

Beneficial Management Practices for Environmental Stewardship in Municipalities



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Acknowledgement

Okanagan Similkameen Stewardship initiatives take place on the traditional, unceded territories of the Syilx/Okanagan and Secwepemc people- the first stewards of these beautiful lands.

Funders of this local resource include:

Okanagan Basin Water Board

Wildlife Habitat Canada

Purpose

This guide is intended to help local governments and their parks staff make informed decisions about parks maintenance options and opportunities to maximize the benefits of natural areas and the ecosystem services they provide for people and wildlife within towns and cities.

This is intended as a living document – changes will continue to be made as we work together with Parks staff and others we hope to continue to learn what works best and what is feasible for parks staff moving forward. To access the most up to date version of this guide please visit www.osstewardship.ca/bmps-municipalities

Management Concern: Encroaching upon and/or disrupting important wildlife habitats

Parks and public spaces have many competing interests. Different people want to see children's playgrounds, sports fields, turf parks or nature parks. It may be easier to incorporate wildlife into some parks but not others. When planning a new park look not only at the type of park that the community wants but also at where the park is in the landscape to assess if it is part of a wildlife corridor.

Recommended Best Management Practices:

BMP Identify and preserve critical habitat

Contact a local biologist to assess if the park is used by species at risk of extinction. Critical Habitat and sensitive ecosystem maps for most endangered species can be found through Okanagan Habitat Atlas (<https://cmnmaps.ca/OKANAGAN/>) and the Conservation Data

Benefits:

Maintaining Critical Habitat for wildlife not only helps to protect populations of endangered wildlife, but also helps to keep common species common. Maintaining habitat means parks users can enjoy wildlife viewing as part of their park experience

These areas also offer ecosystem services like erosion control, water filtration, water storage, and more.

Centre: (<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/request-cdc-data>)

BMP Identify and Preserve wildlife and migration corridors

Corridor mapping has been completed for ungulates, primarily, by the Okanagan Collaborative Conservation Program.

BMP Design trails, maintenance roads and high use areas to minimize environmental impacts

Use permeable materials (i.e. gravel) whenever possible. Ensure that drainage from paths and roads infiltrates into ground and does not drain directly into storm drains or waterways.

BMP Avoid or minimize crossings of wildlife corridors

On the finer scale, collect input from local residents about wildlife use (ie. frog/toad migration routes, painted turtle movement patterns for example) and well-used wildlife trails. When roads, trails, and footpath crossings are necessary, use designs that avoid crossing wildlife trails or include features such as exclusion fencing and culverts to accommodate fish and wildlife movement.



Western Painted Turtles leave their ponds to lay eggs in nearby sandy or gravelly areas. Take care not to create barriers such as roads and curbs between ponds and nesting habitat.

Risks or Downsides:

In the Okanagan we have many species at risk as well as endangered ecosystems. It may not be possible to preserve all critical habitat while providing other services in parks. The areas critical to wildlife are often the areas that people also value most and want access to. Trails along shorelines compete with natural riparian habitats, viewing platforms in marshes are great educational tools and allow wildlife viewing opportunities but are likely to also negatively impact wildlife in the marsh etc. Minimizing these incursions can help balance the desire to connect with nature with protecting nature for future generations.

Management Concern: Maintenance of underused turf area

Turf areas are expensive to maintain, requiring large amounts of water, mowing, fertilizer and herbicides to remain pristine. If these areas are well-used (sports fields, picnicking/event parks, children's areas, etc), these costs can be worthwhile. In areas where turf is unnecessary, such as buffer zones between active uses, there are alternatives that are lower maintenance, better for wildlife, and still aesthetically pleasing.

Recommended Best Management Practice:

BMP Replace lawn with lawn alternatives. If the area still needs to tolerate some foot traffic, use lawn alternative groundcovers.

Steps:

1. Determine the best lawn alternative for the area by considering the following factors:
 - i. How much foot traffic the area gets. Creeping thyme is best for edging or along low walls with no foot traffic.
 - ii. Desired reduction in maintenance – less mowing or no mowing? Yarrow lawns and bee turf still require occasional mowing but significantly less than lawn. Dryland Mix is a good fit for no-mow areas that can still be walk-able.
 - iii. Proximity to riparian areas: Clovers fix nitrogen and can be problematic near water.
 - iv. Desired aesthetic: lawn alternatives differ in how closely they mimic the aesthetics of turf, with some being more lawn-like and others more meadow-like. Natural Dryland Mix provides a natural Okanagan Grassland aesthetic.
2. Select appropriate species. Options include: yarrow, bee-turf, clover, creeping thyme, Kelowna Natural Dryland Mix [25% each of hard fescue, sheep fescue, creeping red fescue, blue fescue]).
3. Remove sod and seed the area.
4. Water to establish new groundcover. All lawn alternatives suggested will eventually require less water than a traditional turf, usually within a couple of years
5. Weed the area until the new lawn is established.

Risks or Downsides:

Lawn alternatives need extra TLC to get them started, especially when compared to sod. Some hand weeding may be required until the lawn alternative gets established, as herbicides will kill the lawn alternative as well as the weeds. This may make lawn alternatives unsuitable for areas near unmaintained or weed-prone sites, though the short-term maintenance cost of weeding may be less than the continual annual mowing cost for a similar lawn area.

Examples of Municipalities Applying BMP

City of Richmond created "bee turf" with West Coast Seeds and has "example lawns".

https://www.richmond.ca/_shared/assets/summernews65206.pdf

Additional Relevant Links and Information

<https://www.westcoastseeds.com/products/bee-turf#full-description-anchor>

Benefits:

Lawn alternatives use less water and less fertilizer, and generally require less mowing than conventional turf. If the alternative turf has flowers it can be beneficial to pollinators. Lawn alternatives in general provide better habitat because they are less dense than turf and create tiny micro-habitats for pollinators and other insects. These insects are food for birds, bats, and other wildlife. Reduced mowing is also beneficial to all sorts of small animals including amphibians and insects. If lawn that is removed is located near wetlands or other water bodies, switching to a lawn alternative and using less fertilizer and herbicide can reduce runoff and improve water quality.



Lawn alternatives are a great addition to a park. They require less water and maintenance, improve biodiversity, and are great for pollinators

BMP Create a pollinator meadow or pollinator garden in buffer areas, between well-used lawn areas, particularly where there is little foot traffic.

Steps:

1. Design pollinator area to buffer different park uses, offer different views to park users. Meadows can be sited to help deter Canada Geese by limiting their sightlines to water from lawn areas.
2. When choosing plants, use a wide variety of species that ensures there will be flowers continuously from early spring to late fall, as pollinators need food all season long. Some good native plant choices are Common Yarrow, Brown-eyed Susan, Silky Lupine, Pussytoes, Showy Milkweed, Goldenrod, Pasture Sage.
3. Source local plants/seed (Xen Xeriscape Endemic Nursery in West Kelowna and Sagebrush Nursery in Oliver are both good sources of native plants)
4. Cover bare areas in between plants with bark mulch or compost like OgoGrow to help suppress weeds
5. Water/irrigate garden until well established. Usually, 2 years of watering is enough to establish native plants or a xeriscape garden

Risks or Downsides:

Pollinator meadows may be considered “messy” to those who are used to trimmed and manicured lawns. If proper care is not taken to ensure good uptake of grasses, invasive species (true weeds) may take hold. Bunchgrasses naturally create bumps and unevenness along the ground that may be a tripping hazard if someone tries to walk through the area, although research is showing that minor hazards enhance child development and improve one’s ability to manage risk. Pollinator gardens require some annual maintenance, such as weeding and spring pruning, instead of weekly mowing or leaf blowing.

Examples of Municipalities Applying BMP

City of North Vancouver partnered with local organisations to plant a pollinator garden instead of adding lawn.

<https://www.cnv.org/City-Hall/News-Room/Whats-New/2022/7/8/New-Pollinator-Garden-Coming-to-Grand-Boulevard-Park>

Additional Relevant Links and Information

https://xerces.org/sites/default/files/publications/21-038_02_Parks-Guidelines_web-screen.pdf

<https://www.osstewardship.ca/pollinators>

<https://okanaganxeriscape.org/>

<https://www.makewaterwork.ca/plants/>

Benefits to pollinator meadows:

Temperate grasslands are one of the most threatened ecosystems on the planet. This is largely because grasslands are generally fairly easy to develop into housing or to turn into agricultural areas. While lawns and grassland may seem superficially similar they have important differences. Grasslands are composed of diverse varieties of grasses, offering homes to many of our species at risk while lawns are nearly sterile of anything but Kentucky bluegrass. By incorporating more species and allowing grasses to grow taller, flower and go to seed, meadows create habitat for many species, from insects to reptiles and birds. Many animals attracted by meadow habitats are beneficial (e.g. pollinators, predatory insects) and others that are pretty or fun to watch (e.g. birds and butterflies), enhancing the park user experience.



Beautiful pollinator garden in North Vancouver.

Management Concern: Unnecessary removal of dead standing trees

Dead standing trees are a critically important part of any habitat. They provide the only nesting locations for cavity-nesting birds such as woodpeckers, swallows, nuthatches, and chickadees. Lack of nesting habitat due to excessive removal of these trunks, also known as “snags”, has been linked to declines in cavity-nesting birds in some areas. Dead-standing trees are often perfectly sturdy and may not pose a fall risk for many years**.

All tree felling, vegetation clearing, or building removal should occur from mid-September to January to minimize the risk of destroying bird nests. If work must happen outside this window a thorough nest search by a QEP (Qualified Environmental Professional – e.g. Biologist) should be conducted to ensure that no active nests are being destroyed or disturbed.

Recommended Best Management Practice:

BMP: Have the tree assessed by a certified danger tree assessor. Leave the entire tree standing if safe to do so, or if some danger is present, consider topping the tree to a designated safe height.

BMP Where proposing to top or remove trees, a person who is appropriately qualified to assess impacts to avian species must be consulted (e.g. a QEP).

BMP Felling or topping trees must be carried out by someone who is appropriately qualified (e.g., a professional forester or certified arborist) to assess and mitigate the impact of the activities or works.

BMP Pruning or removing tree limbs must be prioritized over removing the entire tree.

Risks or Downsides:

A tree that is not a current danger may become a danger eventually as it ages. This can be mitigated by keeping a list of dead-standing trees and having a danger tree assessor check on them annually, along with other trees in the Parks inventory.

Relevant Legislation:

Migratory Bird Convention Act
<https://laws.justice.gc.ca/eng/acts/M-7.01/>

BC Wildlife Act
<https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/legislation-regulation/wildlife-act>

Additional Relevant Links and Information:

**California Board of Forestry & Fire Protection: The Life Cycle of Dead Trees
<https://bof.fire.ca.gov/media/oejmb3fz/2-emc-final-presentation-j-battles-apr-2022.pdf> (pgs 12-17)

Benefits:

Leaving wildlife trees creates better habitat for many species and in turn will create a healthier, more complex ecosystem. These trunks create nesting and hiding locations for birds and other small wildlife, and may also act as roosting posts for helpful birds of prey that reduce rodent populations. Increased bird diversity also leads to increased natural pest control and better wildlife-watching opportunities for the public.



Large wildlife tree in Penticton. Wildlife trees provide nesting habitat for dozens of species of songbirds, create roosting areas for birds of prey, and offer foraging habitat for woodpeckers and other helpful insect-eating birds

Guidelines to avoid harm to migratory birds <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html>

General Nesting Periods <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html>

How Migratory Birds and their nests are protected

<https://www.canada.ca/en/environment-climate-change/services/migratory-birds-legal-protection.html>

Management Concern: Removal of microhabitats, e.g. basking logs, fallen logs, rock piles, etc

Microhabitats are small features within a larger area that provide a specific function in the environment for one or more species. Floating logs on a pond provide basking areas for turtles and amphibians, who must regulate their body temperature by basking in the sun. Basking on land leaves them highly vulnerable to predators, dogs, people, bikes, and cars. Rock piles are used as shelter for many terrestrial species such as ground nesting birds and also provides reptiles and amphibians with sheltered, warm habitat.

Recommended Best Management Practice:

BMP Leave structures/habitat features such as basking logs and rock piles in place, or move them to a nearby suitable and safe space (for both wildlife and for people).

BMP Leave large woody debris and the stumps of large diameter trees in place where it is safe to do so.

Steps: If a tree has fallen in a park or other city-owned natural areas, assess if it is safe or appropriate to leave in place. Is it blocking a path or creating a hazard for hikers, swimmers, or watercraft? Will it cause problems for park maintenance, e.g. impede park workers or authorised vehicle access? If it is safe and appropriate to leave the log, then do so. If it is not safe to leave, then consider following:

1. Is there an area nearby where it could be moved? Could the log be dragged to a backwater or bay that isn't used by swimmers and watercraft? Could it be anchored in place? Is there a garden where a fallen log could be used to create visual interest? Is there a forested or meadow area where mowing isn't a concern?
2. Would moving the tree to the nearby location cause damage to the habitat? Are you likely to break other trees or bushes trying to move the fallen tree to the new location? Are you likely to damage the ground cover by moving the fallen tree to the new location? Consider cutting the trunk into smaller sections to avoid damage.
3. Leaving limbs attached to fallen trees can create habitat, but may also make the tree unstable and more of a hazard in public areas. Consider removing some or all of the limbs to address the hazard while leaving the trunk on site.

Similar steps to those taken for fallen trees should be followed for rock piles. Also consider adding rock piles or large woody debris as a beneficial habitat feature in restored or re-naturalized areas.

Benefits:

Fallen logs are useful to a wide variety of wildlife. Small mammals and birds use logs as lookout points and as the tree begins to decay, spaces between the bark and the tree can provide homes for insects, amphibians and reptiles. As the wood continues to break down, it can create a nurse log for new trees and eventually will leave all its nutrients on site.

Floating logs are crucial to turtles, as they need to bask out of the water to raise their body temperature and be able to properly digest food. While rocks along the shoreline may be used, it leaves turtles very exposed to predators. Large basking logs also provide great wildlife-watching opportunities for the public.

Rock piles provide habitat for many species including birds, snakes and other reptiles. Many of these species provide great rodent and insect control. Having rock piles situated away from public spaces could reduce surprise encounters between people and species like snakes that could lead to safety issues. If snakes have suitable habitat, they are less likely to move into more crowded areas.



Painted Turtles using a floating log to bask

Risks or Downsides: Some may see basking logs and large woody debris as unattractive. Basking logs (or any logs in water) may move during storms and may sink over time creating a hidden hazard for watercraft. Anchoring logs can help avoid this issue. Logs left in moving water could block a culvert downstream so anchoring may be necessary. If annual grate/culvert maintenance is already performed, logs could be moved as part of this annual process or help add protection from other debris.

Additional Relevant Links and Information:

<https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf>

<https://xerces.org/sites/default/files/publications/18-014.pdf>

https://bellevuewa.gov/sites/default/files/media/pdf_document/2020/2020-environmental-best-mgmt-practices-manual.pdf

Relevant legislation

Working in and around water

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water>

Management Concern: Cost of maintenance and unnecessary tidying in natural areas

“Untidiness” creates variety in a habitat and results in many different habitat options for different species who may have similar but not exactly the same needs. Dead-standing trees can be great habitats for organisms like birds and insects. A ground cover of tangled bushes and shrubs can hold up river banks with their roots and help prevent erosion. “Messy” natural areas give wildlife places to hide, nest, forage, roost, or hibernate. Allowing leaves to pile under shrubs and reducing pruning of dead vegetation may reduce maintenance costs in the long term by reducing the frequency of staff visits or allow resources to be shifted to other maintenance activities like hand weeding over leaf blowing.

Recommended Best Management Practice:

BMP Reduce the amount of general tidying in natural areas (as long as it does not create a safety hazard)

Steps:

1. Identify areas where extra ‘manicuring’ may not be needed, e.g. passive recreation spaces (e.g. seating areas where habitat for bird watching would enhance the user experience), underutilized areas of parks, or areas to convert to more natural landscaping within ornamental parks to increase acceptance of alternative park aesthetics.
2. Decide which maintenance practices can be adjusted, reduced or eliminated, for instance:
 - Trees and bushes can be left unpruned if they do not obscure pathways or create a fire or safety hazard.
 - Lawn areas can have reduced mowing frequency.
 - Allow some larger debris (fallen branches, logs, etc) to remain in natural areas if they are not an immediate fire or safety hazard.
 - Reduce or eliminate leaf blowing. Where clear pathways are needed, use as mulch and move leaves to shrub areas or tree root zones.
 - Do not prune/cut back perennials in the fall. Dead seedheads are important food and stems are hibernating areas over winter. Plan to cut back in late spring to support new growth and allow pollinators to emerge.
 - When doing necessary chipping, leave organic debris on site and distribute to maximize ground cover (mulch).
 - Leave plants that may be considered “weeds” when they are actually native to the area.

Benefits:

Allowing complexity and ‘untidiness’ to persist in natural areas can help deter people from going off trail into natural areas, thus reducing trail braiding, erosion, invasive weed spread, and improving overall soil health. Allowing ‘untidiness’ also preserves more natural elements in habitats and gives wildlife places to hide and live.



This ‘messy’ forest area has lots of natural structure and complexity for wildlife.

Risks or Downsides: Unmanicured areas are more likely to attract people looking for somewhere to spend the night. There may be safety concerns, e.g. leaving fallen branches near trails may end up across trails causing hazards to cyclists and accessibility concerns to others.

Examples of Municipalities Applying BMP

City of Bellevue, Washington has detailed practices for maintenance of each type of natural area (slopes, riparian areas, forests, etc) https://bellevuewa.gov/sites/default/files/media/pdf_document/2020/2020-environmental-best-mgmt-practices-manual.pdf

District of Summerland: decommissioned unnecessary and braided trails on Giant's Head Mountain
<https://www.summerland.ca/parks-recreation/parks-trails/giants-head-mountain-trail-re-development-plan>

Additional Relevant Links and Information

<https://www.natureconservancy.ca/en/blog/archive/create-a-messy-garden-for.html>

<https://xerces.org/sites/default/files/publications/18-014.pdf>

Management Concern: Lawn/turf growing to the edge of waterways and wetlands

Lawn and turf managed to the edge of a waterway leaves the bank extremely susceptible to erosion, slumping, and flooding. Expanses of lawn also create ideal conditions for Canada Geese, putting our waterways at risk of excessive fecal contamination.

Recommended Best Management Practice:

BMP Create vegetation buffers using native species. A vegetation buffer is when a combination of trees, shrubs, grasses, and wildflowers separates a body of water from upland areas.

Steps:

1. The easiest and cheapest way to create a buffer is to stop mowing right to the edges of ponds, creeks and other waterways. If there are trees and shrubs nearby, they will eventually colonize the un-mowed area. Establish a minimum buffer of at least 3 metres or wider along the edge.
2. If access to the water is needed, consider planting beds in staggered/overlapping groups with access gaps zig zagging between them. Pathways can be maintained via those gaps, but when looking towards the water from inland, the shrubs appear to form a continuous line of vegetation
3. Better buffers can be achieved by planting native riparian plant species. In order to create a buffer of native species:
 - a. Look around the area that you are planning to plant the buffer. Are there any native shrubs growing along the waterway nearby? If so, planting the same species can increase the chance that your plants will thrive.
 - b. If there are no reference plants nearby, hire a biologist to help create a planting plan for your location. (good plants include Red-osier Dogwood, native willow species [e.g. Bebb's, Pacific, Sandbar], Water Birch, Black Cottonwood, Mountain Alder, Trembling Aspen, native wild roses [e.g. Nootka, Prickly], Common Snowberry, cattails, Goldenrod, Showy Milkweed)
 - c. Unless the site is already full of invasive weed species, removing grass and rototilling is strongly discouraged, as bare soil will create the perfect environment for weed seeds to germinate. Instead, pocket plant in the turf. As the new native plants grow, they should gradually get thicker and eventually out-compete the turf grasses.

Benefits:

Vegetation buffers can help protect water bodies from neighbouring disturbances that can damage the bank and surrounding habitats. The strong roots from native plants in the vegetative buffer improve stability of shorelines and creek banks, decreasing the rate of erosion. These buffers will also reduce pollution in the water by having plant roots act as a filter system. More plants will also result in more habitat for wildlife, including songbirds and pollinator. Retaining a riparian buffer along waterways has value in keeping dog feces out of waterways. Water quality testing has shown high levels of dog- and waterfowl-based E-coli as well as other bacteria in parks with no vegetation buffers along shorelines.



This pond bank is slumping and eroding because there is nothing holding it together except a thin layer of turf grass

Risks or Downsides: Once buffers have grown large enough they may provide habitat and dam materials for beavers. Healthy riparian buffers are quite thick and can create vegetative screens leading to areas that are dark or are hard to visually monitor. There are areas where grouping shrub beds may be helpful to create gaps, or more dense planting with prickly shrubs like rose or Oregon grape can help deter human/dog access.



Examples of Municipalities Applying BMP

Upper Thames River Conservation Authority: good info on vegetation buffers

<https://thamesriver.on.ca/landowner-grants-stewardship/farmland-bmps/farmland-bmp-buffer-strips/>

City of North Vancouver: continuous vegetation buffer along most of creek in Heywood Park

<http://www.cnv.org/-/media/City-of-North-Vancouver/Documents/Parks-and-Environment/Parks/Heywood-Park-Master-Plan-Report.ashx> (PDF download)

City of Kelowna: much of Mission Creek Regional Park has significant riparian buffer along shoreline.

Additional Relevant Links and Information

https://www.fs.usda.gov/t-d/pubs/pdf/riparian_restoration/lo_res/04231201LFront.pdf

Management Concern: Destruction of riparian vegetation during work near waterbodies

Riparian vegetation is essential for proper functioning of streams. Riparian buffers provide critical erosion control and flood protection- allowing water to slow, spread, and sink. In some cases, the removal of riparian vegetation is inevitable, creating potential conflict between environmental values and human interests. It is important for projects to make and implement a plan to protect vegetation during works.

Recommended Best Management Practices

The following is directly from the Province of B.C. - "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia." This document represents BMPs for managing riparian vegetation when conducting Changes In and About A Stream (CIAS) that require authorization under the B.C. Water Sustainability Act.

BMP Clearly mark areas of work and access routes prior to starting work (e.g., for work, staging, storage, access) such that the route taken minimizes disturbance to riparian vegetation. Set up Tree Protection Zones as required by arboricultural standards.

BMP Do not remove more riparian vegetation than what is needed for site access and to complete the works. If soil disturbance is not avoidable, use a native grass seed mix (e.g from XEN or Sagebrush Nursery) on exposed soils to minimize the uptake of weeds and invasive species.

BMP Ensure that roots, trees, and shrubs embedded in the stream bank and channel are avoided, and root protection zones are identified in advance of work commencing for any retained vegetation. Plants should only be removed if there are concerns about human safety or the activities or works cannot be completed without their removal. Removal of trees used by birds and other wildlife while they are breeding, nesting, roosting or rearing young should be avoided to the greatest extent possible. Protected trees (e.g., raptor nest sites) must not be removed. To do otherwise would contravene provincial and federal laws.

Steps:

1. Prior to in-stream works, survey area to assess use by birds and other wildlife. Identify areas that are used for breeding, nesting, roosting, or rearing. (Depending on staff expertise, a QEP may need to be hired).
2. Install silt fencing if soils will be exposed, to prevent sediment from entering the waterway. This may also help to deter wildlife from entering the work area.

BMP Limit potential vegetation clearing by using existing trails, roads or cut lines as access routes.

BMP Salvage plants, seed or live stakes (cuttings harvested from neighbouring native trees) prior to disturbance and save for site restoration following the work.

Steps:

1. Plant salvage is not a substitute for conservation and should be done only under special circumstances: if the habitat is disturbed and under certain threat of destruction. Guidance should be sought from a QEP.
2. Identify plant species and ensure no invasive weeds are collected purposefully or through accidental transport via soil/root pieces.

Benefits:

Vegetation buffers can help protect water bodies from disturbances that can damage the bank/shoreline and surrounding habitats. The strong roots from native plants in the buffer improve bank stability, decreasing the rate of erosion. These buffers will also reduce pollution in the water by having plants act as a filter system.

3. Plants should be carefully dug using a sharp spade and retaining as much of the original root structure as possible.
4. Plants should be carefully moved and stored for as little time as possible after salvaging. If salvaged plants must be stored, roots must be kept moist and they should be stored in a cool, damp, shady location.
5. Plants should be used in conditions similar to the original habitat they were salvaged from. Most indigenous plants can take two years to re-establish (possibly one year if the site has a high water table). During the summer for the first 2-3 years, plants should be watered to ensure they do not dry out.

BMP If vegetation on both sides of the stream or stream channel must be cleared, Strategies must be used to limit stream crossings by equipment as much as possible.

BMP Tree protection measures are used where potential adverse impacts to tree parts are identified.

These can include a Tree Protection Zone (TPZ) designed by an arborist, generally an area calculated as the trunk diameter (DBH in mm) divided by 166. For example, an 800mm DBH tree requires a protection zone placed around the tree 4.8m from the trunk. The temporary TPZ barrier must be sturdy enough to remain in place throughout the construction period – usually posts with orange high-vis fencing is used. Nothing can be stored within the TPZ – no lumber, equipment, or other materials – as the weight will compact and damage roots. Where a full TPZ cannot be maintained due to space constraints, thick layers of mulch and plywood sheets may be used to protect roots. Other root pruning or crown pruning may be needed, but this work must be identified and supervised by a certified arborist.

BMP Trees are felled away from the stream or stream channel, unless there are public or worker safety concerns. Trees that are felled into the stream or stream channel are removed during the instream work timing window in a manner that does not damage the bed or banks of the stream (stream channel) and are placed at a site where they will not enter the stream channel during high flows, unless intentionally being used for habitat restoration.

BMP Removal of riparian trees and shrubs using hand tools/saws is preferable over use of heavy equipment to minimize ground disturbance. Where such heavy equipment must be used, limit the area impacted to only what is absolutely necessary and identify a single access point prior to starting work, to protect the bank from ground compaction where practicable.

BMP Wildlife is excluded (such as through fencing) from the project's disturbance area where activities or works could adversely impact wildlife habitat. If wildlife enter the work area, pause activities. If the wildlife are causing an ongoing disturbance to the work, seek advice from a QEP.

Relevant Information and Citation:

For the use by WSA statutory decision makers during the water authorization process:

“Best Management Practices for Riparian Vegetation Protection”. Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia. Version 2022.01. Government of British Columbia.

Management Concern: Facilities Management - Flood protection

As much of the ground in cities tends to be covered with impermeable surfaces such as sidewalks, parking lots, buildings, etc, this creates a situation where water cannot infiltrate into the ground. Large areas of impermeable surfaces can lead to water pooling, stress on stormwater systems, and lack of water replenishment in groundwater sources.

Recommended Best Management Practice:

BMP Create rain gardens to give water a place to pool and slowly infiltrate into the ground, away from structures, parking areas and roads.

Steps:

1. Locate areas where water pooling is a problem.
2. Disconnect gutters and roof drains from draining to impervious areas. Direct runoff so it flows onto permeable areas – lawns, garden beds, treed areas, etc – that allow the water to slow and sink into the ground.
3. Look for nearby, underutilized areas where a rain garden could be installed (e.g. boulevards, park edges, underused low-lying areas of parking lots).
4. Calculate the area needed for an effective rain garden, which is usually about 20% of the impermeable area.
5. Check BC One Call to make sure there aren't any underground pipes or wires.
6. Dig a small test hole (approx 60 cm deep) and add water to the hole until it is about 20cm deep. Check back in about 12 hours- if the water hasn't been absorbed into the ground then it isn't appropriate soil for a rain garden.
7. Create an inlet for water to get into the garden area. This can be simply a sloped area of lawn or a gap in a curb to direct water into an existing garden bed.
8. Seek advice from a biologist on native plants adapted to the different conditions within the garden. Plants in the centre will need to be moisture loving plants while those around the edges are more likely to dry out and may need to be more drought tolerant.
9. Remove soil to a depth of about 60 cm and replace with a sand-compost mix for good drainage, then plant and mulch with compost. Some areas may benefit from added subsurface water storage – add a perforated pipe at the base of the excavation area to act as a dry well and water distribution system.
10. Water during dry spells as needed until plants establish. If native plant species are chosen, they shouldn't need supplemental water for more than 2-3 years.

Benefits:

Rain gardens offer multiple benefits, including reducing strain on storm water and water treatment systems, park beautification, and recharging aquifers and groundwater. By creating a way for storm water to slowly absorb into the ground, that water gets diverted from storm drains and doesn't need to go through a water treatment plant. Rain gardens can also help provide water for other nearby vegetation like boulevard trees. Pollutants are filtered out by both plants and soils in a rain garden. Rain gardens may also double as pollinator gardens



This new rain garden in a parking lot has gaps punched into the curb to allow water to flow in.

Risks or Downsides: Since storm water is washing into rain gardens, it may bring weed seeds, garbage and/or more pollutants than the garden can handle. There is a limit to the pollution filtering capacity of rain gardens; those situated alongside roads or sidewalks where lots of ice melt and salts are used may not be viable long term due to chemical build up. Salt-loving plants like Daylilies (*Hemerocallis* species), Brown-eyed Susan (*Gaillardia aristata*), Little Bluestem grass (*Schizachyrium scoparium*), Coneflower (*Echinacea* species), Showy Milkweed (*Asclepias speciosa*), and Yarrow (*Achillia millfolium*), can extend the life of the rain garden.

Additional Relevant Links and Information

Comprehensive guide to rain gardens in the Okanagan: https://www.rdno.ca/sites/default/files/2021-09/Simple_How_to-with_Manual.pdf

Erosion and Sediment Control Association of BC: <https://escabc.com/https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines>

Management Concern: Invasive plant infestations.

Once there is an infestation of invasive plants, it can be extremely difficult to completely fix the problem. Invasive plants can have thousands of prolific seeds that rest dormant in the ground for years, making them hard to manage once established. Invasive plants are highly aggressive and can out-compete native plants for resources. This then decreases the plant diversity in the area which can affect the wildlife that live there. There is not a single solution to manage all invasive plants, so one procedure that works on one species might not work on another.

Recommended Best Management Practice:

BMP Manage invasive plants appropriately. Take into consideration species-specific characteristics, whether the invasive plant is an annual, biannual, or perennial, the time of year (ie. early season growth vs. seed set), and the severity of the infestation.

Steps:

1. Train one or more staff members on how to identify invasive species
2. Survey parks and natural areas for invasive species. Invasive species are more likely to be found in natural areas than turf parks, but some invasive species were originally brought to BC as garden plants, (e.g. butterfly bush) so check garden areas as well as natural areas. These surveys are best carried out in early summer when plants are green, and possibly flowering to make identification easier.
3. Prioritize which species are of the highest concern. After surveying parks for a complete list, there will likely be more invasive plants than can be easily managed at once. Species may be prioritized in several different ways:
 - highest impact on recreation (e.g. Puncturevine, Longspine Sandbur)
 - easiest to control or eradicate (e.g. species that are not yet common in the area such as Rush Skeletonweed and Puncturevine, or short lived plants with low seed production such as Houndstongue and Burdock)
 - most likely to cause damage to buildings and other infrastructure (e.g. Japanese Knotweed, Tree of Heaven).
4. Develop a weed management plan. Considerations should include:
 - different control methods (mechanical, biological or chemical control)
 - biology of the weed species in question
 - characteristics of the site, and the size and density of the infestation,
 - potential damage caused by the invasive plant,
 - cost of the control method and whether certain control methods may be more harmful to surrounding vegetation/wildlife than leaving the infestation as is, and

Benefits:

Invasive plants can pose risks to infrastructure (e.g. Japanese knotweed), nearby farming operations (e.g. hoary alyssum) and recreation (e.g. zebra mussels, puncturevine), and can also increase wildfire risk. Tackling invasive species early on is often more economical than battling already established species. By having a plan to inventory and budget for invasive species management it may be possible to halt invaders at the borders of your region and prevent more invasive species from becoming established.



Burdock has large burrs that get caught on clothing, hair, and animal fur. It is biennial and may be managed using mechanical control.

- whether reseeding/replanting with native plants is required (i.e. soil is exposed after large infestations are removed)
5. Some staff may need to complete training to be a pesticide (herbicide) applicator.
 6. Aquatic/semi-aquatic invasive plants like milfoil or yellow flag iris require provincial authorizations before removal.

Risks or Downsides:

Invasive plant management is time consuming, labour intensive, and costly. In some urban areas invasive trees may be the only tree canopy available. Invasive trees will grow with no irrigation in some areas and replacing lost tree canopy with other ornamental trees will take time for the trees to mature, and also potentially some irrigation. A replacement plan where the invasive tree is removed after the new non-invasive tree becomes established may be prudent. The invasive tree still may need some management while the new tree establishes and grows.

Additional Relevant Links and Information:

Resource for invasive plant ID and management: <https://www.oiso.ca/>

Invasive Plant Council of BC. Forestry Operations.

https://bcinvasives.ca/wp-content/uploads/2021/01/Forestry_OperationsFINAL_04_24_2019.pdf

Invasive Plant Council of BC. Roadsides: https://bcinvasives.ca/wp-content/uploads/2021/01/Weeds_Roads_BMP_Guide-2019-web.pdf

Invasive Plant Council of BC. Local Government Call to Action Against Invasive Species:

<https://bcinvasives.ca/wp-content/uploads/2021/09/ISCBC-GovAction-180906-WEB.pdf>

Invasive Plant Council of BC. Invasive Species Toolkit For Local Government, Real Estate Professionals and Land Managers:

https://bcinvasives.ca/wp-content/uploads/2021/01/Local_Govt_Real_Estate_Toolkit_18.12.18_WEB_.pdf

Management Concern: Spreading of invasive plants through people, equipment, and machinery.

Invasive plant seeds are prolific and attach themselves easily to clothing and equipment, leading to inadvertent spreading of invasive weeds to other areas that might have been otherwise unaffected. The invasive plants can then take over the new area and continue to spread. This decreases the biodiversity and complexity in the area, making it less habitable for our native species. Some invasives, like Common Burdock, can even directly affect wildlife; clusters of burrs can trap birds and bats and may result in their death. Once invasive plants establish in an area, it can be difficult to remove them and will end up being a continuous management issue.

Recommended Best Management Practice:

BMP Before moving onto a new site, clean all machinery and get rid any plant material or seeds. Also for any workers on site, clean off boots and clothing before leaving the site to help contain the spread of invasive plants. Install boot brushes at entrance points to well used to trails to help minimise the spread of invasive species. ***This is not applicable to turf parks, only natural areas where invasive species are present. This is most important at sites with infestations of most problematic of weeds. See Table 1 in Appendix A for an overview of common invasive plants.*

Steps:

1. Create a designated equipment washing area. This area must have water spigots and good drainage
2. When planning work days, plan to move from sites with fewest numbers of invasive species to sites with more invasive species. If working on a property where only part of the site has invasive species always start work in the “clean” areas and move into the areas with invasive plants.
3. When moving from a higher infestation site to a lower infestation site, stop at the washing area and use high powered washers to ensure machinery is clean. Areas of particular concern include wheel wells, tires, grills, undercarriages, truck beds, etc. If using smaller equipment like weed whackers or brush cutters, ensure that they are also cleaned and that the bed of the truck used to transport them also gets washed out.
4. Have workers use brushes to remove seeds from pants and boots, either before leaving the infected site or at designated cleaning area where seeds will not be spread or be able to sprout
5. Don't move people or equipment from areas with invasive species to areas without invasive species without first stopping to clean equipment and clothing.
6. Keep in mind that one site may have only Invasive Species A and a second site may only have Invasive Species B. In that case you would want to make sure to clean equipment before moving from either site to the other.

Benefits:

If invasive plants are not spreading, native plants will not have to compete and potentially be taken over by the more aggressive plants. Managing seeds can help keep natural areas functioning as good habitat. Native plants are better suited for native species and provide better, more complex habitat. There would also be less operational costs and less work related to invasive plant management.



Invasive seeds can spread on almost any kind of equipment or fabric. Using good cleaning methods is important to prevent the spread of invasives.

Risks or Downsides:

Taking time to clean personnel and equipment between sites will take extra time, particularly if you need to go back to a city yard or other designated cleaning area. This extra cost is compensated for by reduced time and money spent managing new infestations of invasive species.

*Make sure that equipment won't be damaged by high-pressure washing. *

Additional Relevant Links and Information

District of North Vancouver Invasive Plant Management Strategy: <https://www.dnv.org/community-environment/invasive-plant-management-strategy>

Management Concern: Disturbed areas or informal trails

Disturbed soil and informal trails can easily be taken over by invasive plants since these plants quickly establish themselves in open areas if left unmanaged. Leaving informal trails can also promote the use of these unwanted trails or the creation of other trails that can destroy ground nests, delicate plants, and habitats.

Recommended Best Management Practice:

BMP Plant native plants in disturbed areas to help reclaim the habitat. A high diversity of plants should also be used when replanting. Connect with restoration ecologists and/or local stewardship groups for guidance.

Steps:

1. Look at the disturbed area and decide what is needed. Minor disturbances like desire paths and short, narrow side trails can sometimes simply be blocked off with signs, boulders, and/or large woody debris and left to heal on their own. Larger areas such as wide or heavily braided trails will need more intervention
2. If the site does need extra work, connecting with habitat biologists or conservation organizations may be the best option to create the best restoration plan. Look at plants doing well nearby for ideas on which native species to re-plant with.
3. The disturbed area will need to be physically blocked off until the new plants have fully established, which may take several years depending on the habitat and level of disturbance. Protection caging to deter rodents or deer may also be necessary.

Risks or Downsides: There is a cost of acquiring plants/seed and creating a restoration plan. If the restored area is one that the public is used to using, people may move barriers aside if they are not adequately large, sturdy or heavy. Trails may also be hard to restore due to soil compaction.

Examples of Municipalities Applying BMP

City of Edmonton:

<https://www.edmonton.ca/sites/default/files/public-files/City-Wide Natural Area Management Plan.pdf?cb=1688077385>

District of Summerland Giant's Head Park Redevelopment:

[https://www.summerland.ca/docs/default-source/parks-recreation/18-06-07_ghm_trailsredevelopmentplan_final-\(1\).pdf?sfvrsn=6c47f5fb_0](https://www.summerland.ca/docs/default-source/parks-recreation/18-06-07_ghm_trailsredevelopmentplan_final-(1).pdf?sfvrsn=6c47f5fb_0)

Additional Relevant Links and Information

<https://www.xeriscapenursery.ca/>

<https://www.sagebrushnursery.com>

https://xerces.org/sites/default/files/publications/21-038_02_Parks-Guidelines_web-screen.pdf

Benefits:

More native plants and less invasives results in healthier habitat for native wildlife. Native plants are easy to manage once established and no work would have to be done to manage and remove invasive plants. Having less disturbed areas also just means more habitat in general. Additionally, covering any informal trails can encourage people to use the main trail, meaning less upkeep from the additional trails. Restoration sites can provide excellent opportunities for educational signage.



Photo courtesy of the Central Lake Ontario Conservation Area

Using large logs or rocks makes it more difficult for persistent users to continue accessing the trail. Temporary signage may be helpful.

Management Concern: Mowing over ground-nesting wildlife habitat

There are many ground-nesting birds and small mammals that live in tall grasses in more undeveloped areas. Frequent mowing of these areas can disturb or even cause harm to these species as they are nesting and raising young, since they are hard to detect in tall grass. If timing is not considered, nests and young could be mowed over without a chance to escape. Grass and other vegetation next to creeks and wetlands also provide bank stability, flood protection, and erosion control.

Recommended Best Management Practice:

Do not mow certain areas with wildflowers or in areas with known ground nesting birds. Complete walk-throughs in grassy areas to check for nests and encourage wildlife to move prior to mowing. Develop wildlife-sensitive mowing schedules - time mowing for the summer when the heat reduces the grass growth and to coincide with recreation/operational activities requiring mowed spaces.

Steps:

1. Evaluate undeveloped grassy areas that get regular mowing. What is the reason for mowing? If it is simply aesthetics, consider converting the area to a no-mow area.
2. If the area does need occasional mowing, consider holding off until the most critical period of the nesting window (approximately April-June) is over.
3. After the critical nesting period is over, visual checks and walkthroughs should still be performed before mowing in July and August to ensure there are no lingering nesting birds.

Risks or Downsides: The first mow after the critical nesting period may take longer due to extra vegetation growth. Public complaints may increase, requiring signage to educate residents on the value of no-mow and low-mow lands.

Examples of Municipalities Applying BMP

City of Saanich - has undeveloped grass areas that are mowed infrequently and have schedule mowing that takes into consideration time of year and condition of the area

City of Kelowna - Millard Glen Park, Disc Golf Course on Knox Mountain

Additional Relevant Links and Information

<https://www.saanich.ca/EN/main/parks-recreation-community/parks/park-maintenance/mowing-schedule.html>

Benefits:

No-mowing zones or less frequent mowing can help protect ground-nesting birds such as ducks, quail, killdeer, and shorebirds. Grass and wildflowers that are left to bloom can also be beneficial to insects and pollinators. Furthermore, there will also be less maintenance required in these areas. If the grass is mowed when the heat is strong, the grass will not grow as quickly, meaning more infrequent mows. Letting these areas grow naturally requires less water to maintain (good for water conservation). Not mowing and having vegetation around waterways will result in less flooding and erosion during the wet season since the plants will better stabilise the banks



Many local bird species nest on the ground. Mowing over nests can kill eggs and chicks or leave them extremely vulnerable to being seen by predators

Management Concern: Mowing patterns putting wildlife at risk

Certain mowing patterns can trap wildlife and can cause them a lot of stress or potential harm. Wildlife will naturally move to areas with more cover and vegetation instead of open areas where they are vulnerable to predators (CITE?). If wildlife are in an area that is getting mowed, they will continue to move into unmowed areas. This can lead them to getting trapped in an unmowed area surrounded by an open mowed area. In some of these certain cases, the animal will not move away from the mower until it is too late (i.e. is harmed by the mower) because the idea of the open area is more stressful than the approaching equipment.

Recommended Best Management Practice:

BMP Alter mowing patterns such that you mow towards habitat areas/safe areas or towards escape routes (i.e. avoid mowing towards a single area that may trap wildlife)

Steps:

1. Before mowing, do a visual check of the area to look for wildlife.
2. Establish which areas might be wildlife habitat (ponds, forests, wetlands, lush gardens, areas of longer grass that aren't regularly mowed)
3. Mow from areas without habitat towards areas with habitat. Start from areas beside roads, paths or other hard surfaces and work towards habitat areas. Depending on the size of your mower and the park layout, you may need to drive back over mowed areas to get to your un-mowed areas.

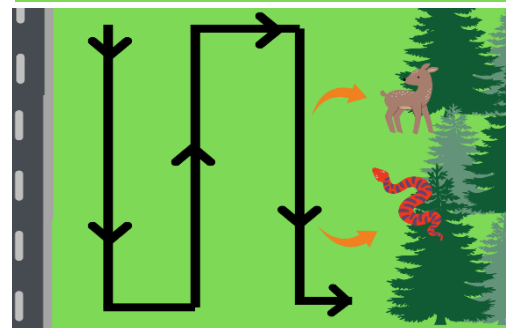
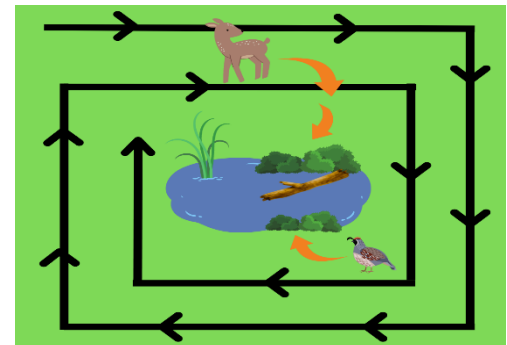
Risks or Downsides: Wildlife-friendly mowing patterns may be slightly less efficient, but wildlife like amphibians, reptiles, and young birds like killdeer or baby quail may be saved by mowing this way.

Additional Relevant Links and Information

<https://www.conservationevidence.com/actions/698>

Benefits:

Altering mowing patterns can give a chance for ground dwelling wildlife, such as fawns, baby birds, snakes, amphibians, to escape into a safe environment. Mowing can still be done while taking into account the safety of the species around.



Alternative mowing patterns (mowing towards habitat areas) allow wildlife to escape somewhere they feel safe.

Management Concern: Coordination and timing of work does not take wildlife into consideration

There are certain times of year where wildlife or habitat are more vulnerable to harm. Doing work in or around water during these times can have a disproportionately negative effect than if work was carried out during designated instream work windows, which generally occur during the lowest flow periods of the year. Fish and amphibian eggs are particularly vulnerable to harm, so work in a fishbearing stream is often prohibited until mid-late summer when the previous year's hatch is completed but current year spawning has not yet taken place. Vulnerable times are not just for wildlife, but the condition of the stream as well. When water flows are high, there can be higher chances of eroding creek banks while working since they are already getting pressure from the high flows.

Recommended Best Management Practice:

BMP Establish Work Timing Schedules where there is a reduced risk in damaging the stream ecosystem and stability. These are times when working in a stream is permitted based on environmental conditions (Fisheries Windows are set by the province) during different times of year.

Steps:

1. Decide if the work that needs to be completed must encroach on aquatic or riparian habitat. If the work can be done in a way that doesn't affect aquatic wildlife or habitat, that is always the best choice.
2. If the work will affect the habitat, figure out whether a provincial Notification or a Permit will be required and gather the required information and paperwork. The Working Around Water - Province of British Columbia Guide may be helpful. See link below.
3. Submit the necessary notification or permit application to FrontCounter BC (link below). Processing time is often more than double the estimated wait time, so plan accordingly. Your local government may also require a permit for work in a riparian (upland) area, even for government projects.
4. Conduct all works within the exact parameters and timing window laid out in the notification or permit.

Benefits:

Working during instream work windows minimizes risks to fish and other wildlife. Because of this, these work windows are the only time of year when work in and around water can legally be done, aside from emergency works.

Risks or Downsides: Work windows are often short (they can be under a month!) making it difficult to get work done in time. Because work windows only come around once a year, there can be a significant delay to works while waiting for the work window to open. Early planning is needed if you need to hire contractors that specialize in this work, so you can be sure they'll be available during the limited work window.

Relevant Legislation and Links

Okanagan, Similkameen and Upper Shuswap Fisheries Timing Windows (*these change each year*):

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/2018_fish_timing_windows_okanaganregion_final.pdf?bcgovtm=news

Front Counter BC: <https://portal.nrs.gov.bc.ca/web/client/home>

Working Around Water - Province of British Columbia Guide

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water>

Management Concern: Excessive fertilizer use

Fertilizer run-off is a big concern when it comes to water quality. When fertilizers are applied to an area near water, rain can wash some of the nutrient-rich fertilizer into waterways. Reductions in water quality have been shown to negatively impact salmon, turtles, salamanders, frogs, and many other aquatic species. Excess nutrients in waterways can also lead to unsightly and smelly algae blooms that can pull all the oxygen out of the water and suffocate other plants and wildlife.

Recommended Best Management Practice:

BMP Do not apply fertilizers, plant non-native legumes, or leave grass clippings close to waterways. Reduce fertilizer use and be very cognizant of locations where runoff is high near storm drains. Use alternative fertilizers or fertilizing methods such as compost top-dressing. If using fertilizer be sure to use it in compliance with the manufacturer labelling for safe application rates.

Steps:

1. Analyse current fertilizer use and decide where fertilizing can be reduced or even eliminated.
2. If fertilizer is needed, assess whether alternative methods are suitable. Depending on the area, alternatives can include:
 - a. Incorporating nitrogen fixing plants into the area (e.g. clover in lawn areas)
 - b. Leave lawn clippings on-site to break down and enrich soil
 - c. Top dress the area with compost
3. If alternative methods are not suitable, consider using organic fertilizers derived from animal/plant matter sources, as they are less water soluble than synthetic fertilizers.
4. If synthetic fertilizers are truly needed, apply the minimum amount needed and ensure fertilizer is spread at least 15 metres away from bodies of water and stormdrains and when there is no rain forecast.

Risks or Downsides:

Alternative methods such as top dressing or leaving clippings may be less aesthetically pleasing.

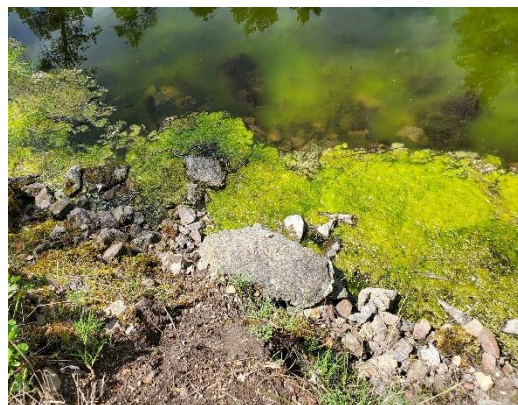
Additional Relevant Links and Information

National Recreation and Park Association: more information on OLMs and IPMs and its uses: [https://www.nrpa.org/parks-recreation-](https://www.nrpa.org/parks-recreation-magazine/2019/march/managing-city-parks-without-synthetic-pesticides-or-fertilizers/)

[magazine/2019/march/managing-city-parks-without-synthetic-pesticides-or-fertilizers/](https://www.nrpa.org/parks-recreation-magazine/2019/march/managing-city-parks-without-synthetic-pesticides-or-fertilizers/)

Benefits:

Overall, using alternative techniques can help provide cleaner and healthier water, both for humans and wildlife. Reducing fertilizers also reduces water runoff contamination, which can reduce pressure on water treatment systems and decrease summer algae blooms. Those blooms have made lakes un-swimmable in recent years.



Excessive algae blooms in ponds and other watercourses can often be attributed to excess nutrients from fertilizer runoff.

Management Concern: Using pesticides as the only source of pest control, especially near water sources.

Many birds and bats rely solely on insects as their source of food. Eliminating insects with pesticides, reduces the amount of food available to birds and bats. Other species like bees and butterflies can be affected negatively by the use of pesticides. These insects are important pollinators that are crucial in pollinating the food we eat. Pesticides can leach into water and cause pollution. This can harm fish but is especially harmful to amphibians. If using pesticides be sure to use them in exact compliance with the manufacturer labelling.

Recommended Best Management Practice:

BMP Reduce use of chemical pesticides wherever possible and implement Integrated Pest Management strategies. Use conventional pesticides as a last resort only. If using conventional pesticides, be very cognizant of spray drift, do not use near water, and ensure applications are focused and specific. Integrated Pest Management techniques include: prevention (monitoring conditions of plants and pests that may or may not be present), biological control (introduce suitable insects that can help manage the pests), plantings to encourage predatory insects or insectivorous birds, and low-toxicity insecticides.

Steps:

1. Identify the type of insect that is causing your issues.
2. Determine the likely outcome if the insects aren't treated: Will the insects kill the host plant? Will they spread and damage other plants? Will they get killed off by frost or persist into future years? If this insect is only a problem to a particular ornamental plant, can those plants be replaced with a more resistant species?
3. Are there mechanical methods for control (e.g. trimming out tent caterpillar nests and removing them)?
4. If herbicide or pesticide applications are to be used, they should be used according to the label by a staff-person with a pesticide applicator's license. Care should be taken to ensure the pesticide is chosen according to:
 - Specific pest
 - Waterbody type and uses
 - Wind
 - Temperature
 - Water depth
 - Efficiency

Benefits:

Using alternative methods, pests can be eliminated without harming other important insects like butterflies, bees, and other pollinators. Reducing insecticide use will also benefit birds and bats that rely on insects as their main source of food. Using pesticides responsibly will additionally reduce the amount of these chemicals entering water bodies and will improve water quality.

Risks or Downsides: If caught early, pest infestations may be spot treated and little pesticide may be needed. If trying other management methods is not successful, the initial infestation will have time to spread and may be harder to control and require more pesticide use than would have originally been needed. Unchecked insect outbreaks may harm or kill their host trees and shrubs.

Examples of Municipalities Applying BMP

<https://www.calgary.ca/parks/pesticide-free.html>

Additional Relevant Links and Information

<https://www.xerces.org/pesticides/pesticides-urban-environments>

Management Concern: Using herbicides as the only source of weed control, especially near water sources.

Herbicides may be harmful to both human and wildlife health. Some herbicides remain active in the soil for years after they are applied and hinder growth of desired plants. Herbicides may run off into water and negatively affect water quality. Herbicides generally will kill both target plants and also any other plants that are exposed. Herbicides may also negatively impact soil biodiversity, leading to the need to use more fertilizers or do more mechanical aeration. If using herbicides, be sure to use them in compliance with the manufacturer labelling for safe application.

Recommended Best Management Practice:

Reduce use of herbicides wherever possible and implement Integrated Weed Management strategies. Use conventional herbicides as a last resort only. If using conventional herbicides, be very cognizant of spray drift, do not use near water, and ensure applications are focused and specific.

Integrated Weed Management techniques include prevention (monitoring conditions of plants and pests that may or may not be present), biological control (introduce suitable insects that can help manage the weeds), mechanical removal of weeds (eg: hand pulling), and using lowest-toxicity herbicides.

Steps:

1. Identify the plants or weeds you want to control and determine if these plants cause problems if left alone. (e.g. dandelions in a portion of a turf park may be unsightly, but don't cause any real "risks" by being there. Puncturevine, by contrast, is a problematic invasive plant that can cause injuries to humans and pets).
2. Determine if there are biocontrol insects for the plants in question and, if so, whether they are present at your site. If they are present, manage the invasive plant population to maintain a population of the biocontrol insects.
3. Consider the following: Can the plant be controlled through mechanical means such as hand pulling, mowing, tilling and replanting, or smothered with mulch?
4. If herbicide or pesticide applications need to be used, they should be used according to the label by a staff-person with a pesticide applicator's license. Care should be taken to ensure the correct pesticide is chosen, taking into account:
 - Specific plant or pest
 - Waterbody proximity, type and uses
 - Wind
 - Temperature
 - Water depth
 - Efficiency

Benefits:

Reducing unnecessary herbicide use can reduce health risks to both humans and animals that may be exposed to residues in parks or other natural areas. Reducing herbicide use may improve the soil microbiome and restore its natural processes, reducing the need for as much fertilizer and mechanical aeration.

Risks or Downsides:

A large area can be treated with herbicide relatively quickly. You may not have the resources to effectively manage weeds in any other way. Some plants are very, very difficult to manage without using herbicides (e.g. Tree of Heaven.)

Examples of Municipalities Applying BMPs

City of Calgary: <https://mapgallery.calgary.ca/apps/thecityofcalgary::integrated-weed-management/explore>

Additional Relevant Links and Information

https://bcinvasives.ca/wp-content/uploads/2021/01/Local_Govt_Real_Estate_Toolkit_18.12.18_WEB_.pdf

Management Concern: Using rodenticides to manage rodents

Rodenticides have been shown to have staggering negative effects on local wildlife populations through direct and secondary poisoning. Songbirds, reptiles, and non-nuisance small mammals such as shrews and voles have been shown to visit bait stations, leading to the death of many of these animals and the effects of secondary poisoning (ingestion of poison by ingesting another poisoned animal) have been well documented in both wild animals and pets. Owls and hawks are particularly susceptible to secondary poisoning, and it is even mentioned in official government Recovery Strategies for some endangered species like Barn Owls.

Recommended Best Management Practice:

BMP Better alternatives to rodenticides include: trapping, access prevention (making it harder for rodents to enter different facilities), and attractant management (if possible reducing what the rodents are attracted to - eg: wood piles, garbage, compost, and potential food sources).

Steps:

1. In areas with rodent problems look for attractants (or hire a pest management company to help with this step)
 - a. Remove attractants that can be removed (eg fallen fruit or nuts from ornamental plants, collect trash from parks more frequently)
 - b. Demolish unused structures and clean up cluttered areas or any debris
 - c. If attractants can be moved to a rodent proof container, make sure they are in rodent proof containers. (eg, metal garbage cans, or consider distributing rodent proof trash cans to residents)
 - d. Create by-laws around leaving pet food outdoors, or leaving birdseed accessible to rodents or on the ground.
2. In buildings with rodent problems look for how the rodents are getting in (a mouse can squeeze through a hole the size of a dime, a rat can get in through a hole the size of a quarter). Once access points are identified plug them with fine (¼ inch) mesh or steel wool. Buildings can also try using ultrasonic pest repellers.
3. Use snap traps inside bait boxes. Keeping traps in bait boxes keeps non-target wildlife, pets and humans safe. Snap traps can generally only catch one mouse/rat at a time so they will need to be checked frequently.
4. Do not keep traps/bait boxes out if you aren't trapping rodents. Bait stations (including poison) can attract rodents and bait boxes can provide safe predator free housing once the trap has been triggered.
(<https://savearlingtonwildlife.org/alternatives-to-rodenticide/>, <https://www.mrpackrat.net/problems-with-poison>)
5. Rodents are attracted to the smells left behind by rodents. Clean up any areas where there has been a rodent infestation, preferably either through pressure washing or spot cleaning with a bleach solution.

Benefits:

Avoiding rodenticides helps protect wildlife such as owls, hawks, and other predators from getting secondary poisoning. This includes pets, like cats and dogs that can be poisoned through hunting these by eating poisoned rodents. Attractant management and prevention of future rodent infestations will reduce costs long term. Using physical traps like snap traps are faster and more humane than poisoning and also allow for sanitary disposal of carcasses, whereas poisoned rodents may die in walls or air vents where removal is difficult and their decomposing bodies can cause unpleasant odours and create health concerns



Rat poisons can lead to the death of entire wildlife families, especially in spring when parents are bringing potentially-poisoned food back to their young.

6. Glue traps are generally not used at large scales but should be avoided. They also often catch non-targeted wildlife and are a very cruel and inhumane method of killing.

Risks or Downsides:

Rodenticides are used because they are cheap and efficient. Switching to mechanical traps will mean that fewer rodents can be killed in a short period of time and that costs will be higher as traps will need to be checked, emptied and reset more frequently. Using mechanical methods the city (or contracted pest control company will also need to handle and dispose of dead rodents). If they are poisoned the bodies often aren't found.

Examples of Municipalities Applying BMPs

Port Moody has strict restrictions on rodenticide use <https://www.portmoody.ca/en/recreation-parks-and-environment/rodents.aspx>?

Additional Relevant Links and Information

https://www2.gov.bc.ca/assets/gov/environment/pesticides-and-pest-management/legislation-consultation-new/bmp_rodent_ipm_for_public.pdf

Additional References

A Users' Guide for Changes In and About A Stream in British Columbia Understanding your obligations under the Water Sustainability Act and Water Sustainability Regulation

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-users_guide.pdf

Natural Resource Best Management Practices

<https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices>

Environmental Best Management Practices: An annotated bibliography and searchable database.




http://www.stewardshipcentrebc.ca/PDF_docs/BMP_Final_Dec_2009.pdf




APPENDIX A: Invasive Plants




Knowing the species-specific characteristics will help determine what the management priorities are and the most efficient way to go about the infestation. Recreation values will increase in areas with a reduction in invasive species.




- Severe invasive species infestations can depress property values.
- Kelowna's natural environment supports a wealth of recreational activities including hunting, fishing, hiking, horseback riding, bird watching, wildlife viewing, camping, mountain biking, picnicking, interpretive programs and photography. Invasive species can impact all of these activities by damaging habitat, impacting fish and wildlife, obstructing trails and recreation equipment, impacting human safety and reducing aesthetics.
- Invasive species directly affect human health and safety in many ways. Poison Hemlock produces skin burns that can cause blisters and long-term scarring.
- Invasive plants have a wide range of detrimental impacts on agriculture, range and forest industries. In BC, the economic impacts of just seven invasive plant species, in the absence of any management, were estimated to be a minimum of \$65 million in 2008, rising to \$139 million by 2020 (Frid et al. 2009).
- Some invasive species such as knotweed (*Reynoutria* spp.) have the ability to cause severe damage to infrastructure and facilities by penetrating concrete and other materials, damaging roads, foundations and drainage systems and inevitably leading to increased costs for maintaining resources and public utilities. Aquatic invasive species such as zebra (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformisbugensis*) create massive colonies that can block water intakes and interfere with municipal water supplies as well as agricultural irrigation and power plant operations.
- Biodiversity: In 1998, the World Conservation Union declared invasive species to be the second greatest threat to biodiversity on the planet, second only to habitat loss. In BC, it is estimated that 25% of our endangered species, 31% of our threatened species, and 16% of our species of special concern are negatively impacted by invasive alien species (Voller and McNay 2007).
- Fire Hazard: Some invasive plant species are extremely flammable and can disrupt natural fire cycles, causing an increased fuel bed load and frequency of fires. For example, cheatgrass provides a continuous bed of highly flammable fuel that can readily carry a fast-moving fire.
- Legal Requirements: Uncontrolled invasive plant infestations on public lands may place local governments in contravention of other provincial and federal laws. The BC Weed Control Act, Integrated Pest Management Act, and Forest and Range Practices Act provide legislation for invasive plant management at the provincial level.




Table 1: Common Invasive Plants found throughout the Okanagan and Similkameen Region.




Invasive Plant	Image/Description	Life Cycle	Management/Notes	Resources
Burdock <i>Arctium minus</i>		Biennial	Easy to control by digging out the crown (top 3-4") of the taproot and bagging old stocks. Burrs are easily picked up and spread by people, animals and wildlife walking by.	https://bcinvasives.ca/invasives/burdock/
Canada thistle <i>Cirsium arvense</i>		Creeping rooted perennial	Found in moist locations.	https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/weeds/canada-thistle
Common tansy <i>Tanacetum vulgare</i>		Perennial - spreads by seeds and roots	Sap is a skin irritant - wear gloves when dealing with it.	https://www.nwcb.wa.gov/weeds/common-tansy




<p>Dalmatian toadflax <i>Linaria dalmatica</i></p>		<p>Creeping rooted perennial.</p>	<p>Manual removal is often ineffective due to creeping roots. Look for presence of biocontrol insect (small black weevil on stems). If present, the insect does a fair job of keeping the number of individuals down.</p>	<p>https://www.nwcb.wa.gov/weeds/dalmatian-toadflax</p>
<p>Hoary alyssum <i>Berteroa incana</i></p>		<p>Annual to short-lived perennial.</p>	<p>*Toxic to horses. Do not let them consume it fresh or dried in hay.</p>	<p>https://extension.umn.edu/horse-pastures-and-facilities/hoary-alyssum</p>
<p>Mullein <i>Verbascum thapsus</i></p>		<p>Biennial to short-lived perennial</p>	<p>While a bit unsightly, is not aggressive and almost never invades heathy habitats</p>	<p>https://hort.extension.wisc.edu/articles/common-mullein-verbascum-thapsus/</p>

<p>Oxeye daisy <i>Leucanthe-mum vulgare</i></p>		<p>Perennial - spreads by seeds and rhizomes.</p>	<p>Escaped ornamental that is still found in generic wildflower seed mixes, so any seed mixes should be sourced from local native nurseries</p>	<p>https://abinvasives.ca/wp-content/uploads/2021/06/140516-FS-OxeyeDaisy1386.pdf</p>
<p>Rush skeletonweed <i>Chondrilla juncea</i></p>		<p>Tap-rooted perennial plant that can spread by seed, root pieces (2 cm) and root buds near top of tap root.</p>	<p>Very difficult to eradicate. Take care to clean equipment/boots between sites that have Rush Skeletonweed and those that do not.</p>	<p>https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5410124.pdf</p>
<p>Sulphur cinquefoil <i>Potentilla recta</i></p>		<p>Perennial- spreads by seeds and stolons</p>	<p>Difficult to eradicate. Tackle this plant when patches are small or you notice it in new areas.</p>	<p>https://kingcounty.gov/en/legacy/services/environment/animals-and-plants/noxious-weeds/weed-identification/sulfur-cinquefoil</p>

<p>Hound's Tongue</p>		<p>Biennial to short lived perennial</p>	<p>Hand pulling can be effective for small infestations. Mowing will not eliminate plants but may reduce seeds.</p>	<p>https://fieldguide.mt.gov/species/Detail.aspx?elcode=pdbor0b070</p>
<p>Poison Hemlock</p>		<p>Biennial</p>	<p>Hand pulling or digging can be effective, but PPE must be worn to avoid skin contact with the plant. Plant can grow to 10 feet, if hand pulling tackle early in the season.</p>	<p>https://www.tnrd.ca/invasive_plant/poison-hemlock/</p>
<p>Puncture vine <i>Tribulus terrestris</i></p>		<p>Annual - shallow tap root</p>	<p>Viciously sharp seeds can pierce skin, bike tires, dog paws</p> <p>Hand removal (do before seed set or wear THICK gloves) or hoeing prior to seed set can be effective. Mulch applied over the winter or before seeds germinate can be effective.</p>	<p>https://www.oiso.ca/species/puncturevine/</p>

<p>Russian Knapweed <i>Rhaphonticum repens</i></p>		<p>Perennial – spreads primarily through roots</p>	<p>Repeated mowing at ground level can exhaust root reserves, this will take several years.</p>	<p>https://fviss.ca/invasive-plant/russian-knapweed</p>
<p>Spotted Knapweed</p>		<p>Biennial or short lived perennial</p>	<p>Pulling cutting and mowing are most effective prior to flowering. Biocontrols do exist and help to control spotted knapweed</p>	<p>https://bcinvasives.ca/invasives/spotted-knapweed/</p>
<p>Diffuse Knapweed</p>		<p>Biennial or short lived perennial</p>	<p>Pulling cutting and mowing are most effective prior to flowering. Biocontrols do exist and help to control spotted knapweed</p>	<p>https://bcinvasives.ca/invasives/diffuse-knapweed/</p>

<p>Russian thistle <i>Salsola</i> <i>tragus/Salsola kali</i></p>		<p>Annual – breaks off at base and becomes a “tumble weed” spreading seeds and collecting along fencelines</p>	<p>Strongly recommend manual removal when plant is young. Mature plants are extremely spiny and difficult to deal with.</p>	<p>https://fviss.ca/invasive-plant/russian-thistle</p>
<p>Chicory <i>Cichorium intybus</i></p>		<p>perennial</p>	<p>Generally seen as a “roadside weed” does not invade natural habitats well. Can look similar to rush skeleton weed</p>	<p>https://www.montana.edu/extension/invasiveplants/extension/monthly-weed-posts/2021_november-chicory.html</p>
<p>Hoary cress <i>Lepidium draba</i></p>		<p>Perennial</p>	<p>Is allelopathic, meaning it produces a chemical from its roots that prevents other plants from growing and enabling itself to spread</p>	<p>https://www.tnrd.ca/invasive_plant/hoary-cress/</p>

<p>Myrtle spurge <i>Euphorbia myrsinites</i></p>		<p>Perennial</p>	<p>Sap is a strong skin irritant that can cause rashes and even blistering. Use gloves if handling</p>	<p>https://www.oiso.ca/species/myrtle-spurge/</p>
<p>Yellow flag iris <i>Iris pseudacorus</i></p>		<p>Perennial</p>	<p>Permits required for working in and around water. Flowers or seed heads can be clipped to reduce spreading through seeds.</p>	<p>https://bcinvasives.ca/invasives/yellow-flag-iris/</p>
<p>Purple loosestrife <i>Lythrum salicaria</i></p>		<p>Perennial</p>	<p>Permits may be required for management activities</p>	<p>https://bcinvasives.ca/invasives/purple-loosestrife/</p>

Japanese knotweed



Perennial

Often called 'bamboo', but is nearly impossible to eradicate. Can destabilize building foundations and push through cement and concrete.

<https://www.oiso.ca/species/knotweed/>