Cypress Provincial Park Invasive Plant Management Strategy

Version June 22, 2017
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Acknowledgements

Cypress Provincial Park has had benefit of countless staff and volunteers dedicated to the issue of invasive species since their impacts in the park were first realized. This strategy would not have been possible without the support of many of these dedicated and knowledgeable people. Some of them spent considerable time compiling resources and sharing information about the park during the development of this strategy. Thank you to everyone who contributed to this project and who will continue to ensure that Cypress Provincial Park is a special place for years to come.

Appendix E provides a list of stakeholder organizations who have historically been involved in invasive plant management at Cypress as well as those who were consulted during the development of this strategy. In addition, several stakeholders are listed in Appendix E who have not been involved to date but may potentially wish to be involved in the future.

Executive Summary

Invasive plants are those which occur outside their natural range and can have significant ecological, social and/or economic impacts once established[1]. Cypress Provincial Park is home to regionally significant native plant communities and offers some of the most accessible subalpine ecosystems in the Lower Mainland. The park's proximity to a large urban center, extremely high visitor numbers and large, cleared land base maintained for ski recreation make it particularly vulnerable to the introduction and spread of invasive plant species.

The park's undisturbed natural areas are relatively free of invasive plants. With a few exceptions, invasive plants are mainly confined to the developed, high use areas of the park (e.g., ski runs, ski facilities, trail edges and roadsides). However, there is an ongoing risk of invasive plants spreading into the park's natural areas. Soil disturbance through construction, maintenance activities, over-use or natural events (e.g. tree blowdowns) presents the greatest risk for invasive plants to become established in the park.

At least seventy introduced non-native plant species have been observed in the park. Over half of these plants are recognized invasive plant species. The vast majority of invasive plants occur at relatively low levels of abundance in the park. Several particularly high risk species are present including giant hogweed (which can cause severe skin burns), knotweed (which can grow through asphalt and take over riparian areas), and reed canarygrass (which can alter and degrade wetland and riparian areas).

Over the past two decades there have been many efforts to control invasive plants in the park. Treatment programs led by BC Parks have dramatically reduced the abundance of giant hogweed and knotweed, and recently BC Parks began a treatment program to reduce the risk of reed canarygrass spreading into wetland complexes. Volunteers, particularly Friends of Cypress Provincial Park (FCPP), have played a key role in detection and reporting new invasive plant occurrences as well as contributing thousands of hours towards manual control of certain species. Cypress Mountain also stewards the ski areas. Their invasive plant management efforts have included ongoing control of Scotch broom on ski runs and establishing a protocol in 2012 to protect the park from arrival of invasive plants in imported substrates.

This Strategy provides a plan for management of existing invasive plants in the park and direction for prevention and management of new infestations. The strategy will foster communication, consistency, cooperation and efficiency in management actions among all land managers and stakeholders in and adjacent to the park. BC Parks will lead implementation and ongoing review and updates of this strategy, with input from key stakeholders.

[1] Canadian Food Inspection Agency. Invasive Alien Plants in Canada – Summary Report.

Summary of Recommendations

PREVENTION

- Design a process for BC Parks to respond to reports of new high priority invasive plant occurrences to confirm identification, map their locations and arrange appropriate treatment. Report occurrences of provincial EDRR species to the Provincial EDRR coordinator and park stakeholder groups.
- Create an EDRR list specific to Cypress, of plants that may occur in the region but are not yet detected in the park. Put a high priority on monitoring and reporting for these species, and highlight these species in education and training. Consider including a link to list on BC Parks' Cypress website.
- Ensure that spread prevention measures are included as part of all communication, education and training efforts.
- Ensure all volunteers, BC Parks staff and contractors, and ski area staff and contractors involved in activities that could spread invasive plants are trained in and are implementing prevention best practices. Invasive plant prevention should be part of day-to-day park and ski area operations.
- Include prevention practices in management plans, project plans, work plans, contract documents, and park use permit conditions.

CONTROL

- Implement a treatment program based on site priorities, species priorities and treatment considerations. Use the information in Appendix C to inform planning.
- Use Best Management Practices (Appendix D) based on science for treatment of invasive plant species.

INVENTORY AND MONITORING

- Undertake a baseline inventory of the park focusing first on priority sites. Update the baseline inventory every 4 to 6 years. Annually update the inventory for Site Priority Group 1.
- Monitor all treatment sites and areas of soil disturbance to ensure follow-up treatment and site restoration occurs as necessary.
- Maintain consistent monitoring records that link to the original baseline inventory.
- Develop and use the same inventory and monitoring data collection standards and format regardless of who is collecting the data (parks or ski area staff, or their contractors, volunteers, etc.) so that data can be easily shared and compared. Use or adapt the Invasive Alien Plant Program (IAPP)[2] standards wherever possible.

[2] Invasive Alien Plant Program

COMMUNICATION

- Develop protocol to report, record and store occurrence data, including from public and volunteers. Use existing provincial tools (IAPP, Report-a-Weed) wherever possible.
- Share information and data among key stakeholders at regular intervals, via meetings and through a stakeholder contact list.
- Develop and offer training as needed for volunteers, park staff, ski facility staff and contractors, ideally as an annual spring session. Support and supplement training by developing resources kits.
- Establish a process for registration and approval of volunteer weed pull activities. Process should be efficient and not create unnecessary barriers to volunteer efforts, but also ensure that activities are coordinated, effective and safe. Use tools and resources from BC Parks volunteer program as appropriate.
- Produce signage and a brochure to build awareness of invasive plants among park users.
- Install boot brush stations and associated signage at key trailheads to prevent transport of seeds and to raise awareness.
- Station volunteers at trailheads on busy hiking days to explain the risks associated with invasive plants and appropriate prevention measures for park users.
- Develop and recommend materials for use on BC Parks websites and social media accounts to build awareness of invasive plant related issues.
- Annually review this Strategy document, particularly the species risk rating and information table as new information becomes available.

1 Introduction

1.1 What are invasive plants?

Invasive species are those that occur outside of their natural range and have significant ecological, social and/or economic impacts once established. Introduced (i.e., exotic or non-native) plants are common in our landscapes. Most are either unable to adapt to local conditions or, if they do establish, do not cause significant impacts. However, a minority of introduced species are considered invasive because they are able to flourish and spread rapidly in the absence of natural predators and other controls. Climate change may also increase our region's vulnerability to the arrival and spread of new invasive species.

SOCIAL IMPACTS	ECOLOGICAL IMPACTS	ECONOMIC IMPACTS
• Introduce health and safety risks for humans and domestic animals • Alter and degrade valued landscapes and view corridors • Impede recreation access	• Reduce biodiversity and alter ecosystem function • Reduce wildlife habitat and forage • Increase vulnerability of species at risk • Increase wildfire risk	• Damage critical infrastructure (drainage systems, roads, building foundations, etc.) • Increase maintenance costs

Invasive plants spread by a variety of means including horticultural activities, improper disposal of waste, soil transfer, water movement, wind, and by hitching a ride on vehicles, people, equipment, animals and birds.

Prevention is critical; once established, invasive species are difficult and costly to control because they are very effective at dispersing, establishing, and reproducing. In most cases, successful treatment of an infestation will require repeated control efforts over multiple years.

1.2 Purpose and Goals

The purpose of the Invasive Plant Management Strategy is to create a plan for management of existing invasive plant infestations within Cypress Provincial Park, and to provide direction for prevention and management of new infestations. The strategy will foster communication, consistency, cooperation and efficiency in management actions among all land managers and stakeholders in and adjacent to the park.

The goals of the Strategy are to:

1. Protect the integrity and function of native ecosystems.
2. Ensure the health and safety of park users.
3. Maintain recreational access and a high quality visitor experience.

The following principles will guide the management of invasive plants in the park:

- Use an Integrated Pest Management approach
- Use regionally and provincially accepted best management practices based on science

- Use a risk management based approach to ensure efficient use of resources

1.3 History of Invasive Plant Management at Cypress

Invasive plant management at Cypress dates back to the late 1990s when BC Parks staff first began managing knotweed. Over the next decade, parks staff and volunteers from Friends of Cypress Provincial Park (FCPP) carried out periodic manual removals of invasive plants, in particular Scotch broom.

In the fall of 2010, knotweed and scentless chamomile were found and treated at Cypress in areas affected by the use of Cypress Mountain as a venue for the 2010 Winter Olympics. These invasive species were likely introduced through contaminated straw used to build up slopes due to low snowpack during the Olympics. Because of the potential for re-growth and for additional invasive plant species to establish, a five year invasive plant management plan was developed for impacted areas. To ensure that sufficient funds would be available to implement this plan, the Vancouver Organizing Committee (VANOC) for the 2010 Olympics made a large donation to the BC Parks Park Enhancement Fund, earmarked for invasive plant management in Cypress Provincial Park. In subsequent years, these funds have been used towards manual or chemical treatments by contractors on knotweed, giant hogweed and 16 other invasive plants considered to be high risk, at various locations throughout the park.

Volunteers, primarily from FCPP, continue to carry out weed pulls, particularly focusing on parking lot 5 and infestations along roadsides and trails. FCPP have played a key role in informal monitoring by reporting on species and sites of concern observed throughout the park. The North Shore Wetland Partners (NSWP) have also contributed to volunteer efforts, most significant of which was leading a restoration project in 2011 to rehabilitate a deactivated trail in the Cypress Creek complex, and drawing attention to reed canarygrass spread within the park.

In 2012, Cypress Bowl Recreations (Cypress Mountain), the operator of the ski areas within the park, developed a long-term Invasive Plant Management Plan for sites where routine maintenance and slope re-contouring require importation of materials (i.e., soil or rock). The plan includes Material Import Protocols[3] to ensure the park is protected from import of invasive plants and noxious weeds through substrates sourced off-site. The plan includes a site tracking matrix for material import locations that is monitored and updated annually and shared with BC Parks. According to the plan, priority invasive plants will be treated if detected on import sites. Separate from their Invasive Plant Management Plan, Cypress Mountain has undertaken manual removal of Scotch broom and has partnered with other stakeholder groups on stewardship projects within their operating area.

[3] BC Parks Material Import Protocols. 2012. Sartori Environmental Services

2 Situation Assessment: Cypress Provincial Park

2.1 Park Vulnerabilities to Invasive Plants

A significant portion of the park's accessible land base is comprised of heavily used recreation areas: ski runs, ski facilities, parking lots, roads and trail networks. These high use areas are juxtaposed with relatively pristine natural areas, most of which are inaccessible to park users.

The high use areas of the park are permanently disturbed and as a result tend to have nutrient poor conditions and exposed mineral soil. Many weed species thrive under these growing conditions, while most native plant species have difficulty re-colonizing or competing. These high use areas are also where invasive plants are most likely to enter the park through human activities. These two factors, soil conditions and human activities, combine to make the high use areas of the park particularly vulnerable to the introduction of invasive plants.

There is an ongoing risk that the high use areas will act as vector areas for the spread of invasive plants into the natural areas of the park. Natural areas in the park are especially vulnerable to a particular suite of invasive plant species: those which are able to establish without soil disturbance (e.g., knotweed) and those which are shade tolerant (e.g., lamium, English ivy). Natural areas that are more open, such as wetlands, are also particularly vulnerable because many invasive plants thrive in higher light conditions. When invasive plants establish in wetlands and riparian areas treatment is challenging due to the sensitive nature of the sites and limited treatment options.

Any activity or event that causes soil disturbance within wetlands and riparian areas creates suitable habitat for invasive plants that require exposed mineral soil for establishment. Due to its abundance and aggressive growth habit, reed canarygrass is the most likely species to establish on newly disturbed soil in the park and therefore represents the greatest threat to the park's wetland complexes if they are subject to any type of soil disturbance (be it human caused or natural disturbance).

2.2 Invasive Plant Sources and Modes of Spread

Invasive plants have been inadvertently introduced and spread within the park by a variety of means including:

- Hitching a ride on vehicles, equipment, people, dogs, wildlife, and birds
- Contaminated substrates imported from on and off-site: soil, gravel, hay
- Soil erosion control seed mixes
- Road and trail vegetation management (e.g., mowing)

Local invasive plant infestations in neighbouring jurisdictions have the potential to continually act as source populations to the park including infestations along lower portions of Cypress Bowl Road, the historic illegal dump site at parking lot 5, and lower elevation trailheads which connect to the park's trail network. The Highway 1 transportation corridor linking the BC Ferry terminal, Sea to Sky Highway, the North Shore and beyond also exposes the park to invasive plants accidentally transported from other parts of the region and province.

2.3 Invasive Plant Abundance and Distribution

The current distribution of invasive plant species in the park reflects its vulnerabilities: with a few exceptions, invasive plants are mainly confined to the developed, high use areas of the park. The park's natural areas are relatively free of invasive plants.

Over seventy non-native, introduced plants have been observed in the park. Thirty of these species have been included in various formal inventory efforts (Figure 1) and 18 have been historically controlled under the direction of BC Parks (Figure 2). With the exception of reed canarygrass, there has not been a wide-scale inventory of invasive plants in the park, so knowledge of abundance and distribution is anecdotal or incomplete for many species.

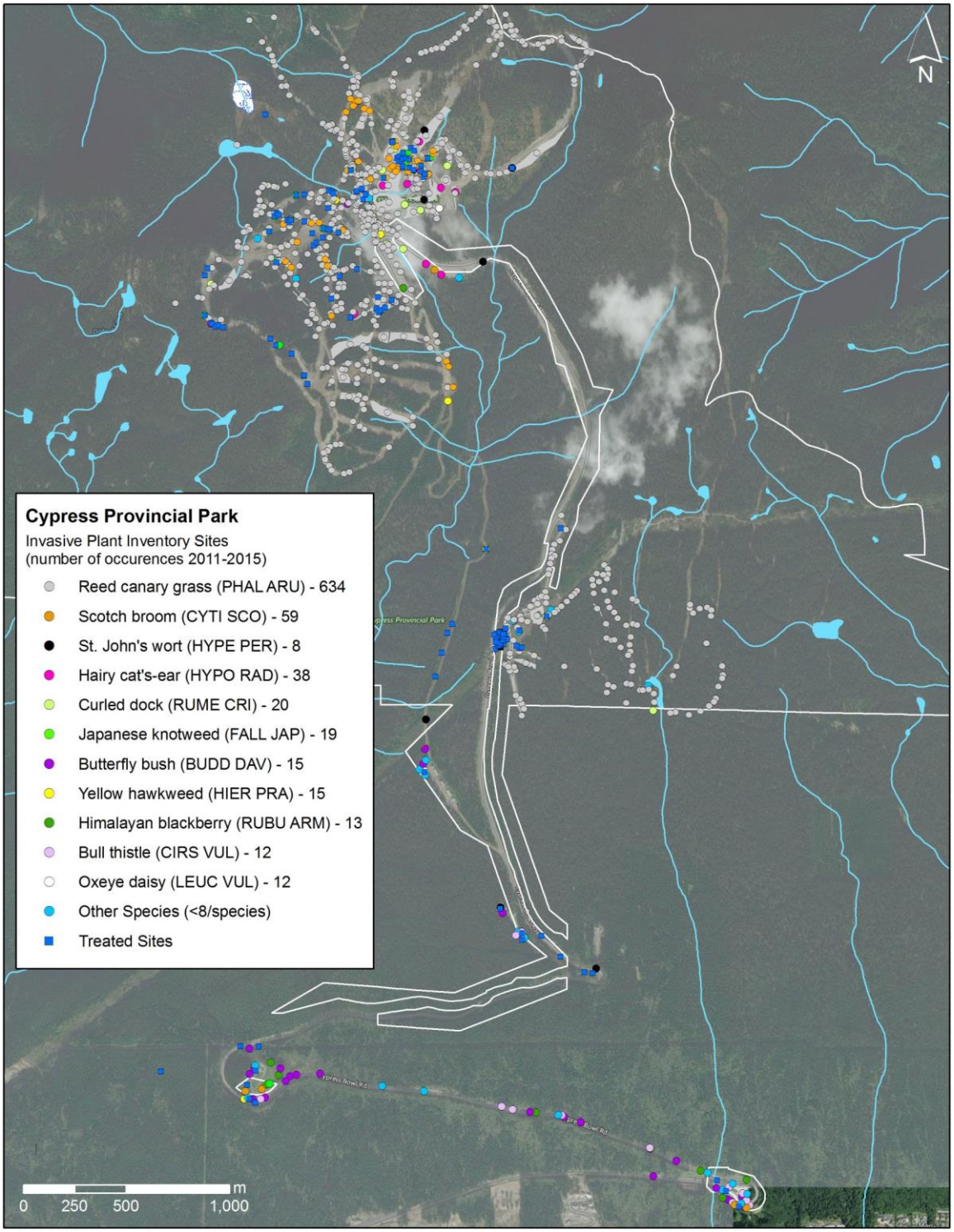

Figure 1. Combined results of invasive plant inventory efforts in the Park since 1999.

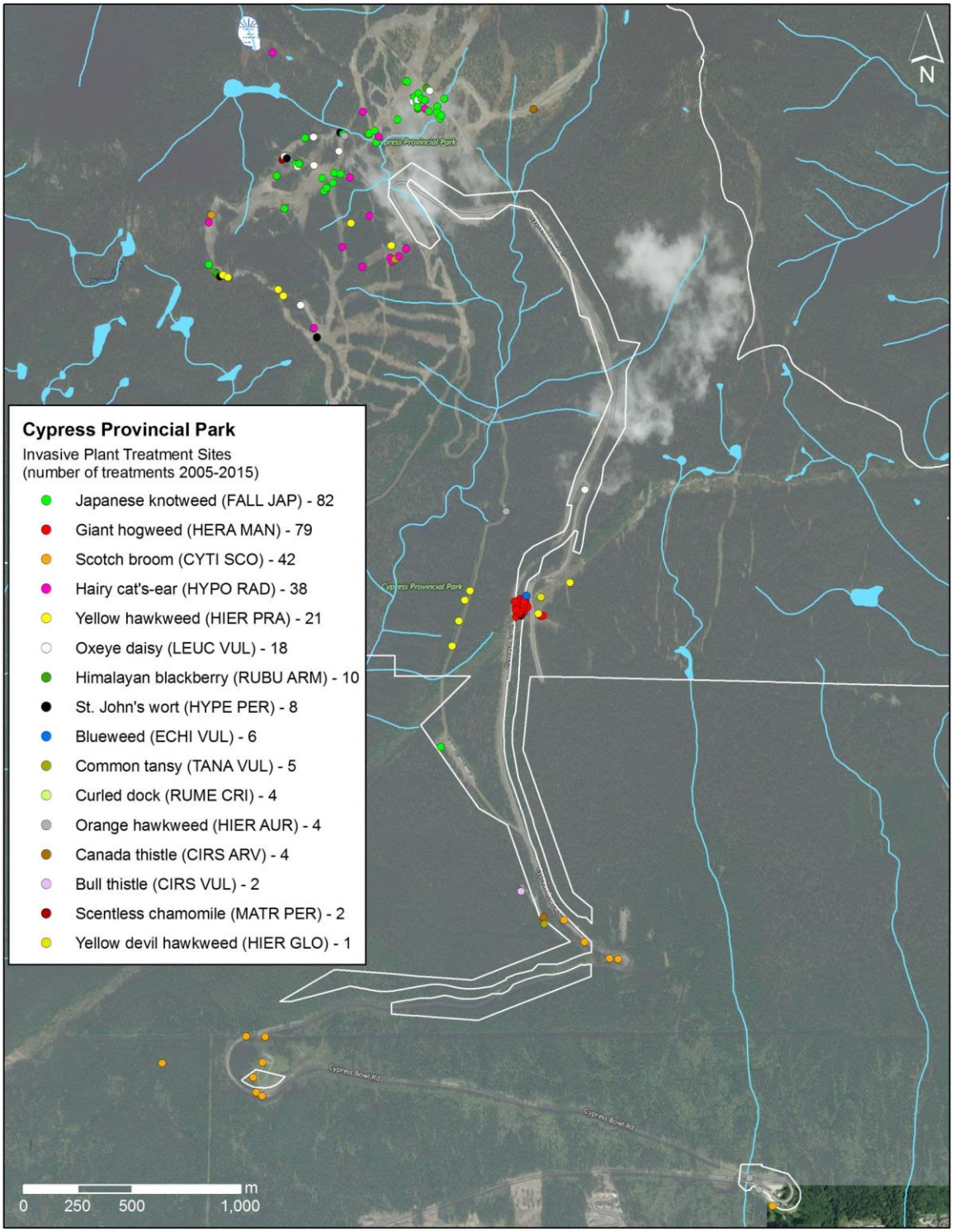

Figure 2. Formally documented invasive plant treatment sites in the Park since 1999.

Of the introduced plants observed in the Park, just over half are locally, regionally or provincially recognized as invasive species, including seven which are classified as Noxious Weeds under the BC *Weed Control Act*. These invasive species are listed in Table 2 in the species priority section of

the Strategy. The invasive potential of the remainder of the introduced species observed in the park is either negligible or not yet known (listed in Appendix B).

Based on inventory work done to date, reed canarygrass appears to be by far the most common invasive plant species in the park. Thus far it is confined to high use areas (primarily ski runs and roadsides) with the exception of occurrences in the Cypress Creek complex below the lodge and scattered locations on several trails. Scotch broom appears to be the second most common invasive plant found in the park, but at much lower abundance than reed canarygrass. It is also confined to ski run and roadside locations. All other invasive plant species appear to be found at low levels of abundance, most being relatively rare in the park. Some species may be more common than currently perceived but haven't yet been thoroughly inventoried.

3 Management Strategies

There are four broad management strategies proposed for the park:

1. *Prevention*: prevent invasive plants from being introduced and reduce the risk of spread
2. *Control*: devise a treatment plan for invasive plants in the park based on site and species priorities
3. *Inventory and monitoring*: inventory and monitor high priority sites and species
4. *Communication*: communicate, educate and offer training to park users, volunteers, stakeholders, and staff to elevate awareness of invasive plants; improve communication and coordination regarding invasive plant management among stakeholders and land managers

3.1 PREVENTION

Preventing the introduction and spread of invasive plants is the cheapest and most effective way to manage the problem. This can be accomplished through early detection of new infestations and prevention measures to reduce the risk of spread. Park users, volunteers, staff, ski facility employees, user groups, other land managers, and contractors all have a role to play in prevention.

3.1.1 Early Detection

The most effective control of invasive plants is achieved when they first arrive by using an approach called *Early Detection and Rapid Response* (EDRR). The cost of EDRR is miniscule compared to the cost of controlling an invasive plant that has established and spread. The province has an EDRR Plan which outlines how new invasive plant incursions that are of risk to BC can be quickly and effectively addressed[4].

There are invasive plant species which have already established in other parts of BC, Metro Vancouver and even the North Shore, but have not yet been detected in the park (e.g., Himalayan balsam, purple loosestrife, yellow flag-iris). Early detection of these species requires a coordinated rapid response both within the park and with neighbouring jurisdictions.

[4] Invasive Plant Early Detection and Rapid Response Plan for British Columbia. 2012.

RECOMMENDATIONS

- Design a process for BC Parks to respond to reports of new high priority invasive plant occurrences to confirm identification, map their locations and arrange appropriate treatment. Report occurrences of provincial EDRR species to the Provincial EDRR coordinator and park stakeholder groups.
- Create an EDRR list specific to Cypress, of plants that may occur in the region but are not yet detected in the park. Put a high priority on monitoring and reporting for these species, and highlight these species in education and training. Consider including a link to list on BC Parks' Cypress website.

3.1.2 Spread Prevention

Everyone who uses and works in the park can take action to prevent the spread of invasive plants. Plant fragments and seed can easily be transported on clothing, gear, fur, vehicles, equipment and in imported substrates. There are two provincial Best Practice guidebooks that should be referred to for prevention measures for parks and protected areas[5] and for roadsides[6]. Below are key prevention measures categorized by activity.

Recreation:

- Stay on trails
- Keep dogs on leash and off of trails not designated for dogs
- Check for soil, seeds and plant fragments on shoes, clothes and gear at trailhead
- Refrain from picking or moving plants, flowers or seed heads
- Follow all signage within the park including notifications of invasive plant treatments

Trail maintenance:

- Ensure all equipment , clothing and gear is clean prior to entering trail (free of soil, seeds, plant fragments)
- Start at furthest point and work towards trailhead, because most invasive plants will be closer to trailhead
- Avoid unnecessary soil disturbance
- Stay on trails as much as possible
- Take steps to ensure soil or gravel placed on trails are invasive plant free (e.g., do not move soil from areas where invasive plants exist and do not stockpile materials or store equipment near existing infestations)
- Monitor sites for invasive plants following site disturbance; the BC Parks Best Management Practices (BMPs) for Invasive Plants recommends monitoring one and three years post-disturbance[5].
- Re-vegetate disturbed areas as quickly as possible following disturbance

Roadside, grass areas and right-of-way maintenance:

[5] Best Management Practices for Invasive Plants in Parks and Protected Areas of British Columbia. 2011.
[6] Best Practices for Managing Invasive Plants of Roadsides. 2010.

- Survey the mowing area first to understand where the problem areas are located and mark or sign problem areas as appropriate
- Evaluate infestations to determine if invasive plants should be left undisturbed to avoid further spread
- Start mowing in areas with no invasive plants and end in areas with the most invasive plants
- Mow at a height of 15 cm above ground level
- Do not mow invasive plants after they flower or have gone to seed

Site disturbance from construction (anywhere in the park) and ski hill maintenance:

- Identify invasive plants in the work area prior to site disturbance and incorporate measures to prevent spread into project (e.g., work in areas with invasive plants last so equipment can remain clean as long as possible)
- Treat invasive plants prior to disturbance or incorporate plant removal into project.
- Ensure contaminated soil and plant parts are appropriately managed and disposed of to prevent spread.
- Designate an area to clean equipment, monitor this area, and have a plan for treatment and appropriate disposal of invasive plant material.
- Use clean equipment at start of work
- Clean equipment periodically during projects to remove seeds and vegetative plant parts, especially where there are priority invasive plants present and before moving to a new area; clean equipment at end of project
- Re-seed/re-vegetate disturbed areas as quickly as possible following disturbance
- Use invasive-free seed mixes, and obtain and check certificates of seed analysis from suppliers to ensure that seeds are not contaminated with invasive plants
- Avoid using straw or hay for erosion control
- Monitor sites for invasive plants following site disturbance; the BC Parks Best Management Practices (BMPs) for Invasive Plants recommend monitoring one and three years' post-construction[7]
- Ensure invasive plant priorities for monitoring and management are consistent with those in this strategy document

Imported materials (anywhere in the park):

- Inventory site prior to importation and if possible treat existing invasive plants
- Take steps to ensure that imported materials are free of invasive plants
- Monitor post-importation (one and three years' post-disturbance is recommended in the BC Parks BMPs)

Invasive plant removal and restoration:

- Mitigate impacts to native plants and wildlife
- Retain native plants in removal areas to encourage natural regeneration and restoration
- Use best management practices for removal of the species in question

[7] Best Management Practices for Invasive Plants in Parks and Protected Areas of British Columbia. 2011.

- Ensure that removal activities, including timing, disposal, etc., do not result in further spread or environmental damage
- Revegetate disturbed areas, ideally with native plants; invasive-free grass seed mixes can be used as a temporary measure before planting with native plants to prevent re-establishment of invasive plants
- Monitor removal and restoration sites for several years post treatment, and quickly treat any new invasive plants
- Ensure volunteers are properly trained and aware of best management practices so their activities are effective and do not inadvertently spread invasive plants or cause environmental damage

RECOMMENDATIONS

- Ensure that spread prevention measures are included as part of all communication, education and training efforts.
- Ensure all volunteers, Park Use Permit holders, BC Parks staff and contractors, and ski area staff and contractors involved in activities that could spread invasive plants are trained in and are implementing prevention best practices. Invasive plant prevention should be part of day-to-day park and ski area operations.
- Include prevention practices in management plans, project plans, work plans, park use permit conditions, and contract documents.

3.2 CONTROL

Three factors must be considered to develop a treatment program for control of invasive plants in the park:

1. Site priorities
2. Species priorities
3. Treatment considerations

3.2.1 Site Priorities

Cypress Provincial Park is home to several subalpine ecosystem types which broadly include forests, open shrub communities, and wetland complexes. These natural areas are valuable not only ecologically but also socially, as they are arguably the most accessible subalpine ecosystems in the region for park users of all ages and abilities. The subalpine wetlands and associated plant communities are considered regionally important sites and a sensitive value to be protected in the park.

Site types in the park have been categorized into four priority groups (Table 1 and Figure 3) for invasive plant management activities. Stream, lake and wetland complexes, rare plant communities, backcountry areas degraded by high use, and maintenance yards have been assigned the highest priority; the first two due to their status as sensitive sites, the third because of its proximity to undisturbed remote habitats, and the fourth due to the high risk of spread by vehicles, equipment and materials stored at these locations.

Invasive plants in the park occur almost exclusively in areas of human disturbance[8]. Therefore site priorities focus on areas of the park used by people. This represents the area most at risk of invasive plant introduction.

Table 1. Site priority groups.

SITE PRIORITY GROUP	DESCRIPTION	INCLUDED SITES
Site Priority Group 1	• Sensitive sites: stream, lake and wetland complexes; significant or rare native plants and plant communities • Backcountry areas degraded by high-use (e.g. braided trails, trampled viewpoints, etc.)[9] • Maintenance yards	• Yew Lake area (including Interpretive Trail and Old Growth Loop) • Warming hut lakes area • Nordic ski area lakes • Black Mountain lakes area • Cypress Creek complex • Backcountry areas degraded by high-use (not yet formally identified) • Maintenance yards • Equipment/materials storage and marshalling areas
Site Priority Group 2	• Hiking trail network to access priority 1 sensitive sites • Primary access routes to the trail network from parking lots (potential vector zones for spread into priority 1 sensitive sites)	• Howe Sound Crest Trail • Baden Powell Trail • Pumphouse Road • West Lake Trail • Burfield Trail • Lost Lake Trail • Powerline (to warming hut lakes) • Access route from parking lot to Yew Lake trailhead and BP/Hollyburn Mtn trailhead, including information kiosks • Parking lot 5 (because it is the access to West Vancouver's Old Growth Conservancy)
Site Priority Group 3	• Summer high use areas	• Parking lots • High View Lookout • Quarry Lookout day use area
Site Priority Group 4	• Winter high use areas • Roadsides	• Ski runs • Cypress Bowl Road • Access road to Nordic area

[8] The exceptions are invasive plants such as English holly, English ivy, spurge laurel, and cherry laurel whose seeds can be spread within inaccessible areas by bird droppings. It is unknown if any of these species occur in inaccessible areas at Cypress. Regardless, given the hazardous terrain in the park and the ease at which human activity (including invasive plant removal) can cause introduction and spread of invasive plants, treatment of these species at inaccessible sites is not included as a priority.

[9] Note that backcountry areas degraded by high use have not been formally identified and thus do not appear in Figure 3.

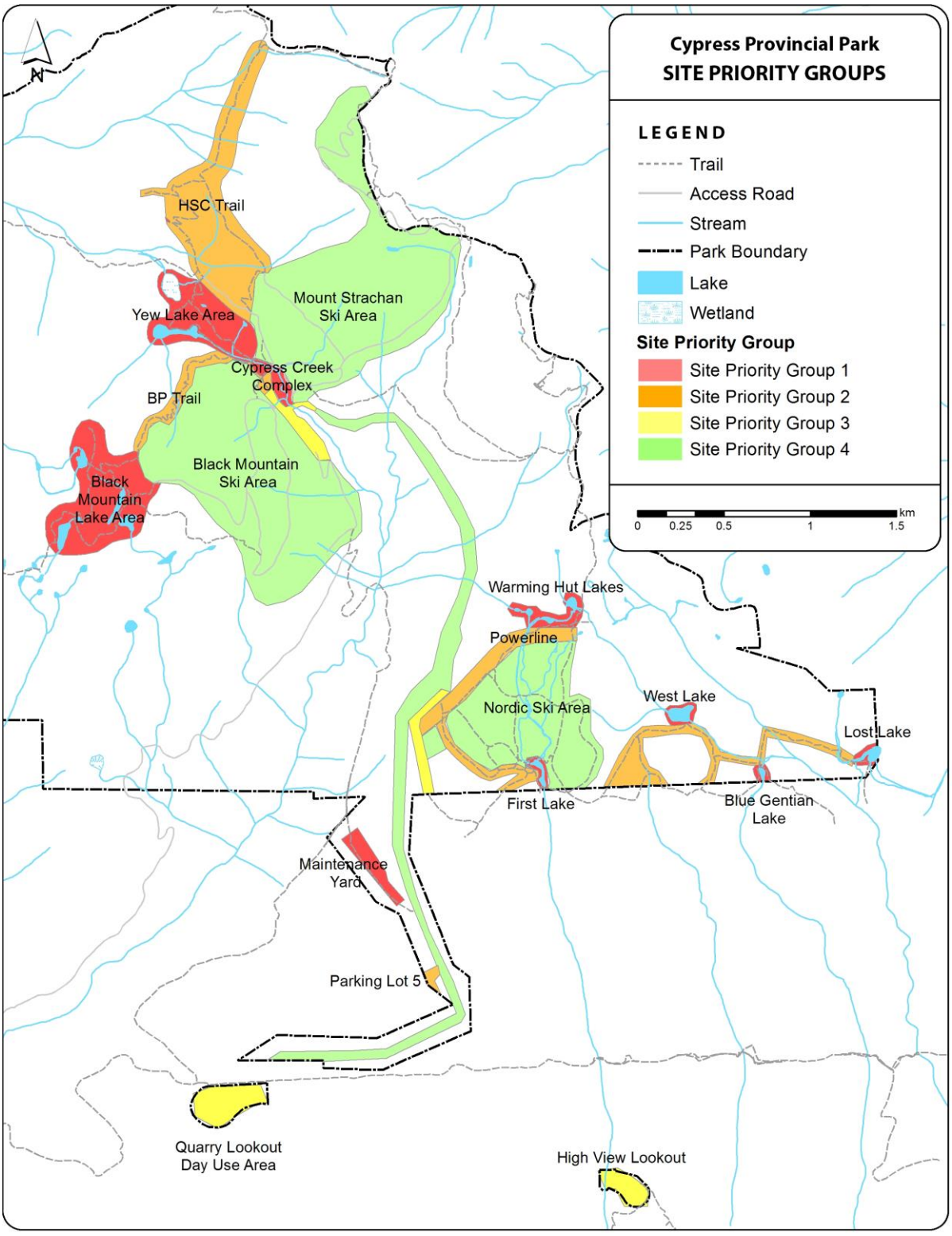

Figure 3. Map of site priority groups.

3.2.2 Species Priorities

A risk rating assessment was developed to guide management priorities for individual invasive plant species. The risk rating was tailored to reflect the goals of the Strategy by evaluating the potential severity of impact a species may have on the park. Five factors were considered for each invasive plant species present in the park:

1. *Habitat susceptibility*. Number of habitat types susceptible to invasion
2. *Colonization*. Likelihood to colonize undisturbed sites (i.e., natural areas)
3. *Health and safety*. Impact on humans, pets and wildlife, including toxicity and hazards
4. *Species impact on environment*. Ability to alter ecosystem function or impede access for humans and wildlife
5. *Persistence*. Level of complexity involved in treatment

The risk rating assessment produces five levels of risk from low to extreme, which are categorized into four groups:

- *Species Priority Group 1*. Extreme and very high risk species
- *Species Priority Group 2*. High risk species
- *Species Priority Group 3*. Moderate risk species
- *Species Priority Group 4*. Low risk species

The outcome for invasive species present in the park is shown in Table 2. Background information on the risk rating assessment is included in Appendix A.

Table 2. Species risk rating assessment and resulting priority groups.

SPECIES PRIORITY GROUP	COMMON NAME	SCIENTIFIC NAME	RISK RANKING	
Species Priority Group 1	Giant hogweed*	*Heracleum mantegazzianum*	14	Extreme
	Knotweed species*	*Polygonum spp.*	12	Very High
	Daphne/spurge laurel	*Daphne laureola*	12	Very High
	English ivy	*Hedera helix*	11	Very High
	Scotch broom	*Cytisus scoparius*	10	Very High
Species Priority Group 2	Lamium	*Lamiastrum galeobdolon*	9	High
	Reed canarygrass	*Phalaris arundinacea*	9	High
	English holly	*Ilex aquifolium*	9	High
	Himalayan blackberry and cutleaf blackberry	*Rubus americanus* and *Rubus laciniatus*	9	High
	Common tansy	*Tanacetum vulgare*	9	High
	Goutweed	*Aegopodium podagraria*	8	High
	Creeping bellflower	*Campanula rapunculoides*	8	High
	Butterfly bush	*Buddleja davidii*	8	High
	Orange hawkweed	*Hieracium aurantiacum*	8	High
	Yellow hawkweed	*Hieracium caespitosum*	8	High
	St. John's wort	*Hypericum perforatum*	8	High
	Pepperweed, perennial	*Lepidium latifolium*	7	High
	Hairy cat's-ear	*Hypochaeris radicata*	7	High
	Canada thistle*	*Cirsium arvense*	7	High

SPECIES PRIORITY GROUP	COMMON NAME	SCIENTIFIC NAME	RISK RANKING	
	Scentless chamomile*	*Matricaria perforata*	7	High
	Tansy ragwort*	*Senecio jacobaea*	7	High
Species Priority Group 3	Creeping buttercup	*Ranunculus repens*	6	Moderate
	Curled dock	*Rumex crispus*	6	Moderate
	Quackgrass	*Elymus repens*	6	Moderate
	Sow thistle, perennial*	*Sonchus arvensis*	6	Moderate
	Common Periwinkle	*Vinca minor*	6	Moderate
	Dame's rocket	*Hesperis matronalis*	5	Moderate
	Common mallow	*Malva neglecta*	5	Moderate
	Burdock species	*Arctium spp*	5	Moderate
	Bull thistle	*Cirsium vulgare*	5	Moderate
	Mountain bluet	*Centurea montana*	5	Moderate
	Orchard grass	*Dactylis glomerata*	5	Moderate
	Oxeye daisy**	*Leucanthemum vulgare*	5	Moderate
	Hedge bindweed	*Calystegia sepium*	5	Moderate
	Bladder campion	*Silene vulgaris*	5	Moderate
	Common bentgrass	*Agrostis capillaria*	5	Moderate
	Timothy grass	*Phleum pratense*	5	Moderate
	Blueweed	*Echium vulgare*	5	Moderate
	Bachelor's button	*Centaurea cyanus*	4	Moderate

* Provincial noxious weeds under the BC *Weed Control Act*

** Regional noxious weed under the BC *Weed Control Act* in other regions of BC but not categorized as noxious on South coast (i.e. at Cypress).

Within Species Priority Group 1, giant hogweed and knotweed have been actively controlled in the park for several years and now exhibit very minor amounts of re-growth. Scotch broom has also been actively controlled for several years, but new seedlings continue to appear on the ski runs and along roadsides due to the longevity of the seed bank. Spurge laurel and English ivy are thought to be relatively rare in the Park; their low abundance provides an opportunity for swift eradication.

The highest risk invasive plants in Species Priority Group 2 include lamium, reed canarygrass, English holly, blackberry and common tansy. Blackberry and common tansy have been actively controlled in some cases but it is presumed that there are occurrences that have not yet been treated. Reed canarygrass is the most abundant invasive plant in the park; it should continue to be strategically controlled to prevent establishment in the park's vulnerable wetland complex ecosystems. Lamium and English holly are thought to be relatively rare in the Park; their low abundance provides an opportunity for swift eradication.

The majority of other identified invasive plant species have very low abundance and distribution in the park. Control of these species at high priority sites is warranted. No species fall within Priority Group 4.

Reed canarygrass at Cypress Provincial Park

Reed canarygrass (RCG) is an aggressive perennial grass which invades a variety of wetland habitat types. It forms dense monocultures resulting in a range of negative ecological impacts, the most pronounced of which is a reduction to biodiversity. The spread of RCG at Cypress was among the top invasive plant related concerns expressed by park stakeholders.

BC Parks carried out an inventory and assessment of RCG in 2015, confirming that it is abundant and widely distributed on the ski hills and roadsides of the park, present but rare along the park's trail system, and thus far not growing directly within any of the park's wetland complexes with the exception of the rehabilitated areas in the Cypress Creek Complex and one occurrence trail-side near Yew Lake. It should be noted that there are many different varieties of reed canarygrass including one native to B.C. Although genetic testing is the only reliable method to discern between the native species and non-native invasive varieties, if the grass is spreading rapidly and aggressively and displacing native vegetation, it is assumed to be the invasive variety. BC Parks began strategic control of the grass along trails and at trailheads in 2016 to reduce the risk of spread into high risk ecosystems.

Any type of activity which exposes bare soil and increases light availability may lead to invasion by RCG. Disturbance from erosion, sedimentation, nutrient enrichment, road salt and hydrological instability or modification can all create favorable conditions for invasion by RCG. Natural disturbance such as slope failure or soil exposure from tree blowdown can lead to invasion. To protect the park's wetland complexes from invasion by RCG it is imperative that soil disturbance in these areas is either avoided entirely or quickly restored, and that susceptible ecosystems be regularly monitored for RCG occurrence. When new occurrences are detected they should be promptly removed.

3.2.3 Treatment Program Considerations

There are four factors to consider in conjunction with species and site priorities to devise an effective treatment program:

1. Stage of invasion
2. Containment strategies
3. Treatment method
4. Restoration

Stage of Invasion

The stage of invasion reflects the abundance and distribution of an invasive plant across potentially suitable growing sites in the park. The risk associated with an invasive plant species combined with its stage of invasion provides a quantifiable way to determine the most appropriate and cost effective response. In the early stages of invasion, eradication is often feasible. Once a species has become established and widely dispersed, eradication is far less realistic. There are three stages of plant invasion:

1. *Introduction*. The species occurs at relatively low levels of infestation. Populations are small and consist mainly of individual plants. **Eradication** at this stage is usually feasible.

2. *Colonization*. The plant begins to spread (patch expansion) and disperse over short distances. Infestation size increases. At this stage eradication is more difficult, but it is feasible to **contain** infestations and prevent further spread.
3. *Naturalization*. The species disperses over long distances and becomes abundant across the landscape. Infestation size is large and widespread. At this stage **circumstantial control** is the only feasible option to control the species at specific sites to reduce impact on valued land or assets.

Based on current information the overwhelming majority of invasive plant species in the park appear to be in the introduction phase, with some approaching the colonization phase. Notable exceptions are Scotch broom and reed canarygrass which are in the colonization and naturalization phases respectively. Table 6 in Appendix C approximates the stage of invasion for each invasive plant species found in the park. Since the park has not had a full scale inventory, stage of invasion is an estimate based on available information.

Containment Strategies

Containment strategies maximize treatment efficacy across a large landscape. Using containment strategies in the park will increase the likelihood that the park's natural areas can be kept free of invasive plants. This is a relatively realistic treatment goal given that current infestations within the park's natural areas are generally small and relatively rare. Containment strategies are as follows:

- Focus on the areas least affected by invasive plants first
- Focus on small isolated patches on the outer edge of the population before large patches
- Start upstream and work downstream to prevent source populations from spreading downstream
- Start at the outer edge of an infestation and work inward
- Focus on 'vector' patches that threaten important areas nearby that are not yet infested or are located on potential movement corridors
- Consider source of infestation and mode of spread: if re-infestation is probable, address that issue before using resources on treatment

Treatment Methods

The appropriate treatment method depends on the species, site conditions, cost-efficiency, feasibility, safety, and risk of environmental harm, all of which are considered as part of an Integrated Pest Management (IPM) decision making process. In IPM programs, all information is considered to determine how best to manage invasive plants in an effective and environmentally sound matter.

There are generally four categories of treatment methods for invasive plants:

1. *Manual/Mechanical*. Using tools to physically remove the plants. This can include everything from hand tools to excavators. Also includes physical treatment such as covering infestations with plastic, cardboard or deep mulch to smother invasive plants.

- High cost in terms of time and labour, effectiveness can be variable, low to moderate environmental impact (poor practices can lead to further spread of invasive plants and further degradation of a site), control method used by volunteers.

2. *Cultural*. Using techniques to encourage the establishment of a healthy vegetation layer that will resist or out-compete invasive plants. Examples include irrigating, fertilizing, re-vegetating, fill planting of trees. Restoration is a type of cultural control.

    - Moderate to high cost, effectiveness highly variable, typically used in landscape, garden, and agricultural settings. Sometimes appropriate in environmentally sensitive areas.

3. *Biological*. Introduction of the plant's natural enemies (e.g., insects, parasites and pathogens) to reduce its population. Currently, there are approved bioagents for five invasive plant species in the park: St. John's wort, Canada thistle, tansy ragwort, scentless chamomile and bull thistle[10]. In the future, bioagents may be available for knotweed, Scotch broom and gorse.

    - Low to moderate cost, effectiveness is variable (may take years, may be unstable and will not eradicate a plant species), not available for most species, research and availability of bioagents is coordinated by the provincial government.

4. *Chemical*. Application of pesticides to control invasive plants. Pesticide use in the park is regulated under the *Integrated Pest Management Act* and Integrated Pest Management Regulation. In compliance with this legislation, BC Parks and their contractors conduct chemical treatments according to a Ministry of Environment approved Multi-agency Pest Management Plan[11], using an integrated pest management approach. The circumstances under which pesticide use will be considered at Cypress are outlined in greater detail in Appendix C. In every case the benefit of treatment must outweigh the potential for negative consequence.

    - Low cost, highly effective, higher environmental risk and social concern, limitations in wetlands and riparian areas, this control method can only be undertaken by trained and licensed contractors.

[10] BC Biocontrol Agent on Invasive Plant Matrix

[11] Invasive Alien Plants Pest Management Plan for Provincial Crown Lands in the South Coastal Mainland Region of British Columbia (June 2016)

Restoration

Removal of invasive plants from a site is only one component of effective treatment. The resulting exposure of bare soil invites invasive plants to re-colonize. Depending on the degree of disturbance resulting from removal of invasive plants, restoration may be warranted to ensure native plant communities re-establish.

Restoration methods include:

- Natural colonization or succession (including altering site conditions to promote succession)
- Seeding of desirable grasses or herbs
- Replanting with appropriate herbs, trees and shrubs
- Planting of live cuttings

Successful restoration planting is dependent on choosing plant species which are ecologically suited to the site conditions. Typically, primary succession herbs, shrubs and trees (those which naturally colonize disturbed sites) will have the highest survival rates.

RECOMMENDATIONS

- Implement a treatment program based on site priorities, species priorities and treatment considerations. Use the information in Appendix C to inform planning.
- Use Best Management Practices (Appendix D) based on science for treatment of invasive plant species.

3.3 INVENTORY & MONITORING

An inventory provides a baseline understanding of species distribution and abundance. This information is necessary to carry out a successful treatment program. The data can be used to identify problematic locations for invasive plant introduction, prioritize control efforts, and monitor change over time to measure success. Complete eradication of a species from the park or designation of invasive plant free zones is not possible without prior knowledge of all invasive plant occurrences.

Over the past two decades there have been several inventories carried out in the park. All have either been restricted to certain areas or certain species. If it is not possible to inventory the entire park then inventory priorities are the same as the site priority groups described in Section 3.2.1 (Table 1 and Figure 3). Note that areas of the park not used by or inaccessible to most park visitors (i.e. areas away from trails or other facilities) may be excluded from inventory. These areas are unlikely to have invasive plants because most introductions are associated with human activity. Also, the hazardous terrain in many areas of the park would make inventory difficult and potentially unsafe.

Monitoring is a critical component of any invasive plant control program to ensure that treatments are effective and re-growth is treated, and to check for the emergence of other invasive plant species. Any time soil is disturbed in the park, whether through construction, trail maintenance, high-use or natural events, monitoring should occur as exposed soil is highly

susceptible to colonization by invasive plants. The BC Parks BMPs for Invasive Plants recommends monitoring one and three years' post-disturbance[12].

RECOMMENDATIONS

- Undertake a baseline inventory of the park focusing first on priority sites. Update the baseline inventory every 4 to 6 years. Annually update the inventory for Site Priority Group 1. Ensure inventory is planned and scheduled in such a way as to maximize probability of detecting invasive plant occurrences.
- Monitor all treatment sites to ensure follow-up treatment and site restoration occurs as necessary.
- Monitor all areas of soil disturbance to detect new occurrences of invasive plants.
- Maintain consistent monitoring records that link to the original baseline inventory.
- Develop and use the same inventory and monitoring data collection standards and format regardless of who is collecting the data (parks or ski area staff, or their contractors, volunteers, etc.) so that data can be easily shared and compared. Use or adapt the Invasive Alien Plant Program (IAPP)[13] standards wherever possible.

3.4 COMMUNICATION

Communication, education and awareness are important components of a successful invasive plant management program. Park users, volunteers, staff, ski facility employees, and contractors need to be aware of the impacts of invasive plants and understand how they can personally prevent introduction and spread. Training can enable volunteers to contribute to the detection of priority species and provide an understanding of best target species and practices for weed pull events. Communication and sharing of data among stakeholders will yield more coordinated, substantial and timely progress towards reducing the impact of invasive plant species on the park.

RECOMMENDATIONS

Reporting, recording and storage of occurrence data, including from public and volunteers:

- Maintain a spreadsheet or database of inventory records. Format should be consistent with data format for inventory and monitoring data collection (Section 3.3). Each site should have a unique ID which is then used to record treatment and monitoring records. The database should be linked to a spatial dataset using the same unique ID. The spatial dataset can be provided to contractors in both shapefile and kmz format for use in their field data collection devices. Use or adapt the Invasive Alien Plant Program (IAPP) standards and upload data into IAPP wherever possible.
- Develop a simple smartphone based protocol for trained volunteers to report new invasive plant sites. For example, dropping a pin in GoogleMaps and emailing the pin with an attached photo. The public can be directed to use the Report-A-Weed app[14].

[12] Best Management Practices for Invasive Plants in Parks and Protected Areas of British Columbia. 2011.
[13] Invasive Alien Plant Program
[14] Report-a-Weed

- Create a simple PDF (paper based) form for volunteers or the public who would like to report new invasive plant sites in a non-digital format. Include a map on the form for marking location.
- Update the base map of inventory and treatment sites annually. Make this information available to relevant land managers, volunteers and the public as both a geo-referenced PDF map and kmz file that can be downloaded onto mobile devices. This will enable volunteers to cross reference plant sightings with existing known locations to reduce the number of repeat reports.

Sharing information and data among key stakeholders:

- Provide an annual opportunity for key park stakeholders to discuss invasive plant management. Incorporate this discussion into existing meetings (e.g. Cypress liaison committee meetings) wherever possible, or hold a stand-alone meeting if and as required. Use this as an opportunity for BC Parks, Cypress Mountain, FCPP, and other stakeholders to share updates and data related to invasive plant management efforts and issues (include review of the latest inventory base map).
- Create a contact list of key stakeholders including affiliation and role. Use the list to communicate important invasive plant related information, advisories and events. Explore opportunities to post information about invasive plant related events and volunteer opportunities on-line where appropriate.

Training and education:

- Develop and offer training as needed, ideally as an annual spring/early summer session, for volunteers interested in invasive plant stewardship activities and relevant park staff, ski facility staff and contractors. Separate training sessions may be required for two main target audiences: 1) volunteers, and 2) park and ski facility staff and contractors. However, opportunities to combine training should be explored.
- Training should include plant identification (both native and non-native species), reporting techniques, best practices for prevention, manual removal and disposal, and protocol for communications with BC Parks.
- Support and supplement training by developing resource kits tailored to two target audiences: 1) volunteers, and 2) park and ski facility staff and contractors. Include topics related to detection and reporting, volunteer weed pull events, plant identification (both native and non-native species), best practices for prevention and treatment, and a list of relevant resources and contacts.
- Establish a process and protocol for registration and approval of volunteer weed pull activities: include acceptable target plants, acceptable locations, and reporting and record keeping expectations. Explore the use of tools and templates available through the BC Parks Volunteer Program for this purpose (e.g., develop a Memorandum of Understanding with FCPP or other groups that provides structure and “pre-approval” for ongoing volunteer invasive plant management activities). Ensure the process is efficient and does not create unnecessary barriers to volunteer efforts, while also ensuring that activities are coordinated, effective and safe.

Public education:

- Produce signage and a brochure to build awareness of invasive plants among park users. Use simple, clear messages with an emphasis on visual communication (e.g. cartoons, photos) so language is not a barrier. Signs and brochures could be provided at BC Parks trailhead kiosks. Key messages could include:
    - Impacts of invasive plants on the park
    - What makes sites vulnerable to invasion: disturbed soil, trampling native vegetation
    - Identification of priority species
    - Prevention actions: stay on trails, keep dogs leashed, check clothing, boots and gear for seeds and plant parts, etc.
    - Volunteer opportunities
- Install boot brush stations and associated signage at key trailheads to prevent transport of seeds and to raise awareness.
- Station volunteers at trailheads on busy hiking days to explain the risks associated with invasive plants and appropriate prevention measures for park users.
- Develop and recommend materials for use on BC Parks websites and social media accounts to build awareness of invasive plant related issues.

Adaptive Management

- Annually review this Strategy document, particularly the species risk rating and information table as new information becomes available. The depth of review and update will vary among years but at a minimum will involve a check of progress on implementation of recommendations. Identification of any changes required to the Strategy document can be part of regular discussions with stakeholders.

4 Implementation

As the land manager for Cypress Provincial Park, BC Parks will lead implementation of the strategy. Implementation of all recommendations will not occur immediately, and will require coordination and cooperation with other stakeholders. BC Parks staff time available to implement these recommendations is limited, so recommendations will need to be prioritized and implemented based on priority. Other stakeholders can play an important role and potentially expedite the implementation of some recommendations where opportunities exist. Some stakeholders such as the Friends of Cypress Provincial Park have already expressed interest in being involved in implementing recommendations. Meetings with stakeholders can be used to discuss priorities for implementation and identify opportunities for stakeholders to take a role in implementing recommendations.

Appendix A – Species Risk Rating Assessment: Background Information

The purpose of the risk rating assessment is to provide BC Parks with a framework to help set invasive plant management priorities. There are 75 introduced, non-native plant species recorded at Cypress Provincial Park. Not all of these species pose a risk to the Park. For some of these species, the risk is not well documented.

Step 1: Determine which species should be included in the risk ranking

Over half of the 75 introduced species (39 in total) are locally, regionally or provincially recognized as invasive and therefore have been included in a risk ranking evaluation. These species are collectively referred to as Invasive Species. Their inclusion was based on meeting at least one of the following criteria:

1. Classified as a Noxious Weed under the BC *Weed Control Act* (including those regulated in specific regions in BC even if not in the Metro Vancouver region)
2. Listed as a priority invasive plant species in the BC Park Threat Analysis (2010) for the Lower Mainland Region
3. Listed as a target invasive plant species by the District of West Vancouver (2014)
4. Historically managed at Cypress under the direction of BC Parks (1999 to present)
5. Noted as an invasive plant species of concern by the ISCBC or the BC Inter-Ministry Invasive Species Working Group
6. Demonstrating invasive tendencies at Cypress Provincial Park (i.e. appears to be spreading in distribution and outcompeting other plants)

The potential impact of the remaining 36 non-native, introduced species found at Cypress is either not yet documented or is known to be negligible. For this reason they are not included in the risk ranking. Not all of these species will necessarily become invasive in the park or pose a risk to the ecosystems or users of the Park. These species are collectively referred to as Non-native Species and are included in a Watch List in Table 4. A species on this list may be moved to the Invasive Species list and risk ranked in the future if new information indicates they are becoming an invasive species of concern either within the Park or within the Metro Vancouver region.

Step 2: Develop a risk ranking evaluation for Cypress

The risk ranking evaluates the potential severity of impact a species may have on the Park and reflects the goals of the Invasive Plant Management Strategy:

1. Protect the integrity and function of native ecosystems.
2. Ensure the health and safety of park users.
3. Maintain recreational access and a high quality visitor experience.

The BC Invasive Plant Core Ranking Process and West Vancouver's invasive plant species risk rating were used as a guide to develop risk ranking criteria suitable for Cypress. The risk ranking

score matrices are shown in Table 3 and Table 4. When evaluating species, the highest applicable score is also chosen. The outcome of the risk ranking is shown in Table 5.

Table 3. Species risk ranking matrix.

SCORE	HABITAT SUSCEPTIBILITY*	LIKELIHOOD TO COLONIZE UNDISTURBED SITES** (NATURAL AREA)	HEALTH AND SAFETY IMPACT	SPECIES IMPACT ON ENVIRONMENT	PERSISTENCE
3	**Four or more** habitat types in the Park are susceptible to invasion	**High potential** to colonize undisturbed sites	The plant or plant parts are **lethal or toxic** or can cause severe pain or discomfort through burning or blistering to humans, pets or wildlife	**Alters waterways** (e.g., increases sedimentation or reduces the amount of open water); **alters soil or water chemistry** (e.g., fixes nitrogen, reduces dissolved oxygen, is allelopathic)	**Requires a trained professional, licensed pesticide applicator or special safety precautions for management;** not typically appropriate for volunteers
2	**Three** habitat types in the Park are susceptible to invasion	**Moderate potential** to colonize undisturbed sites	The plant creates a **fire hazard** or **hazard trees** (by weighing down the tree canopy)	**Excludes use** by humans and wildlife, or forms impassable barrier	**Perennial**; roots must be removed; typically can reproduce by both seed and rhizomes
1	**One or two** habitat types in the Park are susceptible to invasion	**Low potential** to colonize undisturbed sites	The plant **causes discomfort to humans or wildlife** through punctures or scraping; **hosts vermin or disease**	**Out-competes native plant community** thereby reducing the habitat quantity and quality for wildlife	**Annual or biennial**; can be pulled; reproduces by seed only

*For the purposes of this exercise, habitat types are divided into five broad types: Forest, sub-alpine meadow (shrub/herb dominated), riparian, aquatic, and permanently disturbed sites (e.g., ski runs, ski facilities, trails and roadsides)

** Considered undisturbed if an established native plant community is present which has not been impacted by soil disturbance.

Table 4. Species risk ranking score matrix.

SCORE	RISK RATING
13-15	Extreme
10-12	Very High
7-9	High
4-6	Moderate
1-3	Low

Table 5. Species risk ranking evaluation for invasive plant species at Cypress Provincial Park.

COMMON NAME	SCIENTIFIC NAME	HABITAT SUSCEPTIBILITY	LIKELIHOOD TO COLONIZE UNDISTURBED SITES	HEALTH AND SAFETY IMPACT	SPECIES IMPACT ON ENVIRONMENT	PERSISTENCE	RISK RANKING	
Giant hogweed*	*Heracleum mantegazzianum*	3	3	3	2	3	14	Extreme
Knotweed species*	*Polygonum spp.*	3	3	0	3	3	12	Very High
Daphne/spurge laurel	*Daphne laureola*	2	3	3	1	3	12	Very High
English ivy	*Hedera helix*	3	3	2	1	2	11	Very High
Scotch broom	*Cytisus scoparius*	1	2	2	3	2	10	Very High
Lamium	*Lamiastrum galeobdolon*	3	3	0	1	2	9	High
Reed canarygrass	*Phalaris arundinacea*	3	1	0	3	2	9	High
English holly	*Ilex aquifolium*	2	3	1	1	2	9	High
Himalayan blackberry and cutleaf blackberry	*Rubus americanus* and *Rubus laciniatus*	2	2	1	2	2	9	High
Common tansy	*Tanacetum vulgare*	2	1	3	1	2	9	High
Goutweed	*Aegopodium podagraria*	3	2	0	1	2	8	High
Creeping bellflower	*Campanula rapunculoides*	3	2	0	1	2	8	High
Butterfly bush	*Buddleja davidii*	1	2	0	3	2	8	High
Orange hawkweed	*Hieracium aurantiacum*	1	2	0	3	2	8	High
Yellow hawkweed	*Hieracium caespitosum*	1	2	0	3	2	8	High
St. John's wort	*Hypericum perforatum*	1	1	3	1	2	8	High
Pepperweed, perennial	*Lepidium latifolium*	2	2	0	1	2	7	High
Hairy cat's-ear	*Hypochaeris radicata*	1	1	0	3	2	7	High
Canada thistle*	*Cirsium arvense*	2	1	1	1	2	7	High
Scentless chamomile*	*Matricaria perforata*	2	2	0	1	2	7	High
Tansy ragwort*	*Senecio jacobaea*	1	1	3	1	1	7	High
Creeping buttercup	*Ranunculus repens*	2	1	0	1	2	6	Moderate
Curled dock	*Rumex crispus*	2	1	0	1	2	6	Moderate

COMMON NAME	SCIENTIFIC NAME	HABITAT SUSCEPTIBILITY	LIKELIHOOD TO COLONIZE UNDISTURBED SITES	HEALTH AND SAFETY IMPACT	SPECIES IMPACT ON ENVIRONMENT	PERSISTENCE	RISK RANKING	
Quackgrass	*Elymus repens*	2	1	0	1	2	6	Moderate
Sow thistle, perennial*	*Sonchus arvensis*	2	1	0	1	2	6	Moderate
Common Periwinkle	*Vinca minor*	1	2	0	1	2	6	Moderate
Dame's rocket	*Hesperis matronalis*	2	1	0	1	1	5	Moderate
Common mallow	*Malva neglecta*	1	1	0	1	2	5	Moderate
Burdock species	*Arctium spp*	1	1	1	1	1	5	Moderate
Bull thistle	*Cirsium vulgare*	1	1	1	1	1	5	Moderate
Mountain bluet	*Centurea montana*	1	1	0	1	2	5	Moderate
Oxeye daisy**	*Leucanthemum vulgare*	1	1	0	1	2	5	Moderate
Orchard grass	*Dactylis glomerata*	1	1	0	1	2	5	Moderate
Hedge bindweed	*Calystegia sepium*	1	1	0	1	2	5	Moderate
Bladder campion	*Silene vulgaris*	1	1	0	1	2	5	Moderate
Common bentgrass	*Agrostis capillaria*	1	1	0	1	2	5	Moderate
Timothy grass	*Phleum pratense*	1	1	0	1	2	5	Moderate
Blueweed	*Echium vulgare*	1	1	1	1	1	5	Moderate
Bachelor's button	*Centaurea cyanus*	1	1	0	1	1	4	Moderate

* Provincial noxious weeds under the BC *Weed Control Act*

** Regional noxious weed under the BC *Weed Control Act* in other regions of BC but not categorized as noxious on coast (i.e. at Cypress).

Appendix B – Watch List: Additional Introduced Plant Species Observed in the Park

A Watch list of additional non-native, introduced plant species observed in Cypress Provincial Park is compiled in Table 6. The invasive risk of these plants is either undetermined or negligible with the ecosystems of the park. If invasive tendencies are observed in the future, plant species can be evaluated using the species risk ranking matrix (Table 3).

Table 6. Watch List: Non-native species recorded at Cypress Provincial Park.

COMMON NAME	SCIENTIFIC NAME
Alsike clover	*Trifolium hybridum*
Bird's-eye pearlwort	*Sagina procumbens*
Bitter dock	*Rumex obtusifolius*
Black medic	*Medicago lupulina*
Common chickweed	*Stellaria media*
Common comfrey	*Symphytum officinale*
Common plantain	*Plantago major*
Cudweed	*Gnaphalium uliginosum*
Fall dandelion	*Leontodon autumnalis*
Dutch Crocus	*Crocus sp.*
Eastern Solomon's seal	*Polygonatum biflorum*
English-bluebell	*Hyacinthoides non-scripta*
European white birch	*Betula pendula*
Foxglove	*Digitalis purpurea*
Herb robert	*Geranium robertianum*
Kentucky bluegrass	*Poa pratensis*
Lady's-thumb	*Polygonum persicaria*
Lily-of-the-valley	*Convallaria majalis*
Meadow foxtail	*Alopecurus pratensis*
Mullein	*Verbascum thapsis*
Nipplewort	*Lapsana communis*
Peruvian lily	*Alstromeria aurea*
Pineappleweed	*Matricaria discoidea*
Red campion	*Silene dioica*
Red fescue	*Festuca rubra*
Sheep sorrel	*Rumex acetosella*
Smooth brome	*Bromus inermis*
Smooth hawksbeard	*Crepis capillaris*
Spanish bluebells	*Hyacinthoides hispanica*
Welsh poppy	*Meconopsis cambrica*
White clover	*Trifolium repens*

COMMON NAME	SCIENTIFIC NAME
White sweet clover	*Melilotus albus*
Wood groundsel	*Senecio vulgaris*

Appendix C – Treatment Program: Supplemental Information

Species Information Table

There are five fields of information included in the species information table (Table 7) which provides BC Parks a foundation on which to make management decisions:

1. Risk rating
2. Presence (surrogate for Stage of Invasion)
3. Treatment goal
4. Treatment type
5. Volunteer involvement

All of these factors (with the exception of volunteer involvement) are discussed in sections 3.2.2 Species Priorities, 3.2.3 Treatment Program Considerations, and Appendix A Species Risk Rating Assessment. A discussion on volunteer involvement is included in a subsequent section of Appendix C. There is also supplemental information on the use of chemical treatment below in Appendix C

Table 7. Species Information Table.[15]

COMMON NAME	SCIENTIFIC NAME	RISK RANKING		PRESENCE	TREATMENT GOAL	TREATMENT TYPE	VOLUNTEER INVOLVEMENT APPROPRIATE
Giant hogweed*	*Heracleum mantegazzianum*	14	Extreme	Rare	Eradicate	Manual/Chemical	No
Knotweed species*	*Polygonum spp.*	12	Very High	Rare	Eradicate	Chemical	No
Daphne/spurge laurel	*Daphne laureola*	12	Very High	Rare	Eradicate	Manual	No
English ivy	*Hedera helix*	11	Very High	Rare	Eradicate	Manual	Yes
Scotch broom	*Cytisus scoparius*	10	Very High	Common	Contain	Manual	Yes
Lamium	*Lamiastrum galeobdolon*	9	High	Rare	Eradicate	Manual/Chemical	Yes
English holly	*Ilex aquifolium*	9	High	Rare	Eradicate	Manual/Chemical	Yes
Himalayan blackberry and cutleaf blackberry	*Rubus americanus* and *Rubus laciniatus*	9	High	Occasional***	Eradicate	Manual	Yes
Common tansy	*Tanacetum vulgare*	9	High	Occasional***	Eradicate	Manual	Yes
Goutweed	*Aegopodium podagraria*	8	High	Rare	Eradicate	Chemical****	No
Creeping bellflower	*Campanula rapunculoides*	8	High	Rare	Eradicate	Chemical****	No
Butterfly bush	*Buddleja davidii*	8	High	Rare	Eradicate	Manual	Yes
Orange hawkweed	*Hieracium aurantiacum*	8	High	Rare***	Eradicate	Chemical	No
Yellow hawkweed	*Hieracium caespitosum*	8	High	Occasional***	Eradicate	Chemical	No
St. John's wort	*Hypericum perforatum*	8	High	Occasional***	Contain	Manual	Yes
Reed canarygrass	*Phalaris arundinacea*	7	High	Common	Contain	Manual	No
Pepperweed, perennial	*Lepidium latifolium*	7	High	Rare	Eradicate	Manual	Yes
Hairy cat's-ear	*Hypochaeris radicata*	7	High	Rare***	Eradicate	Manual	Yes
Canada thistle*	*Cirsium arvense*	7	High	Occasional***	Contain	Chemical	No
Scentless chamomile*	*Matricaria perforata*	7	High	Rare***	Circumstantial Control	Manual	Yes
Tansy ragwort*	*Senecio jacobaea*	7	High	Rare	Eradicate	Manual	Yes

[15] Note that information in this table is based on current information and is subject to change in response to additional information, in particular new inventory data that may change presence and treatment goals.

COMMON NAME	SCIENTIFIC NAME	RISK RANKING		PRESENCE	TREATMENT GOAL	TREATMENT TYPE	VOLUNTEER INVOLVEMENT APPROPRIATE
Creeping buttercup	*Ranunculus repens*	6	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Curled dock	*Rumex crispus*	6	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Quackgrass	*Elymus repens*	6	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Sow thistle, perennial*	*Sonchus arvensis*	6	Moderate	Rare***	Circumstantial Control	Manual	Yes
Common Periwinkle	*Vinca minor*	6	Moderate	Rare	Circumstantial Control	Manual	Yes
Dame's rocket	*Hesperis matronalis*	5	Moderate	Rare	Circumstantial Control	Manual	Yes
Common mallow	*Malva neglecta*	5	Moderate	Rare***	Circumstantial Control	Manual	Yes
Burdock species	*Arctium spp*	5	Moderate	Rare	Circumstantial Control	Manual	Yes
Bull thistle	*Cirsium vulgare*	5	Moderate	Rare	Circumstantial Control	Manual	Yes
Mountain bluet	*Centurea montana*	5	Moderate	Rare	Circumstantial Control	Manual	Yes
Oxeye daisy**	*Leucanthemum vulgare*	5	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Hedge bindweed	*Calystegia sepium*	5	Moderate	Rare***	Circumstantial Control	Manual	Yes
Bladder campion	*Silene vulgaris*	5	Moderate	Rare***	Circumstantial Control	Manual	Yes
Common bentgrass	*Agrostis capillaria*	5	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Timothy grass	*Phleum pratense*	5	Moderate	Occasional***	Circumstantial Control	Manual	Yes
Blueweed	*Echium vulgare*	5	Moderate	Rare	Circumstantial Control	Manual	Yes
Bachelor's button	*Centaurea cyanus*	4	Moderate	Rare	Circumstantial Control	Manual	Yes

* Provincial noxious weeds under the BC *Weed Control Act*

** Regional noxious weed under the BC *Weed Control Act* in other regions of BC but not categorized as noxious on coast (i.e. at Cypress).

*** Abundance and distribution in the park is very uncertain

**** There is uncertainty around the most effective treatment method for these species.

Volunteer Involvement in Treatment of Invasive Plants

Over the course of the park's history, volunteer efforts have significantly contributed to the management of invasive plants. There are, however, a few circumstances where volunteer involvement in treatment efforts is not recommended:

1. **Species being chemically treated**. Chemical treatment can only be undertaken by staff or contractors holding a Pesticide Applicator's License and with appropriate training.
2. **Human health and safety**. In some cases special training and safety precautions are necessary. Volunteer involvement is only appropriate if training has been undertaken, appropriate precautions are followed, and volunteer activities have been specifically pre-approved by BC Parks.
3. **High risk species** where treatment is time sensitive or where regular monitoring and mapping of treatment sites is critical to the eradication of the plant within the park.
4. Species for which there is a park-wide **treatment program in place**. In these cases accurate and regular monitoring and evaluation may be critical to the success of the program (e.g., reed canarygrass).

In circumstances 3 and 4, it may be possible for volunteers to be involved, but only with substantial training in relevant protocols (e.g., protocols for collection of data for mapping and monitoring). These volunteers would also need work closely with staff or contractors coordinating the project.

Chemical Treatment: When Use is Acceptable

BC Parks Conservation Policy[16] (2014) includes the following statements: "invasive species will be managed or controlled as necessary to protect without jeopardizing: human health, ecosystem health and biodiversity" and; "invasive species control measures will consider the use of pesticides only if other options are unsuitable and there is a reasonable likelihood that the use of a pesticide will achieve management objectives." There are four circumstances when BC Parks would consider chemical treatment. In every case, the benefit of treatment must outweigh the risk (i.e., impact on the environment and people):

1. *Human health and safety at risk*. If manual treatment puts human health and safety in jeopardy then chemical treatment may be an appropriate alternative. For example, the initial manual removal of a large patch of giant hogweed may put staff/contractors unduly at risk of contact with the plant's toxic sap even when full protective gear is worn. In this case, the act of applying chemical treatment is safer than continuously handling the plants during digging and disposal

2. *Manual treatment is ineffective*. If repeat manual treatment does not result in eradication of a plant occurrence, then chemical treatment should be considered. This is primarily appropriate in the case of high risk invasive plants. Inefficacy of manual treatment may be determined based on available research and Best Management Practices OR based on assessment of past treatment efforts in the park

[16] BC Parks Conservation Policy (2014)

3. *Manual treatment causes unacceptable damage*. In some cases manual treatment may cause unacceptable damage to the environment through soil disturbance or trampling of surrounding native vegetation. Soil disturbance may lead to erosion or leave the site unduly vulnerable to invasion by other invasive plant species. Chemical treatment can be considered as an alternative but the benefit of such treatment must still outweigh the consequence to the environment

4. *Manual treatment not feasible*. In some cases manual treatments may be technically possible, but practically not feasible in terms of time, money or other resources. Chemical treatment can be considered in these cases, but is only appropriate in very limited situations where the risk of not treating plants is very high (i.e. benefits strongly outweigh risks). For example, high risk invasive plants are threatening a high value site, or time-sensitive treatments are required to prevent a high risk infestation from spreading.

Appendix D – Best Management Practices for Treatment of Invasive Plants

Sources of Best Management Practice information are provided in the following sections. Research and science in invasive plant management is constantly evolving. Check sources for updates on an annual basis.

Preventative Practices

The following are locally available resources detailing preventative Best Management Practices:

- Invasive Species Council of Metro Vancouver: Weeds in Mind workshops for operations staff
- Invasive Species Council of BC Publications:
    - Best Practice Guides for Invasive Plants in Parks and Protected Area of BC
    - Best Practices for Managing Invasive Plants on Roadsides
- South Coast Conservation Program Restoration Planning: Diversity by Design Guidebooks

Species Specific BMPs

This section provides sources for species specific Best Management Practices for invasive plant species.

- Invasive Species Council of BC TIPS Factsheets
- Field Guide to Noxious Weeds and Other Selected Invasive Plants of BC
- WeedsBC
- West Vancouver Invasive Plants Strategy – Schedule A – Best Management Practices
- Whatcom County Noxious Weed Fact Sheets
- King County Identification and Control of Noxious Weeds

Appendix E – Cypress Provincial Park Stakeholders

Stakeholder organizations involved in invasive species management at Cypress Provincial Park are outlined below in Table 8. This list also includes groups or organizations who have not been involved to date but who were suggested for potential future involvement ("potential stakeholders").

Table 8. Cypress Provincial Park stakeholders.

ORGANIZATION	HISTORICAL INVOLVEMENT IN IPM AT CPP	CONSULTED DURING THE DEVELOPMENT OF IPMS*	POTENTIAL STAKEHOLDER
BC Hydro	✓	✓	
BC Ministry of Transportation and Infrastructure	✓	✓	
BC Parks	✓	✓	
Cypress Mountain Resort	✓	✓	
Cypress Ski Area			✓
Cypress Ski Club		✓	
Diamond Head Consulting Ltd.	✓	✓	
District of West Vancouver	✓	✓	
Elders Council for Parks	✓	✓	
Friends of Cypress Provincial Park	✓	✓	
Groups active in other North Shore provincial parks (dog walkers, recreational groups)			✓
Hollyburn Ridge Association	✓	✓	
Invasive Species Council of Metro Vancouver	✓	✓	
Lynn Headwaters Regional Park partners			✓
Mainroad Howe Sound Contracting LP	✓	✓	
Metro Vancouver			✓
Mount Fromme user groups			✓
Musqueam Nation		✓	
Nature Vancouver	✓	✓	
North Shore Mountain Bike Association		✓	
North Shore Wetland Partners	✓	✓	
Old Growth Conservancy Society	✓	✓	
Sartori Environmental Services (Cypress Mountain Resort contractor)	✓	✓	
Seymour Ski Area			✓
Squamish Nation		✓	
Tsleil-Waututh Nation		✓	

IPM = invasive plant management; CPP = Cypress Provincial Park; IPMS = invasive plant management strategy

*All organizations were invited to participate in the development of the IPMS although participation was varied.

Appendix F – References

The following references were considered during the development of the Cypress Invasive Plant Management Strategy.

Provincial

- BC *Weed Control Act* and *Integrated Pest Management Act* and Regulation
- Invasive Plant Pest Management Plan for Provincial Crown Lands in the South Coastal Region of British Columbia (Ministry of Forests, Lands and Natural Resources, 2016)
- Best Management Practices for Invasive Plants in Parks and Protected Areas of British Columbia (ISCBC & BC Parks, 2011)
- Best Management Practices for Managing Invasive Plants on Roadsides (ISCBC & MOT, 2015)
- BC Invasive Plant Core Ranking Process (ISCBC & BC Inter-Ministry Invasive Species Working Group)
- Invasive Alien Plant Program (IAPP) database

BC Parks

- Invasive Plants in British Columbia Protected Lands: A Strategic Plan (Wikeem & Miller, 2006)
- Invasive Plants in British Columbia Protected Lands: Best Management Practices (Wikeem & Miller, 2006)
- BC Parks Invasive Plants Threat Analysis (Atwood & Young, 2010)
- BC Parks Material Importation Protocols

Cypress Provincial Park

- Cypress Provincial Park Master Plan (BC Parks, 1997)
- Cypress Bowl Invasive Plant Management Plan (Atwood, 2010)
- Reed canarygrass Inventory and Management Recommendations (Diamond Head Consulting, 2015)
- Cypress Mountain Long Term Invasive Plant Management Plan (Sartori Environmental Services, 2016)
- Friends of Cypress Provincial Park newsletters
- Invasive plant inventory, treatment and restoration reports from various volunteer groups, contractors and BC Parks staff

Municipal/Regional

- District of West Vancouver Invasive Plant Strategy (2014)
- City of Coquitlam Invasive Plant Strategy (2008)
- District of North Vancouver Invasive Plant Management Strategy (2014)
- City of Richmond Invasive Species Action Plan (2015)
- City of North Vancouver Invasive Plant Inventory (2011 and 2015)
- Metro Vancouver Regional Parks Integrated Pest Management Plan (2012)