VANCOUVER FRASER PORT AUTHORITY
WSP PROJECT NUMBER: 20M -00758-00

FRASER SURREY PORT LAND – TRANSPORTATION IMPROVEMENTS

INVASIVE SPECIES ASSESSMENT REPORT

MAY 14, 2021

CONFIDENTIAL

FRASER SURREY PORT LANDS – TRANSPORTATION IMPROVEMENTS

INVASIVE SPECIES ASSESSMENT REPORT

VANCOUVER FRASER PORT AUTHORITY

REPORT (DRAFT)

PROJECT NO.: 20M-00758-00
CLIENT REF:#20-0173
DATE: MAY 14, 2021

WSP
840 HOWE STREET, SUITE 1000
VANCOUVER, BRITISH COLUMBIA

T: 604-631-9694
WSP.COM

May 14, 2021

Confidential

Vancouver Fraser Port Authority
Senior Construction Project Specialist
100 The Point, 999 Canada Place
Vancouver, B.C.
V6C 3T4

Attention: Vinil Reddy, M.Sc., MBA, PMP, P.Eng., ENV SP

Dear Madam/Sir:

Subject: Fraser Surrey Ports Land Transportation Improvement – Invasive Species Assessment Report
Client ref.:

WSP is please to submit our Invasive Species Assessment Report for your review and consideration. The Invasive Species Assessment Report presents the survey for invasive plant species, for the proposed activities for the construction and operations of the Fraser Surrey Port Lands Transportation Improvement Project.

We look forward to working with you on this Project to ensure successful and compliant delivery of services.

Yours sincerely,

R. Smedley

Rosalyn Smedley, M.Sc., R.P.Bio.
Biologist

WSP ref.: 20M-00758-00

SIGNATURES

PREPARED BY

Rosalyn Smedley, M.Sc., R.P.Bio
Biologist

14 May 2021
Date

Susan Blundell, M.Sc., R.P.Bio
Plant Ecologist

14 May 2021
Date

APPROVED[1] BY

Michael Taylor, BLA, MRM
Team Lead, Ecology & EIA

14 May 2021
Date

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

CONTRIBUTORS

WSP

Biologist	Rosalyn Smedley, R.P.Bio.
Plant Ecologist	Susan Blundell, M.Sc., R.P.Bio
Reviewer	Michael Taylor

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1 INTRODUCTION

1.1 PROJECT BACKGROUND AND RATIONALE

As a component of the Greater Vancouver Gateway 2030 Program, the Fraser Surrey Port Lands–Transportation Improvements Project (FSPL-TI) (the "Project"), includes an options confirmation review and preliminary engineering design of new or upgraded transportation infrastructure within the City of Surrey FSPL. The Greater Vancouver Gateway 2030 Program is the Gateway Transportation Collaboration Forum's strategy for smart infrastructure investment in removing bottlenecks impeding the growth of trade, while addressing community impacts on good movement and population growth. The primary purpose of the Project is to improve the road network within FSPL and ease congestion in the general area.

1.2 PROPOSED WORKS

The three main components of the FSPL-TI project include:

1. At- Grade Railway Crossing Updates: With extensive amounts of un-signalized railroad crossings along Timberland Road North, vehicles drivers experience stop-go movements as they approach crossings which add delays to already slow-moving traffic in the area. Upgrading the at-grade rail crossings at FSPL will improve the safety and efficiency of road users driving within FSPL.
2. New Roadway Connection for Timberland Road South to Robson Road: Re-alignment of the Robson Road-Timberland Road North corridor with the introduction of the Timberland Road South as the main access road within FSPL will enable most road users to avoid conflicts with at-grade rail crossing along the existing Timberland Road North. Road widening along Timberland Road South, including a new signalized intersection at Timberland Wye is proposed as part of this Project. The project will also provide the long-term rail footprint in the area for trains servicing the planned future terminals. With majority of truck traffic being directed to the new road alignment, this eases up traffic flow on the existing Timberland Road. Changing the inbound container truck movements by providing a dedicated truck auxiliary lane, complete with Vehicle Access Control System (VACS) gates will manage inbound truck traffic into DP Word Fraser Surrey (DPWFS) container gate and streamline traffic flow.
3. Pavement Rehabilitation and Pavement Markings along Robson Road: Rehabilitation of Robson Rd to address pavement and drainage issues which contributes to the overall operation of the road corridor and maintenance costs at FSPL. Enhancement of pavement markings along Robson Rd will allow for better lane usage.

1.3 OBJECTIVES

The objectives of this Invasive Species Assessment Report are to summarize the following:

- Description of existing invasive plant species at the Project Site.
- Identify a Mitigation Plan to prevent the spread of invasive species during construction

— Invasive species monitoring and management plan

A detailed project description and methodology for desktop review and field site visit are available in the Biophysical Survey and Assessment Report. The Biophysical Report also provides a full description of project effects and proposed mitigation measures. This document provides a summary of that information as it pertains to the invasive species.

2 EXISTING CONDITIONS

2.1.1 DESTOP REVIEW

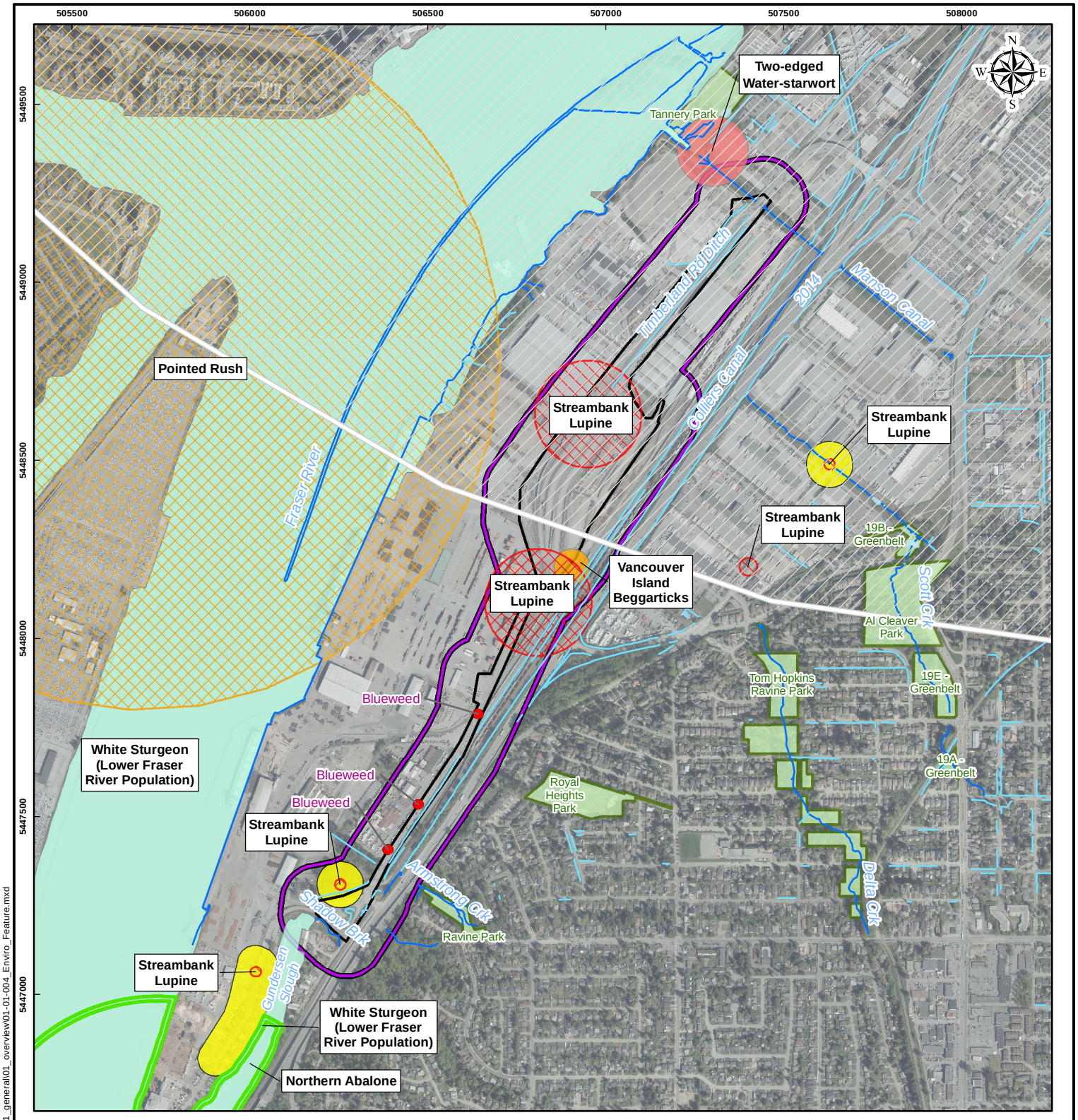
The general environment for the FSPL is predominately anthropogenically affected resulting in small, sporadic, disturbed areas colonized by a variety of native, early successional and invasive vegetation species. The Project area, which is predominately covered by roads, rail and industrial buildings, is located within the Coastal Western Hemlock Very Dry Maritime Biogeoclimatic subzone (CWHxm1). The drier subzones are found only in the central and southern portion of the CWH zone in the rain shadows of the Olympic Mountains, Vancouver Island Ranges, and Coast Mountains (including Metro Vancouver).

2.1.1.1 *INVASIVE PLANT SPECIES*

The desktop study found several invasive plant species inhabit the FSPL (DataBC 2020). Blueweed (*Echium vulgare*)on Figure 1, is the most common invasive plant species located within the Project footprint. Blueweed is categorized as regional containment / control which means the management objective is to prevent further expansion into new areas within the region through establishment of containment lines. Two other invasive plant species, Japanese knotweed (*Fallopia japonica*) and Scotch Broom (*Cytisus scoparius*) also occur near the Project area.

2.1.2 SITE VISIT

A preliminary site visit was conducted on 16 December, 2020 and a detailed site assessment was conducted on April 20, 2021. Table 1 (Figure 2A,2B) provides a summary of invasive/exotic and noxious species of vegetation that was observed during the preliminary site visit. The most common invasive plant species was Himalayan blackberry followed by reed canarygrass, Common tansy, and St. Johns Wort.



Legend

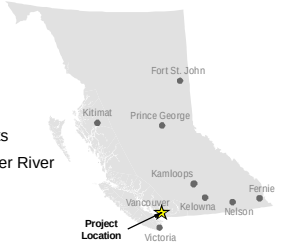
- Populated Place
- IAPP Invasive Plant (Blueweed)
- Ditch
- Creek and River
- Project Area (100m
- Study
- Parks
- Streambank Lupine Critical Habitat
- Waterbody
- Wetlands
- CDC Masked Sensitive

CDC Non Sensitive

- Pointed Rush
- Streambank Lupine
- Two-edged Water-starwort
- Vancouver Island Beggarticks
- White Sturgeon (Lower Fraser River Population)

DFO Aquatic Species at Risk Distribution 2019

- Northern Abalone



0 100 200 300 400 500 Meters

Scale: 1:15,000

References:
Data BC - BC Catalogue
Open Government License
(http://www.data.gov.bc.ca/)
NRCAN Geogratis
Open Government License
(http://geogratis.cgdi.gc.ca/)

CLIENT: PORT of vancouver — Vancouver Fraser Port Authority

PROJECT: Fraser Surrey Port Lands - Transportation Improvements
Preliminary Design Services

TITLE:

Rare / Sensitive Species, Critical Habitat and Invasive Species

DATE:	PROJECT NO:	
June 11, 2020	20M-00758-00	**Figure 1**

GIS FILE: 01-01-004_Enviro_Feature.mxd

COORDINATE SYSTEM:	ANALYST:	REVIEWED:
NAD 1983 UTM Zone 10N	MY	SB

wsp

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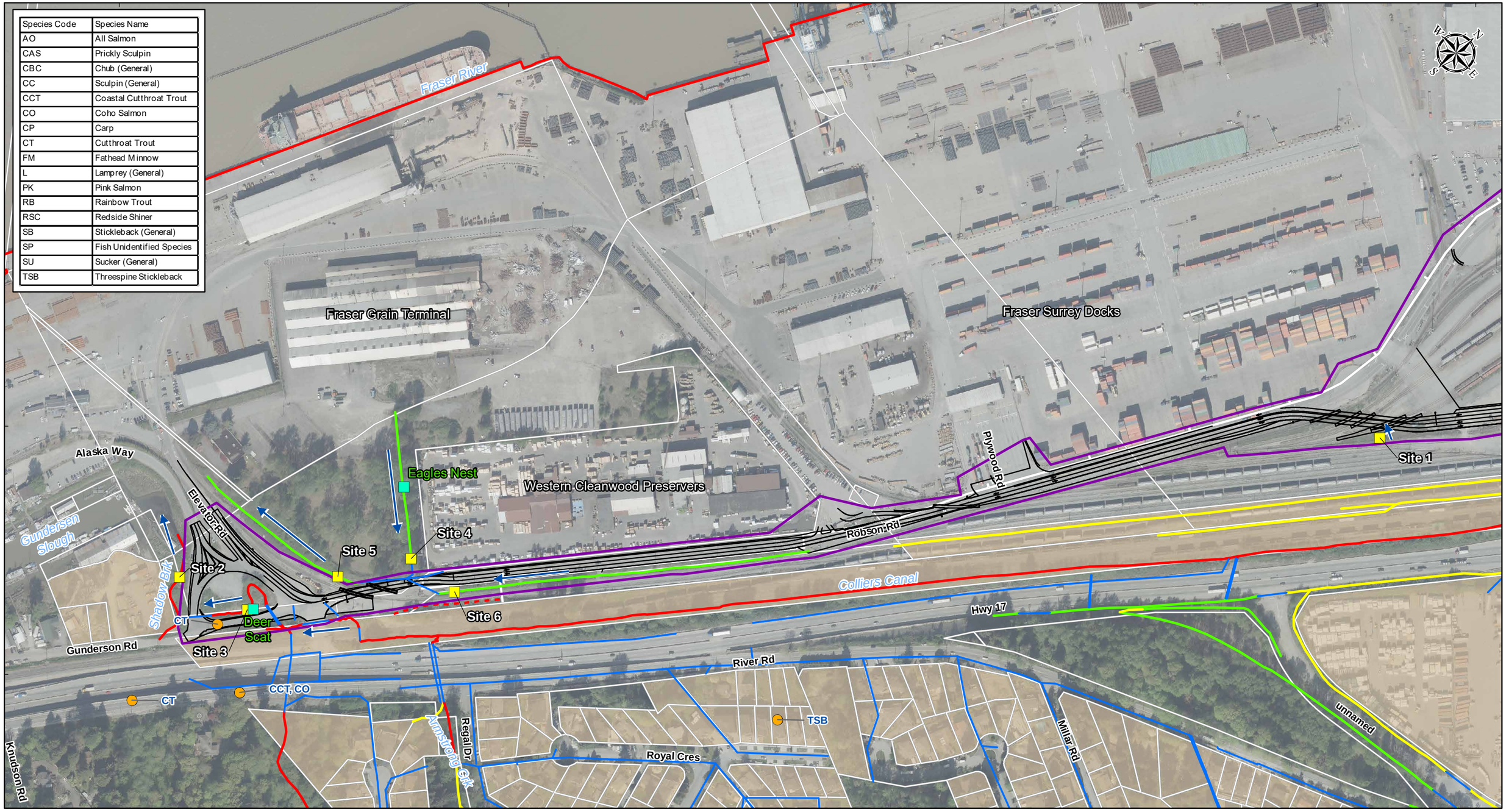
Table 1 - Summary of Exotic/Invasive Vegetation Species at the Project Site

Common Name	Scientific Name	Type[1]	Site #1	Site #1a	Site #2	Site #3	Site #4	Site #5	Site #6	Site #7	Site #8	Site #9	Site #10	Site #11
alfalfa	*Medicago sativa*	2	·	·	·	·	·	·	·	✓	·	·	·	✓
bittercress	*Cardamine sp.*	2	✓	✓	·	·	·	·	·	·	·	✓	·	·
blueweed	*Echium vulgare*	2,3	✓	·	·	·	·	·	✓	✓	·	·	·	·
bull thistle	*Cirsium vulgare*	2,3	·	·	·	·	·	·	·	·	·	✓	·	·
butterfly bush	*Buddleia davidii*	2,3	✓	·	·	·	·	·	·	·	·	·	·	·
changing forget-me-not	*Myosotis discolor*	2	✓	·	·	·	·	·	·	·	·	✓	·	·
common burdock	*Arctium minus*	2,3	·	·	·	·	·	·	·	·	·	✓	·	·
common groundsel	*Senecio vulgaris*	2,3	·	✓	·	·	·	·	·	·	·	✓	·	·
common mullein	*Verbascum thapsus*	2	·	·	·	·	·	·	·	·	·	·	·	✓
dandelion	*Taraxacum officinale*	2	·	·	·	·	·	·	·	✓	✓	✓	·	·
early winter cress	*Barbarea verna*	2,3	·	✓	·	·	·	·	·	·	·	·	·	·
english plantain	*Plantago lanceolata*	2	·	·	·	·	·	·	·	✓	·	✓	·	✓
evening primrose	*Oenothera biennis*	2	·	✓	·	·	·	✓	·	✓	·	·	·	✓
hawkweed	*Hieracium sp.*	2	·	·	·	·	·	·	·	·	✓	·	·	·
hedge bindweed	*Calystegia sepium*	2,3	·	·	·	·	·	·	·	·	·	✓	·	·
hedge mustard	*Sisymbrium officinale*	2	·	·	·	·	·	·	·	✓	·	✓	·	·
herb-Robert	*Geranium robertianum*	2	·	·	·	·	·	·	·	·	✓	·	·	·
Himalayan blackberry	*Rubus armeniacus*	2,3	✓	✓	✓	✓	·	✓	✓	✓	✓	✓	✓	✓
japanese knotweed	*Reynoutria japonica*	2,3	·	·	·	✓	·	·	·	·	·	·	·	·
purple loosestrife	*Lythrum salicaria*	2,3	·	·	·	·	·	✓	✓	✓	·	·	·	·
reed canarygrass	*Phalaris arundinacea*	2,3	·	·	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Scotch broom	*Cytisus scoparius*	2,3	·	·	·	·	·	·	·	✓	·	·	✓	✓
sheep sorrel	*Rumex acetosella*	2	·	·	·	·	·	·	·	✓	·	·	·	·
silver birch	*Betula pubescens*	2	·	✓	·	·	·	·	·	·	·	·	·	·

Common Name	Scientific Name	Type[1]	Site #1	Site #1a	Site #2	Site #3	Site #4	Site #5	Site #6	Site #7	Site #8	Site #9	Site #10	Site #11
smooth cat's ear	*Hypochaeris glabra*	*2,3*	✓	✓	·	·	·	·	·	·	·	✓	·	·
spiny sow-thistle	*Sonchus asper*	*2,3*	·	·	·	·	·	·	·	✓	✓	·	·	·
spotted touch-me-not	*Impatiens capensis*	*2*	·	·	·	·	·	·	·	·	·	✓	·	·
st johns wort	*Hypericum perforatum*	*2,3*	✓	✓	·	·	·	·	·	✓	✓	✓	·	·
stork's bill	*Erodium cicutarium*	*2*	·	·	·	·	·	·	·	·	✓	·	·	·
tansy	*Tanacetum vulgare*	*2,3*	✓	·	✓	✓	·	·	·	✓	·	✓	✓	·
tansy ragwort	*Jacobaea vulgaris*	*2,3*	·	·	·	·	·	·	·	·	✓	✓	✓	·
wild carrot	*Daucus carota*	*2*	·	·	·	·	·	·	·	·	·	·	·	·
wintercress	*Barbarea vulgaris*	*2,3*	·	·	·	·	·	·	·	·	✓	·	·	·

Note: Type: 2= introduced, 3 = invasive, ✓ indicates presence.

Species Code	Species Name
AO	All Salmon
CAS	Prickly Sculpin
CBC	Chub (General)
CC	Sculpin (General)
CCT	Coastal Cutthroat Trout
CO	Coho Salmon
CP	Carp
CT	Cutthroat Trout
FM	Fathead Minnow
L	Lamprey (General)
PK	Pink Salmon
RB	Rainbow Trout
RSC	Redside Shiner
SB	Stickleback (General)
SP	Fish Unidentified Species
SU	Sucker (General)
TSB	Threespine Stickleback



Legend

- FISS Point
- Aquatic Site
- Wildlife Location
- Flow Direction
- Drainage Main
- Parcel
- Private Lands
- Project Design Linework
- Study Area

Watercourse (Fish Classification) - City of Surrey

- A
- AO
- B
- C
- Unknown

0 50 100 Meters

Scale: 1:3,500

Notes: Fish Classification

Class A: Inhabited by fish year-round or potentially inhabited by fish year round. Considered 'streams' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal Fisheries Act

Class A(O): Inhabited by fish primarily during the over-wintering period or potentially inhabited by fish during the over-wintering period with access enhancement. Considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal Fisheries Act

Class B: Provides food/nutrient value to downstream fish habitat. No fish potential present at any time of the year. Considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat by the defined by the Federal Fisheries Act

Class C: A water feature that is not considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Not considered fish habitat as defined by the Federal Fisheries Act. No fish potential present at any time of the year.

References:
Data BC - BC Catalogue
Open Government License (http://www.data.gov.bc.ca/)
NRCAN Geogratis
Open Government License (http://geogratis.cgdi.gc.ca/)

PROJECT:
Fraser Surrey Port Lands - Transportation Improvements
Preliminary Design Services

TITLE:
Project Location and Assessment Area

CLIENT:
PORT of vancouver Vancouver Fraser Port Authority

DATE:	ANALYST:	REVIEWED:	
May 14, 2021	MY	RS	**Figure 2A**

GIS FILE: 02-01-001_Assessment_Area_v2.mxd

PROJECT NO: 20M-00758-00

COORDINATE SYSTEM: NAD 1983 UTM Zone 10N

wsp

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Species Code	Species Name
AO	All Salmon
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CBC	Chub (General)
CC	Sculpin (General)
CCT	Coastal Cutthroat Trout
CO	Coho Salmon
CP	Carp
CT	Cutthroat Trout
FM	Fathead Minnow
L	Lamprey (General)
PK	Pink Salmon
RB	Rainbow Trout
RSC	Redside Shiner
SB	Stickleback (General)
SP	Fish Unidentified Species
SU	Sucker (General)
TSB	Threespine Stickleback

506500 5449000 507000 5449500

5448500 506500

Eagles Nest
Fraser River
CAS, CBC, CCT, CO, CP, CT, FM, RB, SB, SU, TSB
Paper Excellence
Seaspan
Mainland Sand and Gravel
FM, TSB
Dyke Rd
FM, TSB
access road
Faulkner Rd
CAS, CBC, CO, CT, SU, TSB
Pine Rd
Site 9
Timberland Rd North Ditch
Site 7
North Timberland Rd
Timberland Rd West Ditch
turning lane
Tannery Rd
South Timberland Rd
Site 8
Timberland Wye Intersection
Site 10
IDC Yard
Westran
TMS Transportation
Manson Canal
Site 1A
Robson Rd
Site 11
SB
CAS, CO, CT, TSB
TSB
Hwy 17 Onramp
TSB
TSB
Colliers Canal
Hwy 17
2014 Tannery Rd Offramp
CT, SB
SB
Site 1
SB
CT, SB
Scott Crk
103A Ave
SB

Legend

- FISS Point
- Aquatic Site
- Wildlife Location
- Flow Direction
- Drainage Main
- Parcel
- Private Lands
- Project Design Linework
- Study Area

Watercourse (Fish Classification) - City of Surrey
- A
- AO
- B
- C
- Unknown

0 50 100 Meters
Scale: 1:3,500

Notes: Fish Classification

Class A: Inhabited by fish year-round or potentially inhabited by fish year round. Considered 'streams' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal Fisheries Act

Class A(O): Inhabited by fish primarily during the over-wintering period or potentially inhabited by fish during the over-wintering period with access enhancement. Considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal Fisheries Act

Class B: Provides food/nutrient value to downstream fish habitat. No fish potential present at any time of the year. Considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Considered fish habitat by the defined by the Federal Fisheries Act

Class C: A water feature that is not considered a 'stream' as defined by the Provincial Water Sustainability Act and Riparian Areas Protection Regulation. Not considered fish habitat as defined by the Federal Fisheries Act. No fish potential present at any time of the year.

PROJECT:
Fraser Surrey Port Lands - Transportation Improvements
Preliminary Design Services

TITLE:
Project Location and Assessment Area

CLIENT:
PORT of vancouver Vancouver Fraser Port Authority

DATE:	ANALYST:	REVIEWED:	
May 14, 2021	MY	RS	**Figure 2B**

GIS FILE: 02-01-001_Assessment_Area_v2.mxd
PROJECT NO: 20M-00758-00
COORDINATE SYSTEM: NAD 1983 UTM Zone 10N

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3 POTENTIAL PROJECT EFFECTS AND MITIGATION MEASURES

Due to clearing and grubbing activities there is a potential to reduce native plant communities within the project footprint and result in the spread of invasive species. The use of construction vehicles and replanting may also introduce invasive species on site.

To avoid or reduce the potential for the spread of invasive species, all machinery or equipment should arrive on site in good clean condition. Replanting of vegetation should be done using native seed mixes or plants. Any topsoil to be used in planting should be certified weed free. For any invasive species removal and monitoring and Invasive Species Management Plan is provided below. In general, the plan includes limiting the introduction of invasive plants, early detection and eradication, replanting with native species and monitoring. A summary of potential effects and their mitigation measures is provided in the Biophysical Assessment Report.

4 INVASIVE SPECIES REMOVAL AND MONITORING

4.1 INVASIVE SPECIES MANAGEMENT PLAN

An invasive plant management plan includes:

- Limiting the introduction of invasive plant via seed or runners;
- Early detection and eradication of small patches of invasive plants;
- Maintaining desired plant communities through good management;
- Revegetating disturbed sites with desired plants; and,
- Evaluating the effectiveness of prevention efforts and adapting plans for the following year.

4.2 INITIAL EVALUATION

The site was originally assessed in December 2020 and a follow-up assessment was completed in April 2021. Himalayan blackberry, Scotch Broom, St. John's Wort, Butterfly bush, reed canary grass, blueweed and purple loosestrife were encountered.

4.3 ERADICATION AND BEST MANAGEMENT PRACTICES

Once the nature of the infestation has been determined these materials should be removed. The removal method particulars are determined by the plant species where species specific information is available. These best management practices have been summarized from the existing best management practices developed by Metro Vancouver and are available at: Invasive Species (metrovancouver.org).

4.3.1 HIMALAYAN BLACKBERRY

Manual control methods are highly selective and permit weeds to be removed with limited damage to surround native vegetation. The recommended approach, referred to as the Bradley Method, consists of hand removal starting in areas with lesser weed infestation and working towards the worst stands. This approach maximizes the potential for recovery in areas of native vegetation. The manual removal will result in the production of slash, which can be chipped and used as mulch if the cutting takes place prior to seed production.

Freshly cut stumps may be treated with the appropriate concentrated herbicide. All applications of herbicides should be undertaken by a qualified, licensed individual.

Areas of full infestation, such as disturbed newly colonized areas adjacent to the roadway, can be treated by grubbing out the root crowns and major roots in addition to the above ground foliage. Several cuttings may be necessary to eradicate the blackberry. If only a single cutting can be made, the best time is when the plants begin to flower, because at this stage the reserved food supply in the roots has been nearly exhausted and new seeds have not yet been produced.

Initial removal should be followed by herbicide treatment of re-sprouted canes in the fall following burning, subsequent burning or cutting to exhaust the soil seed bank and underground food reserves or revegetation with fast growing or shade tolerant native species. Treatment strategies should be customized based on the size and density of the blackberry infestation as well as the degree of native vegetation present and the ease of access to the affected site. The following best management practices should be followed:

- Scattered individual plants in healthy native vegetation – hand cutting aboveground vegetation and either digging out root crowns or treating freshly cut root crowns with herbicide. Replanting is likely not necessary.
- Small to moderate patches of blackberry within a matrix of native vegetation – hand cutting above ground vegetation; follow up treatment of either treating freshly cut stumps with herbicide or spot spraying resprouted canes between late September and early November. Replanting may be necessary.
- Large patches of blackberry with scattered native vegetation – clear mature vegetation using weed-eaters or similar power tool prior to seed set. Spot-spray resprouting canes at approximately 60 cm in height with herbicides in late summer or fall. If native vegetation is particularly sparse and the site is accessible by tractor, it may be more economical to mow and/or grub the entire area and plant with the appropriate native species.
- Monoculture of blackberry – use appropriate size of mower or weed-eater to remove aboveground vegetation, followed by spraying re-sprouted stems with herbicide. Replant with appropriate native vegetation as soon as possible to minimize the risk of erosion.

It will important to prevent the re-establishment of invasive species in the newly cleared areas. This will be achieved by the immediate stabilization of disturbed soils by the application of mulch, the application of a native grass seed mix or the planting of native shrubs and trees.

4.3.2 REED CANARY GRASS

Digging by shovel can be used to manage small patches less than 10 m^2 and can be accomplished by excavating out the entire root mass. It is preferable that this take place when wet soil conditions are present.

Digging becomes more difficult if the occurrence is larger but a small excavator can likely be used for these occurrences. Care should be taken to remove all the root and rhizome fragments because they can resprout. This method is only advised in areas where environmental values are considered low and this process can be quite disruptive. The type and size of the excavator will be determined by site access and characterization. Operators should be under the supervision of an environmental professional. Care must be taken to thoroughly remove and bury all of the roots and capped soils should not contain any root or the reed canary grass will regenerate. The footprint of the excavation should be large enough to ensure that there are no residual plants left in place.

Alternate to digging or excavation, reed canary grass can be managed by covering the infestation with mulch, hog fuel or geotextile which will suppress growth. This method is only suitable for areas of dense reed canary grass that does not contain other species as the eradication is non-selective. The type of cover material will be determined on the site use after treatment. As it is expected that there will be no plans to remove the cover material a natural cover type such as hog fuel, mulch or a bio-degradable geotextile should be used.

Herbicides that are effective in treating reed canary grass infestations include glyphosate and imazapyr. Chemical treatment is not advised due to the close proximity of streams, ditches and associated riparian habitat.

On site disposal by way of composting is not recommended because rhizomes may propagate new roots if they are exposed to moist soils. Plants can be buried at a depth of 60 cm or greater but cannot be disturbed for at least four years. When disposing off-site plants, plant parts and associated soil should be covered or contained prior to transport to an appropriate disposal site. The Metro Vancouver region has several facilities that accept reed canary grass and infested soils.

4.3.3 JAPANESE KNOTWEED

Japanese knotweed is classed as a noxious weed within all regions of B.C. under the BC Weed Control Act. Japanese knotweed fragments can be spread by infested equipment and mowers as well as improper disposal of removed plant material.

The application of herbicides is the most effective method for managing Japanese knotweed infestations, but B.C. legislation prohibits the use of herbicides within 10 m of natural watercourses. Herbicides that are effective against Japanese knotweed include glyphosate, imazapyr, aminopyralid + metsulfuron methyl, aminopyralid and triclopyr.

The effectiveness of herbicide application can be affected by treatment timing. Herbicides should be applied to actively growing plants, either in the early spring or in the late summer to ensure an adequate surface area for absorption. Although there are various methods of herbicide application including spray-on, wipe-on, knock down and spray and stem injection, stem injection is the safest application method in close proximity to aquatic resources.

Post treatment monitoring is recommended annually with follow up treatments as necessary. Knotweed rhizomes may remain dormant for greater than 10 years.

Although not typically effective on its own using a combination of herbicide application and physical removal can be successful. Excavation with heavy equipment is only effective if all the root material is removed which can require digging to a depth of up to 3 m and up to 20 m wide. If this procedure is not undertaken

with great care there is a high risk of spreading plant fragments. Once excavation is completed all equipment used should be washed on-site before it is transported in order to reduce the risk of spread. Alternately, if the infestation is relatively small pulling and digging can be used.

With regards to disposal the best practice is to avoid the removal of Japanese knotweed offsite. If chemical control methods are effective treated knotweed canes can be left on site to compost and disposal is not necessary. If manual/mechanical methods are used to remove viable plant material and associated soils it can be buried on site at a depth of at least 5 m. Although infested soils can be removed from the immediate area, stockpiled and treated with herbicides it is preferrable that it be buried. Disposal sites should be marked and monitored to ensure that no new knotweed growth occurs.

If on-site disposal is not possible knotweed plants, rhizomes, plant parts, seed and infested soils can be sent to an appropriate off-site facility for deep burial. Materials should be bagged, tarped and securely contained to reduce the risk of spread during transport. Before the transport vehicle leaves the site it should be completely cleaned using a combination of hot water or steam, compressed air and vacuuming.

4.3.4 PURPLE LOOSESTRIFE

Recommended manual or mechanical removal involves pulling or digging new established infestations. Since the plant can reproduce through fragmentation it is crucial to remove all parts of the plan including all root material. Pull or dig purple loosestrife before seed maturity to prevent disturbance and dispersal. Because purple loosestrife can grow in contiguous patches right up to the edge of watercourses, schedule removal works during a period of least risk to fish. Avoid the use of pesticides in riparian areas.

For disposal, it is preferable to remove plant material offsite; however, if this is not possible, plants can be dried onsite and then burned (which requires a burning permit). When disposing offsite, transport plants in tarps or thick plastic bags to an appropriate disposal or compost facility. Before leaving a site, all visible plant parts and soil from vehicles, equipment and gear should be removed and washed if possible, to prevent further spread.

4.3.5 SCOTCH BROOM

Manual and Mechanical methods are recommended for the removal of Scotch Broom. It is important to minimize soil disturbance during all treatments since disturbance facilitates germination. The entire plant should be removed ensuring no seeds are dropped into surrounding disturbed soil. It the whole plant cannot be removed, it is recommended to cut the flower heads off the plant in June or July, before the seeds mature. Chemical treatment can also be used but is dependent on restriction at the site, soil types, and proximity to water. All applications of herbicides should be undertaken by a qualified, licensed individual.

Disposal methods is dependent on the presence or absence of seeds. If seeds are not present then small volumes can be left on site, scattered or mulched and deposited in densely shaded areas where there is no ground vegetation. Large volumes can be chipped and disposed at an appropriate disposal or industrial composting facility. If seeds are present, then plants should be carried on tarps or in a way that prevents seeds from spreading and disposed of at an appropriate facility.

4.4 REPLANTING

Following the removal of the invasive plants the area should be planted with native trees and shrubs including red alder, Scouler's willow, Hooker's willow, Pacific willow, Nootka rose, common snowberry, and salmonberry.

Planting should be scheduled for spring or fall. The placement of mulch will be beneficial as it will reduce the establishment of weeds, retain moisture during periods of hot, dry weather and protect from extreme periods of cold weather.

4.5 MONITORING

In order to determine whether the invasive plant removal strategy has worked a follow-up monitoring program should be implemented and will be included alongside the replanting monitoring program. A monitoring plan provides the blueprint to reach invasive plant management objectives and facilitates continuity in the program from implementation, to evaluation, to adapting management if needed.

Summer monitoring is recommended to capture the greatest diversity of native vegetation and what effect the control is having on the targeted invasive species. This monitoring can coincide with monitoring the success of the new plantings. The process can consist of photo-point monitoring, with the photos taken from the same location and with the same field of view. An initial photo should be taken before any work is done at the site. Photos are also taken after removal and restoration work has taken place. Subsequently, the site should be visited at the same time once a year to the monitor changes over time.

4.6 MAINTENANCE

It is anticipated that as part of the general maintenance of the new landscaping that weeding will take place on a regular basis. As indicated above there are both mechanical and chemical options available to manage the various weeds currently present on the site; the mechanical approach should always be the first consideration and any herbicides applied must be consistent with any regulations by the Vancouver Fraser Port Authority.