Overview Environmental Impact Assessment (UPDATED)

Musqueam Block F
University Endowment Lands

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Executive Summary

Pottinger Gaherty Environmental Consultants Ltd. (PGL) has prepared an overview Environmental Impact Assessment for the Musqueam Indian Band's Block F parcel located on the University Endowment Lands. The Environmental Impact Assessment identifies and describes the current environmental conditions of the Block F parcel as well as environmental best management practices that should be considered during design and implementation of the project. This version is an update to the original report from April 2012 to include new information from additional environmental work, project concept planning, and agency reviews.

Terrestrial and aquatic ecosystems on the site are capable of providing habitat for a variety of wildlife including mammals, birds, amphibians and reptiles. The most valuable habitats on the site are the mature coniferous forest stand and wetland ecosystems. These should be considered for inclusion into the future planned park/open space. Providing vegetated corridors on the edge or across the site should be considered to maintain some habitat connectivity with surrounding areas. Implementing the mitigation measures and best management practices recommended in this report for each phase of the project will serve to reduce the project's impact on environmental values.

Table of Contents

TABLES

FIGURES

APPENDICES

List of Acronyms

BMP	-	best management practice
CDC	**-**	BC Conservation Data Centre
COSEWIC	-	Committee on the Status of Endangered Wildlife in Canada
CWHxm1	-	Eastern Variant of the Very Dry Maritime Subzone of the Coastal Western Hemlock
IBA	-	Important Bird Area
MOE	-	BC Ministry of Environment
PGL	-	Pottinger Gaherty Environmental Consultants Ltd.
SARA	-	*Species at Risk Act*
UBC	-	University of British Columbia
UEL	-	University Endowment Lands

1.0 INTRODUCTION

1.1 Project Overview

Pottinger Gaherty Environmental Consultants Ltd. (PGL) has undertaken and prepared an overview Environmental Impact Assessment for the Musqueam Indian Band's (Musqueam) Block F parcel located on the University Endowment Lands (UEL). The overview Environmental Impact Assessment was completed in advance of Musqueam submitting a rezoning application for the approximate 22 acre site. This version is an update to the original report from April 2012 to include new information from additional environmental work, project concept planning, and agency reviews.

It is understood that the site is currently zoned for medium-density residential uses and accordingly, like other areas that have been developed in the immediate vicinity, it is recognized that the site will be ultimately developed to support Musqueam's economic objectives. Under the Musqueam Reconciliation, Settlement and Benefits Agreement Administration Act, Block F was pre-zoned Multi-Family Residential (MF-1) and the UEL's Official Community Plan and land use bylaws were amended accordingly in order to permit development of the site with residential development.

The Environmental Impact Assessment identifies and describes the current environmental conditions of the Block F parcel (the site) as well as mitigation measures and environmental best management practices (BMPs) that should be considered during design and implementation of the project.

1.2 Regulatory Considerations

There are several environmental regulatory considerations for this site at regional, provincial and federal levels of jurisdiction, of which two government agencies have completed positive reviews.

The proposed project has been reviewed by Fisheries and Oceans Canada (DFO) and they determined that the "project is not likely to result in a contravention of the habitat protection provisions of the *Fisheries Act*." See the DFO response letter in Appendix 4. This review confirmed that the proposed stormwater management measures, including the upgrade to the culvert under University Boulevard, did not pose a risk to downstream fish habitats.

The proposed upgrade to stormwater management of the site was also reviewed as a notification under Section 9 of the *Water Act* by the provincial Ministry of Forests, Lands and Natural Resource Operations, who determined that the project could proceed "subject to the proposed works being consistent with the objectives, standards and the planning, design and operational best practices outlined in our Standards and Best Practices for Instream Works."

This section describes other key regulatory instruments.

1.2.1 Regional

The UEL is governed by the provincial government through the Ministry of Community, Sport and Cultural Development under the *University Endowment Land Act*. Decisions regarding the UEL are guided by the Official Community Plan and the Land Use, Building and Community

Administration Bylaw (UEL, 2012). The Official Community Plan is a broad statement of objectives and policies to guide decisions on planning and land use management within the UEL.

The federal and provincial environmental legislation applicable to the project is described below. Compliance with the Acts and regulations should be addressed by obtaining the required permits, licences and approval, through project design and by applying mitigation and BMPs.

1.2.2 Provincial

The *BC Wildlife Act* protects most vertebrate animals from direct harm or harassment except as allowed by regulation (e.g., hunting or trapping). It is a contravention of the *Wildlife Act* to possess, take, injure, molest or destroy a bird, its nest or eggs except as provided by regulation. Nests of some species including eagles and herons are protected year-round, regardless of whether they are occupied. The typical songbird breeding season in the project site is defined by the Ministry of Environment (MOE, 2006) as April 1 to July 31. Any pre-construction species salvages (involving the capturing and handling of wildlife) will require permits from the MOE under the *BC Wildlife Act*.

The provincial Riparian Areas Regulation (RAR), enacted under Section 12 of the *Fish Protection Act* in July 2004, calls on local governments to protect riparian areas during residential, commercial, and industrial development by ensuring that proposed activities are subject to a science-based assessment conducted by a Qualified Environmental Professional (QEP).

The *Environmental Management Act* regulates pollution prevention; spill reporting, air emissions, and waste disposal and management. Accidental releases during construction would be regulated under this governing body if the spills occurred solely into the soils.

The *Weed Control Act* of BC requires that landowners control the spread of noxious weeds on their property as defined in the Provincial and Regional District Noxious Weed List Schedule A.

1.2.3 Federal

The *Species at Risk Act* (SARA) aims to protect rare species throughout Canada. On private land, specific prohibitions exist to prevent harm to SARA/COSEWIC[1] listed migratory birds and aquatic species.

The *Migratory Birds Convention Act* prohibits the taking or killing of migratory birds, their nests and eggs, and the deposition of harmful substances in areas frequented by migratory birds.

The Canadian Environmental Protection Act, 1999, governs codes of practice respecting pollution prevention or specifying procedures, practices or release limits for environmental control relating to works, undertakings and activities during any phase of their development and operation, including the location, design, construction, start-up, closure, dismantling and clean-up phases and subsequent monitoring activities. Accidental releases during construction would be regulated under this governing body if spills occurred solely into the soils.

[1] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is a committee of experts that determines the national status of wild Canadian species, subspecies, varieties or other designable units that are suspected of being at risk of extinction or extirpation.

The Transportation of Dangerous Goods Act governs the handling or transportation of dangerous goods. Requirements must be followed if substances listed in Schedule A of the Act are transported to/from the site.

2.0 PROJECT DESCRIPTION

2.1 Project Setting

The site is located within Metro Vancouver Regional District, between the City of Vancouver and the University of British Columbia (UBC), on the western tip of British Columbia's Lower Mainland (Figure 1). It is part of the UEL, a separate jurisdiction from both the City of Vancouver and UBC.

The site is a triangular parcel of land bounded by University Boulevard to the east and Toronto Road and Acadia Road to the northwest and west, respectively (Figure 1). Urban development, which is part of UBC, borders the western and southwestern edge of the site while University Golf Club is located northeast of the site. University Hill Secondary School and St. Anselm's Anglican Church are located south and east of the site, respectively.

Pacific Spirit Regional Park is located generally to the north, east and south, and is the largest greenspace remaining within Metro Vancouver excluding the North Shore Mountains.

2.2 Project Design

The proposed site design is currently at the conceptual level (Figure 3) and specific development phasing of the project was not known at the time of this report, although it is anticipated that the project would be phased over a 10- to 12-year time horizon.

It is understood that the rezoning application will seek to include a wider range of land uses including a 120- to 150-room hotel, a small commercial village, as well as allowing for a range of building heights across the site.

A rezoning is being contemplated so as to achieve the following:

- Allow a small commercial village centre including an approximate 120- to 150-room hotel;
- Opportunities to increase urban form variety through introducing variation in building height;
- Increased absorption of the development products offered so as to minimize the overall construction period of the development;
- Increase UEL's tax base by introducing commercial uses which will provide an opportunity to offset the residential base which dominates the UEL;
- Provide job opportunities for Musqueam members; and
- Potentially provide a larger amount of park/open space.

As part of the development, park/open space will be incorporated as well as pedestrian linkages both into and around the site.

We understand that the project design intends to incorporate environmentally responsible practices where practical. Keeping the above context in mind, this overview Environmental Impact Assessment was undertaken on the understanding that the site will be fully developed over time as per the intent of the Musqueam Reconciliation, Settlement and Benefits Agreement Administration Act.

Similar developments that have occurred in the local area with a comparable environmental setting include UBC Wesbrook, Hampton Place, and the residential development located in the southwest corner of the Block F parcel.

2.2.1 Stormwater Management

The proposed benefits to the UEL infrastructure include an upgrade to the culvert under University Boulevard. Replacing the existing 250mm diameter culvert with a larger size pipe will reduce/prevent the flooding of the road which currently occurs during large storm events. Flooding of the road can lead to undermining the integrity of the road structure and eventually lead to failure; this can be avoided with a culvert replacement. The larger sized culvert will maintain existing flow and base flow downstream without increasing the existing flow. A new culvert will allow for improved erosion control by incorporating riprap for inlet and outlet protection into the design.

One large pond surrounded by vegetation and able to capture 1,858m³ of stormwater will be located in the area where the existing stormwater backs up south of University Boulevard in the vicinity of the undersized existing 250mm diameter culvert. A flow control manhole will control the discharge rate to the new 525mm diameter culvert under University Boulevard. The manhole is not to exceed the 100-year predevelopment flow rate. This stormwater travels through a short channel in Pacific Spirit Regional Park, then under the golf course via a culvert, and eventually into Salish Creek which flows to the ocean. A smaller pond that is able to capture 226m³ of stormwater will be located near the southeast corner of the site with overflow discharge to the existing non-fish-bearing ditch in the road right-of-way. This stormwater design has been created with input from PGL to maintain water quality and flows to offsite habitats.

3.0 EXISTING ENVIRONMENTAL CONDITIONS

3.1 Desktop Research and Site Visit

The existing environmental data for the site was compiled through desktop research and supplemented by field visits. A number of data sources were used to collect and review available environmental information for the property including:

- BC Conservation Data Centre and Environment Canada's species at risk databases;
- Literature and studies completed for the properties and nearby areas;
- Government basemaps;
- Orthophotos; and
- Web-based provincial mapping tools.

In addition, PGL biologists completed field visits to:

- Identify, qualify and map environmental features on the site;

- Groundtruth and refine areas of particular sensitivity or value;
- Confirm the connectivity of watercourses; and
- Identify opportunities for ecological enhancement as part of the project.

3.2 Ecosystems

3.2.1 Terrestrial Ecosystems

The site is located in the Eastern Variant of the Very Dry Maritime Subzone of the Coastal Western Hemlock (CWHxm1) Biogeoclimatic Ecosystem Classification Zone. This Variant is characterized by warm, dry summers that experience moist, mild winters with little snowfall. Climax plant communities on zonal sites (i.e., sites influenced by moderate soil moisture and nutrient regimes) are dominated by Douglas-fir (*Pseudotsuga menziesii*) with western hemlock (*Tsuga heterophylla*) and lesser amounts of western redcedar (*Thuja plicata*). Zonal understorey composition typically contains salal (*Gaultheria shallon*), dull Oregon-grape (*Mahonia nervosa*), and red huckleberry (*Vaccinium parvifolium*) with step moss (*Hylocomium splendens*) and Oregon beaked moss (*Kindbergia oregana*).

The site has been historically disturbed through a variety of land uses, most notably forest harvest activities estimated to have occurred within the last 100 to 150 years or less. A trail network is also established throughout the site and is used by the public for walking and cycling. A significant population of invasive plant species can be found throughout including English holly (*Ilex aquifolium*), Himalayan blackberry (*Rubus armeniacus*), and English ivy (*Hedera helix*). The invasive plant populations pose a significant threat to both the health of the existing plant communities and the overall succession and sustainability of the forest.

A total of four polygons were differentiated onsite that exhibited different plant compositions (Figure 2). The field reconnaissance survey was completed in March 2012 and can not be considered exhaustive as many of the species potentially occurring onsite may have been undetected due to dormancy. Observations were recorded for each of the four polygons and are summarized below.

Polygon A

Polygon A was characterized by a deciduous forest stand typical of a recently disturbed, wet site (estimated time since last disturbance was 50 years). The area was generally flat with a wet, organic-rich forest floor, and standing water was common throughout. The deciduous co-dominant layer primarily consisted of black cottonwood (*Populus balsamifera*) with lesser amounts of red alder (*Alnus rubra*), which commonly occur on young, wet, rich sites. Red alder dominated the intermediate/suppressed layers with lesser components of black cottonwood and bitter cherry (*Prunus emarginata*). There was little to no evidence of a regeneration layer in the forest canopy.

The dense understorey in Polygon A was estimated to cover roughly 85% of the forest floor, and contained plants typical of a moist to wet site with rich nutrient conditions. The most common shrub species observed, by far, was salmonberry (*Rubus spectabilis*), which occurred throughout Polygon A in significant abundance. Bracken fern (*Pteridium aquilinum*) was also very common, as well as trailing blackberry (*Rubus ursinus*). Other notable native understorey species included salal, sword fern (*Polystichum munitum*), Indian plum (*Oemleria cerasiformis*), and red huckleberry. Invasive plant species observed within Polygon A included English holly, Himalayan blackberry, English ivy, and cherry-laurel (*Prunus laurocerasus*). Photographs 1 and 2 show the vegetation composition in Polygon A.

Based on cursory field observations, we expect that the site series (anticipated late seral or climax plant community) most likely to occur in Polygon A include:

- CWHxm1-12: western redcedar – Sitka spruce – skunk cabbage (Blue-listed); and/or
- CWHxm1-13 (strongly fluctuating water table): western redcedar – salmonberry (Red-listed).

Red-listed ecosystems are endangered or threatened in BC and Blue-listed ecosystems are of Special Concern. For more information on species and ecological communities at risk refer to Section 3.4 below.

Polygon B

A mixed forest canopy characterized Polygon B. This area had also been disturbed likely within the last 50 years; however, site conditions and land use have allowed for the establishment of more coniferous tree species. The site also contained indications of moist to wet, rich conditions similar to Polygon A, but Polygon B likely experiences drier conditions during summer months that allow for less inundation-tolerant species to establish (i.e., western redcedar). The area was generally flat with some hummocky characteristics creating depressions throughout, which were observed to contain standing water. A small pond created from standing water was observed in Polygon B (Photographs 3 and 4). The co-dominant forest layer consisted of western redcedar with lesser components of black cottonwood and red alder. Western hemlock was also observed, but was not a major component of the overstorey composition. The intermediate/suppressed layers were composed of a similar species make-up, and the regeneration layer was present and dominated by western redcedar.

The understorey in Polygon B was less-dense than Polygon A and was estimated to cover roughly 60% of the forest floor. Salal dominated the shrub layer, which was estimated to account for up to 40% of the cover. Additional understorey species observed included salmonberry, sword fern, and red huckleberry. Invasive plant species observed included English holly, and cherry-laurel. Photographs 5 and 6 show the vegetation composition in Polygon B.

Based on cursory field observations, we expect that the site series most likely to occur in Polygon B are:

- CWHxm1-06: western hemlock – western redcedar – deer fern (Red-listed); with lesser amounts of;
- CWHxm1-01: western hemlock – Douglas-fir – Kindbergia (Red-listed).

Polygon C

Polygon C represented the most established and late seral area on the site. This area was characterized by a mature coniferous forest stand with an estimated time since last disturbance of roughly 100–150 years. The area was sloped to the north-northeast and had an extensive, well-kept trail network throughout. Polygon C was the driest area onsite with a lesser quality nutrient regime given its location on slope. The forest canopy contained a dominant layer composed of Douglas-fir with lesser amounts of western hemlock. Trees in the dominant layer measured roughly 100cm diameter at breast height, and were estimated to be upwards of 40m in height. The co-dominant layer was characterized by similar species composition. Douglas-fir dominated the intermediate layer with lesser amounts of western hemlock and western redcedar. Polygon C had a significant invasion of English holly, with holly shrubs/trees dominating both the suppressed and regeneration layers. The presence and dominance of English holly in these layers does not bode well for the longevity of the forest health, and represents a significant opportunity for restoration.

The understorey in Polygon C was well-established (i.e., estimated 90% cover); however, is significantly threatened by the impacts of English holly. Other than English holly, salal and red huckleberry were dominant species present in the shrub layers. Other native species observed in considerable numbers included salmonberry and dull Oregon-grape with lesser components of sword fern, spiny wood fern, and bracken fern. Additional invasive understorey species included English ivy. Photographs 7 and 8 show the vegetation composition in Polygon C.

Based on cursory field observations, we expect that the site series that occurs in Polygon C is:

- CWHxm1-01: western hemlock – Douglas-fir – Kindbergia (Red-listed).

3.2.2 Aquatic Ecosystems

Wetlands and their associated riparian ecosystems provide greater biological diversity and productivity relative to nearby areas (Fenger et. al, 2006). The current extent of the wetland area (Figure 2) appears to have been influenced by a combination of factors: the drainage barrier created by University Boulevard, backup flooding due to the undersized culvert, recent American beaver (*Castor canadensis*) activity, and wet conditions (i.e., shallow water table). Beavers create wetlands by constructing dams that stop or slow the flow of water. The flooded area on the site is characterized by standing dead deciduous trees including red alder and black cottonwood, with ample woody debris throughout (Photographs 9 and 10). The edge of the flooded wetland area is dominated by salmonberry with lesser amounts of sedges (*Carex* sp.), rushes (*Eleocharis* sp.), sword fern and bracken fern.

A culvert channels water from the wetland (Photograph 11), northeast underneath University Boulevard where it discharges through a storm outfall into Pacific Spirit Regional Park for a short distance before entering a culvert under the golf course. At the north edge of the golf course the stream flows into a large wetland area, which channels water northwest towards Chancellor Boulevard. Here the water flows through a culvert under Chancellor Boulevard and eventually drains north into Salish Creek (fish habitat), which flows to the ocean.

A small stream runs west to east along the southern boundary of the site (Figure 2). The stream is culverted at both ends allowing it to run under a walking path (Photograph 12 and 13). Recent reclamation (i.e., planting) was observed along the south bank of the stream associated with

recent construction activities for the school located south of the site. This surface water was observed in the south field to emerge from a culvert on the south side of an access road to the development south of the Site. The stream continues south into Pacific Spirit Park where it dissipates into a wet forest ecosystem just south of the Heron Trail and transmission line right-of-way parallel to 16th Avenue.

3.3 Wildlife and Wildlife Habitat

3.3.1 Wildlife

The greatest diversity of birds, amphibians and reptiles in BC is found within the Fraser Lowland portion of the Coastal Western Hemlock (CWH) biogeoclimatic zone (Meidinger and Pojar, 1991). However, extensive urban and agriculture development in the Lower Mainland has displaced large mammals such as Roosevelt elk (*Cervus elaphus roosevelti*), grizzly bear (*Ursus arctos*) and grey wolf (*Canis lupus*) (Meidinger and Pojar, 1991). Urban areas in the Lower Mainland support a variety of native and introduced wildlife species. Native species that have adapted to urban habitats include the black-tailed deer (*Odocoileus hemionus columbianus*), coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*).

Coyote, skunk and raccoon all commonly occur in Pacific Spirit Regional Park and therefore potentially onsite, along with smaller mammals such as Douglas squirrel (*Tamiasciurus douglasii*) and a variety of mole, vole and mice species. Amphibians and reptiles including salamander, newt, toad, frog and garter snake species, inhabit the wetter ecosystems within the Park (PSPS, 2012).

Pacific Spirit Regional Park provides a significant area for songbirds, raptors and other woodland forest species due to its area and location. Over 150 different species of birds use a wide variety of habitats within the park, including migratory birds which use the area as a resting, refuelling stopover (Environment Canada, 2012). During the reconnaissance field visit, a variety of bird species were either observed or heard onsite including American Crow (*Corvus brachyrhynchos*), Varied Thrush (*Ixoreus naevius*), Black-capped Chickadee (*Poecile atricapillus*), Winter Wren (*Troglodytes troglodytes*), Dark-eyed Junco (*Junco hyemalis*), and Mallard (*Anas platyrhynchos*).

Pacific Spirit Regional Park was declared an Important Bird Area (IBA) by BirdLife International (BLI) in 1995 (BLI, 2012). BLI is a non-government organization that identifies sites where large bird populations occupy significant habitats, and designates these as IBAs. One of the main reasons for giving IBA status to Pacific Spirit Park was the presence of a large nesting colony of Great Blue Herons (*Ardea herodias fannini*), which nested in the Park's ecological reserve for many years. These herons have since moved on, likely to Stanley Park (BLI, 2012). IBA status provides no legal protection.

3.3.2 Wildlife Habitat

The forested ecosystems on the site can provide both food and nesting, or denning, habitat for a variety of wildlife. A number of wildlife trees were observed onsite in various stages of decay and showing evidence of wildlife use (Photographs 14 and 15). Many animals are wildlife tree-dependent and the trees observed onsite could provide habitat for raptors, woodpeckers, songbirds, bats, and other mammals. In addition, coarse woody debris (downed trees) and other forest floor litter (small branches, leaves and other organic material) observed onsite can provide habitat for small mammals, amphibians, reptiles and invertebrates. Coarse woody debris also

provides feeding opportunities for insect foraging wildlife. The standing water observed on much of the site may provide breeding habitat for amphibians.

Although no eagle or heron nests were identified, there is some potential for these species to nest in mature trees on the site. Great Blue Heron nesting colonies are located in mature or older second-growth forests, usually within 3km of feeding areas (Fenger et al., 2006). Herons feed primarily on aquatic animals in shallow marine, brackish and freshwater environments or on voles in farm fields during the winter. Bald Eagles (*Haliaeetus leucocephalus*) nest in conifer, hardwood or mixed forest ecosystems, typically within 100m of a sizeable water body (e.g., ocean).

Wetlands provide critical habitat for many species of amphibians and birds. Also, many wildlife species are attracted to wetland and riparian habitats by the feeding opportunities they provide. Varied and abundant plant life or insects and amphibians living in the water provide forage that is not available or less abundant in upland habitats. A pair of Mallards was noted foraging in the wetland onsite during the reconnaissance field visit.

Evidence of beaver included constructed lodges and gnawed tree stumps (Photographs 16 and 17). Beaver wetlands provide habitat for a variety of other wildlife including amphibians and waterfowl. This beaver was introduced to the area and has since been relocated (pers. comm. G. Easton).

3.4 Species at Risk

British Columbia's Conservation Data Centre (CDC) collects and disseminates information on plants, animals and ecosystems (ecological communities) at risk in BC. A search of the CDC was completed to generate a list of both federally and provincially listed species at risk occurring in the regional project area and therefore with potential to occur on the site. Species lists generated from the CDC were cross-referenced with Natural Resources Canada's Species at Risk Atlas to ensure that federally designated species likely to occur in the project area (based on habitat requirements) were included. A list of ecological communities at risk in BC was also generated from the CDC to identify those with potential to occur on the site.

Animals, plants and ecological communities of conservation concern potentially occurring on the site are listed in Appendix 2, Tables A2-1 through A2-3, respectively. The lists provided are comprehensive based on searches using general, regional criteria; however, species whose range occurs outside of the project area and/or that prefer habitat conditions not likely provided by the site are identified. Field surveys for wildlife, plant, and ecological communities of conservation concern (i.e., provincially listed and/or protected under the federal *Species At Risk Act*) were not included in the scope of this overview-level assessment.

The CDC Internet Mapping Service was also used to identify the presence/absence of known occurrences of species and ecosystems at risk on or within 1km of the Block F parcel. Historical non-sensitive (species information is publicly available) occurrences of Pacific water shrew (*Sorex bendirii*) and Trowbridge's shrew (*Sorex trowbridgii*) were identified on the site and an occurrence of Horned Lark (*Eremophila alpestris*) (ID 37586) was identified 750m east of the site (Appendix 2). Based on information available from the CDC, the last observation of these three species in the area was in 1973, 1951 and 1956, respectively. A historical occurrence (prior to the 1950s) of southern red-backed vole, *occidentalis* subspecies (*Myodes gapperi occidentalis*) is also known from the area (Pearson and Healy, 2012). Pacific water shrew is listed on Schedule 1 of the *Species at Risk Act*, the official list of wildlife species at risk in Canada. Trowbridge's shrew

and southern red-backed vole, *occidentalis* subspecies are provincially Blue-listed (special concern) and Red-listed (endangered or threatened), respectively.

Wetlands and mature forest ecosystems are the key habitats for many species at risk including Pacific water shrew, Trowbridge's shrew and southern red-backed vole. Given that habitat loss is one of the main reasons that species are at risk today, these types of habitats should be priority for protection where feasible.

4.0 IMPACT ASSESSMENT AND MITIGATION

An impact assessment was completed to identify strategies to avoid key habitats and define mitigation measures which can be applied to reduce potential negative impacts of the proposed development.

4.1 Project Impacts

Based on a preliminary development concept for the project, the impact assessment was completed by identifying the likely interactions between the project components and the current environmental conditions. The need and type of mitigation for these interactions was then identified.

Table A below provides a visual presentation of how the components of the project may interact with the environmental setting. These possible effects are first described below, and then appropriate avoidance or mitigation measures are recommended in Section 4.2 to address potential effects.

Table A: Potential Musqueam Block F Project – Environmental Interaction Matrix

Project Phases/Components	Environmental Components												
	Physical							Biological					
	Land			Water		Air							
	Soil Quality	Sediments	Erosion/Slope Stability	Surface Water Quality	Surface Water Quantity	Air Quality	Noise & Vibration	Vegetation	Sensitive Ecosystems	Fish and Fish Habitat	Wildlife/Wildlife Habitat	Migratory Birds	Species at Risk
Construction													
Clearing and Grubbing	●	●	●	●	●	○	○	●	●	-	●	●	●
Excavation	●	●	●	●	●	●	○	●	●	-	●	○	●
Levelling	●	●	●	●	●	●	○	●	●	-	●	○	●
Culverts	●	●	●	●	●	○	○	●	●	-	○	○	●
Drainage/Ditch	●	●	●	●	●	○	○	●	●	-	●	●	●
Operation													
Maintenance	○	○	○	○	-	○	○	○	○	-	○	○	○
Accident/Malfunctions	●	○	○	●	○	○	○	●	●	-	●	●	●

Notes:
- = no interaction is likely
○ = minor interaction is likely but should not require specific mitigation
● = interaction is likely and mitigation is likely required to manage the effect

Terrestrial Impacts from Clearing and Construction

Clearing vegetation will have certain predictable effects that are typical for land development.

The loss of up to 87% of the vegetation on the site will remove habitat for the animal and plant populations occupying the area. Identical or similar habitat types occur in various locations within the adjacent Pacific Spirit Regional Park and will persist to continue supporting the local populations. With the loss of habitat in Block F, no significant effects are expected on the local populations because of the abundance of similar habitats available in the adjacent park.

The site currently provides connectivity between forested habitat to the north and south/southeast of the site. Habitat conversion through development of the site may cause habitat fragmentation within Pacific Spirit Regional Park. Habitat fragmentation and lack of connectivity can prevent some animals from moving from one area of suitable habitat to another. Fragmentation can also segregate members of the same species from each other. This leads to a reduction in breeding opportunities which may result in smaller less successful populations (Fenger et al, 2006). This effect can be mitigated through the consideration of providing vegetated corridors on the edges or across the site.

Potential impacts on wildlife also include death, injury or disturbance to individuals especially during sensitive periods (i.e., breeding). Impacts on wildlife are most likely to occur during the clearing and construction phases of the project and can lead to the destruction of nests, burrows and/or other den sites as a result of vegetation clearing and grubbing. Standard construction best practices are proposed to address this impact.

The potential for soil erosion is increased during site clearing, especially during seasons of high precipitation. The removal of vegetation will expose soil to precipitation and wind, both of which can accelerate surface erosion. Erosion and runoff could also increase along roadways where removal of vegetation may be required. Exposed soil is also vulnerable to the colonization of invasive plant species.

Impacts to soil may also result from compaction by heavy machinery and the accidental release of vehicle fluids (e.g., gasoline, diesel, oil) associated with equipment and machinery.

Aquatic Impacts from Clearing and Construction

There is potential for aquatic and riparian ecosystems on the site to be impacted through loss, degradation or introduction of sediment. Amphibians and some reptiles frequently require both aquatic and terrestrial habitats over the course of a year. Loss of aquatic habitat could affect amphibian populations using the area, so the preservation and/or creation of surface water features is recommended.

Soil disturbance near water bodies can increase the risk of sediment entering watercourses. Erosion may lead to an increase in the sediment load of surface water, which in turn degrades water quality and aquatic habitat.

Concrete works can adversely impact water quality if concrete wash water is introduced into a watercourse. The wash water could contribute sediment to stream flow as well as raise pH. Potential impacts to soils through the accidental release of pollutants may also adversely affect groundwater.

Although the RAR was determined to apply to the wetland area, the typical assessment and approval process was not applied due to the uncertain influence of the culvert upgrade (needed regardless of the development to address road flooding) which would likely reduce the wetland area. Instead, the proposed project, including the stormwater management plans, was submitted to DFO for review. This regulatory review determined that the planned creation of ponds, including riparian habitat, would maintain the quality and quantity of water to fish habitat over a kilometre (and a few culverts) downstream in Salish Creek.

Air Quality Impacts from Clearing and Construction

The anticipated impacts to air quality are dust generation during the clearing, grubbing and construction phases of the project, and introduction of pollutants to the atmosphere through the burning of fuels for vehicle, equipment and machine operations. Emissions from vehicles and machinery may contribute to greenhouse gases and deleterious substances to the local air shed, and should be managed during construction.

Noise Impacts from Construction

Construction noise may cause some adverse sensory disturbance to wildlife. This could displace wildlife (i.e., cause wildlife to avoid otherwise viable habitat) or disrupt breeding behaviour. This type of disturbance will likely be limited to the construction phase and can be managed using standard procedures.

Impacts from Maintenance

Impacts from maintenance activities are anticipated to be minor and will likely be associated with the maintenance of landscaped areas. Terrestrial and aquatic ecosystems could be impacted by the application of herbicides or pesticides which may be used to control vegetation.

4.2 Impact Mitigation Recommendations

The mitigation measures recommended below have been categorized to provide appropriate measures to be considered for each phase of the project.

4.2.1 Concept Design and Planning Phase

To mitigate environmental impacts of the project during the planning phase, the design should focus on preserving or reducing impacts to the most valuable or sensitive ecosystems identified on the site. We recommend including as much of the wetland and associated riparian areas and mature coniferous forest stand (Polygon C) as possible in the future planned park/open space. Since these areas are adjacent to each other, they could both be incorporated into a designated park. Allowing these areas to remain connected would help maintain biodiversity and reduce impacts to wildlife such as amphibians that require both aquatic and terrestrial habitat. The effects of habitat fragmentation can be reduced not only by maintaining habitat connectivity within the site, but also by maintaining connectivity to adjacent areas (i.e., Pacific Spirit Regional Park) through the use of vegetated corridors.

If it is not feasible to protect parts of these habitats, there are opportunities for onsite and offsite habitat enhancement and compensation. It is possible to enhance existing conditions using engineered solutions from green stormwater treatment and by creating habitats that are limited in the local area.

In addition, the following mitigation measures should also be considered:

- Provide a buffer of low-intensity use around sensitive ecosystems and protected areas (i.e., park, wetland and riparian areas).
- Retain tree, shrub and understorey vegetation that matches that of the area designated as park. This will help reduce the introduction of invasive species into the park.
- Retain natural features such as significant trees and design buildings and infrastructure so that established trees can be retained with enough space to protect root systems.
- Provide nest boxes to help reduce the effects of avian habitat loss where possible.
- Maintain the natural vegetation in wildlife corridors as much as possible.
- Incorporate environmentally friendly stormwater management in the design such as:
  - Reduce the amount of impervious surface created within the developed area;
  - Limit fragmentation of open space and restrict the use of impervious cover for open space;
  - Design runoff management systems to incorporate natural drainage features and follow existing topography and drainage paths wherever possible; and
  - Cluster developments in areas close to existing infrastructure (e.g., water, sewer, and power lines).

4.2.2 Construction Phase

Mitigation during construction involves implementing BMPs designed to protect or reduce impacts to the environmental features onsite. BMPs describe how to control impacts from such things as road dust, oil drips from construction equipment, and erosion/sedimentation that result from construction activities. They also describe how to mitigate impacts to vegetation, wildlife and ecosystems.

The biggest possible measure to minimize impacts to terrestrial ecosystems is to carefully control the amount of clearing. A detailed arborist's assessment should be conducted for each development parcel, to maximize tree-retention capability.

The following are BMPs that can be implemented during construction of the project.

- Minimize the size of the cleared area required for construction, and retain as much natural vegetation as possible.
- Clearly delineate areas to be cleared and establish no-go boundaries for construction crews.
- Construct permanent or temporary fencing around sensitive features and their buffers before starting to clear the site.
- Install silt fencing to control sediment transport as part of an overall sediment and water management plan.
- Avoid soil removal during heavy precipitation events.
- Obtain a professional environmental monitor with the authority to modify construction practices or, if needed, halt construction to protect the environment.

- Preserve snags, downed logs, stumps, and other forest features wherever possible.
- Prior to construction obtain a Qualified Environmental Professional to identify, if present, nests belonging to either eagles or herons which may have been constructed on the site. The nests of these species, whether they are active or not, are protected by the BC *Wildlife Act.*
- Avoid construction during the breeding bird window (April 1 to July 31 for the Lower Mainland). If construction occurs during the breeding bird window, obtain a Qualified Environmental Professional to identify active nests and establish temporary construction buffers around each nest until the nests are no longer active.
- Develop a spill plan that can be effectively implemented in the event of an accident or malfunction.
- Develop an air quality control plan to mitigate impacts of fugitive dust on unpaved roads and reduce greenhouse gases emissions.

The BMPs described here are in accordance with the MOE's *Develop With Care: Environmental Guidelines for Urban and Rural Development in British Columbia* (MOE, 2006). It is good practice for developers to obtain a Qualified Environmental Professional to develop a site-specific Construction Environmental Management Plan for the construction phase of the Project.

The Construction Environmental Management Plan may include, but is not limited to, the following components;

- Air Quality Control Plan;
- Sediment and Erosion Control Plan;
- Spill Contingency and Emergency Response Plan;
- Vegetation Management Plan; and
- Wildlife Management Plan.

4.2.3 Post-construction Phase

The revegetation of building parcels, common areas and street edges all serve to mitigate some of the habitat loss. Native vegetation species with high wildlife values should be planted wherever possible. Herbicides and pesticides used to maintain vegetation should not be applied near aquatic ecosystems.

5.0 CONCLUSION

This overview Environmental Impact Assessment was undertaken within the context that Musqueam's Block F site will ultimately be fully developed as per the intent of the Musqueam Reconciliation, Settlement and Benefits Agreement Administration Act.

Based on this overview, there are no known significant environmental issues that cannot be addressed through the implementation of mitigation measures, environmental BMPs, and a Construction Environmental Management Plan during the construction stage. In an effort to reduce the impacts of the proposed project on the environment, we recommend implementing the mitigation and BMPs described in this report, and consider maximizing the amount of mature coniferous forest and wetland planned for the designated park area.

We trust that this report meets your needs. If you have any questions, please contact Matt Hammond or Stephanie Louie at 604-895-7644 and 604-895-7637, respectively.

Respectfully submitted,

POTTINGER GAHERTY ENVIRONMENTAL CONSULTANTS LTD.

Per:

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SFL/KMG/MNH/stm
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PERSONAL COMMUNICATIONS

Easton, G. 2012. Colliers International, Vancouver, BC

Figures

BC Map Scale 1: 8 000 000, MapArt Publishing 2000.

Map Scale 1: 20 000, Greater Vancouver & Fraser Valley, MapArt Publishing, 2006.

SITE LOCATION

University Endowment Lands
University Boulevard and Acadia Road, Vancouver, BC

MUSQUEAM INDIAN BAND C/O COLLIERS INTERNATIONAL

PGL | Pottinger Gaherty ENVIRONMENTAL CONSULTANTS

N

File No.: 0015-17.01
Date: MAR 2012
Dwg No.: S1
Drawn by.: HLI

FIGURE 1

ORIGINAL IN COLOUR

A — VEGETATION POLYGON

WATERCOURSE / WETLAND

CULVERT

0 100m

Scale 1:2000

ENVIRONMENTAL FEATURES

University Endowment Lands
University Boulevard and Acadia Road, Vancouver, BC

MUSQUEAM INDIAN BAND C/O COLLIERS INTERNATIONAL

N

File No.: 0015-17.01
Date: MAR 2012
Dwg No.: S2
Drawn by.: HLI

PGL | Pottinger Gaherty ENVIRONMENTAL CONSULTANTS

FIGURE 2

ORIGINAL IN COLOUR

N

MUSQUEAM CAPITAL CORPORATION • ROSITCH HEMPILL ARCHITECTS • PWL PARTNERSHIP LANDSCAPE ARCHITECTS INC.

BLOCK F • UNIVERSITY ENDOWMENT LANDS

Illustrative Site Plan

Appendix 1

Photographs

Photograph 1 (above) and Photograph 2 (below): Vegetation composition in Polygon A.

Photograph 3 (above) and Photograph 4 (below): Small pond created by standing water in Polygon B.

Photograph 5 (above) and Photograph 6 (below): Vegetation composition in Polygon B.

Photograph 7 (above) and Photograph 8 (below): Vegetation composition in Polygon C.

Photograph 9 (above) and Photograph 10 (below): Standing trees and woody debris in the wetland.

Photograph 11: Culvert on east side of wetland channelling water northeast under University Boulevard.

Photograph 12: Culvert on the east end of stream along south boundary of the site.

Photograph 13: Culvert on the west end of stream along south boundary of the site.

Photograph 14:

Tree showing evidence of wildlife use.

Photograph 15: Tree showing evidence of wildlife use.

Photograph 16: Abandoned beaver lodge in the wetland.

Photograph 17: Gnawed tree stump (evidence of beaver) in the wetland area.

Appendix 2

CDC Species at Risk Tables and Map

Table A2-1
Animal Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status[1]	Habitat Type
Mammals					
Aplodontia rufa rufa	Mountain Beaver, *rufa* subspecies	Special Concern	1	Blue	TERRESTRIAL
Corynorhinus townsendii	Townsend's Big-eared Bat			Blue	PALUSTRINE; SUBTERRANEAN; TERRESTRIAL
Gulo gulo luscus	Wolverine, *luscus* subspecies	Special Concern		Blue	TERRESTRIAL
Lepus americanus washingtonii	Snowshoe Hare, *washingtonii* subspecies			Red	PALUSTRINE; TERRESTRIAL
Mustela frenata altifrontalis	Long-tailed weasel, *altifrontalis* subspecies			Red	TERRESTRIAL
Myodes gapperi occidentalis	Southern Red-backed Vole, *occidentalis* subspecies			Red	PALUSTRINE; TERRESTRIAL
Myotis keenii	Keen's Myotis	Data Deficient[2]	3	Red	PALUSTRINE; TERRESTRIAL
Sorex bendirii	Pacific Water Shrew	Endangered	1	Red	ESTUARINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Sorex rohweri	Olympic Shrew			Red	TERRESTRIAL
Sorex trowbridgii	Trowbridge's Shrew			Blue	PALUSTRINE; TERRESTRIAL
Ursus arctos	Grizzly Bear	Special Concern		Blue	PALUSTRINE; RIVERINE; TERRESTRIAL
Birds					
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Threatened	1	Red	TERRESTRIAL
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	Special Concern	1	Blue	ESTUARINE; LACUSTRINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Asio flammeus	Short-eared Owl	Special Concern	3	Blue	ESTUARINE; PALUSTRINE; TERRESTRIAL
Botaurus lentiginosus	American Bittern			Blue	ESTUARINE; PALUSTRINE
Brachyramphus marmoratus	Marbled Murrelet	Threatened	1	Blue	ESTUARINE; LACUSTRINE; MARINE; TERRESTRIAL
Butorides virescens	Green Heron			Blue	ESTUARINE; LACUSTRINE; PALUSTRINE; RIVERINE
Chordeiles minor	Common Nighthawk	Threatened	1	Yellow	TERRESTRIAL
Contopus cooperi	Olive-sided Flycatcher	Threatened	1	Blue	PALUSTRINE; TERRESTRIAL
Dendragapus fuliginosus	Sooty Grouse			Blue	TERRESTRIAL
Falco peregrinus anatum	Peregrine Falcon, *anatum* subspecies	Special Concern	1	Red	ESTUARINE; TERRESTRIAL
Hirundo rustica	Barn Swallow	Threatened		Blue	ESTUARINE; LACUSTRINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Hydroprogne caspia	Caspian Tern	Not At Risk		Blue	ESTUARINE; LACUSTRINE; MARINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	Special Concern	1	Blue	PALUSTRINE; TERRESTRIAL

Table A2-1
Animal Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status[1]	Habitat Type
Birds (continued)					
Nycticorax nycticorax	Black-crowned Night-heron			Red	ESTUARINE; LACUSTRINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Patagioenas fasciata	Band-tailed Pigeon	Special Concern	1	Blue	PALUSTRINE; TERRESTRIAL
Phalacrocorax auritus	Double-crested Cormorant	Not At Risk		Blue	ESTUARINE; LACUSTRINE; MARINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Progne subis	Purple Martin			Blue	ESTUARINE; LACUSTRINE; PALUSTRINE; TERRESTRIAL
Strix occidentalis	Spotted Owl	Endangered	1	Red	PALUSTRINE; TERRESTRIAL
Tyto alba	Barn Owl	Threatened	1	Blue	PALUSTRINE; TERRESTRIAL
Amphibians					
Anaxyrus boreas	Western Toad	Special Concern	1	Blue	LACUSTRINE; TERRESTRIAL
Ascaphus truei	Pacific Tailed Frog	Special Concern	1	Blue	RIVERINE; TERRESTRIAL
Rana aurora	Northern Red-legged Frog	Special Concern	1	Blue	LACUSTRINE; PALUSTRINE; RIVERINE; TERRESTRIAL
Rana pretiosa	Oregon Spotted Frog	Endangered	1	Red	LACUSTRINE; PALUSTRINE; RIVERINE
Reptiles					
Charina bottae	Northern Rubber Boa	Special Concern	1	Yellow	TERRESTRIAL
Chrysemys picta pop. 1	Western Painted Turtle - Pacific Coast Population	Endangered	1	Red	LACUSTRINE; PALUSTRINE; RIVERINE
Gastropods					
Allogona townsendiana	Oregon Forestsnail	Endangered	1	Red	TERRESTRIAL
Carychium occidentale	Western Thorn			Blue	TERRESTRIAL
Haliotis kamtschatkana	Northern Abalone	Threatened	1	Red	MARINE
Monadenia fidelis	Pacific Sideband			Blue	TERRESTRIAL
Prophysaon vanattae	Scarletback Taildropper			Blue	TERRESTRIAL
Zonitoides nitidus	Black Gloss			Blue	PALUSTRINE
Insects					
Argia emma	Emma's Dancer			Blue	LACUSTRINE; RIVERINE
Callophrys eryphon sheltonensis	Western Pine Elfin, *sheltonensis* subspecies			Blue	TERRESTRIAL
Callophrys johnsoni	Johnson's Hairstreak			Red	TERRESTRIAL
Epargyreus clarus	Silver-spotted Skipper			Blue	TERRESTRIAL

Table A2-1
Animal Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status[1]	Habitat Type
Insects (continued)					
Epitheca canis	Beaverpond Baskettail			Blue	LACUSTRINE; PALUSTRINE; RIVERINE
Euphyes vestris	Dun Skipper	Threatened	1	Blue	PALUSTRINE; TERRESTRIAL
Octogomphus specularis	Grappletail			Red	LACUSTRINE; RIVERINE
Omus audouini	Audouin's Night-stalking Tiger Beetle	Candidate[3]		Red	ESTUARINE; SUBTERRANEAN; TERRESTRIAL
Danaus plexippus	Monarch	Special Concern	1	Blue	PALUSTRINE; TERRESTRIAL
Pachydiplax longipennis	Blue Dasher			Blue	LACUSTRINE; RIVERINE
Speyeria zerene bremnerii	Zerene Fritillary, *bremnerii* subspecies			Red	TERRESTRIAL
Sympetrum vicinum	Autumn Meadowhawk			Blue	LACUSTRINE; RIVERINE
Tanypteryx hageni	Black Petaltail			Blue	PALUSTRINE

Citation: BC Conservation Data Centre. 2012. BC Species and Ecosystems Explorer. BC Minist. of Environ. Victoria, BC. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Mar 1, 2012).
Search Criteria: Regional District: Metro Vancouver (MVRD), BGC Zone: CWH
[1] See Appendix 3 for definitions and status descriptions.
[2] A species for which there is insufficient scientific information to support status designation
[3] A species that is on the short-list for upcoming assessment.
Species not likely to occur based on available habitat.

Table A2-2
Plant Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status	BEC Zones or Subzones	Habitat Type
Vascular - Monocots						
Carex interrupta	green-fruited sedge			Red	CWHxm	Streamsides and wet places in the lowland zone.
Carex scoparia	pointed broom sedge			Blue	CWHxm	Moist to wet ditches, lakeshores, marshes and meadows in the lowland and montane zones.
Carex vulpinoidea	fox sedge			Blue	CWHxm	Wet meadows, swamps, marshes, and streambanks in the lowland, steppe and montane zones.
Eleocharis parvula	small spike-rush			Blue	CWHxm	Salt marshes, mudflats and sandy shores along the coast.
Eleocharis rostellata	beaked spike-rush			Blue	CWHxm	Salt marshes, hot springs and alkaline or saline ponds in the lowland and steppe zones.
Elodea nuttallii	Nuttall's waterweed			Blue	CWHxm	Lakes, ponds and streams in the lowland, steppe and montane zones.
Glyceria leptostachya	slender-spiked mannagrass			Blue	CWHxm	Brackish tidal marshes, swamps, lakeshores, streamsides and wet meadows in the lowland zone.
Juncus oxymeris	pointed rush			Blue	CWHxm	Wet meadows and riverbanks in the lowland zone.
Lilaea scilloides	flowering quillwort			Blue	CWHxm	Mud flats, ponds and marshes in the lowland zone.
Pleuropogon refractus	nodding semaphoregrass			Blue	CWHxm	Bogs, streambanks, lakeshores, wet meadows, floodplains, thickets and forest openings in the lowland and montane zones.
Wolffia borealis	northern water-meal			Red	CWHxm	Ponds, lakes and slow-moving streams in the lowland and montane zones.
Vascular - Dicots						
Anagallis minima	chaffweed			Blue	CWHxm	Moist to wet river banks, salt marshes, vernal pools and pond margins in the lowland zone.
Bidens amplissima	Vancouver Island beggarticks	Special Concern	1	Blue	CWHxm	Moist to wet ditches, streambanks and pond edges in the lowland zone.
Callitriche heterophylla ssp. *heterophylla*	two-edged water-starwort			Blue	CWHxm	Shallow ponds, slow-moving streams and shorelines in the lowland and montane zones.
Claytonia washingtoniana	Washington springbeauty			Red	CWHxm	Moist to mesic mossy rock outcrops and forests in the lowland and montane zones.
Cuscuta campestris	field dodder			Blue	CWHxm	Parasitic, especially on legumes, in the lowland zone.
Elatine rubella	three-flowered waterwort			Blue	CWHxm	Wet ditches, mudflats and shallow ponds and shorelines in the lowland, steppe and montane zones.

Table A2-2
Plant Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status	BEC Zones or Subzones	Habitat Type
Vascular - Dicots (continued)						
Epilobium leptocarpum	small-fruited willowherb			Blue	CWHxm	Moist meadows and streambanks in the montane to alpine zones.
Helenium autumnale var. *grandiflorum*	mountain sneezeweed			Blue	CWHxm	Moist to mesic streambanks, meadows and forest openings in the lowland, steppe and montane zones.
Hypericum scouleri ssp. *nortoniae*	western St. John's-wort			Blue	CWHxm	Moist to wet streamsides, estuaries, marshes and open slopes in all zones except the alpine and steppe zones.
Lindernia dubia var. *anagallidea*	false-pimpernel			Blue	CWHxm	Wet, sandy or muddy banks and shores in the lowland and steppe zones.
Lindernia dubia var. *dubia*	yellowseed false pimpernel			Red	CWHxm	Wet, sandy or muddy banks and shores in the lowland and steppe zones.
Lupinus rivularis	streambank lupine	Endangered	1	Red	CWHxm	Wet to moist meadows and riverbanks in the lowland zone.
Myriophyllum ussuriense	Ussurian water-milfoil			Blue	CWHxm	Lake margins and muddy river banks in the lowland zone.
Navarretia intertexta	needle-leaved navarretia			Red	CWHxm	Moist meadows and vernal pools in the lowland and montane zones.
Persicaria punctata	dotted smartweed			Blue	CWHxm	Swamps and wet meadows in the lowland and steppe zone.
Rubus nivalis	snow bramble			Blue	CWHxm	Moist forests and glades in the montane zone.
Rupertia physodes	California-tea			Blue	CWHxm	Mesic open forests in the lowland zone.
Sidalcea hendersonii	Henderson's checker-mallow			Blue	CWHxm	Wet meadows, estuaries and tidal flats in the lowland zone.
Verbena hastata var. *scabra*	blue vervain			Red	CWHxm	Moist to wet ditches, meadows and marshes in the lowland and steppe zones.
Vascular - Quillworts						
Isoetes nuttallii	Nuttall's quillwort			Blue	CWHxm	Vernal pools and ephemeral winter seepages in the lowland zone.
Nonvascular						
Alsia californica				Blue	CWH	
Brachythecium holzingeri				Blue	CWH	
Brotherella roellii	Roell's brotherella	Endangered		Red	CWH	
Bryum schleicheri				Blue	CWH	
Callicladium haldanianum				Blue	CWH	

Table A2-2
Plant Species at Risk Potentially Occurring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	COSEWIC[1]	SARA[1]	BC Status	BEC Zones or Subzones	Habitat Type
Nonvascular (continued)						
Diphyscium foliosum				Blue	CWH	
Discelium nudum				Blue	CWH	
Drepanocladus aduncus				Blue	CWH	
Epipterygium tozeri				Blue	CWH	
Fissidens pauperculus	poor pocket moss	Endangered	1	Red	CWH	RIVERINE; TERRESTRIAL
Fissidens ventricosus				Blue	CWH	
Hygrohypnum alpinum				Blue	CWH	
Orthotrichum cupulatum				Blue	CWH	
Orthotrichum striatum				Blue	CWH	
Physcomitrium immersum				Red	CWHxm	
Platyhypnidium riparioides				Blue	CWH	
Pohlia cardotii				Red	CWH	
Ptychomitrium gardneri				Blue	CWH	
Sphagnum contortum				Blue	CWH	

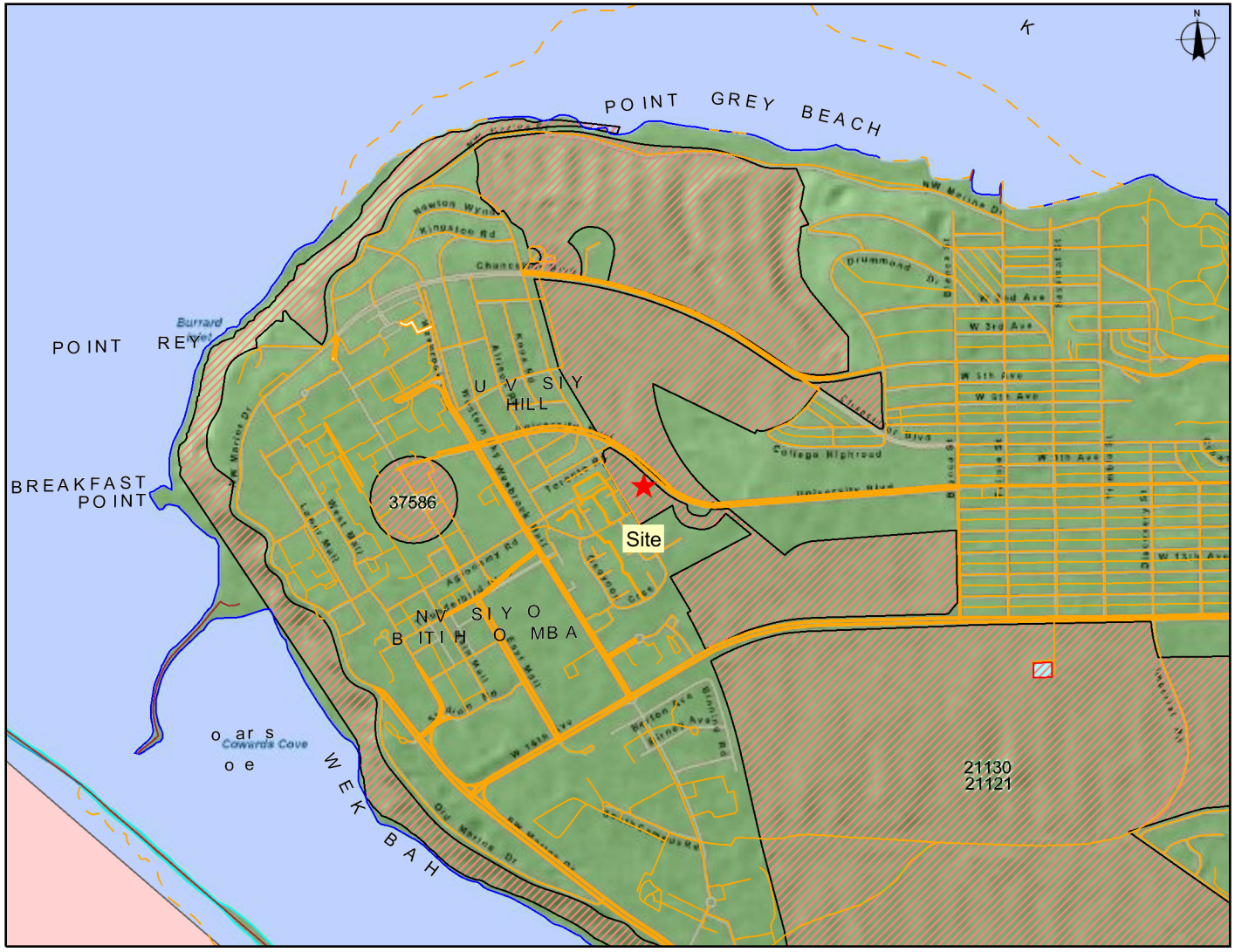
BEC = Biogeoclimatic Ecosystems Classification
Citation: BC Conservation Data Centre. 2012. BC Species and Ecosystems Explorer. BC Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Mar 1, 2012).
Search Criteria: Regional Districts: Metro Vancouver (MVRD), BGC Zone: CWH, Subzone CWHxm
[1] See Appendix 3 for definitions and status descriptions.
Species not likely to occur based on available habitat.

Table A2-3
Ecosystems at Risk Potentially Occuring on Musqueam Block F Parcel
Musqueam Indian Band, PGL File: 015-17.01

Scientific Name	English Name	BC Status[1]	BEC - Site Series	Ecosystem Group
Carex lasiocarpa - Rhynchospora alba	slender sedge - white beak-rush	Red	CWHxm1/Wf53	Wetland, Herbaceous
Carex sitchensis - Oenanthe sarmentosa	Sitka sedge - Pacific water-parsley	Blue	CWHxm1/Wm50	Wetland, Herbaceous
Ledum groenlandicum / Kalmia microphylla / Sphagnum spp.	Labrador tea / western bog-laurel / peat-mosses	Blue	CWHxm1/Wb50	Wetland, Shrub
Leymus mollis ssp. *mollis - Lathyrus japonicus*	dune wildrye - beach pea	Red	CWHxm1	Sparsely Vegetated, Herbaceous
Myrica gale / Carex sitchensis	sweet gale / Sitka sedge	Red	CWHxm1/Wf52	Wetland, Shrub, Herbaceous
Picea sitchensis / Rubus spectabilis Very Dry Maritime	Sitka spruce / salmonberry Very Dry Maritime	Red	CWHxm1/08	Riparian, Forest
Pinus contorta / Sphagnum spp. *Very Dry Maritime*	lodgepole pine / peat-mosses Very Dry Maritime	Blue	CWHxm1/11	Forest, Wetland
Populus balsamifera ssp. *trichocarpa - Alnus rubra / Rubus spectabilis*	black cottonwood - red alder / salmonberry	Blue	CWHxm1/09	Riparian, Forest
Populus balsamifera ssp. *trichocarpa / Salix sitchensis*	black cottonwood / Sitka willow	Blue	CWHxm1/10	Riparian, Forest
Pseudotsuga menziesii / Mahonia nervosa	Douglas-fir / dull Oregon-grape	Red	CWHxm1	Forest
Pseudotsuga menziesii - Pinus contorta / Racomitrium canescens	Douglas-fir - lodgepole pine / grey rock-moss	Red	CWHxm1/02	Woodland, Forest
Pseudotsuga menziesii / Polystichum munitum	Douglas-fir / sword fern	Red	CWHxm1/04	Forest
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	Blue	CWHxm1/03	Forest
Sidalcea hendersonii Tidal Marsh	Henderson's checker-mallow Tidal Marsh	Red	CWHxm1/00	Wetland, Estuarine, Herbaceous
Thuja plicata / Carex obnupta	western redcedar / slough sedge	Blue	CWHxm1/15	Wetland, Forest
Thuja plicata / Lonicera involucrata	western redcedar / black twinberry	Red	CWHxm1/14	Forest
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	Blue	CWHxm1/12	Wetland, Forest
Thuja plicata / Polystichum munitum Very Dry Maritime	western redcedar / sword fern Very Dry Maritime	Blue	CWHxm1/05	Forest
Thuja plicata / Rubus spectabilis	western redcedar / salmonberry	Red	CWHxm1/13	Forest, Riparian
Thuja plicata / Tiarella trifoliata Very Dry Maritime	western redcedar / three-leaved foamflower Very Dry Maritime	Red	CWHxm1/07	Forest
Tsuga heterophylla - Pseudotsuga menziesii / Eurhynchium oreganum	western hemlock - Douglas-fir / Oregon beaked-moss	Red	CWHxm1/01	Forest
Tsuga heterophylla - Thuja plicata / Blechnum spicant	western hemlock - western redcedar / deer fern	Red	CWHxm1/06	Forest
Typha latifolia Marsh	common cattail Marsh	Blue	CWHxm1/Wm05	Wetland, Herbaceous

BEC = Biogeoclimatic Ecosystems Classification
Citation: BC Conservation Data Centre. 2012. BC Species and Ecosystems Explorer. BC Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Mar 1, 2012).
Search Criteria: Regional District: Metro Vancouver (MVRD), BGC Zone, Subzone, Variant, Phase: CWHxm1, Ecogregion: Lower Mainland, Ecosection: Fraser Lowland
[1] See Appendix 3 for definitions and status descriptions.

BC Conservation Data Centre - Occurrence Report
Historical Non-sensitive Occurrences



Map center: 49° 15' 54" N, 123° 14' 12" W

MAP COMPILATION
Projection: Albers Equal Area Conic
Datum: NAD 83

0 900 1800 2700 m.

Scale: 1:30,333

Legend

Non-sensitive Occurrences
- Animal - Vertebrate
- Animal - Invertebrate
- Plant - Vascular
- Plant - Non-vascular
- Ecological Community

Masked Sensitive Occurrences

Big Trees

Occurrence data is updated frequently. This map should be considered out of date 6 months after
March 5, 2012

For more information about the BC CDC visit: http://www.env.gov.bc.ca/cdc/

Index Map

Province of British Columbia
Ministry of Environment

Map Created **March 5, 2012**

Appendix 3

Species at Risk Definitions

Appendix 3
Status Definitions For Provincial and Federal Species at Risk

Status Definitions as per provincial Conservation Data Centre (CDC)

RED: Species that are candidates for Extirpated, Endangered, or Threatened status in BC. Placing taxa on these lists flags them as being at risk and requiring investigation.

BLUE: Species considered of Special Concern in BC. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events.

Status Definitions as per federal Species at Risk Act (SARA)

ENDANGERED: A wildlife species that is facing imminent extirpation or extinction.

THREATENED: A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

SPECIAL CONCERN: A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

SCHEDULE 1: Official list of federally protected species.

SCHEDULE 2 and 3: Species under assessment for inclusion to Schedule 1.

Appendix 4

DFO Response Letter

Fisheries and Oceans Canada | Pêches et Océans Canada

200 – 401 Burrard Street
Vancouver, BC V6C 3S4

Your file *Votre référence*

July 24, 2013

Our file *Notre référence*
13-HPAC-PA2-00439

Jim Ross
Musqueam Capital Corporation
6615 Salish Drive
Vancouver, BC
V6N 4C4

Dear Mr. Ross:

Subject: Musqueam Block F Rezoning

Fisheries and Oceans Canada – Fisheries Protection Program (DFO) received your project proposal on July 09, 2013. Please refer to the file number and title below:

DFO File No.:	**13-HPAC-PA2-00439**
Title:	**Musqueam Block F Rezoning Project**

You may be aware of recent changes to the *Fisheries Act*, however these have not affected the review of your project at this time. For more information on current changes to the *Fisheries Act*, please refer to the DFO website http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm

Our review has focused on the potential impacts to fish and fish habitat that are prohibited by the habitat protection provisions of the *Fisheries Act*.* The information we reviewed consisted of:

- Project Notification and Review Application Form
- Additional application information

We understand that you propose to:

- Construct two detention ponds in the dry; and
- Replace a 200mm culvert with a 525mm culvert for the primary purpose of stormwater management.

*Those sections most relevant to the review of development proposals include 20, 22, 32 and 35 of the *Fisheries Act*. For more information please visit www.dfo-mpo.gc.ca.

Canada

Provided that your project, including mitigation measures, is implemented as you described, DFO has concluded that your project is not likely to result in a contravention of the habitat protection provisions of the *Fisheries Act*. Therefore, you will not need to obtain a formal approval from DFO in order to proceed. It remains your responsibility, however, to meet the requirements of any other federal, provincial and municipal agencies.

This letter does not authorize the harmful alteration or disruption, or the destruction, of fish habitat (HADD) as prohibited by Section 35(1) of the *Fisheries Act*. It is your responsibility to ensure that all related works, undertakings, or activities do not result in the HADD of fish habitat. This letter also does not constitute approval for the deposit of any deleterious substance (e.g. sediment-laden water, or turbid water) into waters frequented by fish.

Please be advised that any unauthorized impacts to fish and fish habitat that result from a failure to implement this proposal as described could lead to corrective action such as enforcement. In addition, under the new *Fisheries Act*, there is a requirement to notify DFO of any harmful alteration or disruption, or destruction of fish habitat that has not been authorized. Please notify DFO by calling the Observe, Record, Report line at 1-800-465-4336.

If your plans have changed or if the description of your proposal is incomplete you should consult our website to determine if a DFO review is required, and if so contact this office to determine if the advice in this letter still applies.

If you have any questions, please contact the undersigned at 604-666-7395, or by email at ReferralsPacific@dfo-mpo.gc.ca.

Yours sincerely,

Stephanie Major
Fisheries Protection Biologist

CC
Bruce Nidle, Pottinger Gaherty Environmental Consultants