Stewardship in Action:
Native Plant Re-establishment
In an Urban Garden

Study Area, April 2011

Prepared by:
Margaret Ferguson

Prepared for:
ER390, Selected Project
Restoration of Natural Systems Program, University of Victoria

July, 2011

Table of Contents

Abstract 1

1.0 Introduction 1

2.0 Methods 4

3.0 Results and Interpretation 5

3.1 Biogeoclimatic Zone 7

3.2 Bowker Creek Watershed 9

3.3 Low Impact Development 12

3.4 Historical Context 12

3.5 Municipal Bylaws 13

3.6 Study Area Assessment 14

3.7 Study Area Plan 23

4.0 Discussion 29

References 33

Appendices

A Photographs 38

B Bylaw No. 4100 Schedule “D” and Schedule “E” 40

C BCOneCall and District of Oak Bay Utility Servicing Information 42

D Feb. 14, 2011 Correspondence to the District re: Schedule “D” 48

E Selected Rain Garden Resources 51

F Feb. 19, 2011 Correspondence to the District re: Boulevard Rain Garden Proposal 52

List of Figures

Figure 1 Context Map....6
Figure 2 Study Area Plan....8
Figure 3 Bowker Creek Watershed....10
Figure 4 Study Area Inventory Plan....15
Figure 5 Study Area Assessment Plan....19
Figure 6 Soil Description Field Form....21
Figure 7 Study Area Concept Plan....24

List of Tables

Table 1 Study Area Plant Species....16
Table 2 Observed Fauna Species....17
Table 3 Potential Plant List (Native)....27
Table 4 Potential Plant List (Cultivars)....28

Abstract

The negative effects on biodiversity from urbanization include habitat loss, altered resource flows, changes in natural disturbance regimes and the introduction of exotic species. Enhanced biodiversity and re-establishment of wildlife corridors can be aided by the re-introduction of native plants in private gardens, which comprise the greatest amount of green space in urban environments. The study area is a 137.5 m^2 portion of a highly modified residential front yard located in Oak Bay on southeastern Vancouver Island, B.C. Its location in the endangered Garry oak *(Quercus garryana Dougl.)* ecosystem and the urbanized Bowker Creek watershed, provide an opportunity to apply stewardship principles to design, construct and maintain a native plant garden to facilitate improved connectivity and biodiversity. This was achieved through an inventory and assessment of study area features, review of urbanization impacts on ecosystem and watershed conditions and an exploration of stormwater capture options. Constraints to development included the limited study area size, occurrence of utility servicing and the application of restrictive bylaws that limit plant selection and bioretention landscaping options. Indigenous plant selection was based on site conditions, wildlife value, minimum maintenance requirements, ornamental value, herbivory resistance, and potential availability and cost. Selected cultivars have also been identified. Site preparation has been completed with the removal and composting of selected shrubs and perennials, the expansion of garden beds with the cultivation of sod and mulching. Further site work will include the application of organic soil amendments, and the purchase and installation of plant material. Maintenance and monitoring schedules appropriate for stewardship gardening were designed to facilitate adaptive gardening practices and assess increased wildlife activity and diversity. Stewardship is achievable at the urban garden scale despite noted challenges. The contribution of native plant gardening to improved connectivity and biodiversity, particularly in highly fragmented and endangered ecosystems and urbanized watersheds, is significant and warrants further application.

1.0 Introduction

The negative impacts of urbanization on biodiversity are varied and significant. These effects include habitat loss leading to fragmentation of natural environments resulting in increased local extinction rates; altered resource flows that include climate change and watershed degradation; changes to natural disturbance regimes including fire suppression; and, the

introduction of exotic species and the resulting changes in species composition (Gaston et al. 2005). For example, the Garry oak *(Quercus garryana Dougl.)* ecosystem in British Columbia is considered one of the most endangered ecosystems in Canada with less than 5% remaining (Fuchs 2001). Settlement and agricultural development on southeastern Vancouver Island in the mid 1800's intensively modified this ecosystem and remnant patches are highly fragmented and impacted by invasive species (MacDougall et al. 2004).

Private gardens are an important component of healthy urban green spaces. They comprise the greatest amount of green space in urban environments and therefore present a significant opportunity to enhance biodiversity and the provision of ecosystem services (Gaston et al. 2005). Private gardens and public green space re-establish essential wildlife corridors. This connectivity between green spaces decreases the probability of species extinction, maintains regional diversity and prevents in-breeding depression through sustained dispersal (Rudd et al. 2002). Private gardens are generally well-maintained environments characterized by high floristic diversity and structural complexity (Thompson 2003). Gardens of all sizes and complexity have the potential to be useful to wildlife; however, native plant status often determines the strength of that relationship (Smith et al. 2006) and in highly modified environments, biodiversity can be enhanced through native plant re-introduction (McKinney 2002). The re-introduction of native plants is one achievable strategy for supporting and enhancing biodiversity in the urban environment (Mooney 2004).

The use of native plants in urban gardens provides benefits to wildlife and humans in myriad ways. Beyond the importance of expanded green space connectivity and increased wildlife habitat, native plant gardens contribute to healthier environments by providing ecosystem services including climate moderation, pollution reduction and watershed

improvements, and increased awareness of ecosystems and the value of biodiversity (GOERT 2009). The restoration of ecosystem services in urban environments improves quality of life for humans and provides education and engagement opportunities (Gaston et al. 2005). In biologically sensitive and endangered ecosystems such as the Garry oak ecosystem, the protection, enhancement and restoration at various scales, including private gardens, contributes to biodiversity conservation and support for stewardship.

Stewardship is "an ethic that recognises the need to conserve and restore ecosystems for current and future generations of all species" (Stewardship Centre, http://www.stewardshipcentre.bc.ca/). It is commonly accepted that stewardship is action-based and a shared responsibility by government, organizations and individuals. Campbell and Pincott (1995) identify principles to guide stewardship at the private garden scale:

- Restore, maintain and enhance natural habitat through appropriate plant selection and avoidance of harmful gardening practices and substances;
- Co-exist with and care for the species attracted to the property;
- Improve the living environment by recycling and composting through the use of natural fertilizers and mulch soil amendments;
- Respect neighbourhood values by maintaining the garden environment at a suitable standard;
- Facilitate greater public awareness of the restoration ethic and process through shared experiences; and
- Monitor and continuously learn about the garden and the broader ecosystem and make adjustments as required.

The intent and scope of this project is to implement stewardship principles to design, construct and maintain a residential native plant garden in the District of Oak Bay (the District) to facilitate improved connectivity and biodiversity. This will be achieved through an inventory and assessment of the study area features and constraints, a discussion of urbanization impacts on the Garry oak ecosystem and watershed conditions, the exploration of stormwater capture options, and the use of communication opportunities and monitoring protocols.

2.0 Methods

The regional ecological zone and the impacts of urban development were documented through the review of published reports and studies. I also examined Bowker Creek watershed issues related to this altered ecosystem through interviews and the review of studies and web materials prepared by the Capital Regional District (CRD) and the Friends of Bowker Creek Society. The regional cultural history was researched through the review of archival documents and interviews.

An inventory and assessment of site features provided the basis for preparing a design for the study area. Municipal bylaws were reviewed for site development opportunities and constraints. I corresponded with the District regarding permitted boulevard plant materials and rain garden design, and researched historical property land use through document review, archival searches and interviews. I documented and mapped existing site conditions and analysis through measurements and observations. This included the preparation of scaled site plans, documentation of existing plant species and observed fauna using authoritative identification references, and applied the resources of municipal engineering services, including BCOneCall

and District of Oak Bay staff. The study area soils were assessed using the B.C. *Terrestrial Ecosystem Mapping* protocol and soil testing laboratory services.

Using collected site information and ecosystem-specific reference materials, I prepared a list of suitable plants for the study area. I also reviewed stormwater capture options and assessed site suitability for a rain garden installation. Rain garden research included literature review, discussions with design professionals, site visits to private and public rain gardens, and participation in a District of Saanich rainwater management seminar.

Maintenance procedures were identified based on accepted organic gardening practices. Through the review of published reports, communication opportunities were identified and monitoring protocols developed, appropriate to the study area. A photographic record of the project was maintained (Appendix A).

3.0 Results and Interpretation

The study area is a portion of the front yard of a residential property located at 1780 Armstrong Avenue in Oak Bay, on southeastern Vancouver Island, B.C. at N 48°25’54.3” Latitude, W 123°18’55.4” Longitude. The District is situated on the shores of Haro Strait in the Salish Sea and is bounded on the west by the City of Victoria and the District of Saanich to the north (Fig. 1).

Oak Bay is defined by its predominantly low density, single-family residential land development, which accounts for 63% of all land use in the District (CDOB 2010b). Public open

space accounts for 18% of land use and is primarily restricted to the foreshore, small neighbourhood parks, playfields and golf courses (CDOB 2010b).

Figure 1. Context Map (CRD Atlas 2011)

The property is situated on a quiet residential street approximately 115 m from the Bowker Creek greenway. The street is a single-block, no-through local road north of Bowker Creek with pedestrian access to the creek and trail system at the south end of the cul-de-sac. There are no sidewalks and vehicle traffic is generally limited to residential access.

The study area encompasses 137.5 m^2 which includes a 67 m^2 private portion and a 70.5 m^2 public boulevard. The property is a generally level, east facing site with an approximate elevation of 15 m ASL. The entire property is a rectangular lot 40.8 m deep and 15.2 m wide, totalling 0.06 ha (Fig. 2). The study area is a highly modified site with limited wildlife value that presents a significant opportunity to demonstrate native plant gardening and stewardship principles. To contain the project scope and cost, the study area excludes existing hard landscaping areas of the front property.

3.1 Biogeoclimatic Zone

The study area is located within the Garry oak ecosystem in the Coastal Douglas-fir, moist maritime (CDFmm) biogeoclimatic zone. In Canada, this coastal rainshadow forest (Pojar and MacKinnon 2004) is limited to the narrow coastal fringes of southeastern Vancouver Island, the Saanich Peninsula, and most of the Gulf islands at elevations below 150 m (MacKinnon 2003). The climate is influenced by the rainshadow effect of the Olympic and Vancouver Island Mountains and is characterized by warm, dry summers and mild, wet winters (Nuszdorfer et al. 1991). The average annual precipitation in Victoria (Gonzales Heights station) is 608 mm, with less than 10% of this precipitation occurring in June, July and August (Environment Canada, http://www.climate.weatheroffice.gc.ca/climate_normals/results_e.html).

Figure 2. Study Area Plan (CRD Atlas 2011)

Rich in diversity but critically endangered, Garry oak and associated ecosystems presently occupy a small part of the CDFmm zone (Erickson 1993), including Oak Bay. Prior to European settlement, the Garry oak ecosystem is thought to have been the dominant vegetative cover within the District (Lea 2006). The conversion of the Garry oak habitat to agriculture and urban development has resulted in few remaining examples of the ecosystem in proximity to the study area, including Garry oak and camas on the Oak Bay High School site.

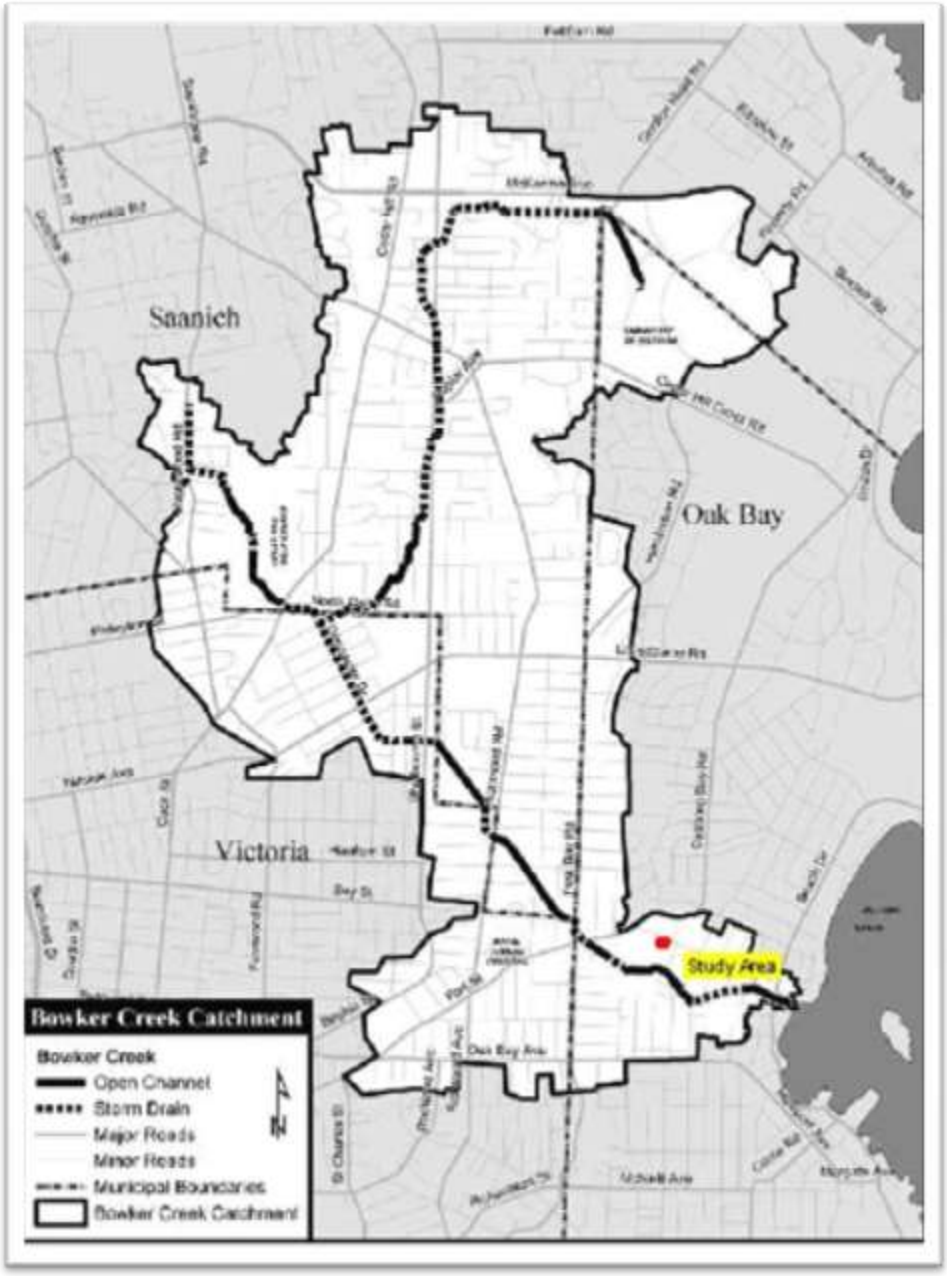
Natural area preservation has been limited due to the more than 50% private ownership (MacKinnon 2003). Habitat loss and invasive species encroachment has resulted in more than 100 species of flora and fauna at risk of extinction (GOERT 2009). Restoration efforts must

strive to improve connectivity and functionality throughout the ecosystem to mitigate the effects of fragmentation and habitat loss (Fuchs 2001).

The Garry oak landscape is characterized by sandy/gravelly beach deposits, rocky ledges and parkland formations with deep, rich soils. The terrain is generally flat with gradients less than 5% and few isolated steep areas comprised of bedrock outcrops (Kerr Wood Leidal 2007). Soils are derived from morainal, colluvial and marine deposits that are poorly formed as a result of a low rate of weathering and are typically dystric, eutric or melanic Brunisols with organically enriched Ah horizons (Erickson and Meidinger 2007). Humus formation is typically Moder to weak Mor (Nuszdorfer et al. 1991).

3.2 Bowker Creek Watershed

The study area is located in the Bowker Creek watershed which encompasses 1,028 ha within the districts of Saanich, Victoria and Oak Bay (Fig. 3). It is considered one of the most highly urbanized watersheds in the CRD with approximately 87% of the watershed developed for urban land uses (Westland Resource Group 2003). It is estimated that 50% of the watershed is impervious due to urbanization (Kerr Wood Leidal 2007). The hydraulic capacity within the watershed is considered inadequate and as a result, frequent flooding occurs (Kerr Wood Leidal 2007).



Not to Scale

Figure 3. Bowker Creek Watershed
(CRD, http://www.bowkercreekinitiative.ca/documents/BCI_08homeownersguide.pdf)

Imperviousness is an indicator with which to measure the impacts of land development on aquatic systems including changes to hydrology, habitat structure, water quality and

biodiversity (Schueler 1994). Based on thresholds developed for urban watersheds impacted by impervious cover, Bowker Creek is considered a "non-supporting" stream where biodiversity cannot be sustained (Schueler 1994). Beyond the impacts to aquatic ecosystems, impervious land cover also contributes to urban heat island effect and changes to local precipitation patterns (Jensen et al. 2010). While water quality has improved with the ongoing repair of sanitary sewer and storm drain cross connections, it is considered to be "fair" based on the type and distribution of benthic invertebrates identified. The eight open reaches of the creek and adjacent riparian areas currently provide only limited habitat for certain plants and animals, including birds, small mammals and aquatic invertebrates (Westland Resource Group 2003). The re-establishment of fish populations in the creek is considered unlikely (Reid Crowther and SHIP Environmental 2000).

At approximately 9.4 km in length, the creek flows through pipes and culverts with only about 30% remaining above ground (Westland et al. 2010). Much of the above-ground sections have been deepened and straightened to carry stormwater runoff within the watershed and artificial banks have been constructed in response to erosion. In some cases, vegetation has been removed to improve drainage and invasive plant species limit the growth of native vegetation.

Prior to the conversion of the Garry oak meadows and woodlands to agricultural and urban development, Bowker Creek was a meandering, low gradient creek with a number of small tributaries and wetland complexes supporting salmon and trout (Friends of Bowker Creek Society, http://members.shaw.ca/bowkercreek/index.htm). First Nations obtained food and fresh water from the creek, and nutrients transported from the watershed helped support a rich marine ecosystem (Westland Resource Group 2003).

3.3 Low Impact Development

The potential exists to improve species diversity with the reduction of water pollutants and improvements to streambank design and vegetation (Reid Crowther and SHIP Environmental 2000). Research, education and restoration activities in the watershed are coordinated by the Bowker Creek Initiative with assistance from the Friends of Bowker Creek Society to improve and expand public awareness of natural systems and biodiversity (CRD, http://www.bowkercreekinitiative.ca/documents/BCI_08homeownersguide.pdf; Friends of Bowker Creek Society, http://members.shaw.ca/bowkercreek/index.html).

A priority initiative is the implementation of low impact development (LID) measures that minimize flooding and pollution of waterways, and improves hydrology across the watershed (Westland Resource Group et al. 2010). LID design includes engineered retention and filtration methods (i.e., the use of permeable paving, downspout disconnection, rainwater harvesting, bioretention landscaping and roof gardens). The implementation of LID measures would also defer expensive storm drainage infrastructure upgrades.

3.4 Historical Context

For thousands of years prior to the arrival of Europeans in the mid 19th century, the Lekwungen People of the Songhees First Nation depended upon the land and water for survival. The lands occupied by the Lekwungen primarily included the Garry oak ecosystem and various sites in Oak Bay are documented (CDOB 2010b). The Lekwungen used landscape management activities, including fire to maintain wildlife habitat and the harvesting of camas *(Camassia spp.)* as a food source (MacKinnon 2003; Fuchs 2001).

With the signing of treaties in 1850, the Hudson's Bay Company (HBC) took possession of lands for occupancy and farming by settlers, including more than 1,000 ha in Oak Bay. By 1858, Oak Bay was subdivided into five large tracts of land; all owned by four employees and the HBC itself (Sparks 2011). John Tod, a retired HBC Chief Factor, purchased 165 ha of arable land in Oak Bay in the vicinity of Bowker Creek. During his lifetime, this area was converted to small farms and market gardens (CDOB 2006), including a 4.05 ha dairy farm on what is now the Oak Bay High School site adjacent to the study area (Sparks 2011). By 1913, the subdivision of lands and the construction of roadways in the District was largely complete (CDOB 2010b).

The study area property was the first residential lot developed on the street with the construction of a small home in 1923, later renovated in 2003. By the early 1950's the 11 remaining residential properties on the street had been developed (Sparks 2011).

3.5 Municipal Bylaws

The study area is subject to a number of bylaws and regulations that are designed to control development and protect health. In April 2011, Bylaw No. 4518, *Pesticide Regulation Bylaw,* came into effect in Oak Bay and reflects an advancement in environmental policy adopted by a number of municipalities throughout the CRD (CDOB 2011). Accordingly, the District will apply integrated pest management principles to protect human health and the natural environment. Bylaw No. 4100, *Streets and Traffic Bylaw,* imposes development restrictions on public lands (including boulevards) adjacent to private property (CDOB 2010c). Boulevard landscaping restrictions are identified in Schedule "D", List of Permitted Boulevard Plantings, and Schedule "E", Boulevard Landscaping Restrictions, that form part of the bylaw (Appendix B).

3.6 Study Area Assessment

The relevant study area features have been inventoried and mapped (Fig. 4). The location of existing garden beds and significant vegetation on and adjacent to the study area were plotted. Utility servicing information was received from the District and BCOneCall (Appendix C).

An inventory of the existing plants in the study area was undertaken in the spring of 2011 (Table 1). The study area contains mainly lawn and a limited number of primarily non-native, ornamental perennial and shrub species. In general, the use of ornamental plants is indicative of gardening practices throughout the District. Accordingly, the existing wildlife habitat value is considered "low" (Chamberlain et al. 2004).

Since 2004, fauna species have been observed throughout the property (Table 2). Bird species observations have been primarily associated with backyard feeders. Many of the identified species are considered common to this ecosystem where habitat is suitable (Gates 2001). Blue orchard mason bees *(Osmia lignaria)* are maintained by the author.

For the most part, these species have adapted to urban conditions, while some introduced species (e.g., house sparrow *(Passer domesticus)*, eastern grey squirrel *(Sciurus carolinensis)*, and the domestic cat *(Felis catus)*) are known to exploit urban environments (Schaefer et al. 2004). Herbivory from deer and bird predation has been observed in the study area.

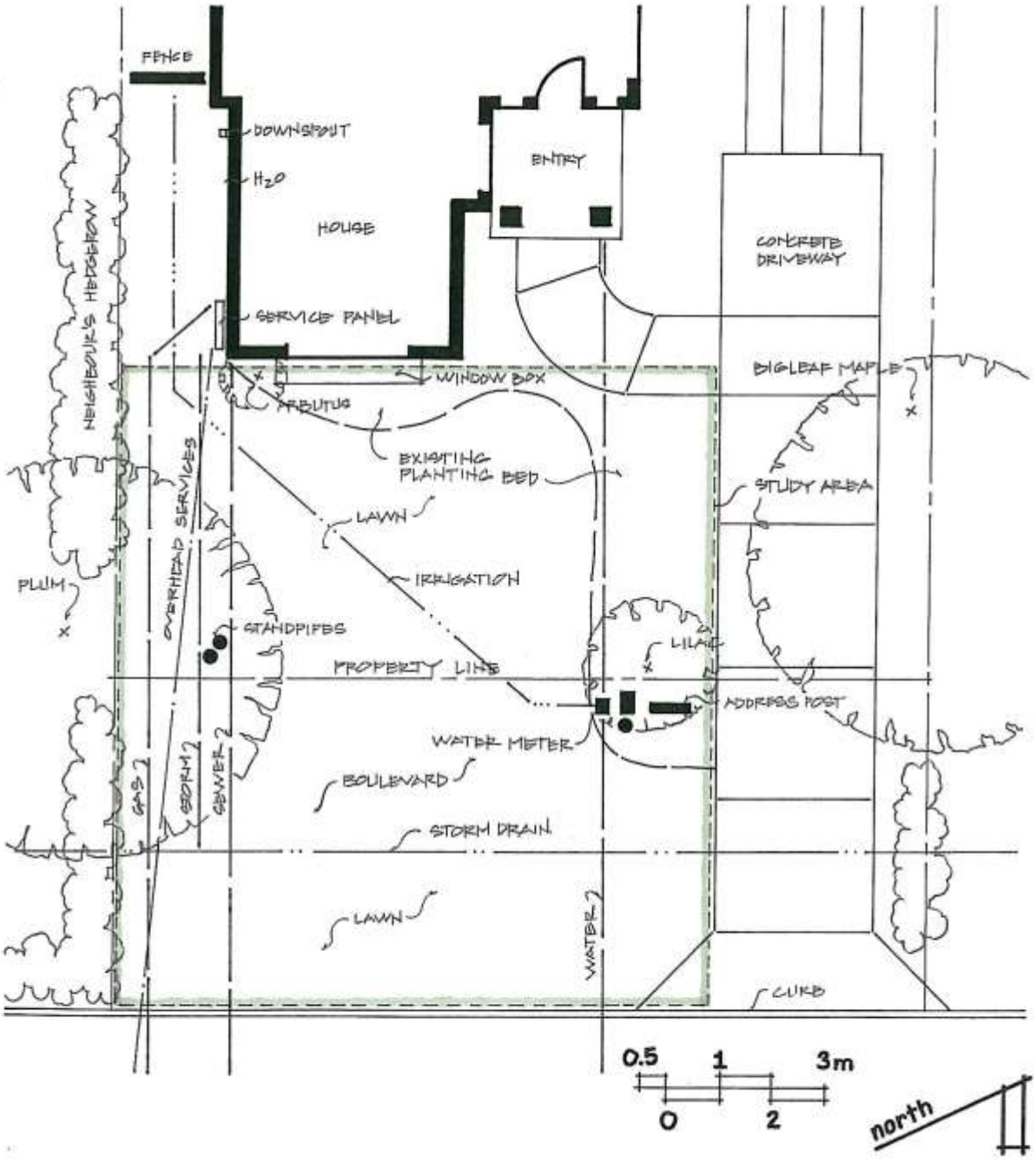


Figure 4. Study Area Inventory Plan

Family[1]	Species[2]	Common Name	Comments
Hylocomiaceae	*Rhytidialdelphus squarrosus*	bent-leaf moss	turf moss
Cupressaceae	*Thuja occidentalis cv.*	eastern arborvitae	small tree
Liliaceae	*Allium vineale*	crow garlic	invasive bulb
	Hyacinthoides sp.	bluebell	spring bulb
	Hyacinthus sp.	hyacinth	spring bulb
	Muscari spp.	grape hyacinth	spring bulb
Amaryllidaceae	*Galanthus spp.*	snowdrop	spring bulb
Iridaceae	*Crocus sp.*	crocus	spring corms
	Iris spp.	iris	rhizomes, bulbs
Poaceae (Gramineae)	*Eltrigia repens*	quackgrass	turf weed
	Festuca spp.	fescue	turf grass
	Poa spp.	bluegrass	turf grass
Berberidaceae	*Berberis thunbergii* 'Monomb'	'Cherry Bomb' barberry	shrub
Ranunculaceae	*Ranunculus repens*	creeping buttercup	turf weed
Buxaceae	*Sarcococca humilis*	sweet box	small shrub
Grossulariaceae	*Escallonia sp.*	escallonia	large shrub
Euphorbiaceae	*Euphorbia characias* 'Tasmanian Tiger'	'Tasmanian Tiger' spurge	perennial
	Euphorbia griffithii 'Dixter'	'Dixter' spurge	perennial
Fabaceae (Leguminosae)	*Trifolium spp.*	clover	turf weed
	Vicia spp.	vetch	turf weed
Rutaceae	*Choisya ternate* 'Sundance'	Mexican orange blossom	shrub
Brassicaceae (Cruciferae)	*Brassica campestris*	field mustard rape	turf weed
	Cardamine oligosperma	little-western bitter-cress	weed
Ericaceae	*Arbutus unedo* 'Elfin King'	strawberry tree	shrub
	Erica carnea spp.	winter heather	small shrub
	Rhododendron PJM 'Elite'	rhododendron	shrub
	Rhododendron sp.	azalea	small shrub
	Vaccinium vitis-idaea	mountain cranberry	native shrub
Lamiaceae (Labiatae)	*Lamium purpureum*	purple deadnettle	turf weed
Oleaceae	*Syringa vulgaris*	common lilac	large shrub
Asteraceae (Compositae)	*Bellis perennis*	English daisy	turf weed
	Hypochaeris radicata	hairy cat's ear	turf weed
	Matricaria discoidea	pineapple weed	turf weed
	Senecio sp.	groundsel	turf weed
	Tanacetum sp.	tansy	turf weed
	Taraxacum officinale	common dandelion	turf weed
Araliaceae	*Hedera helix sp.*	ivy	invasive vine
Caprifoliaceae	*Lonicera nitida* 'Baggesen's Gold'	'Baggesen's Gold' honeysuckle	shrub

Sources: (1) Brickell and Cole 2004; Hitchcock and Cronquist 2001; (2) Brickell and Cole 2004; Personal Records; Pojar and MacKinnon 2004.

Table 1. Study Area Plant Species

Birds[1]		
Falconidae	*Accipiter cooperii*	Cooper's hawk
Odontophoridae	*Callipepla californica*	California quail
Strigidae	*Bubo virginianus*	great horned owl
Trochilidae	*Calypte anna*	Anna's hummingbird
Picidae	*Colaptes auratus*	northern flicker
	Picoides pubescens	downy woodpecker
	Dryocopus pileatus	pileated woodpecker
Corvidae	*Cyanocitta stelleri*	Steller's jay
	Corvus caurinus	northwestern crow
Paridae	*Poecile rufescens*	chestnut-backed chickadee
Aegithalidae	*Psaltriparus minimus*	bushtit
Sittidae	*Sitta canadensis*	red-breasted nuthatch
Certhiidae	*Certhia americana*	brown creeper
Troglodytidae	*Thryomanus bewickii*	Bewick's wren
Regulidae	*Regulus satrapa*	golden-crowned kinglet
	Regulus calendula	ruby-crowned kinglet
Turdidae	*Catharus guttatus*	hermit thrush
	Turdus migratorius	American robin
	Ixoreus naevius	varied thrush
Bombycillidae	*Bombycilla cedrorum*	cedar waxwing
Sturnidae	*Sturnus vulgaris*	European starling
Parulidae	*Dendroica coronate*	yellow-rumped warbler
Emberizidae	*Pipilo maculates*	spotted towhee
	Passerculus sandwichensis	savannah sparrow
	Passerella iliaca	fox sparrow
	Melospiza melodia	song sparrow
	Zonotrichia leucophrys	white-crowned sparrow
	Zonotrichia atricapilla	golden-crowned sparrow
	Junco hyemalis	dark-eyed junco
Fringillidae	*Carpodacus mexicanus*	house finch
	Carduelis pinus	pine siskin
	Carduelis tristis	American goldfinch
Passeridae	*Passer domesticus*	house sparrow
Mammals[2]		
Leporidae	*Sylvilagus floridanus*	eastern cottontail rabbit
Muridae	*Rattus norvegicus*	Norway rat
Sciuridae	*Sciurus carolinensis*	eastern grey squirrel
Felidae	*Felis catus*	domestic cat
Procyonidae	*Procyon lotor*	raccoon
Cervidae	*Odocoileus hemionus*	black-tailed deer
Invertebrates[3]		
Megachilidae	*Osmia lignaria*	blue orchard mason bee
Papilionidae	*Papilio rutulus*	western tiger swallowtail
Limenitidinae	*Limenitis lorquini*	Lorquin's admiral

Sources: (1) Sibley 2003; (2) Fuchs 2001; (3) Canadian Biodiversity Information Facility, http://www.cbif.gc.ca/spp_pages/butterflies/index_e.php.

Table 2. Observed Fauna Species

The site inventory provides the basis for an assessment of the study area features (Fig. 5). The study area is an east-facing site that is exposed to morning and afternoon sun, with the exception of dappled shade conditions under the canopy of a neighbouring ornamental plum *(Prunus cerasifera)* and part-shade conditions along the northeast area adjacent to the house. The study area slopes 1.5% from north to south and less than 1% from the house to the curb. Utility service access to the southeast side of the house is through the study area.

The study area is subject to the District Bylaw No. 4100, *Streets and Traffic Bylaw*. This bylaw requires that no planting is permitted within 2 m of the curb. The remainder of the boulevard is subject to the following restrictions:

- maximum depth that soil may be tilled is 20 cm below the natural grade;
- minimum distance of plantings from a water meter is 1 m;
- maximum plant height is 75 cm above natural grade; and
- plant material species restricted to those listed in Schedule "D" of the bylaw.

A letter submitted by the author to the District on February 14, 2011 provided comments on Schedule "D", particularly as it relates to the inclusion of known invasive plant species and the limited selection of native plants. Acknowledgement was received on March 30, 2011 (Appendix D).

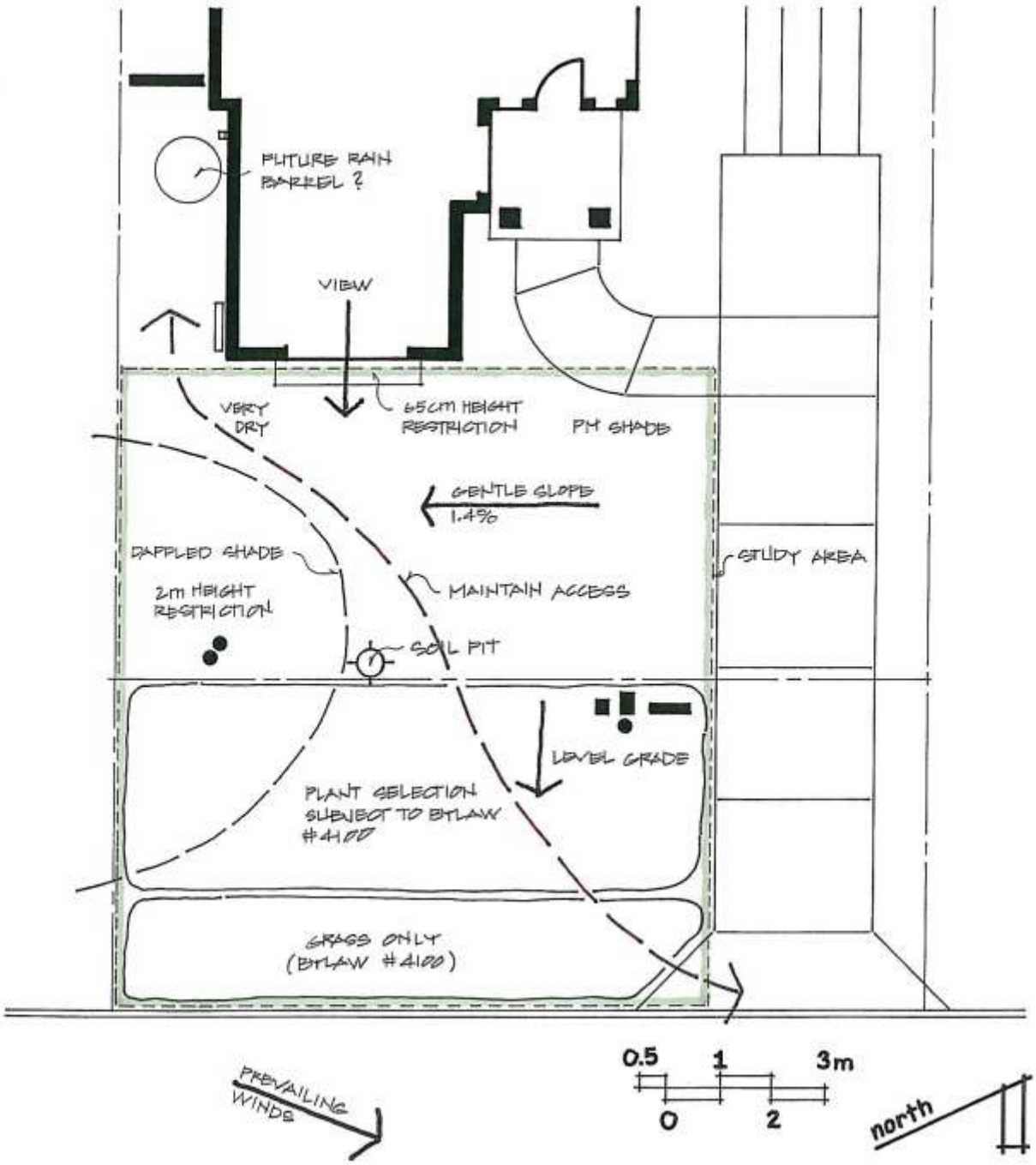
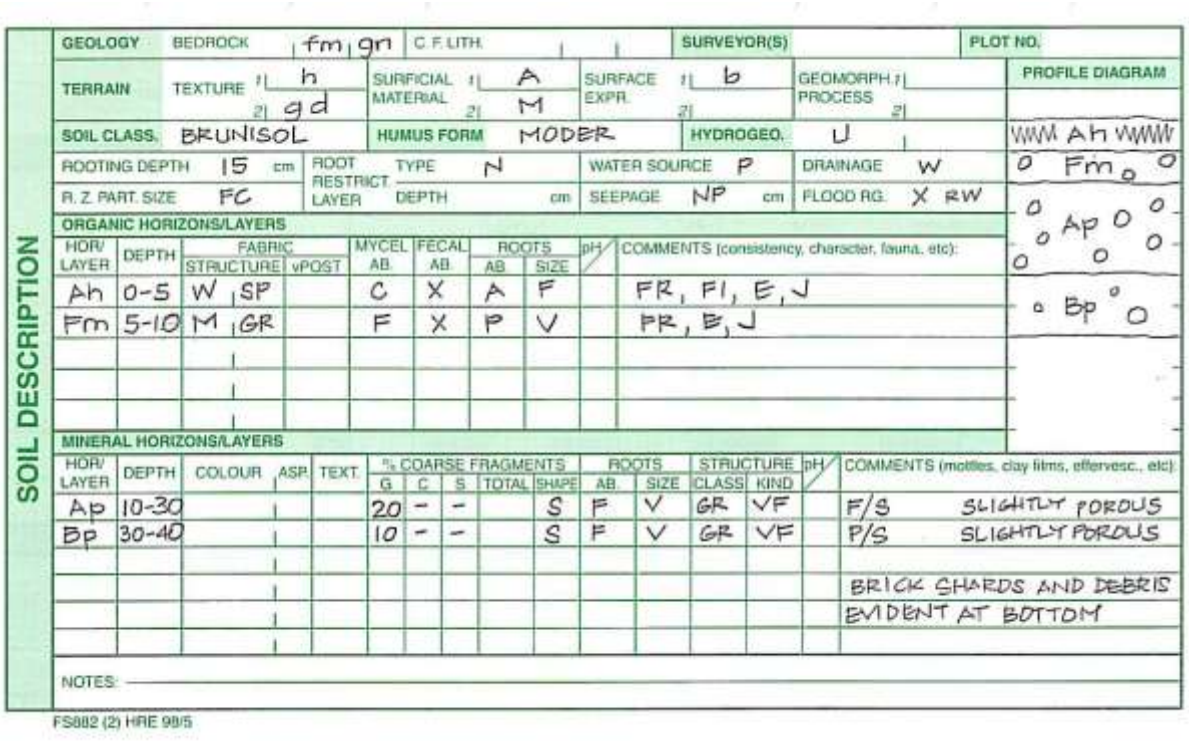


Figure 5. Study Area Assessment Plan

A soil pit (50 cm diameter x 40 cm deep) was excavated on June 8, 2011, to assess the study area soils. This shallow pit is located within the private property and away from known foundation and buried services excavations (Fig. 5). Excavation within the lawn area was considered most suitable due to the study area homogeneity and the potentially lower disturbance rate of the underlying soils. It is not known to what degree the native soils have been altered but urban development has likely had a significant impact on the soil profile through infill, disturbance and compaction. This excavation also provided the opportunity to assess soil texture and water infiltration.

A soil description field form provides a detailed description of the excavation results (Fig. 6) (B.C. Ministry of Environment and B.C. Ministry of Forests 1998). Overall, the soil is a well-draining loam with mixed gravel fragments. Root fragments (few, very fine to fine), soil fauna, as well as debris (brick and glass shards) were observed at all depths. Some mottling and clay layers were evident at the 40 cm depth. No groundwater seepage was observed. A worm test revealed a weak cast, equally gritty and sticky. Soil samples from six sites within the study area were collected and submitted for laboratory testing of nutrient and pH values.

Some 39% of the property is covered by impervious surfaces including roof tops and concrete paving. The remainder of the property, including the study area, is landscaped with more pervious lawn, garden beds and gravel surfacing. Rainwater is collected and removed from the property through downspouts and perimeter drains connected to the storm drainage system.



SOIL DESCRIPTION

GEOLOGY — BEDROCK: fm, gn — C.F. LITH: — SURVEYOR(S): — PLOT NO.:

TERRAIN — TEXTURE: 1| h, 2| gd — SURFICIAL MATERIAL: 1| A, 2| M — SURFACE EXPR.: 1| b, 2| — GEOMORPH. PROCESS: 1|, 2| — PROFILE DIAGRAM

SOIL CLASS: BRUNISOL — HUMUS FORM: MODER — HYDROGEO.: U

ROOTING DEPTH: 15 cm — ROOT RESTRICT. LAYER: TYPE: N, DEPTH: cm — WATER SOURCE: P — DRAINAGE: W

R. Z. PART. SIZE: FC — SEEPAGE: NP cm — FLOOD RG.: X RW

ORGANIC HORIZONS/LAYERS

HOR/ LAYER	DEPTH	FABRIC STRUCTURE	FABRIC vPOST	MYCEL AB.	FECAL AB.	ROOTS AB.	ROOTS SIZE	pH	COMMENTS (consistency, character, fauna, etc):
Ah	0-5	W, SP		C	X	A	F		FR, FI, E, J
Fm	5-10	M, GR		F	X	P	V		FR, E, J

MINERAL HORIZONS/LAYERS

HOR/ LAYER	DEPTH	COLOUR	ASP.	TEXT.	% COARSE FRAGMENTS G	C	S	TOTAL	SHAPE	ROOTS AB.	ROOTS SIZE	STRUCTURE CLASS	STRUCTURE KIND	pH	COMMENTS (mottles, clay films, effervesc., etc):
Ap	10-30				20	-	-		S	F	V	GR	VF		F/S SLIGHTLY POROUS
Bp	30-40				10	-	-		S	F	V	GR	VF		P/S SLIGHTLY POROUS
															BRICK SHARDS AND DEBRIS
															EVIDENT AT BOTTOM

NOTES:

FS882 (2) HRE 98/5

Figure 6. Soil Description Field Form

The management of storm flows in the Bowker Creek watershed is considered a priority in the CRD with LID priorities and initiatives the responsibility of the District (Bandringa 2011). This project provided an opportunity to assess the feasibility of incorporating LID principles. The LID option considered for the study area was the installation of a rain garden.

The review of design criteria and municipal policy provides the basis upon which to evaluate the feasibility of a rain garden installation in the study area (Appendix E). Relevant considerations include:

- To reduce the flooding potential, overflow capability with connection to the storm drainage system is considered necessary. Therefore, the most suitable location for

a rain garden on the property is within the study area, closest to the storm drainage lateral pipe;

- Specific design limitations include:
  - the location of the closest downspout on the southeast side of house drains a very small roof area. The resulting small size of the rain garden would have limited impact on rainwater collection;
  - access through the study area to the southeast side of the house must be maintained for utility servicing;
  - rain gardens should not be sited within 3 m of structures or over buried services due to the depth of excavation and maintenance considerations. The location of buried services throughout the study area creates siting restrictions; and
  - municipalities generally do not approve development in boulevards due to public liability and maintenance issues (Bandringa 2011).
- There are currently no funding sources or other incentives for implementing LID initiatives in the District (Bandringa 2011).

Considering the above, site restrictions limit the feasibility of constructing an effective rain garden in the private portion of the study area. The potential for locating a rain garden in the boulevard was proposed to the District in a letter dated February 19, 2011. No response has been received to date, despite two subsequent inquiries on March 28th and April 10th (Appendix F). Due to design constraints and the lack of response from the District, a rain garden is not considered feasible in the study area. Constructing a rain garden in another area of the property

will be considered and the potential to collect and harvest rainwater for use in the study area explored.

3.7 Study Area Plan

A concept plan delineating the outline of new garden beds was prepared to assist with the site preparation and development of a planting plan (Fig. 7). A landscape contractor was hired in the spring 2011 to assist with the removal of selected ornamental shrubs and perennials, garden bed cultivation and the addition of leaf mulch. Measures were taken to reduce harmful environmental impacts and waste during the site preparation, including the hand tilling of sod into the garden beds and the composting of removed shrubs and perennials. This site preparation method will allow the planting to proceed this year. The expansion of garden beds has decreased the lawn by some 43%. This will allow for improved precipitation infiltration and absorption rates (CRD, http://www.bowkercreekinitiative.ca/documents/BCI_08homeownersguide.pdf).

A number of the existing plant species have been maintained due to their ornamental value and/or high cost of removal. The removal of crow garlic *(Allium vineale)* and ivy *(Hedera helix sp.)* was successful through bulb and root digging.

Upon completion of the site preparation, a 4-6 week (minimum) period is necessary to allow for sod decomposition. During this period, the plant list and quantities will be finalized, and plant material will be sourced. Propagation of suitable native plants found elsewhere on the property will continue. Organic soil amendments will be applied based on the soil nutrient test results (pending), and wood and rock features will be sourced. Planting will commence in late summer of 2011 and continue into spring 2012 to take advantage of winter rains and greater plant material availability.

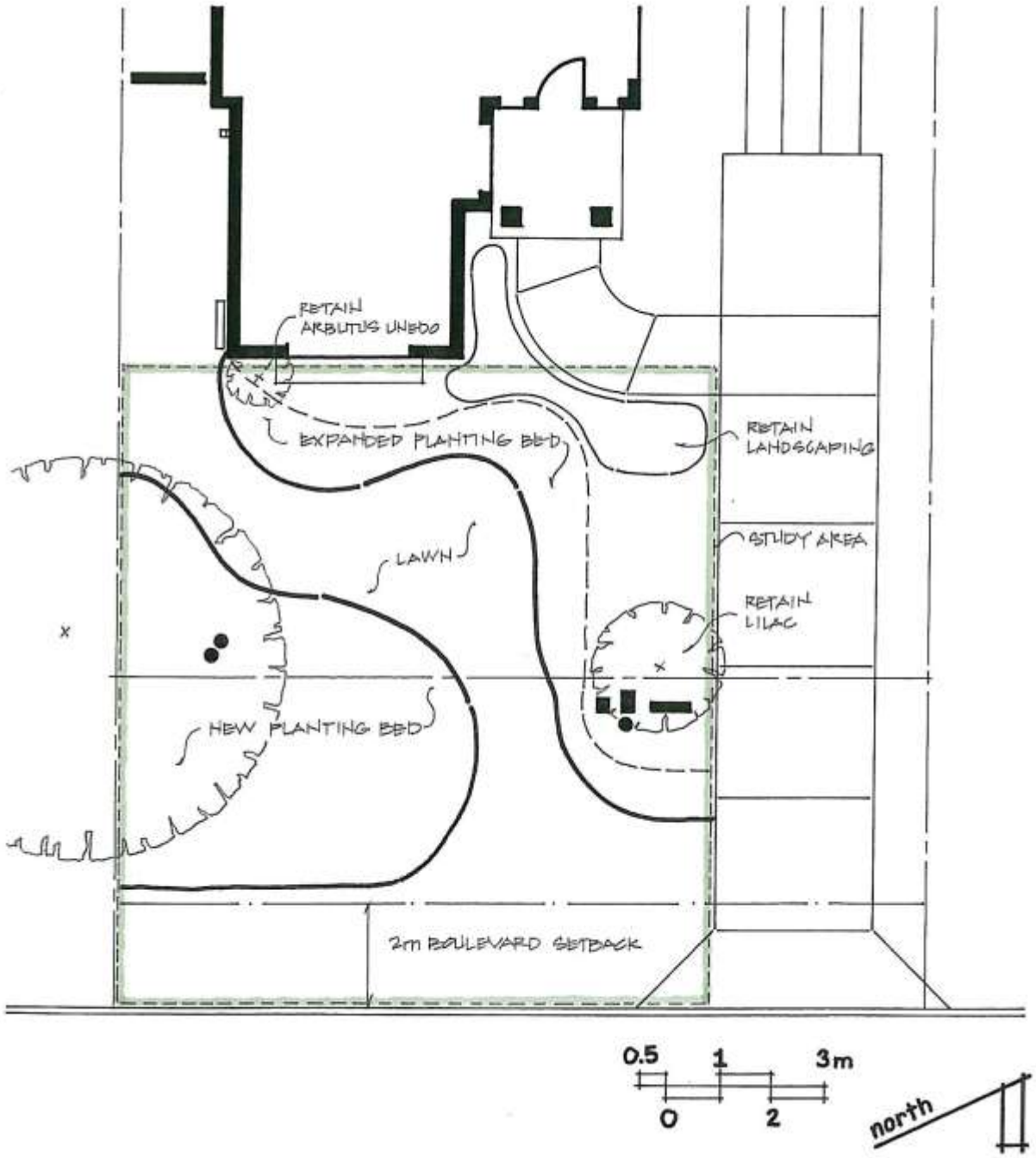


Figure 7. Study Area Concept Plan

A number of opportunities and constraints will influence the development of a native plant garden in the study area. Opportunities include:

- the potential to improve biodiversity at the site and watershed level through the implementation of stewardship principles;
- the availability of excellent planning and design resources, and growing community support for Garry oak habitat restoration and the application of stewardship principles;
- improved public acceptance of healthy and attractive landscape design with the display of native plants in a front garden; and
- the study area proximity increases ease of maintenance and monitoring.

Constraints are:

- limited area within the private portion of the study area restricts the planting of larger Garry oak species;
- underground and overhead services limits plant selection and the incorporation of a rain garden; and
- boulevard development restrictions affect plant selection and the inclusion of other landscaping features.

A list of potential native plants suitable for the study area has been produced (Table 3). Plant selection is based on a number of criteria, including:

- indigenous to the Garry oak ecosystem;
- desired biodiversity improvements (enhanced wildlife value);
- site suitability (garden size, sun exposure, soils and moisture);

- desired maintenance (pest and disease susceptibility, growth habit);
- availability (including propagation sources) and cost;
- ornamental value; and
- resistance to herbivory.

A list of potential plant cultivars that provide similar wildlife value but more adequately address site limitations was also prepared (Table 4). Generally well-suited to the urban garden, plant cultivars have more predictable growth and bloom habits but may be of reduced benefit to wildlife due to dissimilar traits. Varieties that produce seed or fruit have been considered.

Site maintenance will be required to aid in establishing the garden. At a minimum, maintenance efforts will include:

- Water weekly or as required during the growing season for the first two years to establish shrub and tree species;
- Identify and remove pernicious weed and invasive species within the requirements of applicable bylaws and regulations;
- Mulch every 2 years to suppress weeds, maintain soil moisture and add nutrients;
- Provide seedling protection from herbivory and where possible, fauna protection from predation (i.e., wire cages for plants and predator deterrents);
- Over-winter seed bearing plants as a food source; and
- Establish a pruning schedule that emphasizes biodiversity needs and plant health as well as aesthetic appeal.

Sun Tolerant							
Species	**Common**	**Soil Conditions**			**Wildlife Value**		
		Drought Tolerant	**Well-Drained**	**Nutrient-Rich**	**Deer Resistant**	**Attracts Pollinators**	**Food Source**
Trees and Shrubs							
Amelanchier alnifolia	Saskatoon	✓					✓
Holodiscus discolor	oceanspray	✓	✓		✓	✓	✓
Juniperus communis	common juniper	✓			✓		✓
Philadelphus lewisii	mock orange	✓		✓		✓	✓
Ribes sanguineum	red-flowering currant	✓	✓			✓	✓
Perennials							
Achillea millefolium	common yarrow		✓			✓	
Allium acuminatum	Hooker's onion	✓	✓				
Allium cernuum	nodding onion	✓			✓		
Anaphalis margaritacea	pearly everlasting	✓	✓			✓	✓
Antennaria sp.	pussytoes		✓				
Arctostaphylos uva-ursi	kinnikinnick	✓				✓	✓
Armeria maritime	common thrift	✓	✓			✓	
Aster chilensis	coast aster	✓				✓	
Brodiaea coronaria	harvest brodiaea	✓	✓				
Camassia quamash	common camas	✓				✓	
Delphinium menziesii	Menzies' larkspur	✓				✓	
Eriophyllum lanatum	wooly sunflower	✓					
Festuca idahoensis	Idaho fescue	✓	✓				
Fritillaria affinis var. *affinis*	chocolate lily	✓	✓				
Plectritis congesta	sea blush						
Sedum spathulifolium	broad-leaved stonecrop	✓	✓			✓	
Sisyrinchium douglasii	satin flower	✓	✓				
Solidago canadensis	Canada goldenrod	✓		✓		✓	✓
Triteleia hyacinthine	fool's onion	✓	✓				
Viola adunca	western dog violet	✓					

Part Shade Tolerant							
Species	**Common**	**Soil Conditions**			**Wildlife Value**		
		Drought Tolerant	**Well-Drained**	**Organic Soils**	**Deer Resistant**	**Attracts Pollinators**	**Food Source**
Trees and Shrubs							
Acer circinatum	vine maple				✓		
Lonicera ciliosa	trumpet honeysuckle	✓				✓	✓
Mahonia nervosa	low Oregon grape	✓			✓		✓
Oemleria cerasiformis	Indian plum			✓			✓
Rosa gymnocarpa	baldhip rose	✓	✓			✓	✓
Vaccinium ovatum	evergreen huckleberry	✓	✓			✓	✓
Perennials							
Aquilegia formosa	western red columbine					✓	✓
Dicentra formosa	western bleeding heart					✓	✓
Dodecatheon hendersonii	Henderson's shootingstar	✓		✓			
Erythronium oregonum	white fawn lily	✓	✓				
Heuchera micrantha var. *diversifolia*	small-flowered alumroot	✓	✓	✓			
Polystichum munitum	sword fern	✓			✓		
Trientalis latifolia	broad-leaved starflower	✓		✓			

Sources: Campbell 1995; GOERT 2009; Washington Native Plant Society (http://www.wnps.org/landscaping/herbarium/index.html); HAT 2009; Pettinger and Costanzo 2002.

Table 3. Potential Plant List (Native)

Cultivars							
Species	**Common**	**Soil Conditions**			**Potential Wildlife Value**		
		Drought Tolerant	**Well-Drained**	**Organic Soils**	**Deer Resistant**	**Attracts Pollinators**	**Food Source**
Trees and Shrubs							
Acer circinatum 'Pacific Fire'	'Pacific Fire' vine maple			✓			
Cornus alba 'Prairie Fire'	'Prairie Fire' dogwood	✓			✓	✓	✓
Juniperus virginiana 'Blue Arrow'	'Blue Arrow' juniper	✓			✓		✓
Juniperus communis 'Effusa'	'Effusa' common juniper	✓			✓		✓
Physocarpus opulifolius 'Seward'	'Seward' eastern ninebark	✓				✓	✓

Table 4. Potential Plant List (Cultivars)

Public communication is an essential component of ecological restoration. Effective communication facilitates improved awareness of local environmental issues and participation in restoration processes. Stewardship project communication provides an opportunity to advance awareness of improved biodiversity and the use of native plants in urban gardens. The accessibility of the study area within an urban residential neighbourhood provides an excellent opportunity to communicate stewardship principles and interact with residents. The site preparation process has generated interest from the neighbourhood with residents and pedestrians asking questions and visiting the site to see the progress.

Two key stakeholder groups have been identified: the local resident population and the gardening community at-large. Local residents may express support or concern regarding the garden and engagement of this group is through informal communication (i.e., site signage, plant labelling and information exchange while in the garden). Gardening community engagement may take the form of presentations and garden tours involving the Victoria Master Gardener Association and the Native Plant Study Group, of which the author is a member. A project notice will be sent to various organizations including the Bowker Creek Initiative, Friends of Bowker Creek Society, GOERT, Habitat Acquisition Trust (HAT), and the District.

4.0 Discussion

The benefits of native plant gardening, particularly in terms of stewardship, are well documented. There are also a number of challenges associated with the planning and execution of restoration projects at the private garden scale. These include:

- Native plant availability – potential native plant sources include purchase, salvage and propagation. Local, reputable nurseries are increasingly supplying native plant material as demand grows but inadequate stock and cost can be a limiting factor. It is not always possible to ascertain plant provenance and ethical collection may be a concern. Due to irregular scheduling, plant salvage opportunities such as the Saanich Native Plant Salvage Program are not a reliable source of material. Propagation may reduce costs but additional skills and slow growth rates for some species extends the garden establishment period.
- Negative community perception – perceived diminution of property values due to the prevailing undervaluing of native plants and the limited tolerance of informal "wild" gardens, especially in front yards. A well designed and maintained native plant garden may help to change attitudes and improve neighbourhood acceptance.
- Herbivory – deer and rabbit damage must be anticipated. Damage can be mitigated through plant selection and, structural and mechanical deterrents.
- Unwanted wildlife – predation threats and/or the introduction of unwanted invasive species must be considered in the design and installation of site features (i.e., brush piles, feeders and houses).
- Study area conditions – a well established garden depends on selecting the right plant for the right location. Soil structure, texture, available moisture and light conditions will restrict plant selection and influence maintenance requirements.
- Regulatory requirements – bylaws and regulations will affect the project. Awareness of these requirements will reduce potential conflicts.

The intent of this project is to apply stewardship principles in the development of an urban native plant garden. While the realization of these principles is reliant upon the completion of the planting plan, a number of principles have been applied in the planning and site preparation tasks. When the planting is complete, monitoring will be initiated and the need for design amendments and adaptation to the maintenance regime will be evaluated. Fauna observations specific to the study area were not maintained prior to the site preparation. Observations will be recorded over the next year to develop baseline information upon which to assess changes in wildlife activity and diversity as the garden becomes more productive. The following monitoring activities respond to the stewardship principles:

- Walk through the garden once a week (at a minimum) throughout the year to assess garden vigour and to monitor flora and fauna relationships;
- Maintain a photo inventory and record flora observations including growth rate, bloom period, mortality, and diseases;
- Assess and respond to herbivory and predation; and
- Record fauna species diversity and activity (feeding, nesting, movement and predation).

Project scheduling delays were encountered as a result of the lack of response to communication and design inquiries with interest groups and regulatory authorities. Consequently, the completion of project tasks including the application of soil amendments, and the purchase and planting of shrubs and perennials is pending. These delays have not adversely affected the project as it is not dependent upon funding deadlines or volunteer support. Further planting delays may be encountered if certain selected plant material is not available in 2011.

Stewardship is achievable at the small, private garden scale. As part of a matrix of green spaces, private gardens make significant contributions to biodiversity and connectivity (Rudd et al. 2002). The proximity of the study area to Bowker Creek is an important consideration for undertaking such a project, particularly as improvements are made to the greenway as outlined in key planning documents for the watershed. A second consideration is the importance of restoration in the highly fragmented and endangered Garry oak ecosystem. While attempts were unsuccessful to identify specific site reference conditions, the research and documentation of restoration techniques and data for this ecosystem provides invaluable resources upon which to focus stewardship actions in the study area and throughout the District.

The author wishes to acknowledge the following individuals for their generous support and advice during the preparation of this project: Jean Sparks, Oak Bay Archivist; Taylor Davis, Terra Remote Sensing Inc. and Oak Bay resident; Natalie Bandringa, Bowker Creek Initiative Coordinator; Scott Murdoch, Murdoch de Greeff Inc., and most importantly, Andy Swiderski.

References

Bandringa, N. 2011. Bowker Creek Initiative Coordinator. Capital Regional District. Personal communication.

B.C. Ministry of Environment, Lands, and Parks, and B.C. Ministry of Forests. 1998. Field manual for describing terrestrial ecosystems. Land Management Handbook 25. Victoria.

Brickell, C., and T. Cole, ed. 2004. A-Z encyclopaedia of garden plants. Canadian ed. Toronto: Dorling Kindersley.

Campbell, S. 1995. Naturescape British Columbia: Native Plant and Animal Booklet, Georgia Basin. Ministry of Environment, Lands and Parks.

Campbell, S., and S. Pincott. 1995. Naturescape British Columbia: The Provincial Guide. Ministry of Environment, Lands and Parks.

Canadian Biodiversity Information Facility. http://www.cbif.gc.ca/spp_pages/butterflies/index_e.php (accessed 2 June 2011).

Capital Regional District (CRD). Bowker Creek homeowner's guide. http://www.bowkercreekinitiative.ca/documents/BCI_08homeownersguide.pdf (accessed 24 February 2011).

---. Atlas. http://crdatlas.ca. (accessed 24 May 2011).

Chamberlain, D.E., A.R. Cannon, and M.P. Toms. 2004. Associations of garden birds with gradients in garden habitat and local habitat. Ecography 27:589-600.

Corporation of the District of Oak Bay (CDOB). 2011. Pesticide Regulation Bylaw No. 4518. http://www.oakbaybc.org/bylaws/4518.pdf (accessed 2 March 2011).

---. 2010. Zoning Bylaw No. 3531. http://www.oakbaybc.org/bylaws/3531.pdf (accessed 2 March 2011).

---. 2010b. Official Community Plan Bylaw No. 394. http://www.oakbaybc.org/bylaws/3943.pdf (accessed 13 March 13 2011).

---. 2010c. Streets and Traffic Bylaw No. 4100. http://www.oakbaybc.org/bylaws/4100.pdf (accessed 2 March 2011).

---. 2006. Oak Bay, British Columbia: in photographs. Victoria: Oak Bay.

Environment Canada. Climate Normals 1971-2000 for Victoria Gonzales Heights. http://www.climate.weatheroffice.gc.ca/climate_normals/results_e.html (accessed 23 February 2011).

Erickson, W.R. 1993. Garry oak ecosystems. Ecosystems in British Columbia At Risk Series. Ministry of Environment, Lands and Parks, Conservation Centre. Victoria, B.C. 6 pp.

Erickson, W.R. and D.V. Meidinger. 2007. Garry oak (*Quercus garryana*) plant communities in British Columbia: a guide to identification. B.C. Ministry of Forests and Range, Research Branch. Victoria, B.C. Technical Report 040.

Friends of Bowker Creek Society. http://members.shaw.ca/bowkercreek/index.html (accessed18 March 2011).

Fuchs, M.A. 2001. Towards a recovery strategy for Garry oak and associated ecosystems in Canada: ecological assessment and literature review. Technical Report GBEI/EC-00-030. Environment Canada, Canadian Wildlife Service, Pacific and Yukon Region.

Garry Oak Ecosystems Recovery Team (GOERT). 2009. 2nd ed. The Garry oak gardener's handbook: Nurturing native plant habitat in Garry oak communities. http://www.goert.ca/documents/GOERT_Gardeners_Handbook.pdf (accessed 24 February 2011).

Gaston, K.J., P.H. Warren, K. Thompson, and R.M. Smith. 2005. Urban domestic gardens (IV): the extent of the resource and its associated features. Biodiversity and Conservation 14:3327-3349.

Gates, B.R. 2001. Checklist of Birds: Victoria and Southeastern Vancouver Island. Victoria Natural History Society Pamphlet.

Habitat Acquisition Trust (HAT). 2009. Gardening with native plants. http://www.hat.bc.ca/attachments/HAT_Garden_Brochure_web.pdf (accessed 24 February 2011).

Hitchcock, C.L., and A. Cronquist. 2001. 12th ed. Flora of the Pacific Northwest. Seattle: University of Washington.

Jensen, C.A., R.J. Quinn, and T.H. Davis. 2010. Urban Watershed Management: Using remote sensing to implement low impact development. 3rd International Conference on Infrastructure Systems, November 11-13. Shenzhen, China.

Kerr Wood Leidal Associates Ltd. 2007. Bowker creek master drainage plan. Prepared for the Bowker Creek Urban Watershed Renewal Initiative.

Lea, T. 2006. Historical Garry oak ecosystems of Vancouver Island, British Columbia, pre-European contact to the present. Davidsonia 17(2):34-50.

MacDougall, A.S., B.R. Beckwith, and C.Y. Maslovat. 2004. Defining conservation strategies with historical perspectives: a case study from a degraded oak grassland ecosystem. Conservation Biology 18(2):455-465.

MacKinnon, A. 2003. West coast, temperate, old-growth forests. Forestry Chronicle 79(3):475-484.

McKinney, M.L. 2002. Urbanization, biodiversity, and conservation. Bioscience 52(10):883-890.

Mooney, P. 2004. The use of ecological restoration techniques to manage urban and urban fringe sites for avian diversity. 16th International Conference, Society for Ecological Restoration, August 24-26. Victoria, Canada.

Nuszdorfer, F.C., K. Klinka, and D.A. Demarchi. 1991. Chapter 5: Coastal Douglas-fir zone. Pages 81-93. In Ecosystems of British Columbia. Compiled and edited by D. Meidinger, and J. Pojar. B.C. Ministry of Forests.

Pettinger, A., and B. Costanzo. 2002. Rev. Native plants in the coastal garden. North Vancouver: Whitecap.

Pojar, J., and A. MacKinnon. 2004. Rev. Plants of coastal British Columbia. Vancouver: Lone Pine.

Reid Crowther and Partners Ltd., and SHIP Environmental Consultants Ltd. 2000. Bowker creek watershed assessment. Prepared for the Capital Regional District. Available at: http://www.bowkercreekinitiative.ca/index.htm.

Rudd, H., J. Vala, and V. Schaefer. 2002. Importance of backyard habitat in a comprehensive biodiversity conservation strategy: a connectivity analysis of urban green spaces 10(2):368-375.

Schaefer, V., H. Rudd, and J. Vala. 2004. Urban Biodiversity: exploring natural habitat and its value in cities. Concord:Captus.

Schueler, T. 1994. The importance of imperviousness. Watershed Protection Techniques 1(3):100-111.

Sibley, D.A. 2003. Sibley field guide to birds of western North America. New York: Knopf.

Smith, R.M., K. Thompson, J.G. Hodgson, and K.J. Gaston. 2006. Urban domestic gardens (IX): composition and richness of the vascular plant flora, and implications for native biodiversity. Biological conservation 129:312-322.

Sparks, J. 2011. Archivist. District of Oak Bay Archives. Personal communication.

Stewardship Centre for British Columbia. http://www.stewardshipcentre.bc.ca/ (accessed 18 May 2011).

Thompson, K., K.C. Austin, R.M. Smith, P.H. Warren, P.G. Angold, and K.J. Gaston. 2003. Urban domestic gardens (I): putting small-scale plant diversity in context. Journal of Vegetation Science 14:71-78.

Washington Native Plant Society. Native Plants for Western Washington Gardens and Restoration Projects. http://www.wnps.org/landscaping/herbarium/index.html (accessed 11 May 2011).

Westland Resource Group Inc., Kerr Wood Leidal Associates Ltd., and Murdoch de Greef Inc. 2010. Bowker creek blueprint: a 100 year plan to restore the Bowker creek watershed.

Prepared for the Bowker Creek Urban Watershed Renewal Initiative. Available at: http://www.bowkercreekinitiative.ca/index.htm.

Westland Resource Group Inc. 2003. Bowker creek watershed management plan. Prepared for the Capital Regional District. Available at: http://www.bowkercreekinitiative.ca/index.htm.

Appendices

Before renovation (April 2011)

After – new garden bed mulched (June 2011)

Before renovation (April 2011)

After – expanded garden bed mulched (June 2011)

Propagation of *Allium cernuum* (Spring 2011)

Soil Pit (June 2011)

Hand tilling of sod by landscapers (June 2011)

Temporary sign (June 2011)

SCHEDULE “D”
Bylaw No. 4100

List of Permitted Boulevard Plantings*

Category	Botanical Name	Common Name
Shrubs	Erica darlyensis or carnea	Heather
	Pinus mugho (dwarf)	Mugo Pine
	Genista lydia/pilosa	Ornamental Broom
	Viburnum davidii	David Viburnum
	Hebe	Veronica
	Spiraea japonica	Spiraea
	Caryopteris	Bluebeard
	Gaultheria procumbens	Wintergreen
Ferns	Blechtum spicant	Deer Fern
	Polystichum munitum	Western Sword Fern
	Adiantum pedatum	Maidenhair Fern
Grasses	Festuca (dwarf cultivars only)	Fescue
	Carex (dwarf cultivars only)	New Zealand Sedge
	Mahonia nervosa	Dull Oregon Grape
Perennials	Cinereum	Hardy Geranium
	Hosta	Plaintain Lily
	Sedum	Stonecrop
	Armeria maritime	Sea Thrift
	Dianthus	Pinks
	Coreopsis	Tickseed
	Sempervivum	Hens and Chicks
	Galium odoratum	Sweet Woodruff
	Gallardia grandiflora	Blanketflower
	Phormium cookianum (dwarf)	New Zealand Flax
Groundcover	Thymus	Thyme
	Arctostaphylos Uva-ursi	Kinnikinnick
	Vinca minor	Dwarf Periwinkle
Bulbs	Narcissus	Daffodil
	Crocus	Crocus
	Tulipa	Tulip
	Iris	Iris
	Galanthus	Snowdrop
	Dicentra spectabilis	Bleeding Heart

* Except where otherwise indicated, each plant listed includes all cultivars of the plant, i.e., cultivated as distinguished from botanical varieties.

SCHEDULE “E”
Bylaw No. 4100

Boulevard Landscaping Restrictions

Maximum plant height:	75 centimetres above natural grade
Minimum distance of plantings from inboard side of public sidewalk	2 metres
Minimum distance of plantings from curb, if no public sidewalk:	2 metres
Minimum distance of plantings from roadway edge, if no curb or public sidewalk:	2 metres
Maximum depth that soil may be tilled:	20 centimetres below natural grade
Minimum distance of plantings from any water meter, manhole, utility cover or utility pole:	1 metre
Minimum distance of plantings from any fire hydrant:	2 metres
Minimum distance of plantings from any boulevard tree:	2 metres

Request 2011232117.txt

From: info@bconecall.bc.ca
Sent: June-03-11 3:23 PM
To: fergusonm@shaw.ca
Subject: Request 2011232117

BC ONE CALL
Locate Request Confirmation
Reason Code:ROUTINE LOCATE
Request type:CORRECTION
Ticket #:2011232117

CALLER INFORMATION

MARGARET FERGUSON
HOMEOWNER
Fax.:
Pag.:
Alt Cont.:
Email:ferguson

Excavator Type:HOMEOWNER
Tel.:
Cel.:
Tel.:

DIG LOCATION

City:OAK BAY
Comments :
Address To:
Street :
Nearest Intersecting Street :
CRANMORE RD
Second Intersecting Street :

Latitude: 48.43155300 Longitude: -123.31532800

Additional Dig Information:

PRV RES PROP - FRT *** CORR : A/P CALLER WORKING ON BLVD - 01/06 - 3:21PM - FRS ***
Private Property: Yes Dig Area Marked: No Machine Dig: No
Public Property: Yes Planning/Design: No Hand Dig : No

The following utility owners have been notified of your proposed excavation site:

-FORTISBC - GAS -BC HYDRO DIST -TELUS -C
-TELUS

Legend: -C = Cleared

PLEASE REMEMBER:

You must notify any other parties who may have underground facilities in the dig area.

Your excavation activity must start within 14 calendar days of placing this request.

You must call back prior to excavation if this request is for design and planning.

You are not clear to excavate until all members notified have contacted you.

Contractors please remove locate flags upon completion of excavation.

Page 1

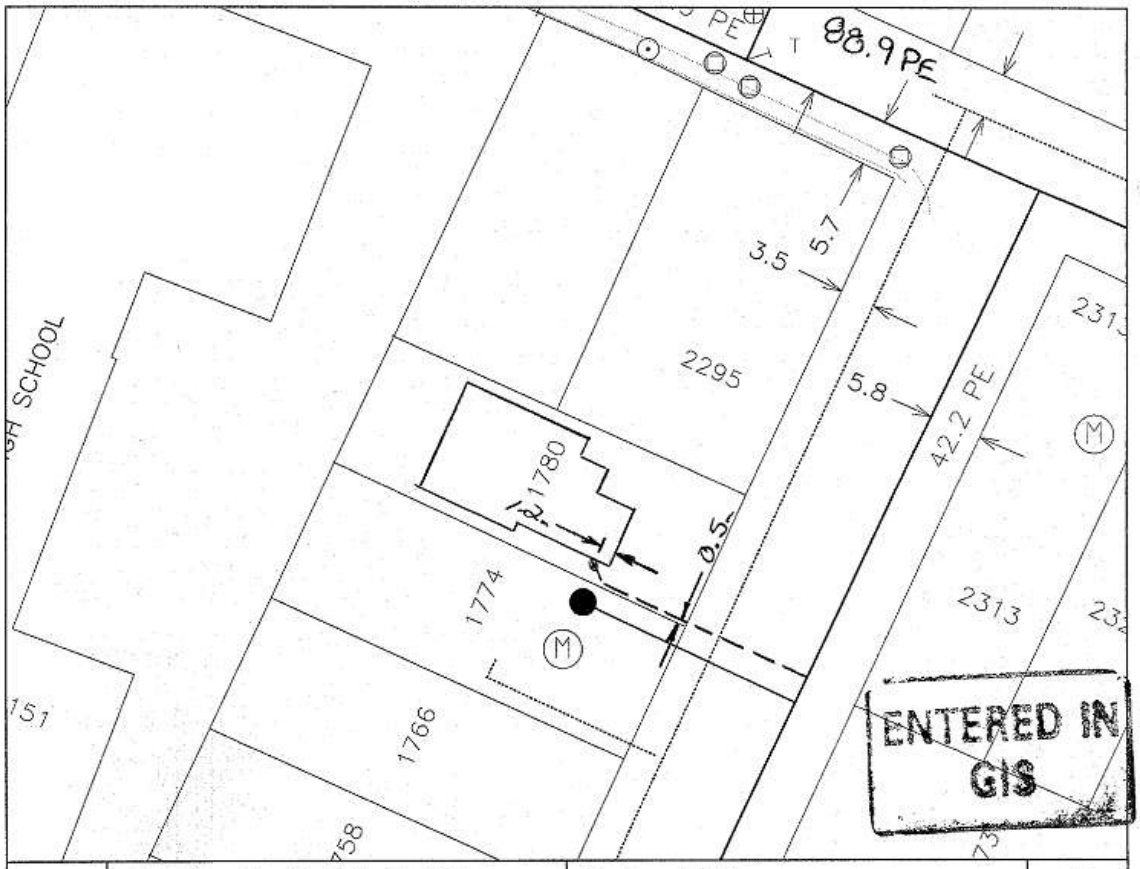
1730 ARMSTRONG AVENUE OAK BAY 6/8/2011 12:51:51 PM

ATTENTION: DO NOT RELY ON THIS INFORMATION ALONE. You must manually dig to locate gas lines before using excavation machinery. All locations are shown approximate only & gas lines built after the date below are not in this information package. FortisBC will not accept responsibility for errors or omissions. Depth of gas line are not available due to possible change of grade.

GAS SERVICE RECORD

Address or Lot # | Street Name | Town: OAK BAY

AREA CODE: 9031 | ACCOUNT: Cramore Rd. | WO#



MAIN DIA mm: 42.2	DEPTH AT MAIN cm: .70	C & M Report #	Millivolt Reading	PIPE: STEEL ☐ PE ☑ — CONTINUITY TEST ☐ — LOCATE ☐ (MAIN / SERVICE)
SERVICE DIA mm: 15.9	DEPTH AT PL cm: .70	AIR TEST 800 KPa for 15 Minutes — SIGNATURE:		METER # — METER TYPE — READING — KPA
PE COIL #: 524	SERVICE PIPE INSTALLED:			FUSERS NAME (Print): D. MACE, D. EVANS — COMP. CREW CONT.: CENTRA
PIPE MANUFACTURER: WIRTH	Main To Property Line (metres): 14.8			
PIPE INSPECT. DATE: SS 02 11 17	Property Line To Riser (metres): 6.6			DATE INSTALLED: 06 06 03 (D M Y)
	TOTAL SERVICE LENGTH (metres): 21.4			

Distribution: ORIGINAL – DISTRICT OFFICE. COPY – HEAD OFFICE. COPY – MUNICIPALITY OFFICE

BC hydro

reliable power,
at low cost,
for generations

Underground Locates
BC 1 Call Phone: 1-800-474-6886
BC Hydro Phone: 1-866-960-3740
BC Hydro Fax: 1-866-844-3498
BC Hydro Email: bchlocates@bchydro.com

Location of B.C. Hydro's Electrical System

The attached drawing shows the location of our electrical distribution system near your location request. Our database, to the best of our knowledge, shows that there is overhead service.

Please note, BC Hydro does not have any record of any private property subfeeds beyond the point of original connection. Please contact a private locator on electrical subfeeds.

PLEASE DIG CAREFULLY AND SAFELY!

If you have any questions, please call our office at 1-866-960-3740 Monday to Friday 8:00am to 4:00pm.

British Columbia Hydro & Power Authority, Bag 6500, 3333 22nd Ave., Prince George, BC V2N 4K4
www.bchydro.com

From: ab1calltickets@telus.com

Sent: June-06-11 1:43 PM

To: ferguson

Subject: Please DO NOT reply back to this automated email.

==========

To: HOMEOWNER Attn: MARGARET FERGUSON

Voice: Fax:

Re: Please DO NOT reply back to this automated email.

This is an important Safety Message from TELUS Communications. We are responding to your request to locate TELUS underground facilities in the specific area of excavation listed on this One Call ticket. Your locate request has been reviewed and its status is explained below. NOTE: This message was generated by an automated system. Please DO NOT reply back to this automated email.

==========

Ticket: 2011232117

County: BRITISH COLUMBIA Place: OAK BAY

Address: Crossed out for personal information protection

ISLOKBA:

Review of Dig-site specified on this locate request has determined there is no conflict with TELUS facilities. We will not be marking TELUS at this time. Although we have cleared this ticket we ask you to use caution while excavating. Any changes to your Dig Site, notify BC 1 Call. TELUS clearance is valid for 14 days. Any questions regarding clearance, please call 1-877-453-2322 for clarification. NOTE: PDFs ARE SENT ONLY WHEN CONFLICT IS IMMINENT WITHIN THE DIG AREA. *Please Note* TELUS records show Aerial (Over Head) phone lines at the Dig Site address on your locate request. Spoke to Margaret

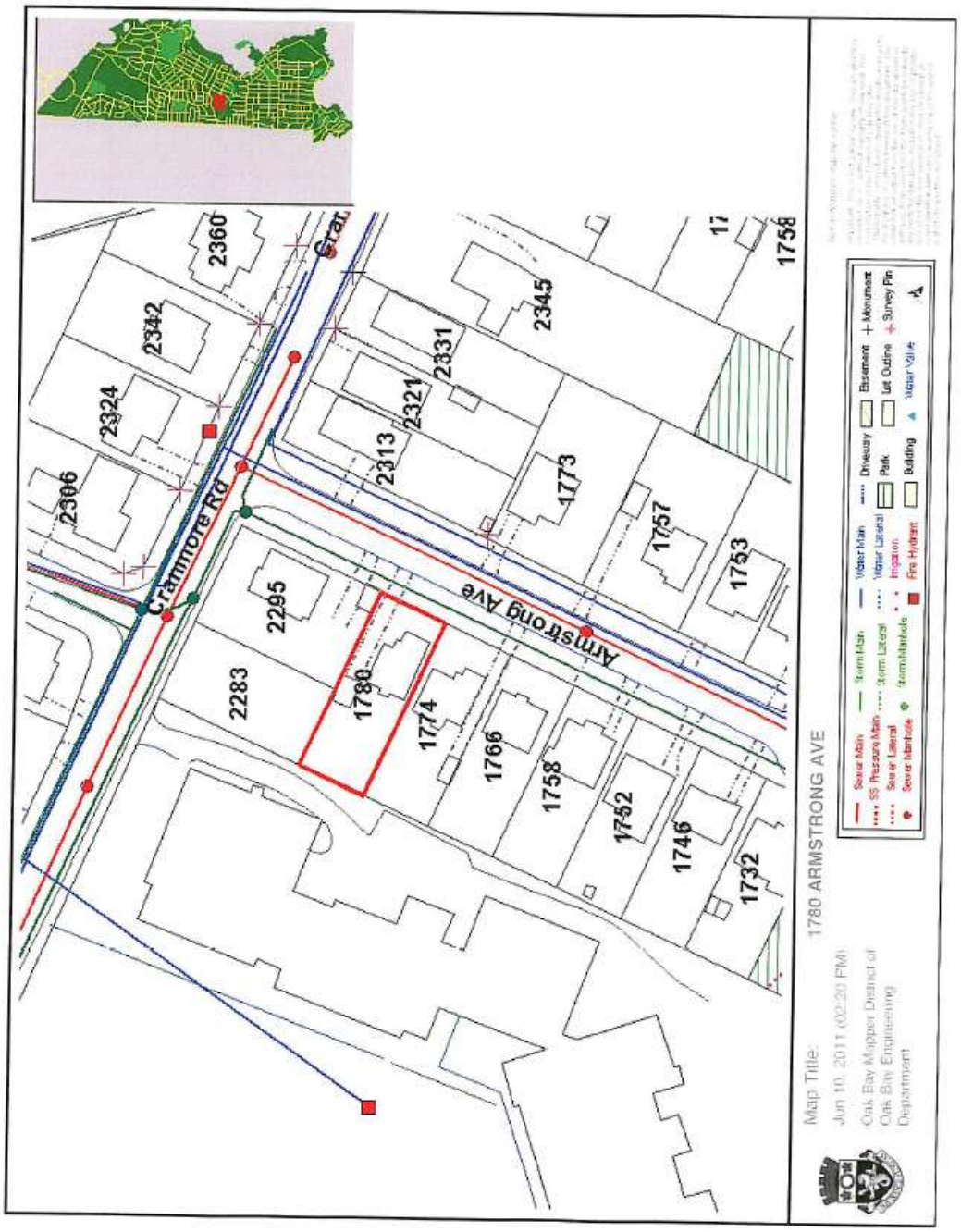
==========

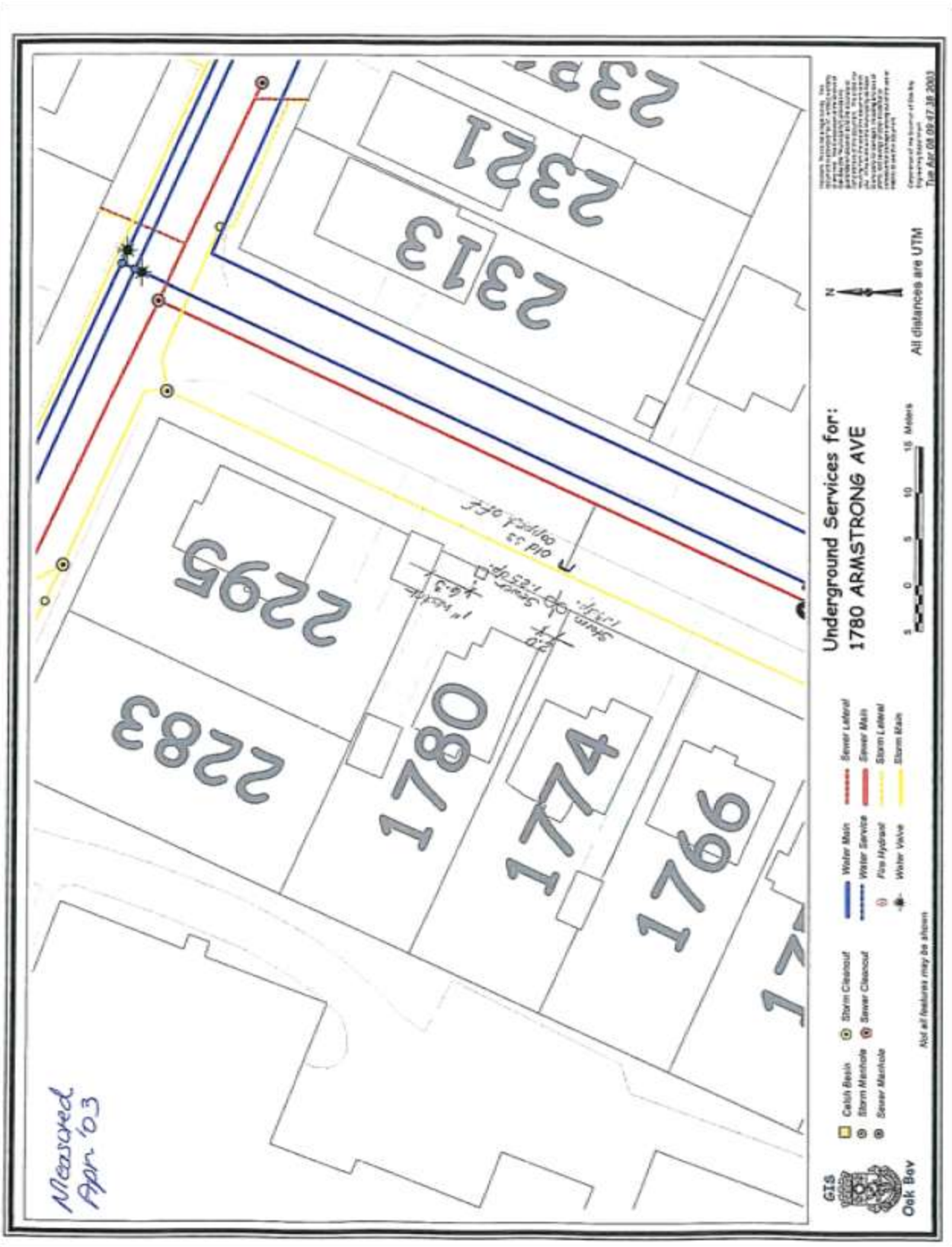
If you have any questions regarding this response, please call the TELUS Cable Screening Department in AB @ 1-800-980-0030 or TELUS Cable Screening Department in BC @ 1-877-453-2322 for clarification. Any damage to TELUS facilities, MUST be reported as a "Dig Up" to your provincial ONE CALL Office ASAP.

Thank you for calling before you dig!

==========

This message was generated by an automated system. Please do not reply to this email.


Map Title:
1780 ARMSTRONG AVE
Jun 10, 2011 (02:20 PM)
Oak Bay Mapper Disclaimer
Oak Bay Engineering Department
Crammore Rd
Armstrong Ave
2360
2342
2324
2306
2313
2321
2331
2345
1773
1757
1753
1758
2295
2283
1780
1774
1766
1758
1752
1746
1732
Sewer Main
Storm Main
Water Main
Driveway
Basement
Monument
SS Pressure Main
Storm Lateral
Water Lateral
Park
Lot Outline
Survey Pin
Sewer Lateral
Irrigation
Building
Water Valve
Sewer Manhole
Storm Manhole
Fire Hydrant


Underground Services for:
1780 ARMSTRONG AVE
All distances are UTM
Tue Apr 05 09:47:38 2011
Measured Apr '03
2313
2321
2295
2283
1780
1774
1766
Water Main
Water Service
Fire Hydrant
Water Valve
Sewer Lateral
Sewer Main
Storm Lateral
Storm Main
Catch Basin
Storm Manhole
Sewer Manhole
Storm Cleanout
Sewer Cleanout
Not all features may be shown
GIS
Oak Bay

Margaret Ferguson

February 14, 2011 Mail

District of Oak Bay
2167 Oak Bay Avenue
Victoria, BC V8R 1G2

Attention: Dave Marshall, Director of Engineering Services

Re: Bylaw No. 4100, Schedule "D" List of Permitted Boulevard Plantings

Dear Mr. Marshall,

As a resident of Oak Bay who is considering restoring their front yard into a native plant garden, and as a trained landscape architect, a member of the Victoria Master Gardener Association and a student of the University of Victoria Restoration of Natural Systems program, I am providing the following comments on the List of Permitted Boulevard Plantings that is part of municipal Bylaw No. 4100.

The benefits of native plants are well documented and should be promoted by the District particularly in boulevards where plants can undergo adverse environmental conditions including, drought, pollution, and physical damage. The availability of native plants for purchase is becoming more widely available and agencies such as the Garry Oak Ecosystem Restoration Team (http://www.goert.ca/) provide gardeners with invaluable information about native plant gardening. The restrictive nature of the bylaw and the limited number of identified native plant species makes it difficult to achieve a viable native plant garden.

Schedule E provides height and setback restrictions that makes execution and enforcement achievable without the complications of plant identification. I would suggest that the plant list be considered a guide only, allowing homeowners adjacent to boulevards the opportunity to use an expanded range of native plants. For further guidance, the bylaw should also state that native plants are encouraged and that invasive species are not permitted thus meeting goal (t) stated in the Official Community Plan:

To preserve and enhance the quality of the natural environment of Oak Bay.

Regarding invasive species, I would also like to bring to your attention to two plants identified on the list that are potential problems for the natural environment. The first is the groundcover *Vinca minor* (periwinkle). Periwinkle has been identified by a number of agencies as an invasive plant, and is considered:

- An 'Invasive Plant' by the Invasive Plant Council of BC (*Grow me Instead: Beautiful Non-Invasive Plants for your Garden* – A Guide for Southern British Columbia). The page of this brochure identifying the problem with *Vinca* and recommended substitution plants is attached;
- An 'Invasive Plant' in Saanich (*Controlling Invasive Plants on Your Property* brochure). Victoria has also identified ongoing treatment of periwinkle in Summit Park;
- A plant to be 'Controlled' on the list of Priority Invasive Plants in the South Coastal Mainland Region by the Coastal Invasive Plant Committee, the Sea to Sky Invasive Species Council, the Fraser Valley Invasive Plant Council, and the Greater Vancouver Invasive Plant Council (*Pest Management Plan for Invasive Alien Plant and Noxious Weed Control on Provincial Crown Lands within the South Coastal Mainland of British Columbia*, 2011); and
- A 'Species of Concern' in the Lower Mainland identified by Evergreen Canada (*Invasive Species – Stop the Spread* brochure).

The second potential problem plant included on the list is *Iris* (Iris). One species in particular is *Iris pseudacorus* (Yellow flag). It is also a listed invasive species by the same identified agencies.

Consideration should be given to removing *Vinca minor* and *Iris pseudacorus* from the list to avoid future problems. The District should also consider preparing an invasive species brochure similar to Saanich that would help residents and the landscape industry identify and control invasive species in Oak Bay.

Thank you for considering these comments. I would be pleased to speak with you regarding this subject.

Sincerely,

M. Ferguson

Margaret Ferguson, CSLA

attachment

From: Dave Marshall [dmarshall@oakbaybc.org]
Sent: March-30-11 9:52 AM
To: ferguson
Subject: Permitted Boulevard Plantings

Thankyou for your letter of February 14th with regard to permitted plantings. Your insight and knowledge in this area is useful to us and I will pass along to our parks department for their consideration. It was envisioned when the bylaw was adopted that there would be changes over time to address items such as you have commented on.

Thanks

Dave M

David Marshall B.Sc., A.Sc.T.
Director of Engineering Services
The Corporation of The District of Oak Bay
2167 Oak Bay Avenue
Victoria, British Columbia, V8R 1G2
Tel: 250-598-3042
Fax: 250-598-9108
Cellular: 250-812-7114
email: dmarshall@oakbay.ca
web: www.oakbaybc.org

Selected Rain Garden Resources

Bannerman, R. 2003. Rain Gardens: a how-to manual for homeowners. University of Wisconsin Extension.

Canada Home and Mortgage Corporation (CMHC). Rain Gardens: Improve Stormwater Management in your Yard. Available at: http://www.cmhc-schl.gc.ca/en/co/maho/la/la_005.cfm.

Capital Regional District (CRD). Watershed Protection: Rain Gardens. Available at: http://www.crd.bc.ca/watersheds/lid/garden.htm.

City of Portland. 2009. How to manage stormwater: rain gardens. Available at: http://www.portlandonline.com/BES/index.cfm?a=188636&c=46962.

Hinman, C. 2007. Rain Garden Handbook for Western Washington Homeowners: designing your landscape to protect our streams, lakes, bays and wetlands. Washington State University. Pierce County Extension.

Hinman, C. 2005. Low Impact Development: technical guidance manual for Puget Sound. Washington State University. Pierce County Extension.

Malmkvist, L. 2011. Homeowner Rainwater Management Seminar. May 28, 2011. Available at: http://www.swell.ca/.

February 19, 2011 Email and Mail

District of Oak Bay
2167 Oak Bay Avenue
Victoria, BC V8R 1G2

Attention: Dave Marshall, Director of Engineering Services

Re: Proposed Alterations to 1780 Armstrong Avenue Front Yard and Boulevard

Dear Mr. Marshall,

As part of a University of Victoria Restoration of Natural Systems program project, I am preparing a restoration plan for my front yard and garden. This plan is to include a conversion of lawn and shrub beds to a native plant garden. I am also considering the construction of a rain garden as a contribution to minimizing runoff which is an important urban watershed issue.

Armstrong Avenue is a short, no-through road north of Bowker Creek. Drainage is generally north-south toward Bowker Creek from Cranmore Avenue. The street does not include sidewalks but receives considerable pedestrian traffic due to the proximity of the creek, recreation centre and Oak Bay High School. The approximate landscape area dimensions of the front property are (see attached photo):

Total Landscape Area (soft landscape, excluding driveway)	37' width x 40' length;
Private Portion	37' width x 19.5' length;
Boulevard Portion	37' width x 20.5' length;

Dependent upon design data, a rain garden within the boulevard that channels runoff from the impervious road surface catchment area, may be feasible and effective. The rain garden design would include a curb cut and suitable native plant material. I have discussed this project with Taylor Davis who designed and built the first rain garden in Oak Bay.

The approval and assistance from the District is requested. I would be interested to discuss this project with you.

Sincerely,

M. Ferguson

Margaret Ferguson, CSLA