2265 NARAMATA ROAD, NARAMATA

Lot 1, Plan KAP16214, District Lot 206, Similkameen Div of Yale Land District

ENVIRONMENTAL ASSESSMENT

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1.0 INTRODUCTION

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by Silverspan Trams Inc. (client) to complete an Environmental Assessment (EA) of proposed development activities at 2265 Naramata Rd, Naramata, BC (subject property; **Figure 1**). The subject property is legally described as Lot 1, Plan KAP16214, District Lot 206, Similkameen Division of Yale Land District, Except Plan H17800. The subject property is situated along the eastern shoreline of Okanagan Lake and occurs within the Regional District of Okanagan-Similkameen (RDOS) Electoral Area "E" (Naramata) Environmentally Sensitive Development Permit Area and the Watercourse Development Permit (WDP) Area. The development within the subject property therefore requires an EA to address the potential for adverse environmental effects associated with the proposed works.

This EA report has been prepared to accompany a site-specific Official Community Plan (OCP) amendment to Naramata's OCP (Bylaw No. 2458, 2008). The amendment pertains to Section 23.3.7 to add another condition under the "Expedited Development Permit" category to allow for a tram to be partially constructed within the Streamside Protection and Enhancement Area (SPEA) on the subject property. This report addresses Naramata's DP area guidelines, identifies aquatic and terrestrial resource values within proximity to the development footprint, assesses the impacts of the proposed works, and subsequently provides mitigation measures to protect and enhance the natural integrity of the riparian and foreshore area.

2.0 PROPOSED WORKS AND BACKGROUND

The proposed works include the construction of a tram southwest of the existing residence from the edge of the orchard to the beach area adjacent to Okanagan Lake in order to access the foreshore from the subject property (**Photos 1 and 2; Figure 2; Appendix A**). The tram will be built at an approximate 36-degree incline followed by a 41-degree incline consistent with the existing bank grade and will be approximately 96.01 m long. The carriage dimensions will be 1.524 m by 1.219 m. The upper landing of the tram will be located southwest of the existing residence with an open track design. A few native shrubs and grasses are the only vegetation throughout the path of the proposed tram other than the invasive tree of heaven (*Ailanthus altissima*) located at the lower landing of the tram (See Section 6.0; **Photo 3**). The upper landing of the tram is located at the edge of the orchard in the backyard, bordering the northern boundary of the property, with a proposed new deck extending to the rear entry of the upper landing of the tram (**Photo 4**). The proposed lower landing of the tram will be approximately 3.0 m^2 and a small set of five stairs will extend from the side exit of the lower landing down to the beach area (**Photo 5**). The entirety of the tram will be constructed above the high-water level (HWL) of Okanagan Lake. The tram alignment will use a total of 16 sets of screw piles all spaced approximately equidistant. The shear frame of the tram will be anchored to a newly poured concrete block (**Appendix A**). A

portion of the proposed tram footprint (16.7 m^2) encroaches within the SPEA, with the total footprint of the tram estimated to be 109.9 m^2 (**Figure 2**). A geotechnical assessment has been completed for the proposed tram and is provided in **Appendix B**.

The subject property has very limited and dangerous access to the foreshore. There is no existing foreshore access (i.e., established trail, staircase or tram) down to the lake; the only possible method of accessing the foreshore from the subject property is to scale down the dangerously steep hillside. This method of access could easily result in hazardous situations, such as individual injury and/or slope failure on an unstable hillside. Furthermore, it limits access to the foreshore to only the fittest of individuals. Considering a dock is to be constructed in the summer of 2022, a safe, designated method of foreshore access is required so that all individuals of the household, young and old, can safely access and enjoy the waterfront from the subject property.

There are several foreshore access options available to lakefront property owners: a trail, a staircase or a tram. Under the Riparian Areas Protection Regulation (RAPR), the construction of a new permeable (i.e., gravel or similar) trail in the SPEA is permitted (per. comm. Andrew Appleton, RAPR Coordinator). RAPR would also allow for the *replacement* of a staircase or similar structure within the SPEA if it were to become damaged or destroyed (no more than 75% damaged), as long as the replacement structure is identical (i.e., same materials and footprint; RAPR S.3(3)). However, RAPR does not allow for the construction of a *new* foreshore access structure such as a staircase or tram in the SPEA.

Despite what RAPR indicates and the Province has deemed non-compliant, municipalities such as the Regional District of Central Okanagan, Regional District Okanagan Similkameen, City of Kelowna, City of West Kelowna, District of Peachland, District of Lake County and others have allowed the construction of new foreshore access structures such as staircases and trams, assuming there is only a single access route.

As Qualified Environmental Professionals (QEPs), Ecoscape can assure that the proposed tram to allow for foreshore access directly from the subject property that would partially be constructed within the SPEA would not result in a harmful alteration, disruption or destruction (HADD) of the natural features, functions and conditions of fish and fish habitat under the Federal *Fisheries Act*. Alternatively, at this particular site we could not make the same assurance that the construction of a trail would not result in a HADD due to the impacts associated with a trail, although it would be considered RAPR compliant and consequently meet the requirements under Section 27.3.7 of the Naramata OCP. The creation of a trail would result in significantly greater environmental impacts to the SPEA in comparison to that of a tram because of the cut/fill element to create a path of a reasonable grade, and from the "switchbacks" that would be required across the steep slope through the SPEA (**Photo 10**). Consequently, the switchbacks and cut/fill activities associated with a trail can leave a permanent scar on the sensitive, naturally eroding, steep slope shrub-steppe ecosystem. The extensive cut/fill activities that would be required to construct a trail on a steep slope like the subject property's would dramatically increase the risk of slope failure compared to

constructing a tram down a steep slope. If an unstable slope were to fail into the lake from constructing a trail, it would almost certainly result in a HADD due to infilling of the lake.

These ecosystems are incredibly vulnerable to such disturbances and can take an incredibly long time to recover and re-establish if the trail were to be decommissioned. Alternatively, a tram would have a significantly smaller footprint that is also less permanent; a tram can be decommissioned in less than a day by hand and only leave behind the helical screw piles (**Photo 9, 11**). Trams also result in fewer impacts compared to a trail as far fewer vegetation removals would be required considering the majority of a tram is hovering over the ground and it is only the helical screw piles that are permanent (**Photo 8**).

Furthermore, because of the hovering nature of trams, they have no impact on shading as sunlight can penetrate and they do not facilitate invasive species establishment like a trail would from extensive earthworks. For example, a 60 m long tram could result in a permanent disturbance of only 0.076 m^2 from the remaining helical screws following decommissioning (**Photo 11**). It can then be estimated that the permanent disturbance associated with the proposed 96.01 m long tram would only be 0.122 m^2. As seen in **Photo 10**, the permanent disturbance footprint associated with a switchback trail down a steep, silty, slope could be extensive. If a trail like this were to be constructed on the subject property instead of a tram, the permanent disturbance footprint could be well over 600 m^2 (400 m long by 1.5 m wide trail) and the temporary disturbance footprint considering cut and fill slopes could easily exceed 1,000 m^2 as the slope is significant for the bottom two-thirds of the subject property.

Considering the significant environmental impacts and the potential for a HADD under the Federal *Fisheries Act* associated with constructing a RAPR compliant trail down a steep slope to the foreshore, it is proposed that a tram be permitted at the subject property through a site specific OCP amendment. The amendment would add a condition to allow for a tram with a total footprint of 109.9 m^2 to be partially constructed within the SPEA / WDP area (only 16.7 m^2 within the SPEA/WDP area) on the subject property in order to allow for foreshore access from upland (**Figure 3**).

3.0 ENVIRONMENTAL SETTING

A site assessment of the subject property was conducted on August 31, 2021, by Octavia Mahdiyan, M.Sc., B.I.T., Natural Resource Biologist, with Ecoscape. Riparian setback requirements from Okanagan Lake were determined following the Naramata's OCP, with reference to the Provincial Riparian Areas Protection Regulation (RAPR), which considers the present and potential fisheries resource values. The following sections describe the conditions of the subject property.

3.1 Terrestrial Conditions

The subject property occurs within an agricultural area along the eastern shoreline of Okanagan Lake and contains an existing single-family dwelling. The subject property is bounded by Okanagan Lake to the west, residential properties to the north and south, and Naramata Rd to the east. A dirt path provides crossing over to the neighbor's property, which provides foreshore access down the hill to the beach area (**Photos 6**).

The subject property occurs within the Okanagan variant Very Dry Hot subzone of the Ponderosa Pine biogeoclimatic zone (PPxh1). The PP zone occupies low elevations within the very dry valleys of the southern Interior Plateau of BC and is generally the driest forested region in the province. The climate consists of hot dry conditions in the summer, and cool conditions with little snow in the winter. Historically, fire has played an essential role in the ecology of this zone. The PPxh1 is dominated by open canopy forests of Ponderosa pine with a bunchgrass understory (Hope et al., 1991).

The BC Conservation Data Centre (CDC) was accessed on September 20, 2021 and reviewed for at-risk ecological communities that occur within a 1.0 km radius of the subject property. No plant species at risk were observed within the subject property. A list of native plant species found within the subject property is included in **Table 1** and a list of exotic plant species are provided in **Table 2**.

Table 1. Native plant species observed within the subject property			
Family	**Scientific Name**	**Common Name**	**BC List [1]**
Asteraceae	*Artemisia tridentata ssp. tridentata*	Big sagebrush	Yellow
Berberidaceae	*Berberis aquifolium*	Tall Oregon-Grape	Yellow
Caprifoliaceae	*Symphoricarpos albus*	Common Snowberry	Yellow
Pinaceae	*Pinus ponderosa*	Ponderosa Pine	Yellow
Pinaceae	*Pseudotsuga menziesii*	Douglas-fir, Interior	Yellow
Poaceae	*Pseudoroegneria spicata*	Bluebunch wheatgrass	Yellow
Rosaceae	*Amelanchier alnifolia*	Saskatoon	Yellow

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened. **Various**: May be one of multiple potential listings, depending upon more detailed taxonomic classification.

Table 2. Exotic plant species observed within the subject property			
Family	**Scientific Name**	**Common Name**	**BC List [1]**
Asteraceae	*Cirsium spp.*	Thistle	Exotic
Elaeagnaceae	*Elaeagnus angustifolia*	Russian olive	Exotic
Simaroubaceae	*Ailanthus altissima*	Tree of heaven	Exotic

[1] **Exotic**: Species that have been moved by humans to areas outside of their native ranges where they have become established.

3.2 Wildlife

Due to the scope of this assessment, a detailed wildlife assessment of the subject property was not conducted. During the site visit on August 31, 2021, a number of mature trees, tree snags, shrubs, and a well-developed and diverse understory where observed. The native vegetation on the subject property provides optimal perching, foraging, and nesting habitat for a diversity of birds and other wildlife.

3.2.1 Species at Risk

The CDC was accessed on September 20, 2021 and reviewed for species-at-risk occurrence records, wildlife species inventory records and critical habitat occurrences within a 1.0 km radius of the subject property. Species-at-risk results are provided in **Table 3**. Critical habitat occurrences are provided in **Table 4**.

Table 3. Species-at-risk occurrences within 1 km of the subject property (CDC 2021b)				
Common Name	**Species**	**BC List [1]**	**Shape ID / Occurrence ID**	**Distance**
American badger	*Taxidea taxus*	Red	74373 / 12564357	10 km grid square overlapping the subject property. Last observed in 2012.

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

Table 4. Critical habitat occurrences within 1 km of the subject property (CDC 2021b)				
Common Name	**Species**	**BC List [1]**	**Critical Habitat ID**	**Distance [2]**
Great Basin Gophersnake	*Pituophis catenifer deserticola*	Blue	71541	Proposed critical habitat occurring in a 10 km grid square overlapping the subject property.
Great Basin Spadefoot	*Spea intermontana*	Blue	61759	Proposed critical habitat occurring in a polygon overlapping the subject property.
Western rattlesnake	*Crotalus oreganus*	Blue	71773	Proposed critical habitat occurring in a polygon overlapping the subject property.
Lewis's Woodpecker	*Melanerpes lewis*	Red	7392	Proposed critical habitat occurring in a polygon overlapping the subject property.

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

Data from the BC Species and Ecosystems Explorer was also queried and species-at-risk that use the habitat types occurring on the subject property were determined. This determination was done by querying species-at-risk within the relevant biogeoclimatic zone and examining their habitat type usage (BC CDC, 2020b). Only species with frequently-facultative use or obligate use of habitat types on site have been indicated within **Table 5**. Those species with occasional-facultative use or no use have been omitted.

Table 5. Species-at-risk frequent-use habitat presence (CDC, 2021b)					
Species Group	**Scientific Name**	**Common Name**	**BC List [1]**	**Use of Habitat Present**	**Likelihood to occur**
Amphibians	Lithobates pipiens	Northern Leopard Frog	Red	Obligate	Low
	Spea intermontana	Great Basin Spadefoot	Blue	Obligate	Moderate
Birds	Aechmophorus clarkii	Clark's Grebe	Red	Obligate	Low
	Aechmophorus occidentalis	Western Grebe	Red	Frequent	Low
	Ardea herodias herodias	Great Blue Heron, herodias subspecies	Blue	Frequent	Moderate
	Bartramia longicauda	Upland Sandpiper	Red	Frequent	Low
	Botaurus lentiginosus	American Bittern	Blue	Frequent	Low
	Buteo swainsoni	Swainson's Hawk	Red	Frequent	Moderate
	Butorides virescens	Green Heron	Blue	Frequent	Low
	Catherpes mexicanus	Canyon Wren	Blue	Frequent	Low
	Chondestes grammacus	Lark Sparrow	Blue	Frequent	Low
	Contopus cooperi	Olive-sided Flycatcher	Blue	Frequent	High
	Cygnus columbianus	Tundra Swan	Blue	Frequent	Low
	Cypseloides niger	Black Swift	Blue	Frequent	Low
	Eremophila alpestris merrilli	Horned Lark, merrilli subspecies	Blue	Frequent	Low
	Falco mexicanus	Prairie Falcon	Red	Frequent	Low
	Falco peregrinus anatum	Peregrine Falcon, anatum subspecies	Red	Frequent	Low
	Falco rusticolus	Gyrfalcon	Blue	Frequent	Low
	Hirundo rustica	Barn Swallow	Blue	Frequent	High
	Hydroprogne caspia	Caspian Tern	Blue	Frequent	Low
	Icteria virens	Yellow-breasted Chat	Red	Frequent	Moderate
	Larus californicus	California Gull	Blue	Obligate	Low
	Megascops kennicottii macfarlanei	Western Screech-Owl, macfarlanei subspecies	Blue	Frequent	Low
	Melanerpes lewis	Lewis's Woodpecker	Blue	Frequent	Low
	Melanitta perspicillata	Surf Scoter	Blue	Frequent	Low
	Nycticorax nycticorax	Black-crowned Night-heron	Red	Frequent	Low

Table 5. Species-at-risk frequent-use habitat presence (CDC, 2021b)					
Species Group	**Scientific Name**	**Common Name**	**BC List [1]**	**Use of Habitat Present**	**Likelihood to occur**
	Oreoscoptes montanus	Sage Thrasher	Red	Obligate	Low
	Patagioenas fasciata	Band-tailed Pigeon	Blue	Frequent	Low
	Pelecanus erythrorhynchos	American White Pelican	Red	Obligate	Low
	Phalaropus lobatus	Red-necked Phalarope	Blue	Frequent	Low
	Psiloscops flammeolus	Flammulated Owl	Blue	Frequent	Low
	Recurvirostra americana	American Avocet	Blue	Frequent	Low
	Sphyrapicus thyroideus	Williamson's Sapsucker	Blue	Frequent	Low
	Spizella breweri breweri	Brewer's Sparrow, breweri subspecies	Blue	Frequent	Low
	Sterna forsteri	Forster's Tern	Red	Frequent	Low
Bivalves	Gonidea angulata	Rocky Mountain Ridged Mussel	Red	Obligate	Moderate
Gastropods	Galba truncatula	Attenuate Fossaria	Blue	Obligate	Low
	Hemphillia camelus	Pale Jumping-slug	Blue	Obligate	Low
	Magnipelta mycophaga	Magnum Mantleslug	Blue	Obligate	Low
	Pristiloma arcticum	Northern Tightcoil	Blue	Obligate	Low
	Promenetus umbilicatellus	Umbilicate Sprite	Blue	Obligate	Low
	Stagnicola apicina	Abbreviate Pondsnail	Blue	Obligate	Low
Insects	Aeshna constricta	Lance-tipped Darner	Blue	Obligate	Low
	Apodemia mormo	Mormon Metalmark	Red	Obligate	Low
	Argia emma	Emma's Dancer	Blue	Obligate	High
	Cicindela decemnotata	Badlands Tiger Beetle	Red	Obligate	Low
	Cicindela pugetana	Sagebrush Tiger Beetle	Blue	Obligate	Moderate
	Enallagma clausum	Alkali Bluet	Blue	Frequent	Low
	Erythemis collocata	Western Pondhawk	Blue	Obligate	Moderate
	Hesperia nevada	Nevada Skipper	Blue	Obligate	Low
	Libellula pulchella	Twelve-spotted Skimmer	Blue	Obligate	Moderate
	Lycaena nivalis	Lilac-bordered Copper	Blue	Frequent	Low
	Macromia magnifica	Western River Cruiser	Blue	Frequent	Moderate

Table 5. Species-at-risk frequent-use habitat presence (CDC, 2021b)					
Species Group	**Scientific Name**	**Common Name**	**BC List [1]**	**Use of Habitat Present**	**Likelihood to occur**
	Ophiogomphus occidentis	Sinuous Snaketail	Blue	Obligate	Moderate
	Phanogomphus graslinellus	Pronghorn Clubtail	Blue	Frequent	Low
	Pholisora catullus	Common Sootywing	Blue	Frequent	Low
	Pyrgus communis	Checkered Skipper	Blue	Frequent	Moderate
	Satyrium semiluna	Half-moon Hairstreak	Red	Obligate	Low
Mammals	Antrozous pallidus	Pallid Bat	Red	Frequent	Low
	Corynorhinus townsendii	Townsend's Big-eared Bat	Blue	Frequent	Moderate
	Euderma maculatum	Spotted Bat	Blue	Frequent	Low
	Gulo gulo luscus	Wolverine, luscus subspecies	Blue	Frequent	Low
	Myotis ciliolabrum	Western Small-footed Myotis	Blue	Frequent	Low
	Myotis thysanodes	Fringed Myotis	Blue	Frequent	Low
	Ovis canadensis	Bighorn Sheep	Blue	Frequent	Low
	Perognathus parvus	Columbia Plateau Pocket Mouse	Blue	Frequent	Low
	Rangifer tarandus pop. 1	Caribou (Southern Mountain Population)	Red	Frequent	Low
	Reithrodontomys megalotis	Western Harvest Mouse	Blue	Frequent	Low
	Sorex merriami	Merriam's Shrew	Red	Frequent	Low
	Sorex preblei	Preble's Shrew	Red	Frequent	Low
	Taxidea taxus	American Badger	Red	Frequent	Moderate
	Ursus arctos	Grizzly Bear	Blue	Frequent	Low
Reptiles	Crotalus oreganus	Western Rattlesnake	Blue	Frequent	Moderate
	Hypsiglena chlorophaea	Desert Nightsnake	Red	Frequent	Moderate
	Phrynosoma douglasii	Pygmy Short-horned Lizard	Red	Frequent	Low
	Pituophis catenifer deserticola	Gopher Snake, deserticola subspecies	Blue	Frequent	Moderate
	Plestiodon skiltonianus	Western Skink	Blue	Frequent	Moderate
Turtles	Chrysemys picta pop. 2	Painted Turtle - Intermountain - Rocky	Blue	Obligate	Low

Table 5. Species-at-risk frequent-use habitat presence (CDC, 2021b)					
Species Group	**Scientific Name**	**Common Name**	**BC List [1]**	**Use of Habitat Present**	**Likelihood to occur**
		Mountain Population			

[1] **Yellow**: Not considered at risk. **Blue**: Of special concern. **Red**: Endangered or threatened.

3.3 Aquatic Conditions

Kokanee (*Oncorhynchus nerka*) are the fish species of primary concern with respect to shoreline development and aquatic habitat alteration along Okanagan Lake. The Okanagan Large Lakes Foreshore Protocol identifies sensitive zones around Okanagan Lake for shore spawning Kokanee, as well as for Rocky Mountain Ridged Mussel (RMRM; *Gonidea angulata*) and foreshore plant species-at-risk (SAR; BC MoFLNRORD, 2018a). The Property occurs within a No Colour Zone for Shore Spawning Kokanee, Freshwater Mussels and Foreshore Plant SAR. A No Colour Shore Spawning Kokanee Zone indicates that no recent or historic shore spawning is known to occur. Freshwater Mussel and Foreshore Plant SAR No Colour Zones indicate that the habitat has not been assessed for RMRM and foreshore plant SAR as of 2017 (BC MoFLNRORD, 2018a).

The subject property occurs along Okanagan Lake Foreshore Inventory and Mapping (FIM) Segment 11 (**Figure 1**), which is described as rural with a medium level of impact (10-40%) and 11% of the shoreline disturbed (Schleppe, 2010). The shore type of the approximately 3,407 km segment is described as having a cliff/bluff shore type composed of 30% gravel, 25% bedrock, 20% cobble, 15% boulder, and 10% sand with a medium (25-75%) level of embeddedness.

The littoral zone is classified as being wide (>50 m) with a tall shrub riparian band at the toe of the slope with a moderate number of conifers with abundant (>50%) shrub cover. Foreshore modifications include 4 docks and retaining walls covering approximately 1% of the segment. The subject property's foreshore condition is generally consistent with adjacent private properties and the FIM data. The current and potential Aquatic Habitat Index (AHI) rating is high and very high, respectively. Juvenile rearing potential is rated as High. **Table 6** provides a list of native and non-native fish and mussel species documented to occur in Okanagan Lake and may be found near the subject property.

Table 6. Fish species found in Okanagan Lake (BC MoE, 2021)	
Common Name	**Scientific Name**
Brook Trout	*Salvelinus fontinalis*
Bull Trout	*Salvelinus confluentus*
Burbot	*Lota lota*
Carp	*Cyprinus carpio*
Chiselmouth (formerly Chiselmouth Chub)	*Acrocheilus alutaceus*
Cutthroat Trout	*Oncorhynchus clarkii*
Kokanee	*Oncorhynchus nerka*
Lake Chub	*Couesius plumbeus*
Lake Trout	*Salvelinus namaycush*
Lake Whitefish	*Coregonus clupeaformis*
Largescale Sucker	*Catostomus macrocheilus*
Leopard Dace	*Rhinichthys falcatus*
Longnose Dace	*Rhinichthys cataractae*
Longnose Sucker	*Catostomus catostomus*
Mountain Whitefish	*Prosopium williamsoni*
Northern Pikeminnow	*Ptychocheilus oregonensis*
Peamouth Chub	*Mylocheilus caurinus*
Prickly Sculpin	*Cottus asper*
Pumpkinseed	*Lepomis gibbosus*
Pygmy Whitefish	*Prosopium coulterii*
Rainbow Trout	*Oncorhynchus mykiss*
Redside Shiner	*Richardsonius balteatus*
Slimy Sculpin	*Cottus cognatus*
Smallmouth Bass	*Micropterus dolomieu*
Yellow Perch	*Perca flavescens*
Western Floater Mussel	*Anodonta kennerlyi*
Western Ridged Mussel	*Gonidea angulata*
Winged Floater Mussel	*Anodonta nuttalliana*

4.0 RIPARIAN SETBACK ASSESSMENT

Riparian setback requirements for the subject property are regulated under the Provincial RAPR and the RDOS Naramata OCP. Section 23.2 Environmentally Sensitive Development Permit Areas of the RDOS's OCP addresses the issue of a natural development area and states that:

> *"To regulate development activities within environmentally sensitive areas in order to protect important sensitive ecosystems and biological diversity including valuable habitat for endangered species of native, rare vegetation or wildlife, and provide wildlife corridors and secondary habitat."*

Further, Section 23.3 Watercourse Development Permit Area addresses the issue of an area adjacent to waterbodies and states that:

> *"To regulate development activities within riparian assessment areas as a means to protect aquatic habitat, enhance, conserve and restore watercourses and their riparian areas."*

The specific size of the setback is individually determined for each watercourse by guidelines set forth in the RDOS OCP and by the Provincial RAPR. As per RAPR, the setback determination is based on the HWL or a set geodetic elevation, which is the case for Okanagan Lake. The geodetic elevation to be used for Okanagan Lake is 343 m.a.s.l. (BC MoFLNRO, 2014) and will be referred to as the HWL for ease of interpretation.

As per the RAPR, the HWL has been used to determine the appropriate riparian setbacks from Okanagan Lake. Riparian setbacks are based on ZOS for the following three factors:

- Litter fall and insect drop (15 metres);
- Large woody debris, bank, and channel stability (15 metres); and
- Shade (30 metres due south).

The SPEA is then determined from the ZOS with the greatest setback area. The provincial RAPR results in a 15 metres ZOS for setback from the HWL of Okanagan Lake. **Figure 2** illustrates the various setbacks in relation to the tram and the resultant SPEA from Okanagan Lake. The proposed tram will be located partially inside the SPEA (16.7 m^2; **Figure 3**).

5.0 IMPACT ASSESSMENT

The proposed works include the construction of a new tram, using low impact techniques. All rails and equipment will be carried down the slope by hand to the proposed tram location. No cranes or heavy equipment will be required. The footprint of the tram and associated landings will occupy approximately 109.9 m^2; with SPEA encroachment of approximately 16.7 m^2. Impacts to the existing riparian area will be limited to trimming present native shrubs and grasses. The tram is proposed to be anchored with piles, and there will be minimal disturbance.

Construction activities within the riparian area and on slopes with shallow soils have the potential to impact fisheries habitat and aquatic resource values. With appropriate mitigation measures in place, impacts on terrestrial and aquatic resource values as a result of construction and operation of the tram should be negligible. However, potential environmental impacts could include the following:

- There is a potential for the release of fine sediments through erosive processes during construction activities;
- Improper handling and disposal of construction materials and debris could result in the addition of deleterious substances to Okanagan Lake and subsequent negative impacts to fish, wildlife, associated habitat, and surface water quality;
- Improper fuel storage and/or poorly maintained equipment used during construction could create spill potential that could negatively impact fish, wildlife, and associated habitats; and
- Vegetation removal and disturbance outside of the tram footprint, during or after construction would result in a loss of riparian area. Potential for additional disturbance and/or lack of appropriate restoration could create conditions favorable for the colonization of non-native and invasive plant species.

Section 6.0 below provides specific recommendations to mitigate these potential impacts. As already indicated, adverse effects associated with construction activities will be negligible, if the mitigation measures proposed are implemented.

6.0 RECOMMENDED MITIGATION MEASURES

6.1 Best Management Practices

- All works must generally conform to the Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia (Polster et al., 2014)
- The appropriate Development Permits and approvals must be obtained prior to construction activities within the subject property. The Development Permit must be kept onsite at all times.
- No works can occur below the High Water Level of Okanagan Lake without a Provincial Section 11 permit in hand.

6.2 Protection of the SPEA

- To reduce ground disturbance, shrubs and grasses occurring within the tram footprint should be cut at the base of the stem at ground level, rather than digging up

the roots. This practice should be implemented with long-term tram maintenance where trimming of shrubs is necessary to maintain proper system function;

- Limit soil disturbance wherever possible to prevent erosion and the establishment of invasive plant species;
- No disturbance or additional vegetation clearing should occur outside of the immediate footprint of the tram;
- Although not anticipated, if areas of exposed soils are left following tram construction, the areas should be planted with native grass plugs or shrubs;
- Non-native tree of heaven and Russian olive was found near the proposed lower landing of the tram within the subject property (**Photo 7**). Ecoscape recommends that the tree of heaven and Russian olive be removed by hand, and the disturbed area be replanted with native plantings such as big sagebrush (*Artemisia tridentata*) and hydroseeded with grass seed mix (see Section 6.8 below); and,
- Only vegetation native to the Okanagan and suited to the site conditions and regional climate should be planted within the SPEA.

6.3 Erosion, Sediment and Deleterious Substance Control

This section addresses minimizing the potential for the introduction of deleterious substances to Okanagan Lake and the SPEA. The following recommendations must be adhered to throughout all stages of tram construction:

- The release of fine sediments, concrete-laden water or other substances deleterious to the environment (e.g., gasoline or construction debris) must be prevented at all times;
- Silt fence must be installed between the proposed works and Okanagan Lake to mitigate the risks to aquatic resources associated with runoff and sediment transport. Silt fence must be staked into the ground and trenched a minimum of 15 centimeters to prevent flow underneath the fence and must remain taut to prevent material from moving over the fence. Silt fencing should contain sufficient storage capacity to collect runoff and sediment deposition during storm events. Ongoing monitoring and maintenance of the silt fence must occur on a regular basis to ensure adequate function. *As this site consists predominantly of vegetated areas and the works do not involve any excavation, the risk of erosion is low. The need for a silt fence is not necessary given the minimal amount of disturbance expected.*
- All construction debris must be kept outside of the SPEA and should be removed from the subject property on a regular basis;

- Ensure that onsite machinery is in good operating condition, clean, and free of leaks, excess oil or grease. No equipment refueling can take place within 30 m of Okanagan Lake; and
- A spill containment kit should be kept readily available if any equipment (i.e., excavator) is used during construction in case of the accidental release of a deleterious substance to the environment. Amount of spill kits onsite will be dependent on the amount of machinery. 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**, Ecoscape, and the RDOS.

6.5 Foreshore Land Use

The following recommendations must be adhered to in order to prevent additional shoreline disturbance:

- No beach grooming, addition of sand, removal or alteration of cobbles/boulders, dredging or removal of riparian vegetation is to occur at any time. There must be no disturbance to substrates occurring along the foreshore of the subject property.
- No works are to occur below the 343 m.a.s.l. HWL without having a provincial *Water Sustainability Act* Section 11 Notification application submitted, approved and in the possession of the property owner and contractor. The tram has been designed so that all works will be completed above PNB and the HWL.
- The construction of permanent structures such as patios, retaining walls, boardwalks, boat houses, hot tubs, pools, etc. are not permitted within the SPEA.
- No dredging or placement of fill below the 343 m.a.s.l. elevation should occur at any time.

6.6 Fisheries Timing Windows

Timing windows ensure that instream works avoid causing harm to spawning habitat, fish eggs, and juvenile fish, while also preventing impacts to adults and juveniles that may be migrating, over-wintering, or rearing. The subject property is located within a No Colour Zone for shore spawning Kokanee, and as such there are no timing window restrictions (BC MNFLNRORD, 2018).

6.7 Noise and Vibration

Vibration caused by jackhammers or other heavy equipment used in close proximity to Okanagan Lake have the potential to cause serious harm to fish. Damage to fish organs, fish

eggs or larvae may result if appropriate mitigation measures are not implemented. The recommendations provided are most pertinent to works occurring during spawning periods in Okanagan Lake but should be considered for works occurring at any time. Although not anticipated for this project, the Fisheries and Oceans Canada Guidelines for use of Explosives In or Near Canadian Waters (http://www.dfo-mpo.gc.ca/Library/232046.pdf) should be adhered to at all times, specifically where the noise and vibration levels from the use of impact hammers have the potential to exceed guidelines.

6.8 Invasive Plant Management

- Upon the completion of the proposed works, invasive plant species must be removed from any disturbed areas and the SPEA. Ongoing invasive weed management may continue to be required as necessary within the subject property. Chemical pesticides/herbicides and fertilizers must not be used due to the close proximity to Okanagan Lake. Furthermore, it is recommended that invasive species are pulled by hand.
- Invasive plant species must be disposed of in a landfill and not composted. Invasive plant species must not be transported to or deposited in other natural areas.
- Areas of exposed soils resulting from invasive species removal or site development in general should be seeded with a native grass seed mix that must be Canada Agricultural Grade #1 to minimize weed seed counts (**Table 7**). Grass seed should be applied in the spring or fall, not during periods of extremely hot and/or dry weather (i.e., July and August).

Table 7. Recommended grass seed mix for disturbed areas

Common Name	Scientific Name	Seed Weight
Bluebunch wheatgrass	*Pseudoroegneria spicata*	35%
Slender wheatgrass	*Agropyron trachycaulum*	35%
Rocky Mountain fescue	*Festuca saximontana*	10%
Perennial ryegrass	*Lolium perenne*	10%
Sheep fescue	*Festuca ovina*	10%

6.9 Restoration Works and Vegetation

A portion of the proposed tram will encroach into the SPEA. The SPEA encroachment area is estimated to be 16.7 m^2. Restoration opportunities at a ratio of 3:1 for the 16.7 m^2 of encroachment should equal an area of at least 50.1 m^2. It is important to note that the actual

disturbance of the tram within the SPEA is expected to be much less than 50.1 m^2 as a majority of the minimal vegetation below the tram will remain intact. Only the vegetation at the location of the screw piles will be disturbed, thus our recommendations will reflect the disturbance of the tram based on the disturbance of the screw piles. Restoration should be maximized within the space available and should occur entirely within the SPEA. The exact locations of the planting pockets will be chosen in a field fit manner by the environmental monitor (EM) and plantings will be placed in areas where exposed soil is present or where non-native species have been removed. The recommended plant species and quantities are listed below in **Table 8**. At this stage it is understood that a formal landscape plan will not be prepared for the subject property.

Table 8. Summary of native plant shrub and grass species appropriate for restoration planting

Common Name	Scientific Name	Min Size	Quantity
Trees			
Pacific willow	*Salix lasiandra var lasiandra*	1 gal	1
Shrubs			
Common snowberry	*Symphoricarpos albus*	1 gal	5
Oregon-grape	*Berberis aquifolium*	1 gal	5
Nootka rose	*Rosa nutkana*	1 gal	5
Big sagebrush	*Artemisia tridentata*	1 gal	4
		TOTAL	**20**

*Please note that a combination of species should be planted to enhance the diversity of the site. Exact quantities will depend on the extent of disturbance.

**Upland species should be planted on the slope, while riparian species should be planted within the narrow riparian fringe adjacent to the beach. Big sagebrush should be planted on the slope.

Another significant contribution to restoring the riparian area at the subject property to a natural condition will be the removal of invasive species throughout the subject property. Invasive species will be removed by hand and will require annual maintenance and management to prevent re-establishment. Areas where invasive species have been removed should be planted with restoration plantings. The following recommendations are to be adhered to in regard to restoration at the subject property:

- Exposed soils must be densely planted with native vegetation. Only native vegetation from local stock should be planted within the SPEA, unless approved by the EM.
- A pointed spade should be used when removing established invasives in order to ensure the bulk of the root structures are removed.

- Trees should be planted at a density of 3 m^2 on center and shrubs should be planted at a density of 1.5 m^2 on center.
- Plantings should be installed in groups or clusters as opposed to an evenly distributed, grid-like pattern. This will help prevent plant mortality due to invasive plant management. The placement and distribution of plantings will be completed in a field-fit manner under the direction of the EM.
- All native seeding and planting must be done in either early spring or in autumn for greatest success.
- Watering should occur for the first two growing seasons, until plants are established. Spring and fall watering, if necessary, should be timed to water every 3 or 4 days. In summer, watering should be deep, but infrequent – occurring once per week. Irrigation should be timed to augment rainfall and a rainfall sensor would help to reduce water consumption. Hand watering and drip irrigation are both acceptable methods.
- Vegetation should be trimmed annually, if necessary, during annual tram maintenance.
- A target of 80% plant survival is recommended after two years. If the total number of plants drops below 80% of the original number planted, fill/replacement planting will be required.
- While wood fiber or rock mulch may be used around plants, bark mulch in close proximity to Okanagan Lake should be avoided due to the potential for toxic leachates.

7.0 ENVIRONMENTAL MONITORING

An environmental monitor (EM) should be retained to document compliance with mitigation measures and recommendations and provide guidance for implementation of operational best practices (i.e., erosion and sediment control, restoration, and enhancement design). In the event that greater disturbance occurs due to unforeseen circumstances, the EM will recommend further measures to protect/restore the natural integrity of the site. The EM should be notified a minimum of 48 hours prior to initiation of construction works in order to schedule monitoring visits. An environmental monitoring schedule and standard requirements are as follows:

- A pre-construction meeting should 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 proposed location of erosion and sediment control measures will be reviewed.
- The EM will be an appropriately Qualified Environmental Professional (QEP) authorized to 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 on a monthly basis to project completion will likely be sufficient; however, this will be dependent on the works occurring and the RDOS requirements.
- A copy of the development permit and this assessment report should be kept readily available at the site for reference while the work is being conducted.
- Monitoring reports should be completed on a regular basis and submitted to all relevant contractors and regulatory agencies. A further report should be generated upon substantial completion of construction and restoration works. A follow-up monitoring visit two years post construction may be required by the RDOS to document survival of native riparian plantings.

7.1 Performance Bonding

Performance bonding is typically required by the RDOS to ensure recommended mitigation measures are adhered to and an EM is retained to document compliance with municipal and provincial guidelines and best management practices. Bonding in the amount of 125% of the estimated value of environmental monitoring is generally required to ensure faithful performance and that all mitigation measures are completed and function as intended. Security deposits shall remain in effect until the RDOS has been notified, in writing by the EM that the objectives have been met and substantial completion of the restoration works has been achieved (**Table 9**).

Table 9. Cost estimate for enhancement plantings, environmental monitoring, and bonding

Item	Location	Quantity	Unit	Material Cost	Installed Cost*
Trees	Within SPEA	1	1 gallon	$10 (based on $10/plant)	$30.00
Shrubs	Within SPEA	19	1 gallon	$190 (based on $10/plant)	$570.00
Environmental Monitoring of construction works and restoration (including substantial completion/post development report)					$800.00
				Total	**$1,400.00**
				125% Bond	**$1,750.00**

*Installed cost is estimated at 300% of the material cost

**The above estimate for environmental monitoring is over the maintenance phase only.

NOTE: Costs provided are estimates for bonding purposes only. These costs may vary depending upon site conditions

8.0 CONCLUSION

This report pertains to existing and potential site conditions at the subject property with respect to riparian and upland habitats in relation to the proposed development. As per the requirements of the RDOS, this report identifies potential environmental impacts and appropriate mitigation measures to protect the natural integrity of both terrestrial and aquatic communities. Provided that mitigation measures within this report are adhered to, impacts to the aquatic and terrestrial communities should be avoided.

9.0 CLOSURE

This EA has been prepared for the exclusive use of Silverspan Trams Inc. Ecoscape has prepared this EA with the understanding that all available information on the present and proposed use of the subject property has been disclosed. Silverspan Trams Inc. has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information.

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

Respectfully Submitted

ECOSCAPE ENVIRONMENTAL

CONSULTANTS LTD.

Prepared by:

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Natural Resource Biologist

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Natural Resource Biologist

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Reviewed by:

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10.0 REFERENCES

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PHOTOS

Photo 1. View facing west of the existing family residence. Photos 1-7 taken August 31, 2021.

Photo 2. View facing northwest of the corner of the existing orchard where the proposed upper landing platform of the tram will be installed (represented by the red circle).

Photo 3. View of invasive species located to the south of the proposed tram.

Photo 4. View facing southwest of the approximate tram location (represented with a red line) looking down towards Okanagan Lake.

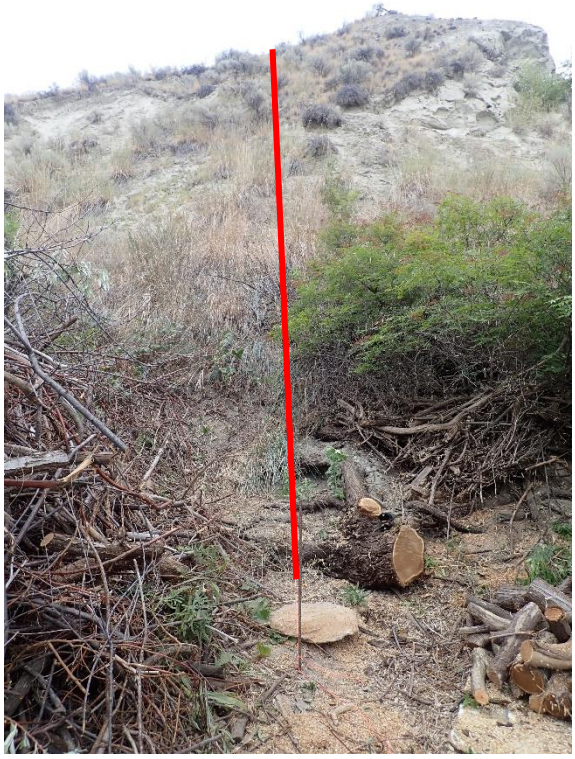


Photo 5. View facing northeast of proposed tram location (represented with red line) looking up towards the residence.

Photo 6. View of existing foreshore area.

Photo 7. View of invasive tree of heaven and Russian olive (circled in red) and wood stockpiles and cleared debris on the beach area.

Photo 8. View of example tram to illustrate how it hovers over the landscape and the minimal permanent footprint associated with the helical screws.

Photo 9. View of a helical screw pile.

Photo 10. View of example trail/road to illustrate how extensive cuts and fills and switchback can severely alter the landscape in order to achieve the required grades.

Photo 11. View of a tower bracket on two piles and their minimal permanent footprint.

FIGURES

FIGURE 1
Site Location and Fisheries Information

Project:	Environmental Assessment
Location:	RDOS
Project No.:	21-3948
Prepared for:	Silverspan Trams Inc.
Prepared by:	Dan Austin, GIS Specialist Ecoscape Environmental Consultants Ltd.
Coordinate System:	NAD83-UTM Zone 11
Imagery:	City of Kelwona, 2020
Field Visit:	August 30, 2021
Map Date:	September 30, 2021

313200 313300 313400 313500 313600 313700 313800

5493800 5493700 5493600 5493500 5493400

N

Subject Property
2265 Naramata Rd.
PID: 008-674-566
Plan No: KAP16214
Regional District of South
Okanagan - Similkameen

GAWNE RD

NARAMATA RD

11

Okanagan Lake

0 12.5 25 50 75 100 125
Meters

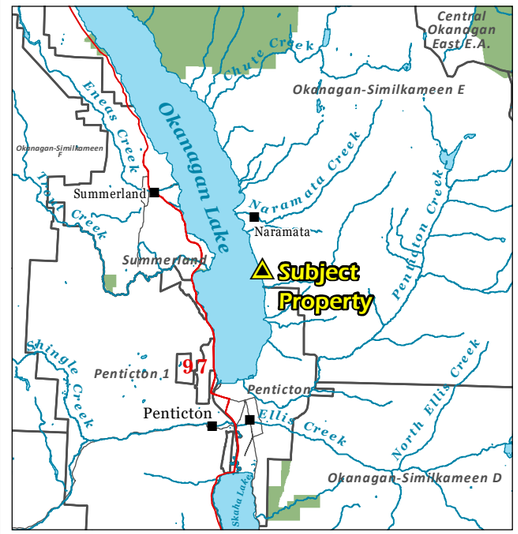
LEGEND

- Regional Location of Subject Property
- WSI Survey
- WSI Incidental
- Subject Property
- Cadastre
- Streams
- Segment Break
- Foreshore Inventory Mapping (FIM)

Okanagan Large Lakes Foreshore Protocol

- Historical Kokanee Spawning Records
- Kokanee Spawning Black Zone
- Kokanee Spawning Red Zone
- Kokanee Spawning Yellow Zone
- Mussel Red Zone
- Mussel Yellow Zone
- Foreshore Plants Black Zone
- Foreshore Plants Red Zone
- Foreshore Plants Yellow Zone

Regional Location of Subject Property



DISCLAIMER

The data displayed is for conceptual purposes only and should not be interpreted as a legal survey or for legal purposes. If discrepancies are found between the data portrayed in this report and that of a legal survey, the legal survey will supersede any data presented herein.

ECOSCAPE
Environmental Consultants Ltd.

FIGURE 2
Riparian Areas Regulation Assessment

Project:	Environmental Assessment
Location:	RDOS
Project No.:	21-3948
Prepared for:	Silverspan Trams Inc.
Prepared by:	Dan Austin, GIS Specialist Ecoscape Environmental Consultants Ltd.
Coordinate System:	NAD83-UTM Zone 11
Imagery:	City of Kelwona, 2020
Field Visit:	August 31, 2021
Map Date:	October 15, 2021

313400

5493600

N

Approximate High Water Level 343 m.a.s.l. (FIM)

Subject Property

Approximate Tram Footprint (109.9 m ^{2})

Streamside Protection and Enhancement Area (SPEA) (2845 m ^{2})

Tram SPEA Encroachment (16.7 m^2)

Photo 1

Photo 2

11

30 m Riparian Areas Regulation Assessment Area

Okanagan Lake

Zone of Sensitivity - Litterfall (15m)

Zone of Sensitivity - Large Woody Debris (15m)

Zone of Sensitivity - Shade (30m due south)

0 2.5 5 10 15 20 25

Meters

5493500

313400

LEGEND

- Segment_Break
- Foreshore Inventory Mapping (FIM)
- Approximate High Water Level (343 m.a.s.l.)
- Zone of Sensitivity - Litterfall
- Zone of Sensitivity - Large Woody Debris
- Zone of Sensitivity - Shade (30 m due south)
- Riparian Areas Regulation Assessment Area
- SPEA Encroachment Area
- Streamside Protection and Enhancement Area
- Tram Footprint
- Subject Property
- Streams and Rivers
- Cadastre

Photos

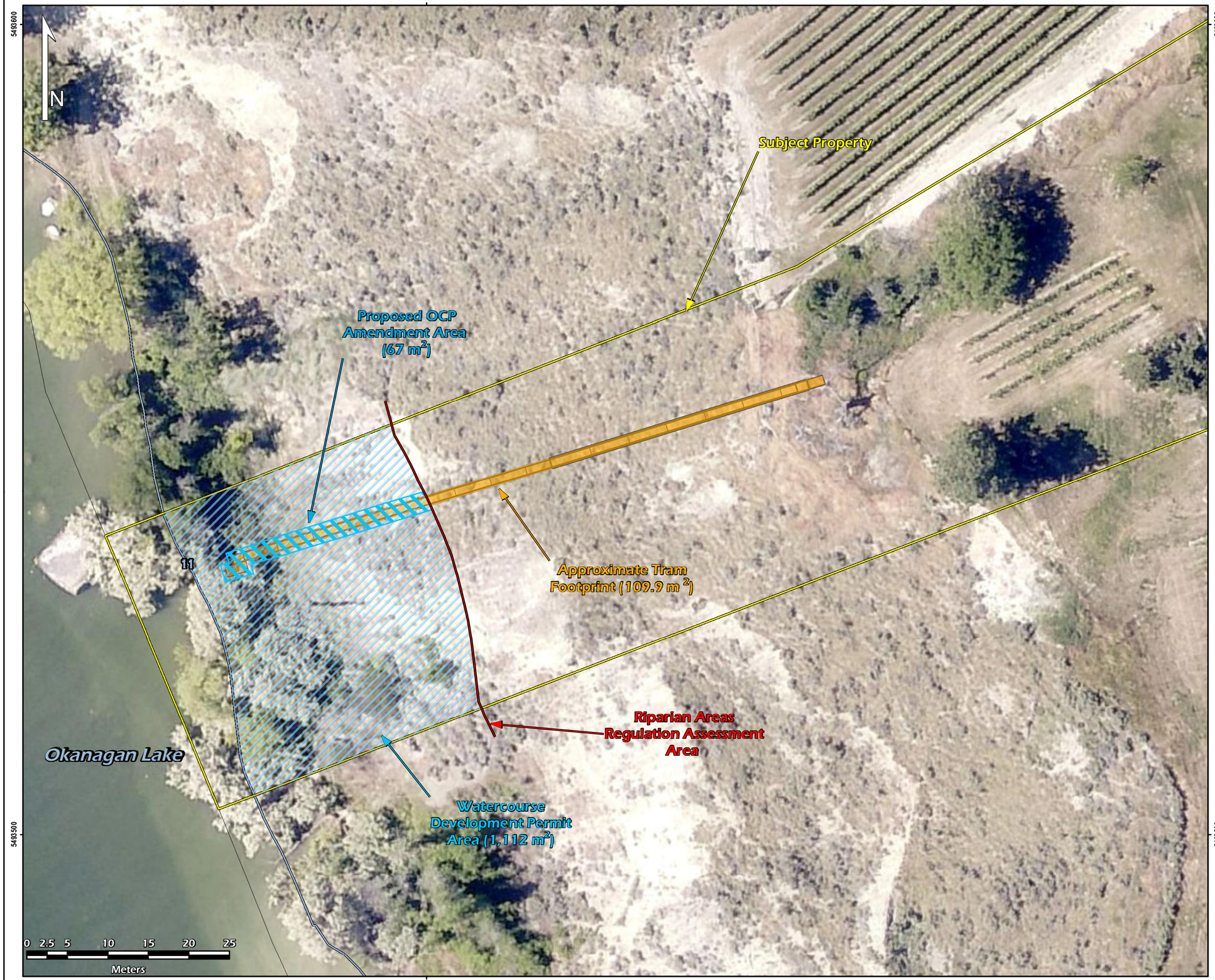
Photo 1: Start of Tram looking down towards Okanagan Lake

Photo 2: End of Tram Looking Up

ECOSCAPE
Environmental Consultants Ltd.

FIGURE 3
Proposed OCP Amendment Area

Project:	Environmental Assessment
Location:	RDOS
Project No.:	21-3948
Prepared for:	Silverspan Trams Inc.
Prepared by:	Dan Austin, GIS Specialist Ecoscape Environmental Consultants Ltd.
Coordinate System:	NAD83-UTM Zone 11
Imagery:	City of Kelwona, 2020
Field Visit:	August 31, 2021
Map Date:	January 25, 2022



LEGEND

- Foreshore Inventory Mapping (FIM)
- Riparian Areas Regulation Assessment Area
- Proposed OCP Amendment Area
- Watercourse Development Permit Area
- Tram Footprint
- Subject Property
- Cadastre

ECOSCAPE
Environmental Consultants Ltd.

APPENDIX A

Tram Design (Provided by Silverspan Trams)

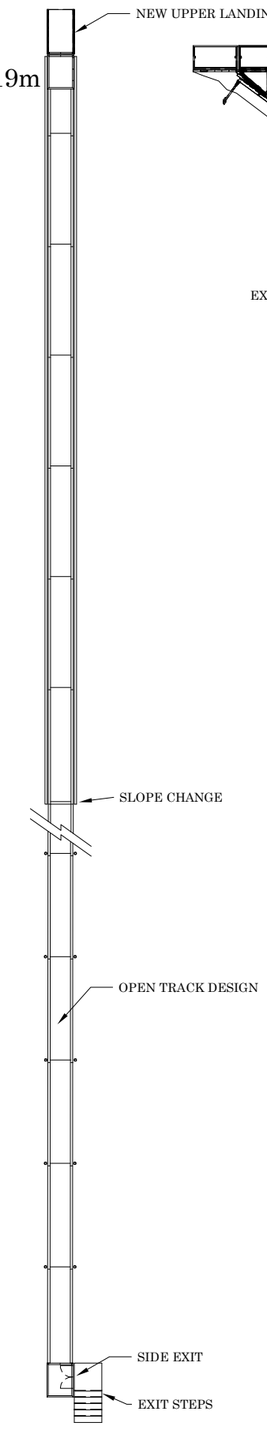
SILVERSPAN TRAMS INC.

SILVERSPAN TRAMS INC

Title:	2265 NARAMATA ROAD - Personal Use Tram		
Date:	AUGUST 5, 2021	Dwg.#	LO-WB-01

Tram Length: ~96.01 m
Incline: 36° & 41°
Carriage Dimensions: 1.524m x 1.219m

This is to certify that all tram components have been designed by Wayne Danforth, (a B.C. registered Professional Engineer) and that same will be fabricated, assembled and installed under his direct supervision.



PLAN VIEW

PROFILE VIEW

APPENDIX B

Shoreline Tram Geotechnical Assessment (Prepared by SNT Geotechnical Ltd.)

Suite #4, 385 Baker Street
Nelson, BC, V1L 4H6
250 801 5325

SHORELINE TRAM
GEOTECHNICAL ASSESSMENT

for

2265 Naramata Road
Penticton, BC

November 17, 2021

Report Number: 540.21.50
Distribution:
Wayne Becking – 1 copy
Silverspan Trams Inc. - 1 copy
SNT Geotechnical Ltd. – 1 copy

Table of Contents

1. Introduction

At the request of Wayne Becking, SNT Geotechnical Ltd. (SNTG) performed an assessment for the foundations of a shoreline surface tram system proposed at 2265 Naramata Road in Penticton, BC. The development is to comprise a surface mounted tram system, approximately 96m long and 1.22m wide. The purpose of the assessment was to perform the investigation and analysis required to specify the configuration of the foundation components necessary to support the proposed structure. The geotechnical design recommendations are strictly for the design of the foundations for the proposed surface tram, and does not include an assessment of the global stability of the overall slope.

The overall tram system is being designed and constructed by Silverspan Tram Inc. (STI) of Kelowna, BC. This report summarizes our investigation, the results of our analysis and our recommendation for the various foundation components for the tram.

2. Terms of Reference

The following is a summary of the geotechnical services for the proposed tram.

2.1. Preliminary Work, Field Assessment & Geotechnical Design Services

- Review topography, surficial soils, bedrock and drainage;
- Communication with Silverspan Trams Inc. to understand geotechnical engineering support needs;
- Perform slope stability and foundation analyses to assess tram foundation locations and provide recommendations for foundation construction;
- Provide summary report of the investigation, analyses, recommendations and construction drawings.

Figure 1 - Property Location (RDOS Parcel Viewer, 2021)

3. Background Information

The geotechnical assessment involved the collection and review of available geological and geotechnical information, the review of available historical government air photos, and a site review to assess surficial soil conditions and observe the installation of a test pile by the contractor. Background information available and reviewed included:

- Google Earth Imagery
- Historical Air photos
- Geological Mapping (Nasmith, 1962)
- IMAPS BC Mapping
- Nearby water well logs
- Geohazards of the South Okanagan (Tannant, 2011)

4. Site Location and General Description

The surface tram is to be located on the lakeshore bluffs on the east side of the Okanagan Lake valley, south of the Village of Naramata (UTM 11N: 5,493,550m N 313,450m E).

The bluff upon which the tram will be constructed is comprised of undeveloped steep silt banks, and vegetated with sage and grasses. It is understood that the tram will comprise of an aluminum track supported on helical pile bents placed incrementally along the slope face. (see Figure 2).

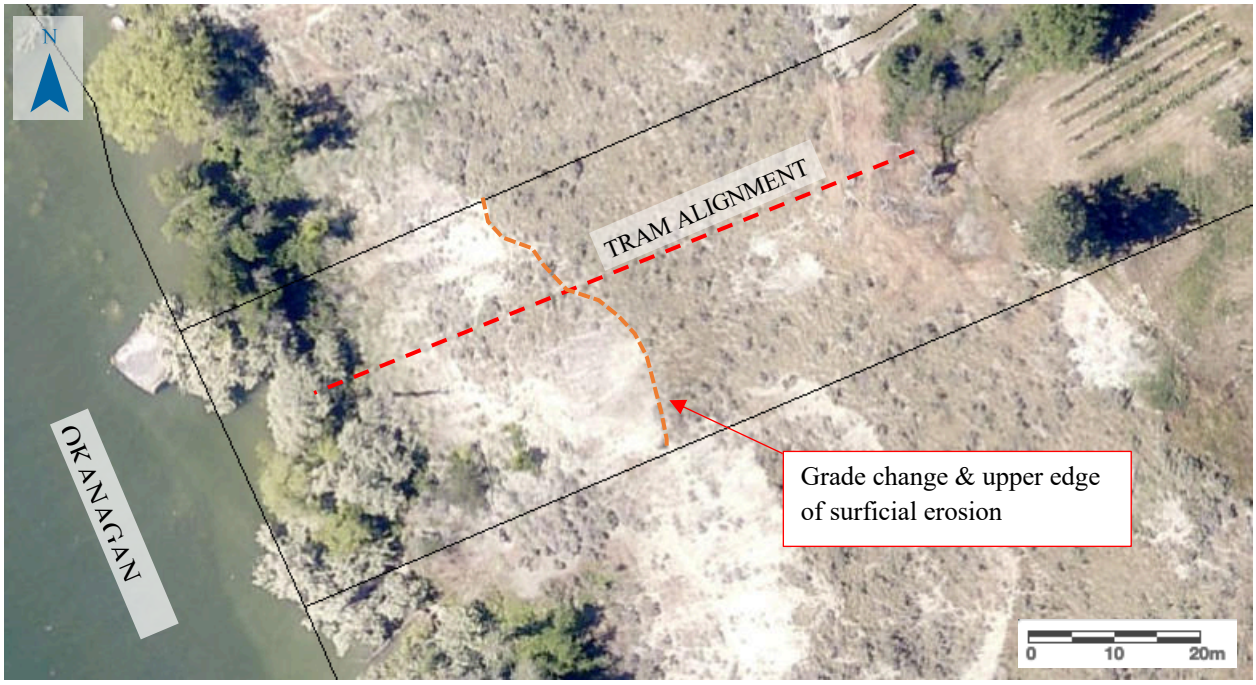


Figure 2 - Location Overview (RDOS Parcel Viewer, 2021)

The terrain at the upper landing is comprised of terrain sloping at approximately 15-20% and vegetated with grasses and brush. From the upper landing, the terrain steepens to approximately 65-70% slope and is well vegetated with sage brush and minor grasses. Approximately 50m down the slope the terrain steepens to approximately 85-90% and is moderately vegetated with sage brush and grasses. The top of the tram is located at an elevation of approximately 406 m, and the is at lake level at 347 m. The bottom landing is located along the shoreline beach and is comprised of well vegetated gently sloping terrain (<15%) consisting of sand, gravels and cobbles.

4.1. Bedrock Geology

Bedrock mapping performed by the Geological Survey of Canada (GSC) indicates that the area is underlain by Middle Jurassic granodiorite (Okulitch, 2013). No surficial rock outcroppings were observed within 100m of the site making confirmation of bedrock composition difficult.

4.2. Geomorphology

Surficial geomorphology mapping for the site indicates that the soils observed in the immediate area are a consequence of a glaciolacustrine depositional environment (Nasmith, 1962). The predominate landforms observed in the area comprise of silt terraces and bluffs; strongly confirming the mapping information.

5. Field Work

A field assessment was conducted on July 5th, 2021 by Mike Walsh, P.Eng., of SNTG. The assessment involved the following:

- the review of the pile system;
- the observation of the proposed helical pile installation method and;
- review of surficial terrain characteristics of the upper and lower landing sites and along the slope of the proposed tram alignment.

5.1. Pile System and Installation

The piles are custom built by STI and consist of a Schedule 40 steel pipe shaft with a single 360^0 helix flange welded to the pipe. The steel pipe is a 50mm diameter (OD) and the helix is comprised of 4.75mm (3/16") thick steel flange developing a 152mm diameter (OD) helix.

The pile installation system uses a modified portable electric power drive with two extension arms used to provide a rotational reaction force. Vertical reaction force is developed by the machine weight with additional downforce provided by the weight of the installation personnel.

5.2. Description of Surface Conditions

As described in Section 4, the slope is comprised of an upper 35m long section with an average slope of 65-70% and a lower 45m long section sloping at 85%. Both sections are underlain by the silt deposits that are pervasive throughout the area and are known to extend to considerable depth (>30m) based on local well logs.

The upper slope is well vegetated and appears to have formed from surficial erosion caused by post glacial overland flow from the bench above. The lower slope appears to be the remnant surface resulting from surficial erosion and sloughing caused by seasonal surface saturation and the upslope retrogression of lakeshore erosion at the toe of the slope. Based on observation of the similar erosion action along the

lakeshore to the north and south of the site, this remnant slope angle appears to be the natural angle of repose for the dry silt material.

Based on a review of aerial images dating back to 1985, the erosion of the steeper lower slope in the vicinity of the tram alignment has been relatively stable with no significant erosion observed in the area over that time period. Moreover, no observable slope movement occurred as a consequence of the high local groundwater elevation combined with the record high lake levels and extreme storms that caused significant shoreline erosion and damage throughout the shoreline of Okanagan Lake in 2018

The toe of the slope at the beach elevation is well vegetated with trees, bushes and grasses and presently exhibits no evidence of erosion that may cause further retrogressive surficial slope movement.

No zones of groundwater seepage or bedrock was observed on the slope.

6. Foundation Assessments

6.1. Design Loads

SNTG utilized the configuration of the tram foundation elements detailed in the STI tram design drawing *LO-WB-1* dated August 5, 2021 and in an August 30th, 2021 email from Grayson Syrda of STI to assess the foundation requirements of the proposed surface tram. The design drawing indicated that all tram components were designed by Wayne Danforth, P.Eng..

Based on this information, Table 1 summarizes the unfactored design loading.

Live Load	6.50 kN
Pier Dead Load (upper terminal)	2.10 kN
Pier Dead Load (tram bents)	1.60 kN
Vertical Dead Load (lower terminal)	30.4 kN
Vertical Live Load (lower terminal)	6.50 kN
Track Thrust Dead Load (lower terminal)	19.9 kN
Track Thrust Live Load (lower terminal)	4.26 kN

Table 1 - Unfactored Tram Loads

The proposed tram foundations are to comprise of two pile bents supporting the upper terminal and the surface track and, a concrete thrust block at the lower terminal.

6.2. Soil Strength Information

Terrain elevation information was obtained from the STI design drawing and from the contour data presented in the RDOS Parcel Viewer mapping (RDOS, 2021).

Although soil strength testing was not performed on the site soils, the silt material forming the soil structure in the area is known as the Penticton Silts and are pervasive throughout the southern Okanagan

valley and been extensively studied for various projects and historic landslides. Work completed by Iravani (1999) performed an extensive investigation into the local silt soil; establishing a thorough understanding of its soil strength parameters through back calculation of historic slide events and extensive soil testing.

Based on investigations by Iravani (1999), throughout the southern Okanagan valley, the Penticton Silts were found to have a friction angle (Ø) of approximately 37^0 and a cohesion (c) ranging between 60 kPa for moist in-situ material, up to 800 kPa for dried material. These values are considered moderate to very high for a silt soil, however, Iravani (1999) indicates this is due to the predominance of mica (muscovite) and chlorite mineralization present and the strong inter-particle physiochemical bonding that they develop.

Further work completed by SNTG (2020) involving soil strength testing and back calculation of a slide event in the Penticton silt also tended to confirm these soil strength parameters.

For analyzing the proposed tram foundation components, we utilized the following conservative soil strength characteristics:

Friction Angle (ø)	32^0
Cohesion (c)	40 kPa
Unit Weight (kN/m^3)	16.5 (dry) - 17.0 (moist)

Table 2 - Penticton Silt properties used for modelling

Given the steep gradient of the slope, the low permeability of the silt soil and the lack of indication of any historic seepage within the local slope face, and nearby well logs, we have assumed that a groundwater table is not present within the shallow foundation depth of the pile foundations. However, as the thrust block to be located at the lower terminal will be located at the lakeshore, we have assumed an entirely submerged condition for the foundation at this location.

6.3. Helical Pile Design

The bearing capacity design of the helical piles was based on the methodology presented in the Canadian Foundation Engineering Manual (2006). A Limit States Design approach was used to determine the determine the design structural loads and the resistance of the foundation elements. An Ultimate Limit State (ULS) scenario was used with the following design factors:

Live Load Factor	1.5
Dead Load Factor	1.25
Foundation Resistance Factor	0.3

Table 3 - ULS Design Load Factors

Based on the above factors (Table 3) and the unfactored design loads outlined in Table 1, the factored design loads for the differing foundation elements are presented in Table 4.

Pier Load (upper terminal bents)	12.4 kN
Pier Dead Load (track bents)	11.8 kN

Table 4 - Factored Tram Loads

It should be noted that the loads outlined in Table 4 are per foundation bent that comprise of two individual piles, consequently the design pile load will be half these values.

Utilizing the design loads presented in Table 4 and the foundation resistance factor presented in Table 3, the design pile embedment depths were determined and are outlined in Table 5.

Upper Terminal Pile	2.35m
Track Bent Pile	2.20m

Table 5 - Pile Embedment Depths

These embedment depths are measured perpendicular to an intact and unweathered surface grade. An additional 0.50m has been included in the embedment depth to compensate for surface saturation and potential erosion that may impact the pile design capacity. Site erosion is further discussed in Section 7.

6.4. Lower Terminal Foundation

The bearing and thrust capacity of the lower foundation was based on methodologies presented in the Canadian Foundation Engineering Manual (2006). Based on the load factors (Table 3) and the unfactored design loads outlined in Table 1, the factored design loads for the lower terminal foundation are presented in Table 6.

Vertical Load (lower terminal)	47.8 kN
Track Thrust Load (lower terminal)	30.9 kN

Table 6 - Factored Tram Loads

Lateral capacity to resist the thrust force of the track at the lower terminal is developed through passive resistance of the buried foundation pushing against the surrounding soil and, the friction along the base of the foundation.

Although site specific soil testing was not performed at the lower terminal site, it was conservatively estimated that the foundation soils would comprise of the silt deposits predominant on the slope above. In addition, the soil would be assumed to be fully submerged in the design scenario; reducing the passive resistance force available from the surrounding soil.

Based on the forces presented in Table 6, we recommend the lower terminal comprise of a foundation block with the following characteristics:

Height Buried Vertical Face	1.20m (min)
Width Buried Vertical Face	1.50m (min)
Length of Foundation	2.25m (min)

Table 7 - Lower Terminal Foundation

It should be noted the reference to "Vertical Face" in Table 7 refers to the foundation end facing the lake; where longitudinal track load will be transferred into the soil.

The proposed foundation configuration is not intended as an absolute, and alternative foundation configurations are possible. Potential alternatives using differing foundation widths and/or depths as well as partially utilizing helical piles to reduce foundation size are possible. The contractor should contact SNTG to explore additional configurations if interested.

Based on the foundation design loading and the above recommended foundation configuration, the foundation bearing pressure is anticipated to be less than 20 kPa; well below the 100 kPa design capacity calculated for the local soil.

7. Discussion - Slope Erosion

As outlined in Section 5.2, the tram alignment crosses the steeper lower slope area that has been established through intermittent retrogressive surficial sloughing. Although it does not appear any significant movement or erosion of the slope has occurred in the last 30+ years, there is a reasonable potential to expect some level of minor surface erosion and potentially less frequent but more significant surface sloughing of the slope in proximity to the tram alignment.

As the more significant surface sloughing has been suspected to have been caused by shoreline toe erosion, it will be imperative that the shoreline vegetation continue to be preserved along the toe of the slope to act as a buffer for erosion control. Nevertheless, in the absence of toe erosion, some level of surficial sloughing may still occur due to extreme surface saturation caused by prolonged rainfall and/or rapid snowmelt.

As outlined in Section 6.3, an additional 0.50m of embedment was included in the pile depths to account for the potential loss of surface material from slow surface erosion over time. However, there is a risk in an extreme circumstance, a significant sloughing event may occur where a thin zone of saturated soil may shift downslope. Such an event would cause a lateral load on the exposed pile stickup which may deflect or damage the pile supports and/or connection to the track.

In receipt of this report, it is acknowledged by the client that the slope is prone to future erosion events that have the potential to damage the foundations of the tram system and potentially make the system unsafe to operate. SNTG has attempted to offset some of this risk by increasing the pile embedment and

providing recommendations in Section 8 to further mitigate some of this risk, however, it is unrealistic within the scope of such a project to develop a foundation configuration on the present terrain that would completely eliminate such risk.

8. Recommendations

8.1. General

Upon review of the geotechnical aspects of the property, SNTG is of the opinion that from a geotechnical perspective, the proposed surface tram is feasible, provided our recommendations are followed during design and construction of the project.

As noted in Section 1.1, footings have been designed to support the proposed surface tram under typical operating conditions, and not to increase the stability of the slope. There is a reasonable degree of confidence that a well-constructed and maintained structure will not collapse, but may experience structural and non-structural damage as a consequence of such a slope failure.

8.2. Vegetation & Surface Soil Management

Surface vegetation like sage and grasses help stabilize the silt surfaces and slopes, preventing soil erosion and instability (Gray 1982).

Maintaining vegetation and minimizing exposed soil surfaces is essential for the prevention of erosion, especially along the tram alignment. Removal of vegetation should be minimized, however, if required for the installation of the tram and its foundation elements, several mitigative measures should be implemented to ensure soil stability:

- Vegetation should be removed through close-cutting, leaving the root mass in place;
- If root masses are removed, any depressions should be infilled and levelled with compacted soil;
- Consistent grading of the soil surface should be maintained without depressions or areas where surface flow can pool or concentrate;
- The soil surrounding the pile collars should be mounded with compacted soil to prevent the collection or redirection of surface water into the pile penetration and;
- In the vicinity of the pile foundations and along the tram alignment, all soil exposed during the construction should be reseeded with native grasses and covered with a pinned in place biodegradable erosion control matting such as Nilex S32BD (or equivalent).

8.3. Lower Terminal Foundation

The lower terminal foundation will support the longitudinal track load and will rely on the surrounding soil to support the load. To ensure optimal conditions for this foundation we provide the following recommendations:

- The base of the excavation should be compacted under the supervision of the engineer or record prior to the placement of the foundation;

- The backfill surrounding the foundation should comprise of well graded granular material smaller than 75mm and;
- The backfill should be compacted in loose lifts not exceeding 300mm and compacted to a minimum of 95% Standard Proctor Maximum Dry Density (SPMDD).

8.4. Operation & Maintenance

As the tram is to be constructed within a zone of possible erosion, it is imperative that provisions be included in the operations and maintenance (O&M) manual of the tram where time or event triggered checks be implement to ensure its continued safe operation. It is recommended that the following provisions be included in the O&M manual for the tram:

- Inspections of the piled foundations should be performed after the following:
  - After the seasonal Spring melt, estimated as mid-March to mid-April;
  - After an intense rainfall where more than 25mm of rain has fallen over 24 hr or;
  - After high lake elevation accompanied by wind causing intense wave action on the shoreline.
- Prior to the installation of the piles, the shaft shall be marked with red paint, shrink wrap and/or tape 150mm wide beginning at a point 300mm below the embedment depths presented in Table 5 (the Erosion Limit Marker (ELM));
- Inspections of the piled foundation should comprise of:
  - Review of the pile alignment to ensure no bending, buckling or rotation;
  - Review of the track to pile bent attachment to ensure an intact connection;
  - Review of the pile embedment to ensure the ELM on the shaft is not exposed and;
  - Documentation of the date of inspection.

Should a non-satisfactory condition be observed for any of the inspection points, the tram should not be used until a review by STI and/or a qualified geotechnical engineer.

9. Field Reviews

It is recommended that SNTG review any modifications to the design of the surface track and/or loading criteria to confirm that the assumptions and methods used in the geotechnical design are still valid. Provisions should be made for geotechnical reviews and approval of the foundation component installations.

An important purpose of providing an adequate level of review is to check that our recommendations and/or conclusions, based on our initial observation, continue to be relevant to the proposed design and recommendations. To provide an adequate level of review, qualified geotechnical personnel should review the following tasks during construction:

- Review the proposed pile locations to establish the natural undisturbed horizon and review the location for the presence of any large soil discontinuity;
- Observation of pile Erosion Limit markings;

- Review of pile installation methods;
- Final review of pile installations and soil surface revetments;
- Review of the foundation subgrade and backfill for the lower terminal;
- Provide review comments, including any discrepancies found with respect to specifications and the need for any modifications to the design or methods.

10. Conclusions

In view of the above information and recommendations, it is our opinion the surface tram can be founded in the proposed location. However, it is incumbent on the client that they recognize and acknowledge the erosion risks outlined in Section 7 and implement an inspection program as outlined in Section 8.4 to ensure the integrity of the foundation elements supporting the tram.

11. Closure – Report Use and Limitations

This report is prepared for the exclusive use of Wayne Becking and his contractors and consultants and, may not be used by other parties without the written permission of SNT Geotechnical Ltd. The Regional District of Okanagan Similkameen may also rely on the findings of this report for permitting purposes

If the design plans change, or if during construction soil conditions are noted to be different from those described in this report, SNT Geotechnical should be notified immediately in order that the geotechnical recommendations can be confirmed or modified, if required. Further, this report assumes that field reviews will be completed by SNT Geotechnical during construction.

It should be noted that the conclusions provided in this geotechnical assessment are based on a limited soils investigation. Subsurface conditions at other locations could vary and the actual extent of subsidence could be substantially different from anticipated values.

This report should not be included in the specifications without suitable qualifications approved by the geotechnical engineer. The site contractor should make their own assessment of subsurface conditions and select the construction means and methods most appropriate to the site conditions.

The use of this report is subject to the conditions on the Report Interpretation and Limitations sheet which is included with this report (Appendix A). The reader's attention is drawn specifically to those conditions, as it is considered essential that they be followed for proper use and interpretation of this report.

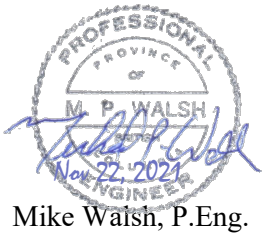
The geotechnical aspects of the final design drawings and specifications should be reviewed by this office prior to tendering and construction, to determine that the intent of this report has been satisfied. During construction, sufficient subgrade inspections should be carried out to review the exposed soil conditions and determine if they are consistent with those encountered in the investigation, as well as to monitor

conformance to the geotechnical specifications. Adequate field review, observation, and testing during construction are necessary for SNTG to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, SNTG's responsibility is limited to interpreting accurately the information encountered at the investigation locations, at the time of their determination or measurement during the preparation of the Report. Where conditions encountered at the site differ significantly from those anticipated in this report, it is a condition of this report that SNTG be notified of any changes and be provided with an opportunity to review and revise the recommendations within this report. The material in this report reflects SNTG's best judgment and professional opinion in light of the information available to it at the time of preparation. Any use which a third party makes of this report or any reliance on or decision to be made based on it are the responsibility of such third parties. SNTG accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or action based, or lack thereof, on this report. No other warranty is made, either expressed or implied.

Soil and groundwater conditions shown in the factual data and described in this report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal, and meteorological conditions.

The report and assessment have been carried out in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. The discussion and recommendations presented above are based on limited field investigation, boreholes, and inferences from surficial features. Inherent variability in surface and subsurface conditions may create unforeseen situations.

Prepared by:



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Appendix A – Report Interpretation and Limitations

REPORT INTERPRETATION AND LIMITATIONS

1. STANDARD OF CARE

SNT Geotechnical Ltd. (SNTG) has prepared this report in a manner consistent with generally accepted engineering consulting practices in this area, subject to the time and physical constraints applicable. No other warranty, expressed or implied, is made.

2. COMPLETENESS OF THIS REPORT

This Report represents a summary of paper, electronic and other documents, records, data and files and is not intended to stand alone without reference to the instructions given to SNTG by the Client, communications between SNTG and the Client, and/or to any other reports, writings, proposals or documents prepared by SNTG for the Client relating to the specific site described herein.

This report is intended to be used and quoted in its entirety. Any references to this report must include the whole of the report and any appendices or supporting material. SNTG cannot be responsible for use by any party of portions of this report without reference to the entire report.

3. BASIS OF THIS REPORT

This report has been prepared for the specific site, development, design objective, and purpose described to SNTG by the Client or the Client's Representatives or Consultants. The applicability and reliability of any of the factual data, findings, recommendations or opinions expressed in this document pertain to a specific project as described in this report and are not applicable to any other project or site, and are valid only to the extent that there has been no material alteration to or variation from any of the descriptions provided to SNTG. SNTG cannot be responsible for use of this report, or portions thereof, unless we were specifically requested by the Client to review and revise the Report in light of any alterations or variations to the project description provided by the Client.

If the project does not commence within 18 months of the report date, the report may become invalid and further review may be required.

The recommendations of this report should only be used for design. The extent of exploration including number of test pits or test holes necessary to thoroughly investigate the site for conditions that may affect

Construction costs will generally be greater than that required for design purposes. Contractors should rely upon their own explorations and interpretation of the factual data provided for costing purposes, equipment requirements, construction techniques, or to establish project schedule.

The information provided in this report is based on limited exploration, for a specific project scope. SNTG cannot accept responsibility for independent conclusions, interpretations, interpolations or decisions by the Client or others based on information contained in this Report. This restriction of liability includes decisions made to purchase or sell land.

4. USE OF THIS REPORT

The contents of this report, including plans, data, drawings and all other documents including electronic and hard copies remain the copyright property of SNTG. However, we will consider any reasonable request by the Client to approve the use of this report by other parties as "Approved Users."

With regard to the duplication and distribution of this Report or its contents, we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of this Report by those parties. The Client and "Approved Users" may not give, lend, sell or otherwise make this Report or any portion thereof available to any other party without express written permission from SNTG. Any use which a third party makes of this Report – in its entirety or portions thereof – is the sole responsibility of such third parties. SNT GEOTECHNICAL LTD. ACCEPTS NO RESPONSIBILITY FOR DAMAGES SUFFERED BY ANY PARTY RESULTING FROM THE UNAUTHORIZED USE OF THIS REPORT.

Electronic media is susceptible to unauthorized modification or unintended alteration, and the Client should not rely on electronic versions of reports or other documents. All documents should be obtained directly from SNTG.

5. INTERPRETATION OF THIS REPORT

Classification and identification of soils and rock and other geological units, including groundwater conditions have been based on exploration(s) performed in accordance with the standards set out in Paragraph 1.

These tasks are judgmental in nature; despite comprehensive sampling and testing programs properly performed by experienced personnel with the appropriate equipment, some conditions may elude detection.

As such, all explorations involve an inherent risk that some conditions will not be detected. Further, all documents or records summarizing such exploration will be based on assumptions of what exists between the actual points sampled at the time of the site exploration. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of and accept this risk.

The Client and "Approved Users" accept that subsurface conditions may change with time and this report only represents the soil conditions encountered at the time of exploration and/or review. Soil and ground water conditions may change due to construction activity on the site or on adjacent sites, and also from other causes, including climactic conditions.

The exploration and review provided in this report were for geotechnical purposes only. Environmental aspects of soil and groundwater have not been included in the exploration or review or addressed in any other way.

The exploration and Report is based on information provided by the Client or the Client's Consultants, and conditions observed at the time of our site reconnaissance or exploration. SNTG has relied in good faith upon all information provided. Accordingly, SNTG cannot accept responsibility for inaccuracies, misstatements, omissions, or deficiencies in this Report resulting from misstatements, omissions, misrepresentations or fraudulent acts of persons or sources providing this information.

6. DESIGN AND CONSTRUCTION REVIEW

This report assumes that SNTG will be retained to work and coordinate design and construction with other Design Professionals and the Contractor. Further, it is assumed that SNTG will be retained to provide field reviews during construction to confirm adherence to building code guidelines and generally accepted engineering practices, and the recommendations provided in this report. Field services recommended for the project represent the minimum necessary to confirm that the work is being carried out in general conformance with SNTG's recommendations and generally accepted engineering standards. It is the Client's or the Client's Contractor's responsibility to provide timely notice to SNTG to carry out site reviews.
The Client acknowledges that unsatisfactory or unsafe conditions may be missed by intermittent site reviews by SNTG. Accordingly, it is the Client's or Client's Contractor's responsibility to inform SNTG of any such conditions.

Work that is covered prior to review by SNTG may have to be re-exposed at considerable cost to the Client. Review of all Geotechnical aspects of the project are required for submittal of unconditional Letters of Assurance to regulatory authorities. The site reviews are not carried out for the benefit of the Contractor(s) and therefore do not in any way effect the Contractor(s) obligations to perform under the terms of his/her Contract.

7. SAMPLE DISPOSAL

SNTG will dispose of all samples 3 months after issuance of this report, or after a longer period of time at the Client's expense if requested by the Client. All contaminated samples remain the property of the Client and it will be the Client's responsibility to dispose of them properly.

8. SUBCONSULTANTS AND CONTRACTORS

Engineering studies frequently requires hiring the services of individuals and companies with special expertise and/or services which SNT Geotechnical Ltd. does not provide. These services are arranged as a convenience to our Clients, for the Client's benefit. Accordingly, the Client agrees to hold the Company harmless and to indemnify and defend SNT Geotechnical Ltd. from and against all claims arising through such Sub consultants or Contractors as though the Client had retained those services directly. This includes responsibility for payment of services rendered and the pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. These conditions apply to specialized sub consultants and the use of drilling, excavation and laboratory testing services, and any other Sub consultant or Contractor.

9. SITE SAFETY

SNT Geotechnical Ltd. assumes responsibility for site safety solely for the activities of our employees on the jobsite. The Client or any Contractors on the site will be responsible for their own personnel. The Client or his representatives, Contractors or others retain control of the site. It is the Client's or the Client's Contractors responsibility to inform SNTG of conditions pertaining to the safety and security of the site – hazardous or otherwise – of which the Client or Contractor is aware.

Exploration or construction activities could uncover previously unknown hazardous conditions, materials, or substances that may result in the necessity to undertake emergency procedures to protect workers, the public or the environment. Additional work may be required that is outside of any previously established budget(s). The Client agrees to reimburse SNTG for fees and expenses resulting from such discoveries. The Client acknowledges that some discoveries require that certain regulatory bodies be informed. The Client agrees that notification to such bodies by SNTG Geotechnical Ltd. will not be a cause for either action or dispute