

BCIT Invasive Plant Management Plan



Photo Credit: Lia Bijman

Prepared for:

**British Columbia Institute of
Technology**
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Project No. 106187-01

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1.0 INTRODUCTION

Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Canada Inc., and the Invasive Species Council of Metro Vancouver were retained by the British Columbia Institute of Technology (BCIT) to develop an Invasive Plant Management Plan (IPMP) for their five campuses across the Greater Vancouver region of BC (**Figure 1**).

1.1 What are Invasive Plants?

Invasive species are plants and animals that occur outside of their natural range and have significant negative impacts on native species. Many non-native species are not able to adapt to local conditions and are not considered invasive, but some are able to flourish and spread rapidly to the detriment of the native plants and animals. The impacts from invasive species may be social, ecological, or economic. Social impacts include health and safety risks to humans and domestic animals, impeding recreational access, or degrading landscapes and views.

Invasive plants may become established through various means, such as vegetation disturbance with removal and transfer of soil and plant products, movement of people and equipment, landscape maintenance activities, poorly executed restoration projects through planting of non-native species or weeds in seed mixes, and dispersal by water, animals, and wind. The presence of invasive plants in areas adjacent to development or disturbance may increase the risk of introduction or dispersal. Animals, especially birds, can easily spread invasive seeds across landscapes, increasing invasive plant distribution.

1.2 Invasive Plant Management Purpose and Objective

The purpose of this IPMP is to develop a strategy to address the establishment and proliferation of invasive plants across each of the five Metro Vancouver campuses. The objective of the IPMP is to provide BCIT with a plan to mitigate the impacts of invasive plants on native ecosystems within the campuses through the implementation of control and monitoring procedures. The successful management of invasive plants will require a long-term adaptive management approach to maximize success.

2.0 BACKGROUND

2.1 Campus Locations

BCIT operates across five main campuses in and around the Greater Vancouver region (**Figure 1**):

- Burnaby (Main) Campus, Burnaby.
- Downtown Vancouver Campus, Vancouver.
- Aerospace Technology Campus, Richmond.
- Marine Campus, North Vancouver.
- Annacis Island Campus, Delta.

BCIT Campus Overview

Legend

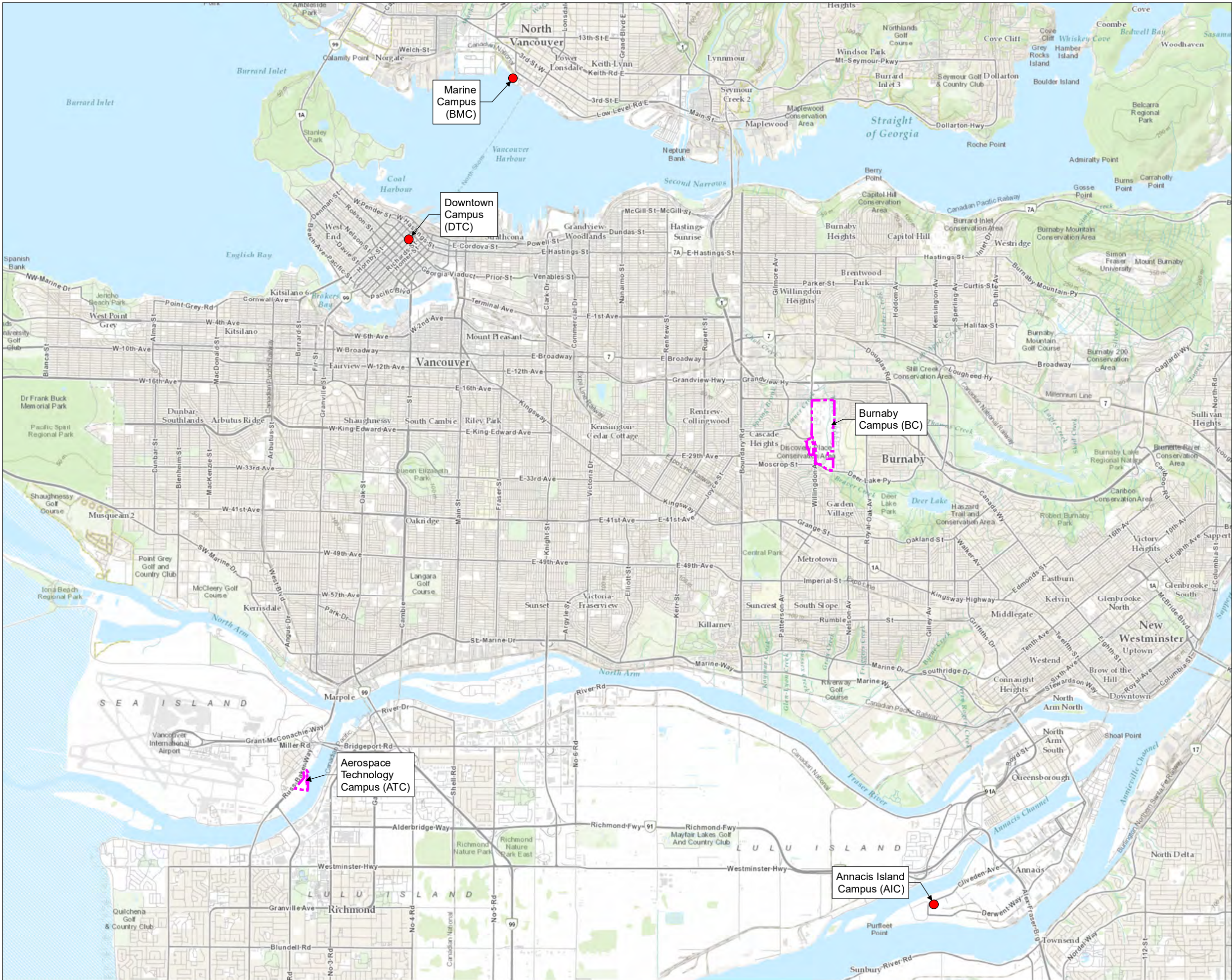
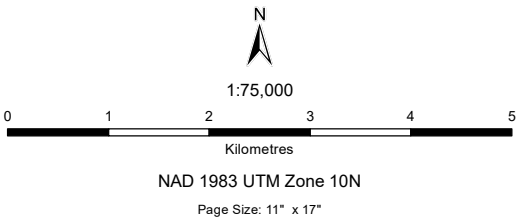
- BCIT Campus Location
- ▭ BCIT Campus Boundary

Notes

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Sources

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- Aerial Image: ESRI World Topographic



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2.2 Historical Invasive Plant Management Work on BCIT Campuses

BCIT has conducted some invasive plant management at the Burnaby (Main) Campus in recent years with a focus on knotweed (*Fallopia* / *Reynoutria* sp.)¹. The primary treatment method has been chemical, with the first treated area located northwest of Carey Avenue and Kyle Street (**Figure 2c**). The knotweed was chemically treated with glyphosate three times in 2020, twice in September and once in October; this treatment resulted in the death of the knotweed in that area. Treatments of glyphosate were also applied in September and October 2020 by Premier Landscaping to the knotweed population near Guichon Creek at the southeast corner of campus where Kyle Street turns from north-south to east-west (**Figure 2d**). Additional spot treatments were applied along the trails in the forested area of the Burnaby (Main) Campus.

Previous invasive plant assessments and management plans have been conducted by BCIT students in 2018 and 2019 (Kelly et al. 2018, Tan et al. 2019). The plan included management options for English ivy (*Hedera helix*), Himalayan blackberry (*Rubus armeniacus*), English holly (*Ilex aquifolium*), and cherry laurel (*Prunus lauracerasus*). Prior to 2018, students and instructors in the Fish, Wildlife and Recreation Program conducted several knotweed management trials in the area around the landscape compound site (northeast corner of the Kyle Street and Carey Avenue intersection). This work also involved the planting of native trees, however, many of these plants did not survive.

In 2019 BCIT Facilities Services partnered with the Invasive Species Council of British Columbia (ISCBC) in coordinating youth volunteers from Moscrop Secondary School to conduct weed pulls at the Burnaby (Main) Campus, focusing on ivy and Himalayan blackberry.

Additionally, the BCIT Society of Ecological Restoration Club has hosted events and completed stewardship work at the Burnaby (Main) Campus. Invasive plant pulls and native plantings occurred largely at the north end of Guichon Creek, adjacent to Parking Lots D & F.

BCIT horticultural staff also work to keep invasive plants out of landscape beds and natural areas. For example, they have done manual control within the riparian areas of Guichon Creek for the purposes of restoration and infrastructure maintenance (e.g., clearing weirs).

An area of knotweed was also treated on the southeast corner of the Aerospace Technology Campus (**Figure 4**). An herbicide application sign at the site indicates treatment is a City of Richmond initiative².

2.3 Legislative Context

The management of invasive plants are regulated at federal, provincial, and municipal levels. These acts and regulations are designed to reduce effects to native vegetation communities and are outlined in **Table 1**.

¹ Four invasive knotweed species are known to occur in BC: Japanese knotweed (*Reynoutria japonica* var. *japonica*), giant knotweed (*Reynoutria sachalinensis*), Bohemian knotweed (*Reynoutria x bohemica*), and Himalayan knotweed (*Koenigia polystachya*). All four species are similar in appearance, biology, impacts, and distribution. The species assumed present around Guichon Creek at the Burnaby (Main) Campus is Bohemian knotweed (T. Murray, pers. comm. 2020), however, methods of control will be discussed under the general title of “knotweeds.”

² The City of Richmond maintains parts of the trail that runs along the middle arm of the Fraser River.

Table 1 Regulatory and Policy Setting for Invasive Plants

Legislation	Agency	Descriptions and Prohibitions	Relevant Campus
Federal			
<i>Plant Protection Act</i> S.C. 1990, c.22	Agriculture and Agri-Food Canada	This Act prevents the importation, movement and spread of pests that are harmful to plants. Regulated species include plant and plant pests.	All
<i>Seeds Act</i> , R.S.C. 1985, c. S-8	Agriculture and Agri-Food Canada	This Act and its corresponding Seeds Regulations regulate the seeds in Canada that are released into the environment that are designated as Prohibited Noxious Weeds.	All
<i>Pest Control Products Act</i> , S.C. 2002, c. 28	Health Canada	Regulates pesticide registration and use within Canada. It determines pesticides effects on human health and safety, environmental impacts, compliance, and enforcement.	All
Provincial			
<i>Weed Control Act</i> , RSBC 1996, c. 487	Ministry of Agriculture	This Act aims to control the spread of designated noxious weeds on all provincial public and private land in BC. There is an obligation under the Act for the land occupier to control these designated noxious weeds. There are currently 39 species classed as noxious within all regions of BC, and 27 additional species are listed as noxious weeds within the boundaries of certain Regional Districts, but not within Metro Vancouver (Government of British Columbia 2011).	All
<i>Integrated Pest Management Act</i> SBC 2003, c. 58	Ministry of Justice	This Act provides regulates the sale and use of pesticides in BC.	All
<i>Community Charter Act</i> SBC 2003, c. 26	Ministry of Environment	Authorizes municipalities to regulate invasive plants on private property through the use of bylaws. Regulatory powers depend on the threat posed (environmental, nuisance or public health concern).	All
<i>Water Sustainability Act</i> 2014, c. 15	Ministry of Forests, Lands, Natural Resource Operations and Rural Development	Authorizes changes in and about a stream. Includes removal and planting of vegetation near and within watercourses.	All
Municipal			
Burnaby Pesticide Use Control Bylaw, No. 12465, 2008	City of Burnaby	Limits use of pesticides on private and public lands. A permit must be obtained for pesticide use.	Burnaby (Main) Campus
Integrated Pest Management (IMP) Policy		An ecological approach to the management of pest problems including weeds on public and private lands.	
Delta Property Enhancement Bylaw No. 7055	City of Delta	An owner of a property must not allow the accumulation or growth of noxious weeds on their property.	Annacis Island Campus
Pesticide Use Control Bylaw No. 6788		Regulates the use of pesticides for “cosmetic” purposes on all public or private lands. A permit must be obtained for pesticide use.	

Legislation	Agency	Descriptions and Prohibitions	Relevant Campus
Unsightly Premises Bylaw No. 7162, 2001	City of Richmond	Requires residents maintain property to not accumulate noxious matter or substances and be clear of weeds.	Aerospace Technology Campus
Pesticide Use Control Bylaw No. 8514, 2009		Limits use of pesticides on residential properties and city land. A permit must be obtained for pesticide use.	
Health By-Law No. 9535	City of Vancouver	Limits use of pesticides. A permit must be obtained for pesticide use.	Downtown Campus
Stream and Drainage System Protection Bylaw No. 7541, 2003	City of North Vancouver	Regulates, prohibits, and imposes requirements in relation to the protection of the natural environment on public or private property.	Marine Campus
Cosmetic Pesticide Use Control Bylaw No. 8041, 2009		Regulates the use of pesticides for cosmetic purposed within the city. A permit must be obtained for pesticide use.	
Nuisance Abatement Bylaw No. 5659, 1986		Requires property owners to keep their property clear of noxious weeds.	

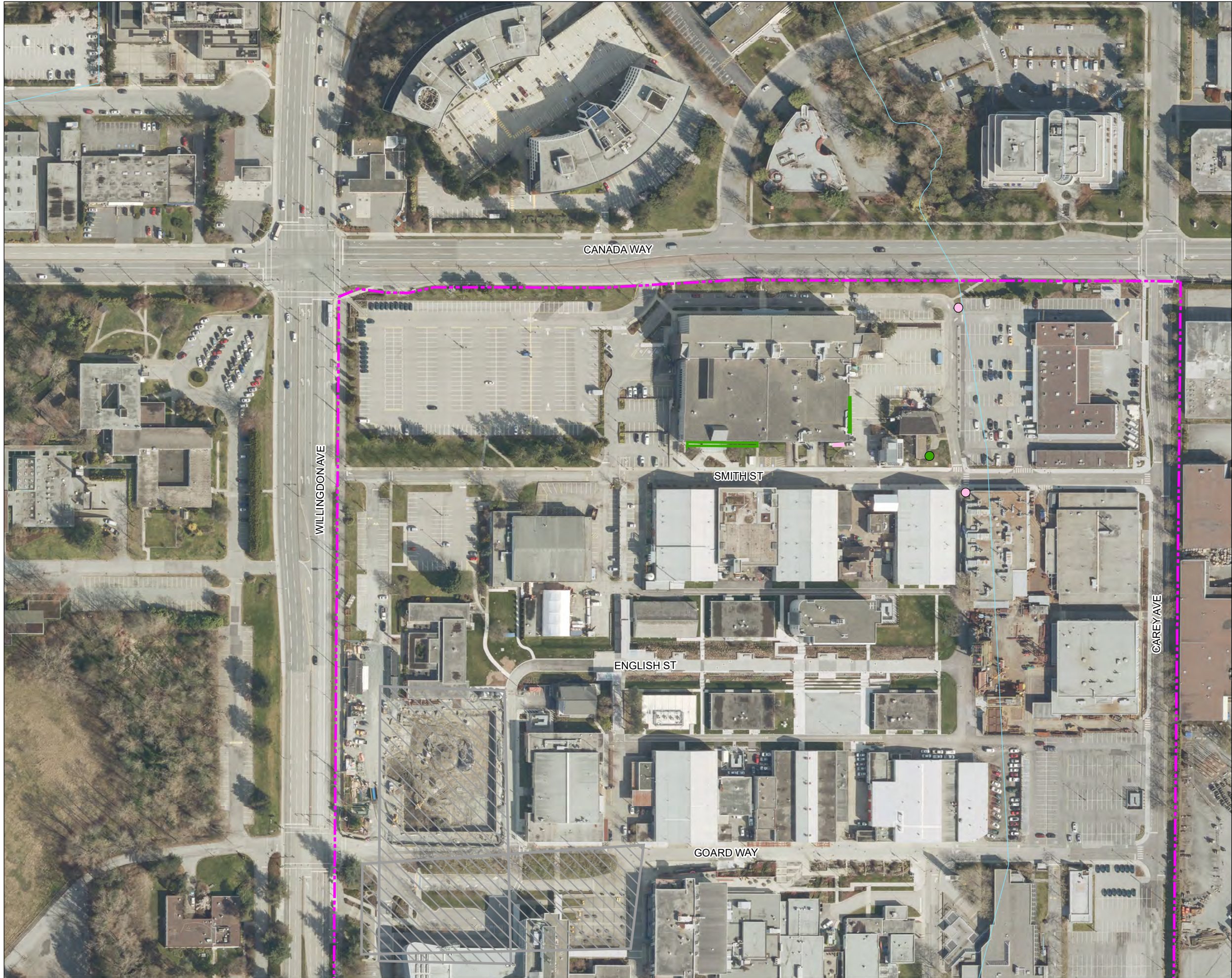
3.0 INVASIVE PLANT ASSESSMENT

3.1 Invasive Plant Determination

A Hemmera qualified environmental professional (QEP) conducted invasive plant inventories to document invasive plant species composition and distribution at each BCIT Campus. These inventories were conducted on foot from August 10 to 12, 2021. Invasive plants and their locations were recorded using a georeferenced map on an iPad, with representative photos captured for the various species observed. The geomatics team then took the field data and produced distribution maps outlining the invasive plant locations for each campus (**Figure 2** through **Figure 6**).

3.2 Invasive Plant Species Observed

All campuses were surveyed for noxious species as regulated under the BC *Weed Control Act* (**Table 2**) and invasive plant species of regional concern. Of the invasive plants observed, four are classified as Noxious Weeds and are priority species for management. Photos of each invasive species are included in **Appendix A**.



**Burnaby Campus
Invasive Plant Location**

Legend

Site Boundary	Invasive Plant Area
Construction Area - Not Surveyed	Cherry Laurel
Watercourse	Ivy

Invasive Plant Location

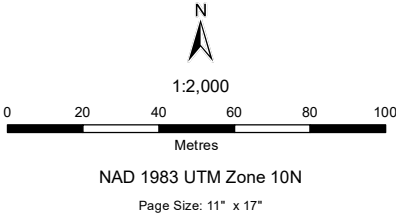
- Cherry Laurel
- Ivy

Notes

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Sources

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- Aerial Image: City of Burnaby, 2020



Burnaby Campus
Invasive Plant Location

Legend

Site Boundary

Construction Area - Not Surveyed

Watercourse

Invasive Plant Location

Cherry Laurel

English Holly

European bittersweet

Hedge Bindweed

Himalayan Balsam

Himalayan Blackberry

Ivy

Purple Loosestrife

Sow Thistle

Invasive Plant Area

Cherry Laurel

Himalayan Blackberry

Himalayan Blackberry and English Holly

Himalayan Blackberry and Hedge Bindweed

Himalayan Blackberry and Ivy

Ivy

Knotweed

Periwinkle

Purple Loosestrife

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- Aerial Image: City of Burnaby, 2020

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Figure 2b

Hemmera
An Ausenco Company

British Columbia
Institute of Technology

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Burnaby Campus
Invasive Plant Location

Legend

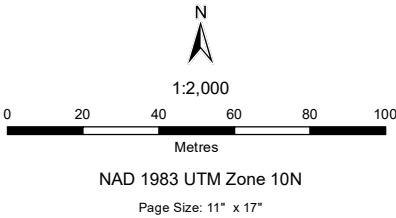
<div><div></div></div> Site Boundary	<div><div></div></div> Invasive Plant Area
<div><div></div></div> Watercourse	<div><div></div></div> Cherry Laurel
<div><div></div></div> Invasive Plant Location	<div><div></div></div> English Holly
<div><div></div></div> Cherry Laurel	<div><div></div></div> Himalayan Blackberry
<div><div></div></div> English Holly	<div><div></div></div> Himalayan Blackberry and Bindweed
<div><div></div></div> European bittersweet	<div><div></div></div> Himalayan Blackberry and Cherry Laurel
<div><div></div></div> Hedge Bindweed	<div><div></div></div> Himalayan Blackberry and English Holly
<div><div></div></div> Himalayan Balsam	<div><div></div></div> Himalayan Blackberry and Hedge Bindweed
<div><div></div></div> Himalayan Blackberry	<div><div></div></div> Himalayan Blackberry and Ivy
<div><div></div></div> Horse Chestnut	<div><div></div></div> Ivy
<div><div></div></div> Ivy	<div><div></div></div> Knotweed
<div><div></div></div> Knotweed	<div><div></div></div> Treated Knotweed
<div><div></div></div> Lady's Thumb	<div><div></div></div> Purple Loosestrife
<div><div></div></div> Purple Loosestrife	<div><div></div></div> Small Flower Impatiens
<div><div></div></div> Reed Canarygrass	<div><div></div></div> Sow Thistle
<div><div></div></div> Sow Thistle	
<div><div></div></div> Spurge Laurel	
<div><div></div></div> White Sweet Clover	
<div><div></div></div> Yellow Archangel	

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Burnaby Campus
Invasive Plant Location

Legend

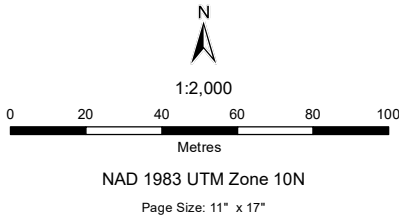
<div><div></div></div> Site Boundary	<div><div></div></div> Invasive Plant Area
<div><div></div></div> Watercourse	<div><div></div></div> Cherry Laurel
<div><div></div></div> Barnyard Grass	<div><div></div></div> English Holly
<div><div></div></div> Cherry Laurel	<div><div></div></div> Himalayan Blackberry
<div><div></div></div> Common Mallow	<div><div></div></div> Himalayan Blackberry and Cherry Laurel
<div><div></div></div> Common periwinkle	<div><div></div></div> Himalayan Blackberry and English Holly
<div><div></div></div> English Holly	<div><div></div></div> Himalayan Blackberry and Hedge Bindweed
<div><div></div></div> European bittersweet	<div><div></div></div> Himalayan Blackberry and Ivy
<div><div></div></div> Hedge Bindweed	<div><div></div></div> Himalayan Blackberry and Knotweed
<div><div></div></div> Himalayan Balsam	<div><div></div></div> Himalayan Blackberry, Knotweed, and Hedge Bindweed
<div><div></div></div> Himalayan Blackberry	<div><div></div></div> Ivy
<div><div></div></div> Ivy	<div><div></div></div> Knotweed
<div><div></div></div> Knotweed	<div><div></div></div> Treated Knotweed
<div><div></div></div> Lady's Thumb	<div><div></div></div> Periwinkle
<div><div></div></div> Portugal Laurel	<div><div></div></div> Small Flower Impatiens
<div><div></div></div> Reed Canarygrass	<div><div></div></div> Sow Thistle
<div><div></div></div> Sow Thistle	
<div><div></div></div> Spurge Laurel	
<div><div></div></div> White Sweet Clover	

Notes

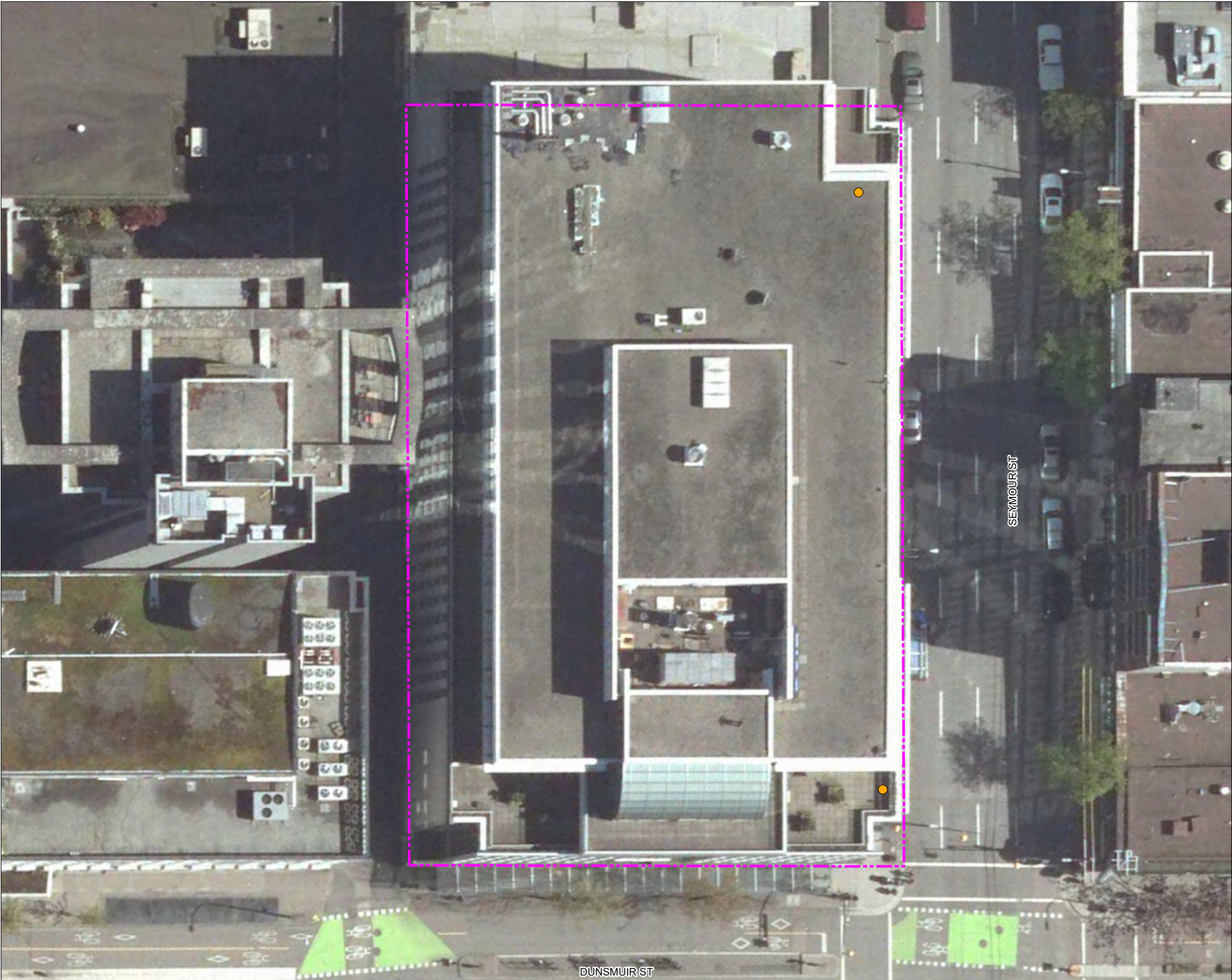
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Downtown Vancouver Campus
Invasive Plant Locations

Legend

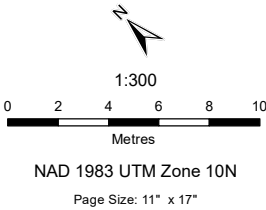
- Site Boundary
- Invasive Plant Location
 - Himalayan Blackberry

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Aerospace Technology Campus
Invasive Plant Locations

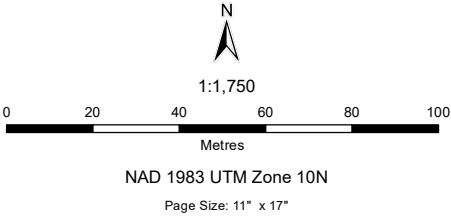
Legend	
<div><div></div>Site Boundary</div>	
Invasive Plant Location	
<div><div></div>Butterfly-Bush</div>	
<div><div></div>Canada Thistle</div>	
<div><div></div>Canada Thistle and Himalayan Blackberry</div>	
<div><div></div>Cherry Laurel</div>	
<div><div></div>Common Tansy</div>	
<div><div></div>Common periwinkle</div>	
<div><div></div>Cutleaf Blackberry</div>	
<div><div></div>English Holly</div>	
<div><div></div>European bittersweet</div>	
<div><div></div>Hedge Bindweed</div>	
<div><div></div>Himalayan Blackberry</div>	
<div><div></div>Ivy</div>	
<div><div></div>Ivy and English Holly</div>	
<div><div></div>Ivy, Himalayan Blackberry, Common Tansy, and St Johns Wort</div>	
<div><div></div>Purple Loosetrife</div>	
<div><div></div>Reed Canarygrass</div>	
<div><div></div>Scotch Broom</div>	
<div><div></div>St John's Wort</div>	
Invasive Plant Area	
<div><div></div>Cherry Laurel and Hedge Bindweed</div>	
<div><div></div>Himalayan Blackberry</div>	
<div><div></div>Himalayan Blackberry and Hedge Bindweed</div>	
<div><div></div>Himalayan Blackberry and Ivy</div>	
<div><div></div>Himalayan Blackberry, Knotweed, and Ivy</div>	
<div><div></div>Ivy</div>	
<div><div></div>Landscaped Cherry Laurel</div>	
<div><div></div>Purple Loosetrife</div>	
<div><div></div>Reed Canarygrass</div>	
<div><div></div>Reed Canarygrass and Purple Loosetrife</div>	
<div><div></div>Treated Knotweed</div>	

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**Marine Campus
Invasive Plant Locations**

Legend

Site Boundary

Invasive Plant Location

- Cherry Laurel
- Himalayan Blackberry
- Ivy
- St John's-wort

Invasive Plant Area

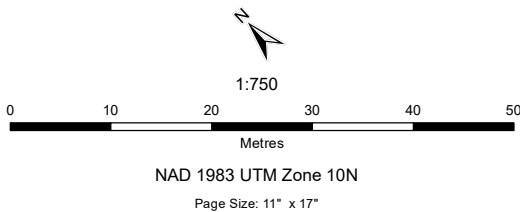
- Cherry Laurel
- Himalayan Blackberry
- Ivy
- St John's-wort

Notes

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Annacis Island Campus
Invasive Plant Locations

Legend

Site Boundary

Invasive Plant Location

- English Holly
- Himalayan Blackberry
- Scotch Broom

Invasive Plant Area

- Canada Thistle and Milk Thistle
- Canada Thistle, Himalayan Blackberry, and Common Tansy
- Himalayan Blackberry

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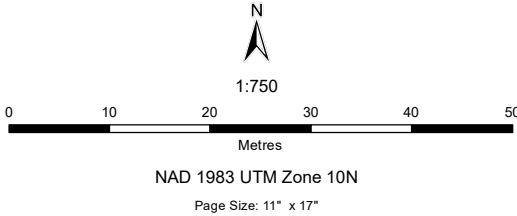


Table 2 Invasive Plant Species Observed at BCIT

Common Name	Scientific Name	Campus Observed ¹					Photo Number
		BC	DT	ATC	MC	AI	
Barnyard grass	<i>Echinochloa muricata</i>	✓					1
Butterfly-bush	<i>Buddleja davidii</i>			✓			2
Canada thistle*	<i>Cirsium arvense</i>			✓		✓	3
Cherry laurel	<i>Prunus lauracerasus</i>	✓		✓	✓		4
Common mallow	<i>Malva sylvestris</i>	✓					5
Common periwinkle	<i>Vinca minor</i>	✓		✓			6
Common tansy	<i>Tanacetum vulgare</i>	✓		✓		✓	7
Cutleaf blackberry	<i>Rubus laciniatus</i>			✓			8
English holly	<i>Ilex aquifolium</i>	✓		✓		✓	9
European bittersweet	<i>Solanum dulcamara</i>	✓		✓			10
Hedge bindweed	<i>Calystegia sepium</i> ssp. <i>sepium</i>	✓		✓			11
Himalayan balsam	<i>Impatiens glandulifera</i>	✓					12
Himalayan blackberry	<i>Rubus armeniacus</i>	✓	✓	✓	✓	✓	13
Horse chestnut	<i>Aesculus hippocastanum</i>	✓					14
Ivy species (English or Irish)	<i>Hedera helix</i> , <i>Hedera hibernica</i>	✓		✓	✓		15
Knotweed* (Bohemian, giant, Japanese, and/or Himalayan knotweed)	<i>Reynoutria x bohemica</i> , <i>Reynoutria sachalinensis</i> , <i>Reynoutria japonica</i> var. <i>japonica</i> , <i>Koenigia polystachya</i>	✓		✓			16
Lady's-thumb	<i>Persicaria maculosa</i>	✓					17
Milk thistle*	<i>Silybum marianum</i>					✓	18
Portugal-laurel	<i>Prunus lusitanica</i>	✓					19
Purple loosestrife*	<i>Lythrum salicaria</i>	✓		✓			20
Reed canarygrass	<i>Phalaris arundinacea</i>	✓		✓			21
Scotch broom	<i>Cytisus scoparius</i>			✓		✓	22
Small flower impatiens	<i>Impatiens parviflora</i>	✓					23
Annual sow-thistle*	<i>Sonchus oleraceus</i>	✓					24
Spurge laurel	<i>Daphne laureola</i>	✓					25
St. John's wort	<i>Hypericum perforatum</i>			✓	✓		26
White sweet-clover	<i>Melilotus albus</i>	✓					27
Yellow archangel	<i>Lamium galeobdolon</i>	✓					28

¹ BC=Burnaby (Main) Campus, DT= Downtown Campus, ATC= Aerospace Technology Campus, MC=Marine Campus, AI= Annacis Island Campus

* Noxious weed regulated under the BC *Weed Control Act*

3.3 Invasive Plant Abundance and Distribution

Based on the inventory work conducted by Hemmera, Himalayan blackberry was the most common invasive plant species within BCIT campuses, appearing at all five campuses. Ivy was the next most prevalent plant species observed; ivy was introduced as a landscaped plant on most campuses but has become widely dispersed. Extensive amounts of ivy were observed on large trees at the Burnaby and Aerospace Technology Campuses (**Figure 2** and **Figure 4**).

3.3.1 Burnaby (Main) Campus

The Burnaby (Main) Campus is the largest BCIT campus and has been highly developed; however, this campus has natural forested areas remaining at the south end of the campus, as well as west of Willingdon Avenue (**Figure 2**). The forested areas have multiple trails running through them for recreational use. There is also a creek, Guichon Creek, that enters campus at Deer Lake Parkway and travels north above ground to Building SE16 then underground exiting at Canada Way.

This campus had the most extensive invasive plant distribution of all BCIT campuses. The northern end of the campus, which is more developed than the southern area, had a relatively small number of invasive plant species, with landscaped plants (e.g., ivy and cherry laurel) composing the majority of species observed.

Most invasive plant species were centered around Guichon Creek, the forest at the southern end of the campus, and the forest around on the west side of campus, west of Willingdon Avenue (**Figure 2c**). Himalayan blackberry, ivy, cherry laurel, and knotweed were the most widely distributed species on campus, followed by English holly.

3.3.2 Downtown Vancouver Campus

The Downtown Campus is entirely developed, and therefore has very little space for invasive plant species to establish. Himalayan blackberry, however, was observed on the second-floor balcony of the building (**Figure 3**).

3.3.3 Aerospace Technology Campus

The Aerospace Technology Campus is mostly developed with a stretch of forested area bordering the east side of campus and Fraser River (**Figure 4**). The forested area had an extensive number of invasive plant species present. Himalayan blackberry and ivy were the most widely distributed species, followed by purple loosestrife (*Lythrum salicaria*). Two areas of knotweed were located on the campus, with one being previously chemically treated. Landscaped cherry laurel was observed at multiple locations across the campus, with some instances of the species extending into the forested area.

3.3.4 Marine Campus

The marine campus is mostly developed with a few trees along the north border and southeast corner. The Marine Campus was composed primarily of landscaped plants, with both cherry laurel and ivy observed (**Figure 5**). St. John's wort (*Hypericum perforatum*) was observed near the marine dock and the east side of the building among the landscaping. Himalayan blackberry was also observed in a small area near the marine dock.

3.3.5 Annacis Island Campus

The Annacis Island Campus is almost entirely developed except for some trees along the northern, eastern, and western borders. The invasive species were observed in the east and west sides of the campus, with the majority coming through the fence from the neighbouring property to the east (**Figure 6**). Himalayan blackberry and two species of thistle, Canada thistle (*Cirsium arvense*) and milk thistle (*Silybum marianum*), were the most observed species.

3.4 Species Impacts

3.4.1 Noxious Weeds

As noxious weeds are regulated under the BC *Weed Control Act*, and require the land occupier to control them, these species are a priority for management over the other invasive plants on BCIT campuses. Noxious species observed were knotweed, purple loosestrife, Canada thistle, milk thistle, and annual sow-thistle (*Sonchus oleraceus*).

Knotweed outcompetes native species and destroys habitats, causing social, economic, and environmental impacts (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021l). The root system of knotweed causes stream bank erosion and damages building foundations and other structures. Knotweed spreads easily from small stems and root fragments left in the soil making it a difficult species to manage.

Purple loosestrife can quickly overrun waterways and marshes. It is able to decrease the species diversity of the area and decrease the food and habitat available for local wildlife (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021h). The plant attracts local pollinators, diverting them from native plants.

Thistle and sow-thistle species infest crops, pastures, roadsides, and riverbanks. They can spread rapidly though horizontal roots and form dense patches of monocultures (City of Delta 2016).

3.4.2 Widely Occurring Species

Himalayan blackberry and ivy were the most widely occurring species across the five BCIT campuses. Although Himalayan blackberry supplies limited food value to people and wildlife throughout the Lower Mainland, it forms dense thickets which obstruct roads, walkways, and signs (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021f). The impenetrable thickets of live and dead canes can degrade the quality of riparian habitats and forest edges; Himalayan blackberry shrubs provide limited food, nesting sites, and wildlife cover, but overall, offers poorer quality habitat compared to native shrubs, causing a reduction in biodiversity.

Ivy grows in dense monocultures along the ground and climbs trees and structures. It smothers native vegetation, specifically trees, and inhibits the understory growth of riparian forests (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021f). Ivy cover deprives tree bark of normal contact with air and microorganisms, and its weight can break branches or topple trees. Ivy berries can have detrimental effects to native birds as they are mildly toxic, and the berries and leaves are also toxic to humans and livestock.

3.4.3 Other Invasive Plants

The impacts of the remaining invasive plants observed at BCIT are summarized in **Table 3**.

Table 3 Invasive Plant Impacts

Common Name	Species Impacts
Tree/Shrub	
Butterfly-bush	Large seed bank is easily spread by wind and water and can grow after many years in the soil replacing native species.
Laurel (cherry, Portugal, and spurge)	Seeds are dispersed easily by birds and small mammals and outcompetes native species for light, nutrients, and space.
Cutleaf blackberry	Similar to Himalayan blackberry, outcompetes native blackberry and creates impenetrable thickets which can degrade habitat and biodiversity.
English holly	Forms dense thickets, can suppress native tree growth, and out-competes native vegetation for water.
Horse chestnut	A tree with seeds, bark, flowers, and leaves that are toxic to humans and wildlife.
Scotch broom	Outcompetes conifer seedlings with dense infestations, obstructs road sightlines and increases wildfire fuel loads.
St. John's wort	Crowds out natural plants and is toxic to farm animals.
White sweet-clover	Grows easily in open habitat where it grows taller and denser than many native plants, shading them out.
Grass	
Barnyard grass	Invades riparian communities and occurs along roadsides, ditches and in disturbed areas. Outcompetes native plants by removing up to 80% of available soil nitrogen.
Reed canarygrass	Forms dense, persistent monocultures in wetlands, ditches, floodplains, and wet meadows. Excludes other plants by forming a thick sod layer covering the ground.
Herbaceous Plant	
Common mallow	Produces a large number of seeds that are easily distributed and outcompetes native species.
Common tansy	Displace native vegetation and can be toxic to grazers.
European bittersweet	Plant is toxic to people, pets, and livestock. Highly competitive near creeks, rivers and streams and interferes with fish movement by creating false gravel beds.
Hedge bindweed	Fast growing following soil disturbance threatening newly installed plants or structures. Weighs down branches or stems of other plants and can cause breakage.
Himalayan balsam	Abundance of seeds quickly dominate areas causing homogeneous stands along creeks, riverbanks, trail edges and grassy clearings. Annual die back results in bare soil, which may cause soil erosion.
Lady's-thumb	Outcompetes crops in agricultural areas. Occurs along roadside and ditches and in disturbed areas.
Common periwinkle	Displaces native plant species by forming extensive mats along the forest floor.
Small flower impatiens	Prolific seed production and spread outcompetes native species. Annual die back results in bare soil, which may cause soil erosion.
Yellow archangel	Aggressive and well adapted plant with seed dispersal through ants.

4.0 MANAGEMENT PLAN

There are five key management strategies proposed for Invasive Plant Management at the BCIT campuses:

1. Prevention: prevent invasive plants from being introduced and reduce the risk of spread at sites.
2. Control: create a treatment plan for invasive plants at BCIT.
3. Restoration: following removal of invasive plants, restore using native plant species.
4. Communication: educate and train staff to elevate awareness of invasive plants on campus.
5. Campus Involvement Opportunities: provide opportunities for students, employees, and campus users to get involved in ongoing invasive species management across campuses.

4.1 Prevention

Preventing the introduction and spread of invasive species onto BCIT campuses is the most efficient option to manage invasive plant proliferation. Although there are many invasive species already present on BCIT campuses (**Section 3.0**), prevention of further invasive plant establishment is an effective approach to reducing invasive plants from occupying new areas of the campuses.

4.1.1 Early Detection

For many invasive plant species, there is a limited time between the introduction of the invasive plant and it becoming distributed across a larger geographic area. Once invasive plants are established and spreading, the cost of treatment increases exponentially (IMISWG 2014). The province of BC has an Early Detection and Rapid Response program (EDRR) which outlines the approach to identify, systemically eradicate, contain, or control species before they disperse³. By implementing this approach, grounds crews can identify invasive plant species early and prevent their spread throughout campuses.

Recommendations:

- Develop a process for grounds crews and contractors to report new invasive plant occurrences to confirm identity, map their locations, and arrange appropriate treatment.
- Create an EDRR species list that contains plants in the region which are not yet detected on campus. This list should include the Provincial invasive plant candidates for eradication. Species on this list that are found in BC must be reported to the province and are candidates for eradication under the Provincial EDRR program. Make the EDRR species list a high priority for grounds crews and contractors to monitor and report on these species.

4.1.2 Avoid Planting Invasives

Multiple invasive species throughout BCIT campuses appear to have been introduced by landscaping, including ivy and laurel (cherry, Portugal, and spurge), which consequently spread to other areas of the campuses.

³ [Invasive Species Early Detection and Rapid Response Plan for British Columbia](#)

Recommendations:

- Eliminate the use of invasive plants in future landscaping activities on campuses, using non-native or native species instead. The most commonly observed species observed on BCIT campuses that are currently or can become invasive, and are commonly introduced through horticulture activities, were:
 - Ivy.
 - Cherry laurel.
 - Chocolate vine (*Akebia quinata*).
 - Japanese pachysandra (*Pachysandra terminalis*).
- Ensure that all development projects, landscape designs, on-campus stewardship activities and student research/projects do not include the introduction of invasive species. Staff and/or QEPs should carefully review all landscape plans, plantings lists; and seed mixes.

4.1.3 Spread Prevention

Soil, seed, and plant fragment movement to and from BCIT campuses, as well as across campuses, can increase invasive species proliferation.

Recommendations:

- Site disturbance from construction related activities:
 - Identify invasive plants in a work area prior to site disturbance and incorporate measures to prevent spread into the construction area.
 - Confirm all invasive plant parts and contaminated soil are properly managed and disposed of to inhibit spread.
 - Clean machinery prior to use and remove seeds and vegetative plant matter from equipment before moving locations.
 - Revegetate disturbed areas as rapidly as possible following disturbance.
 - Attempt to source and use invasive-free seed mixes.
 - Ensure all construction contractors are familiar with, and use, best practices for prevention and management of invasive species. Include this requirement in procurement documents.
- Imported materials:
 - Confirm all imported materials to BCIT campuses are free of noxious invasive plant species.
 - Monitor post-imported areas. BC Parks Best Management Practices recommend one and three year post-disturbance monitoring (BC Parks 2011).
- Education:
 - Encourage campus users to stay on trails and check their clothes and shoes for soil, seeds, and plant fragments.
 - Add signage to areas with invasive and noxious species to educate campus users about prevention measures.
- Trail and landscaping maintenance:
 - Begin maintenance activities at the furthest point from the trail (where native vegetation is more prevalent) and work towards the trailhead (where invasive plants become more established).

- Avoid unnecessary soil disturbance or movement. Do not move soil from areas with invasive plants to new areas of BCIT campuses.
- Continue to monitor newly disturbed areas for invasive plants.
- Prohibit new plantings of known invasive plant species and gradually replace existing landscaped invasive plants with native or non-invasive species.

4.2 Control

As many invasive species have established at BCIT campuses (**Section 3.3**), setting species priorities is important to begin the control process. Management of invasive plants already on BCIT campuses will limit the dispersal.

General Recommendations:

- Use locally sourced best practices for managing invasive species including:
 - Metro Vancouver and Invasive Species Council of Metro Vancouver⁴ (ISCMV).
 - Invasive Species Council of BC⁵.
- Techniques sourced from outside the region may not necessarily be recommended or legal for the region. Many best management guides exist for high priority species in the region (Metro Vancouver 2021a). In the absence of a local best management guide, consult a regional expert or QEP for recommendations before undertaking management activities.
- Review ISCMV best practices and follow recommendations for BCIT planting, renewal, restoration and landscaping efforts on all campuses.
- All removed plant material must be disposed of properly. Disposal options are outlined in **Section 4.2.1.2**.
- Obtain a permit under the *Water Sustainability Act* for all work conducted in or about a stream, such as Guichon Creek.
 - Submit a Notice of Authorized Change (Notification) through FrontCounter BC website at least 45 days prior to manual or chemical control of an invasive species near a stream.

4.2.1 Noxious Weeds

As noxious species are regulated under the *Weed Control Act*, they have a higher management priority than other invasive species. Four types of noxious weeds were found at BCIT: knotweed, purple loosestrife, sow-thistle, and thistle. Management techniques for these species are outlined below.

4.2.1.1 Knotweed

Invasive knotweeds (such as Japanese knotweed (*Reynoutria japonica* var. *japonica*) and Bohemian knotweed (*Reynoutria x bohemica*) can tolerate a range of soil types and climates, and thrive in roadside ditches, low-lying areas, irrigation canals, and other water drainage systems (ISCBC 2016, Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021I). Knotweed was found in multiple locations of the southern forest of the Burnaby (Main) Campus (**Figure 2**) and at the north end of the Aerospace Technology Campus (**Figure 4**).

⁴ <http://www.metrovancouver.org/services/regional-planning/conserving-connecting/invasive-species/Pages/default.aspx>

⁵ <https://bcinvasives.ca/resources/publications/>

Chemical treatment is generally thought to be the most effective way to combat knotweed, while manual removal is only recommended under specific circumstances where site-specific characteristics and restoration objectives allow for it. This method is usually considered when sites have very small and recently established populations or when chemical control is not permitted.

On the Burnaby (Main) Campus, herbicide treatment is the only acceptable treatment method to the City of Burnaby. Under the provincial *Integrated Pest Management Act* Regulations, the use of herbicides within 10 m of natural watercourses is prohibited, except for glyphosate products, which can be applied up to 1 m from the high-water mark (Government of British Columbia 2016). The “bend and treat” method is recommended in situations where plants are located within the 0 to 1 m riparian zone (bending knotweed away from the waterbody may allow herbicide to be applied to some of the knotweed rooted within 1 m of the water).

Herbicides must only be applied by certified pesticide applicators therefore consultation with a licensed weed control professional is required. The City of Burnaby has a preference to use Diamond Head Consulting for knotweed removal as they are currently under contract (2021) to the City to provide herbicide application for invasive plants and are already familiar with Burnaby Corporate Standards for the use and application of pesticides for invasive knotweeds. There are several targeted techniques that can be used to selectively apply systemic herbicides to knotweed (e.g., hand spraying, back-pack spraying, stem injection, and wipe on applications). Refer to Best Management Practices for Knotweed Species in the Metro Vancouver Region (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021g) for more information.

Knotweed removal and management typically requires on-going treatment. An adaptive management approach will likely be required to maximize the likelihood of successfully eradicating this species. Following the subsequent herbicide applications, a QEP will confirm how long monitoring should occur.

As herbicide treatment is the accepted method of knotweed control, knotweed disposal is not anticipated. In the unlikely circumstance of any knotweed requiring removal from site, all plant material must be disposed of properly to avoid introducing knotweed to new areas (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021g). Any knotweed plant parts including roots, stems, flowers, and seeds, must be bagged or tarped before transporting to a designated disposal site (e.g., landfill, transfer station, or waste to energy facility). The BCIT Transportation and Grounds Manager will maintain records of all knotweed disposal to verify compliance.

4.2.1.2 Purple Loosestrife

Purple loosestrife can tolerate a wide range of habitat but prefers riparian areas and wetlands (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021h). Purple loosestrife was observed at the Burnaby (Main) Campus at the north end of Guichon Creek (**Figure 2**) and the north end of the Aerospace Technology Campus (**Figure 4**).

Due to the small size of the purple loosestrife populations on the BCIT campuses, manual/mechanical removal is likely the most effective method. The plants should be pulled from the base, taking care to remove all rhizomes. The remaining root fragments will re-grow and therefore should be dug up and removed. Manual removal should be complete in July to August when the plant is in bloom but prior to seeds appearing. Note that due to the sensitivity and access/safety challenges of the wetland sites where purple loosestrife is found at the Main Campus, it is advised that only staff and contractors who are trained in working around water conduct control efforts. This work likely requires the use of waders to enter the water body.

Adaptive management will be required to maximize the likelihood of successfully removing this species, depending on outcomes of initial management efforts. Complete removal of purple loosestrife is unlikely within the first year, but repeated annual removal should contain the plant to lower levels.

All removed plant material must be disposed of properly, following methods described in the Best Management Practices for Purple Loosestrife in the Metro Vancouver Region (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021h). Disposal options are provided in the Metro Vancouver document Disposal Options for Invasive Species (Metro Vancouver 2021b). The recommended disposal method is industrial green waste processing, which is available at Metro Vancouver Transfer Stations.

4.2.1.3 Thistle and Sow-thistle

Thistle species are generalists and can be found in almost every plant community where there is soil disturbance or bare ground (ISCBC 2019a). Thistle was observed throughout the Burnaby (Main) Campus (**Figure 2**), the north end of the Aerospace Technology Campus (**Figure 4**), and on the west side of the Annacis Island Campus (**Figure 6**).

Annual sow-thistle has rapid germination and establishes over great distances allowing it to colonize areas rapidly (CSISS 2019). Sow-thistle was observed at the Burnaby (Main) Campus near Guichon Creek (**Figure 2**).

Mechanical control of thistle and sow-thistle species can be an effective management technique. Mowing should be complete at the bud stage before seed-set. Regular cutting of adult plants can reduce plant and population growth, but will not entirely remove the plant (ISCBC 2019a; CSISS 2019).

If plants are cut down prior to flowering, plant material can be left onsite to decompose. However, if plants are cut after flowering, all plant parts should be bagged and removed. Disposal options are outlined in **Section 4.2.1.2**.

Chemical control is also an option away from riparian areas. Further details on types of herbicides recommended can be found in the Invasive Species Control of BC Canada Thistle Factsheet (ISCBC 2019a).

4.2.2 Widely Occurring Species

Himalayan blackberry and ivy were the most extensive invasive plants observed at BCIT campuses. Himalayan blackberry was observed at all five campuses and ivy was seen at the Burnaby (Main) Campus, the Aerospace Technology Campus, and the Marine Campus. Both of these species are easily spread and can overtake large areas of native vegetation, creating monocultures. If removal of both species is not desired for the BCIT campuses, measures should be taken to decrease the areas they cover and manage future dispersal.

4.2.2.1 *Himalayan Blackberry*

Himalayan blackberry can be removed by mechanical methods including cutting, mowing, and pulling with an excavator bucket, which can be very effective at controlling the species when done persistently over several years. Chemical (herbicide) treatment for Himalayan blackberry is not commonly recommended (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021e). Himalayan blackberries often grow in riparian areas where the pesticide use is restricted. If incorrectly applied, herbicide will only kill the top portions of the plant, and vegetative growth from lateral roots can be caused by some herbicide use.

Hand digging is the most effective way of removing the tap-root/root system entirely, though in large monocultures, machine excavation can be more efficient, when followed up with hand removal of broken root crown. If the root system is not removed, Himalayan blackberry will grow back quickly. As mechanical treatment measures can stimulate strong regrowth, follow-up hand digging to remove the entire root system will be required. Following removal of Himalayan blackberry, an effective way to reduce regrowth is to apply approximately 5 to 10 centimetres of wood chip mulch over the removal area and replant with native shrubs and trees to compete with new Himalayan blackberry encroachment.

Adaptive management will be required to maximize the likelihood of successfully removing this species, depending on outcomes of initial management efforts. Complete removal of Himalayan blackberry is not expected within the first year and control is recommended twice yearly, in late spring and in fall.

All removed plant material must be disposed of properly, following methods described in the Best Management Practices for Himalayan Blackberry in the Metro Vancouver Region (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021e). Disposal options are outlined in **Section 4.2.1.2**.

4.2.2.2 *Ivy*

Ivy can be managed with persistent mechanical treatment (i.e., removing new shoots and roots regularly) (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021a). Removal methods for ivy consist of mechanically hand pulling and cutting of vines in late summer or fall when plants are easier to remove (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021a). Ground-creeping vines will be cut and pulled (i.e., mechanical removal) to prevent rooted portions from re-growing. Removal of climbing vines growing on a host plant (e.g., mature trees) are a priority for removal. These can be cut at a comfortable chest height to sever upper portions from the roots, ultimately killing upper portions. Rooted vines should be pulled as they remain alive after cutting. Vines remaining in the upper canopy of the host plant should not be removed but left to decompose naturally.

All removed plant material must be disposed of properly. Disposal options are outlined in **Section 4.2.1.2**.

4.2.3 Other Invasive Plants

Best management practices for other invasive species found at BCIT are summarized in **Table 4**.

Table 4 Control Mechanisms for Invasive Species

Common Name	How to Remove/Control
Barnyard grass	Manually remove the plant prior to seed germination and cover area with mulch to suppress growth.
Butterfly-bush	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout. Bag seeds and flower heads to avoid spread (ISCMV 2021).
Common mallow	Mechanically remove entire plants (including roots), and cover area with mulch to suppress growth.
Common periwinkle	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout (Diamond Head 2015).
Common tansy	Hand pull the plants (including roots) using gloves and protective clothing. Herbicides can be used away from riparian areas and further details can be found in Invasive Species Council of BC Common Tansy Factsheet (2019b)
Cutleaf blackberry	Follow methods for removal outlined with Himalayan blackberry in Section 4.2.2.1 .
English holly	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021b).
European bittersweet	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout (RDOS 2021)
Hedge bindweed	Mechanically remove the new seedlings once 5-6 leaves have fully developed (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021c). Repeat this removal 6-8 times during the first growing season and 3-5 times in the second season to kill the plant in about two years.
Himalayan balsam	Manually pull the plant by hand before seed capsules mature (late May to early June) due to the explosive nature of seed dispersion (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021d). Monthly pulls should be conducted with a minimum of two hand pulls per season.
Horse chestnut	Manually remove the tree (including roots).
Lady's-thumb	Mechanically remove the plant prior to flowering (DiTomaso and Kyser 2013).
Laurel (cherry, Portugal, and spurge)	Mechanically remove entire plants (including roots), focusing first on adult plants as plants do not set seed until approximately four years of age (Coastal ISC 2009).
Reed canarygrass	Manually remove the plant and cover area with mulch to suppress growth (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021i). As reed canarygrass is intolerant of shade, forming a shade canopy over it will discourage growth and seed germination
Scotch broom	Manually remove the entire plant, ensuring no seeds are dropped into the soil and minimize soil disturbance (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021j). If it is not feasible to remove the entire plant, the flower heads can be cut off in June or July before the seeds mature.

Common Name	How to Remove/Control
Small flower impatiens	Manually remove the plant by hand from the base of the plant prior to seed set in the spring (Diamond Head 2015). Best management practices for Himalayan balsam outlined above can also be applied to this species (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021d).
St. John's wort	Hand pulling can be effective for small areas of growth.
White sweet-clover	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout (Ontario Invasive Plant Council 2013). Treatment may be required in multiple years.
Yellow archangel	Mechanically remove entire plants (including roots), as any remaining underground parts will re-sprout (Metro Vancouver and the Invasive Species Council of Metro Vancouver 2021k). Cover treatments of black plastic or thick layers of mulch may be effective.

4.3 Restoration

Invasive plant management, as described in **Section 4.2**, is only one part of the effective treatment process as exposed bare soil can invite invasive species in to re-colonize. Depending on the size of the invasive removal site, restoration may be required to ensure a native plant community establishes. Restoration with native plant species, either from sapling trees and shrubs or seeding with non-invasive grass mix should be applied to the exposed area.

Recommendations:

- Plant suitable native plant species appropriate for BCIT campuses, listed in **Table 5**.
- Shrubs and trees should be planted at a combined density of 1 plant/m², such that tree spacing should be 3 m from other trees while shrubs will fill in between trees. Trees and shrubs should be field-fit under the supervision of a QEP.
- Shrub species should be planted in groupings of 2-3 and in such a way as to fill in empty spaces around existing native plants in order to out-compete and shade out invasive plants and reduce long-term maintenance challenges.
- Optimize planting time to mid to late fall to optimize plant survival through root establishment during rainy months (planting trees in the spring requires additional watering during the summer, which adds logistical challenges and decreases likely survival, which is why fall planting is recommended).
- Source native plants from a reputable nursery and place orders using scientific names (**Table 5**).
- Check plants upon delivery and prior to planting for health and size and for the presence of plant disease or pests
- Retain tree nursery tags during planting to help with identification during future monitoring events.

Table 5 Recommended Native Plant Species and Pot Sizes

Common Name	Scientific Name	Recommended Pot Size (Gallons)
Trees		
Douglas-fir	<i>Pseudotsuga menziesii</i>	2
Grand fir	<i>Abies grandis</i>	5
Crabapple, Pacific	<i>Malus fusca</i>	5
Bigleaf maple	<i>Acer macrophyllum</i>	5
Native dogwood	<i>Cornus nuttallii</i>	5
Sitka spruce	<i>Picea sitchensis</i>	5
Vine maple	<i>Acer circinatum</i>	5
Western hemlock	<i>Tsuga heterophylla</i>	5
Western redcedar	<i>Thuja plicata</i>	5
Shrubs		
Common snowberry	<i>Symphoricarpos albus</i>	1
Beaked hazelnut	<i>Corylus cornuta</i>	1
Black twinberry	<i>Lonicera involucrata</i>	1
Nootka rose	<i>Rosa nutkana</i>	2
Hardhack	<i>Spiraea douglasii</i>	1
Osoberry (Indian plum)	<i>Oemleria cerasiformis</i>	1 & 2
Red elderberry	<i>Sambucus racemosa</i>	1
Red-osier dogwood	<i>Cornus sericea</i>	2
Salmonberry	<i>Rubus spectabilis</i>	2
Thimbleberry	<i>Rubus parviflorus</i>	2
Ferns		
Sword fern	<i>Polystichum munitum</i>	1

4.4 Communications

Communication, education, and awareness to maintenance and landscaping staff as well as staff, students, and the public on BCIT campuses will be an important component of invasive plant management efforts. Individuals who are aware of the impacts invasive species can have on the native ecosystems and how they can be involved in management efforts are more likely to take appropriate steps to reduce invasive plant dispersal. Education can inspire people to contribute to detection and invasive plant removal events (Section 4.5).

Recommendations:

- Maintain a database of invasive plant records, including spatial datasets (such as those shown on **Figure 2** to **Figure 6**). Record all treatment methods applied to each species or individual plant. Upload data into the BC Invasive Alien Plant Program (IAPP) Database (Government of British Columbia 2021).
 - Establish a protocol to collect data on treatments and volunteer weed pull activities.

- Integrate invasive plant reporting into regular landscape operations.
- Develop and offer regular training to staff, contractors and students, ideally in the spring/early summer season.
 - Training should include plant identification, reporting techniques, manual removal, and disposal techniques.
- Produce and install permanent signage to build awareness of invasive plants on BCIT campuses and to showcase campus efforts.
 - Place signage where invasive plant management has or will occur and at ongoing stewardship program locations. Include information about how people can find out more or get involved.
 - If particular challenges are identified on BCIT campuses, such as illegal dumping, off-trail use, unsanctioned plantings, or presence of a toxic invasive plant, consider installing signage to alert the public to the problem and how to improve the problem.
- Share the work being done for invasive species management in campus communications. If possible, engage the communications department for student involvement in signage and outreach product design.

4.5 Campus Involvement Opportunities

Although most invasive plants, especially those that require herbicide treatment or are toxic, should be left to landscaping staff and contractors, there may be opportunities to get the wider BCIT community involved in invasive plant management. This may be through volunteer opportunities or student projects. Herbicide treatment, work on toxic species, and all work near riparian areas must be reserved for certified landscaping staff or contractors.

Recommendations:

- Identify a BCIT contact for campus involvement activities for all coordination of campus events. This may be done internally or through a third party such as Invasive Species Council of Metro Vancouver.
- Explore all opportunities for collaboration and outreach on campus. Opportunities are to be actioned and outcomes captured within direction of the BCIT Transportation and Grounds manager to ensure initiatives are in line with the contracted works assigned as part of this IPMP.
- Organize school involvement or wider volunteer events to remove invasive species. Allow the community to get involved with removal activities for less toxic plants including:
 - Barnyard grass
 - Butterfly-bush
 - Laurel
 - Common mallow
 - Cutleaf blackberry
 - Hedge bindweed
 - Himalayan blackberry
 - Ivy
 - Lady's-thumb
 - Common periwinkle
 - Reed canarygrass
 - Small flower impatiens
 - White sweet-clover
 - Yellow archangel

- Get the broader BCIT community, such as students and other volunteers, involved in restoration work (**Section 4.3**) to enhance community engagement.
- Host annual stewardship events with the help of the Transportation and Grounds team at BCIT, with events that could be directly linked to invasive species or wider ecological enhancement of BCIT campuses, including garbage cleanup or BioBlitz⁶ events.
- Advertise events through campus calendars and flyers.
- Engage relevant campus departments who may be able to provide services through student's course work. Confirm any operations work that is approved fits into the larger management plan for the campus.
- Engage relevant campus groups, such as Ecological Restoration Club, Indigenous Culture Club, BCIT Green Team, to increase support from volunteers on campus.

⁶ [Canadian Wildlife Federation: Bioblitz \(cwf-fcf.org\)](http://www.cwf-fcf.org/bioblitz)

5.0 IMPLEMENTATION

Proper implementation of the Management Plan outlined in **Section 4.0** will optimize the project success. Areas containing noxious weeds (**Section 3.4.1**) should be prioritized in year one as a requirement of land occupiers under the BC *Weed Control Act*. To manage these species BCIT should retain a certified herbicide applicator and execute the first round of mitigation of the existing noxious species. The results of the treatments to noxious species should be monitored and adaptive management applied to the program to continue moving it forward.

5.1 Adaptive Management Plan

An adaptive management approach will likely be required to maximize the likelihood of successfully removing invasive plant species. Adaptive management includes analyzing a situation, developing and executing a plan, monitoring the results, and adapting or changing the approach, as necessary. For example, it will take months or longer to determine how successful invasive species treatment options have been. If treatment options are not delivering the desired outcomes, a change in approach may be warranted.

Adaptive management may include replacing dead native plant stock, invasive plant management or mulching with disease-free, non-cedar, wood or bark mulch. Maintenance activities may include watering plants during the dry summer months (i.e., installing slow-release water bags on trees) and/or regularly removing competitive, undesirable, invasive vegetation regrowth from the restoration areas.

As described in **Section 4.2**, efforts to remove many of the invasive plants, including noxious purple loosestrife, Himalayan blackberry, and knotweed, will likely involve reinfestation. Adaptive management will be used to refine approaches as success of removal techniques becomes known. As knotweed is anticipated to persist after initial treatment efforts, where chemical treatment is deemed appropriate, spot treatment applications will be used to target specific areas of recurrence.

5.2 Long Term Maintenance

Annual monitoring to determine survivorship of restoration plants and effectiveness of invasive plant removal should occur following the methods described in **Section 4.2** and **4.3**. Should invasive plants persist or recur, adaptive management will be used to refine approaches to prevent invasive plant re-establishment. Dead or dying plants should be replaced annually.

In addition to the annual monitoring, as part of the BCIT Invasive Species Management Plan, the BCIT grounds crew will conduct regular maintenance activities at the restoration sites. These activities will include weed removal, watering, and replacing any failed plantings. Inspections by the grounds crew and maintenance activities will occur more frequently in the first 2 years to confirm native plantings are establishing as intended. All grounds crew members should be informed of restoration efforts to avoid inadvertent removal of native vegetation plantings (i.e., it is not uncommon for restoration efforts to get accidentally mowed/cut/flailed during routine maintenance).

Finally, a recurring invasive plant inventory is recommended to occur every 3 to 5 years, with an updated Invasive Plant Management Plan (such as this document) to highlight any documented changes observed during the inventory. This will allow BCIT to monitor the effectiveness of the existing plan, to update with current best management practices, and to add additional species which may occur on the site in the future.

6.0 CLOSURE

This Work was performed in accordance with PO103733 between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and British Columbia Institute of Technology (Client), dated July 15, 2021 (Contract). This Report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by British Columbia Institute of Technology. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

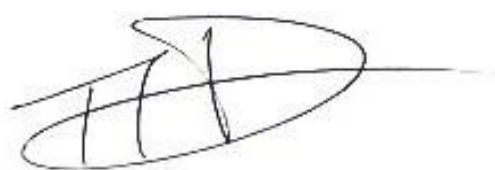
We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

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APPENDIX A

Photographs



Photo 1 Barnyard Grass



Photo 2 Butterfly-bush



Photo 3 Canada thistle



Photo 4 Cherry laurel



Photo 5 Common mallow



Photo 6 Common periwinkle



Photo 7 Common tansy



Photo 8 Cutleaf blackberry



Photo 9 English holly



Photo 10 European bittersweet



Photo 11 Hedge bindweed



Photo 12 Himalayan balsam



Photo 13 Himalayan blackberry



Photo 14 Horse Chestnut



Photo 15 Ivy



Photo 16 Knotweed



Photo 17 Lady's-thumb



Photo 18 Milk Thistle



Photo 19 Portugal laurel



Photo 20 Purple loosestrife



Photo 21 Reed canarygrass



Photo 22 Scotch broom



Photo 23 Small flower impatiens



Photo 24 Annual sow-thistle



Photo 25 Spurge laurel



Photo 26 St. John's wort



Photo 27 White sweet-clover



Photo 28 Yellow archangel