APPENDIX A - ENVIRONMENTAL ASSESSMENT



Hume Park Environmental Overview Assessment

Hume Park
New Westminster, BC

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1.0 Introduction

Hume Park is a 12.8-hectare park located on the southern bank of the Brunette River in the City of New Westminster, east of East Columbia Street (Figure 1). It is located on the northern boarder of New Westminster, south of Highway 1 and west of Brunette Avenue. The park was established in 1912, and is a community park used by many in the local Sapperton neighbourhood area and beyond.

The park borders the Brunette River which is a major fish-bearing river feeding into the Fraser River. There is an active floodplain of the river part of which has been developed into a passive park with a baseball diamond. A steep forested slope extends south up to the upper park area which has been developed into a variety of recreation features including playing fields, lacrosse rink, water park and an outdoor swimming pool. There are a number of large open grown and mature trees in this area. There are a number of well used trails including the Brunette Fraser Greenway which runs along the east side of the park.



Upper lacrosse rink



Upper baseball diamond and playground in the background



The Brunette River



The lower baseball diamond and picnic shelter

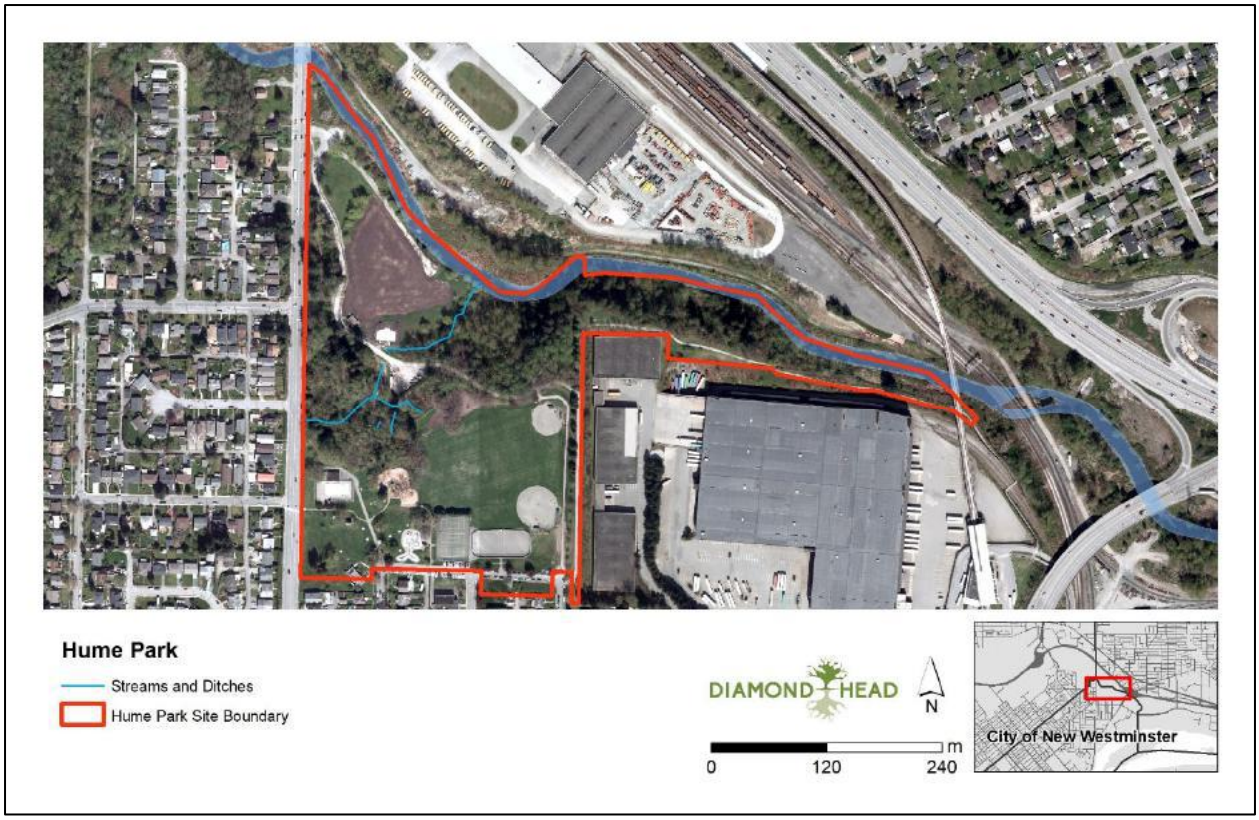


Figure 1: Site location of Hume Park, along the southern bank of the Brunette River.

Various municipal legislation creates a vision for parks and natural areas throughout New Westminster. These include the Urban Forest Management Strategy (2015), the Official Community Plan – Our City 2041 (2017), and Envision 2032 – Sustainability Framework (2013). Also, recommendations and guidelines for the management of the Brunette River Corridor is provided within the Brunette River Master Plan – Riparian Management and Development Permit Guidelines (DRAFT 2016). These documents support sustainable, ecologically diverse natural areas by protecting existing trees and natural areas, increasing tree canopy cover, daylighting streams, building green infrastructure, protecting and restoring riparian areas, creating a network of green spaces and corridors, and mitigating the impacts of climate change.

The Brunette River has been identified as one of the most important natural areas in New Westminster. This has been reinforced through the Natural Features Development Permit Areas (DPA), which focuses exclusively on the Brunette River. This DPA is designated in order to preserve the valuable aquatic and wildlife habitat on the Brunette River

Hume Park represents a critical opportunity to protect and enhance the Brunette river and its riparian habitat. This river is considered an important site for green infrastructure within Metro Vancouver, as over 20% of the watershed area consists of protected park, waterbodies, wetlands or undeveloped green space. This environmental overview assessment identifies existing natural values, opportunities for enhancement, and constraints associated with the site. The intent of this report is to inform the future master planning process for Hume Park.

2.0 Existing Conditions

The study area for this inventory includes all of upper and lower Hume Park, as well as the adjacent riparian area along Brunette River east of Hume Park (Figure 1). The following is a summary of the natural features and functions observed on site.

2.1 Topography

The park borders the Brunette River, which is a significant watercourse in the region connecting Burnaby Lake to the Fraser River. There is a large and distinct floodplain adjacent to the River. This includes the existing baseball diamond, turf grass area used for passive recreation, and the adjacent parking lot. The baseball court in the lower Hume Park was raised with fill to reduce the likelihood of it flooding. South of this there is a moderate to steep slope with a distinct slope break, above which the grade is flat and has been extensively developed for recreation including playing fields, a swimming pool and playgrounds. Further east, the river runs up against a steep slope with no defined floodplain. This slope extends up to a slope break above which there is gently sloping terrain with the Brunette Fraser Greenway trail.

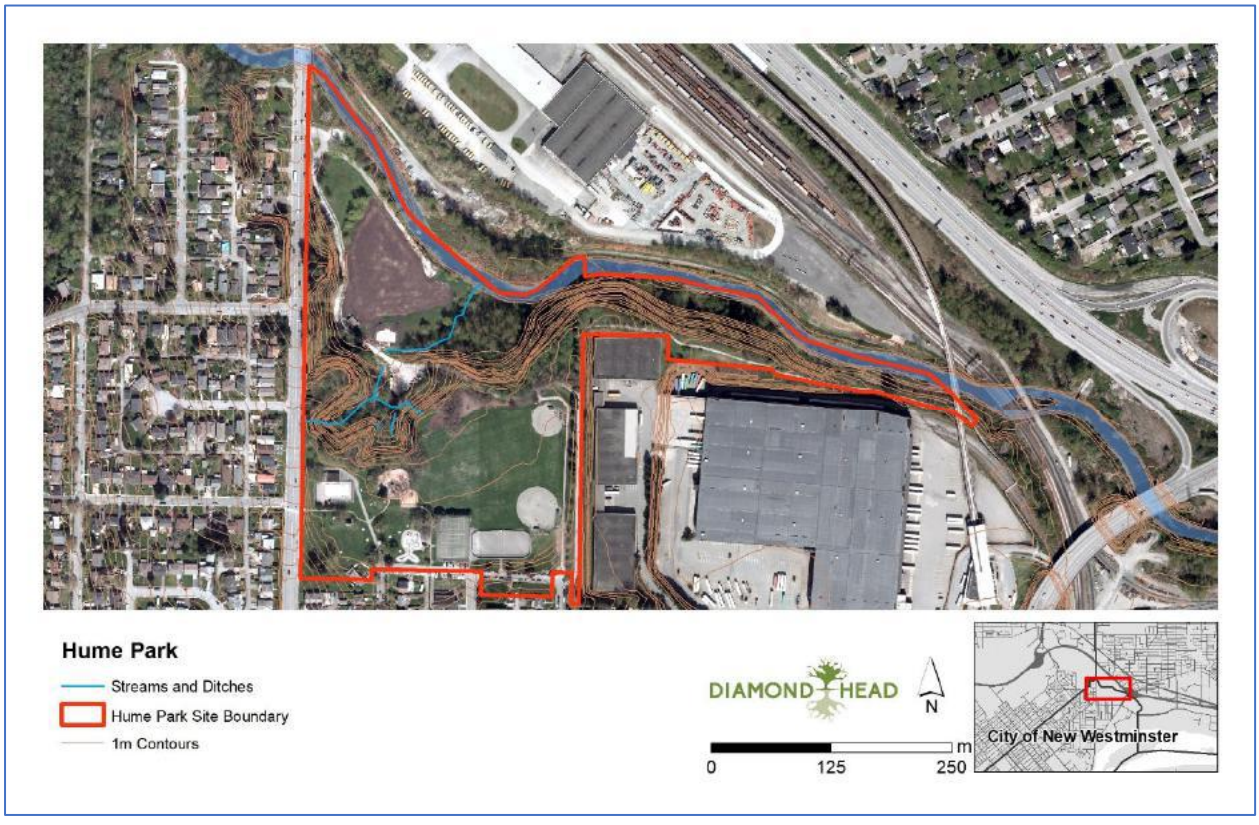


Figure 2: Topography of the site

2.2 Biogeoclimatic Ecosystem Classification

The project site is located in the Dry Maritime Coastal Western Hemlock (CWHdm) Subzone, as defined by the Biogeoclimatic Ecosystem Classification (BEC) system of BC. This zone experiences warm, relatively dry summers and moist, mild winters with little snowfall. Growing seasons are long, and feature only minor water deficits on zonal sites.

Site level classification (Site Series) is defined by soil moisture and nutrient availability and describes the late seral or climax plant community that will develop through natural succession. Soils are generally rich across all natural areas in the Park. The moisture regime changes with topographical features. The floodplain areas are very wet and classified as medium bench floodplains - site series 09. The steep slopes above this are classified as site series 07 lower on the slope and slightly drier site series 05 above.

2.3 Plant Communities

The project site has been divided into polygons with similar plant communities. These are mapped and described in more detail in Appendix 1. Much of the original forest that would have been native to this area has been previously cleared in the early 20th century. The areas below the top of banks were left to regenerate naturally except for the baseball diamond area, which has been maintained as turf grass.

The floodplain area south of the baseball diamond has been enhanced in recent years with plantings and removal of invasive species. It has a high water table and floods seasonally. The overstory consists of mostly Black cottonwood (*Populus trichocarpa*) with mixed shorter red alder (*Alnus rubra*). The understory consists of mainly salmonberry (*Rubus spectabilis*), Indian plum (*Oemleria cerasiformis*), red osier dogwood (*Cornus sericea*), vine maple (*Acer circinatum*) and sedges. There is a high cover in this area of the invasive small touch-me-not (*Impatiens parviflora*), Policeman's helmet (*Impatiens glandulifera*) and patches of English Ivy (*Hedera helix*).

The forests growing above the floodplain on the slopes consist of a mix of native conifer and deciduous species. The main canopy consists of a mix of species including mostly bigleaf maple (*Acer macrophyllum*) and red alder. There are scattered individual and small groups of conifers including Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*). There are some dominant Douglas-firs that are growing well above the main canopy. Some non native trees have established in this natural area including some non native pine and oaks.

The understory in these areas is generally dense and lush with a variety of species. The most abundant include sword fern (*Polystichum munitium*), vine maple, Indian plum, salmonberry, Clasping twisted stalk (*Streptopus amplexifolius*), bracken fern (*Pteridium aquilinum*), and false lily of the valley (*Maianthemum dilatatum*). There are a high number of invasive species that have established in these areas including English ivy, Himalayan blackberry (*Rubus armeniacus*), English holly (*Ilex aquifolium*) and small touch-me-not.

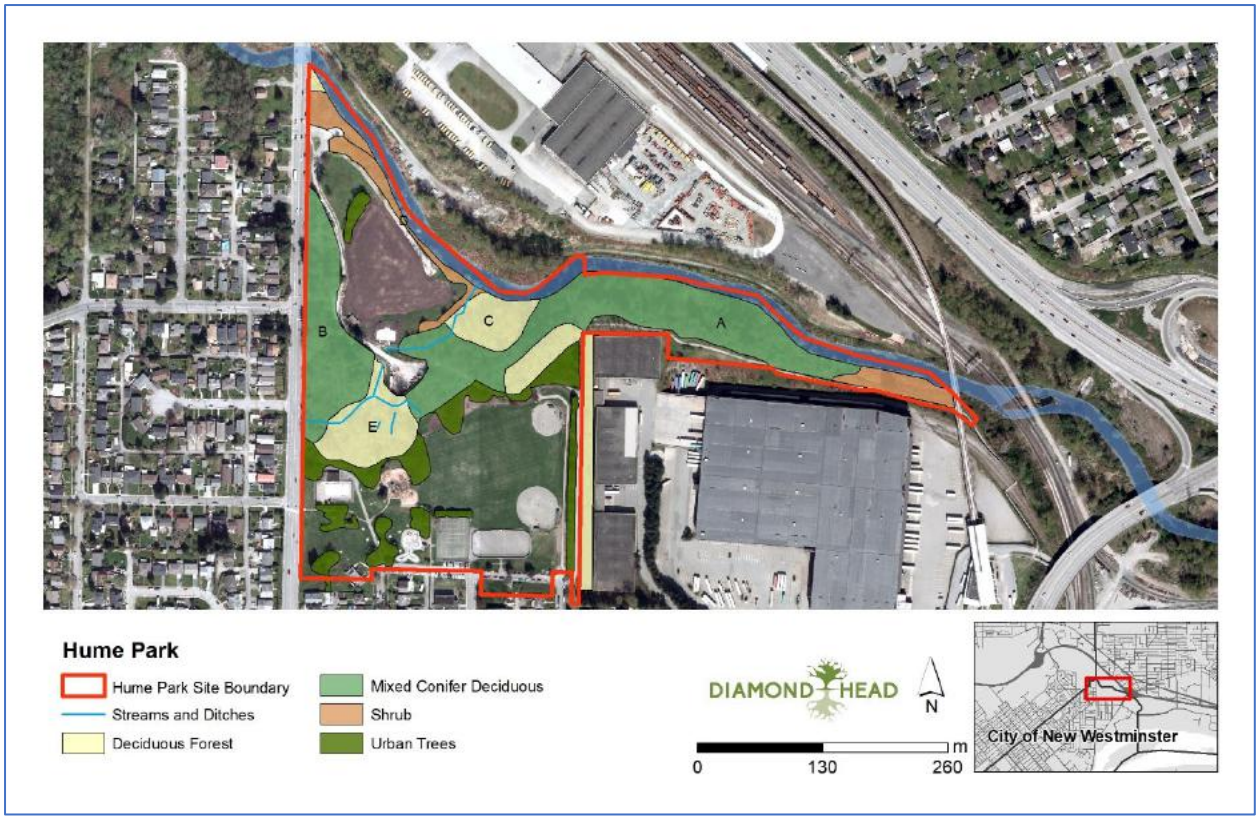


Figure 3: Ecotype polygons



View of floodplain restoration area



View of blackcottonwood floodplain from above



View of slope natural area and floodplain below



Dominant Douglas-fir on upper slope

2.3.1 Invasive Species

There is a high incidence of invasive plant species that have established around the edges of the developed areas as well as in the natural forest areas. The most extensive include Small flowered touch-me-not, English ivy and Himalayan blackberry. These species affect large part of the natural areas. One species of particular concern includes Japanese knotweed (*Fallopia japonica*), which was found growing along the Brunette river and along trails south east of the lower Hume Park baseball diamond. Other less prominent invasives include Cherry laurel (*Prunus laurocerasus*), goutweed (*Aegopodium podagraria*), English holly, lamium (*Lamiastrum galeobdolon*), common periwinkle (*Vinca minor*), wild chervil (*Anthriscus sylvestris*) and bamboo (*Bambuseae spp.*).

Past incidences of invasive species on site have largely been concentrated along the Brunette River. This includes several incidences of Japanese Knotweed, as well as Himalayan blackberry, English holly, English Ivy. Due to the hard work of dedicated City employees, some invasive species have been removed from the bank of the Brunette River, and a section of the riparian area replanted with native vegetation. However, any of the knotweed within 1 m of the highwater mark of the River cannot be treated with its most effective removal method, glyphosate, due to the proximity to the River.

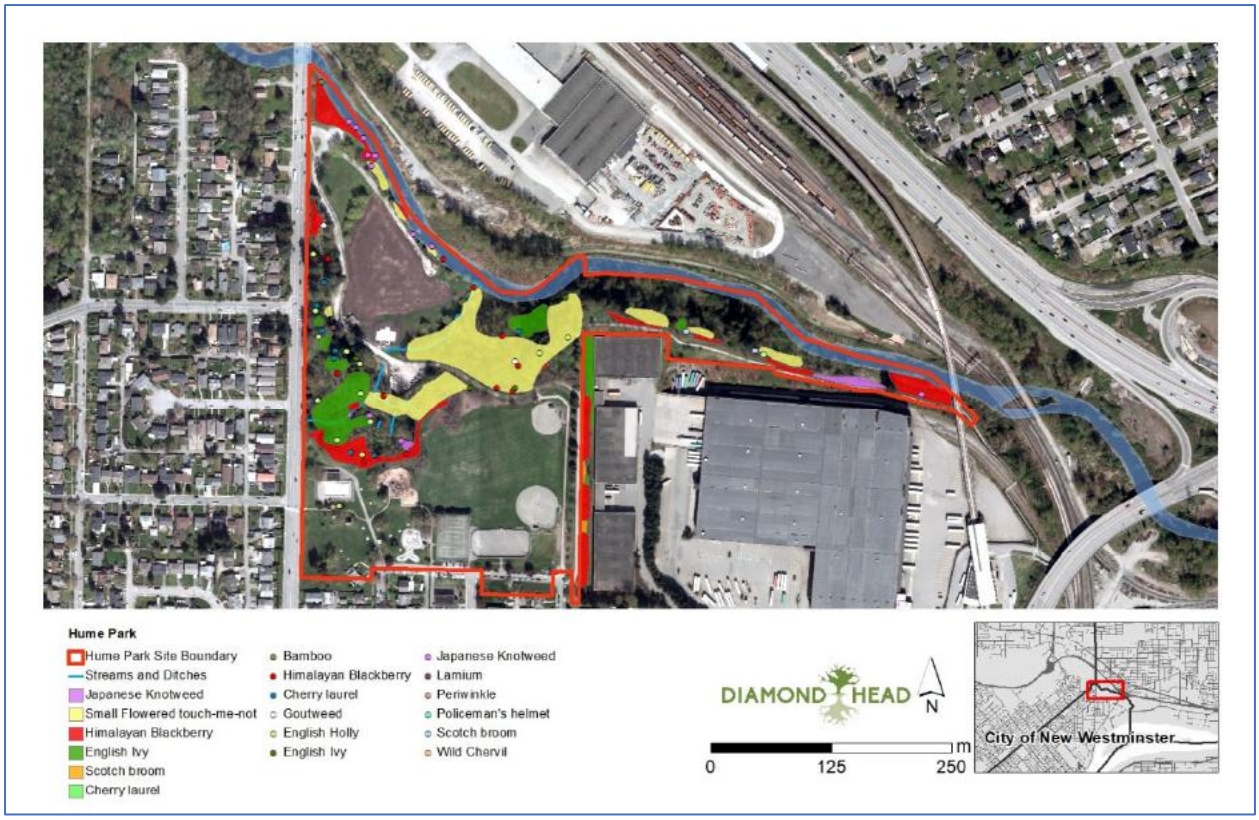
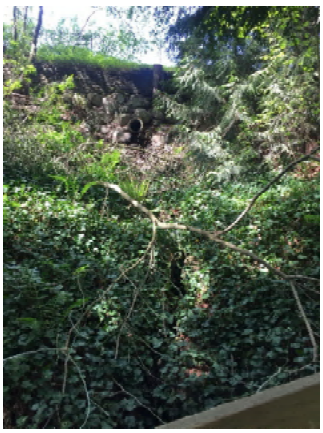


Figure 4: Location of Invasive Plant Species



The cover of small flowered touch-me-not is extensive is some parts of the park.



English Ivy is prevalent throughout the park



Japanese knotweed is present in multipole locations throughout the park.



Japanese knotweed has been manually removed near the edge of the Brunette River; however, it cannot be treated chemically as it is within 1m of the highwater mark.



Himalayan blackberry along the Brunette River



Himalayan blackberry bordering the upper park

2.4 Watercourses and Drainage

Hume park is set along the banks of the Brunette River. This river is considered a major fish-bearing watercourse in New Westminster, and is an important tributary of Fraser River. There are no other named watercourses on site; however, there are several stormwater outfalls which are brought above ground within the park. These are likely fed by stormwater from the surrounding residential areas, flow overland through the park and drain into the Brunette River.

2.4.1 The Brunette River

The Brunette River flows from Burnaby Lake (northwest of the City) into the Fraser River providing regional connectivity. The Brunette River is a major fish bearing tributary of the Fraser River. The Brunette River is home to multiple species of fish. Fish found in the reach adjacent to Hume Park in recent years includes: Coastal Cutthroat Trout, Coho Salmon, Dolly Varden, Largemouth Bass, Nooksack Dace, Northern Pikeminnow, Peamouth Chub, Prickly Sculpin, Pumpkinseed, Rainbow Trout, Steelhead, and Threespine Stickleback. Other species that have been found in the River in the last 10 years includes: Brassy Minnow, Brook Trout, Brown Catfish, Carp, Goldfish, Pacific Lamprey, Redside Shiner, River Lamprey, and Signal Crayfish.

The River has experienced pressure from past developments, which has reduced the amount of functioning riparian habitat along its banks. Many areas of the river banks downstream of Hume have been development and/or are dominated by invasive plants. At Hume, the areas adjacent to the River have undergone significant effort in recent years to remove invasive species and replant with native trees and shrubs. This has included the installation of at least two rain gardens, which can help retain water in the river banks. This can reduce the quantity and improve the quality of stormwater entering Brunette River. This restoration area, however, is narrow due to the presence of a walkway. There have also been instream restoration works to enhance fish habitat. These include installation of large woody debris and boulders.



Brunette River in front of Hume Park, facing east



Brunette River in front of Hume Park, facing west



Large Woody Debris has been installed to improve in stream habitat.



Brunette River at the western end of Hume Park, facing east.



View of rain gardens installed along the bank of the Hume Park reach of the Brunette River.



Example photo of high concentrations of invasive species along the banks of Brunet River, with Japanese knotweed visible on the banks of the Hume Park reach and thick Himalayan blackberry on the opposite bank.

2.4.2 Unnamed watercourses

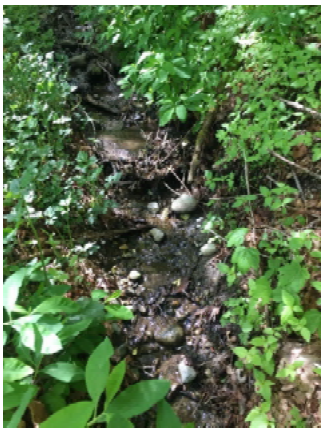
There are a number of stormwater outfalls from the upper playing field area and East Columbia Street that converge before flowing through a culvert under Hume Park road, connecting to a ditch that was constructed along the south side of the lower baseball diamond. This ditch drains into the Brunette River. These water features are all non-fish bearing; however, they provide important water and nutrient input to the Brunette River.

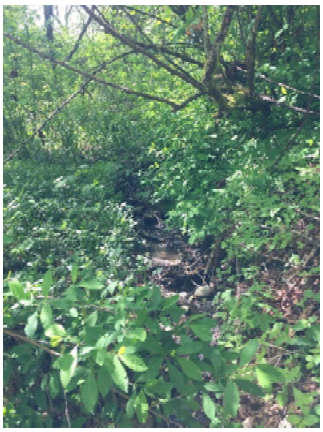


Stormwater outfall from the upper playing fields.



Some stormwater outfalls extend down the slope in pipes.





Views of the streambed above the culvert



View of culvert below Hume Park Rd



View of culvert under Hume Park Rd



Ditch that extends along the south side of the lower baseball diamond.

2.4.3 Watercourse Setbacks

The City of New Westminster has adopted Provincial guidelines for Riparian Area Regulations (RAR). The Streamside Protection and Enhancement Area required to be protected for the Brunette river under RAR is 30m measured back from the edge of the high water mark or floodplain. In addition to this, measures are required to ensure that this area remains geotechnically stable and the trees remain windfirm. The smaller stormwater outfall drainage features require a 10m setback.

Due to the importance of the Brunette River, the City recognizes that there are additional values to consider such as the protection of wildlife passage, habitat for species at risk, encouraging urban forest cover, and fostering opportunities for recreational use. The Master Plan recognizes four landscape zones to best protect the river and its riparian habitat. At Hume park these zones include the following:

- Naturalized Zone – includes the area from the active river channel to 10m above Top of Bank in order to accommodate a wildlife corridor. This area is to be restored and protected as natural habitat.

- Transition Zone – measured as 10m beyond the boundary of the Naturalized Zone, this area can accommodate a pathway or low impact amenities.

- Activity Zone – measured as a 20m area beyond the Transition Zone this area can be programmed for more intensive landscape programming in support of adjacent recreational programming, stormwater management and habitat enhancement.



Figure 5: Streams and riparian setbacks

2.5 Wildlife

The park is part of an important regional wildlife corridor that connects Burnaby Lake to the Fraser River. The Brunette River supports a diverse fish and wildlife community, many of which are Species of Conservation Concern (SCC). There are a number of ecological features of interest throughout the site. This includes wildlife trees, significant trees, rain gardens, and areas with minimal understory species (play areas).

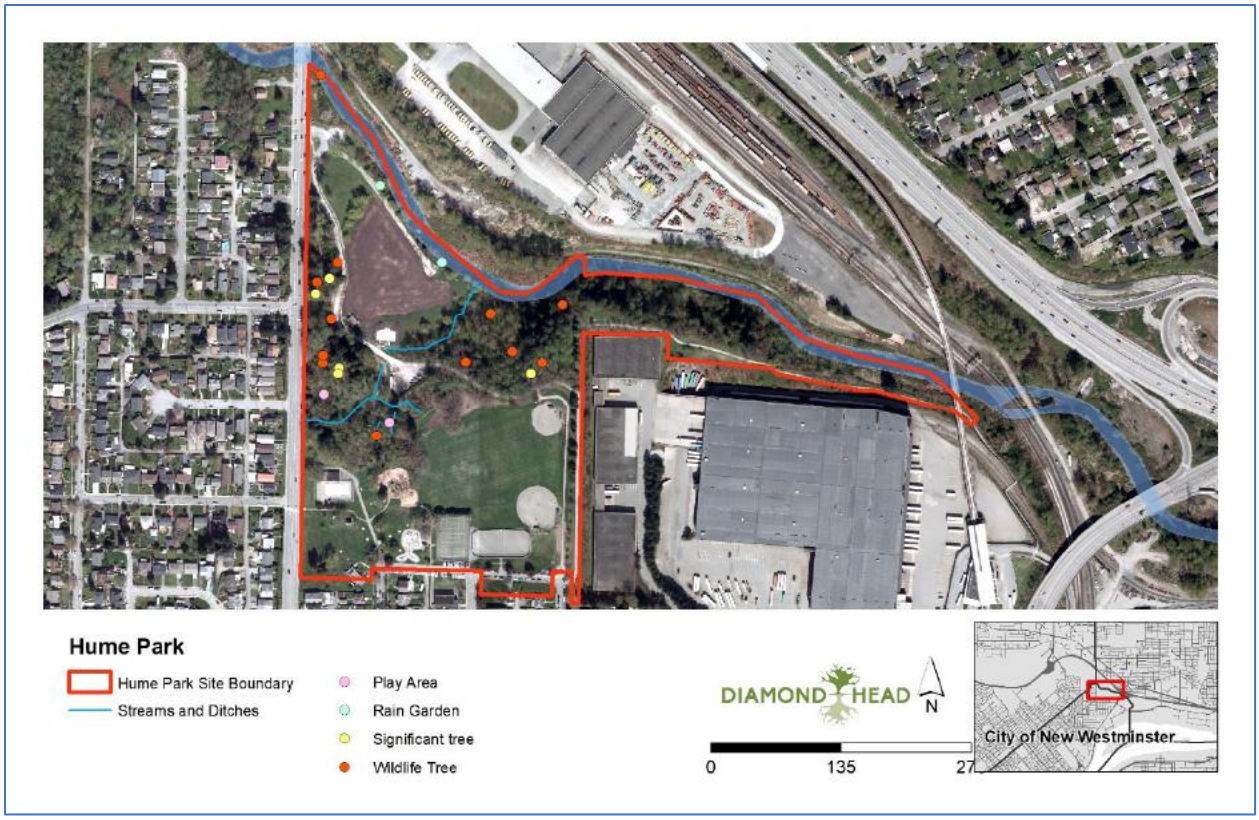


Figure 6: Location of various ecological features

A detailed wildlife survey was not completed for this site. The following is a general account of what species may be expected to be present for some or all of the year based on existing habitat and habitat condition. Any species confirmed visually or audibly were also included.

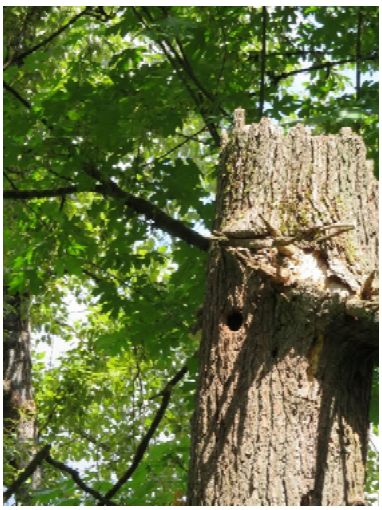
2.6 Birds

Birds that inhabit this area are likely diverse due to the diversity of habitat features providing both cover habitat and forage opportunities. There is suitable habitat present for resident and migratory bird families including raptors, doves, kingfishers, swallows, hummingbirds, woodpeckers, great blue herons, flycatchers, wrens, jays, crows, chickadees, nuthatches, thrushes, vireos, warblers, sparrows, and finches. There are a number of high value dead standing wildlife trees that were identified. Also, some of the large dominant conifer trees provide suitable roosting and nesting habitat for raptors.

Birds that were noted (visibly or audibly) during various site visits includes: black-throated grey warbler, black-capped chickadee, song sparrow, spotted towhee, northern flicker, Swainson's thrush, hummingbird, red-breasted nuthatch, northwestern crow, willow flycatcher, pine siskin, and Cedar waxwing.



High value wildlife tree



Close-up of nesting cavity



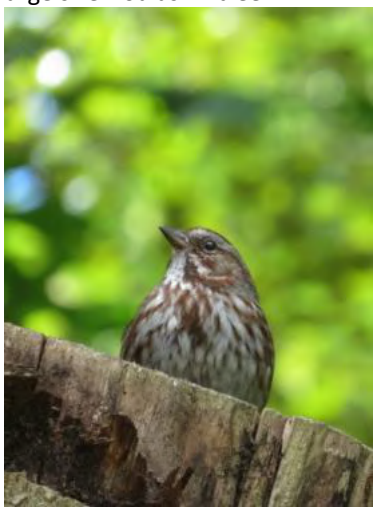
Large size Doulas-fir tree



Cedar Waxwing



Spotted Towhee



Song sparrow

2.6.1 Mammals

Larger mammals found in this area include Coyote as well as some incidence of Black tailed deer and Black Bear. Habitat exists for a number of medium size mammals likely include American Beaver, American Mink, Virginia Opossum, Raccoon, Striped Skunk, and possibly Muskrat and Short-tailed Weasel. It is likely that otter inhabit this reach of the Brunette. Smaller mammals likely include the families for mouse, squirrel, mole, shrew, vole and possible hares. Bats that could potentially use this area include Big Brown bat, Townsend's Big-eared bat and Little brown myotis. A bat box was noted at the top of bank along the pathway on the western end of the site.

2.6.2 Herpetofauna

No formal survey for reptiles and amphibians was conducted; however, some are expected to inhabit this area based on the habitat present. There are some wetland areas within the natural floodplain of the Brunette that may permit breeding habitat for some species. Also, there are numerous natural areas adjacent to wetlands and open water that provide high value habitat for amphibians.

Species that may be present for part or all of the year include those associated with terrestrial habitats for some of their life cycle; these include the Red-legged Frog (*Rana aurora*), Pacific Treefrog (*Pseudacris regilla*), Northwestern Salamander (*Ambystoma gracile*), Long Toed Salamander (*Ambystoma macrodactylum*), Ensinata salamander (*Ensanita eschscholtzii*), and Common Garter Snake (*Thamnophis sirtalis*).

2.6.3 Fish

Fish species in the Brunette River include the endangered Nooksack Dace (see Species at Risk section), Brassy Minnow, Brook Trout, Brown Catfish, Carp, Coastal Cutthroat Trout, Coho Salmon, Dolly Varden, Goldfish, Largemouth Bass, Northern Pikeminnow, Pacific Lamprey, Peamouth Chub, Prickly Sculpin, Pumpkinseed, Rainbow Trout, Redside Shiner, River Lamprey, Signal Crayfish, Steelhead Trout, and Threespine Stickleback.

2.7 Species at Risk

The BC Conservation Data Centre (CDC) records BC's most vulnerable vertebrate animals and vascular plants, each of which is assigned to a provincial Red or Blue list according to their provincial conservation status rank. Species or populations at high risk of extinction or extirpation are placed on the Red list and are candidates for formal endangered species status. Blue-listed species are considered vulnerable to human activity and natural events.

There is a known population of Nooksack Dace (*Chehalis* lineage) in the Brunette River. No other known occurrences of species at risk have been recorded by the Conservation Data Centre within the study area. There are a number of public and masked occurrences south and west of the Park. Due to the presence of the Brunette river, the floodplain wetlands and forest habitat, there are a number of species at risk that could potentially inhabit this area. Wildlife species at risk that could potentially inhabit the study area, or the adjacent natural area, are listed in
Table 1.

Table 1: Species at Risk that could potentially inhabit the areas in and adjacent to the study area

Common Name	Scientific Name	B.C. Status
Long-tailed weasel	*Mustela frenata altifrontalis*	Red
American Bittern	Botaurus lentiginosus	Blue
Green Heron	Butorides virescens	Blue
Southern Red-backed Vole	*Clethrionomys gapperi occidentalis*	Red
Keen's Long-eared Myotis	*Myotis keenii*	Blue
Pacific Water Shrew	*Sorex bendirii*	Red
Great blue heron	*Ardea herodias*	Blue
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Blue
Purple Martin	Progne subis	Blue
Red-legged Frog	*Rana aurora*	Blue
Olive-sided Flycatcher	*Contopus cooperi*	Blue
Barn Swallow	*Hirundo rustica*	Blue
Western Screech-Owl, kennicottii subspecies	*Megascops kennicottii kennicottii*	Blue
Band-tailed Pigeon	*Patagioenas fasciata*	Blue
Trowbridge's Shrew	*Sorex trowbridgii*	Blue

3.0 Opportunities for Enhancement

There are multiple opportunities for enhancement to the natural areas and functions throughout the park. These are summarised below for consideration during the park planning process.

3.1 Enhance Riparian Vegetation

While a functioning riparian area provides shade, nutrients, and filtering capacity for the river and its inhabitants, it also serves multiple ecological functions on land. It provides habitat for terrestrial species, improves the aesthetics of the river edge for park users, and is part of a flood mitigation plan for the park and surrounding areas.

There has been considerable effort in recent years to restore the riparian areas of the Brunette River. These restoration efforts have helped to reduce the concentrations of invasives and provide additional shade and water filtration, especially through the use of naturalized rain gardens. However, these efforts should be further enhanced where possible to include a 30 m setback from the Brunette River. The Brunette River is a vital ecological area in New Westminster, and is the only area protected under the Natural Features Development Permit Area. This restoration would extend the existing vegetated edge south beyond the existing trail. Ideally this trail would be realigned further away from the Brunette River. If possible, the trail should also be resurfaced with porous materials to improve infiltration.

The west side of the watercourse that is adjacent to the baseball field requires a 10m riparian zone. Portions of this area include the maintained turf grass. This 10m zone should be restored to a natural plant community. Table 2 includes a list of trees and shrubs that are ecologically suitable for these floodplain areas.

Table 2: Native tree and shrub species recommended for replanting the berm along Brunette River and along the baseball diamond watercourse to enhance riparian areas.

Botanical Name	Common Name
Trees	
Alnus rubra	Red Alder
Populus trichocarpa	Back Cottonwood
Picea sitchensis	Sitka Spruce
Thuja plicata	Western Red Cedar
Rhamnus purshiana	Cascara
Salix Sp	Willow (Pacific, Scouler, Sitka)
Malus fusca	Pacific Crab Apple
Shrubs	
Lonicera involucrata	Black Twinberry
Rubus spectabilis	Salmonberry
Crataegus douglasii	Black hawthorn
Ribes bracteosum	Stink currant
Cornus stolonifera	Red-osier Dogwood
Oplopanax horridus	Devil's club
Oemleria cerasiformis	Indian Plum
Sambucus racemosa	Red elderberry
Spiraea douglasii	Hardhack
Physocarpus capitatus	Pacific Ninebark

The Brunette River Master Plan guidelines include the naturalization of the area within 10m of the top of bank of the slope. Generally, there are trails and disturbance up to the top of bank in the park. In many areas there is a band of invasive plants in this area. Where possible it is recommended that invasive species be removed and this area be replanted with an ecologically suitable plan community. Table 3 includes a list of trees and shrubs that are ecologically suitable for this area.

Table 3: Native tree and shrub species recommended for replanting within 10m above the top of bank

Botanical Name	Common Name
Trees	
Pseudotsuga menziesii	Douglas-Fir
Acer macrophyllum	Broadleaf Maple
Rhamnus purshiana	Cascara
Thuja plicata	Western Red Cedar
Malus fusca	Pacific Crab Apple
Shrubs	
Acer circinatum	Vine Maple
Symphocarpos albus	Snowberry
Corylus cornuta	Beaked Hazelnut
Gaultheria shallon	Salal
Ribes sanguineum	Red Flowering Currant
Polystichum munitum	Sword Fern
Oemleria cerasiformis	Indian Plum
Amelanchier alnifolia	Saskatoon
Mahonia nervosa	dull Oregon-grape
Rosa gymnocarpa	Baldhip Rose

3.2 Reduction of Impervious Surfaces

There are areas of lower Hume park that are currently paved and within the riparian area of Brunette River. Reducing the area of impervious surfaces would allow water to be retained and drain out more naturally into Brunette River, improving its quality and reducing the quantity released all at once. Opportunities to move, reduce the size, or redo the parking lot adjacent to the river with a more pervious material should be considered. Reducing the large area of impervious surfaces from the parking lot could include re-establishing it with pavers. This would allow for the establishment of trees, which would provide shade, helping to mitigate the impact of the urban heat island effect. Options should be explored to naturalize this infrastructure. For example, bioswales could be placed around or throughout the parking lot to help reduce the speed and improve the quality of run off from the parking lot. These structures would allow the urban-pollutant laden water to infiltrate into the bioswales.



Parking lot adjacent to the Brunette River.



Entrance road to the baseball diamond parking lot.

3.3 Removal of Invasive Species

Invasive species should be managed to protect natural biodiversity and prevent further spread and encroachment to and from adjacent areas. These should be treated using the current best management practices for each species. Manual removal is recommended wherever possible in order to minimize the introduction of chemical herbicides into sensitive environmental areas. Some species, such as Japanese knotweed, do not respond to manual control methods and chemical control methods such as foliar Glyphosate application should be considered. This method has been recently used with success to treat knotweed along the Brunette river edge. Two other patches that were identified should be treated to prevent their further spread.

Invasive species control and removal should always be considered a first step in a more holistic process of ecological restoration. Areas with extensive invasive species removal should be replanted as soon as feasible with native plant communities, as invasive species are quick to colonize disturbed areas. Areas with extensive removal or control are often very susceptible to reinvasion by the same or other species if not replanted with native species.

3.4 Dog Park

A dog park is currently located within the riparian area off of the top of bank. Ideally, this dog park would be located further back from the top of bank, outside of the riparian area. This would decrease the likelihood of animal waste being washed into the Nicomekl River and improve the quality of stormwater run off. This area should then be restored with native vegetation, as per the setback zones discussed in Section 2.4.3.





View of the dog park and paved path along the top of bank.

3.5 Incorporation of Natural Play Elements

Naturalized parks can help to capture kids' imaginations during play. The placement of natural features such as tree stumps, mounds, boulders and large logs will provide some additional habitat while also encouraging children to explore.



Figure 7: Some forested areas of the park with informal walking paths and minimal understory vegetation appear to be well-used.

3.6 Wildlife Habitat Features

Areas that have previously been disturbed or are dominated by invasive species provide a limited diversity of habitat features. Creation of additional artificial and natural habitat features wherever possible will improve overall biodiversity in the park. Habitat enhancement recommendations are conceptually illustrated in Figure 8.

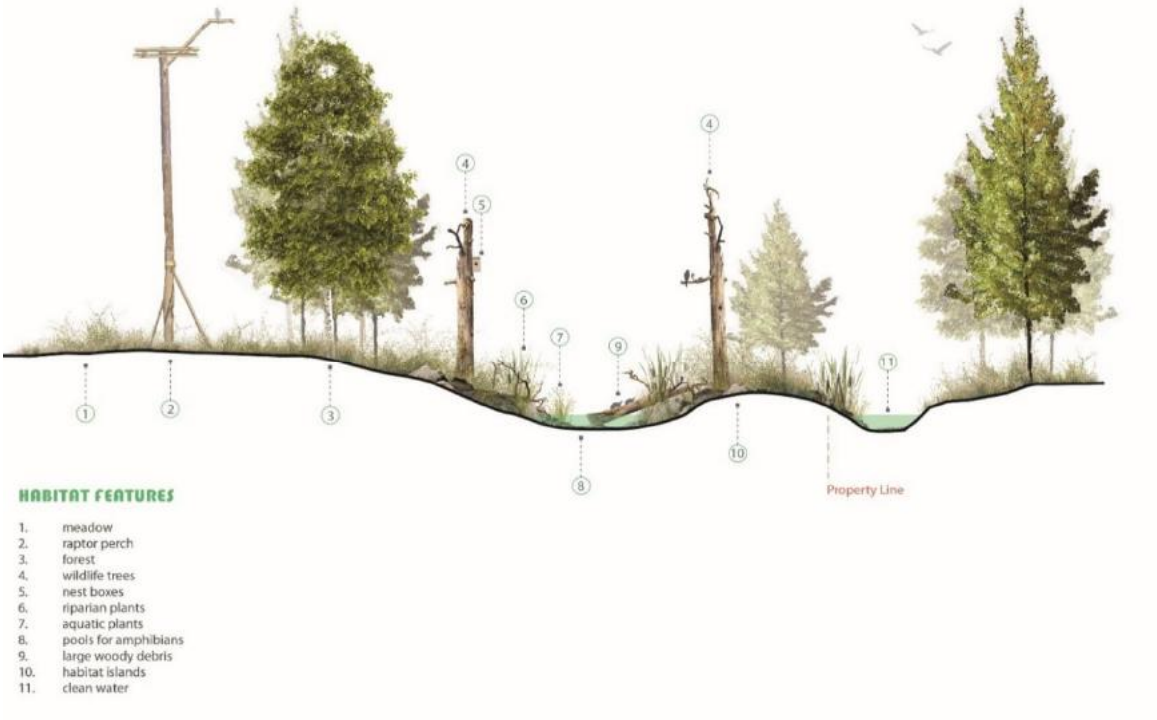


Figure 8: Habitat Features to be Incorporated into the Environmental Program.

Large Woody Debris

Larger tree trunks that have fallen are often called downed wood, large woody debris (LWD) or coarse woody debris (CWD). These features provide shelter, feeding sites, and movement pathways for wildlife. They also act as nurse logs for plants, add organic matter and nutrients to the soil, and help to stabilize slopes, reduce erosion, and control sediment runoff. The presence of LWD in riparian areas is an important habitat feature for the red listed Pacific Water Shrew.

- Generally speaking, more wood is preferable to less; target density should be a minimum of 200 pieces per hectare (two per 100 m^2);
- Preferred sources are native conifer species. The amount of western redcedar placed near water sources should be minimal due to the levels of auxins (plant hormone) present in the wood;
- Large stumps or logs should be used. Logs should be a minimum of 30 centimetres diameter and four (4) metres long;
- Large woody debris should be strategically interconnected, with some extending into the water; single pieces, including stumps, can also be placed in the water to provide cover habitat.

Standing Wildlife Trees

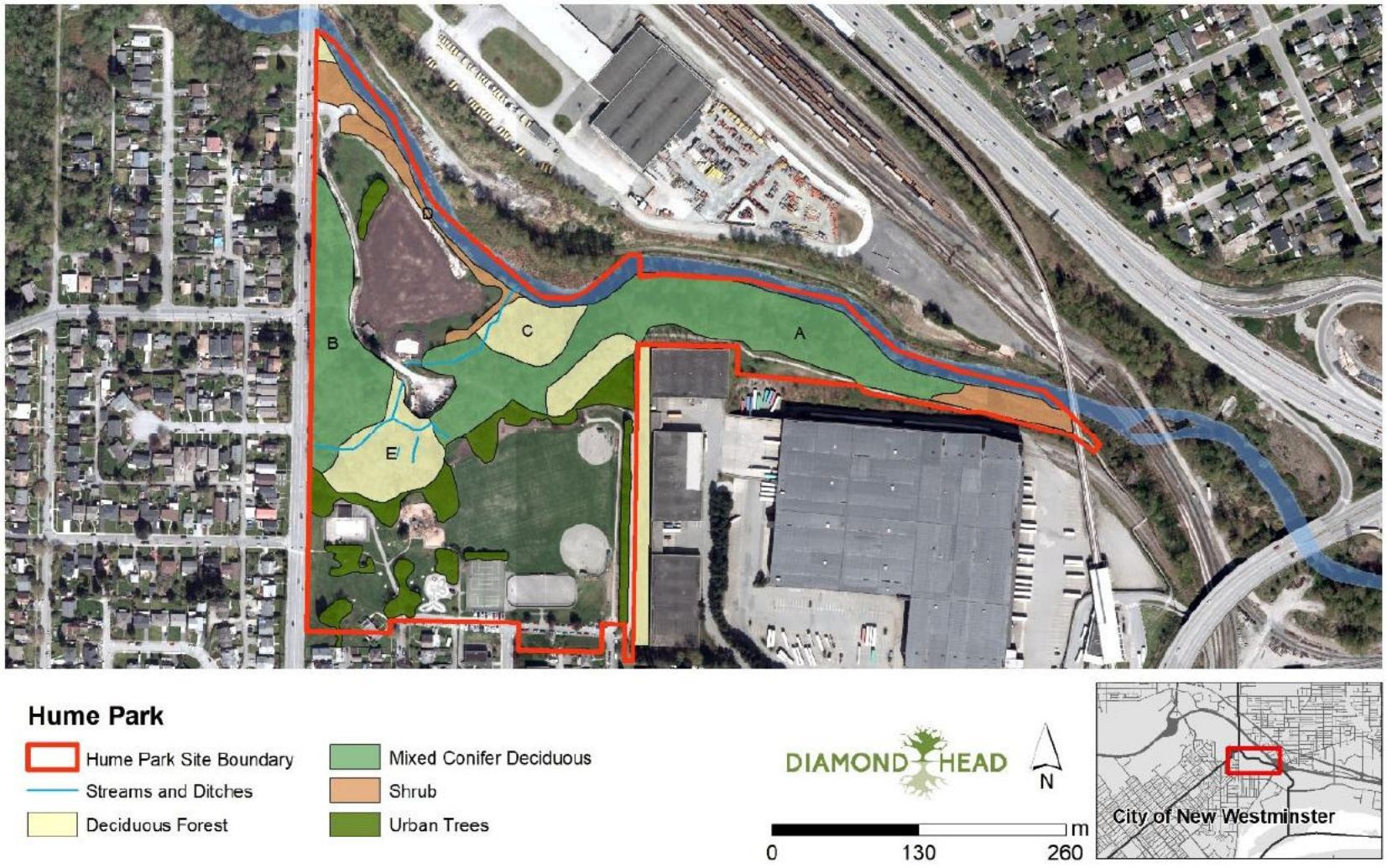
Dead standing trees or 'planted wildlife trees' are important habitat features for birds, mammals, amphibians and other organisms. They provide forage, roosting and nesting sites for a diversity of bird species. They are also a source of organic nutrient inputs. If at any point an excavator is being used on site, it could be used to install wildlife trees. These should be placed along the Brunette River where possible as a priority.

- Wildlife tree density should target 25 stems/ha;
- Logs should be native conifer species;
- One third to one half the length of a wildlife tree should be buried to ensure stability;
- Trees should be placed leaning away from structures and people;
- Logs should be a minimum of 40 cm in diameter and 6 m long; and
- Wildlife trees should be installed at variable spacing (single trees no closer than 10 metres apart) and in clusters (several trees grouped together).

Raptor Perches and Nests

Raptors have a preference for perching above hunting areas. The playing field, meadow habitat and wetland areas should provide good habitat for prey. Raptors perches should be installed in the floodplain area along the forest edge and along the Brunette River. Perches can be metal or wood poles with a perch/nesting structure at the top.

Appendix 1 Vegetation Inventory



Polygon A:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Loamy sand	4 (5)/D	Moder/3	CWHdm SS05 (80%) SS07(20%)

UNDERSTORY VEGETATION (60% cover)		
26-50%	11-25%	6-10%
		Sword fern - *Polystichum munitum*
		Indian plum - *Oemleria cerasiformis*
		Vine maple - *Acer circinatum*
1-5%	Trace (+)	Invasive Species
Clasping twisted stalk - *Streptopus amplexifolius*	*Laburnum spp.*	English holly - *Ilex aquifolium*
Pacific Bleeding Heart - *Dicentra formosa*		English ivy - *Hedera helix*
Mountain Sweet-cicely – *Osmorhiza chilensis*		Small flowered touch-me-not - *Impatiens parviflora*
Common Horsetail - *Equisetum arvense*		Buttercup - *Ranunculus repens*
Common Snowberry – *Symphoricarpos albus*		Himalayan blackberry – *Rubus armeniacus*
Salmonberry – *Rubus spectablis*		Wild Chervil - *Anthriscus sylvestris*
Thimbleberry – *Rubus parviflorus*		Policeman's helmet – *Impatiens glandulifera*
Purple leaved willowherb - *Epilobium ciliatum*		
Herb Roberts - *Geranium robertianum*		
Bitter dock - *Rumex obtusifolius*		
Fringecup – *Tellima grandiflora*		
Lady fern - *Athyrium filix-femina*		
Goat's beard - *Aruncus dioicus*		
Common foxglove – *Digitalis purpurea*		
Large-leaved avens – *Geum macrophyllum*		
Dull Oregon grape – *Mahonia nervosa*		

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species[1] (% by volume; + denotes <10%)	Fd100%	Mb70% Dr30% Cw+ Hw+	Mb80% Dr20% Cw+ Hw+	Mb90% Pr+ Sm+	Mb100% O+
Density (stems/ha)	10	250	150	100	50
Tree diameter at breast height (cm)	70	60	30	8	
Tree height (m)	45	32	20	4	
Live crown ratio	60	65	50	40	
Crown closure (%)	50				

[1] Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Sm (sitka mountain ash), Mx (Boxelder maple), O (Oak species), Sc (Sycamore) P (Pine) C (Cascara)

Polygon B:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4 (5)/D	Moder/3	CWHdm SS05(90%) SS07(10%)

UNDERSTORY VEGETATION (50% cover)		
26-50%	11-25%	6-10%
		Salmonberry - *Rubus spectablis*
	Clasping twisted stalk - *Streptopus amplexifolius*	Indian plum - *Oemleria cerasiformis*
		Bracken fern - *Pteridium aquilinum*
		False lily of the valley - *Maianthemum dilatatum*
1-5%	Trace (+)	Invasive Species
Sword fern - *Polystichum munitum*	Mock-orange – *Philadelphus lewisii*	Small flowered touch-me-not - *Impatiens parviflora*
Saskatoon – *Amelanchier alnifolia*		Mountain ash - *Sorbus aucuparia*
Beaked hazelnut - *Corylus cornuta*		English holly - *Ilex aquifolium*
Common Horsetail - *Equisetum arvense*		English ivy - *Hedera helix*
Common foxglove – *Digitalis purpurea*		Himalayan blackberry - *Rubus armeniacus*
Grass spp.		Cherry laurel - *Prunus laurocerasus*
Herb Roberts - *Geranium robertianum*		Japanese Knotweed - *Fallopia japonica*
Fringecup – *Tellima grandiflora*		Goutweed - *Aegopodium podagraria*
Vine maple - *Acer circinatum*		Buttercup - *Ranunculus repens*
Dull Oregon grape – *Mahonia nervosa*		Morning glory - *Calystegia sepium*
Trailing blackberry – *Rubus ursinus*		*Robinia spp.*
Pacific Bleeding Heart - *Dicentra formosa*		Wild Chervil - *Anthriscus sylvestris*
Goat's beard - *Aruncus dioicus*		Policeman's helmet – *Impatiens glandulifera*
Sweet-scented bedstraw – *Galium triflorum*		
Mountain Sweet-cicely – *Osmorhiza chilensis*		

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species[1] (% by volume; + denotes <10%)	Act10% Fd90%	Mb90% Cw10%Hw+%	Mb60% Cw30% Hw10%	Mb70% Cw20% Hw10% SORSIT+	Mb100%
Density (stems/ha)	20	100	150	150	10
Tree diameter at breast height (cm)	90	80	30	15	
Tree height (m)	45	35	20	8	
Live crown ratio	70	60	50		
Crown closure (%)	50				

[1] Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Sm (sitka mountain ash), Mx (Boxelder maple), O (Oak species), Sc (Sycamore) P (Pine) C (Cascara)

Polygon C:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Loamy Sand	6-7/D	Moder/3	CWHdm 09 (floodplain)

UNDERSTORY VEGETATION (80% cover)		
26-50%	11-25%	6-10%
Salmonberry - *Rubus spectablis*		Indian plum - *Oemleria cerasiformis*
		Common Horsetail - *Equisetum arvense*
	Sedges - *Carex Sp.*	Large-leaved avens – *Geum macrophyllum*
	Red osier dogwood - *Cornus stolonifera*	Hardhack – *Spiraea douglasii*
		Grass spp.
1-5%	Trace (+)	Invasive Species
Sword fern - *Polystichum munitum*		English holly - *Ilex aquifolium*
Thimbleberry – *Rubus parviflorus*		English ivy - *Hedera helix*
Lady fern - *Athyrium filix-femina*		Small flowered touch-me-not - *Impatiens parviflora*
Fringecup – *Tellima grandiflora*		Creeping buttercup - *Ranunculus repens*
Twinberry - *Lonicera involucrata*		Mountain ash - *Sorbus aucuparia*
Vine maple - *Acer circinatum*		Policeman's helmet – *Impatiens glandulifera*
Willow spp.		Himalayan blackberry - *Rubus armeniacus*
Nootka Rose – *Rosa nutkana*		

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species[1] (% by volume; + denotes <10%)		Act100%	Act50% Dr50%	Dr50% Mb10% O10% W10%	Dr80% W20% Mb+ O+
Density (stems/ha)		200	150	100	50
Tree diameter at breast height (cm)		65	30	10	
Tree height (m)		38	34	6	
Live crown ratio		60	60	50	
Crown closure (%)	45				

[1] Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Sm (sitka mountain ash), Mx (Boxelder maple), O (Oak species), Sc (Sycamore) P (Pine) C (Cascara)

Polygon D:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	5-6/D	Moder/5	CWHdm 09

UNDERSTORY VEGETATION (90% cover)		
26-50%	11-25%	6-10%
	Nootka Rose – *Rosa nutkana*	*Grass sp.*
		Willow Sp.
		Common Snowberry – *Symphoricarpos albus*
		Pacific ninebark – *Physocarpus capitatus*
1-5%	Trace (+)	Invasive Species
Stinging nettle - *Urtica dioica ssp. gracilis*		Himalayan blackberry - *Rubus armeniacus*
Indian plum - *Oemleria cerasiformis*		Japanese knotweed - *Fallopia japonica*
Salmonberry - *Rubus spectabilis*		Small flowered touch-me-not - *Impatiens parviflora*
Common Horsetail - *Equisetum arvense*		Creeping buttercup - *Ranunculus repens*
Thimbleberry – *Rubus parviflorus*		Policeman's helmet – *Impatiens glandulifera*
Vine maple - *Acer circinatum*		Morning glory - *Calystegia sepium*
Hardhack – *Spiraea douglasii*		
Twinberry - *Lonicera involucrata*		
Bracken fern - *Pteridium aquilinum*		
Dull Oregon grape – *Mahonia nervosa*		

Trees species along this riparian edge include a number of mature non native species including mostly weeping willow with some spruce and red maple. These are 8-15m tall. There have been a high number of trees planted in this area in recent years including Sitka spruce, western redcedar, Douglas-fir and Red alder. These are 1-3m tall.

Polygon E:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	(4)5-6/D	Moder/3	CWHdm SS07(50%) SS07(50%)

UNDERSTORY VEGETATION (50% cover)		
26-50%	11-25%	6-10%
	Salmonberry - *Rubus spectablis*	Sword fern - *Polystichum munitum*
		Indian plum - *Oemleria cerasiformis*
		Beaked hazelnut - *Corylus cornuta*
		Thimbleberry – *Rubus parviflorus*
1-5%	Trace (+)	Invasive Species
Bracken fern - *Pteridium aquilinum*	*Red huckleberry – Vaccinium parvifolium*	Mountain ash - *Sorbus aucuparia*
Red elderberry – *Sambucus racemose ssp pubens*		Small flowered touch-me-not - *Impatiens parviflora*
Red-osier dogwood – *Cornus stolonifera*		English holly - *Ilex aquifolium*
Common Horsetail - *Equisetum arvense*		English ivy - *Hedera helix*
Purple leaved willowherb - *Epilobium ciliatum*		Himalayan blackberry - *Rubus armeniacus*
Herb Roberts - *Geranium robertianum*		Japanese Knotweed - *Fallopia japonica*
Fringecup – *Tellima grandiflora*		
Vine maple - *Acer circinatum*		Buttercup - *Ranunculus repens*
Salal – *Gaultheria shallon*		Morning glory - *Calystegia sepium*
Trailing blackberry – *Rubus ursinus*		Policeman's helmet – *Impatiens glandulifera*
Goat's beard - *Aruncus dioicus*		
Saskatoon – *Amelanchier alnifolia*		
Lady fern - *Athyrium filix-femina*		
Mock-orange – *Philadelphus lewisii*		
Wall lettuce – *Lactuca muralis*		

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species[1] (% by volume; + denotes <10%)	Act100%	Mb70% Dr30%	Mb80% Mx 20% Pr+ O+ Sc+P+	Mb80% Dr10% Mx 10% Sm+ Pr+ O+ Sc+ P+ C+	Mb100%
Density (stems/ha)	20	100	50	150	30
Tree diameter at breast height (cm)	80	70	30	15	
Tree height (m)	40	30	20	8	
Live crown ratio	70	60	60		
Crown closure (%)	30				

[1] Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Sm (sitka mountain ash), Mx (Boxelder maple), O (Oak species), Sc (Sycamore) P (Pine) C (Cascara)

Appendix 2 Statement of Limitations

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