identifying characteristics: Goldenrod is a tall, unbranched perennial with crowded, narrow, pointy leaves and pyramidal heads of small yellow daisy-like flowers. Flowering starts in July or August and continues into October-November. Their seeds are crowned with short off-white fluffy hairs and 10,000 seeds may be produced from a single flowering shoot, with high fertility. Other names for this species include Canadian goldenrod, meadow goldenrod, common goldenrod, giant goldenrod, tall goldenrod, and shorthair Goldenrod.

What it does in the ecosystem: Goldenrod has a reputation of being weedy due to its aggressive rhizomatous growth, which enables rapid colonization in disturbed sites and causes them to be difficult to control. Goldenrod typically grows in moist soil with moderate levels of organic matter. The plant establishes by seed, seedlings, or rhizomes and typically inhabits dry, open slopes in upland prairies, disturbed land, and poorly-managed grasslands. It also relies on pollination by insects and bees.

Management: Cutting can be effective if carried out twice a year, repeatedly over several years in May or August. Herbicides can also be effective when shoots are less than 15 cm tall.

Prickly Lettuce

Lactuca serriola






Identifying characteristics: Prickly lettuce seedling leaves are oblong football shaped to egg shaped with bases that abruptly taper into a short stalk, and usually have a few fine hairs on the edges. The mature plant is erect and can grow up to 2m tall. Stems branch at the flower head and lower portions of stems are smooth or have bristly hairs. Leaves are egg shaped, deeply lobed or non-lobed, have prickly edges, have a row of prickly bristles on the lower mid-vein, and are alternate to one another along the stem. Flowers bloom from April through October. Flower heads consist of numerous pale-yellow flowers that attach to outward-extending branches. Individual flowers look like small dandelion flowers. Prickly lettuce is a milkweed plant, so if the stem or root is broken, it will emit a milky substance.

What it does in the ecosystem: Prickly lettuce thrives in open, sunny, disturbed places and reproduces by wind or animal dispersal. Dense proliferation of this plant can out-compete other native species.

Management: Hand pulling is the method of choice for young plants. Mature plants have a taproot that will have to be dug using a spade or shovel. Mowing is not recommended as a means of controlling this weed, as the rosette is generally lower than most mower blades and the removal of the stem is not enough to destroy the plant. Organic methods of control include herbicides that contain clove oil and acetic acid. As with chemical fertilizers, care must be taken to protect surrounding plants. Remove stems before or during the flowering phase to reduce propagation of prickly lettuce. Afterwards, till the area to destroy any remaining plants.

Redroot Pigweed

Amaranthus retroflexus






Identifying characteristics: Redroot pigweed is an annual broadleaved weed that grows about two to 1 m high. The plant is named for its pinkish to red root or taproot. Vertical white veins are often visible down the length of the stem, which is often branched above and somewhat hairy. Leaves are oval with a tapering point, arranged alternately along the stem and branches, and are occasionally tinted red. The flowers are small, light green, and occur in dense, branching at the ends of branches. Flowering occurs from June through November. The seed is round, flat, shiny and black.

What it does in the ecosystem: Redroot pigweed thrives in open, sunny, disturbed places and reproduces by wind or animal dispersal. Dense proliferation of this plant can out-compete other native species.

Management: Maintaining a vigorous, desirable plant population that can shade the soil and weed seedlings will discourage pigweed colonization. Mulching the soil will also provide necessary shade. Frequent mowing can prevent seed production, and frequent hand-pulling, hoeing, tilling, and digging can help control seedlings.

Yellow Flag Iris

Iris pseudacorus






Identifying characteristics: Yellow flag iris is an herbaceous wetland perennial plant that typically between 1-1.5 m tall. It has long, erect leaves and bright yellow flowers of typical iris form that bloom in summer. Yellow flag iris grows best in very wet conditions, and is often common in wetlands where it tolerates submersion, low pH, and anoxic soils.

What it does in the ecosystem: This plant spreads fast, by both water-dispersed seed and rhizomes that can survive prolonged dry conditions. It is also known to quickly out-compete other wetland plants, forming almost impenetrable thickets.

Management: Small stands of yellow flag iris can be controlled through hand removal. Gloves should be used when handling this plant, as the sap can cause skin irritation in some people. Plants should be dug, taking care to remove as many rhizomes as possible. Plant parts should be disposed of responsibly, as rhizomes can resprout if left on the ground. The area should be monitored for regrowth from missed rhizomes. Some control may be obtained for plants in standing water by cutting all leaves and stems below the waterline.

Appendix D
Diseases & Pests

Diseases & Pests

Overview

Trees and shrubs can be affected by a wide variety of pests or diseases caused by insects, fungi, and other pathogens. Pests typically refer to insects whereas diseases are abnormalities caused by microorganisms such as fungi and bacteria or by environmental stress such as drought, temperature extremes, and air pollution. Diseases are often difficult to diagnosis since different causal agents can produce similar symptoms. Accurate diagnosis is essential to developing effective treatment programs and may require third-party consultation from a local tree expert. Damage from pests and disease is not just limited to plant leaves and stems. Branches, roots, flowers, and fruit can be affected as well.

An organic management program integrates principles of ecology into pest control practices and uses only non-toxic methods for treating and preventing pests and diseases. This approach is known as Integrated Pest Management and aims to use a combination of tactics to reduce the status of pests while maintaining a quality environment. The definition for integrated pest management most relevant to this guide comes from Flint and van den Bosch (1981): "An ecologically based pest control strategy that relies heavily on natural mortality factors and seeks out control tactics that disrupt these factors as little as possible." (Cornell University)

Pest and disease problems can be managed using a decision making process that considers the following:

- Maintain healthy plants to resist diseases and pests.
- Periodic inspections of trees and shrubs.
- Verification that pests and/or disease are the issue.
- Identification of the host and the pest.
- Careful selection and execution of the appropriate management strategy.
- Follow-up monitoring of the host plant and pest.
- Evaluation of the management plan.

Effective Integrated Pest Management Strategies

Integrated Pest Management incorporates physical, cultural and biological controls first, then chemical controls as an option of last resort. An effective integrated pest management strategy is designed around six basic components:

- **Regular observation** is critically important as a monitoring strategy. Observation has two parts: inspection and identification. Visual inspection as well as insect and spore traps can be used to monitor pest levels, behavior, and reproductive cycles. Many development cycles of pests and diseases follow specific weather and seasonal patterns, which can also be used to anticipate outbreaks.
- **Emphasis should be on control,** not eradication, since clearing out an entire disease or pest population is often impossible, expensive, and unsafe for the environment. Therefore, acceptable pest levels or "thresholds" should be established as pest, host, and site-specific.
- **Preventative cultural controls** include monitoring soil health and moisture levels. Inadequate or shifting moisture levels can weaken plants and make them susceptible to pest problems. Other cultural controls include proper fertilizing with slow release nitrogen and micronutrients and mulching with wood or bark chips. Plant "quarantine" or relocating a small specimen to a more hospitable environment can also be helpful. Periodic inspections are also essential to detect pest infestations before they reach damaging levels. In extreme cases, heavily diseased plants must be pruned or removed entirely, and all tools washed to prevent spread of infections.
- **When a pest exceeds** an acceptable threshold, physical or mechanical controls should be employed first. These include removing insect larvae and adults by hand, using a soft bristled brush, a vacuum, hanging traps, sticky traps around tree trunks, or water jet sprays - all with the aid of a stepladder if necessary. New or small infestations may be secured off with a barrier material or pruned away.
- **Biological controls** include attracting and/or releasing beneficial insects. For example, ladybugs prey and control populations of aphids whereas ladybird beetles, lacewings, rove beetles and ground beetles prey on scale insects. Beneficial fungi and bacteria can be added to the soil of some plants vulnerable to root diseases, as a way to reduce the need for fungicides. Biological insecticides, derived from naturally occurring microorganisms (e.g. Bt, entomopathogenic fungi and entomopathogenic nematodes) also fall in this category.
- **If organic means are ultimately not working,** resort to conventional chemical techniques used by the City of Toronto Parks, Forestry & Recreation Division to eradicate the pest or disease. Matching the application technique to the crop, the pest, and the pesticide is critical and should be used only at specific times in the pest's life cycle. Limit use over consecutive years in order to determine the effectiveness of the previous treatment. Low-volume spray equipment can also help reduce overall pesticide use and labor cost.

Sources

City of Toronto Parks, Forestry & Recreation
Cornell University Entomology Department
Bartlett Tree Experts
Tree Canada

Diseases & Pests

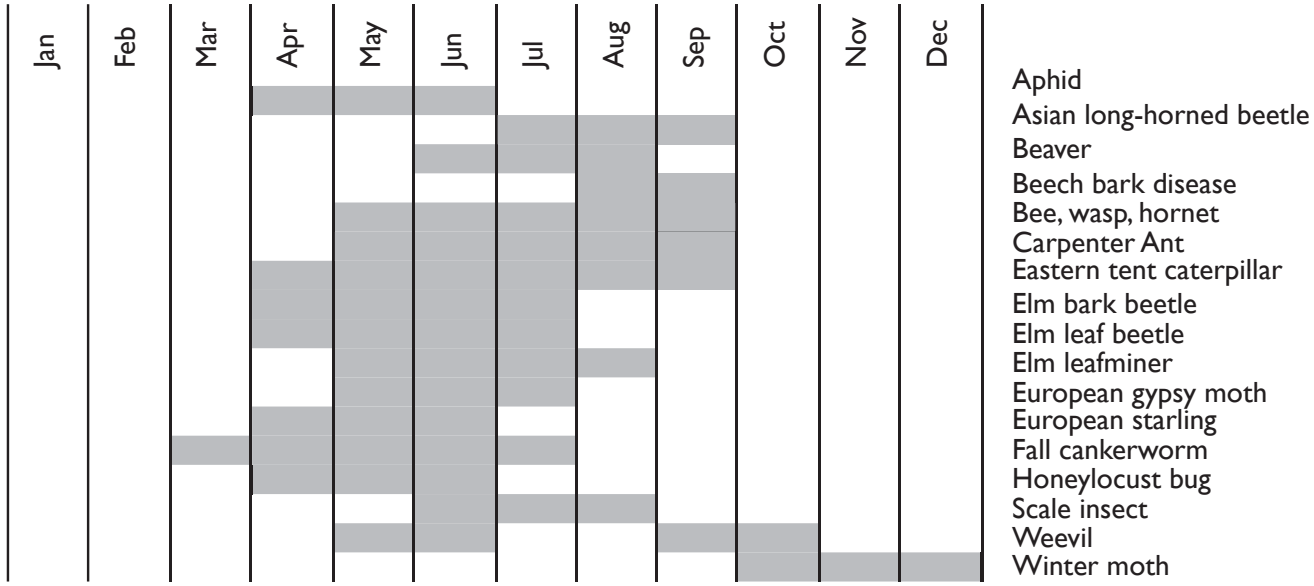
Common Tree Diseases

- Apple scab
- Anthracnose (ash, oak, sycamore, etc.)
- Bacterial leaf scorch disease
- Beech bark disease
- Black knot fungus
- Drought and temperature extremes
- Dutch elm disease
- Galls
- Girdling roots
- Leaf blotch of horse-chestnut
- Needlecast
- Nutrient deficiency
- Oak wilt
- Phytophthora root rot
- Powdery mildew
- Tar spot
- Verticillium wilt
- Water stress
- Wood decay

Common Tree Pests

- Ambrosia beetle
- Aphid
- Asian long-horned beetle
- Beaver
- Bee, wasp and hornet
- Carpenter ant
- Eastern tent caterpillar
- Elm bark beetle
- Elm leaf beetle
- Elm leafminer
- European gypsy moth
- European starling
- Fall cankerworm
- Flat-headed borer
- Gypsy moth
- Hemlock wooly adelgid
- Honeylocust bug and leafhopper
- Japanese beetle
- Scale insect
- Spider mite
- Termite
- Weevil
- Winter moth

Pest Calendar: When to Look



For details on each pest or disease listed here, visit Toronto's web site on Tree Pests.

Appendix E
Resources

Information

WEBSITES

Organic Land Management

- Society for Organic Urban Land Care: http://www.organiclandcare.org/
- NOFA Organic Land Care: http://www.organiclandcare.net
- Canadian Organic Growers: http://www.cog.ca/
- Organic Council of Ontario: http://www.organiccouncil.ca/directory
- Organic Federation of Canada: http://www.organicfederation.ca/

Soil Management

- Soil Food Web New York
  Biological soil testing agency and general organic soil management resource: http://soilfoodwebnewyork.com/
- Ontario Ministry of the Agriculture and Food
  Chemical and physical soil testing agency: http://www.omafra.gov.on.ca/english/crops/resource/soillabs.htm
- Compost Council of Canada
  Local Compost and Compost Tea resources: http://www.compost.org
- USDA Natural Resources Conservation Service
  http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/

Organic Lawn Management

- Safe Lawn: www.safelawn.org

Invasive Plant Management

- Ontario Ministry of the environment By-Laws
  http://www.ene.gov.on.ca/environment/en/category/pesticides/STDPROD_079350.html
- Ontario Invasive Plant Council
  http://www.ontarioinvasiveplants.ca
- Ontario Ministry of Natural Resources
  http://www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STDPROD_068690.html
- USDA International Invasive Plants Canada
  http://www.invasivespeciesinfo.gov/international/canada.shtml\
- Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas
  Authors: Mandy Tu, Callie Hurd, & John M. Randall, Version date: April 2001
  http://www.invasive.org/gist/handbook.html. Refer to Chapters 1-4.

PUBLICATIONS

Organic Land Management

- Society for Organic Urban Land Care
  http://www.organiclandcare.org/free-education/organic-land-care.html
- NOFA Standards for Organic Land Care: Practices for Design & Maintenance of Ecological Landscapes, 4th Ed., 2009
  http://www.organiclandcare.net/store/nofa-standards-organic-land-care

Organic Lawn Management

- Organic Lawn Care Manual, Paul Tukey, Storey Publishing, 2007: www.safelawns.org

Organic Diseases and Pest Control

- The Organic Gardener's Handbook of Natural Pest and Disease Control, Rodale Garden Books, 2010
  http://www.rodaleinc.com/products/books/organic-gardeners-handbook-natural-pest-and-disease-control-complete-guide-maintaining-healthy-garden-and-yard-tSoil Management
- Soil Design Protocols for Landscape Architects & Contractors, Craul and Craul, Wiley Publishing, 2006
- Soil Biology Primer, Tugel, A.J., A.M. Lewandowski, and D. Happe-vonArb, eds. 2000.
  http://store.swcs.org/index.cfm?fuseaction=c_Products.viewProduct&catID=574&productID=5154
- USDA Natural Resources Conservation Site
  http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html
- The Soil Biology Primer, Elaine R. Ingham, Andrew R. Moldenke and Clive A. Edwards, Soil and Water Conservation Society, in Coorperation with the USDA Natural ResourcesConservation Service, 2000.
  Available on-line: http://soils.usda.gov/sqi/concepts/soil_biology/biology.html
- The Compost Tea Brewing Manual, Ingham, Elaine R., 5th Edition, 2005
  http://livingsoilsp2011.files.wordpress.com/2011/05/brew-manual-04-28-08.pdf
- Landscape Pest Identification Cards, Agriculture and Natural Resources Publication 3513, Larry L. Strand, Jack Kelly Clark, Statewide Integrates Pest Management Program, University of California, Regents of the University of California, Division of ANR, 2011

PEOPLE

Park Design (Please contact MVVA first)

- Landscape Architects/Design Lead

  MICHAEL VAN VALKENBURGH ASSOCIATES, INC. (MVVA)
  231 Concord Avenue
  Cambridge, MA 02138
  Tel: 617.864.2076
  http://www.mvvainc.com/
  Design Lead: Michael Van Valkenburgh
  Project Principal: Laura Solano lsolano@mvvainc.com
  Project Manager: Emily Mueller De Celis emuellerdeelis@mvvainc.com

- Planting Soil Scientist

  PINE AND SWALLOW ENVIRONMENTAL (PSE)
  867 Boston Road
  Groton, MA 01450
  Tel: 978.448.9511
  http://www.pineandswallow.com
  Soil Scientist: John Swallow, PHD

- Ecologist

  GREAT ECOLOGY, INC.
  2231 Broadway, Suite 4
  New York, NY 10024
  Tel: 212.579.6800
  http://greatecology.com
  Ecologist: Mark Laska, PHD

- Organic Lawn Management

  PAUL TUKEY
  Safe Lawn
  http://www.safelawns.org/blog/about-paul-tukey/
  www.safelawns.org

- Organic Soil Management

  ASTRID MUSCHALLA, HORTICULTURALIST
  Oasis Institute for Healthy Living Inc.
  49 Warren Lane, PO Box 191
  Wolfe Island, Ontario, K0H 2Y0
  Tel: 905.636.9734
  astrid.oasis@gmail.com
  www.oasishealthylivinginstitute.org

  ERIC T. FLEISHER, HORTICULTURALIST
  F2 Environmental Design, Inc.
  New York, NY
  Tel: 917.903.9286
  t@f2environmentaldesign.com
  http://www.f2environmentaldesign.com/contact.html

  ELAINE R. INGRAHAM, PHD.
  Soil Food Web, Inc.
  635 SW Western Blvd
  Corvallis OR 97333
  Tel: 541-257-2612
  soilfoodweb@aol.com
  http://www.soilfoodweb.com/
  http://earthfort.com/

Material References

MATERIALS

Plants

- Trees and Shrubs

  BRAUN NURSERY LIMITED
  2004 Glancaster Road
  Mount hope, ON
  Tel: 905.648.1911
  www.braungroup.com

  CONNAN NURSERIES / CBV HOLDINGS
  656 Robson Rd
  Waterdown, ON
  Tel: 905.689.3554
  www.connon.ca

  DUTCHMASTER NURSERIES, LTD
  3735 Sideline 15
  Pickering, ON
  Tel: 905 683 8211
  www.dutchmasternurseriesltd.com

  SHERIDAN NURSERIES
  RR#4 12302 Tenth Line
  Georgetown, Ontario L7G 4S7
  Tel: 416 798-7970
  www.sheridannurseries.com

- Ground Cover

  ACORUS RESTORATION NATIVE PLANT NURSERY
  722 6th Conc RR1
  Walsingham, ON N0E 1X0
  Tel: 519.586.2603
  http://www.ecologyart.com/

- Lawns and Prairies

  THE GRASS COMPANY LTD
  Windsor, ON
  Tel: 519.671.5388
  Contact: Bill Aimers, Adam Aimers

Planting Soil

- Planting Soil Blenders

  EARTHCO SOIL / G&L
  401 Bowes Rd
  Concord, ON L4K 1J4
  Tel: 416-789-4749
  http://www.earthcosoils.com

  HUTCHESON SAND MIXES
  8 West Street S
  Huntsville ON P1H 1P2
  T: 705. 789.4457
  http://hutchesonsand.com

  J. JENKINS AND SONS
  12519 Woodbine Avenue
  P.O. Box 720
  Gormley, ON L0H 1G0
  T: 416-783-6137 / 905-773-2000
  http://jenkinssoil.com/

  GRO-BARK (ONTARIO) LTD.
  155 Frobisher Dr. Unit F-220
  Waterloo, ON N2V 2E1
  Phone (519) 885-3411
  http://www.gro-bark.com

- Sand

  HUTCHESON SAND MIXES
  8 West Street S
  Huntsville ON P1H 1P2
  T: 705. 789.4457
  http://hutchesonsand.com

  LAFARGE CANADA INC.
  334 Ave. Avro
  Pointe-Claire, Quebec H9R 5W5
  Tel : 514,428,7300
  http://www.lafarge-na.com/

- Compost / Pine Fines

  GRO-BARK (ONTARIO) LTD.
  155 Frobisher Dr. Unit F-220
  Waterloo, ON N2V 2E1
  Phone (519) 885-3411
  http://www.gro-bark.com

  MILLER COMPOST
  1351 Bloomington Road East Richmond Hill, ON
  Tel: 866-887-6457

Material References

Soil Amendments

- Compost Tea / Liquid Biological Amendments (LBA) Applicator:

  ORGANIC SOLUTIONS / SHADY LANE EXPERT TREE CARE INC.
  17468 Warden Avenue
  Newmarket, ON L3Y 4W1
  Tel: 905.773.5906
  http://www.organicsoilsolutions.ca/aboutus.htm

  GARDENER'S PANTRY
  info@gardenerspantry.ca
  Victoria, BC
  Tel: 250.216.3733
  www.gardenerspantry.ca

  CHATHAM-KENT ORGANIC EPICENTRE
  http://ckorganic.ca

  BIO-AG CONSULTANTS AND DISTRIBUTORS
  http://www.bio-ag.com/products/soilamendments/

  BIOSA
  http://www.biosa.com/index.html

- Organic Fertilizer

  SUSTANE NATURAL FERTILIZER
  310 Holiday Avenue
  Cannon Falls, Minnesota 55009
  Tel: 800-352-9245
  http://www.sustane.com/index.html

Miscellaneous Materials

- Organic De-icing Products

  ENVIRO-MELT – WITH CMA (CALCIUM MAGNESIUM ACETATE)
  The Kissner Group
  32 Cherry Blossom Road
  Cambridge, ON N3H 4R7
  Tel: 800.434.8248
  http://www.kissner.com/ice-melt/#tab-id-3

MICHAEL VAN VALKENBURGH ASSOCIATES, INC
231 CONCORD AVENUE | CAMBRIDGE, MA 02138 | WWW.MVVAINC.COM