TERRENO "A Hillside Development"

Lot 1, Plan 84653, 2755 McCurdy Road, Kelowna, BC

Environmental Impact Assessment

Prepared For:

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May 2022 File No. 19-2765

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1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) has been retained by Troika Management Corp. (Troika) to complete an Environmental Impact Assessment (EIA) of the hillside portion (area west of Mill Creek) of a property in Kelowna, BC near the west end of McCurdy Road in relation to a proposed development (Figure 1) (Appendix A). The subject property is legally described as Lot 1, Plan K84653 and is currently zoned as A1 (Agriculture-1) (hereafter referred to as the subject property). Ecoscape understands that rezoning is proposed for the subject property for increased density. This report pertains to the rezoning and proposed development; it provides a summary of existing environmental and biological resources, addresses the potential impacts from the proposed development, and recommends mitigation measures to be implemented during construction, and proposed restoration of the subject property. A Restoration and Compensation Plan (RCP) (restoration plan) created by Ecoscape has been included within **Appendix B** of this report and will be submitted to the Province as a part of the WSA Section 11 Approval (R8005509) for the McCurdy Road extension. Finally, this report considers other municipal projects such as the McCurdy Road extension, and the Central Okanagan Multi-modal Corridor (COMC), but is not a cumulative impacts assessment of all potential impacts that may arise from several, intertwined processes. A phasing plan has not yet been created, however will be determined at a later date.

1.2 Project Description

The subject property is approximately 25 hectares and triangular in shape. The proposed hillside development will be residential in nature and will include townhouses and condominium apartments within three (3) phases. The development footprint covers approximately **5.94 hectares** within the subject property boundaries and includes the proposed McCurdy Road extension - but not the COMC. It should be noted that construction of a detention pond, multi-plate culvert, and extension of Mount Baldy Drive, are either partially or fully outside of the property boundaries.

The location of the proposed development of the hillside property has been constrained by the following roadway and gas line easements:

1. The proposed 4-lane, Central Okanagan Multi-modal Corridor (COMC) will occur at the base of the hillside west of Mill Creek (extending north/south bisecting the subject property), the proposed COMC alignment has been provided by D.E. Pilling & Associates Ltd. It is recognized that the COMC may have profound environmental implications for wildlife that frequent the area, however, the proposed COMC was not evaluated as part of the current or previous assessments undertaken by Ecoscape for the subject property. The COMC has only been considered to ensure that proposed compensation and wetland enhancements do not fall within the proposed COMC footprint. *Currently the proposed location of detention pond one is within the proposed*

pathway of the COMC; however, it is anticipated that the pond could be moved if COMC receives approval at a future date.

2. Second, there is a Fortis gas line easement that runs in a north/south direction and bisects the subject property.

The subject property also contains two riparian corridors that include Mill Creek (Waterbody ID 310-808200) and Unknown Creek (Watershed Code 310-808200) - which enters the subject property on the western boundary and flows into Mill Creek. A specific name for the Unknown Creek was not found within varied municipal online mapping services (i.e., RDCO GIS Kelowna Map Viewer), or the Sensitive Habitat Inventory and Mapping (SHIM) Data Base for the Kelowna area; however, the Unknown Creek is labeled as Dilworth Creek within the BC Habitat Wizard iMap service. For better clarity, the Unknown Creek will be referred to as Dilworth Creek throughout this report (Habitat Wizard 2021).

It is critical to ensure that development adjacent and within these riparian corridors allows for adequate wildlife movement and continued riparian function. Other development limitations include areas with slopes greater than 30% and the presence of high-value environmentally sensitive areas (ESA) and rare grassland and woodland ecosystem communities (**Figures 2 & 3**).

1.3 Background

A previous environmental assessment and sensitivity analysis to address the environmental inventory stage of the project was completed by Ecoscape in September 2019. This assessment provided initial development recommendations which have been taken into consideration during the designing of the proposed development (**Appendix A**). Much of the previously collected information has been retained in this current report, although ecosystem polygons have been updated to reflect current conditions. Additional site visits were undertaken in August 2021 to reassess the site, and in August and September 2019 to reassess the wetland extents, which were also mapped in 2011, 2016, and 2019. The proposed works have been detailed on **Figure 4**.

Additional permitting related to the development that has been completed at this time includes:

- *A Water Sustainability Act (WSA)* Section 11 Notification (R8005878) application submission to the Province for replacement of the existing culvert crossing over Mill Creek (Waterbody ID 310-808200) as part of the McCurdy Road extension. *The WSA Section 11 application is currently under review by MFLNRORD, and is awaiting updated culvert designs for the crossing.*
- A WSA Section 11 Notification (R8005508) application for installation of a culvert to maintain drainage from an ancillary channel south of Dilworth

Creek, to the existing cat-tail marsh located on the east side of the proposed extension of Mount Baldy Drive. *On June 8, 2021, a WSA Section 11 Notification permit was issued for the work outlined within the application.*

• *WSA* Section 11 Approval (R8005509) application for extension of McCurdy Road from its terminus at Mill Creek to Mount Baldy Drive, and its intersection with a cattail marsh associated with Dilworth Creek. *The WSA Section 11 application is currently under review by MFLNRORD, and is awaiting a restoration and compensation plan currently in development by Ecoscape.*

Designs for the development – including the detention pond, and multi-plate culvert proposed for Mill Creek have been included within **Appendix A** of this report.

2.0 ENVIRONMENTAL ASSESSMENT

An environmental site assessment was carried out by Natural Resource Biologists Jason Schleppe, M.Sc., R.P. Bio, and Mary Ann Olson-Russello, M.Sc., R.P. Bio. of Ecoscape on April 4 and June 11, 2008. Additional wetland mapping was undertaken by Kyle Hawes, R.P. Bio. and Mary Ann Olson-Russello, M.Sc., R.P. Bio. on August 22, 2011, and further visits were completed on April 1, 2016 by Jason and Mary Ann to confirm existing conditions and to determine appropriate locations for wetland enhancement. Additional site visits were undertaken in August and September 2019 to reassess the wetland extents, and most recently in August 2021 to reassess the site conditions. Data collection and reporting standards are pursuant to the COK Official Community Plan (OCP).

The following sections detail the data collection methods that were used to assess the subject property and the resulting ecological conditions and values present.

2.1 Vegetation and Ecosystem Mapping

2.1.1 Methods

Updated ecosystem mapping for the central Okanagan Valley provided the foundation for habitat mapping within the subject property (Haney and Iverson 2009). Haney and Iverson (2009) should be referenced for specific details of methods and procedures used in the creation of the Sensitive Ecosystem Inventory (SEI). However, in short, a bioterrain approach was used to create polygons, as they were delineated on 1:15,000 color aerial photographs. Polygons were more or less drawn around areas of uniform vegetation, topography and terrain features and were subsequently digitized and compiled in a geographic information system (GIS) (**Figure 2**).

With the SEI data as a baseline, polygons within the subject property were groundtruthed to verify the accuracy of the ecological classification, and to make note of any significant findings (e.g. raptor nests, degree of pine beetle infestation, recent land clearing, and extent of disturbance). Higher resolution mapping was used to delineate environmentally sensitive features and the SEI polygons were modified to reflect the additional detail (**Figure 3**). Specifically, Ecoscape collected GPS data that delineates the top of bank of the riparian corridor of Dillworth Creek/cattail marsh and offset Mill Creek by 30 meters (m) in order to create single polygons that uniformly and accurately represent the boundaries of these sensitive riparian corridors. Ecoscape assigned the 30 m offset based on the requirements of the COK OCP, which was designed to meet or surpass the Provincial Riparian Areas Protection Regulation (RAPR). Proposed riparian setbacks along the are also consistent with the COK OCP (City of Kelowna 2011).

2.1.2 Terrestrial Ecosystems

The subject property occurs in the Okanagan very hot dry Ponderosa Pine variant (PPxh1). The SEI identified ten (10) different ecosystem types that occur within thirty-three (33) ecosystem polygons after the higher resolution mapping was completed (**Figure 2**). **Table 1** summarizes the ecosystem codes, site series, and the polygon numbers for where each ecosystem is located.

Table 1. Distribution of ecological communities occurring on the subject property.					
Ecosystem Code Site Series Site Series Name		Polygon(s)			
CD 00		Black cottonwood/Douglas-fir - Snowberry - Red- osier dogwood	7, 8		
CF	N/A	Cultivated Field	13, 14, 29,		
СТ	CT 00 Cattail Marsh		15		
DM	08	Douglas-fir – Water birch – Douglas maple	1, 20, 33		
ES	N/A	Exposed Soils	19		
FB 00 Rough fescue – Blue		Rough fescue – Bluebunch wheatgrass	2, 3, 9, 17, 23		
PF	05	Ponderosa pine – Bluebunch wheatgrass – Rough fescue	11, 24, 25,		
PW	01	Ponderosa pine – Bluebunch – Idaho fescue	21, 31		
SB	00	Selaginella – Bluebunch wheatgrass rock outcrop	22		
WB	93	Bluebunch wheatgrass - Balsamroot	4, 12, 16, 26, 27, 28, 32		

Generally, the study area consists of an open, grassland community with pockets of coniferous forest. Additionally, there are two distinct riparian corridors: 1) Mill Creek (Watershed code: 310-808200) is a 4th order stream, with a stream magnitude of 78 and occurs along the eastern boundary of the subject property; 2) Dilworth Creek, which enters the subject property along the northwest boundary and eventually flows into Mill Creek. A small ancillary channel and cattail march also exist along the western boundary of the subject property. The provincial RAPR is applicable to both of these stream corridors, noting that the City of Kelowna has self-declared compliance with RAPR and operates through the Official Community Plan only. As such, Ecoscape has prepared this report to comply with City of Kelowna OCP policies, using their standard Terms of Reference.

The slope and aspect of the subject property is highly variable, and includes east, north and south facing slopes, gullies, as well as relatively flat areas. Portions of the land are intact and relatively natural in character, while other parts have substantial anthropogenic disturbance in the form of invasive plants (likely a result of intensive cattle grazing), old-dilapidated structures, piles of wood and farming waste, 4x4ing, and environmental impacts as a result of recent blasting activities for the COMC (Olson and Schleppe 2008) (**Photos 1, 2, 3 and 4**).

The extent of weedy vegetation varies throughout the subject property depending on the level of disturbance and the specific ecosystem community. Areas with the greatest invasive species coverage includes the grassland community in the northern portion of the subject property (polygons 4 and 5), the immediate area surrounding the gas line easement, and the cultivated fields which are directly adjacent to riparian association of Mill Creek. The dominant grassland weeds are sulphur cinquefoil (*Potentilla recta*), cheatgrass (*Bromus tectorum*) and diffuse knapweed (*Centaurea diffusa*).

The gas line easement bisects the subject property and extends across many of the ecosystem polygons (**Figure 2**). Generally, the area of easement is less than 10% of the polygon area, therefore it is not specified as its own decile for classification/identification purposes. Nevertheless, it should be noted that the area in and around the gas line easement has been modified and therefore it generally has lower ecological value than adjacent non-disturbed lands.

The SEI identified three distinct grassland communities within the subject property: 1) Rough fescue – Bluebunch wheatgrass (FB-PPxh1-00) tends to be the most disturbed and is found along the northern and southern boundaries of the property (**Photo 1**); Bluebunch wheatgrass – Balsamroot (WB-PPxh1-93) is much more intact, with little weed coverage in most areas (**Photo 5**). This community tends to occur on steeper slopes where there has been less disturbance, and; 3) Selaginella - Bluebunch wheatgrass - Rock outcrop (SB-IDFxh1-00) only sparsely occurs, representing approximately 2% of the subject property (**Photo 6**).

The treed terrestrial ecosystem types within the subject property include Ponderosa pine - Bluebunch wheatgrass - Rough fescue (PF – PPxh1 – 05) and Ponderosa pine - Bluebunch wheatgrass - Idaho fescue (PW – PPxh1 – 01) (**Photo 7**). These ecosystems occur as relatively small pockets mostly along the western boundary of the subject property. The conifers in these communities are a structural stage 5 and are likely to be between 40 and 80 years old. These communities tend to be dry, are often associated with very shallow soils and occur in the mid to upper portions of slopes. The forest canopy is relatively open with only 20-40% crown closure. Ponderosa pine tends to dominate in the PW – PPxh1 – 01 ecosystem, while Ponderosa pine and interior-Douglas fir more equally occur in the PF – PPxh1 – 05 community. Herbs commonly associated with these ecosystems include arrow-leaved balsamroot (*Balsamorhiza sagittata*) and yarrow (*Achillea millefolium*).

Cultivated fields also occur within the subject property, extending along the western side of Mill Creek and also in the northwestern corner. It is thought that the fields were primarily used for growing hay (Phillips 2006), however, with the lack of attention in recent years, they also support a variety of weedy species.

2.1.3 Riparian Ecosystems

The Black cottonwood/Douglas fir – Common Snowberry – Red-osier Dogwood Riparian community (CD – IDFxh1 – 00) extends along Mill Creek (**Photo 8**). This ecosystem is commonly associated with active floodplains and fluvial terraces with subsurface water. Within the subject property it exists as a narrow, riparian fringe (<10 m). The dominant tree species are black cottonwood (*Populus balsamifera* ssp. *trichocarpa P. trichocarpa*), and willow (*Salix* spp.) The understory is a dense network of shrubs and herbs, including Douglas maple (*Acer glabrum*), snowberry (*Symphoricarpos albus*), red-osier dogwood (*Cornus stolonifera*), stinging nettle (*Urtica dioica*), and reed canarygrass (*Phalaris arundinacea*).

The ancillary riparian corridor along the west side of the subject property consists of two watercourses. Dilworth Creek enters the subject property in the northwest corner and is agriculturally fed (pers. comm., Kyle Hawes) and appears to maintain flows year around. The other watercourse originates from an immediately adjacent property that was historically used for mushroom farming. During the 2011, 2015, and 2021 site visits, flows were still originating from the property, however downstream wetlands were less extensive than previously documented. The extents of the wetlands were field truthed and re-delineated in 2019 to accurately document this transitioning area. Nevertheless, there are multiple cattail marsh systems (CT) that maintain dense cattail (*Typha latifolia*) stands both within the ancillary riparian corridor, and Mill Creek (**Photo 9**).

The remaining ecosystem component of the ancillary riparian corridor is classified as Douglas-fir – Water birch – Douglas maple (DM – PPxh1 – 08) (**Photo 10**). This ecosystem extends from the western property boundary across to Mill Creek. Species documented within this community include: Douglas maple (*Acer glabrum*), interior-Douglas fir (*Pseudotsuga menziesii* var. *glauca*), mock-orange (*Philadelphus lewisii*), red-osier dogwood (*Cornus stolonifera*), trembling aspen (*Populus tremuloides*), prickly rose (*Rosa acicularis*), black hawthorn (*Crataegus douglasii*), and Saskatoon (*Amelanchier alnifolia*).

2.1.4 Conservation Status of Ecosystem Communities

Table 2 presents the ecosystem codes, their associated site series name and provincial status identified on the subject property. Red listed communities are defined as those which are thought to be extirpated, endangered or threatened. Blue listed are considered either vulnerable or at risk. Of the ten ecosystem types, four are provincially Red-listed, three are provincially Blue-listed, one is not classified and two are anthropogenic units (CF and ES) (CDC 2021).

Table 2. Conservation status of ecological communities occurring within the subject property.			
Ecosystem Code	Site Series	Site Series Name	Provincial Status
CD	00	Black cottonwood/Douglas fir-Common Snowberry- Red-osier Dogwood Riparian	Red Listed
CF	N/A	Cultivated Field	-
СТ	00	Cattail Marsh	Blue Listed
ES	N/A	Exposed Soils	-
DM	08	Douglas-fir - Water birch - Douglas maple	Red Listed
FB	00	Rough fescue - Bluebunch wheatgrass	Red Listed
PF 05		Ponderosa pine - Bluebunch wheatgrass - Rough fescue	Red Listed
PW	01	Ponderosa pine - Bluebunch wheatgrass - Idaho fescue	Blue Listed
SB	00	Selaginella - Bluebunch wheatgrass rock outcrop	Not classified
WB	93	Bluebunch wheatgrass – Arrowleaf balsamroot	Blue Listed

2.2 Wildlife Resource Values

Bird species recorded (visual/song/call) during previous site assessments include California Quail (*Callipepla californica*), Black-billed Magpie (*Pica hudsonia*), Pygmy Nuthatch (*Sitta pygmaea*), American Crow (*Corvus brachyrhynchos*), Black-capped Chickadee (*Poecile atricapilla*), Northern Flicker (*Colaptes auratus*), Ring-necked Pheasant (*Phasianus colchicus*), American Robin (*Turdus migratorius*), Brewer's Blackbird (*Euphagus cyanocephalus*), Song Sparrow (*Melospiza melodia*), Red-winged Blackbird (*Agelaius phoeniceus*), Red-tailed Hawk (*Buteo jamaicensis*), Cedar Waxwing (*Bombycilla cedrorum*), Belted Kingfisher (*Ceryle alcyon*), Killdeer (*Charadrius vociferous*) Canada Goose (*Branta Canadensis*), Mallard (*Anas platyrhynchos*), Common Snipe (*Gallinago gallinago*), American Goldfinch (*Carduelis tristis*), Rock Dove (*Columba livia*), Violet-green Swallow (*Tachycineta thalassina*), Eastern Kingbird (*Tyrannus tyrannus*) and Gray Catbird (*Dumetella carolinensis*). Many of the incidental observations occurred within or adjacent to the riparian corridors. A Red-Tail Hawk nest was also found on April 1, 2016 within the Mill Creek corridor (**Figure 3**).

The study site is also utilized by deer, as scat, bedding sites and game trails were found throughout. Other species documented on site include Yellow Bellied Marmot (*Marmota flaviventris*) and Garter Snake (*Thamnophis sirtalis*). Additional evidence of species presence includes beaver dams, and a network of denning holes at the base of the hillside approximately 50 m from Mill Creek (**Photos 11 & 12**) (**Figure 2**). Ecoscape suspects that these dens are likely used by coyotes but may also support badger. Previous environmental reporting for the site indicated some evidence of badger activity near the south end of the subject property, however, nothing was observed to indicate a resident badger (Phillips 2006; Personal Communication -C. Hoodicoff 2008). During the September 12, 2019 site visit, Ecoscape identified two burrows near the north end of the site (**Figure 2**).

The relatively few pockets of coarse and fine talus found in the southwestern and northwestern portion of the subject property provide important habitat for reptiles (**Photo 13**). Reptiles in particular use these features for denning, security cover and basking sites. Reptiles that be most likely to utilize the subject property include the Racer (*Coluber constrictor*), Western Skink (*Eumeces skiltonianus*), Gopher Snake (*Pituophis catenifer deserticola*), common garter snake (*Thamnophis sirtalis*), terrestrial Garter Snake (*Thamnophis elegans vagrans*), and Northern Alligator Lizard (*Elgaria coerulea*). Ecoscape observed a Common Garter Snake in Mill Creek.

Detailed wildlife surveys were not conducted at the time of the 2021 site visit; however, Ecoscape has previously identified important areas for wildlife corridors within the subject property and surrounding area including from Mill Creek, into natural areas of Dilworth Mountain, and to both agricultural and park area to the north and east of the subject property (see Section 2.5 below).

According to the Conservation Data Centre, Shape ID 74373, Occurrence ID 10214, spans a vast area east of Okanagan Lake, including the proposed work area and represents a sighting of the provincially Red-listed American Badger (Taxidea taxus) (BC CDC 2021). The American Badger was last observed in Kelowna in June 2016, denning adjacent parking lots at the University of British Columbia Okanagan, several kilometers northeast of the subject property (Hawes & Olson-Russello 2016). Shape ID 103065, Occurrence ID 12793, occurs 1.5 km northeast of the proposed work area, and represents a sighting of the Blue-listed Painted Turtle, intermountain subspecies (Chrysemys picta), last observed in 2009 (BC CDC 2032). Areas of cattail marsh along the ancillary riparian corridor may provide suitable habitat for turtles, specifically the painted turtle. Shape ID 103721, Occurrence ID 12986, occurs approximately 450 m south of the subject property, and represents a Provincially Blue-listed common cattail marsh (Typha latifolia) ecological community. Shape ID 77205, Occurrence ID 10409 occurs along the riparian corridor adjacent to Mill Creek and represents a Provincially Red-listed black cottonwood / common snowberry - roses ecological community.

Multiple critical habitat areas occur within the subject property. Critical habitat ID 61422, Object ID 10312571 represents critical habitat for the provincially Red-listed, Yellow-Breasted Chat (*Icteria virens*), and occurs along the riparian area of Mill Creek within the east side of the subject property. Critical habitat ID 71533, Object ID 10322412 represents critical habitat for the provincially Blue-listed Great Basin Gophersnake (*Pituophis catenifer deserticola*) and encompasses the subject property. A sighting of a Great Basin Gophersnake along the section of the Okanagan Rail Trail adjacent to the subject property was recorded in May 2021.

2.3 Fisheries Resource Values

Mill Creek is located to the east of the subject property, and Dilworth Creek enters the subject property on the western boundary and flows into Mill Creek. Mill Creek supports a broad range of fish species including Eastern Brook Trout (*Salvelinus*)

fontinalis), Burbot (Lota lota), Carp (Cyprinus carpio), Kokanee (Oncorhynchus nerka), Largescale Sucker (Catostomus macrocheilus), Northern Pikeminnow (Ptychocheilus oregonensis), Peamouth Chub (Mylocheilus caurinus), Prickly Sculpin (Cottus asper), Rainbow Trout (Oncorhynchus mykiss) and Redside Shiner (Richardsonius balteatus).

Sensitive habitat inventory and mapping (SHIM) has been completed for Mill Creek (Hawes 2006). Within the City of Kelowna, Mill Creek extends approximately 23 km, of which about 21 km (89%) have been anthropogenically modified. A run/glide hydraulic character predominates for nearly 40% of the SHIM stream length. Riffle-pool character accounts for about 31%, while very slow-moving slough/pond, influenced by beaver together account for about 29% of the SHIM stream length (Hawes 2006).

Mill Creek, adjacent to the subject property, averages 11.2 m in width and has an average gradient of 0.6%. The creek channel exhibits riffle pool morphology, with substrates ranging from silts to gravel. There is at least one area of good spawning habitat in the portion of Mill Creek adjacent to the subject property (Phillips 2006).

2.4 Riparian Assessment

The riparian setback from Mill Creek is 30 m from the top of bank, following the City of Kelowna OCP. A vegetated swale from the outflow of detention pond 1 and the McCurdy Road crossing are the only portions of the development that occur within the 30 m setback of Mill Creek within the subject property.

In accordance with the COK OCP, a 15 m setback is required from existing wetlands and a 15 m setback from Dilworth creek and the ancillary creek are included within the development, noting that some riparian offsetting is required for two small building encroachments (**Figure 4**). These encroachments have been reduced from previous development proposals.

2.5 Wildlife Connectivity and Key Wildlife Crossings

Wildlife corridors generally occur in gullies and low-lying areas, or at the toe or on top of steep ridges. Ecoscape has previously identified important areas for wildlife corridors within the subject property and surrounding area including from Mill Creek, into natural areas of Dilworth Mountain and to both agricultural and park area to the north and east of the subject property (**Figure 7**). Mill Creek is considered an important riparian corridor for a variety of wildlife, and it is critical to maintain wildlife movement across the subject property to Mill Creek and beyond. **Figure 7** shows the future zoning of areas surrounding the subject property (taken from the COK website) and hence illustrates the network of parks/open space that likely facilitates the movement of wildlife within the surrounding environment. As the subject property becomes developed, it will be important to extend the park/open space areas from adjacent properties into the subject property, in order to maintain wildlife movement to Mill Creek.

The McCurdy Road crossing at Mill Creek has the potential to hinder wildlife movement. Therefore, a critter corridor and wildlife/pedestrian corridor are proposed along the roadway extension to maintain various wildlife and herptile movement patterns within the subject property (**Appendix A**).

The COMC also has potential to hinder wildlife movement. Ecoscape understands that the design and construction of a road within the McCurdy Road ROW and the COMC are not the responsibility of the developers, nor is it associated with this development, and incorporation of wildlife crossings at these locations is at the discretion of the COK.

2.6 Environmental Sensitivity Analysis

The Environmental Sensitivity Analysis (ESA) was completed for each delineated TEM polygon that occurs within the subject property. Professional judgment was used to evaluate ecosystem polygons based on criteria including: provincial Conservation Data Center (CDC) status (i.e., Red or Blue listed), rare and endangered species occurrence potential, landscape condition (i.e., connectivity, fragmentation), successional status, regional rarity, critical and specialized habitat features, fragility, and relative biodiversity.

The ESA indicated that **9%** of the subject property falls within the very high sensitivity category (ESA 1), 33% has high sensitivity (ESA 2), **41%** is within the moderate sensitivity category (ESA 3) and **17%** has low sensitivity (ESA 4) (**Table 3**) (**Figure 3**).

The subject property is **25 hectares** in size with the proposed development footprint being approximately **5.94 hectares** (**Figure 3**). **Table 3** summarizes the area of each ESA value lost to development based on the current proposed development footprint.

Table 3. Percent composition of ESA loss to development within the study area.					
ESA Value	Area (m²)	Percentage (%)	Area Within Development Footprint (m²)	Area Outside Development Footprint (m²)	ESA Lost to Development (%)
Very High	22,734	9.0%	6,495	16,239	29
High	83,735	33.0%	16,173	67,562	19
Moderate	103,852	41.0%	29,759	74,094	29
Low	43,205	17.0%	6,973	36,231	16

As indicated in **Table 3**, approximately **29%** of the very high-value ESA and **19%** of the high-value ESA will be lost to the proposed development. The loss of very high-value habitat is due to encroachment within the riparian setbacks of the ancillary riparian corridor. It should be noted that the areas of high sensitivity (ESA 2) that

occur within the proposed development footprint are within the lower end of the high sensitivity ESA gradient even though the ecosystems are Provincially listed. They have been downgraded because of the moderately urban nature of the surrounding areas (i.e., habitat fragmentation), a lack of a continuous connection to adjacent habitats (i.e., it is somewhat like an island), and moderate invasive species presence (**Figure 3**). The remainder of the development footprint occurs within moderate to low-value ESA.

3.0 IMPACT ASSESSMENT

Potential environmental impacts from proposed development are typically associated with the clearing, grubbing, and earthworks required for construction of permanent structures, including site servicing, driveways, and other infrastructure. The following section provides an overview of potential impacts to terrestrial resources on the property from development. Provincial best management practices (BMPs) and mitigation measures must be incorporated into the planning and construction phases. The majority of potential impacts on terrestrial habitats can be mitigated by implementing appropriate measures. However, without appropriate mitigation, the following are potential environmental impacts:

- The subject property has a number of hill features; therefore, there is the potential for the loss of this type landform through construction activities and earthworks.
- Potential for the release of deleterious substances (e.g., fuel, oil, hydraulic fluid) to the environment as a result of improper storage, equipment refueling, and/or poorly maintained equipment.
- Potential to directly or indirectly impact wildlife and their habitat, such as herptiles, avian species, and small mammals, during clearing, earthworks, and roadworks. This includes disruption of migration, breeding, or other behavior, as a result of tree falling, site grading, construction noise, impacts to air quality, and other alterations to existing wildlife habitat and cover. Herptile sweeps should occur prior to grading, clearing or grubbing. Dens should be inspected prior to disturbance (Appendix D).
- Establishment of invasive weeds would deteriorate wildlife habitat and natural condition of surrounding ecosystems.

As with any land development, there will be an incremental loss of natural lands, and this incremental loss has not been fully considered in a Cumulative Impacts Assessment as part of this report. A cumulative impact assessment goes beyond what is typical of an impact assessment for sites of this size, as they are typically completed for larger, more regional-type assessments. In addition to the impacts listed above, there is the potential for recreational activities associated with the future proposed development, post construction, that may impact terrestrial areas through encroachment into Environmentally Sensitive Areas. As these impacts result from human activities and behavior, they are highly variable and thus hard to account for and not considered in this assessment (e.g., walking trails).

3.1 Riparian and Aquatic Resources

The proposed development will result in losses to habitat within the riparian setback of the ancillary riparian corridor and wetlands; thus, compensation is proposed in the form of native species planting and wetland enhancement/development along the Mill Creek corridor and has been outlined within **Section 6.0** and **Appendix B** of this report.

The proposed road alignments are driven by the requirements of the COK, and have received approval through a formal Letter of Consent from the COK to Troika Management Corp. With the appropriate wetland and biodiversity enhancement, the proposed development is not anticipated to have a significant impact on aquatic resource values within the subject property or to downstream environments, provided the proposed recommendations are implemented. **Figure 5** shows the proposed development and encroachment within the riparian setbacks along the ancillary creek, Dilworth Creek, Mill Creek, and associated wetlands.

The following is a list of potential impacts if recommendations are not implemented accordingly:

- Erosion along the ancillary riparian corridor and Mill Creek may result, if proper mitigation measures are not implemented.
- Release of fine sediments during construction may impact water quality and downstream fish habitat.
- Release of other deleterious substances (e.g., gasoline, hydraulic fluid, etc.) from machinery may impact water quality and downstream fish habitat.
- Potential unnecessary loss of riparian vegetation or agriculturally created cattail marshes.

4.0 MITIGATION MEASURES AND RECOMMENDATIONS

Ecoscape provides the following general mitigation strategies for development within the subject property, based on the existing ecosystems and environmental sensitivity analysis. In addition to the recommendations provided herein, the proponent and individual property owners can find additional information on best management practices in the following documents (the URL for these reference documents has been provided in parentheses so that they can be sourced online):

• All works must generally conform to the Develop with Care Environmental Guidelines for Urban and Rural Land Development in British Columbia (2014) (http://www.env.gov.bc.ca/wld/BMP/bmpintro.html#second)_

- Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014) (http://www.env.gov.bc.ca/wld/documents/bmp/HerptileBMP_complete.pdf)
- Best Management Practices for Amphibian and Reptile salvages in British Columbia (2016) http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do;jsessionid=vQ4j XRsDC5mQXkGb1H3GYHGKyT712l7LGjmx818Ksg9hclhpXQ5B!101758496?su bdocumentId=10351
- Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013) (http://www.env.gov.bc.ca/wld/documents/bmp/raptor_conservation_guidelines_2013.pdf)
- Standards and Best Practices for instream Works (2004) https://www2.gov.bc.ca/assets/gov/environment/natural-resourcestewardship/best-management-practices/iswstdsbpsmarch2004.pdf.

4.1 Design

Habitat fragmentation through urbanization affects numerous ecological processes across multiple spatial and temporal scales, including changes in abiotic regimes, shifts in habitat use, altered population dynamics of species, and changes in species compositions (Bond 2003). Fragmentation of habitats can ultimately result in displacement or the local extirpation (extinction at a local scale) of species. However, the effects of fragmentation can be minimized if ecological processes are incorporated in the development design. A number of area specific recommendations and development guidelines were proposed in the initial EA report in 2008 and these have been considered in the current proposed development. These included the following:

- **Minimize the development footprint:** The current proposed development footprint has been reduced substantially from the initial designs. Further, the current proposed development footprint is smaller than previous submissions.
- Limit the proposed clearing activities to the building footprint and required amenities only: The proposed development footprint size is similar to the size of the building footprint with limited additional clearing of vegetation proposed.
- Avoid environmentally sensitive features: The current proposed development footprint has been designed to avoid environmentally sensitive features along Mill Creek. However, other riparian features and high value grasslands and woodlands will be impacted from encroachment of access roads and residential structures.
- Allow for wildlife corridors: Three main wildlife corridors were identified that bisect the subject property and a further wildlife corridor that extends north south adjacent to the west of Mill Creek was identified.

- The current proposed development allows for two of the identified wildlife corridors to be maintained (Figure 7), the wildlife corridors will be located within areas proposed for restoration (details of restoration recommendations are provided in Section 6.0). It should be noted that Ecoscape has made recommendations for inclusion of wildlife accesses across the COMC roadway and attempted to prioritize them. If these crossings are not incorporated into the COMC design, ESA values on the site will likely drop by one category (i.e., ESA 2 becomes ESA 3).
- Where possible, roads should be designed to follow the natural topography of the subject property: The majority of the proposed roadways within the current project follow the natural topography of the site.

At this time, site designs for the proposed development have been completed; however, future revisions are anticipated to be needed during the DP application process with the COK. If future revisions to the site designs are needed, then the following recommendations should be followed:

4.2 Roads

- Where possible, use natural topography to avoid extensive cuts and fills.
- Use retaining wall structures rather than fill slopes to reduce footprints and visual impacts of the proposed development.
- Wildlife crossings of roads should be incorporated into the road design. These culverts should also have adequate lighting, and inclusion of road grading or other mitigative measures that will facilitate movement through the structure. Finally, use of stacked rock retaining walls to direct movement of small wildlife to the culvert is preferred. These retaining walls can also be used to minimize roadway footprints.

4.3 Stormwater Management

Stormwater management will occur through construction of two detention ponds adjacent to the McCurdy Road extension, and a detention tank and control release at the south end of the development. Both detention ponds will collect surface water flow from McCurdy Road, detain flows and allow for settling of suspended material, before outflowing into Mill Creek. A rip rap swale is proposed from detention pond one to the riparian area adjacent to Mill Creek. Flows from the detention tank will be released upland along the east side of the development, and outflow into Mill Creek overland.

Designs for each detention pond has been included in **Appendix A** of this report; however, the following general stormwater management recommendations should be considered if any revisions to the existing designs are needed:

- Oil water separators should be used wherever possible for roadway and parking lot storm systems.
- Above-ground detention basins should include the following elements, if included in the design:
 - A forebay area with a designated sediment cleanout location is intended to capture and detain small storm events or the first flush from larger events;
 - A secondary bay for larger storm events can be vegetated using native vegetation and should be considered a natural space with minimal disturbance;
 - Soft engineering of storm water detention basins is generally preferred. Therefore, permanent coconut matting of suitable capacity is preferred over rip rap. This style of construction is generally more cost efficient and allows for easier weed management.
- Where possible, a combination of coconut matting and vegetation, and rock check dams are preferred for roadside ditching rather than armouring with rip rap. Although most roadways will be serviced with curb and gutter, if some roads use ditching, softer engineering techniques should be considered where feasible that consider factors such as grades, volumes, ditch material, and end point of discharge.

4.4 Recreation

Wildlife corridors, no build zones and restoration areas can have two uses. Generally, some recreational activities may occur in these areas, however, they are primarily set aside for wildlife. The following are general recommendations for recreational development:

- Any park/trail systems proposed adjacent to and/or bisecting the very high ESA/movement corridors, should be designed to include minimal lighting. If lighting is required, directional lighting towards the ground should be used in these areas;
- Uncontrolled access to sensitive ecosystems may result in continuous operational impacts. Designated trails should be established with interpretive signage posted to educate residents regarding the significance of sensitive habitats;
- Low split rail fences should be erected in areas of higher sensitivity to reduce uncontrolled use of natural areas;
- Trail development should be directed towards the edges of no build areas rather than in the centre of them. Ultimately, these edges will act as buffer zones, and will be prone to weed infestation, etc. Thus, by directing all

disturbances to these areas, natural areas will maintain a higher biological value and disturbances will be concentrated;

- Site plan development should incorporate sufficient areas of suitable grades for trail construction (e.g., some areas of less than 30% slope, preferably some with less than 10%). This will reduce the footprints of proposed trails within more sensitive areas;
- Trail planning should include consideration of hazard tree management. Where possible, large diameter trees that may be damaged by the pine beetle should be avoided to ensure that these trees remain as suitable wildlife snags rather than be felled due to hazard tree management activities.
- Trail development should not occur within wildlife reserve areas. Further environmental inventories are required to determine the extents of these areas, but generally larger undisturbed areas should be considered reserve areas.
- Pedestrian and petal bike activity off the designated trails needs to be avoided. Furthermore, Ecoscape recommends a strict moratorium on motorized vehicles (except for emergency and maintenance vehicles), especially in and around the riparian corridors.

5.0 CONSTRUCTION RECOMMENDATIONS

Construction activities must be restricted to the development footprint, which includes any associated earthworks, access to the site, storage of material and any proposed vegetation clearing. The following recommendations must be followed during the course of construction.

5.1 Site Clearing

- The clearing limits for the proposed development footprint (including access ways) should be clearly flagged/delineated prior to any earth works, to prevent equipment access to environmentally sensitive areas and to prevent damage to existing native vegetation. Delineation of extents of disturbance should remain in place throughout the project duration, this could be through the use of temporary orange snow fence.
- Vegetation, soil and rock excavated from the development footprint should be taken offsite and disposed of/recycled appropriately or stored onsite within the development footprint if reuse onsite is proposed. Excavated materials should not be stockpiled out of the proposed development footprint. *Note, storage of blast rock material may also occur within a previously blasted area, and this has not been addressed within this report.*
- Vegetation clearing within the study area should not occur during the general breeding bird season (i.e., **February 1 to September 14**). It is an offence to

harm a bird or its eggs during the nesting period, as per the provincial *Wildlife Act* and federal *Migratory Birds Convention Act*. If vegetation clearing is required during this time, a pre-construction nest survey should be conducted by a qualified environmental professional (QEP) to identify and clearly mark active nests.

5.2 Erosion and Sediment Control

The mitigation described below should be followed as required to provide erosion and sediment control associated with the environmentally sensitive habitats identified in the assessment.

- Silt fencing will be installed as directed by the EM in a field-fit manner. Silt fence must be staked into the ground and trenched a minimum of 15 cm to prevent erosion underneath the fence.
- Silt fencing will be monitored on a regular basis and any damages or areas where the integrity and function of the fencing has been compromised should be repaired or replaced promptly.
- Silt fence must remain in place where required until the completion of the project. Other sediment and erosion control measures may include check dams (e.g., rock, sand bag, hay bales) to slow flows along drainage channels and ditch lines, sumps, or other settling areas for turbid waters.
- The release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into any drainage or gully must be prevented at all times.
- Any erosion and sediment control plan for the development should incorporate the measures described below to mitigate risks associated with sediment and erosion during construction works. The plan is generally based upon provincial BMPs and other specifications and includes the following principles:
 - Construction works should be conducted during periods of warm, dry weather with no forecasted precipitation;
 - Construction works should be scheduled to reduce the overall amount of time soils are exposed;
 - Natural drainage patterns should be maintained where possible;
 - Existing native vegetation should be retained where possible;
 - Stormwater and sediment-laden runoff should be directed away from exposed soils within the construction area;
 - Sediment-laden water should not be directed to any surface water feature, gully, or other drainage system;
 - Slopes should be stabilized as soon as possible following disturbance;

- Other erosion and sediment control measures should be implemented, inspected, maintained, and/or replaced as required to provide appropriate mitigation.
- Exposed soils along slopes must be stabilized and covered where appropriate using geotextile fabric, poly sheeting, tarps, or other suitable materials to reduce the potential for erosion resulting from rainfall, seepage, or other unexpected causes.
- Seed and re-vegetate cuts and fills as well as disturbed slopes as early as possible following clearing activities.
- Adjacent roadways (Mt. Baldy Drive) must be kept clean and free of fine materials. Sediment accumulation upon the road surfaces must be removed and disposed of appropriately. This may require the installation of a clean blast-rock pad at the ingress/egress point for the development to reduce the amount of sediment material conveyed offsite during hauling activities.

5.3 Spill Containment

Spills of deleterious substances can be prevented through awareness of the potential for negative impacts and with responsible housekeeping practices onsite. Maintenance of a clean site and the proper use, storage and disposal of deleterious liquids and their containers are important to mitigate the potentially harmful effects of spills and/or leaks. The following BMP are adapted from Chilibeck et al. (1992) to provide guidance in the control of deleterious substances.

- Ensure that onsite machinery is in good operating condition, clean and free of leaks, excess oil or grease. Equipment used should be pressure washed off-site to remove surface oil and grease. Equipment tracks should also be free of invasive plant species fragments and seeds. The machinery should be site inspected by the environmental monitor prior to deployment.
- Spill containment kits should be kept readily available onsite during construction in case of the accidental release of a deleterious substance to the environment. Any spills of a toxic substance of reportable quantities should be immediately reported to the Provincial Emergency Program 24 hour hotline at 1-800-663-3456.
- Equipment refueling or servicing should not be conducted within 30 m of Mill Creek, Dilworth Creek, or any wetland area.
- Spills occurring on dry land must be contained, scraped and disposed of appropriately.
- Contaminated material must be stored on tarps and covered to prevent mobilization, and will be disposed of in accordance with the *Environmental Management Act*.

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5.4 Fish Habitat and Water Quality

Works must be conducted in accordance with the Provincial *Water Sustainability Act*, the *Fish Protection Act* and the Federal *Fisheries Act*. Further, all appropriate permits for working in and around water must be in hand prior to the onset of work. Finally, the Habitat Officers Standard Terms and Conditions must be implemented at all times. The following are specific recommendations to address working near fish bearing waters:

- Fish presence is confirmed within Mill Creek. Other aquatic organisms, including amphibians and invertebrates, may also occur within the creeks and wetland areas. Works with the potential to directly impact fish or other aquatic organisms will require an aquatic lifeform salvage to capture and relocate wildlife.
- Aquatic lifeform and wildlife salvages will be conducted at any isolated aquatic areas, prior to construction works. Ecoscape will obtain the necessary fish collection permits prior to conducting salvage activities. Depending on the conditions, the EM will utilize a backpack electrofishing unit to actively collect fish for removal. Alternatively, baited minnow traps may be used to passively collect fish. Fish will be returned to the stream outside of (i.e., upstream) the isolation area. The EM will also search for aquatic organisms in wetted areas and along the banks or shoreline. Any wildlife encountered will be captured carefully by hand or using a soft mesh dip and immediately returned to the water on the outside of the isolated area.
- If de-watering of aquatic habitats is required, it should be conducted with suitably sized submersible pumps with appropriate fish screens to prevent the entrainment of fish and other aquatic organisms, as per DFO guidelines (DFO 1995). If dewatering is required, turbid waters should be pumped to a flat vegetated area where waters can slowly infiltrate to the ground and suspended particles can settle out of the water. Other measures that may be required during dewatering include attachment of a geotextile fabric bag to the end of the discharge pump to retain sediment and/or installation of additional geotextile fabric or silt fencing to prevent the migration of turbid waters directly to aquatic environments. Dewatering plans will be required to accompany Section 11 Notifications for proposed construction projects.
- Water quality monitoring should be undertaken by the environmental monitor (Ecoscape) while instream works are occurring and will be completed as follows:
- Water quality sampling will be conducted *in situ* with a portable Turbidimeter to measure ambient Nephelometric Turbidity Units (NTU) and a portable pH meter. If sampling of total suspended solids (TSS) is deemed necessary, samples will be collected in 1 litre bottles and analyzed *ex situ* at a reputable laboratory (e.g., CARO).

- Water quality sampling will be collected at a minimum of four (4) sampling stations including, but not limited to:
 - Upstream from the construction activities (background);
 - Immediately adjacent to construction activities;
 - Approximately 10 metres downstream from construction activities; and
 - Approximately 100 metres downstream from construction activities.
- Turbidity levels will be monitored as required in Mill Creek and Dilworth Creek must conform to the MOE guidelines for fish and aquatic habitats (BC MoE, 2016).
 - During clear flow periods, induced turbidity should not exceed 8 NTU above background levels and no more than an average of 2 NTU above background levels over a 30-day period.
 - During turbid flow periods, induced turbidity should not exceed background levels by more than 5 NTU at any time when background turbidity is between 8 and 50 NTU. When background exceeds 50 NTU, turbidity should not be increased by more than 10% of the measured background level at any one time.
- pH levels will be monitored as required for works occurring near streams.
 - Emergency measures should be implemented if downstream pH has changed more than 1.0 pH unit, measured to an accuracy of +/-0.2 pH units from the background level, or is recorded to be below 6.0 or above 9.0 pH units.

5.5 Emergency Spill/Response

Spills of deleterious substances can be prevented through awareness of the potential for negative impact on aquatic habitats and with responsible housekeeping practices onsite. Maintenance of a clean site and the proper use, storage and disposal of deleterious liquids and their containers are important to mitigate the potentially harmful effects of spills and/or leaks. MSDS for all potentially hazardous materials will be kept onsite during construction activities. The following BMPs are adapted from Chilibeck *et al.* (1992) to provide guidance in the control of deleterious substances.

- Preventative measures the contractor will undertake to prevent spills from occurring include safe containment, labelling, and storage of all deleterious substances present onsite, securing stored hazardous or toxic materials to prevent vandalism or theft, disposing of used containers properly, and using appropriate personal protective equipment when handling, transporting, or disposing of hazardous or toxic substances.
- The contractor will ensure all equipment and machinery are in good operating condition, free of leaks, excess oil, and grease. No equipment refueling or

servicing will be undertaken within 30 m of any watercourse, waterbody, or surface water drainage.

- The contractor will ensure that fuel, oil, hydraulic fluid, and other hazardous or deleterious materials are stored at least 30 m away from any watercourse or surface water drainage. This includes tanks, barrels, drums, generators, and other equipment.
- All spill events will be immediately recorded and reported to the site supervisor and EM. Spills shall be contained, absorbed, and disposed of in accordance with the regulations outlined in the *Environmental Management Act* and using the following general steps:
 - Assess, monitor and prevent the hazard or threat;
 - Stabilize, contain, remove and clean up the hazard or threat;
 - Evacuate persons;
 - Recover and rehabilitate wildlife;
 - Restore wildlife habitat;
 - $\circ~$ Take other steps to address the long term impacts resulting from the spill;
 - Report the spill event (within 48 hours).
- Spills occurring on dry land will be contained, scraped and stored for disposal upon project completion. Contaminated material will be stored on tarps and covered to prevent mobilization and will be disposed of in accordance with the *Environmental Management Act*.
- In the event of a spill, the site supervisor will be immediately notified by workers onsite. The supervisor will then be responsible for contacting a mechanic (if necessary), the Ministry Representative, and the environmental monitor. The BC Ministry of Environment and/or Department of Fisheries and Oceans (DFO) may also be contacted if deemed appropriate. Copies of contact phone numbers for notification of all of the required authorities in the event of a spill/emergency response will be posted and clearly visible at the site.
- Spill containment kits will be kept in all machines operating along the creek channel and an additional kit will be stationed onsite in case of the accidental release of a deleterious substance to the environment. Kits will generally include absorbent pads and/or socks, pillows, disposal bags, disposable gloves, and floating booms.
- Any spills of a toxic substance shall be immediately reported to the Provincial Emergency Program 24 hour hotline at 1-800-663-3456.

5.6 Invasive Plant Management

The subject property should be regularly monitored for encroachment of invasive plants, particularly in the areas proposed for restoration. It is assumed that if restoration areas are transferred to the City of Kelowna, then the City will continue with on-going weed control. If observed, invasive plants should be manually removed (e.g., pulled by hand) and disposed of appropriately. Mechanical methods may also be appropriate including the use of hand-held weed whackers; however, the areas where mechanical methods are proposed would need to be approved by the environmental monitor. The use of herbicides/pesticides is not recommended within the subject property.

- Disturbed areas with high potential for invasive plant encroachment should be remediated with grass seed and possibly native plantings. The environmental monitor should review the seed mix prior to application to ensure that the mix does not contain invasive species. Ecoscape can provide the client recommendations regarding local suppliers who can provide appropriate upland seed mixes based on the ecological communities within the site.
- Weed management and erosion control must occur in all areas disturbed during development. If additional disturbance occurs outside the development footprint, these areas will need to be addressed by the EM and restored with native plantings.
- Any contractor onsite must ensure that all equipment and vehicles are washed and free of weed seeds prior to mobilization and de-mobilization. Vehicles and equipment should not be stored, parked, or staged within weed infested areas if possible. Contractor clothing should also be inspected daily for signs of weed seeds. If found, weed seeds should be disposed of in a contained refuse bin for offsite disposal.
- Care must be taken to ensure that invasive species removal does not impact existing or planted native tree and shrub species.
- Invasive plant species must be disposed of in a landfill; however, invasive species material must not be composted in the yard waste section of the landfill. Invasive plant species must not be transported to or deposited in other natural areas.

5.7 Air Quality

During the construction of the proposed development air quality measures must be adhered to as follows:

• No idling of construction vehicles.

• Dust suppression measures will be implemented as needed, this could include the use of a water truck to wet down access roads. If a water truck is used, additional sediment control measures may need to be implemented to avoid sediment runoff from access ways.

5.8 Waste Management

Solid waste is typically generated through normal land clearing and construction activities. Waste can be managed through awareness of the potential for negative impact on aquatic habitats and with responsible housekeeping practices onsite. Maintenance of a clean project site and the proper disposal of waste material are important to mitigate potentially harmful effects.

- Reduce the amount of construction and demolition refuse by encouraging source separation of materials at construction sites.
- Reduce the amount of land-clearing waste by limiting the amount of clearing undertaken. This also helps to protect natural habitats and minimize erosion and sediment concerns.
- Maintain a tidy construction site with appropriate receptacles for waste, rubbish

6.0 **RESTORATION RECOMMENDATIONS**

A restoration plan has been created by Ecoscape to compensate for the encroachment within the riparian and wetland setbacks as per the COK OCP, and due to the loss of high (ESA 2) and very high (ESA 1) areas due to the proposed development and McCurdy Road extension (**Appendix B**) (**Figures 5 & 6**). The compensation plan provides conceptual plans and locations for offsetting through enhancement of riparian and wetland habitat adjacent to the ancillary riparian corridor and Mill Creek and has been attached to **Appendix B** of this report.

From an environmental perspective the loss of wetlands is not considered ideal and these areas have been identified as very high value. The loss of **768** m^2 of wetland habitat will be compensated with **2,304** m^2 of additional wetland habitat present in Restoration Area 1, with **855** m^2 of the above value being open water habitat being created (**Figure 6**). Wetland losses will be compensated at a ratio of **3:1** to ensure that no-net loss of wetland function occurs in the context of the future COMC corridor. Additionally, wetland complexing including more diverse habitats (i.e., open water, complex edges, cattail island, etc.) than exclusive cattail marshes will be used to improve and create high biodiversity habitat and provide very high value ecosystem service for wetland habitat constructed to maximize the benefit of enhancement. **Appendix F** outlines the proposed design for the wetland compensation, and specific guidelines that will be followed during construction.

The loss of **8,501** \mathbf{m}^2 of riparian habitat will be compensated with at least **17,002** \mathbf{m}^2 of riparian habitat being compensated out of the available **21,056** \mathbf{m}^2 within the subject property. Riparian losses will be compensated at a **2:1** ratio, due to the relative lower risk of enhancement failure, with efforts being focused along the riparian area adjacent to Mill Creek. In addition, upland enhancements will also be undertaken to offset losses to terrestrial ecosystems.

6.1 Restoration Guidelines

6.1.1 Fill Slopes

Areas and vegetation disturbed during construction of the proposed development should be remediated following construction to mitigate erosion potential and temporal loss of vegetation. Only native vegetation consistent with the site conditions should be planted.

The following provides guidelines for restoration of fill slopes within the development footprint, noting that a detailed landscape plan has been prepared at this time by Ecora (**Appendix C**), and these recommendations are for fill slopes outside of the prepared landscape plan; however, the planting recommendations should be followed for the landscaping portion to ensure consistency between the two areas. The following provide specific guidelines for fill slope restoration:

- Soil conditions are important to consider during restoration:
 - If possible, less optimal growing soils (i.e., increase in fractured rock, no top soil or little mineral soil, etc.) should be placed on south facing slopes. South facing slopes on this site tend to have a grassland association, suggesting that these locations are not typically naturally treed with coniferous species such as interior Douglas fir or Ponderosa pine.
 - If possible, more optimal growing soils (e.g., topsoils, more mineral soils, etc.) should be placed on north facing slopes. These slopes will have a higher moisture regime, typical of pre-construction site conditions, and will better develop back to a forested community.
- Large woody debris (LWD) from clearing should be placed on all fill slopes. The target density for is 5 pieces / 1000 m² (50 pieces per hectare).
- In **southern facing areas**, the following are specific design guidelines:
 - Slope restoration should contain a minimal tree and shrub density (approximately 100 stems per hectare. The following are species to consider:
 - Ponderosa Pine
 - Snowberry and rose

- Rabbitbrush
- All areas should be seeded with a terrestrial seed mix that contains a high percentage of bluebunch wheatgrass, as this is the most likely benchmark grass species. The grass seed mix should be approved by an Environmental Professional prior to application, as various different mixes are suitable. Ecoscape can provide the client recommendations regarding local suppliers who can provide appropriate upland seed mixes based on the ecological communities within the site.
- Where geotechnically feasible, areas of larger fractured rock, with high interstitial space can be included. These areas can help create herptile habitat, by providing opportunities for basking, and potentially winter denning.
- In **northern facing areas**, the following are specific design guidelines:
 - Slope restoration should contain a tree density of approximately 400 to 500 stems per hectare and a moderate shrub density of 500 stems per hectare. The following are species to consider:
 - Ponderosa Pine
 - Saskatoon Berry
 - Snowberry and rose
 - Mock orange
 - Oregon grape
 - All areas should be seeded with a terrestrial seed mix that contains a high percentage of bluebunch wheatgrass and various types of native fescue species. The grass seed mix should be approved by an Environmental Professional prior to application, as various different mixes are suitable.
 - $\circ~$ These areas should have planting pockets, or increased top soils used where needed to improve restoration success.

6.1.2 Upland Areas and Ecosystems

A landscape plan has been prepared by Ecora and will encompass the areas directly around the development. However, many areas of the subject property will remain intact post development, and could benefit from restoration. The following provides some specific guidelines for terrestrial ecosystem restoration, which can be completed at the development permit stage, or at time of construction. The following provides guidelines for restoration areas:

- Many areas have an infill of native trees (Ponderosa Pine and Interior Douglas Fir) due to the lack of a recent fire regime. Forest thinning of small diameter trees will improve habitats, and act to help mitigate future fire risks. The following should be considered if removal of infill trees occurs:
 - $\circ~$ Trees for thinning should generally be less than 15 cm in diameter, as these trees have lower habitat value.
 - Thinning should try to create a naturally open woodland. If some areas only contain smaller diameter trees, some should remain.
 - $\circ~$ In mature areas, a few smaller diameter trees should remain as recruitment for larger trees.
 - All dead standing trees, that are not within, or pose little threat to structures, should be left to stand or alternatively, topped.
- Invasive plant management should occur, particularly as the existing gas easement is a source of weed seed propagation.
- Since there will be a loss of some forested communities, bird and bat boxes must be placed in the remaining forested areas. A density of 3 structures per 1000 m² or 30 / hectare for both birds and bats would provide additional cavity nesting habitat to offset any losses associated with nesting opportunity.
- Bat House Design Details as per Building Home for Bats A Guide for Bat Houses in British Columbia (2015):
 - See **Appendix E** for house design requirements.
 - Vents are recommended for bat houses within the Okanagan due to the intense heat that may be experienced during the summer months.
 - Bat houses should be located at least 10' above the ground although 12'-20' is optimal. Bat houses should face due south to allow for the best temperature gradient. A slippery metal guard should be mounted near the base to deter predators such as weasels and cats. The bat house should be mounted at least 6 m from the nearest tree branches to reduce predation by raptors.
 - The south facing slope near a riparian area or wetland is the preferred location for the bat house. Locations should be reviewed by the QEP or EM prior to installation.

7.0 ENVIRONMENTAL MONITORING

A suitably qualified environmental monitor (EM) is typically required by the City of Kelowna to be retained during construction to document compliance with mitigation measures and provide guidance for implementation of best practices. If greater disturbance occurs due to unforeseen circumstances, the EM will recommend further

measures to protect/restore the natural integrity of the site. The EM must be notified a minimum of 48 hours prior to initiation of construction works to schedule site visits.

- A pre-construction meeting must be held between the EM and the contractor(s) undertaking the work onsite to ensure a common understanding of the mitigation measures and best practices required for the project. At this time the location of erosion and sediment control measures will be reviewed.
- The EM will be an appropriately Qualified Environmental Professional (QEP) that will halt construction activities should an incident arise that is causing undue harm (unforeseen or from lack of due care) to terrestrial, aquatic or riparian resource values.
- Environmental monitoring is typically conducted on a minimum monthly basis for the duration of the construction works. However, this will be dependent on the nature of the works occurring, construction schedule, and if works are occurring near wetlands or streams.
- Construction activities should be monitored full-time (i.e., daily) during startup and any high-risk activities within proximity to the top of the ravine banks or other environmentally sensitive areas, and on a minimum weekly basis during any other construction activity to the completion of the works.
- A copy of the DP and this assessment report must be kept readily available at the site for reference while the work is being conducted.
- Summary monitoring reports will be completed on a regular basis (i.e., monthly) and submitted to the client, City of Kelowna and appropriate contractors. A final report will be submitted upon substantial completion of construction and restoration works.
- Follow-up monitoring of restoration works will need to take place 1, 2, and 3 • years post-completion to document adequate removal of non-native trees, establishment of seed. and successful grass invasive plant control/management. Ongoing maintenance will be recommended as required, with reports provided to the client, City of Kelowna, and appropriate contractors. If disturbance occurs outside of the development footprint, additional restoration recommendations will be provided by the EM.

8.0 PERFORMANCE BONDING

Performance bonding is typically required by the COK to ensure that the recommended mitigation measures are adhered to, and any restoration is completed as required. Security deposits shall remain in effect until the COK has been notified, in writing by the EM that the objectives have been met, and substantial completion of the restoration works has been achieved.

A cost estimate has been prepared to address the COK performance bonding requirements. Ecoscape estimates that the total cost for planting, associated install and construction costs (i.e., heavy machinery), associated environmental monitoring of riparian and wetland restoration, and preparation of a substantial and total completion report will be approximately **\$157,200**, not including GST (**Table 4**). Specific quantities of plantings needed for restoration can be found within **Appendix B & F** of this report.

Table 4. Cost estimate for restoration planting and bonding.					
Item	Location	Quantity	Unit	Cost*	
Trees and shrubs for riparian and wetland restoration	Restoration Area (refer to Appendix B & F)	7,500 plants/trees	1 gallon, but larger stock is acceptable	\$112,500 (At \$15 per shrub/tree)	
Heavy Machinery for Wetland Restoration	Restoration Area	70 hours	Per hour	\$29,000 (At 180 per hour excavator, \$120 for skid steer and excavator)	
Invasive Species Management	100 hours (12 visits at 8 Restoration Area hours per visit over install and maintenance period)		Per hour	\$1,500 (At \$15 per hour)	
Environmental Monitoring plus Substantial/Total Completion visits	Restoration Area	120 hours**	Per hour	\$12,000 (At \$100 per hour)	
Vegetation Management (i.e., beaver/deer guard)		Per hour	\$1,000 (At \$20 per hour)		
Grass Seed	Restoration area	20 kg	Per kg	\$1,200 (At \$60 per kg)	
			Grand Total	\$157,200	

*Installed costs are assumed to be based upon owner installation. A landscaping company and distributor of native plant stock may be able to provide a more accurate estimate to complete the prescribed works.

**The estimate for environmental monitoring includes bi-yearly visits during the maintenance period and total completion visit.

9.0 CONCLUSION

Ecoscape acknowledges that the subject property contains a variety of different habitats, several of which are rare or endangered. Development within the subject property is also restricted due to a number of development limitations including the COMC alignment, easements within the subject property (McCurdy Road ROW, gas easement) and riparian corridors.

Ecoscape acknowledges that the proposed development within the subject property will have a direct loss of multiple Red and Blue-listed ecosystems; however, due to existing disturbance and invasive species growth present within the property, these losses are not as severe compared to if these ecosystems were more naturalized. Additionally, due to an restoration and compensation plan proposed as apart of the development, it is our opinion that the proposed development will result in an overall net neutral change to the wetland health in the region along the two riparian corridors within the subject property, noting this considers that future City infrastructure such as the COMC will likely be constructed at some point.

Where applicable and appropriate, we have attempted to state how failure to incorporate our recommendations and best management practices may impact the environmental values within the property. If appropriate environmental design is not incorporated into the COMC (i.e., wildlife crossings across the COMC) it would result in poor connectivity between upland areas and Mill Creek, which would likely reduce most ESA 2 to ESA 3 because they would no longer be connected to riparian habitats (i.e., the close proximity of these dry sites is influenced by the proximity of high-value riparian habitat).

Recommendations for the subject property address development guidelines, construction and restoration activities. Recommendations include incorporating riparian restoration in the form of wetland creation and enhancement along the Mill Creek corridor. Remaining terrestrial areas will also be enhanced and bat/bird boxes installed.

10.0 CLOSURE

This report has been prepared for the exclusive use of Troika Management Corp. Ecoscape has prepared this report with the understanding that all available information on the present and proposed use of the subject property has been disclosed. Troika Management Corp. has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. This report should not be interpreted as an endorsement of the proposed works, but as a tool for decision making.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

This report has been adapted from the September 2019 report prepared by:

Kristina Deenik, B.Sc., Senior Natural Resource Biologist



Jason Schleppe, M.Sc., R.P.Bio. Senior Natural Resources Biologist Direct Line: (778) 940-3479

May 2022 updates were prepared and reviewed by:

find Molark

Kris Mohoruk, B.Sc. Natural Resource Biologist Direct Line: (778) 940-1937

Attachments:

Photographs Figures (1 – 7) Appendices (A –F)



Jason Schleppe, M.Sc., R.P. Bio. Senior Natural Resource Biologist Direct Line: (778) 940-3479

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PHOTOGRAPHS


Photo 1. Shows a grassland portion (Rough Fescue – Bluebunch wheatgrass) of the subject property that tends to be invested with invasive species (Photo taken April 4, 2008).



Photo 2. Depicts 4x4 activity in the riparian corridor of the tributary to Mill Creek (Photo taken April 4, 2008).





Photo 3. Shows old, dilapidated structures that occur immediately adjacent to Mill Creek.



Photo 4. Shows some of the impacts from blasting activity for the Central Okanagan Multimodal corridor (Photo taken Sept 12, 2021).



Photo 5. Shows the Bluebunch Wheatgrass – Balsamroot ecosystem community (WB) that occurs throughout the subject property (Photo taken April 4, 2008).



Photo 6. Depicts the Selaginella – Bluebunch Wheatgrass rock outcrop (SB) association (Photo taken April 4, 2008).



Photo 7. Shows the Rough fescue – Bluebunch Wheatgrass community that occurs within the subject property (Photo taken April 4, 2008).



Photo 8. The above photo depicts the Black cottonwood/Douglas-fir – Common Snowberry-Red-osier Dogwood Riparian fringe community (CD-IDFxh1- 00) that lines Mill Creek (Photo taken April 4, 2008).



Photo 9. The above photo depicts the cattail marsh that is associated with the ancillary riparian corridor to Mill Creek (Photo taken on June 11, 2008).



Photo 10. The above photo depicts the Douglas-fir – Water birch – Douglas maple (DM-PPxh1-08) community that lines the tributary to Mill Creek (Photo taken on June 11, 2008).



Photo 11. Depicts a beaver dam that was constructed along Mill Creek



Photo 12. Depicts a single burrow that was apart of a network of burrows that occurred approximately 50 m from Mill Creek.



Photo 13. View of talus located within the northwest corner of the subject property (Photo taken September 12, 2019).

FIGURES













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APPENDIX A: Development Designs Completed by D. E. Pilling & Associates Ltd.



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C5	20.00m	2.791m	007•59'48"	1.398m	0+087.57	0+090.36	
C6	20.00m	2.257m	006 ° 27'58"	1.130m	0+121.30	0+123.55	
C7	20.00m	11.825m	033 ° 52'37"	6.091m	0+151.20	0+163.03	
C8	12.00m	9.858m	047°04'07"	5.226m	0+170.51	0+180.37	
C9	12.00m	30.938m	147•43'13"	41.467m	0+191.82	0+222.76	
C10	12.00m	13.581m	064*50'36"	7.622m	0+254.94	0+268.52	
C11	15.00m	7.529m	028°45'28"	3.845m	0+270.66	0+278.19	

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APPENDIX B: Restoration and Offsetting Plan Created by Ecoscape



Environmental and Economical Solutions

May 12, 2022

Project No: 19-2765

Stephen Duke Troika Management Corp. 302-554 Leon Ave Kelowna, BC V1Y 6J6

Subject: Wetland Restoration and Offsetting Plan for Proposed McCurdy Road Extension and Development near Mill Creek, Kelowna, BC

1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) has been retained by Troika Management Corp. (client) to provide a Restoration and Compensation Plan (RCP) for the proposed works related to a multi-family development and extension of McCurdy Road within a hillside property located between Mill Creek and Mt. Baldy Drive in Kelowna BC (**Figure 1**). The proposed works will occur within the parcel legally described as Lot 1, PID 027-196-011, Plan K84653, and is currently zoned as A1 (Agriculture-1) (subject property).

This plan has been prepared to provide a detailed wetland restoration plan to compensate for the loss of the wetland feature associated with the development and road extension. Recommendations for implementation of the restoration works are also provided. The City of Kelowna (CoK) has provided a letter of support for the project, which highlights the extensive design process identifying the road extension as a necessary piece of public infrastructure. While attempts have been made to avoid the wetlands, design constraints and long-term infrastructure needs have made this not feasible. This report is intended to facilitate and provide guidelines for the entire compensation requirements for the development and extension of roadways.

1.1 Proposed Works

The proposed works are detailed in **Figure 4** of this report, and include the following

- Extension of Mt. Baldy Drive;
- Extension of McCurdy Road, including crossing of the wetland, Dilworth Creek, and an ancillary channel;
- Development of multi-family housing consisting of townhomes and condominiums in three (3) phases and requires construction of the McCurdy Road extension. The McCurdy Road extension and Mt. Baldy extension have been part of the City's long-term plans, and the development is presented herein as supporting information;

- Associated site clearing, grubbing, and grading;
- Construction of two stormwater detention ponds with outfalls, detention tank with outfall, sanitary sewer, watermains, and other associated utilities with the residential development and the road.
- Restoration and enhancement activities to compensate for the loss of wetland and riparian habitat.

2.0 SITE CONTEXT

The subject property is approximately **25 hectares** and triangular in shape (**Figure 1**). The proposed hillside residential development will include townhouses and condominium apartments within three phases, and the proposed road infrastructure improvements. The development footprint covers approximately **5.94 hectares** within the subject property boundaries and includes the proposed McCurdy Road extension. It should be noted that the development does extend beyond the property boundaries of the subject property, as Mt. Baldy Drive and McCurdy Road are to be joined with existing infrastructure as part of the extension (**Figure 4**).

Within the subject property, additional future infrastructure requirements are either proposed or are existing and have a direct impact on areas feasible for restoration:

- 1. The proposed 4-lane, Central Okanagan Multi-modal Corridor (COMC) will occur at the base of the hillside west of Mill Creek (extending north/south bisecting the subject property), the proposed COMC alignment has been provided by D.E. Pilling & Associates Ltd. It is recognized that the COMC may have profound environmental implications for wildlife that frequent the area, however, the proposed COMC was not evaluated as part of the current or previous assessments undertaken by Ecoscape for the subject property. The COMC has only been considered to ensure that proposed compensation and wetland enhancements do not fall within the proposed COMC footprint. *Currently the proposed location of detention pond one is within the proposed pathway of the COMC; however, it is anticipated that the pond could be moved if COMC receives approval at a future date.*
- 2. An existing Fortis gas line easement that runs in a north/south direction and bisects the subject property.

The subject property also contains two riparian corridors that include Mill Creek and Dilworth Creek - which enter the subject property on the western boundary and flows into Mill Creek. An ancillary creek enters the property along the southwest property boundary adjacent to 745 Rifle Road. As wetlands and riparian areas will be impacted by the McCurdy Road and Mt. Baldy Drive extensions, it is important that any losses be offset, and the remaining riparian habitat be conserved (**Figure 5**).

2.1 Land Use Planning

The proposed COMC corridor has been identified for future development by the City of Kelowna for the last 20 years and is considered as a priority for development. Some

preliminary blasting and grading of the right of way has been completed within the subject property.

The location and proposed extension of McCurdy Road has been under evaluation since 2008. The expansion of McCurdy Road is part of the COMC corridor planning, and the greater traffic planning strategy held by the COK. Development limitations such as areas with slopes greater than 30%, the presence of high-value environmentally sensitive areas (ESA) and rare grassland and woodland ecosystem communities, and tie-in considerations for the planned COMC corridor have limited the location of McCurdy Road to its current proposed location. Currently the proposed location of storm pond one is within the proposed pathway of the COMC; however, it is anticipated that the pond could be move in the future if COMC receives approval.

While avoidance is the preferred option to mitigate impacts of development, physical site constraints eliminate the possibility of alternative routes for the road, therefore avoidance of the wetland is not an option. The road expansion has been designed to minimize impacts to the degree possible, and so any additional mitigation measures to reduce the impact of the development must rely on on-site restoration and habitat enhancements.

3.0 HABITAT VALUES

Wetlands are a high value habitat, with many varied species relying on them in some way or use them more frequently than other habitat types. Habitat values for wildlife and plant species are discussed below.

3.1 Terrestrial Ecosystems

An environmental site assessment was carried out by Natural Resource Biologists Jason Schleppe, M.Sc., R.P. Bio, and Mary Ann Olson-Russello, M.Sc., R.P. Bio. of Ecoscape on April 4 and June 11, 2008. Additional wetland mapping was undertaken by Kyle Hawes, R.P. Bio. and Mary Ann Olson-Russello, M.Sc., R.P. Bio. on August 22, 2011, and further visits were completed on April 1, 2016 by Jason and Mary Ann to confirm existing conditions and to determine appropriate locations for wetland enhancement. Additional site visits were undertaken in August and September 2019 to reassess the wetland extents, and most recently in August 2021 to reassess the site conditions. Data collection and reporting standards are pursuant to the COK Official Community Plan (OCP).

The ancillary riparian corridor along the west side of the subject property consists of two watercourses. Dilworth Creek enters the subject property in the northwest corner and is agriculturally fed (pers. comm., Kyle Hawes) and appears to maintain flows year around. The other ancillary channel originates from an immediately adjacent property that was historically used for mushroom farming. During the previous site visits, flows were still originating from the property, however downstream wetlands were less extensive than previously documented. The extents of the wetlands were field truthed and re-delineated in 2011 to accurately document this transitioning area. Nevertheless, there are multiple cattail marsh

systems (CT) that maintain dense cattail (*Typha latifolia*) stands both within the ancillary riparian corridor, and Mill Creek.

The riparian corridor along Dilworth Creek is typical of a Douglas-fir – Water birch – Douglas maple (DM – PPxh1 – 08) ecosystem. This ecosystem extends from the western property boundary across to Mill Creek. Species documented within this community include: Douglas maple (*Acer glabrum*), interior-Douglas fir (*Pseudotsuga menziesii* var. *glauca*), mock-orange (*Philadelphus lewisii*), red-osier dogwood (*Cornus stolonifera*), trembling aspen (*Populus tremuloides*), prickly rose (*Rosa acicularis*), black hawthorn (*Crataegus douglasii*), and Saskatoon (*Amelanchier alnifolia*).

The riparian area of Mill Creek is primarily made up of Black cottonwood/Douglas fir – Common Snowberry – Red-osier Dogwood Riparian communities (CD – IDFxh1 – 00), which commonly associated with active floodplains and fluvial terraces with subsurface water. Generally, the riparian forest exists as a narrow, riparian fringe (<10 m) within the subject property and has been impacted from historical agronomic activity. The dominant tree species are black cottonwood (*Populus balsamifera* ssp. *trichocarpa P. trichocarpa*), and willow (*Salix* spp.) The understory is a dense network of shrubs and herbs, including Douglas maple (*Acer glabrum*), snowberry (*Symphoricarpos albus*), red-osier dogwood (*Cornus stolonifera*), stinging nettle (*Urtica dioica*), and reed canarygrass (*Phalaris arundinacea*).

Pockets of dense cattail marsh wetlands are also present along Mill Creek, however, agricultural practices adjacent to Mill Creek impacted the riparian vegetation, and have resulted in an influx of weedy species now that cultivation has ceased. **These low-lying formerly cultivated areas on flood benches are potential targets for restoration works and riparian habitat enhancement.**

In accordance with the COK OCP, a 15 m setback is required from existing wetlands and a 15 m setback from ancillary creek and Dilworth Creek are included within the development, noting that some riparian offsetting is required for two small building encroachments.

3.2 Wetland Value

The wetland that will be impacted as a result of the proposed works is in a highly disturbed area and is a uniform cattail marsh. As a result, when considered in combination with the impacts from a future COMC, the enhancement of wetland and riparian habitat adjacent to the larger, more intact habitat along Mill Creek should result in a more contiguous wetland and riparian habitat post construction of the COMC. Although any loss of wetland habitat is considered to be a significant risk, Ecoscape anticipates that impacts to aquatic and riparian resource values as a result of the construction can be mitigated through restoration and enhancement plans detailed herein are adhered to – assuming that the proposed COK COMC road infrastructure is built. It is noted here that this impact statement does not consider long term, cumulative impacts to the wetland and riparian habitat associated with the proposed works and similar proposals occurring within nearby wetland habitat from infrastructure

such as the COMC. There is insufficient data to comment on how this loss influences the magnitude of cumulative losses at a local or regional scale.

4.0 **RESTORATION & COMPENSATION PLAN**

The following wetland restoration and riparian enhancement measures have been developed based on the results of the impact assessment, the observed conditions of wetlands on the subject property, and potential for long-term isolation due to the COMC. The restoration plans outlined here are subject to change depending on the site conditions observed during the proposed works and restoration activities. Detailed designs for the wetland restoration plan will be provided as per of the City of Kelowna Development Permit process, where the City of Kelowna will review the information prior to issuance of the DP. The proposed enhancements provide a summary of the total area that will be constructed to mitigate habitat impacts, where specific details will adhere to the design criteria and information in this report.

The restoration plan is based on the following best management practices for wetland construction and restoration:

- Standards and Best Practices for Instream Works: Habitat Enhancement & Restoration BC MoWLAP, 2004;
- Riparian Revegetation BC MoELP & DFO;
- Restoring Wetlands in Washington Stevens & Vanbianchi, 1993;
- Provincial Mitigation and Compensation Policy (BC MoE, 2014).
- Principles and guidelines for wetland restoration (Ramsar, 2002)
- Guideline for Wetland Establishment on Reclaimed Oil Sands Leases (Alberta Environment, 2007)
- Okanagan Wetlands Action Plan (Okanagan Basin Water Board, 2019)
- Ecological Restoration Guidelines for British Columbia (BC MoWLAP, 2017)

British Columbia does not have a defined offset requirement specific to wetlands similar to other provinces (e.g., Alberta's *Wetland Mitigation Directive*), however environmental mitigation and offset planning is addressed in the *Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures*) (BC MoE, 2014). No mandated ratios currently exist for wetland replacement; however, the Province recommends that offsets be constructed in order to maintain ecological equivalency (BC MoE, 2014).

Compensation ratios have been selected based on conservation targets set by the City of Kelowna, regional planning groups and Okanagan biodiversity enhancement targets. Compensation rations were developed using this guidance, planning for a total net improvement of habitat function, and looking to buffer habitat function loss from both a temporary loss due to time needed to re-establish habitat function in restored areas and loss of some of the enhancement area through restoration failure. Wetland losses will be compensated at a ratio of 3:1 to ensure that no-net loss of wetland function occurs in the context of the future COMC corridor. Wetland losses are mostly associated with cattail marsh, which is also one of the easier wetland ecosystem communities of offset for. Additionally,

wetland complexing including more diverse habitats (i.e., open water, complex edges, cattail island, etc.) than exclusive cattail marshes will be used to improve and create higher biodiversity habitats.

Riparian losses will be compensated at a 2:1 ratio, due to the relative lower risk of enhancement failure, with the compensation focused along Mill Creek (**Figure 6**). Ecoscape has proposed four locations where riparian enhancement can occur, as well as proposed wetland offsetting proposed to occur at an existing cattail marsh adjacent to Mill Creek. Between the four proposed restoration and wetland enhancement areas, it is estimated that approximately **19,306 m**² of enhancement will occur out of the **24,562 m**² available within the subject property. A preliminary design of the offset plan is outlined in **Figure 6**, and designs for the proposed wetland along with construction guidelines has been included within **Appendix F** of this report. The following sections outline the restoration plans to address these restoration and enhancement requirements.

Table 1 shows the habitat balance addressing the impacts of the resulting disturbance to the wetlands within the property and the proposed restoration, compensation, and enhancement efforts, the areas of each are provided below.

Table 1. Wetland Ha				
Disturbance/Loss	Total Area (m²)	Compensation Ratio	Restoration/Enhancement Requirement (m ²)	Available Restoration/Enhancement Area Within Property (m ²)
Wetlands	768	3:1	2,304	3,506
Riparian Areas	8,501	2:1	17,002	21,056
Total Required	Restoration/I	Enhancement Area	19,306	24,562

4.1 Wetland Basin Construction and Restoration

The loss of **768** m^2 of wetland habitat will be compensated with **2,304** m^2 of additional wetland habitat present in Restoration Area 1, with approximately **855** m^2 of open water habitat being created, to give a compensation ratio of 3:1. Figure 6 shows an approximate plan of the new wetland, and **Appendix F** includes wetland construction methods and approximate shrubs (~1,200 1-gallon) required within 15 m bandwidth around the wetland. The wetlands will be constructed using standard techniques and design criteria as attached within **Appendix F** of this report; however, the wetland construction will take place on-site under the direction of the EM. General construction guidelines are outlined below:

- Native wetland plants and organic materials within the proposed wetland extension area, as well as from within the footprint of McCurdy Road will be stripped and stockpiled prior to clearing. Invasive vegetation will be removed from the site.
- The wetland basins will be approximately 2 m deep and will be dug within the footprint of the proposed wetland extension (**Figure 6**). The wetland perimeter and wetland bottom will be irregularly shaped in order to create a diversity of micro-habitats and a

variety of water depths. The wetland basin will be constructed in a field fit manner with the EM and contractor.

- The basin will be designed with deep water in the center and shallow benches along the edges to facilitate greater structural complexity with the establishment of robust emergent vegetation (e.g., cattails), submerged and floating aquatic vegetation.
- The existing subsoil conditions, soil saturation, water depth, and duration and frequency of inundation of wetlands adjacent to Mill Creek are considered to fluctuate year-round, with water depth fluctuations being less than 1 vertical meter. In general, it is our belief that the proposed wetland will be wetted on a near year-round basis.
- If required, a pond liner of either clay, bentonite, or a geogrid style, will be installed to retain waters within the basin. If soils are suitable for water retention (i.e., impermeable layer), then pond liners may not be required. This will ensure that proposed works do not create a potential water loss, and result in water retention properties similar to the existing conditions.
- Approximately 20-30 cm of organic material excavated from the basin footprint will be placed throughout over the liner or impermeable layer. The organic layer will support beneficial microbes that will provide water quality benefits.
- Once the subgrade of the basin and benches have been excavated, a coarse rocky substrate will be placed on the pond floor in shallower areas and along the pond margins to provide some structure to the banks.
- Native wetland plants that were stockpiled during the initial clearing stage **may** be replanted along the perimeter of the new wetland basin.
- Standing dead trees (snags) and coarse woody debris will also be retained for the wildlife habitat value they provide.
- Large woody debris salvaged from the site will be placed along the banks extending into the deeper parts of the basin to provide potential basking habitat and to increase structural diversity of the habitat that will benefit reptiles and amphibians.
- Bank slopes should be varied to control water depth and hydroperiod.
- The constructed wetland will be hydrologically connected to Mill Creek and adjacent wetlands; however, it will be designed to be isolated from other waterbodies via surface flows.

4.2 Riparian Enhancement

Ecoscape has provided a riparian enhancement plan to address the loss of riparian habitat surrounding the unnamed stream and Mill Creek as a result of the proposed road extension and multi-family development. Restoration efforts should work to mimic the existing Black cottonwood/Douglas fir – Common Snowberry – Red-osier Dogwood Riparian communities (CD – IDFxh1 – 00) surrounding Mill Creek.
- Native plantings of shrubs and trees suitable for the wetland and riparian areas will be installed at a compensation ratio of 2:1, meaning that the loss of 8,501 m² of riparian habitat will result in a riparian enhancement area with a total area of at least 17,002 m² out of the available 21,056 m² of riparian habitat within the subject property.
- Trees should be planted 3 m on center and shrubs should be planted 1.5 m on center. As such, each tree occupies 7 m², and each shrub occupies approximately 1.8 m². Trees and shrubs should be planted to have equal coverage. Therefore, taking into a buffer for some anticipated loss of plantings during restoration, at minimum, a total of 950 trees and 5,350 shrubs should be planted within the riparian enhancement area to meet the required 17,002 m². A list of suitable broadleaf species for riparian areas, based upon the presence of existing shrubs, is provided in Table 2.

Table 2. Recommended broadleaf plant species and numbers for riparian enhancement.				
Туре	Common Name	Scientific Name	Number	
Tree	black cottonwood	Populus trichocarpa		
	Pacific willow	Salix lucida	950	
	trembling aspen	Populus tremuloides		
	water birch	Betula occidentalis		
Shrub	black hawthorn	Crataegus douglasii	5,350	
	choke cherry	Prunus virginianus		
	Douglas maple	Acer glabrum		
	Scouler's willow	Salix scouleriana		
	common snowberry	Symphoricarpos albus		
	red-osier dogwood	Cornus stolonifera		
	Nootka rose	Rosa acicularis		
	tall Oregon-grape	Mahonia aquifolium		
		Total	6,300	

• Plants should be installed as shown in the typical drawing below. In general, the top of the root ball will be installed level with existing ground and the surrounding area covered with 5 to 10 cm of mulch. The excavation for the plant roots must be at least twice the width of the root ball and backfilled with excavated soil along with appropriate soil amendment (compost or mulch), if required. Hydroseed will be applied to all exposed soils and areas between plantings. The EM will review the plants, planting installation procedures, and condition following planting works.





- Plants should be installed in groups or clusters and make use of suitable micro-climates such as moisture-receiving areas, coarse woody debris, and remnant patches of natural vegetation. Planting should not be completed in an evenly distributed, grid-like pattern. The placement and distribution of plantings will be completed in a field-fit manner under the direction of the EM. **Figure 6** shows a typical distribution to be used in the placement of shrubs, targeting at least 80% ground coverage.
- If feasible, native willow (*Salix* spp.) live stakes should be joint planted amongst any installation of rip rap for bank erosion protection. Live stakes should be installed at a density of approximately 4 stakes per linear meter, recognizing that survival of live stakes will likely be around 25%.
- Planting is recommended in the spring or fall and watering should occur for the first three growing seasons, until the plants are established.
- A target of 80% plant survival is recommended after three years. Additional plantings may be required if the target survivorship is not met.
- Areas of exposed soils surrounding the riparian plantings (i.e., both within and outside of the riparian restoration areas) must be re-vegetated using an appropriate riparian grass seed mix immediately following the completion of the riparian plantings.
- The seed mixture must consist of native and non-invasive species, must be certified Canada Grade #1, and must be reviewed and approved by the EM prior to application.

Ecoscape can provide the client recommendations regarding local suppliers who can provide appropriate upland seed mixes based on the ecological communities within the site.

4.3 Maintenance Plan

Ecoscape understands that the City of Kelowna expects a minimum of a 3-year maintenance plan to ensure success of the restoration and compensation works which will include, at a minimum, **80% survival of planting, successful colonization of desirable grasses, and control of noxious and invasive plant species.** Key components of the recommended maintenance plan to help achieve these goals are provided below.

- Minimum target survival for all plantings will be 80% survivorship after 3 years. Maintenance and monitoring should be conducted at the end of each season (i.e., late summer or early fall) over the 3 year period to determine the condition of the restoration works and to ensure restoration objectives are being met. A suitably qualified environmental professional should be responsible for monitoring plant success and recommending supplemental plantings or other maintenance to help ensure the 80% survivorship is met.
- To help meet the 80% survivorship objective, routine watering will be required during periods of heat and/or drought over the 3-year maintenance period.
- Weed control within the riparian restoration area is essential to ensure the successful establishment of riparian species. It is recommended that the contractor responsible for maintenance should retain the services of a QEP, and budget for at least 3 visits per year for weed control activities (i.e., pulling, bagging, and disposal) and watering.

4.3.1 Invasive Plant Management

- Identification of existing weed populations and prevention of spread is the most efficient form of weed management. To this end, the EM will employ the following weed management plan measures:
 - The EM will identify and delineate any existing species and populations of weeds present within the work site.
 - The EM will inform and educate the contractor about the weed species and locations onsite. If necessary, weed infested areas will be delineated with flagging tape or snow fencing to prevent access.
 - Where feasible, the existing weeds will be removed (by hand pulling) and dispose of offsite at an appropriate landfill. If weed infested areas are identified, then mechanical means (i.e., tilling and mowing) can be used depending on the species present.
 - Areas where weed populations have been identified will not be used for excavation and placement of fill. If excavation of weed infested areas is required, the soils will be disposed of offsite.

$\circ~$ Pesticides, herbicides, or other chemical control measures cannot be used.

- Prevention of the spread of invasive plant species can be achieved by limiting disturbance to soils and native vegetation.
- Equipment used onsite must arrive with tracks free of soil and vegetation fragments to minimize addition and spread of invasive plant species to the project area.
- Pesticides, herbicides, or other chemical control measures must not be used due to close proximity to wetlands. Invasive species are to be pulled by hand or mowed regularly.
- Invasive species removal should occur before peak flowering times to avoid seed distribution and further spread of invasive species.
- Invasive species should be disposed of offsite at an appropriate landfill. They must not be transported to or deposited in other natural areas.

5.0 CONCLUSION

It is our opinion that the proposed development will result in an overall net neutral change to the wetland health in the region, with the remediation options implemented. Rerouting the road will result in increased terrestrial impacts to the upland area, and reduce the conservation value of the land intended to be held in a conservation covenant by the City of Kelowna as it will result in a fragmented area.

Ecoscape has prepared this report with the understanding that all available information on the past, present, and proposed conditions of the site have been disclosed. Troika Management Corp has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information. This report should not be interpreted as an endorsement of the proposed works, but as a municipal tool for decision making.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted, ECOSCAPE Environmental Consultants Ltd.

Prepared by:

Reviewed by:

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APPENDIX C: Landscape Plan Created by Ecora







ENVIRONMENTAL RESTORATION AREA

BLUEGREEN ARCHITECTURE INC

D.E. Pilling SASSOC. E

ecora

ECOSCAPE

These drawings are instruments of service, are the exclusive property of the architect and cannot be reproduced or used for construction without the architect's prior written permission.

This drawing must not be scaled. The general contractor shall verify all dimensions, datums and levels prior to commencement of work.

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+	80 Cor 90 Ect	reopsis grandiflora ninacea purpurea 'Magnus'	Tickseed Magnus Coneflower	#01 P #01 P	0.45m x 0.45m x 0.45m x 0.75m x 0.75m x	Sheet Title	
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	PLANT LIST - BLOCK C QTY BOTANICAL NAME	COMMON NAME SIZE	ROOT Mature Plant Size (Ht.xWd.)	
	Cercidiphyllum japonicum Katsura Tree' Fraxinus pennsylvanica	Katsura Tree 6cm Cal Patmore Green Ash	B&B 10.0m x 7.0m B&B 9.0m x 7.0m	
	10 Platanus x acerifolia 'Bloodgood 10 Prunus virginiana	y ['] Bloodgood' London 6cm Planetree Cal Chokecherry Cal	B&B 12.0m x 4.0m B&B 9.0m x 6.0m	
	5 Quercus bicolor 'Bonnie and Mike' 10 Quercus macrocarpa	White Oak 6cm Cal Bur Oak 6cm Cal	B&B 8.0m x 7.0m B&B 15.0m x 15.0m	
	Shrubs 40 Amelanchier alnifolia 40 Cornus alba 'Baihalo'	Saskatoon Serviceberry #02 Ivory Halo Dogwood #02	Potted 1.5m x 1.5m Potted 1.5m x 1.5m	NO. DATE RECORD OF REVISIONS
	35 Ericameria nauseosus 60 Euonymus alatus 'Compactus' 35 Rhus aromatica 'Gro-Low'	Rubber Rabbitbrush #02 Dwarf Winged Burning Bush #02 Fragrant Sumac #02	Potted 1.0m x 1.5m Potted 2.0m x 1.5m Potted 1.0m x 1.8m	
	50 Salix purpurea 'Nana' 50 Salix purpurea 'Nana' 50 Symphoricarpos albus	Dwarf Blue Artic#02Willow#02Common Snowberry#02	Potted1.5m x 1.5mPotted1.2m x 1.2m	
	180 Deschampsia cespitosa 'Bronzeschleier' 180 Helictotrichon sempervirens	Bronze Veil Heir Grass #01 Blue Oat Grass #01	Potted 0.9m x 0.75m Potted 0.9m x 0.9m	
	 180 Molina arundinacea 250 Panicum virgatum 'Shenadoah' 180 Pennisetum alopecuroides 100 Sebias the second second	Grass #01 Switch Grass #01 Fountain Grass #01 Home State #01	Potted1.0m x 1.2mPotted1.2m x 1.0mPotted0.6m x 0.6m	
	Perennials 180 Achillea filipendulina 'Cloth of Gold'	Little Bluestem #01 Varrow 'Cloth of Gold' #01	Potted 0.9m x 0.6m Potted 1.2m x 0.6m	
	90 Coreopsis grandiflora 120 Echinacea purpurea 'Magnus'	Tickseed #01 Magnus Coneflower #01	Potted 0.45m x 0.45m Potted 0.75m x 0.75m	
	120 Eupatorium dubium 'Baby Joe' 120 Matteuccia struthiopteris 180 Monarda didyma 'Jacob Cline' Nepeta x faassenii 'Walker's	Dwarf Joy Pye Weed #01 Ostrich Fern #01 Bee Balm #01	Potted 0.75m x 0.9m Potted 0.75m x 0.6m Potted 1.2m x 0.75m	
	 90 Low' 180 Perovskia atriplicifolia 120 Salvia nemerosa 'Caradonna' 	Walker's Low Catmint#01Russian Sage#01Sage#01	Potted 0.5m x 0.9m Potted 1.2m x 1.2m Potted 0.6m x 0.65m	2 21/05/18 DEVELOPMENT PERMIT
OCK B (SEE LDP 02a)	HYDROSEED - SEED MIX Seed Weight BOTANICAL NAME	COMMON NAME		1 19/11/18 DEVELOPMENT PERMIT
	40% Pseudoroegneria spicata	Bluebunch wheatgrass		NO. DATE RECORD OF ISSUED
	10%Festuca idahoensis10%Balsamorhiza sagittata	Idaho Fescue Arrowleaf Balsamroot		
	10%Achillea millefolium10%Gaillardia aristata	Common Yarrow Blanket Flower		"A HILLSIDE COMMUNITY"
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	PLANT LIST - BLOCK D QTY BOTANICAL NAME COMMON NAME SIZE ROOT Mature Plant Size (Ht.xWd.)	
	Trees Deciduous 6cm 9 Cercidiphyllum japonicum Katsura Tree 6cm Cal B&B Determine generative genetative genetative generative generative genetative generative ge	
	10 Planetree Cal B&B 12.0m x 4.0m 7 Prunus virginiana Chokecherry 4cm Cal B&B 9.0m x 6.0m 3 Quercus macrocarpa Bur Oak 6cm Cal B&B 15.0m x 15.0m	
	Shrubs Saskatoon 60 Amelanchier alnifolia Serviceberry #02 Potted 1.5m x 1.5m	NO. DATE RECORD OF REVISIONS
	60Cornus alba 'Bainalo'Ivory Halo Dogwood#02Potted1.5m x 1.5m50Ericameria nauseosusRubber Rabbitbrush#02Potted1.0m x 1.5m70Euonymus alatus 'Compactus'Dwarf Winged Burning Bush#02Potted2.0m x 1.5m	
	60Rhus aromatica 'Gro-Low'Fragrant Sumac#02Potted1.0m x 1.8m90Salix purpurea 'Nana'Dwarf Blue Artic Willow#02Potted1.5m x 1.5m80Symphoricarpos albusCommon Snowberry#02Potted1.2m x 1.2m	
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	80 Molina arundinacea Purple Moor Grass #01 Potted 1.0m x 1.2m 100 Panicum virgatum 'Shenadoah' Switch Grass #01 Potted 1.2m x 1.0m	
	B0 Schizachyrium scoparium Little Bluestem #01 Potted 0.6m x 0.6m Perennials #01 Potted 0.9m x 0.6m 450 Achillea filipendulina 'Cloth of xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
	ISO Gold' Yarrow Cloth of Gold' #01 Potted 1.2m x 0.6m 70 Coreopsis grandiflora Tickseed #01 Potted 0.45m x 90 Echinacea purpurea 'Magnus' Magnus Coneflower #01 Potted 0.75m x	
	90 Eupatorium dubium 'Baby Joe' Dwarf Joy Pye Weed #01 Potted 0.75m x 0.9m 120 Matteuccia struthiopteris Ostrich Fern #01 Potted 0.75m x 0.6m 130 Monarda didyma 'Jacob Cline' Bee Balm #01 Potted 1.2m x 0.75m	
	60 Nepeta x faassenii 'Walker's Low' Walker's Low Catmint #01 Potted 0.5m x 0.9m 130 Perovskia atriplicifolia Russian Sage #01 Potted 1.2m x 1.2m 20 Sate #01 Potted 1.2m x 0.9m	2 21/05/18 DEVELOPMENT PERMIT
	90 Salvia hemerosa Caradonna oage #01 Polled 0.011 x 0.0511	
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	Seed Weight BOTANICAL NAME COMMON NAME 40% Pseudoroegneria spicata Bluebunch wheatgrass	TERRENO
	20% Festuca campestris Rough Fescue 10% Festuca idahoensis Idaho Fescue 10% Balsamorbiza sagittata Arrowloof Poleomroot	"A HILLSIDE COMMUNITY" KELOWNA, BC
	10% Achillea millefolium Common Yarrow 10% Gaillardia aristata Blanket Flower	Shoot Title
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	QTY BOTANICAL NAME Trees Deciduous Cercidiphyllum japonicum	COMMON NAME SIZE ROOT Mature Plant Size (Ht.xWd.)	
	Katsura Tree' 5 Fraxinus pennsylvanica 'Patmore 6 Platanus x acerifolia 'Bloodgood'	Cal Patmore Green Ash 4cm Cal B&B 9.0m x 7.0m "Bloodgood' London 6cm Cal Planetree Cal	
	15 Prunus virginiana 6 Quercus bicolor 'Bonnie and Mike'	Chokecherry 4cm Cal B&B 9.0m x 6.0m White Oak 6cm Cal B&B 8.0m x 7.0m	
	6 Quercus macrocarpa Shrubs 50 Amelanchier alnifolia	Bur Oak 0cm Cal B&B 15.0m x 15.0m Saskatoon Serviceberry #02 Potted 1.5m x 1.5m	
	 50 Cornus alba 'Baihalo' 40 Ericameria nauseosus 60 Euonymus alatus 'Compactus' 	Ivory Halo Dogwood #02 Potted 1.5m x 1.5m Rubber Rabbitbrush #02 Potted 1.0m x 1.5m Dwarf Winged Burning Bush #02 Potted 2.0m x 1.5m	
	 40 Rhus aromatica 'Gro-Low' 100 Salix purpurea 'Nana' 60 Symphoricarpos albus 	Designant Sumac #02 Potted 1.0m x 1.8m Dwarf Blue Artic #02 Potted 1.5m x 1.5m Willow #02 Potted 1.2m x 1.2m	
	Grasses 210 Deschampsia cespitosa 'Bronzeschleier' 210 Helictotrichon sempervirens	Bronze Veil Heir Grass #01 Potted 0.9m x 0.75m Blue Oat Grass #01 Potted 0.9m x 0.9m	
	 200 Molina arundinacea 150 Panicum virgatum 'Shenadoah' 220 Pennisetum alopecuroides 200 Sehimerium 	Purple Moor Grass Grass#01Potted1.0m x 1.2mSwitch Grass#01Potted1.2m x 1.0mFountain Grass#01Potted0.6m x 0.6m	
	220 Scnizachyrium scoparium Perennials 230 Achillea filipendulina 'Cloth of Gold'	Little Bluestem #01 Potted 0.9m x 0.6m Yarrow 'Cloth of Gold' #01 Potted 1.2m x 0.6m	
	 150 Coreopsis grandiflora 160 Echinacea purpurea 'Magnus' 170 Eupatorium dubium 'Baby Joe' 	Tickseed #01 Potted 0.45m x 0.45m Magnus Coneflower #01 Potted 0.75m x 0.75m x Dwarf Joy Pye Weed #01 Potted 0.75m x 0.9m	
	 180 Matteuccia struthiopteris 200 Monarda didyma 'Jacob Cline' 150 Nepeta x faassenii 'Walker's Low' 	Ostrich Fern #01 Potted 0.75m x 0.6m Bee Balm #01 Potted 1.2m x 0.75m Walker's Low Catmint #01 Potted 0.5m x 0.9m	2 21/05/18 DEVELOPMENT PERMIT
	150 Perovskia atriplicifolia160 Salvia nemerosa 'Caradonna'	Russian Sage#01Potted1.2m x 1.2mSage#01Potted0.6m x 0.65m	1 19/11/18 DEVELOPMENT PERMIT
	HYDROSEED - SEED MIX Seed Weight BOTANICAL NAME	COMMON NAME	NO. DATE RECORD OF ISSUED Project
	40% spicata 20% Festuca campestris	Bluebunch wheatgrass Rough Fescue	TERRENO
	10%Pestuca hanoensis10%Balsamorhiza sagittata10%Achillea millefolium	Arrowleaf Balsamroot Common Yarrow	"A HILLSIDE COMMUNITY"
	10% Gaillardia aristata	Blanket Flower	
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HYDROZONE LEGEND:

LOW WATER REQUIREMENTS GRASSES / PERENNIALS
MEDIUM WATER REQUIREMENTS SHRUBS
HIGH WATER REQUIREMENTS SOD AREA

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"A HILLSIDE COMMUNITY" KELOWNA, BC				
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EXTEND FINISH TO EDGE OF TOOLED JOINT. NO TROWEL EDGES

-50mm (10mm MINUS) OF CRUSHED ROCK. 2 TO 3 INCHES OF APPROVED CRUSHED GRAVEL BASE

NOTES:

1. DEPTH OF ROOTBALL TO MATCH ORIGINAL ROOTBALL DEPTH ESTABLISHED IN THE NURSERY. ANY TREES PLANTED TOO LOW SHALL BE RAISED AT CONTRACTOR'S EXPENSE.

USE (2) 75 X 2000mm HGT. PRESSURE TREATED STAKES. POSITION STAKE OUTSIDE OF THE ROOTBALL. ENSURE STAKES PENETRATE INTO A SOLID SUB-SOIL BASE.

-GUYWIRE SYSTEM

-PLANT TREE WITH TRUNK FLARE AT FINISHED GRADE OF MULCH

-50mm SPECIFIED MULCH

- DEPTH VARIES TO SUIT ROOTBALL SIZE

FOLD / REMOVE TOP QUARTER OF WIRE BASKET. REMOVE BURLAP FROM TOP OF ROOT BALL. COMPACT SOIL IN LIFTS AS BACKFILLING

BASE OF TREE PIT TO BE COMPACTED TO STABILIZE TREE.

SPECIFIED MULCH

REMOVE DEAD, DYING AND-

DAMAGED BRANCHES BY PRUNING

220 ------ VARIES ------

5 SHRUB PLANTING 1:20

-ADJACENT PAVING (SEE PLAN)

-NON-WOVEN

SIZE AND TYPE

1. REMOVE CONTAINER ROOT SYSTEM WITHOUT

NOTES:

WHEN PLANTING

-GROWING MEDIUM POCKET

-NATIVE SUBGRADE

-SCARIFY PIT BOTTOM

DISTURBING THE ROOT SYSTEM OF THE PLANT 2. CONTRACTOR TO ALLOW FOR SETTLEMENT

-PREPARE GROWING MEDIUM SAUCER AROUND PLANTS

BLUEGREEN ARCHITECTURE INC E. Pilling Sassoc. **610** ec ECOSCAPI hese drawings are instruments of service, are the exclusive property of the architect and cannot be reproduced or used for construction without the architect's prior written permission. This drawing must not be scaled. The general contractor shall verify all dimensions, datums and levels prior to commencement of work. TROIKA TERRENO DEVELOPMENT JV NO. DATE RECORD OF REVISIONS 2 21/05/18 DEVELOPMENT PERMIT 1 19/11/18 DEVELOPMENT PERMIT NO. DATE RECORD OF ISSUED TERRENO "A HILLSIDE COMMUNITY" KELOWNA, BC Sheet Title DETAIL DRAWINGS

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APPENDIX D: BMPs for Herptile Crossing Structures

Provincial BMPs for Amphibians and Reptiles

Routing of new roads to avoid important wetlands and key migration routes is the best measure to minimize effects of roads on amphibian and reptile populations. Where avoidance is impossible or roads already exist, fencing and crossing structures can be used.

Permanent mitigation measures include tunnel systems, other crossing structures, and relocations of breeding sites. Recommendations for effective amphibian and reptile tunnel and fencing systems adjacent to roads include the following:

a) Tunnel and fencing systems:

- Proper location of tunnels and fences is based on specific knowledge of target species and their migration routes in the area; orient tunnels along known routes between winter/foraging grounds and breeding grounds.
- Tunnels can be constructed of a variety of materials, including concrete, steel, PVC piping, and polymer surface products. Steel is thought to be less desirable because of its high conductivity and coldness during spring migratory periods; metals leaching from galvanized steel may be harmful to amphibians.
- Tunnels with large diameter (such as 1 m) are effective and also allow for passage of a variety of other animals; interval between tunnels should be 50 m or less.
- Smaller tunnels with overhead openings for ambient light and moisture are effective; the small openings are covered by metal grates to minimize interference with vehicle movements along roads.
- Tunnels should not exceed 30 35 m in length.
- Ensure that drainage is adequate to avoid flooding of tunnels.
- Fencing is needed to intercept movements of animals and direct them towards the tunnels. Where the drift fencing is parallel to the road, additional fences are needed to funnel the animals towards the tunnel entrance; drift fences can be constructed of various materials, including concrete, rigid plastic, and polyethylene sheets. Fences should be sufficiently long, be constructed of durable materials, and be regularly inspected for damage. Berms with sloping earth and retaining walls can also be deployed along portions of the system.
- Fences about 50 cm in height appear to be suitable for most species; bury the bottom 6 10 cm of the drift fence to prevent animals from tunneling underneath.

b) Relocation of breeding sites:

• Where the probability of road mortality is high, relocation of breeding sites may be an option. This might involve construction of a permanent fence to keep animals away from the road and the creation or enhancement of alternative breeding sites. This is an option where most habitats are on one side of the road.

c) Stream culverts:

• For stream-dwelling amphibians (Coastal Giant Salamander and Tailed frogs), open bottom culverts are thought to facilitate movements of animals across roads. This culvert design eliminates contact with steel and maintains natural substrates along the bottom of the culvert.

Check-list:

- Do the targeted species of amphibians and reptiles use the structures provided?
- Are road mortalities reduced?
- Are there problems with animals breaching the fences or going around them?
- If breeding sites were relocated, are animals using the new areas as planned?
- Who is responsible for ensuring that the structures are functioning properly?
- Does the monitoring plan address the effectiveness of the structures; has it been implemented; are the results summarized on a regular basis?

5.3.6 Pollution Control Measures for Amphibians and Reptile Habitats

Amphibians and reptiles in the vicinity of populated areas are exposed to a wide variety of contaminants that have the potential to affect their health, survival, and persistence in these landscapes. The main types of pollutants include pesticides, sediments, organic matter, nutrients, heavy metals, and petrochemicals. Some chemical compounds act as endocrine disrupters (EDCs) and can interfere with hormone signals during sensitive developmental periods. Heavy metals are highly toxic to amphibians. All these substances can be transported through surface run-off or in ground water and will eventually end up in ponds and wetlands. Pesticides are often the most common contaminants in amphibian and reptile habitats.

The main sources of pollutants in urban and rural environments include:

APPENDIX E: Bat Box Design Requirements for the Okanagan

The purpose of this document is to provide information about effective bat house design and placement for private landowners in BC. There is still much for us to learn about how bats determine which roost is most suitable, so try experimenting by putting bat houses in different locations, varying the dimensions, or staining one and not the other. Monitor occupancy by bats in summer by looking for guano under the bat house or observing the bat house at dusk to see if bats fly out. Register your bat house and report your results to the BC Community Bat Program (Appendix 1 or http://bcbats.ca/index.php/bat-house) so we can continue to improve the information in this document.

Key Features of Effective Bat Houses

There are several factors to consider when building or purchasing a bat house. Factors that influence success in attracting bats include the design, size, number of chambers, chamber spacing, surface roughness, and presence of vents and landing strip. Other factors to consider when selecting a style are cost, size of the bat colony (if you are excluding bats from a building), and location options. The most common designs on the market are bat boxes, rocket boxes and condos (see *Bat House Designs* section).

APPENDIX F: Wetland Design Created by Ecoscape

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