

Derwent Way Soil Transfer and Barge Facility Biophysical Assessment and Vegetation Plan New Westminster, BC – Revision 3



PRESENTED TO
Summit Earthworks Inc.

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ACRONYMS & ABBREVIATIONS

BC MoE	British Columbia Ministry of Environment
BC MoF	British Columbia Ministry of Forests
BMP	Best Management Practices
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CDC	Conservation Data Centre
DBH	Diameter at Breast Height
DFO	Fisheries and Oceans Canada
MBCA	Migratory Bird Convention Act
QEP	Qualified Environmental Professional
SARA	Species at Risk Act

LIMITATIONS OF REPORT

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1.0 INTRODUCTION AND PROJECT DESCRIPTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Summit Earthworks Inc. to conduct a biophysical assessment, an invasive species assessment, and develop a vegetation plan for the proposed Derwent Way Soil Transfer and Barge Facility project located on Derwent Way in New Westminster, BC (the Property) (Figure 1).

The proposed project consists of the construction of a new soil transfer and barge facility on a vacant lot adjacent to Derwent Way in New Westminster, British Columbia (the Project). The soil transfer and barge facility will consist of a lined 2,600 m² material storage area, a lock-block wall and soil berm along the western boundary of the site, a floating barge conveyor structure, a weigh scale, a scale house, a wheel wash station, and supporting civil infrastructure such as roads and drainage.

2.0 BIOPHYSICAL ASSESSMENT

2.1 Background Information

The purpose of the biophysical assessment was to assess the habitat suitability for potential sensitive features (i.e., fish, vegetation, or wildlife) of management concern protected by federal or provincial Acts (listed below) which have the potential to be affected by Project activities. For the purposes of this Project, a sensitive feature of management concern is a species that meets at least one of the following criteria:

- listed as 'Special Concern', 'Threatened', or 'Endangered' under the *Species at Risk Act* (SARA) (Federal);
- assessed as 'Special Concern', 'Threatened', or 'Endangered' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Federal);
- protected by the *Migratory Birds Convention Act* (Federal);
- protected by the *Wildlife Act* (Provincial);
- assessed as 'Blue', 'Yellow' or 'Red' by the British Columbia Conservation Data Centre (Provincial); or
- protected under the *Fisheries Act* (Federal).

2.2 Desktop Review

Prior to visiting the site, Tetra Tech completed a background information review for the Property and surrounding areas. IMapBC was used to complete the review by selecting layers specific to sensitive wildlife, fish, and vegetation features at or near the Property (Figure 2). In addition, British Columbia Ministry of Environment's (BC MoE) Habitat Wizard was also used for background information regarding fish and/or fish habitat at or near the Property.

2.3 General Site Conditions

On April 28, 2016 between 12:00 – 16:00 Tetra Tech field staff, Lucas Hennecker, R.B.Tech., visited the Property. The purpose of the site visit was to complete a biophysical assessment and to assess the Property's overall vegetation conditions, including invasive species. The Property is located directly adjacent to the Fraser River; therefore, the assessment focused on features as they relate to the natural settings of the area (i.e., fish, vegetation, and nesting birds). Weather conditions during the site visit were sunny and approximately 17°C. Tidal heights during the site visit ranged from approximately 4 ft. to 9.5 ft., with the overall fluctuation for April 28 being approximately 4 ft. to 14.5 ft. Overall, the Property is quite disturbed by human activity; however, there is the potential for features of management concern to occur at or in the vicinity of the Property.

2.4 Fish and Fish Habitat

An initial review of background information for fish and/or fish habitat within or near the Project area was sourced from BC MoE’s Habitat Wizard Streams Reports for the Fraser River. The Fraser Rivers Watershed Code is 100 and Waterbody Identifier is 00000LFRA (BC MoE, 2016c). The overall length is 1,387.85 m, stream order is 9, and the stream magnitude is 61800 (BC MoE, 2016c). Table 2-1 below lists the fish species known to be present within the Fraser River and included as part of a commercial, recreational, or Aboriginal fishery, or a species of management concern.

Table 2-1: Fish Species Present Within Fraser River

Fish Species Common Name	Fish Species Scientific Name
Bull Trout	<i>Salvelinus confluentus</i>
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>
Chum Salmon	<i>Oncorhynchus keta</i>
Coastal Cutthroat Trout	<i>Oncorhynchus clarkii</i>
Coho Salmon	<i>Oncorhynchus kisutch</i>
Cutthroat Trout	<i>Oncorhynchus clarkii</i>
Dolly Varden	<i>Salvelinus malma</i>
Eulachon	<i>Thaleichthys pacificus</i>
Green Sturgeon	<i>Acipenser medirostris</i>
Kokanee	<i>Oncorhynchus nerka kawamurae</i>
Mountain Whitefish	<i>Prosopium williamsoni</i>
Pink Salmon	<i>Oncorhynchus gorbuscha</i>
Pygmy Whitefish	<i>Prosopium coulterii</i>
Rainbow Trout	<i>Oncorhynchus mykiss</i>
Sockeye Salmon	<i>Oncorhynchus nerka</i>
Starry Flounder	<i>Platichthys stellatus</i>
Steelhead	<i>Oncorhynchus mykiss irideus</i>
Westslope Cutthroat Trout	<i>Oncorhynchus clarkii lewisi</i>
White Sturgeon	<i>Acipenser transmontanus</i>

BCMOE, 2016c

Prior to conducting the site visit, a search of iMapBC for information regarding sensitive fish or fish habitat at or near the Property was completed (Figure 2). According to iMapBC, one fish species at risk was identified as having the potential to occur at or near the Property:

- White Sturgeon (*Acipenser transmontanus pop. 4*) is a red listed species in British Columbia, provincially ranked as S2 and globally ranked as G4T2 (BC MoE, 2016d). This species does not have a SARA status; however, is designated as Threatened by COSEWIC. According to iMapBC, there have been three observations of this species downstream of the Property; at approximately 300 m, 650 m and 950 m (BC MoE, 2016d). All observations of sturgeon were at the juvenile life stage which is consistent with the habitat conditions in the vicinity of the Property; juveniles prefer slow moving sloughs and backwaters, whereas adults typically occur in deeper, faster waters of the main stem (BC MoE, 2016b).

On April 28, 2016 Tetra Tech field staff assessed the fish habitat on the Fraser River adjacent to the Property. It was observed that most or all of the foreshore was heavily rip rapped with angular boulders, which may be due to the Property's proximity to a bridge crossing immediately downstream. During low tide, a very limited amount of natural river bed composed of finer sediment was observed at the base of the bank; however, overall the foreshore consisted of rip rap (Photo 1). The bank upstream of the property, and the opposite bank had little to no rip rap present.



Photo 1: Foreshore of Property consisting primarily of rip rap

At the Property, minimal vegetation was observed within the intertidal zone, which included sedge species (*Carex* sp.), rush species (*Juncus* sp.) and reed canary grass (*Phalaris arundinacea*). Within the rip rap, shrub species such as red alder (*Alnus rubra*), Pacific ninebark (*Physocarpus capitatus*), willow species (*Salix* sp.) and sword fern (*Polystichum munitum*) were observed. In addition, there was a moderate amount of Himalayan blackberry (*Rubus discolor*) and a minimal amount of Scotch broom (*Cytisus scoparius*) present within the rip rap. At the top of the bank, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) was the dominant tree species.

The Fraser River side channel, which the Property is adjacent to, does provide suitable habitat for the fish species listed above. However, given the condition and availability of the habitat at the Property (i.e., heavily rip rapped), Project activities are unlikely to negatively affect these species.

In addition to the Fraser River, there is an unnamed ditch (Photo 2) which runs along the north and east boundary of the Property. During the site visit, the ditch did not contain any water. If water was to flow through the ditch, it is expected to flow north, adjacent to the Property, until the railway tracks south of Salter Street, at which point it is culverted across the Property access road into a neighbouring site. At this point it is unknown as to where the ditch flows; however, based on a review of aerial photographs it appears it would flow east, towards the Stanley Street Greenway, which ultimately would flow south to the Fraser River.

The ditch, though it was dry at the time of the assessment, did not appear to provide suitable fish habitat. It is heavily armoured with cobble sized angular rip rap. The gradient is suitable for fish; however, the channel is uniform and does not appear to provide any niche habitat (i.e., riffles and pools), and it is unknown as to whether there is a barrier to fish passage between the Property and potential connection with the Fraser River.



Photo 2: Unnamed ditch along north and east boundary of Property

2.5 Wildlife and Wildlife Habitat

Prior to conducting the site visit, a search on iMapBC for information regarding sensitive wildlife and wildlife habitat at or near the Property was completed (Figure 2). According to iMapBC, no wildlife species or habitat communities at risk were identified as having potential to occur on the Property.

On April 28, 2016, Tetra Tech field staff assessed the Property for wildlife and wildlife habitat. Upon review of the Property, it was observed that most or all of Property has the potential to provide suitable habitat for wildlife, particularly bird species. Tetra Tech did not locate any nests during the site visit; however, non-detection does not preclude their presence. Elevated bird activity was observed within the eastern, more heavily vegetated and treed area of the Property. Two Great blue Herons (*Ardea herodias*) were observed approximately 75 m upstream of the Property on the mud flats of the Fraser River (Photo 3).



Photo 3: Great blue heron approximately 75 m upstream of Property

It should be noted that Section 34 of the BC *Wildlife Act* prohibits the destruction of an egg or active nest of any bird species and prohibits the destruction of a nest of Bald Eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*), Peregrine Falcon (*Falco peregrinus*), Gyrfalcon (*Falco rusticolus*), Great-blue Heron, or Burrowing Owl (*Athene cunicularia*) regardless of whether it is occupied.

If vegetation clearing is required at the Property during the general bird nesting period (April 1– August 31), Tetra Tech recommends a Qualified Environmental Professional (QEP) complete a pre-clearance nest survey to verify no active bird nests will be affected prior to clearing the vegetation. The pre-clearance nest survey should be completed within one week of clearing vegetation. If clearing does not take place within this seven day period following the survey, an additional survey should be completed. Should an active nest be detected, clearing would have to stop until the nest is no longer active.

2.6 Vegetation and Ecological Conditions

Prior to conducting the site visit, a search on iMapBC for information regarding sensitive vegetation and ecological communities at or near the Property was completed (Figure 2). According to iMapBC, two plant species at risk were identified as having the potential to occur on the Property:

- pointed rush (*Juncus oxymiris*) is a blue listed species in British Columbia, provincially ranked as S3 and globally ranked as G5 (BCMOE, 2016d). This species does not have a SARA or COSEWIC status. The location of the Property falls within a polygon identified as having the potential to support this species (BC MoE, 2016d). Rush species were identified on-site; however, species specific distinguishing features were not present, therefore classifying down to species was not possible. There is a potential for the rush species identified on site to be *Juncus oxymiris*; however, an assessment later in the growing season when distinguishing characteristics are present would be required for confirmation; and

- flowering quillwort (*Lilaea scilloides*) is a blue listed species in British Columbia, provincially ranked as S2S3 and globally ranked as G5 (BC MOE, 2016d). This species does not have a SARA or COSEWIC status. This species has been identified as potentially occurring on the shoreline of Annacis Island, which at its closest point is approximately 160 m from the Property, across the Fraser River (BC MoE, 2016d). During the site visit, there was no indication of this species being present on the Property.

On April 28, 2016, Tetra Tech field staff conducted a general vegetation assessment of the Property.

Vegetation at the site consists predominantly of introduced, invasive, and/or noxious weed species. The native vegetation present is indicative of a young-mature second growth forest ecosystem. The dominant tree species is black cottonwood, with bigleaf maple (*Acer macrophyllum*) and red alder also making up portion of the stand. Understory species include common hawthorn (*Crataegus monogyna*), common horsetail (*Equisetum arvense*), common snowberry (*Symphoricarpos albus*), and fireweed (*Epilobium angustifolium*).

The Property, is located within the low elevation Coastal Western Hemlock Dry Maritime (CWHdm) biogeoclimatic subzone. This subzone is characterized as having relatively dry, warm summers and mild, moist winters with low snowfall (BC MoF, 1994). The Property is primarily a previously disturbed site, with much of the area consisting of exposed mineral soil with little to no organic material present.

During the vegetation assessment, Tetra Tech completed a general tree mensuration of the Property. The dominant tree species, black cottonwood, ranged in height from approximately 17.0 m to 28.0 m. The average diameter at breast height (DBH) was observed to be approximately 30.0 cm; however, measurements ranged from 15.0 cm to 60.0 cm. A rough count was completed; estimating there to be approximately 90 trees fitting the above mentioned characteristics.

No rare plants were observed during the assessment; however, non-detection does not preclude their presence.

Table 2-2 below is a detailed list of the native vegetation species identified on the Property, while Table 2-3 provides a detailed list of non-native, invasive, and/or noxious vegetation species present on the Property.

Table 2-2: Native Vegetation on the Property

Common Names	Scientific Names	Comments
bigleaf maple	<i>Acer macrophyllum</i>	Tree
black cottonwood	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	Tree/Shrub
paper birch	<i>Betula papyrifera</i>	Tree/Shrub
red alder	<i>Alnus rubra</i>	Tree/Shrub
willow species	<i>Salix</i> sp.	Tree/Shrub
black hawthorn	<i>Crataegus douglasii</i>	Shrub
casacara	<i>Rhamnus purshiana</i>	Shrub
common hawthorn	<i>Crataegus monogyna</i>	Shrub
common snowberry	<i>Symphoricarpos albus</i>	Shrub
Pacific ninebark	<i>Physocarpus capitatus</i>	Shrub
red-osier dogwood	<i>Cornus stolonifera</i>	Shrub
Saskatoon	<i>Amelanchier alnifolia</i>	Shrub
common horsetail	<i>Equisetum arvense</i>	Herb
fireweed	<i>Epilobium angustifolium</i>	Herb
rush species	<i>Juncus</i> sp.	Herb
scouring rush	<i>Equisetum hyemale</i>	Herb

Table 2-2: Native Vegetation on the Property

Common Names	Scientific Names	Comments
sedge species	<i>Carex</i> sp.	Herb
sword fern	<i>Polystichum munitum</i>	Fern

Table 2-3: Non-Native, Invasive and/or Noxious Vegetation

Common Names	Scientific Names	Provincial Ranking
buttercup species	<i>Ranunculus</i> sp.	Unregulated Invasive of Concern
Canada thistle	<i>Cirsium arvense</i>	Regulated
common dandelion	<i>Taraxacum officinale</i>	Not Listed
common tansy	<i>Tanacetum vulgare</i>	Regulated
crown vetch	<i>Coronilla varia</i>	Not Listed
English holly	<i>Ilex aquifolium</i>	Unregulated Invasive of Concern
English ivy	<i>Hedera helix</i>	Unregulated Invasive of Concern
field bindweed	<i>Convolvulus arvensis</i>	Unregulated Invasive of Concern
Himalayan blackberry	<i>Rubus discolor</i>	Unregulated Invasive of Concern
wall lettuce	<i>Mycelis muralis</i>	Not Listed
common periwinkle	<i>Vinca minor</i>	Unregulated Invasive of Concern
reed canary grass	<i>Phalaris arundinacea</i>	Not Listed
ribwort	<i>Plantago lanceolata</i>	Not Listed
Scotch broom	<i>Cytisus scoparius</i>	Unregulated Invasive of Concern
tansy ragwort	<i>Senecio jacobaea</i>	Regulated
unidentified garden ornamental	n/a	Not Listed
white clover	<i>Trifolium repens</i>	Not Listed

ISCBC, 2014a

In early 2016, Vancouver Fraser Port Authority (VFPA) Environmental Programs conducted an invasive species survey for high-priority invasive plants, and the Property was included in this survey. During the survey, purple loosestrife (*Lythrum salicaria*) was identified on the Property. This species is Provincially Regulated in British Columbia, and therefore needs to be properly and effectively removed from the Property during construction to prevent its spread.

3.0 VEGETATION PLAN

As noted in Section 2.6 above, several large trees (black cottonwood), were observed growing on the Property. As per the design specifications, most trees growing within 10 m of the ordinary high water mark of the Fraser River (i.e., within and at the top of the rip rap bank) will be retained (Figure 3). An exception will be the trees and other vegetation at the eastern corner of the Property along the Fraser River that require removal, topping and/or limbing to enable the conveyor structure adequate clearance over the foreshore.

Clearing work will only occur within the conveyor structure alignment over the Fraser River foreshore (Figure 3). A strip of approximately 2 to 3 m will be permanently removed to accommodate a conveyor structure.

Retaining most trees along the shoreline of the Fraser River will provide a visual screen of the cleared Property and will help reduce or maintain current noise levels. In addition, these trees will also provide riparian habitat which will benefit wildlife (e.g., nesting and perching birds).

In addition to retaining select trees on the Property, a screening/landscaping buffer will be installed along the western Property boundary (Figure 3). The purpose of this buffer is to provide a visual screen of the cleared area and help reduce or maintain current noise levels that may affect neighbouring residences to the west of the Property. The screening/landscaping buffer will be as per the design specifications outlined below (Section 3.1) and will follow, as closely as feasible, the Queensborough Community Plan.

According to the Queensborough Community Plan, the Property is located within the Queensborough Light Industrial and Mixed Employment Land Use Area (CONW, 2014). Within this Land Use Area the plan recommends the following:

- Each development must integrate trees, including shade trees;
- Retain existing mature trees wherever possible. Where tree removal is unavoidable, replace with a number, species and size of trees that creates equal value;
- Tree species and other plant materials must be of high quality;
- Select species that are successful in the urban environment, easy to maintain, are non-invasive and suited to Queensborough's high water table. Selected tree species should also have less aggressive rooting habits;
- For all shade trees, broadleaf deciduous tree species should be used wherever possible. Species that have a minimum mature height of 15 meters (49 feet) should be selected;
- Plant all trees so that they will successfully become established and develop a full canopy over time; and
- Develop and/or enhance areas of understory vegetation using diverse, multi-story planting which will support habitat for wildlife.

3.1 Plants Suggested for Planting

Taking into consideration the Queensborough Community Plan and Port Metro Vancouver requirements, Tetra Tech recommends selecting primarily native species for planting on the Property. Planting native species will not only provide positive visual aesthetics and noise buffering, but it will also increase biodiversity on the Property and make it more difficult for invasive species to colonize/re-colonize and spread. The species recommended are predominantly those that were identified during the site assessment. Additional species are recommended based on the Property's geographic location and the objective of providing a functional screen/buffer. Table 3-1 provides a list of recommended species for planting at the Property.

Table 3-1: Native Plants Suggested for Planting

Common Names	Scientific Names	Comments
Swedish columnar aspen	<i>Populus tremula erecta</i>	Tree
willow sp.	<i>Salix sp.</i>	Tree/shrub
baldhip rose	<i>Rosa gymnocarpa</i>	Shrub
black hawthorn	<i>Crataegus douglasii</i>	Shrub
common snowberry	<i>Symphoricarpos albus</i>	Shrub
hardhack	<i>Spiraea douglasii</i>	Shrub
oceanspray	<i>Holodiscus discolor</i>	Shrub
Pacific ninebark	<i>Physocarpus capitatus</i>	Shrub
red elderberry	<i>Sambucus racemosa ssp. pubens</i>	Shrub
red-osier dogwood	<i>Cornus stolonifera</i>	Shrub
Saskatoon	<i>Amelanchier alnifolia</i>	Shrub
sword fern	<i>Polystichum munitum</i>	Herb

Swedish columnar aspen (*Populus tremula erecta*) was selected as the only tree species for planting at the Property. The rationale for selecting this species is that it will provide an ideal screen for the Property and is well suited to the ecology of the site. It is not considered a native species; however, it is in the same genus as the dominant tree species currently growing at the Property (black cottonwood). It is characterized as growing to approximately 15 m in height and has a horizontal spread of approximately 3 m (BLS, 2015). It is known to grow fast, prefers full sunlight and is capable of adapting to dry conditions or standing water (BLS, 2015).

Tetra Tech recommends allowing for a 2 – 3 m wide planting area along the western boundary of the Property at the toe of the proposed berm. Trees should be planted approximately 3 m apart in a linear windrow design (Figure 3). It is anticipated that approximately 50 trees will be required. In addition, trees should be planted in similar design (i.e., 3 m apart and linear windrow) along the top of the rip rap bank along the Fraser River where clearing is required to accommodate the conveyor structure installation (Figure 3). Based on the width of the clearing area, it is anticipated that approximately 2 – 3 trees will be required. In addition, Tetra Tech recommends staking the entire length of the rip rap bank (excluding the conveyor structure location) with willow stakes (*Salix sp.*), as this will provide additional screening/buffering for the Property and improve habitat along the armoured foreshore of the Fraser River. It is expected that over time the trees will grow to provide a suitable aesthetic screen/buffer for the Property.

The remaining species selected for planting will be native shrubs and herbs listed in Table 3-1 above. These plants should be planted at an offset 1 m spacing (BC MoE, 2008). For planting along the western boundary of the Property, plants should be planted around the trees as well as up the west slope of the proposed berm (Figure 3). For planting along the top of the rip rap bank along the Fraser River, plants should be planted around the trees, as well as any plantable areas not paved or rip rapped (Figure 3). To encourage plant survival, watering may be required during the hot dry summer months.

Prior to planting, soils within planting areas should be ripped to alleviate compaction and a certified weed-free topsoil imported to improve the planting substrate. In addition, importing a mulch to cover exposed soils will help in reducing the re-colonization and spread of invasive plant species.

4.0 INVASIVE SPECIES ASSESSMENT

4.1 Background Information on Invasive Plants

The purpose of the invasive species assessment was to assess the effect of invasive species on the Property and develop a plan for removing and controlling these plants. Many introduced, invasive plants are regulated under the British Columbia *Weed Control Act*. The *Weed Control Act* (1996) states that “*in accordance with the regulations, an occupier must control weeds growing or located on land and premises, and on any other property located on land and premises, occupied by that person*”. For the purposes of this project only ‘Regulated’ and ‘Unregulated Species of Concern’ will be managed for. A list of all provincially regulated noxious plants in British Columbia and additional unregulated invasive plants of concern in British Columbia is included in Appendix B (ISCBC, 2014a).

4.2 Invasive Plants Identified at the Property

On April 28, 2016 Tetra Tech field staff assessed the Property for invasive plant species. A detailed vegetation inventory was not within Tetra Tech’s scope of work; however, a general invasive vegetation assessment was completed, which identified numerous invasive species on the Property. In addition, VFPA identified purple loosestrife on the Property which was not observed by Tetra Tech. Section 2.6 above provides details of the non-native, invasive, and/or noxious vegetation species identified on the Property.

In general, the most dominant invasive species identified throughout the Property were Himalayan blackberry and Scotch broom. Moderate amounts of reed canary grass were identified throughout the Property, while Canada thistle, common tansy, and tansy ragwort were relatively sparse. English holly was present in the southeast and northwest corners of the Property, while English ivy was present on one tree on the west side of the Property and as ground cover on the east side of the Property. Field bindweed and common periwinkle occurred in sparse amounts on the east side of the Property.

4.3 Managing for Invasive Plants on the Property

Several invasive species have been identified on the Property. Each species has their own specific best management practices (BMPs) for control; however, the following general BMPs (ISCBC, 2014b-f) are presented for removing, controlling, and introducing non-native, invasive and/or noxious vegetation:

- Upon removal of invasive plants, promptly establish native shrubbery and trees for shading and competition;
- Maintain or establish healthy plant communities that are resistant to invasion by invasive plants;
- Regularly monitor (e.g., monthly) for invasive plant species in both disturbed and undisturbed areas;
- Verify soil, gravel, and other fill materials used during construction are not contaminated with invasive plants or seeds. Post-construction and during daily operations, all material imported to site should be contained within the lock-block walls and on paved areas to prevent the inadvertent spread of invasive plant propagules that may be present; soils imported to site should never mix with native soil material;
- Avoid unloading, parking, or storing equipment and vehicles in infested areas;
- Minimize soil disturbance during activities and re-vegetate exposed soil with native, fast growing species as soon as possible;
- Minimize soil disturbance in areas directly adjacent to existing invasive species infestations and contain or localize seed spread;

- Remove plants, plant parts, and seeds from personal gear, clothing, pets, vehicles, and equipment. Wash vehicles, including tires and undercarriage and equipment at designated cleaning sites (e.g., wheel washes) before leaving the site;
- Create and maintain a 'containment line' between infested and non-infested areas. Boundaries can be more easily monitored and controlled to prevent the spread onto adjacent lands;
- Bag or tarp plants, plant parts, and seeds before transporting to a designated disposal site (e.g., landfill); and,
- Take special care when controlling invasive plant species near streams, or ditch lines, to prevent the movement of plant parts downstream. Wheel wash water should also be contained, treated, and disposed of appropriately.

4.4 Species Specific Control Methods for Identified Invasive Plants

Control methods for species identified on the Property with a provincial ranking of either 'Unregulated Invasive of Concern' or 'Regulated' are discussed further in this section. Invasive plant material should be disposed of at a landfill facility approved to receive such material. It should be noted that control methods that suggest the use of herbicides typically require permits. Given the Property's close proximity to the Fraser River, permits for the use of herbicide may be difficult to obtain. Herbicide recommendations and use should consider site characteristics and be prescribed based on site goals and objectives. Herbicide labels and other sources of information should be reviewed prior to selection and application. It is recommended that a professional experienced in the application of herbicides be consulted if they are to be used. The following provides species specific control methods:

Canada thistle (*Cirsium arvense*)

- Mechanical control method: Mowing is the most effective means of control when completed at the bud stage. Regular cutting can help wear down plant reserves, reduce plant growth, and reduce populations, but is not likely to kill the plant. For disposal, if plants are cut prior to flowering, the plant material can be left on the site to decompose. If plants are cut post flowering, all plant parts, including flower heads, should be bagged and disposed of at an appropriate landfill. Care should be taken to verify plant parts are not dispersed during transport (ISCBC, 2014b).
- Chemical control method: Herbicide is effective when used in the spring on new germinants and will suppress mature plants with repeated treatments. Spring applications provide good control and suppression of top growth. Applications can also provide good control up to the early bud stage. Herbicide can also be applied in the fall after the first hard frost (ISCBC, 2014b).

Common tansy (*Tanacetum vulgare*)

- Control method: Common tansy cannot be controlled with one single mowing event, as the plant will simply respond with increased growth. Mowing sites very low to the ground before July can prevent seed production. Combined mowing and subsequent herbicide treatment of re-growth can be an effective control method. Treatments will likely need to be repeated over several years. Hand pulling may be used in areas where mowing and herbicide application are not feasible (ISCBC, 2014c).

English holly (*Ilex aquifolium*)

- Manual and mechanical control method: Small plants can be dug or pulled up when soil is moist. Minimize soil disturbance as much as possible when removing roots. Cutting holly at the base usually results in re-sprouting, but with monitoring and follow up holly can be suppressed (King County, 2008).
- Chemical control method: For large trees with thick stems, cut the holly as close to the ground as possible and apply herbicide directly to the cut portion. Frilling (making deep cuts at a 45 degree angle into the tree's bark

using an axe or sharp chisel) and pouring herbicide into the cuts immediately afterward is also effective. Monitor for seedlings and root re-sprouting (King County, 2008).

English ivy (*Hedera helix*)

- Manual and mechanical control method: Cutting, pulling and digging can be an effective removal method. Key steps are to remove as much ivy stem and root as possible while at the same time minimizing soil disturbance. Cut large vines at the bases of trees and pull vines from the soil and attempt to remove as much of the root as possible. Follow-up treatments will likely be needed for one year or more to pull re-sprouting ivy. Dispose of ivy cuttings at an appropriate landfill (Oregon State University, 2008).
- Chemical control method: A waxy layer is present on ivy leaves which can act as a barrier to foliar-applied herbicides. Young ivy leaves, which have not formed this thick waxy layer, will absorb more herbicide than older leaves. Applying an acid before the herbicide may increase ivy's absorption of herbicide. Winter applications generally provide more effective control than growing-season applications. Cutting woody stems of ivy vines and applying herbicide to the cut surfaces along with either foliar treatment or pulling up ivy ground cover can be a very effective means of control. When applying herbicide to ivy growing on trees, ensure overspray is not applied to the tree itself (Oregon State University, 2008).

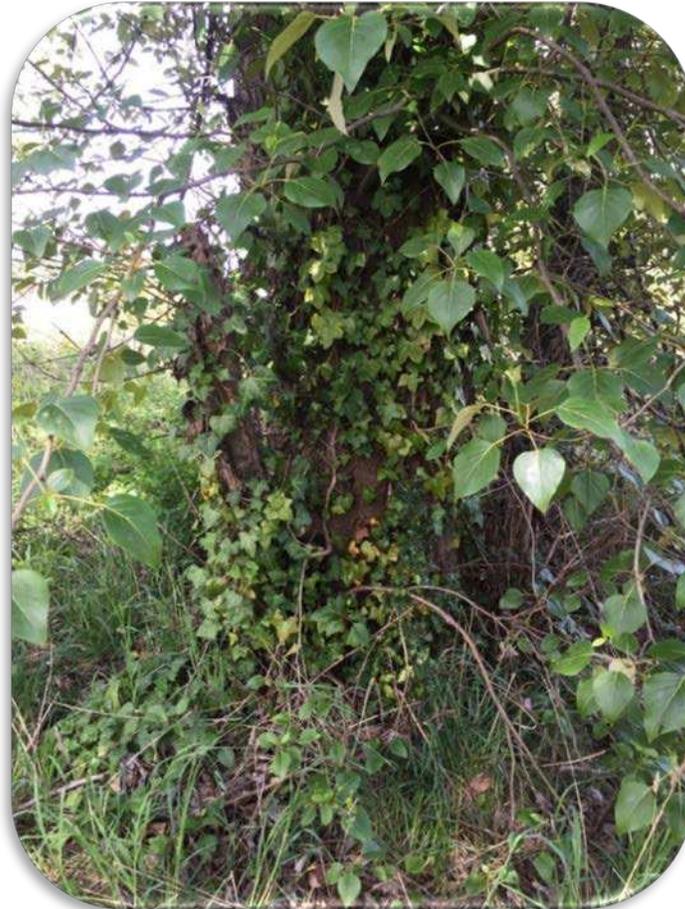


Photo 4: English ivy growing on a tree on the west side of the Property

Field bindweed (*Convolvulus arvensis*)

- Control method: Manually remove as much of the plant as possible. In general, mechanical control is not a promising option because plants are able to reproduce from roots, and seeds remain viable in the soil for long periods of time. Field bindweed prefers full sunlight and mesic to dry conditions. Early native plant establishment may discourage re-colonization of field bindweed since it is not very competitive under shady conditions. Dispose of all plant materials at an appropriate landfill. Herbicide treatment can also provide good control (WSNWCB, 2010).

Himalayan blackberry (*Rubus discolor*)

- Control method: Mowing can be a very effective control method, but can also harm desirable plant species. If roots are not manually removed, mowing several times per year over several years is necessary to exhaust root reserves. If mowing or cutting is only carried out once per year, it should be when the plants begin to flower. Do not mow where soil is highly susceptible to compaction or erosion, or where soil is very wet. Since mechanical control can stimulate strong re-growth, follow-up with either spot applications of herbicide or hand digging to remove the entire root system (ISCBC, 2014d).



Photo 5: Himalayan blackberry growing throughout the Property

Common periwinkle (*Vinca minor*)

- Control method: Periwinkle can be pulled by hand or dug up, being sure to remove underground portions. Where appropriate, mowing can be used to cut plants back but will likely have to be repeated regularly. Mowing followed by application of herbicide provides good control. Dispose of all vines at an appropriate landfill (Swearingen et al., 2010).



Photo 6: Common periwinkle growing on the east side of the Property.

Purple loosestrife (*Lythrum salicaria*)

- Control method: Purple loosestrife can be effectively hand-pulled from the base of the plant or dug up. Ensure the entire plant is removed, including all roots and rhizomes, and all parts are disposed of at an appropriate facility (e.g., transfer station). Seedlings start in June and the plant flowers in July and August; therefore, the optimal time for removal is during July or August prior to seed. Ensure removal is completed within this window, as late season removal (i.e., September) the plants will likely have already gone to seed and will then proliferate the following season. Mowing is not a recommended means of controlling purple loosestrife as plant fragments can produce new shoots and may facilitate further spreading (King County, 2011).



Photo 7: Purple loosestrife was identified by VFPA on site¹.

Scotch broom (*Cytisus scoparius*)

- Mechanical control method: Remove Scotch broom before it flowers in the late winter, early spring to prevent seed maturation. Minimize soil disturbance as much as possible. Larger plants should be cut close to ground level before flowering and seed set, while plants with stems less than 1.5 cm in diameter may be hand pulled. Due to large seed banks and re-sprouting potential, mechanical treatments may need to be repeated over a 3 to 5 year period. Mechanical control is most effective when all of the plant is removed, no seeds are dropped, and soil disturbance is minimized (ISCBC, 2014e).

¹ Photo courtesy of Invasive Species Council of BC: <http://bcinvasives.ca/invasive-species/identify/invasive-plants/purple-loosestrife/>.

- Chemical control method: Herbicides have some success of control, but long seed viability in the soil requires repeated treatments over many years. Selective spot spraying, basal stem injection, or cut surface application methods are recommended to minimize non-target damage (ISCBC, 2014e).



Photo 8: Scotch broom growing near the top of the bank along the southern boundary of the Property.

Tansy ragwort (*Senecio jacobaea*)

- Mechanical control method: This method of control is effective on established stands when the root system can be removed in its entirety or frequently removed to prevent the growth of seedlings and root sprouts. Repeated mowing before flowering can prevent seed production. While light removal can encourage growth, repeated heavy cutting can be used as a control technique. Hand pulling is only effective in small infestations. Periodic re-treatment will be necessary. Pull plants when soils are moist to completely remove root mass. Vegetative reproduction is stimulated by mowing, grazing, or poor hand removal where the rootstalk is not completely removed. If plants are hand pulled or cut prior to flowering, the plant material can be left on the site to decompose. If plants are cut post flowering, all plant parts, including flower heads, should be bagged and disposed of at the landfill (ISCBC, 2014f).



Photo 9: Tansy ragwort growing on the Property.

5.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



for

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FIGURES

- Figure 1 Site Plan
- Figure 2 Sensitive Biological Features
- Figure 3 Vegetation Plan



LEGEND

- Property Boundary (approximate)
- 'A' Land
- 'B' Water

NOTES
 Base data source:
 Imagery provided by Google Earth (2014).

STATUS
ISSUED FOR USE

**DERWENT WAY SOIL TRANSFER AND
BARGE FACILITY - BIOPHYSICAL
ASSESSMENT AND VEGETATION PLAN**

Site Plan

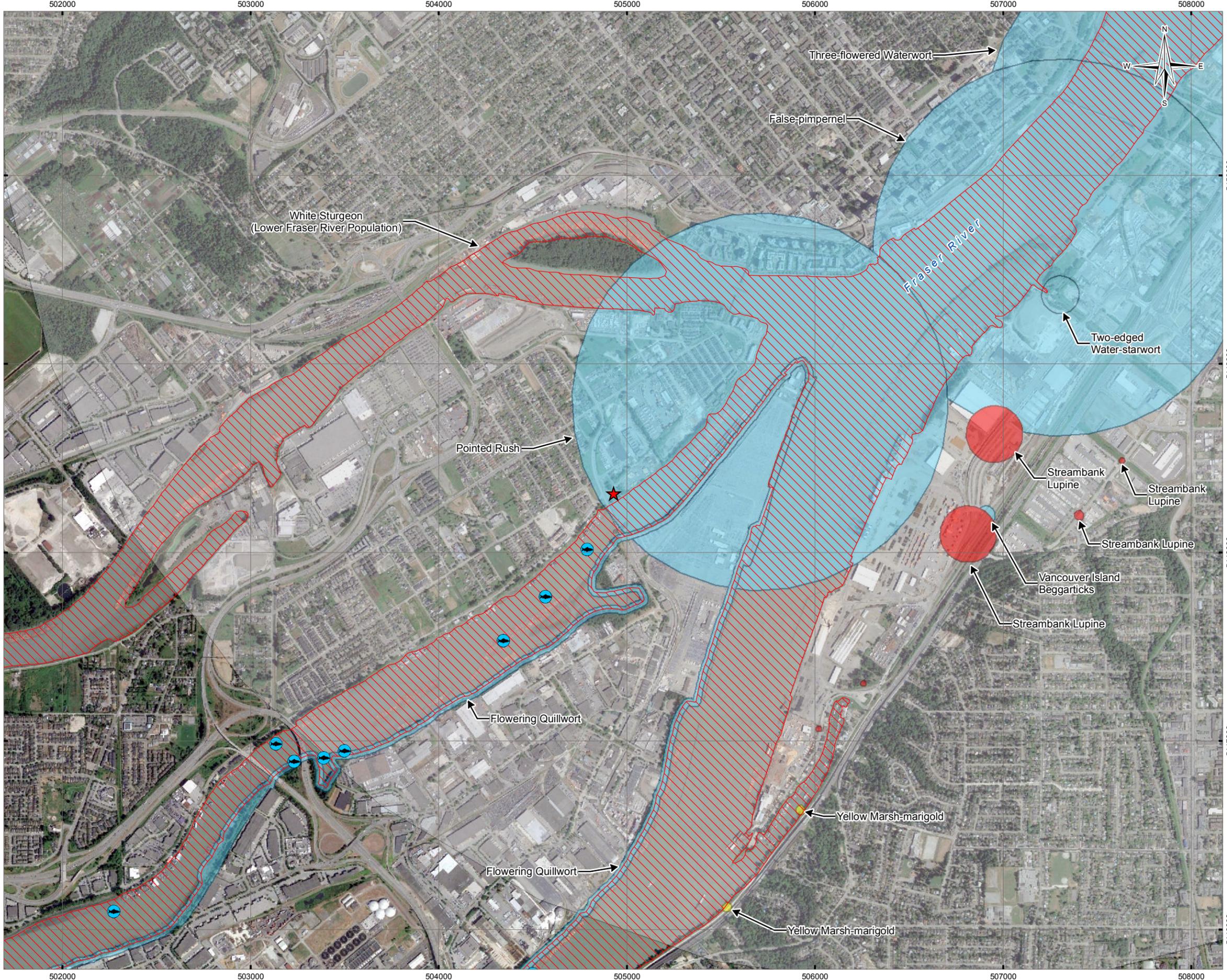
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PROJECT NO. ENG.VGEO03082-01	DWN SL	CKD MEZ
APVD LH	REV 2	
OFFICE Tl-VANC	DATE April 18, 2017	

Figure 1

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LEGEND

- ★ Site Location
- White Sturgeon Known Observations

Conservation Data Centre Species at Risk

Species Type and BC List Status

- Vascular Plant - Blue Listed
- Vascular Plant - Red Listed
- Vascular Plant - Yellow Listed
- Vertebrate Animal - Red Listed
- Masked Occurrence

NOTES
 Base data source:
 CDC data and White Sturgeon observations downloaded from DataBC.
 Imagery provided by Google Earth (2014).

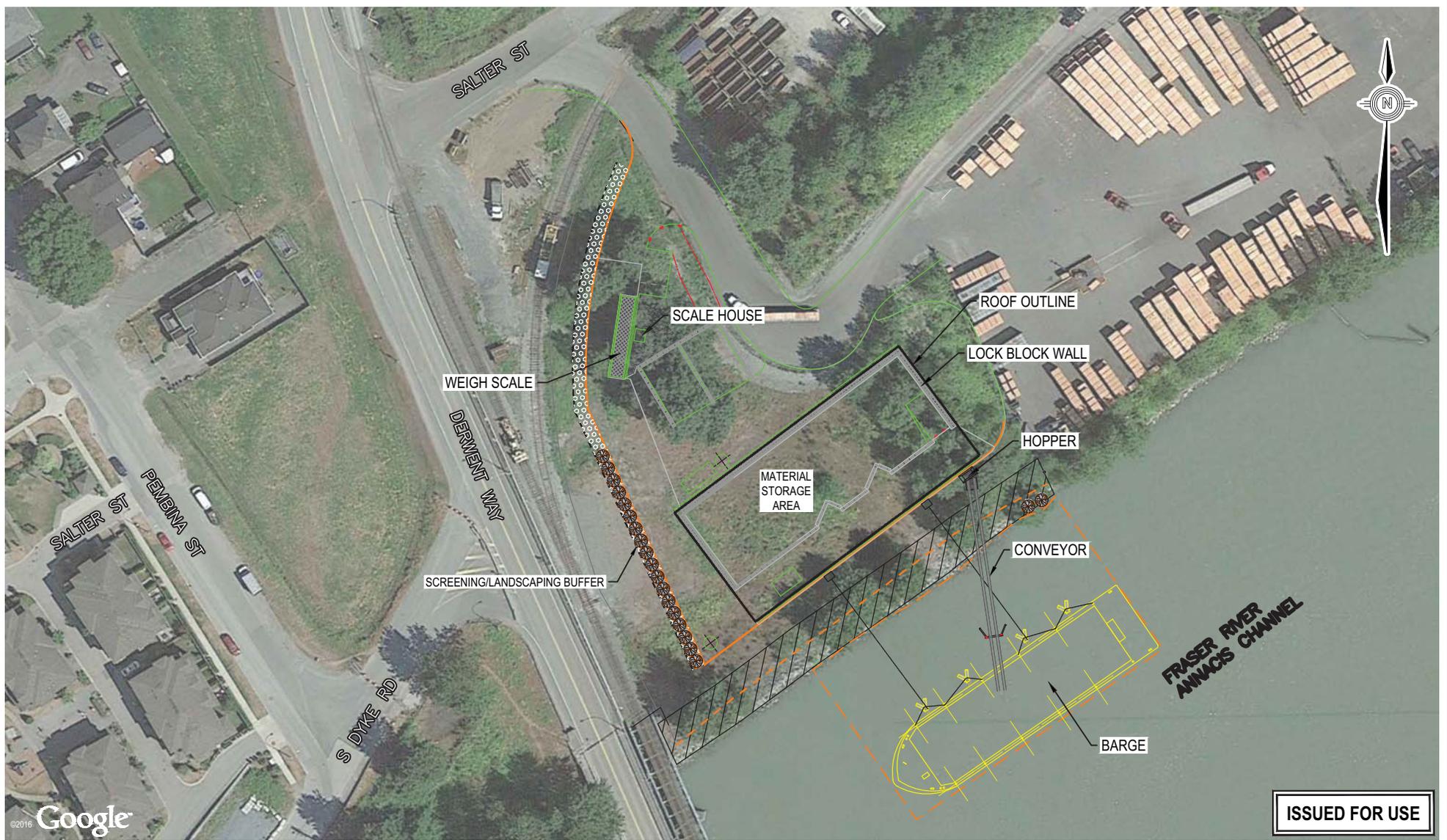
STATUS
ISSUED FOR USE

DERWENT WAY SOIL TRANSFER AND BARGE FACILITY - BIOPHYSICAL ASSESSMENT AND VEGETATION PLAN

Sensitive Biological Features

PROJECTION UTM Zone 10	DATUM NAD83	CLIENT SUMMIT EARTHWORKS
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PROJECT NO. ENG.VGEO03082-01	DWN SL	CKD MEZ
	APVD LH	REV 2
OFFICE TI-VANC	DATE April 18, 2017	

Figure 2



ISSUED FOR USE

LEGEND

-  TREE PLANTING LOCATIONS
-  SHRUB/HERB PLANTING AREA
-  RETENTION TREES (WITHIN 10 m OF HIGHWATER MARK)

NOTES

1. Imagery from Google Earth Pro.
2. Based on Dwg. LEASE PLAN No. 2016-015 by Vancouver Fraser Port Authority Engineering Department and Dwg. P151207-A-01 by PSA Engineering Ltd.

SCALE 1:1000



CLIENT



**DERWENT WAY SOIL TRANSFER AND BARGE FACILITY
BIOPHYSICAL ASSESSMENT AND VEGETATION PLAN**

VEGETATION PLAN

PROJECT NO. ENG.VGEO03082-01	DWN RH	CKD LH	REV 4
OFFICE VANC	DATE April 18, 2017		

Figure 3

APPENDIX A

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

NATURAL SCIENCES

This report incorporates and is subject to these "General Conditions".

1.1 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development or activity, and/or a specific scope of work. The report may include plans, drawings, profiles and other supporting documents that collectively constitute the report (the "Report").

The Report is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contract entered into with the Client (either of which is termed the "Services Agreement" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Report when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Report is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Report.

Where TETRA TECH has expressly authorized the use of the Report by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these General Conditions as well as any limitations on liability contained in the Services Agreement with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these General Conditions and the Services Agreement prior to making any use of the Report. Any use made of the Report by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Report and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH 's professional work product and shall remain the copyright property of TETRA TECH.

The Report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Report, if required, may be obtained upon request.

1.2 ALTERNATIVE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of the Report or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH 's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive the original signed and/or sealed version for a maximum period of 10 years.

Both electronic file and hard copy versions of TETRA TECH 's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH 's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Report have been conducted in accordance with the Services Agreement, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Report.

TETRA TECH professionals are bound by their ethical commitments to act within the bounds of all pertinent regulations. In certain instances, observations by TETRA TECH of regulatory contravention may require that regulatory agencies and other persons be informed. The client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 ENVIRONMENTAL ISSUES

The ability to rely upon and generalize from environmental baseline data is dependent on data collection activities occurring within biologically relevant survey windows.

1.5 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Services Agreement, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

General Conditions

NATURAL SCIENCES

1.6 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Report, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.7 GENERAL LIMITATIONS OF REPORT

This Report is based solely on the conditions present and the data available to TETRA TECH at the time the data were collected in the field or gathered from publically available databases.

The Client, and any Authorized Party, acknowledges that the Report is based on limited data and that the conclusions, opinions, and recommendations contained in the Report are the result of the application of professional judgment to such limited data.

The Report is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present at or the development proposed as of the date of the Report requires a supplementary investigation and assessment.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design or scope, in consideration of the level of the environmental baseline information that was reasonably acquired to facilitate completion of the scope.

The Client acknowledges that TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of property, the decisions on which are the sole responsibility of the Client.

1.8 JOB SITE SAFETY

TETRA TECH is only responsible for the activities of its employees on the job site and was not and will not be responsible for the supervision of any other persons whatsoever. The presence of TETRA TECH personnel on site shall not be construed in any way to relieve the Client or any other persons on site from their responsibility for job site safety.

APPENDIX B

INVASIVE PLANT SPECIES OF BRITISH COLUMBIA

Provincially Regulated Noxious Plants

Common Names	Scientific Names	Common Names	Scientific Names
Bur Chervil	<i>Anthriscus caucalis</i>	Knotweed, Himalayan	<i>Polygonum polystachyum</i>
Canada Thistle	<i>Cirsium arvense</i>	Knotweed, Japanese	<i>Fallopia japonica</i>
Common Reed	<i>Phragmites australis subsp. australis</i>	Leafy Spurge	<i>Euphorbia esula</i>
Cordgrass, Dense-flowered	<i>Spartina densiflora</i>	Milk Thistle	<i>Silybum marianum</i>
Cordgrass, English	<i>Spartina anglica</i>	North Africa Grass	<i>Ventenata dubia</i>
Cordgrass, Saltmeadow	<i>Spartina patens</i>	Nutsedge, Purple	<i>Cyperus rotundus</i>
Cordgrass, Smooth	<i>Spartina alterniflora</i>	Nutsedge, Yellow	<i>Cyperus esculentus</i>
Crupina, Common	<i>Crupina vulgaris</i>	Purple Loosestrife	<i>Lythrum salicaria</i>
Dodder	<i>Cuscuta spp.</i>	Rush Skeletonweed	<i>Chondrilla juncea</i>
Flowering Rush	<i>Butomus umbellatus</i>	Scentless Chamomile	<i>Matricaria maritima</i>
Garlic Mustard	<i>Alliaria petiolata</i>	Sow-thistle, Annual	<i>Sonchus oleraceus</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>	Sow-thistle, Perennial	<i>Sonchus arvensis</i>
Giant Mannagrass/Reed Sweetgrass	<i>Glyceria maxima</i>	Tansy Ragwort	<i>Senecio jacobaea</i>
Gorse	<i>Ulex europaeus</i>	Toadflax, Common / Yellow	<i>Linaria vulgaris</i>
Hound's-tongue	<i>Cynoglossum officinale</i>	Toadflax, Dalmatian	<i>Linaria genistifolia</i>
Jointed Goatgrass	<i>Aegilops cylindrica</i>	Velvetleaf	<i>Abutilon theophrasti</i>
Knapweed, Diffuse	<i>Centaurea diffusa</i>	Wild Oats	<i>Avena fatua</i>
Knapweed, Spotted	<i>Centaurea stoebe</i>	Yellow Flag Iris	<i>Iris pseudacorus</i>
Knotweed, Bohemian	<i>Fallopia x bohémica</i>	Yellow Starthistle	<i>Centaurea solstitialis</i>
Knotweed, Giant	<i>Fallopia sachalinensis</i>		

Additional Unregulated Invasive Plants of Concern in British Columbia

Common Names	Scientific Names	Common Names	Scientific Names
Baby's Breath	<i>Gypsophila paniculata</i>	Field Bindweed	<i>Convolvulus arvensis</i>
Bachelor's Buttons	<i>Centaurea cyanus</i>	Foxtail Barley	<i>Hordeum jubatum</i>
Bladder Campion	<i>Silene cucubalus</i>	Goatsbeard - Western	<i>Tragopogon dublus</i>
Bull Thistle	<i>Cirsium vulgare</i>	Himalayan Blackberry	<i>Rubus discolor</i>
Butterfly Bush	<i>Buddleja davidii</i>	Himalayan Balsam	<i>Impatiens glandulifera</i>
Chicory	<i>Cichorium intybus</i>	Knapweed, Brown	<i>Centaurea jacea</i>
Cluster Tarweed	<i>Madia glomerata</i>	Mountain Bluet	<i>Centaurea montana</i>
Common Mallow	<i>Malva neglecta</i>	Nightshade	<i>Solanum spp.</i>
Common Periwinkle	<i>Vinca minor</i>	Nodding Thistle	<i>Carduus nutans</i>
Creeping Buttercup	<i>Ranunculus repens</i>	Russian Olive	<i>Elaeagnus angustifolia</i>
Curled Dock	<i>Rumex crispus</i>	Scotch Broom	<i>Cytisus scoparius</i>
Daphne	<i>Daphne laureola</i>	St. John's-Wort	<i>Hypericum perforatum</i>
Didymo	<i>Didymosphenia geminate</i>	Tamarisk	<i>Tamarix chinensis, T. ramosissima</i>
English Holly	<i>Ilex aquifolium</i>	Teasel	<i>Dipsacus fullonum</i>
English Ivy	<i>Hedera helix</i>	Water Hemlock	<i>Cicuta douglasii</i>
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Yellow Archangel	<i>Lamium galeobdolon</i>