Flume Creek at Margaret Road and Beach Avenue
Roberts Creek, BC

Environmental Overview Assessment

PREPARED FOR:
Ministry of Transportation and Infrastructure
310 – 1500 Woolridge Street
Coquitlam, BC V3K 0B8

PREPARED BY:
PGL Environmental Consultants
#1500 – 1185 West Georgia Street
Vancouver, BC V6E 4E6

PGL ENVIRONMENTAL CONSULTANTS

solve and simplify

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List of Acronyms

BEC	-	Biogeoclimatic Ecosystem Classification
CDC	-	Conservation Data Centre
CSP	-	Corrugated Steel Pipe
CWHxm1	-	Eastern Dry Maritime subzone of the Coastal Western Hemlock
DFO	-	Fisheries and Oceans Canada
EOA	-	Environmental Overview Assessment
MOTI	-	Ministry of Transportation and Infrastructure
PGL	-	PGL Environmental Consultants
QEP	-	Qualified Environmental Professional
SAR	-	Species at Risk
SARA	-	*Species at Risk Act*
SEI	-	Sensitive Ecosystem Inventory
WSA	-	*Water Sustainability Act*

1.0 INTRODUCTION AND BACKGROUND

Pottinger Gaherty Environmental Consultants (PGL) was retained by the Ministry of Transportation and Infrastructure (MOTI) to complete an Environmental Overview Assessment (EOA) of proposed flood damage remediation works (the Project) where Flume Creek crosses Margaret Road and Beach Avenue on the Sunshine Coast (the Sites; Figure 1). The Sites are located within the territories of the shíshálh Nation.

Widespread flooding from an atmospheric rain event in November 2021 resulted in roadway washout and culvert barrel exposures at both Flume Creek culverts. Proceeding the flooding, temporary culverts were installed, and the roadways at both locations were rebuilt to provide emergency relief to the surrounding community. Riprap was placed at the inlet and outlet of each crossing to provide erosion protection. At the Beach Avenue crossing, four 800mm-diameter, circular, Corrugated Steel Pipe (CSP) culverts were installed beside each other, while three 800mm-diameter CSP culverts were installed in a triangular formation at the Margaret Road crossing. The proposed works include replacing the temporary culverts with permanent structures.

The Sites have been flagged by MOTI as a priority for repair works. It is understood the Project will be completed as part of the provincial Disaster Financial Assistance Arrangements work underway across southern BC in response to the fall 2021 floods. The engineer design drawings are being reviewed by the Project Team (Appendix 3). The scope of proposed permanent works based on the provided drawings include:

- Removing accumulated debris and gravel/sand substrate that may have accumulated at the culvert inlets/outlets during the atmospheric river event;
- Removing the four temporary CSP culverts at Beach Avenue and the three temporary CSP culverts at Margaret Road, which were installed under emergency works;
- Installing two side-by-side (double-barrel) concrete-box culverts at Margaret Road crossing (both culverts 12.5m long; one barrel with a width of 2.7m and a height of 1.5m, the other barrel a width of 2.1m and height of 1.2m), complete with a concrete headwall and fish baffles (spacing of fish baffles is to be determined);
- Installing two side-by-side (double-barrel) concrete-box culverts at Beach Avenue crossing (both 13m long; one barrel with a width of 2.1m and height of 1.2m, the second barrel with a width of 2.7m and height of 1.5m), complete with a concrete headwall and fish baffles (spacing of fish baffles is to be determined);
- Embedding 300mm-thick fisheries gravel along one of the double-barrel culverts at Margret Road and Beach Avenue crossings and at the headwall of the culvert outlets;
- Clearing and grubbing (minor vegetation removal) at culvert inlets/outlets and along the road edges (both sites) to accommodate the riprap armouring and road/driveway rebuilding;
- Stripping surface material and installing non-woven geotextile fabric to be covered by 450mm-thick class 25kg riprap armouring at the inlet and outlet of both Flume Creek crossings (Margaret Road: 67m^2 of riprap at the inlet and 95m^2 at the outlet; Beach Avenue: 64m^2 of riprap at the inlet and 87m^2 riprap at the outlet);
- Excavating, stripping, rebuilding, grading, and paving an approximately 90m-long section of Margaret Road and 60m-long section of Beach Avenue; and
- Minor regrading of a residential driveway off Margaret Road.

Construction of the Project is scheduled to begin in 2023 upon receiving regulatory approvals, and the estimated permitting and construction schedule is shown in Table A. Details outlining permitting requirements and timing of construction within reduced-risk timing windows for fish and wildlife are described in Section 6.0.

Table A: Estimated Project Timeline

Development Task	Proposed Start	Proposed Finish
Permitting[1]		
Water Sustainability Act Change Approval Application	February 2023	May 2023
Fisheries Act Request for Project Review	February 2023	May 2023
Fish and Wildlife Salvage Applications (Ministry of Forests)	February 2023	May 2023
Construction		
Preparation	July 26, 2023	October 31, 2023
Instream/riparian work[2]	August 1, 2023	October 31, 2023
Other work conducted away from streams including road repair work provided Erosion and Sediment Control measures are in place and are maintained.	August 1, 2023	No end date

1.1 Objectives

The objective of this EOA was to complete a biological inventory of the Sites, including an assessment of the terrestrial, aquatic, and riparian environment. This EOA provides:

- A description of the terrestrial and aquatic conditions near the Project footprint, including a review of vegetation, wildlife, fish and fish habitat, and species at risk (SAR) that may interact with the proposed works; and
- Guidance to avoid and mitigate impacts to environmental resources, including recommendations for the Project design.

The outcomes of this report are intended to serve the dual purpose of supporting detailed design processes as well as environmental regulatory submissions. Our approach consisted of a desktop review of pertinent resources and a reconnaissance-level field assessment.

This report is organized into ten sections:

- Section 1 introduces the proposed Project and objective of this report;
- Section 2 outlines the scope of work and describes the methods with which data was collected to prepare this report;
- Section 3 describes the regulatory framework for the proposed Project;
- Section 4 provides a brief overview of the Site's conditions;
- Section 5 describes the environmental conditions at each site and observations from field visits;
- Section 6 outlines the potential permit, approvals, and timelines for the works occurring and associated least-risk work windows;
- Section 7 gives briefly summarizes the findings and recommendations for optimal avoidance and mitigation measures; and
- Sections 8, 9, and 10 provide standard limitations, closing remarks, and referenced material used to compile this report.

[1] For the permitting section in this table, the proposed start and finish refers to when the application will be submitted to the regulatory agencies and when PGL expects to receive the permit.
[2] Instream works can be conducted prior to the start date if streams are dry upon the confirmation of a Qualified Environmental Professional.

2.0 SCOPE OF WORK

To complete the EOA, PGL:

- Reviewed orthophotographic/aerial imagery and available base maps of the Sites, paying particular attention to watercourses, potential habitat areas, and general land uses and disturbance;
- Identified fish-bearing watercourses near the Sites, as indicated by internet-based federal and provincial databases (Habitat Wizard, Fisheries and Oceans Canada (DFO) - Aquatic Species at Risk map [DFO, 2020]);
- Reviewed distribution and habitat suitability characteristics for SAR provided by the BC Conservation Data Centre (CDC) (see Appendix 2 for SAR status definitions), BC Species and Ecosystems Explorer and iMapBC;
- Reviewed Environment Canada's Sensitive Ecosystems Inventory (SEI) of the Sunshine Coast and Adjacent Islands Mapping Index and associated report catalogue; and
- Visited the Sites and conducted a habitat assessment.

Site visits were conducted by Qualified Environmental Professional (QEP) Katharine Scotton, B.Sc., R.P.Bio., and field technician Hayley Howes, B.Sc., on May 25 and 26, 2022. The weather conditions during the site visits were 12˚C and overcast with occasional light drizzle on May 25 and 13˚C with sun and cloud on May 26.

The information obtained from the identified resources, in combination with our site visit, was sufficient to complete our EOA.

3.0 REGULATORY CONTEXT

Margaret Road and Beach Avenue are managed by MOTI and thus fall primarily under the purview of provincial government; however, federal and regional legislation also apply. The proposed Project is subject to an extensive set of integrated and multi-scalar laws, regulations, guidelines, best practices, and standards. The following environmental legislation are most relevant to this Project.

- Provincial *Water Sustainability Act* (WSA): The purpose of the WSA is to safeguard ground and surface water in BC through licensing its diversion or extraction and prohibiting changes in and about a stream (inclusive of wetlands and some ditches) without prior approval (Government of BC 2014). Works in and near Flume Creek (e.g., bank armouring, culvert replacement, and road re-surfacing) and other aquatic features affiliated with the Sites typically require a notification or Change Approval under the WSA, based on the nature of the works;
- Federal *Fisheries Act*: Prohibits the harmful alteration, disruption, or destruction of fish habitat, or the unauthorized death of fish, and is administered by DFO (Government of Canada, 1985). The *Fisheries Act* applies to any proposed activities in or around fish habitat, inclusive of aquatic features that discharge to fish habitat. Proposed works that align with a DFO Code of Practice can typically proceed with a Notification. Where works are not covered by a Code of Practice, or cannot meet the required mitigation measures included in the Code of Practice, a Request for Project Review should be submitted to DFO to determine whether the Project is likely to result in harmful alteration, disruption, or destruction of fish habitat; and
- Federal *Species at Risk Act* (SARA): There are two primary mechanisms by which the SARA may interact with the proposed works: (i) protecting land identified as critical habitat for SAR, and (ii) protecting SAR and their residence (e.g., a nest or den) from harm (Government of

Canada, 2022). The SARA typically only applies on federally administered land[3]. As such, the SARA has limited preview onsite. However, we have assumed MOTI wishes to satisfy the management intent of the SARA where practical.

Table B provides a high-level overview of other laws, regulations, guidelines, best practices, and standards that may also apply in select circumstances. It is the responsibility of MOTI and contractors to understand how these guidelines apply to the proposed works and achieve compliance with immovable regulatory requirements.

Table B: Applicable Legislation, Regulations, and Guidelines for the Sites

Federal Legislation	Provincial Legislation	Guidelines
Fish and Fish Habitat		
• *Fisheries Act* (Canada), 1985 (Government of Canada, 1985a)	• *Riparian Areas Protection Act*, 1997 (Government of BC) • *Riparian Areas Protection Regulation*, 2019 (Government of BC) • *BC Water Sustainability Act,* 2014 (Government of BC 2014)	• Land Development Guidelines for the Protection of Aquatic Habitat, 1993 (DFO and MELP 1992) • A Users' Guide for Changes in and About a Stream in BC (Gov. of BC, 2022a) • Requirements and Best Management Practices for Making Changes In and About a Stream in BC (Gov. of BC, 2022b) • Guidelines for Reduced Risk Instream Work Window (MOE, 2006) • Guidelines for the Capture, Handling, Scientific Study and Salvage of the Salish Sucker (Pearson, 2015)
Wildlife		
• *Migratory Birds Convention Act* (Canada), 1994 (Government of Canada 1994a) • *Species at Risk Act* (Canada), 2002 (Government of Canada 2002) • *Wildlife Act (Canada)*, 1985, (Government of Canada 1985b)	• *BC Wildlife Act,* 1996 (Government of BC 1996)	• Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MOE 2014a) • Guidelines for Amphibians and Reptile Conservation during Urban and Rural Land Development in BC (BC MOE 2014b) • Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia 2013 (BC MOE 2013) • Guidelines to Reduce Risk to Migratory Birds (Government of Canada, 2021) • Best Management Practices Guidelines for Pacific Water Shrew in Urban and Rural Areas (DRAFT) (Craig, Vennesland and Welstead, 2010)

[3] Except for aquatic SAR and migratory bird SAR, for which protection is extended to non-federal land.

Federal Legislation	Provincial Legislation	Guidelines
Water Quality		
• *Canadian Environmental Protection Act*, 1999 (Government of Canada, 1999)	• *BC Environmental Management Act,* 2003 (Government of BC 2003) • *BC Water Sustainability Act,* 2014 (Government of BC 2014)	• Approved Water Quality Guidelines (BC), 2021 (BC ENV 2021) • Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2022) • A Users' Guide for Changes in and About a Stream in BC (Gov. of BC, 2022a) • Requirements and Best Management Practices for Making Changes In and About a Stream in BC (Gov. of BC, 2022b)
Soil		
• *Canadian Environmental Protection Act*, 1999 (Government of Canada, 1999)	• None	• Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2022)
Vegetation		
• None	• *BC Weed Control Act, 1985 (Government of BC 1996)*	• Best Management Practices for Managing Invasives on Roadsides (MOTI, 2019)
Other		
• None	• *BC Forest and Range Practices Act,* 1996 (Government of BC 2002) • *BC Heritage Conservation Act,* 1996 (Government of BC 1996)	• Archaeological Impact Assessment Guidelines, Rev. 1998 (Gov. of BC 1989)

4.0 SITE OVERVIEW

The Sites are located at the crossings of Flume Creek at Margaret Road (UTM 10U, 0451467, 5475649) and just westward, at the crossing of Flume Creek at Beach Avenue (UTM 10U 0451444, 5475520), in Roberts Creek, British Columbia. Both Sites had pre-existing culverts, which were washed out during high rain and flood events during the fall of 2021. Temporary culverts were installed to provide access to residential properties in this area.

Current land use observed on and near the Sites included: roadways (Margaret Road and Beach Avenue), residential properties, public park and picnic areas, camp facilities (Camp Douglas), and surrounding forested areas. These Sites are located near the eastern border of the Roberts Creek municipality and receive regular traffic. Temporary road surfaces were at an elevation of approximately 1m above Flume Creek and consisted of one or multiple temporary, corrugated-steel culverts covered by riprap and structural road fill.

5.0 ENVIRONMENTAL CONDITIONS

PGL completed a desktop review of available resources prior to the site visit. A summary of both desktop and field observations is provided in the following sections.

5.1 Vegetation and Ecological Conditions

The Sites lie within the Eastern Dry Maritime subzone of the Coastal Western Hemlock (CWHxm1) Biogeoclimatic Ecosystem Classification (BEC) zone.

All descriptions of BEC subzone characteristics provided below are derived from *A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region (*Green and Klinka, 1994).

5.1.1 CWHxm1 (Eastern Very Dry Maritime; Coastal Western Hemlock Subzone)

The CWHxm1 BEC subzone is confined to a small area on southeastern Vancouver Island and the Sunshine Coast. This is the smallest and most at-risk zone in the province and is a conservation concern. The climate is warm and dry in the summer. Winters are typically mild and moister, with almost no snowfall.

Undisturbed forests are dominated by Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and western redcedar (*Thuja plicata*). Minor arbutus (*Arbutus menziesii*) may occur on very dry sites. The shrub and herb layers are dominated by salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*), oceanspray (*Holodiscus discolor*), baldhip rose (*Rosa gymnocarpa*), snowberry (*Symphoricarpos alba*), western trumpet honeysuckle (*Lonicera ciliosa*), vanilla leaf (*Achlys triphylla*), and various lilies. The moss layer includes Oregon beaked moss (*Kindbergia oregana*) and electrified cat's-tail moss (*Rhytidiadelphus triquetrus*).

5.1.2 Invasive Alien Plant Program Observations

PGL searched for recorded invasive species within and around the Sites using the Invasive Alien Plant Program webmap. No invasive plant species were recorded within or immediately adjacent the Sites. However, invasive species including Japanese knotweed (*Reynoutria japonica),* Bohemian knotweed (*Polygonum x bohemicum*), Himalayan blackberry (*Rubus armeniacus*), and English ivy (*Hedera helix*) were observed between 150m and 300m from either Site. It is noted that invasive species were observed onsite during the field visit, as described in Section 5.1.3.3

5.1.3 Onsite Vegetation Observations

The following subsections describe the vegetation conditions observed at each site.

5.1.3.1 Flume Creek at Beach Avenue

Flume Creek upstream of Beach Avenue featured low banks and cleared properties on the northeast side. The canopy cover was approximately 20% and was dominated by western redcedar, bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), and Douglas-fir, with subdominant grand fir. The understorey contained sword fern (*Polystichum munitum*), lady fern (*Athyrium filix-fermina*), salmonberry (*Rubus spectabilis*), ocean spray, beaked hazelnut (*Corylus cornuta*), common horsetail (*Equisetum arvense*), western skunk cabbage (*Lysichiton americanus*), salal, sedges (*Carex spp*.), and periwinkle (*Vinca major*).

Vegetation downstream of the temporary culvert was similar in composition to upstream. All species that were present upstream were also present downstream of the temporary culvert, as well as several additional species.

5.1.3.2 Flume Creek at Margaret Road

Flume Creek upstream and downstream of Margaret Road featured similar mature growth to the Beach Avenue site, including Douglas-fir and western redcedar as the dominant trees with sub-dominant red alder, bigleaf maple, and western hemlock. Canopy cover was approximately 40%. Banks are low (approximately 0.75m) and quite undercut, and the site is very disturbed where works occurred. Understorey species include lady fern, sword fern, deer fern (*Struthiopteris spicant*), salmonberry, goat's beard (*Aruncus dioicus*), skunk cabbage, salal, red huckleberry (*Vaccinium parvifolium*), three-leaved foamflower (*Tiarella trifoliata*), and costal hedge nettle (*Stachys chamissonis*).

5.1.3.3 Invasive Plants

Invasive plant species were abundant in and around Flume Creek at both Sites. This included Himalayan blackberry non-native ivy (*Hedera sp.*), spurge (Daphne) laurel (*Daphne laureola*), bindweed (*Convolvulus arvensis*), creeping buttercup (*Ranunculus repens*), cleavers (*Galium aparine*), English holly (*Ilex aquifolium*), wall lettuce (*Lactuca muralis*), and Robert's geranium (*Geranium robertianum*).

The crossing of Flume Creek at Beach Avenue featured additional non-native plants, including periwinkle (*Vinca minor*) and Spanish bluebell (*Hyacinthoides hispanica*).

5.1.3.4 Sensitive Ecosystem Inventory

The SEI of the Sunshine Coast and Adjacent Islands Map Index was used to determine the sensitive ecosystem within which the Sites are located. Sensitive ecosystems are fragile and/or rare and are ecologically important because of the diversity of species they support. Flume Creek has a combination of three SEI classes and subclasses. These are described as follows:

A Primary ecosystem of 60% **Riparian 'Fringe'**, a secondary ecosystem of 20% **Wetland 'Swamp'**, and a tertiary ecosystem of 20% **Riparian 'High Bench Floodplain'**.

Riparian habitats are areas directly adjacent waterbodies and are easily influenced by erosion, sedimentation, flooding, and/or subterranean irrigation due to proximity to the waterbody (Meidinger *et al.*, 2014). **Riparian 'Fringe' habitat** is a narrow linear community along open waterbodies where there is little to no floodplain.

Riparian 'High Bench Floodplain' habitat is only periodically and briefly inundated by high waters, but lengthy subsurface flow in the rooting zone. This is typically conifer-dominated floodplains of larger coastal rivers (Environment Canada, 2005).

Wetland 'Swamp' habitats are wooded wetlands dominated by 25% or more cover of flood-tolerant trees or shrubs. These occur in a poor to very rich wetland on mineral soils or with an organic layer over mineral soil, with gently flowing or seasonal flooding within the water table. Swamps are high in nutrient mineral and oxygen content (Environment Canada, 2005).

Field surveys confirmed that the description in the SEI of the Sunshine Coast and Adjacent Islands is generally accurate for the Sites.

5.2 Wildlife and Wildlife Habitat

The site is in the Georgian Depression Ecoprovince. Ecoprovince descriptions can be used to provide general wildlife characteristics and identify expected wildlife species for a particular area. The following fauna descriptions are derived from *The British Columbia Ecoregion Classification* (Demarchi, 2011).

Mule deer (*Odocoileus hemionus*) are very abundant in the Georgian Depression Ecoprovince, both in urban and rural settings. Cougars (*Puma concolor*), American black bears (*Ursus americanus*), and coyotes (*Canis latrans*) are also common throughout, as well as several small mammals, including Virginia opossum (*Didelphis virginiana*) (introduced), Trowbridge's shrew (*Sorex trowbridgii*), shrew-mole (*Neurotrichus gibbsii*), Townsend's mole (*Scapanus townsendii*), coast mole (*Scapanus orarius*), Douglas' squirrel (*Tamiasciurus hudsonicus*), and creeping vole (*Microtus oregoni*). It is possible for most of these species to occur on/near the Sites, except for the Virginia opossum.

The Georgian Depression Ecoprovince supports the highest diversity of bird species in BC, as roughly 90% of all species known to occur in the province occur here. Approximately 60% of all species known to breed in BC also occur here. Given its location within the Fraser River corridor, it is likely that many of these species could occur on/near the Sites, either as transient visitors or residents.

Barn Owl (*Tyto alba*) and Anna's Hummingbird (*Calypte anna*) are only found within the Georgian Depression Ecoprovince within BC. In addition, Purple Martin (*Progne subis*), bushtit (*Psaltriparus minimus*), and Hutton's Vireo (*Vireo huttoni*) breed only within this ecoprovince in BC. It is expected that these species would occur on/near the Sites. Pileated woodpeckers *(Dryocopus pileatus)* commonly breed in this Ecoprovince (Easton, 2015), which are listed under the Migratory Bird Regulation, 2022. Nest cavities of pileated woodpeckers are used by other birds and mammals (secondary cavity nesters) in the years following the creation of the cavities. The nest cavities are therefore important components of the nest web, have year-round protection, and require proof of inactivity for 36 months before removal.

The ecoprovince is home to a variety of reptiles and amphibians, both native and introduced. Some species that may occur on the site include northwestern gartersnake (*Thamnophis ordinoides*), northwestern salamander (*Ambystoma gracile*), ensatina (*Ensatina eschscholtzii)*, American bullfrog (*Lithobates catesbeiana*) (introduced), and green frog (*Lithobates clamitans)* (introduced).

5.2.1 Onsite Wildlife Observations

Several terrestrial wildlife species were confirmed present during the field surveys through visual and or auditory identification. This included the Bald Eagle (*Haliaeetus leucocephalus*), Anna's Hummingbird (*Calypte anna*), American Robin (*Turdus migratorius*), and Pacific-slope Flycatcher (*Empidonax difficilis*). The mature forest and understorey habitat provides suitable nesting and feeding opportunities for a large variety of avian species including raptors, songbirds, and woodpeckers. Abundant coarse woody debris present in the riparian area of the Sites also offered potential cover habitat for terrestrial species of amphibians and small mammals. Other significant wildlife habitat features were not observed at the site.

5.3 Aquatic Features and Fish Habitat

Flume Creek is part of the Wilson Creek watershed, originating as an outlet from Randall Lake to the north and its surrounding wetlands. Flume Creek outlets to the Pacific Ocean just south of Beach Avenue.

5.3.1 Flume Creek at Margaret Road

Flume Creek flows from the northeast underneath Margaret Road in a riffle-pool sequence, through a temporary passing built in a triangular arrangement of three culverts. The creek is very disturbed where the emergency works occurred. The banks were slightly undercut with top of bank approximately 0.75m above the surface of the water. There was a channelized ditch on the east side of Margaret Road entering the creek on the upstream side of the culverts. The ditch was incised 0.5 to 0.75m deep with thick vegetation cover. Downstream of Margaret Road was a pile of sand deposited on river left. The stream widened just after the culvert outlet to a wetted width of 10m. The banks were slightly lower than upstream at 0.2m to top of bank. Substrates consisted of cobble in riffles, and small round gravel and sands in the pools. Banks were slightly undercut. There was a second channelized ditch on river right, entering the main channel from the north by the culvert outlet. Large woody debris was sparse both upstream and downstream of the culvert. Water quality sampling results for Flume Creek at Margaret Road can be seen below in Table C.

5.3.2 Flume Creek at Beach Avenue

The crossing of Flume Creek at Beach Avenue is approximately 120m southwest of the Margaret Road crossing. The main creek meanders from the west and crosses underneath Beach Avenue from the west. It has a wetted width of approximately 2.7m. The substrates consist of small cobble, gravels, and sand with 30% embeddedness. There are four culverts arranged horizontally across the width of the creek, with the western most culvert perched slightly higher (about 10–30cm above the water level at the time of the survey) than the remaining three, slightly smaller culverts. There were two footbridges within the Project footprint, one 40m upstream of Beach Avenue, and one 30m downstream of Beach Avenue. After crossing underneath the road, the main channel bends to the west around a tight 270-degree corner. The banks were severely undercut where there was a deep pool and a bedrock outcrop on river left. Between the temporary culvert and this pool, the canopy cover was denser before it opens toward the outlet to the ocean. The banks downstream of the culvert were slightly higher at approximately 0.75m to top of bank, and there was no significant large woody debris presence.

Water quality within Flume Creek was clear, with very low turbidity, and high dissolved oxygen. Water quality sampling results collected from Flume Creek on May 26, 2022, are summarized in Table C. It is worth noting that pH at both Sites was below BC's minimum water quality guidelines for freshwater aquatic life (6.5–9.0pH), which could provide potentially sub-optimal conditions for salmonids.

Table C: Water Quality at Flume Creek

Sample Location	Temperature (°C)	DO (mg/L)	Conductivity (µs/cm)	Turbidity (NTU)	pH
Water Quality Station 1 – Margaret Road	10.4	13.57	35.0	0.65	6.02
Water Quality Station 2 – Beach Avenue	10.6	13.78	35.6	0.61	6.15

5.3.3 Fish and Fish Habitat

Fish habitat at the site is considered suitable year-round. There are no barriers to fish passage present from the mouth of Flume Creek all the way upstream through both site footprints. Fish occurrences within Flume Creek have been documented on the publicly available provincial database, Habitat Wizard. These include chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), and cutthroat trout (*Oncorhynchus clarkii*). A 1m waterfall at the mouth of Flume Creek may restrict fish migration, and any cutthroat trout present are likely to be resident (non-anadromous) fish. Data does not exist classifying the cutthroat trout sub-species; however, given the location of the observations, it is assumed that cutthroat trout present are the provincially Blue-Listed coastal cutthroat trout (*Oncorhynchus clarkii clarkii*).

5.4 Species at Risk

PGL searched the provincial CDC Species and Ecosystems Explorer database for SAR that could potentially occur on the site. Additionally, the CDC was consulted to identify provincially listed Ecosystems at Risk within the CWHxm1 subzone with the potential of occurring onsite.

Detailed surveys for focal wildlife, plant, and ecosystems of conservation concern (i.e., listed by the CDC and/or protected under the SARA) were not included in the scope of this overview assessment. Therefore, it is assumed that the listed species and ecosystems that use habitat types provided in or around the site may potentially occur in this area.

All animals and plants of conservation concern potentially associated with the site are listed in Tables 1 and 2, respectively, and a description of SAR status definitions is provided in Appendix 2. The provided lists are comprehensive; however, species that utilize habitat conditions not likely present at the site are acknowledged wherever possible. A detailed habitat suitability assessment would likely result in a smaller, more site-specific list of potential species.

PGL also reviewed CDC iMap to confirm the presence/absence of known masked sensitive occurrences (occurrences are identified, but species information is not publicly available) and non-sensitive occurrences (species information is publicly available) of SAR and Ecosystems at Risk and federally designated Critical Habitat for SAR on or within 2km of the site. SAR likely to occur include the following:

- Sitka Spruce *(Picea sitchensis)*/Salmonberry (*Rubus spectabilis*) Very Dry Maritime – Provincially Red-listed Ecological Community;
- Marbled Murrelet (*Brachyramphus marmoratus*) Proposed Critical Habitat; and
- Coastal cutthroat trout – Provincially Blue-Listed.

5.4.1 Sitka Spruce/Salmonberry Very Dry Maritime (CWHvm1-09)

The site lies within a BC Red-Listed sitka spruce/salmonberry very dry maritime ecological community. This community occurs within high bench floodplains that experience flooding at greater than five-year intervals. Soils are typically sorted silts, sandy loams, or sands. This is due to a high percentage of fluvial materials and a surface cap of fine sediments, with a medium to rich nutrient regime (BC Conservation Data Centre, 2022).

Sitka Spruce is the expected climax species with a canopy dominated by red alder, and less dominant western red cedar and bigleaf maple. The understorey layer consists of dominating salmonberry and lesser devil's club (*Oplopanax horridus)*, stink currant (*Ribes bracteosum)*, trailing blackberry (*Rubus ursinus)*, vanilla leaf (*Achlys triphylla*), sword fern (*Polystichum munitum*), enchanter's nightshade (*Circaea alpina*), piggy black plant (*Tlomiea menziesii*), foamflower (*tiarella trifoliata*), cooley's hedge-nettle (*Stachys cooleyae*), sweet-scented bedstraw (*Galium triflorum*), lady fern (*Athyrium filix*-femina), coastal leafy moss (*Plagiomnium insigne*), and palm tree moss (*Leucolepis menziesii*).

5.4.2 Marbled Murrelet (*Brachyramphus marmoratus)*

Marbled Murrelet are listed as Threatened by the Committee on Status of Endangered Wildlife in Canada and are provincially Red-Listed, which means they are legally designated or being considered for legal designation as Endangered or Threatened within the Province of British Columbia (Burger, 2004).

Marbled Murrelet Proposed Critical Habitat has been applied across the south coast mainland of BC as a precautionary measure by the province. Marbled Murrelet are small seabirds that require old growth forest habitat for nesting. They will fly up to 65km inland from their foraging areas of saltwater to find suitable nesting habitat; but most nests are located within 30km of the sea (Environment Canada, 2014). Suitable nesting habitat for Marbled Murrelet was not identified at the Sites as the mature trees were not old enough to provide nesting platforms in the upper canopy.

5.4.3 Coastal Cutthroat Trout

Coastal cutthroat trout require small, low-gradient coastal streams and estuarine habitats, most often within 150km from the mouth of a river. They prefer well-shaded streams at sub-18˚C. Most individuals are anadromous, though some will spend the entirety of their life cycle in freshwater. Spawning occurs on small gravel substrates. Fry will typically move into larger water bodies, before migrating to sea within their first one to three years of life, typically spending two to five months here in late spring or early summer. Overwintering occurs in freshwater streams the remainder of the year (B.C. Conservation Data Centre, 1995).

6.0 RESTORATION PLANTING REQUIREMENTS

A detailed Restoration Planting Plan will be required prior to construction that provides details of the number of each plant species and the areas where they should be planted. At this time, a list of plant species proposed for any restoration planting areas at the Site is shown in Table D.

Table D: Proposed Planting List for Restoration Planting Areas

Common Name[4]	Scientific Name
Trees	
Douglas-fir	*Pseudotsuga menziesii*
Western hemlock	*Tsuga heterophylla*
Western redcedar	*Thuja plicata*
Bigleaf maple *	*Acer macrophyllum*
Red alder*	*Alnus rubra*

[4] Plant species were chosen based on the CWHxm1 biogeoclimatic ecosystem classification zone suitability or based on the presence observed during the Site visit as indicated with "*".

Common Name[4]	Scientific Name
Grand fir*	*Abies grandis*
Shrubs	
Salal	Gaultheria shallon
Dull Oregon-grape	*Mahonia nervosa*
Red huckleberry	*Vaccinium parvifolium*
Baldhip rose	*Rosa gymnocarpa*
Ocean spray	*Holodiscus discolor*
Sword fern	*Polystichum munitum*
Lady fern*	*Athyrium filix-femina*
Deer fern*	*Struthiopteris spicant*
Salmonberry*	*Rubus spectabilis*
Beaked hazelnut*	*Corylus cornuta*
Goat's beard*	*Aruncus dioicus*

Seed composition that will be spread within disturbed areas and restoration planting areas will follow the Standard Specifications for Highway Construction, Section 757 – Revegetation Seeding (MOTI, 2020).

Any areas requiring planting or that have been disturbed from the works adjacent to Flume Creek will be seeded with the Riparian Area Mix that consists of:

- Slender wheatgrass 40%;
- Perennial rye 25%;
- Kentucky bluegrass 15%;
- Timothy 10%;
- Redtop 5%; and
- Junegrass 5%

7.0 PERMIT APPROVALS AND TIMELINES

Anticipated environmental permits and approvals required for this Project include:

- **WSA Change Approval**: Bank stabilization works, as required for the proposed culvert repair, will require a WSA Change Approval;
- ***Fisheries Act* Request for Review**: Works are expected to occur proximal to, and within, the wetted perimeter of Flume Creek, which is a known fish-bearing watercourse. To confirm compliance with provisions of the *Fisheries Act* and SARA, a Request for Review should be submitted to DFO. The proposed works are not anticipated to require authorization under the *Fisheries Act.* The DFO Request for Review is expected to require 60 to 90 days for a response from DFO; and
- **Fish and Wildlife Salvage Permits:** As works are expected to occur within fish and wildlife habitat, relevant salvage permits should be secured prior to the commencement of activities. Fish and wildlife salvage permits (provincial and federal) should be submitted a minimum of 60 days prior to the start of works. These include:
  - *Fisheries Act* fish salvage permit;
  - *Wildlife Act* general wildlife permit (salvage); and
  - *Wildlife Act* fish salvage permit.

The following permits and approvals are not anticipated:

- *Land Act* Crown Land Use Permit;
- WSA Short Term Use Approval (groundwater extraction); and
- *Fisheries Act* Authorization.

7.1 Timing Windows

Least-risk timing windows for fish and wildlife anticipated to be present at the site during the proposed work are summarized in Table E.

Table E: Least-risk Timing Windows for Fish and Wildlife

Species	Least Risk Window	Reference
Cutthroat Trout	August 1–October 31	MOE, 2006
Pacific Salmon	July 15–September 15	MOE, 2006
Bald Eagle	September 1–December 31	BC MOE, 2014a
Herons	September 15–January 15	BC MOE, 2014a
Raptors	October 1–February 28	BC MOE, 2014a
Songbirds	September 1–February 28	BC MOE, 2014a
Amphibians	August 1–October 31	FLNRORD, 2016

For coho and cutthroat trout, it is assumed that spawning generally occurs in reaches of the watershed with abundant pebbles and gravels with cool flowing water.

For avian species, the breeding season begins to wind down in late summer. Breeding activity is dependent on the weather and resource conditions from year to year, so caution should be used when planning activities that fall outside the least-risk windows. If work cannot be avoided outside the least-risk window, a QEP should be consulted to conduct pre-clearing nest surveys to determine the risk of breeding activity, establish buffers, and conduct ongoing monitoring.

Given the above least-risk windows and the known and assumed uses of the site by the species anticipated to be present, a general timing window of August 1–September 15 is appropriate for the Sites if water is present.

7.1.1 Working Outside of Reduced-Risk Timing Window

It is anticipated that works may extend past the reduced-risk timing window, based on MOTI's requirement to conduct extensive instream works on multiple sites on the Sunshine Coast (not described in this EOA) that are a priority for bank stability and public safety. The works will not extend past October 31 to protect amphibian and trout species potentially present within the Site. Conducting instream works past September 15 extends past the Pacific salmon reduced-risk window, which is recommended to prevent interference during the spawning season. Additional mitigation measures to reduce the potential impacts of the works on spawning Pacific salmon should be implemented. This includes completing the initial diversion of the stream prior to the end of the reduced-risk work window and increasing environmental monitoring to the minimum of daily inspections. The work zone will be isolated, and therefore, the migration of spawning Pacific salmon

may be blocked. If spawning Pacific salmon are observed downstream of the Site, the environmental monitor will relocate fish upstream of the culvert. Details of the relocation plan will be submitted in the fish salvage permit applications.

It is also noted that if the watercourse is dry, work may take place in the dry stream channel outside of the reduced-risk instream work window, provided other species (birds and amphibians) have also been considered and risks have been mitigated. Works away from streams and riparian habitat, including the proposed road works, can occur outside of the reduced-risk timing window.

8.0 CONCLUSIONS AND RECOMMENDATIONS

PGL conducted an EOA to identify environmental conditions at two temporary culverts carrying Flume Creek, underneath Margaret Road and Beach Avenue, respectively, in Roberts Creek, BC. Temporary culvert replacement works occurred during the emergency operations after the flooding of fall 2021. Replacement of the temporary culverts and associated roadway has been flagged as a priority for MOTI. Improvements to fish passage and prevention of potential future failures has been considered.

The most prominent environmental features at the Sites include ideal substrates for fish spawning (i.e., cobbles, gravels, and fines of varying sizes) and physical features for fish habitat, (i.e., plunge pools, shady overhanging banks). These provide habitat for potential SAR such as coastal cutthroat trout and other salmonids that may be present.

Instream and riparian work proposed for the Project will require several regulatory permits and approvals, as outlined in Section 6. Restoration of the work areas will be required to maintain a no-net-loss of habitat for both the provincial and federal permitting processes.

The most suitable period for conducting instream and riparian works for the proposed Project is August 1–September 15, taking into consideration the potential fish and wildlife species present at the Site and their life histories. However, works may be conducted outside of the least-risk instream work window if the watercourse is dry, or until October 31 if additional mitigation measures are applied including completing the initial diversion of the stream prior to September 15 and increasing monitoring frequency.

Based on PGL's assessment, four key categories for environmental due diligence measures to reduce the risk to fish and wildlife species and their habitats have been identified: Planning and Design, Pre-Construction, Construction Mitigation, and Post-Construction The categories and recommended measures are outlined below.

Planning and Design

- Culvert design specifications should include:
  - Provision for fish passage under Margaret Road and Beach Avenue, such as the use of an open-bottomed pipe arch culvert or box culvert;
  - Alignment similar to that of the natural stream channel while also aiming for the shortest culvert length (do not skew alignment greater than 30˚ to the stream); and
  - Adequate water depth and velocity to allow adult and juvenile fish passage, including creation of a thalweg within natural bottomed culvert.
- Access for maintenance equipment to remove accumulated debris or conduct repairs and restoration
- Ensure culvert positioning does not block roadside drainage ditches at Margaret Road

Pre-Construction

- Prepare a Construction Environment Management Plan to identify Best Management Practices, construction-specific mitigation, erosion and sediment control plan, environmental monitoring requirements, and emergency plans as per Standard Specifications for Highway Construction, Section 165 – Protection of the Environment (MOTI, 2020)
- Prepare regulatory permits and approvals (Section 6)
- Prepare an Invasive Plant Management Plan

Construction Mitigation

- Conduct instream and riparian work during the most suitable least-risk window of August 1–September 15
- Follow Construction Environment Management Plan and Standard Specifications for Highway Construction, Section 165 – Protection of the Environment (MOTI, 2020)
- Delineate Environmentally Sensitive Areas
- Ensure water quality and quantity is maintained upstream and downstream of the work area, including the use of temporary bypasses
- Retain a QEP experienced in identifying, handling, and salvaging fish and wildlife to conduct fish salvage and wildlife salvages (if needed)
- Retain a QEP to conduct raptor and pileated woodpecker nest surveys prior to Site preparation
- Retain a QEP to conduct pre-clearing nest surveys prior to site preparation (clearing and grubbing) and noise generating activities if occurring outside the breeding bird least-risk window (September 1–February 28 for songbirds), or as directed by the QEP
- Ensure full-time monitoring of instream works by a QEP
- Remove invasive plant species and seed contaminated soils and dispose at a certified facility

Post-Construction

- Conduct a post-construction monitoring assessment one year post completion of the works that includes:
  - Structural stability;
  - Fish passage and water flow;
  - Planting and/or seed growth success; and
  - Fish habitat use.

9.0 STATEMENT OF LIMITATIONS AND CONDITIONS FOR REPORT

9.1 Complete Report

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to PGL by the Client, communications between PGL and the Client, and any other reports, proposals or documents prepared by PGL for the Client relative to the specific site described herein, all of which together constitute the Report.

In order to properly understand the suggestions, recommendations and opinions expressed herein, reference must be made to the whole of the Report. **PGL is not responsible for use by any part of portions of the Report without reference to the whole report.**

9.2 Basis of Report

The Report has been prepared for the specific site and purposes that are set out in the contract between PGL and the Client. The findings, recommendations, suggestions, or opinions expressed in the Report are only applicable to the site and purposes in relation to which the Report is expressly provided, and then only to the extent that there has been no material alteration to or variation from the information provided or available to PGL.

9.3 Use of the Report

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report or any portion thereof without PGL's written consent, and such use shall be on terms and conditions as PGL may expressly approve. Ownership in and copyright for the contents of the Report belong to PGL. Any use which a third party makes of the Report, is the sole responsibility of such third party. **PGL accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report.**

10.0 CLOSING

We trust our report meets your needs. If you have any questions, please contact Stewart Brown at 604-895-7612.

PGL ENVIRONMENTAL CONSULTANTS

Per:

Hayley Howes, B. Sc., BIT,
Environmental Consultant

Stewart Brown, M.Sc., P.Ag., R.P.Bio.
Lead Consultant

HAH/CSB/neg/mtl
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11.0 REFERENCES

B.C. Conservation Data Centre. 2009. Ecological Community Summary: *Picea sitchensis / Rubus spectabilis* Very Dry Maritime. B.C. Minist. of Environment. Available: https://a100.gov.bc.ca/pub/eswp/ (accessed Jul 4, 2022).

BC Conservation Data Centre (BC CDC). 1995. Species Summary: *Oncorhynchus clarkii clarkii*. B.C. Minist. of Environment. Available: https://a100.gov.bc.ca/pub/eswp/ (accessed Mar 14, 2022).

BC Ministry of Environment (MOE). 2013. *Guidelines for Raptor Conservation during Ruban and Rural Land Development in British Columbia (2013).* Available at: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/raptor_conservation_guidelines_2013.pdf. Accessed March 2022.

BC MOE. 2014a. *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia.* Victoria, BC.

BC MOE. 2014b. Guidelines for Amphibians and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014). Available at: http://www.env.gov.bc.ca/wld/documents/bmp/HerptileBMP_complete.pdf. Accessed March 2022.

BC Ministry of Environment and Climate Change Strategy (BC ENV). 2021. *British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary*. Water Quality Guideline Series, WQG-20. Prov. B.C., Victoria B.C. Available at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed March 2022.

Ministry of Environment. 2023. Invasive Alien Plant Program Database and Map Display. Available at: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species/iapp. Access January 2023.

Berger, A.E., 2004. Standard Methods for Identifying and Ranking Habitat or Marbled Murrelets (*Brachyramphus marmoratus*) in British Columbia Using Air Photo Interpretation and Low-Level Aerial Surveys. Ministry of Land and Air Protection Biodiversity Branch, Victoria, BC., and Ministry of Forests Vancouver Forest Region Nanaimo, BC.

CCME (Canadian Council of Ministers of the Environment). 2022a. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. Available at: http://ceqg-rcqe.ccme.ca/en/index.html#void. Accessed January 2022.

Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks (DFO and MELP). 1992. *Land Development Guidelines for the Protection of Aquatic Habitat*. Available at: http://stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/LandDevelopmentGuidelines.pdf . Accessed January 2022.

Demarchi, D.A. 2011. *The British Columbia Ecoregion Classification*. Ministry of Environment. Victoria, BC. Third Edition.

Environment Canada – Regional District of Comox-Strathcona, March, 2005. Sensitive Ecosystems Inventory of the Sunshine Coast and Adjacent Islands. Retrieved from https://a100.gov.bc.ca/pub/acat/documents/r3758/sun_092g041_1130980183301_bf70e627bdd341179d6fadfdf56e484d.pdf

Government of Canada. 1985a. *Fisheries Act* [R.S.C. 1985, c.F-14, s. 1]. Environment Canada. Ottawa, ON.

Government of Canada. 1985b. *Canada Wildlife Act* [R.S.C. 1985, c. W-9]. Environment Canada. Ottawa, ON.

Government of Canada. 1985c. *Wildlife Area Regulations* [C.R.C., c. 1609]. Environment Canada. Ottawa, ON.

Government of Canada. 1985d. *Canadian Navigable Waters Act* [R.S.C., 2019, c. 28, s. 46]. Ottawa, ON.

Government of Canada. 1994a. *Migratory Birds Convention Act* [S.C. 1994, c. 22]. Environment Canada. Ottawa, ON.

Government of Canada. 1994b. *Migratory Bird Sanctuary Regulations* [C.R.C., c. 1036]. Environment Canada. Ottawa, ON.

Government of Canada. 1999. *Canadian Environmental Protection Act* [S.C. 1999, c. 33]. Environment Canada. Ottawa, ON.

Government of Canada. 2002. *Species at Risk Act* [S.C. 2002, c. 29]. Environment Canada. Ottawa, ON.

Government of Canada. 2019a. *Impact Assessment Act* [S.C. 2019, c. 28, s. 1]. Ottawa, ON.

Government of Canada. 2019b. *Environmental Emergency Regulations*, 2019 [S.O.R./2019-51]. Ottawa, ON.

Government of Canada. 2021. *Guidelines to reduce risk to migratory birds*. Available at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html. Accessed January 2022.

Green, R.N., and K. Klinka. 1994. A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region. Research Branch, BC Ministry of Forests. Victoria, BC.

Meidinger, D., J. Clark, and D. Adamoski. 2014. *Sensitive Ecosystem Inventory for Metro Vancouver & Abbotsford, 2010-2012.* Metro Vancouver, Langley BC. 49 pp + Appendices.

Ministry of Forests, Lands, and Natural Resource Operations (FLNRORD). 2016. Best Management Practices for Amphibian and Reptile Salvages in British Columbia. Version 1.0., June 2, 2016.

Figures

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N

CAREY ROAD

MARGARET ROAD

PARK AVENUE

FLUME CREEK

BEACH AVENUE

FLUME ROAD

FLUME CREEK CROSSING AT MARGARET ROAD

FLUME CREEK CROSSING AT BEACH AVENUE

Subject Site

Road Centreline

Watercourse

Parcel boundary and site features are approximate and are presented for discussion purposes only.

0 160 m

1:3,000

2021 orthoimage and street map from ESRI
Road and watercourse data from BC Open Data
NAD 1983 UTM Zone 10N

W:\BC Project Files\0300-3999\0346-65.01\Flume Creek\03466501_EOA_0010_FlumeCreek_SiteLocation.mxd

SITE LOCATION

Flume Creek Crossing at Margaret Road & Beach Avenue, Roberts Creek, BC

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PGL ENVIRONMENTAL CONSULTANTS

File No.:	Dwg No.:	FIGURE
0346-65.01	EOA_0010	1
Date: JUL 2022	Drawn by: RSS	

- Subject Site
- Critical Habitat - Sitka Spruce/Salmonberry
- Proposed Critical Habitat - Marbled Murrelet (Fine-Filtered)
- Proposed Critical Habitat - Marbled Murrelet (Blanket)
- Road Centreline
- Watercourse
- Chum Salmon, Coho Salmon, Cutthroat Trout
- Coho Salmon
- Cutthroat Trout

Parcel boundary and site features are approximate and are presented for discussion purposes only.

0 1,100 m

1:20,000

2021 orthoimage from ESRI
Road and environmental feature data from BC Open Data
NAD 1983 UTM Zone 10N

SPECIES AT RISK CRITICAL HABITAT

Flume Creek Crossing at Margaret Road & Beach Avenue, Roberts Creek, BC

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PGL ENVIRONMENTAL CONSULTANTS

File No.:	Dwg No.:	FIGURE
0346-65.01	EOA_0020	2
Date: JUL 2022	Drawn by: RSS	

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Tables

PGL ENVIRONMENTAL CONSULTANTS

Table 1
SAR Animals
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC list	COSEWIC	SARA
Bivalves				
Musculium partumeium	Swamp Fingernailclam	Blue		
Musculium transversum	Long Fingernailclam	Blue		
Ostrea lurida	Olympia Oyster	Blue	SC (May-11)	SC (Jun-03)
Sphaerium occidentale	Herrington Fingernailclam	Blue		
Sphaerium patella	Rocky Mountain Fingernailclam	Red		
Sphaerium striatinum	Striated Fingernailclam	Blue		
Gastropods				
Allogona townsendiana	Oregon Forestsnail	Red	E (Apr-13)	E (Jan-05)
Carychium occidentale	Western Thorn	Blue		
Deroceras hesperium	Evening Fieldslug	Red	Data Deficient (Nov-03)	
Galba bulimoides	Prairie Fossaria	Blue		
Galba dalli	Dusky Fossaria	Blue		
Galba parva	Pygmy Fossaria	Blue		
Galba vancouverensis	Vancouver Fossaria	Red		
Gyraulus crista	Star Gyro	Blue		
Haliotis kamtschatkana	Northern Abalone	Red	E (Apr-09)	E (Jan-00)
Hemphillia dromedarius	Dromedary Jumping-slug	Red	T (May-14)	T (Jan-05)
Hemphillia glandulosa	Warty Jumping-slug	Red	SC (Apr-13)	SC (Jan-05)
Nearctula sp. 1	Threaded Vertigo	Blue	SC (Apr-10)	SC (Jul-12)
Physella propinqua	Rocky Mountain Physa	Blue		
Physella virginea	Sunset Physa	Blue		
Planorbula campestris	Meadow Rams-horn	Blue		
Pristiloma johnsoni	Broadwhorl Tightcoil	Blue		
Promenetus umbilicatellus	Umbilicate Sprite	Blue		
Prophysaon coeruleum	Blue-grey Taildropper	Blue	T (Apr-16)	T (Feb-19)
Stagnicola caperata	Wrinkled Marshsnail	Blue		
Stagnicola traski	Widelip Pondsnail	Blue		
Insects				
Anarta edwardsii	Edwards' Beach Moth	Red	E (May-21)	E (Feb-11)
Argia emma	Emma's Dancer	Blue		
Argia vivida	Vivid Dancer	Blue	SC (May-15)	SC (Feb-19)
Bombus occidentalis	Western Bumble Bee	Blue	T (May-14)	
Callophrys eryphon sheltonensis	Western Pine Elfin, *sheltonensis* subspecies	Blue		
Callophrys johnsoni	Johnson's Hairstreak	Red		
Callophrys mossii mossii	Moss' Elfin, *mossii* subspecies	Red		
Cercyonis pegala incana	Common Wood-nymph, *incana* subspecies	Red		
Chlosyne hoffmanni	Hoffman's Checkerspot	Red		
Cicindela hirticollis	Hairy-necked Tiger Beetle	Blue		
Coenonympha tullia insulana	Common Ringlet, *insulana* subspecies	Red		
Copablepharon fuscum	Sand-verbena Moth	Red	E (Nov-13)	E (Jul-05)
Danaus plexippus	Monarch	Red	E (Nov-16)	SC (Jun-03)
Enallagma clausum	Alkali Bluet	Blue		

Table 1
SAR Animals
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC list	COSEWIC	SARA
Epargyreus clarus	Silver-spotted Skipper	Blue		
Epargyreus clarus californicus	Silver-spotted Skipper, *californicus* subspecies	Red		
Erynnis propertius	Propertius Duskywing	Red		
Erythemis collocata	Western Pondhawk	Blue		
Euphydryas editha taylori	Edith's Checkerspot, *taylori* subspecies	Red	E (May-11)	E (Jun-03)
Euphyes vestris	Dun Skipper	Blue	T (Apr-13)	T (Jun-03)
Hesperia colorado oregonia	Western Branded Skipper, *oregonia* subspecies	Red	E (Nov-13)	
Icaricia icarioides blackmorei	Boisduval's Blue, *blackmorei* subspecies	Blue		
Icaricia saepiolus insulanus	Greenish Blue, *insulanus* subspecies	Red	E (May-12)	E (Jun-03)
Octogomphus specularis	Grappletail	Red	SC (May-21)	
Omus audouini	Audouin's Night-stalking Tiger Beetle	Red	T (Nov-13)	T (Jun-18)
Ophiogomphus occidentis	Sinuous Snaketail	Blue		
Pachydiplax longipennis	Blue Dasher	Blue		
Papilio indra	Indra Swallowtail	Red		
Parnassius clodius claudianus	Clodius Parnassian, *claudianus* subspecies	Blue		
Parnassius clodius pseudogallatinus	Clodius Parnassian, *pseudogallatinus* supspecies	Blue		
Parnassius smintheus olympiannus	Rocky Mountain Parnassian, *olympiannus* subspecies	Blue		
Speyeria zerene bremnerii	Zerene Fritillary, *bremnerii* subspecies	Red		
Sympetrum vicinum	Autumn Meadowhawk	Blue		
Tanypteryx hageni	Black Petaltail	Blue		
Tramea lacerata	Black Saddlebags	Red		
Amphibians				
Anaxyrus boreas	Western Toad	Yellow	SC (Nov-12)	SC (Jun-18)
Aneides vagrans	Wandering Salamander	Blue	SC (May-14)	SC (Feb-18)
Ascaphus truei	Coastal Tailed Frog	Yellow	SC (Nov-11)	SC (Jun-03)
Dicamptodon tenebrosus	Coastal Giant Salamander	Blue	T (May-14)	T (Jun-03)
Lithobates pipiens	Northern Leopard Frog	Red	E (Dec-21)	E (Jun-03)
Rana aurora	Northern Red-legged Frog	Blue	SC (May-15)	SC (Jan-05)
Rana pretiosa	Oregon Spotted Frog	Red	E (May-11)	E (Jun-03)
Mammals				
Aplodontia rufa	Mountain Beaver	Yellow	SC (May-12)	SC (Jun-03)
Cervus elaphus roosevelti	Roosevelt Elk	Blue		
Corynorhinus townsendii	Townsend's Big-eared Bat	Blue		
Eptesicus fuscus	Big Brown Bat	Yellow		
Eschrichtius robustus	Grey Whale	Blue	SC / E / Not at Risk (May-04)	SC (Jul-05)
Eumetopias jubatus	Steller Sea Lion	Blue	SC (Nov-13)	SC (Jul-05)
Gulo gulo	Wolverine		SC (May-14)	SC (Jun-18)
Gulo gulo luscus	Wolverine, *luscus* subspecies	Blue	SC (May-14)	SC (Jun-18)
Gulo gulo vancouverensis	Wolverine, *vancouverensis* subspecies	Red	SC (May-14)	SC (Jun-18)
Lasionycteris noctivagans	Silver-haired Bat	Yellow		
Lasiurus cinereus	Hoary Bat	Yellow		
Lepus americanus washingtonii	Snowshoe Hare, *washingtonii* subspecies	Red		
Mirounga angustirostris	Northern Elephant Seal	Red	Not at Risk (May-86)	

Table 1
SAR Animals
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC list	COSEWIC	SARA
Mustela frenata altifrontalis	Long-tailed weasel, *altifrontalis* subspecies	Red		
Mustela richardsonii anguinae	Ermine, *anguinae* subspecies	Blue		
Myodes gapperi occidentalis	Southern Red-backed Vole, *occidentalis* subspecies	Red		
Myotis californicus	Californian Myotis	Yellow		
Myotis evotis	Long-eared Myotis	Yellow		
Myotis lucifugus	Little Brown Myotis	Yellow	E (Nov-13)	E (Dec-14)
Myotis volans	Long-legged Myotis	Yellow		
Myotis yumanensis	Yuma Myotis	Yellow		
Oreamnos americanus	Mountain Goat	Blue		
Pekania pennanti	Fisher			
Scapanus townsendii	Townsend's Mole	Red	E (Nov-14)	E (Jan-05)
Sorex bendirii	Pacific Water Shrew	Red	E (Apr-16)	E (Jun-03)
Sorex navigator brooksi	Western Water Shrew, *brooksi* subspecies	Blue		
Sorex rohweri	Olympic Shrew	Red		
Sorex trowbridgii	Trowbridge's Shrew	Blue		
Ursus arctos	Grizzly Bear	Blue	SC (May-12)	SC (Jun-18)
Birds				
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Red	T (Apr-13)	T (Jun-03)
Aechmophorus occidentalis	Western Grebe	Red	SC (May-14)	SC (Nov-17)
Aeronautes saxatalis	White-throated Swift	Blue		
Ammodramus savannarum	Grasshopper Sparrow	Red		
Ammospiza nelsoni	Nelson's Sparrow	Red	Not at Risk (May-98)	
Ardea herodias fannini	Great Blue Heron, *fannini* subspecies	Blue	SC (Mar-08)	SC (Feb-10)
Asio flammeus	Short-eared Owl	Blue	T (May-21)	SC (Jul-12)
Athene cunicularia	Burrowing Owl	Red	E (Apr-17)	E (Jun-03)
Bartramia longicauda	Upland Sandpiper	Red		
Botaurus lentiginosus	American Bittern	Blue		
Brachyramphus marmoratus	Marbled Murrelet	Blue	T (May-12)	T (Jun-03)
Branta bernicla	Brant	Blue		
Branta canadensis occidentalis	Canada Goose, *occidentalis* subspecies	Red		
Buteo lagopus	Rough-legged Hawk	Blue	Not at Risk (May-95)	
Buteo swainsoni	Swainson's Hawk	Red		
Butorides virescens	Green Heron	Blue		
Calcarius pictus	Smith's Longspur	Blue		
Calidris canutus	Red Knot	Red	E / T (Nov-20)	T / E (Feb-10)
Cardellina canadensis	Canada Warbler	Blue	SC (Nov-20)	T (Feb-10)
Chondestes grammacus	Lark Sparrow	Blue		
Chordeiles minor	Common Nighthawk	Yellow	SC (May-18)	T (Feb-10)
Coccothraustes vespertinus	Evening Grosbeak	Yellow	SC (Nov-16)	SC (May-19)
Coccyzus americanus	Yellow-billed Cuckoo	Red		
Contopus cooperi	Olive-sided Flycatcher	Blue	SC (May-18)	T (Feb-10)
Cygnus columbianus	Tundra Swan	Blue		
Cypseloides niger	Black Swift	Blue	E (May-15)	E (May-19)

Table 1
SAR Animals
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC list	COSEWIC	SARA
Dolichonyx oryzivorus	Bobolink	Blue	T (Apr-10)	T (Nov-17)
Eremophila alpestris strigata	Horned Lark, *strigata* subspecies	Red	E (May-18)	E (Jul-05)
Euphagus carolinus	Rusty Blackbird	Blue	SC (Apr-17)	SC (Mar-09)
Falco mexicanus	Prairie Falcon	Red	Not at Risk (May-96)	
Falco peregrinus	Peregrine Falcon		SC (Apr-07)	SC (Jan-00)
Falco peregrinus anatum	Peregrine Falcon, *anatum* subspecies	Red	Not at Risk (Dec-17)	SC (Jun-12)
Falco peregrinus pealei	Peregrine Falcon, *pealei* subspecies	Blue	SC (Dec-17)	SC (Jun-03)
Falco rusticolus	Gyrfalcon	Blue	Not at Risk (May-87)	
Fratercula cirrhata	Tufted Puffin	Blue		
Fratercula corniculata	Horned Puffin	Red		
Fulmarus glacialis	Northern Fulmar	Red		
Glaucidium gnoma swarthi	Northern Pygmy-owl, *swarthi* subspecies	Blue		
Hirundo rustica	Barn Swallow	Blue	SC (May-21)	T (Nov-17)
Hydroprogne caspia	Caspian Tern	Blue	Not at Risk (May-99)	
Icteria virens	Yellow-breasted Chat	Red	E (Nov-11)	E (Jun-03)
Larus californicus	California Gull	Blue		
Limnodromus griseus	Short-billed Dowitcher	Blue		
Limosa haemastica	Hudsonian Godwit	Red	T (May-19)	
Megascops kennicottii	Western Screech-Owl	No Status	T (May-12)	T (Jan-00)
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	Blue	T (May-12)	T (Jan-05)
Melanerpes lewis	Lewis's Woodpecker	Blue	T (Apr-10)	T (Jul-12)
Melanitta americana	Black Scoter	Blue		
Melanitta perspicillata	Surf Scoter	Blue		
Nannopterum auritum	Double-crested Cormorant	Blue	Not at Risk (May-78)	
Numenius americanus	Long-billed Curlew	Blue	SC (May-11)	SC (Jan-05)
Nycticorax nycticorax	Black-crowned Night-heron	Red		
Oporornis agilis	Connecticut Warbler	Blue		
Oreoscoptes montanus	Sage Thrasher	Red	E (Dec-21)	E (Jun-03)
Patagioenas fasciata	Band-tailed Pigeon	Blue	SC (May-21)	SC (Feb-11)
Pelecanus erythrorhynchos	American White Pelican	Red	Not at Risk (May-87)	
Phalaropus lobatus	Red-necked Phalarope	Blue	SC (Nov-14)	SC (May-19)
Pinicola enucleator carlottae	Pine Grosbeak, *carlottae* subspecies	Blue		
Pluvialis dominica	American Golden-Plover	Blue		
Pooecetes gramineus affinis	Vesper Sparrow, *affinis* subspecies	Red	E (May-18)	E (Dec-07)
Progne subis	Purple Martin	Blue		
Ptychoramphus aleuticus	Cassin's Auklet	Red	SC (Nov-14)	SC (May-19)
Recurvirostra americana	American Avocet	Blue		

Table 1
SAR Animals
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC list	COSEWIC	SARA
Setophaga castanea	Bay-breasted Warbler	Red		
Setophaga virens	Black-throated Green Warbler	Blue		
Sterna forsteri	Forster's Tern	Red	Data Deficient (May-96)	
Strix occidentalis	Spotted Owl	Red	E (Mar-08)	E (Jun-03)
Synthliboramphus antiquus	Ancient Murrelet	Blue	SC (Nov-14)	SC (Aug-06)
Tringa incana	Wandering Tattler	Blue		
Tyto alba	Barn Owl	Red	T (Nov-10)	T (Jun-18)
Uria aalge	Common Murre	Red		
Uria lomvia	Thick-billed Murre	Red		
Urile penicillatus	Brandt's Cormorant	Red		
Fish				
Acipenser medirostris	Green Sturgeon	Blue	SC (Nov-13)	SC (Aug-06)
Acipenser transmontanus	White Sturgeon		E / T (Nov-12)	E (Jan-00)
Acipenser transmontanus pop. 4	White Sturgeon (Lower Fraser River Population)	Red	T (Nov-12)	
Catostomus sp. 4	Salish Sucker	Red	T (Nov-12)	T (Jan-05)
Cottus aleuticus pop. 1	Coastrange Sculpin, Cultus Population	Red	E (Nov-19)	T (Jun-03)
Gasterosteus aculeatus pop. 2	Little Quarry Lake Benthic Threespine Stickleback	Red	T (Nov-15)	
Gasterosteus aculeatus pop. 3	Little Quarry Limnetic Threespine Stickleback	Red	T (Nov-15)	
Gasterosteus sp. 16	Vananda Creek Limnetic Stickleback	Red	E (Apr-10)	E (Jun-03)
Gasterosteus sp. 17	Vananda Creek Benthic Stickleback	Red	E (Apr-10)	E (Jun-03)
Gasterosteus sp. 2	Enos Lake Limnetic Stickleback	Red	E (May-12)	E (Jan-05)
Gasterosteus sp. 3	Enos Lake Benthic Stickleback	Red	E (May-12)	E (Jan-05)
Gasterosteus sp. 4	Paxton Lake Limnetic Stickleback	Red	E (Apr-10)	E (Jun-03)
Gasterosteus sp. 5	Paxton Lake Benthic Stickleback	Red	E (Apr-10)	E (Jun-03)
Hybognathus hankinsoni - Pacific group	Brassy Minnow - Pacific Group	Blue		
Oncorhynchus clarkii clarkii	Cutthroat Trout, *clarkii* subspecies	Blue		
Rhinichthys cataractae - Chehalis lineage	Nooksack Dace	Red	E (Dec-18)	E (Jun-03)
Salvelinus confluentus	Bull Trout	Blue	SC (Nov-12)	
Salvelinus confluentus pop. 28	Bull Trout - South Coast Population	Blue	SC (Nov-12)	SC (Aug-19)
Spirinchus sp. 1	Pygmy Longfin Smelt	Red	Data Deficient (Nov-04)	
Thaleichthys pacificus	Eulachon	Blue	E / T (May-11)	
Reptiles				
Charina bottae	Northern Rubber Boa	Yellow	SC (Apr-16)	SC (Jan-05)
Chrysemys picta	Northern Painted Turtle		E / SC (Apr-06)	E / SC (Dec-07)
Chrysemys picta pop. 1	Northern Painted Turtle - Pacific Coast Population	Red	T (Sep-21)	E (Dec-07)
Contia tenuis	Common Sharp-Tailed Snake	Red	T (Dec-21)	E (Jun-03)
Dermochelys coriacea	Leatherback Sea Turtle	Red	E (May-12)	E (May-17)

Citation: B.C. Conservation Data Centre. 2022. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed May 19, 2022).

Search Criteria: Municipality: District of Sechelt; Biogeoclamatic unit: Coastal Western Hemlock Very Dry Martitime (CWHxm)

Note: Marine mammals (e.g., whales) were excluded from this list due to the Sites being terrestrial based with no offshore marine component.

[1] See Appendix 2 for definitions and status descriptions.

Species not likely to occur based on available habitat.

Table 2
SAR Plants
Flume Creek at Margaret Road and Beach Avenue, Sunshine Coast, BC, Ministry of Transportation and Infrastructure, PGL File: 346-65.01

Scientific Name	English Name	BC List	COSEWIC	SARA
Nonvascular Plants				
Bartramia aprica	rigid apple moss	Red	E (Nov-09)	E
Callophrys mossii mossii	Moss' Elfin, *mossii* subspecies	Red		
Entosthodon fascicularis	banded cord-moss	Blue	SC (May-15)	SC
Fabronia pusilla	silver hair moss	Red	E (May-12)	E
Fissidens pauperculus	poor pocket moss	Red	E (May-11)	E
Pinus contorta / Sphagnum spp. *Very Dry Maritime*	lodgepole pine / peat-mosses Very Dry Maritime	Blue		
Rhododendron groenlandicum / Kalmia microphylla / Sphagnum spp.	Labrador-tea / western bog-laurel / peat-mosses	Blue		
Seligeria acutifolia	acuteleaf small limestone moss	Red	E (May-18)	E
Syntrichia laevipila	twisted oak moss	Blue	SC (Nov-14)	SC
Tsuga heterophylla / Buckiella undulata	western hemlock / flat-moss	Blue		
Tsuga heterophylla - Pseudotsuga menziesii / Eurhynchium oreganum	western hemlock - Douglas-fir / Oregon beaked-moss	Red		
Dicots				
Abronia latifolia	yellow sand-verbena	Blue		
Callitriche heterophylla var. *heterophylla*	two-edged water-starwort	Unknown		
Calystegia soldanella	beach bindweed	Blue		
Camissonia contorta	contorted-pod evening-primrose	Red	E (Apr-06)	E (Dec-07)
Castilleja levisecta	golden paintbrush	Red	E (Nov-07)	E (Jun-03)
Castilleja victoriae	Victoria's owl-clover	Red	E (Apr-10)	E (Jul-12)
Claytonia washingtoniana	Washington springbeauty	Red		
Corispermum hookeri var. *pseudodeclinatum*	British Columbia bugseed	Unknown		
Crassula connata	Erect Pigmyweed	Blue		
Hosackia gracilis	seaside bird's foot lotus	Red	E (Nov-10)	E (Jun-03)
Lathyrus littoralis	silky beach pea	Red	T (Apr-13)	
Limnanthes macounii	Macoun's meadow-foam	Red	T (Nov-04)	T (Aug-06)
Lomatium dissectum	fern-leaved desert-parsley	Red		
Lupinus microcarpus var. *microcarpus*	dense-flowered lupine	Red	E (May-05)	E (Aug-06)
Meconella oregana	white meconella	Red	E (May-05)	E (Feb-11)
Microseris bigelovii	coast microseris	Red	E (Apr-06)	E (Aug-06)
Nuttallanthus texanus	Texas toadflax	Blue		(Dec-07)
Orthocarpus bracteosus	rosy owl-clover	Red	E (May-04)	E
Plagiobothrys figuratus ssp. *figuratus*	fragrant popcornflower	Red	E (Mar-08)	E (Jul-05)
Polygonum paronychia	black knotweed	Blue		(Feb-10)
Psilocarphus elatior	tall woolly-heads	Red	E (May-18)	E
Pyrola aphylla	leafless wintergreen	Blue		(Jun-03)
Ranunculus alismifolius var. *alismifolius*	water-plantain buttercup	Red	E (Apr-09)	E
Ranunculus californicus	California buttercup	Red	E (Nov-08)	E (Jun-03)
Sabulina pusilla	dwarf sandwort	Red	E (May-04)	E (Feb-11)
Sanicula arctopoides	bear's-foot sanicle	Red	T (Nov-15)	T (Jul-05)
Sanicula bipinnatifida	purple sanicle	Red	T (May-01)	T (Jun-03)
Sericocarpus rigidus	white-top aster	Blue	SC (Apr-09)	SC (Jun-03)
Silene scouleri ssp. *scouleri*	coastal Scouler's catchfly	Red	E (May-03)	E (Jun-03)
Trifolium depauperatum var. *depauperatum*	poverty clover	Blue		(Jan-05)
Trifolium dichotomum	Macrae's clover	Red		
Triphysaria versicolor ssp. *versicolor*	bearded owl-clover	Red	E (Nov-11)	E
Utricularia ochroleuca	ochroleucous bladderwort	Blue		(Jun-03)
Monocots				
Allium amplectens	slimleaf onion	Blue		
Carex tumulicola	foothill sedge	Yellow	E (Mar-08)	E
Festuca rubra ssp. *mediana*	dwarf red fescue	Yellow		(Feb-10)
Sisyrinchium idahoense var. *segetum*	Idaho blue-eyed-grass	Red		
Ferns				
Dryopteris arguta	coastal wood fern	Blue	SC (May-21)	SC
Polystichum californicum	California Sword-fern	Red		(Jun-03)
Woodwardia fimbriata	giant chain fern	Blue		

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Search Criteria: Municipality: District of Sechelt; Biogeoclamatic unit: Coastal Western Hemlock Very Dry Maritime (CWHxm)

[1] See Appendix 2 for definitions and status descriptions.

Species not likely to occur based on available habitat.

Table 3
Ecological Community
Flume Creek at Margaret Road and Beach Avenue
Sunshine Coast, BC, Ministry of Transportation and Infrastructure,
PGL File: 346-65.01

Scientific Name	English Name	BC List
Ecological Community		
Arbutus menziesii / Arctostaphylos columbiana	arbutus / hairy manzanita	Red
Carex lasiocarpa - Rhynchospora alba	slender sedge - white beak-rush	Red
Carex lyngbyei Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	Red
Carex macrocephala Herbaceous Vegetation	large-headed sedge Herbaceous Vegetation	Red
Carex sitchensis - Oenanthe sarmentosa	Sitka sedge - Pacific water-parsley	Blue
Deschampsia cespitosa - Sidalcea hendersonii	tufted hairgrass - Henderson's checker-mallow	Red
Deschampsia cespitosa ssp. *beringensis - Hordeum brachyantherum*	tufted hairgrass - meadow barley	Red
Distichlis spicata - Sarcocornia pacifica	seashore saltgrass - Pacific swampfire	Red
Eleocharis palustris Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	Blue
Festuca roemeri - Koeleria macrantha	Roemer's fescue - junegrass	Red
Juncus arcticus - Plantago macrocarpa	arctic rush - Alaska plantain	Red
Leymus mollis ssp. *mollis - Lathyrus japonicus*	dune wildrye - beach pea	Red
Myrica gale / Carex sitchensis	sweet gale / Sitka sedge	Red
Picea sitchensis / Rubus spectabilis Dry	Sitka spruce / salmonberry Dry	Red
Picea sitchensis / Rubus spectabilis Very Dry Maritime	Sitka spruce / salmonberry Very Dry Maritime	Red
Pinus contorta / Sphagnum spp. *Very Dry Maritime*	lodgepole pine / peat-mosses Very Dry Maritime	Blue
Populus tremuloides / Malus fusca / Carex obnupta	trembling aspen / Pacific crab apple / slough sedge	Red
Populus trichocarpa - Alnus rubra / Rubus spectabilis	black cottonwood - red alder / salmonberry	Blue
Populus trichocarpa / Salix sitchensis	black cottonwood / Sitka willow	Blue
Pseudotsuga menziesii / Polystichum munitum	Douglas-fir / sword fern	Red
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	Red
Rhododendron groenlandicum / Kalmia microphylla / Sphagnum spp.	Labrador-tea / western bog-laurel / peat-mosses	Blue
Ruppia maritima Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red
Salix sitchensis - Salix lasiandra var. *lasiandra / Lysichiton americanus*	Sitka willow - Pacific willow / skunk cabbage	Red
Sarcocornia pacifica - Lysimachia maritima	American glasswort - sea-milkwort	Red
Schoenoplectus acutus Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue
Selaginella wallacei / Cladina spp.	Wallace's selaginella / reindeer lichens	Blue
Sidalcea hendersonii Tidal Marsh	Henderson's checker-mallow Tidal Marsh	Red
Thuja plicata / Carex obnupta	western redcedar / slough sedge	Red
Thuja plicata / Lonicera involucrata	western redcedar / black twinberry	Red
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	Blue
Thuja plicata / Polystichum munitum - Lysichiton americanus	western redcedar / sword fern - skunk cabbage	Blue
Thuja plicata / Polystichum munitum Dry Maritime	western redcedar / sword fern Dry Maritime	Red
Thuja plicata / Polystichum munitum Very Dry Maritime	western redcedar / sword fern Very Dry Maritime	Red
Thuja plicata / Rubus spectabilis	western redcedar / salmonberry	Red
Thuja plicata / Tiarella trifoliata Dry Maritime	western redcedar / three-leaved foamflower Dry Maritime	Blue
Thuja plicata / Tiarella trifoliata Very Dry Maritime	western redcedar / three-leaved foamflower Very Dry Maritime	Blue
Tsuga heterophylla / Buckiella undulata	western hemlock / flat-moss	Blue
Tsuga heterophylla - Pseudotsuga menziesii / Eurhynchium oreganum	western hemlock - Douglas-fir / Oregon beaked-moss	Red
Tsuga heterophylla - Thuja plicata / Struthiopteris spicant	western hemlock - western redcedar / deer fern	Red
Typha latifolia Marsh	common cattail Marsh	Blue

Appendix 1

Site Photographs

PGL
ENVIRONMENTAL CONSULTANTS

Photograph 1:

Flume Creek – View facing upstream from Margaret Road (May 26, 2022)

Photograph 2:

Flume Creek at Margaret Road – Temporary culvert from upstream side, facing downstream (May 26, 2022)

Photograph 3:

Flume Creek – View facing downstream from Margaret Road (May 26, 2022)

Photograph 4:

Flume Creek at Margaret Road – Temporary culvert from downstream side, facing upstream (May 26, 2022)

Photograph 5:

Flume Creek – View facing upstream from Beach Avenue (May 25, 2022)

Photograph 6:

Flume Creek at Beach Avenue – Temporary culvert from upstream side, facing downstream (May 25, 2022)

Photograph 7:

Flume Creek – View facing downstream from Beach Avenue (May 25, 2022)

Photograph 8:

Flume Creek at Beach Avenue – Temporary culvert from downstream side, facing upstream (May 25, 2022)

Appendix 2

Status Definitions for Provincial and Federal SAR

PGL ENVIRONMENTAL CONSULTANTS

Appendix 2
Status Definitions For Provincial and Federal Species at Risk

Status Definitions as per provincial Conservation Data Centre (CDC)

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

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

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

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

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

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

SCHEDULE 1: Official list of federally protected species.

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

Appendix 3

Detailed Design Drawings

PGL
ENVIRONMENTAL CONSULTANTS

BRITISH COLUMBIA

Ministry of Transportation and Infrastructure

PROJECT NO. 14005

FLUME CREEK
DFAA FLOOD DAMAGE

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

Refer to Tender Drawing Package Approval Form	Refer to Tender Drawing Package Approval Form
DIRECTOR, ENGINEERING	REGIONAL DIRECTOR
DATE	DATE

DRAWING NUMBER: R1-1027-000
REV:

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\000_CoverKeyPlanLegend\R1-1027-000.dwg

LOCATION MAP
N.T.S

BRITISH COLUMBIA
Ministry of Transportation and Infrastructure

PROJECT NO. 14005

FLUME CREEK
DFAA FLOOD DAMAGE

MARGARET RD: STA. 101+36.000 - STA. 102+25.000 (0.89 km)

BEACH AVE: STA. 201+11.539 - STA. 201+70.693 (0.59 km)

N: 475613.652, E: 451469.172

GRADING AND DRAINAGE CONTRACT

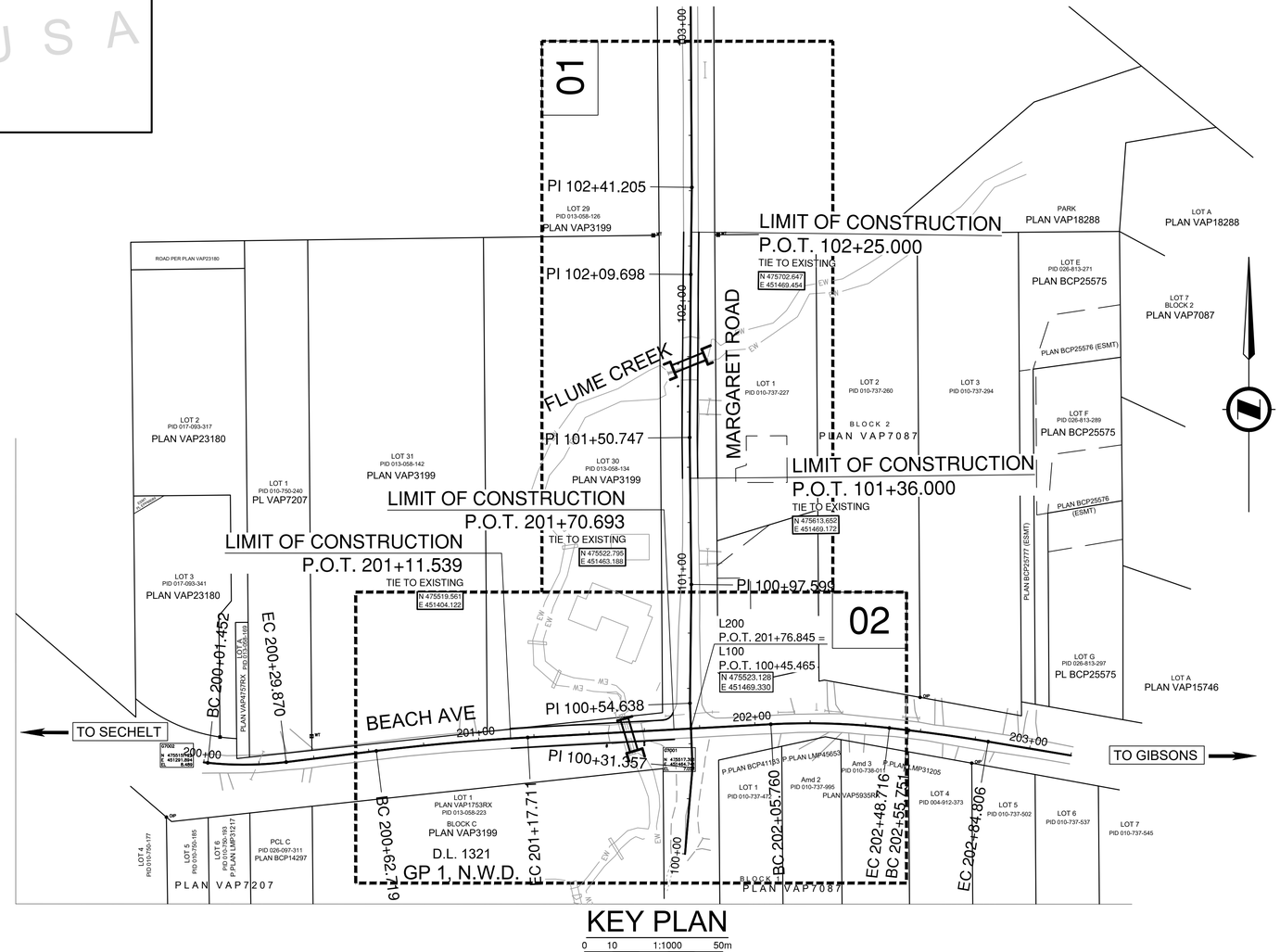
DRAWING INDEX

Date: April 29, 2022 | **Origin:** GCM314369 confirmed with NRCAN CACS | URBAN SYSTEMS
Project: Margaret Rd - Hwy 101 Emergency Culvert Replacement | **Tack Point:** GCM314369 (08H2546) | **ACSF:** 0.9996343
Horizontal Datum: UTM Z10 NAD 83 CSRS | **Vertical Datum:** CGVD28 HT2.0

Point ID	Local Northing (m)	Local Easting (m)	Ortho. Ht (m)	UTM Northing (m)	UTM Easting (m)	C.S.F.	Class	Type
08H2546	476642.668	448326.049	7.852	5476642.668	448326.049	0.9996343	Origin	GCM
G7001	475517.392	451464.741	7.021	5475517.803	451463.593	0.9996306	Primary	Rebar
G7002	475515.122	451291.894	8.489	5475515.534	451290.809	0.9996306	Primary	Rebar
G7006	475480.436	451757.517	11.428	5475480.861	451756.262	0.9996296	Primary	Rebar

All local coordinates are derived by first scaling from the Tack Point and then removing the millionth digit from the Northing

Notes:



KEY PLAN

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

URBAN SYSTEMS

DRAWING NUMBER: R1-1027-001 | REV:

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\000_CoverKeyPlanLegend\R1-1027-000.dwg

LEGEND

SYMBOLS (EXISTING)

AERIAL UTILITIES

- POWER POLE
- POWER POLE WITH TRANSFORMER
- POWER / TELEPHONE POLE WITH TRANSFORMER
- POWER GUY POLE
- POWER / TELEPHONE POLE
- POWER / TELEPHONE GUY POLE
- ANCHOR OR GUY WIRE
- DEADMAN
- TELEPHONE POLE
- TELEPHONE GUY POLE
- HIGH TENSION POLE
- HIGH TENSION TOWER (HT)
- UTILITY POLE (UP)

SURVEY

- CONTROL POINT
- CONTROL MONUMENT
- LEGAL MONUMENT (MON)
- STANDARD IRON PIN FOUND (OIP)
- CAPPED IRON PIN (CIP, OIP)
- LEAD PLUG
- BENCHMARK
- SPOT ELEVATION

GEOTECHNICAL

- TESTPIT
- TESTHOLE (TH)
- OBSERVATION WELL (OW)

DETAIL

- GATE POST (GP)
- MAILBOX (MB)
- OLD POST (Post)
- DELINEATOR POST (DP)
- FLAGPOLE (FP)
- DECORATIVE TREE
- TREE
- PILING (Piling)
- CONCRETE PILLAR
- WELL
- SWAMP
- DIRECTIONAL ARROW

DRAINAGE & UTILITIES

- STORM MANHOLE (MH Storm)
- STANDARD CATCH BASIN
- ROUND CATCH BASIN
- DRYWELL (MH/CB Drywell)
- CB MANHOLE
- CULVERT INLET (CI)

DRAINAGE & UTILITIES

- CULVERT OUTLET (CO)
- SANITARY MANHOLE (MH San)
- UTILITY MANHOLE (MH Vault)
- WATER MANHOLE (MH Water)
- MANHOLE UNKNOWN (MH Unk)

ELECTRICAL

- JUNCTION BOX (JB)
- UTILITY VAULT (JB)
- LAMP STANDARD (LS)
- UTILITY KIOSK
- UTILITY PEDESTAL (PED)
- TRAFFIC COUNTER
- TRAFFIC SIGNAL
- TRAFFIC SIGNAL CONTROLLER

METERS

- VALVE (V)
- WATER VALVE (WV)
- WATER METER (WM)
- FIRE HYDRANT (FH)
- WELL
- STANDPIPE / WATER BLOW OFF (SD)
- AIR VALVE (AIR)
- GAS VALVE (GV)
- SERVICE METER (SV)

UNDERGROUND

- VENT/BREATHER PIPE (BP)
- FILLER CAP (FC)
- FUEL / GAS PUMP (FP)
- FUEL TANK (FT)
- SEPTIC TANK (ST)
- UNDERGROUND MARKER (MISC) (UM)
- IRRIGATION JUNCTION BOX (IJ)
- IRRIGATION SPRINKLER HEAD (IS)

ROAD SIGNS

- STANDARD SIGN
- COMMERCIAL SIGN
- SIGN BRIDGE STRUCTURE
- CANTILEVER STRUCTURE
- TWO POST SIGN
- TWO POST SIGN (BREAKAWAY)
- STANDARD DAVIT POLE - TYPE 3
- STANDARD COMBINATION POLE - TYPE 1
- HEAVY DUTY DAVIT POLE - TYPE 6
- HEAVY DUTY COMBINATION POLE - TYPE 7
- HEAVY POLE - TYPE H
- HEAVY COMBINATION POLE - TYPE H

LINE TYPES (EXISTING)

LOT BOUNDARIES

- SECTION LINE / DISTRICT LOT
- 1/4 SECTION BOUNDARY
- LOT BOUNDARY
- EASEMENTS

LINE TYPES (EXISTING)

MAN-MADE FEATURES

- RAILWAY TRACKS
- RAILWAY BALLAST
- ROAD MARKING - YELLOW
- ROAD MARKING - WHITE
- ROAD MARKING - BROKEN
- CROSSWALK
- STOP LINE
- EDGE OF ROAD - PAVED
- EDGE OF ROAD GRAVEL
- GRAVEL SHOULDER
- DIRT ROAD
- GRAVEL ROAD
- EDGE OF GRAVEL
- SIDEWALK
- CONCRETE PAD
- FENCE
- TOP OF CURB
- CL OF GUTTER
- CONCRETE ROAD BARRIER
- TOP OF FILL
- RIP RAP
- BUILDING
- TREE LINE
- LAWN LINE

HYDRAULIC

- CULVERT
- DITCH CENTER
- DITCH EDGE
- CENTER OF CREEK
- HIGH WATER (HWM)
- EDGE OF WATER (EW)
- HIGH WATER MARK (EXTREME)
- SEEPAGE LINE

TOPOGRAPHY

- BASE OF SLOPE
- MARSH
- TOP OF ROCK
- SLIDE
- TALUS
- TRAIL
- TOP OF SLOPE

UTILITIES

- OVERHEAD UTILITY
- PIPELINE (GAS) (G)
- UG ELECTRIC (UE)
- UG COMMUNICATION (UT)
- STORM SEWER (S)
- SANITARY SEWER (SAN)
- WATER MAIN (W)
- MISCELLANEOUS UNDERGROUND (UG)

SYMBOLS (PROPOSED)

AERIAL UTILITIES

- POWER POLE
- POWER POLE WITH TRANSFORMER
- POWER / TELEPHONE POLE WITH TRANSFORMER
- POWER GUY POLE
- POWER / TELEPHONE POLE
- POWER / TELEPHONE GUY POLE
- ANCHOR OR GUY WIRE
- DEADMAN
- TELEPHONE POLE
- TELEPHONE GUY POLE
- HIGH TENSION POLE
- HIGH TENSION TOWER (HT)

DETAIL

- GATE POST (GP)
- MAILBOX (MB)
- POST (Post)
- POST MOUNTED DELINEATOR (DP)
- FLAGPOLE (FP)
- DIRECTIONAL ARROW

DRAINAGE & UTILITIES

- MANHOLE
- STORM MANHOLE (MH Storm)
- STANDARD CATCH BASIN
- VARIABLE DEPTH CATCH BASIN
- SPILLWAY
- HEADWALL
- DRYWELL (MH/CB Drywell)
- TELEPHONE MANHOLE (MH Tel)
- POWER MANHOLE (MH Power)
- SANITARY MANHOLE (MH San)
- UTILITY MANHOLE (MH Vault)
- WATER MANHOLE (MH Water)
- MANHOLE UNKNOWN (MH Unk)

ELECTRICAL

- JUNCTION BOX (JB)
- UTILITY VAULT (JB)
- LAMP STANDARD
- UTILITY KIOSK
- UTILITY PEDESTAL (PED)
- TRAFFIC SIGNAL
- TRAFFIC SIGNAL CONTROLLER
- UNDERGROUND ELECTRICAL TRANSFORMER (XF)

METERS

- VALVE (V)
- WATER VALVE (WV)
- WATER METER (WM)
- FIRE HYDRANT (FH)
- STANDPIPE / WATER BLOW OFF (SD)
- AIR VALVE (AIR)
- GAS VALVE (GV)
- SERVICE METER (SV)

UNDERGROUND

- VENT/BREATHER PIPE (BP)
- FILLER CAP (FC)
- FUEL / GAS PUMP (FP)
- FUEL TANK (FT)
- SEPTIC TANK (ST)
- UNDERGROUND MARKER (MISC) (UM)

ROAD SIGNS

- STANDARD SIGN
- BARRIER MOUNTED DELINEATOR
- RELOCATED OVERHEAD SIGN
- TWO POST SIGN
- TWO POST SIGN (BREAKAWAY)
- STANDARD DAVIT POLE - TYPE 3
- STANDARD COMBINATION POLE - TYPE 1
- HEAVY DUTY DAVIT POLE - TYPE 6
- HEAVY DUTY COMBINATION POLE - TYPE 7
- HEAVY POLE - TYPE H
- HEAVY COMBINATION POLE - TYPE H
- CANTILEVER STRUCTURE
- SIGN BRIDGE STRUCTURE

PATTERNS

- LEVELLING COURSE
- PAVEMENT MILLING
- PAVEMENT REMOVAL
- RIPRAP
- TURF REINFORCEMENT MATTING

REMOVALS / RELOCATES

- POWER POLE
- TELEPHONE POLE
- HIGHWAY SIGNS

LINE TYPES (PROPOSED)

FEATURES

- HIGHWAY CONTROL LINE (100+00)
- MINOR CONTROL LINE (100+00)
- CLEARING AND GRUBBING (CL. & GR.)
- PAVEMENT EDGE
- SHOULDER EDGE
- CURB AND GUTTER
- RAISED ISLAND
- SAWCUT
- RUMBLE STRIP
- RETAINING WALL
- FENCE
- TOP OF CUT / BOTTOM OF FILL (TOES) (C/F)
- 100mm - YELLOW PAINT LINE (SOLID)
- 100mm - WHITE PAINT LINE (SOLID)
- 100mm - CONTINUITY PAINT LINE (BROKEN) (3 3 3)
- 100mm - LANE PAINT LINE (BROKEN) (8 5 8)
- CONCRETE BARRIER
- DITCH CENTER / ADDITIONAL DITCHING
- DITCH EDGE

BOUNDARIES

- RIGHT OF WAY
- TEMPORARY LICENCE TO CONSTRUCT (T.L.T.C.)

UTILITIES

- OVERHEAD UTILITY
- PIPELINE (GAS) (G)
- SERVICE LINE (GAS)
- UG ELECTRIC (UE)
- UG COMMUNICATION (UT)
- STORM SEWER (S)
- SUB DRAIN (SD)
- CULVERT
- SANITARY SEWER (SAN)
- WATER MAIN (W)
- MISCELLANEOUS UNDERGROUND (UG)

NOTE:
NOT ALL SYMBOLS AND LINE TYPES ILLUSTRATED IN THIS LEGEND ARE UTILIZED IN THE FOLLOWING DESIGN

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

SCALE

CAD FILENAME R1-1027-000
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

URBAN SYSTEMS

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED S.CAVASINNI DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN S.CAVASINNI DATE 2022-12-02

LEGEND

FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-002	

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\000_CoverKeyPlanLegend\R1-1027-000.dwg

LOT 29
PID 013-058-126
PLAN VAP3199

LOT 30
PID 013-058-134
PLAN VAP3199

LIMIT OF CONSTRUCTION
P.O.T. 101+36.000
TIE TO EXISTING
N 475613.682
E 451469.133

LIMIT OF CONSTRUCTION
P.O.T. 102+25.000
TIE TO EXISTING
N 475702.248
E 451469.454

PI 100+97.599

PI 101+50.747

PI 102+09.698

PI 102+41.205

MARGARET ROAD

MATCHLINE SEE DWG No. R1-1027-102

N 475613.570
E 451458.450

CL&GR

N 475640.012
E 451458.257

REMOVE EX. CULVERTS

LOCATION OF WATERMAIN PHYSICAL LOCATE VIA HYDROVAC (TYP.)

CONCRETE HEADWALL (TBD)

N 475639.976
E 451456.798

T.L.T.C.

CL&GR

N 475655.074
E 451450.006

N 475657.831
E 451458.127

12.5m W2700xH1500 CONC
STA. 101+76.529
E. INV. 8.697
W. INV. 8.957

12.5m W2100xH1200 CONC
STA. 101+79.615
E. INV. 8.997
W. INV. 9.407

N 475702.714
E 451457.799

101+00

359°20'46"

102+00

0°23'57"

0°41'29"

359°37'43"

L100

2.75

0.5

800ø CSP 15.111m

800ø CSP 15.285m

800ø CSP 15.040m

6.049m 600ø CSP

9.98m 600ø CSP

5.757m 600ø CSP

EDGE OF GRAVEL

PAVEMENT EDGE

N 475613.724
E 451478.567

REGRADE EX. DRIVEWAY

N 475652.697
E 451478.282

CONCRETE HEADWALL SEE DWG. R1-1027-701 FOR DETAILS (TYP.)

450mm THICK CLASS 25kg RIP RAP SEE DWG. R1-1027-701 FOR DETAILS (TYP.)

N 475665.593
E 451478.188

N 475667.820
E 451486.762

N 475658.804
E 451489.793

N 475702.599
E 451477.921

PL EPP121268 (ESMT)

PLAN
EPP121267 (COV)

LOT B
PID 031-806-651
PLAN EPP121266

LOT A
PID 031-806-643
PLAN EPP121266

LOT 2
PID 010-737-260

LOT B
PID 007-194-927
PLAN VAP18288

D.L. 1318
GP 1, N.W.D.

ISSUED FOR
50% DESIGN
2022-12-02
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CL & GR TOTAL
THIS DWG 0.148 ha.

FOR PROFILES SEE DWG
R1-1027-201

FOR DRAINAGE AND UTILITIES
SEE DWG R1-1027-701 to R1-1027-702

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
-TACK POINT: GCM 08H2546
-ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
-ROTATION: NOT APPLIED
-TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREON IS APPROXIMATE ONLY AND PREDOMINANTLY BASED ON AS-BUILT INFORMATION. THE CONTRACTOR WILL CONFIRM THE FIELD LOCATIONS OF THESE UTILITIES WITH THE UTILITY STAKEHOLDERS.

101
102

URBAN SYSTEMS

SCALE 0 2 1:250 12m

CAD FILENAME R1-1027-100
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED S.CAVASINNI DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN S.CAVASINNI DATE 2022-12-02

PLAN

FLUME CREEK
DFAA FLOOD DAMAGE
STA. 100+05.000 TO 103+00.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-101	

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\100_Plans\R1-1027-100.dwg

MATCHLINE SEE DWG No. R1-1027-101
LOT 31
PID 013-058-142
PLAN VAP3199
LOT 30
PID 013-058-134
PLAN VAP3199
PLAN
EPP121267
(COV)
LOT B
PID 031-806-651
PLAN EPP121266
LOT 2
PID 010-737-260
LIMIT OF CONSTRUCTION
P.O.T. 201+11.539
TIE TO EXISTING
LIMIT OF CONSTRUCTION
P.O.T. 201+70.693
TIE TO EXISTING
MARGARET ROAD
N 475543.138
E 451435.555
N 475537.007
E 451433.557
T.L.T.C.
CL&GR
N 475537.973
E 451446.413
N 475533.041
E 451447.763
N 475530.066
E 451450.935
N 475531.046
E 451462.739
L200 STA. 201+76.844 =
L100 STA. 100+45.465
ROAD PER PLAN EPP121266
PI 100+54.638
PI 202+27.291
30KM/H
CAUTION PEDESTRIANS
PS-001-Tb/PS-004
REMOVE AND
DISPOSE EX. 3 - 15m
800Ø & 1 - 15m 1000Ø
CSP CULVERTS
BEACH AVE
N 475529.053
E 451438.732
PI 200+90.225
CL&GR
WIRE HEIGHT
=5.75m
WIRE HEIGHT
=5.87m
202+00
L200
150Ø PVC WM
96°44'03"
N 475526.146
E 451403.713
201+00
3.6
0.5
86°53'22"
357°44'39"
G7001
P.PLAN LMP45653
82°57'03"
PAVEMENT EDGE
EDGE OF GRAVEL
N 475509.614
E 451425.076
N 475509.610
E 451404.740
LOCATION OF U/G UTILITY PHYSICAL
LOCATE VIA HYDROVAC (TYP.)
N 475513.415
E 451463.697
N 475512.944
E 451456.548
P.PLAN BCP43133
PI 100+31.357
R 250.000 Rt
Δ 9°50'41"
Tc 21.531
Arc 42.956
Ec 0.925
R 800.000 Rt
Δ 3°56'19"
Tc 27.507
Arc 54.992
Ec 0.473
13.0m W2100xH1200 CONC
STA. 201+52.667
N. INV. 5.155
S. INV. 4.693
N 475508.632
E 451458.872
N 475511.642
E 451442.499
N 475503.857
E 451449.756
EC 201+17.711
BC 200+62.719
BC 202+05.7
LOT 1
PID 010-737-472
Amd 2
PID 010-737-995
Amd 3
PID 010-738-011
EC 202+48.716
PLAN VAP5935RX
13.0m W2700xH1500 CONC
STA. 201+55.602
N. INV. 4.705
S. INV. 4.393
CONCRETE HEADWALL
SEE DWG. R1-1027-702
FOR DETAILS (TYP.)
450mm THICK CLASS 25kg RIP RAP
SEE DWG. R1-1027-702 FOR DETAILS (TYP.)
LOT 1
PLAN VAP1753RX
PID 013-058-223
BLOCK C
PLAN VAP3199
D.L. 1321
GP 1, N.W.D.
100+00
BLOCK 1
PLAN VAP7087
D.L. 1318

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

CL & GR TOTAL
THIS DWG 0.0877 ha.

FOR PROFILES SEE DWG
R1-1027-201

FOR DRAINAGE AND UTILITIES
SEE DWG R1-1027-701 to R1-1027-702

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
- TACK POINT: GCM 08H2546
- ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
- ROTATION: NOT APPLIED
- TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREON IS APPROXIMATE ONLY AND PREDOMINANTLY BASED ON AS-BUILT INFORMATION. THE CONTRACTOR WILL CONFIRM THE FIELD LOCATIONS OF THESE UTILITIES WITH THE UTILITY STAKEHOLDERS.

101
102

URBAN
SYSTEMS

SCALE 0 2 1:250 12m

CAD FILENAME R1-1027-100
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

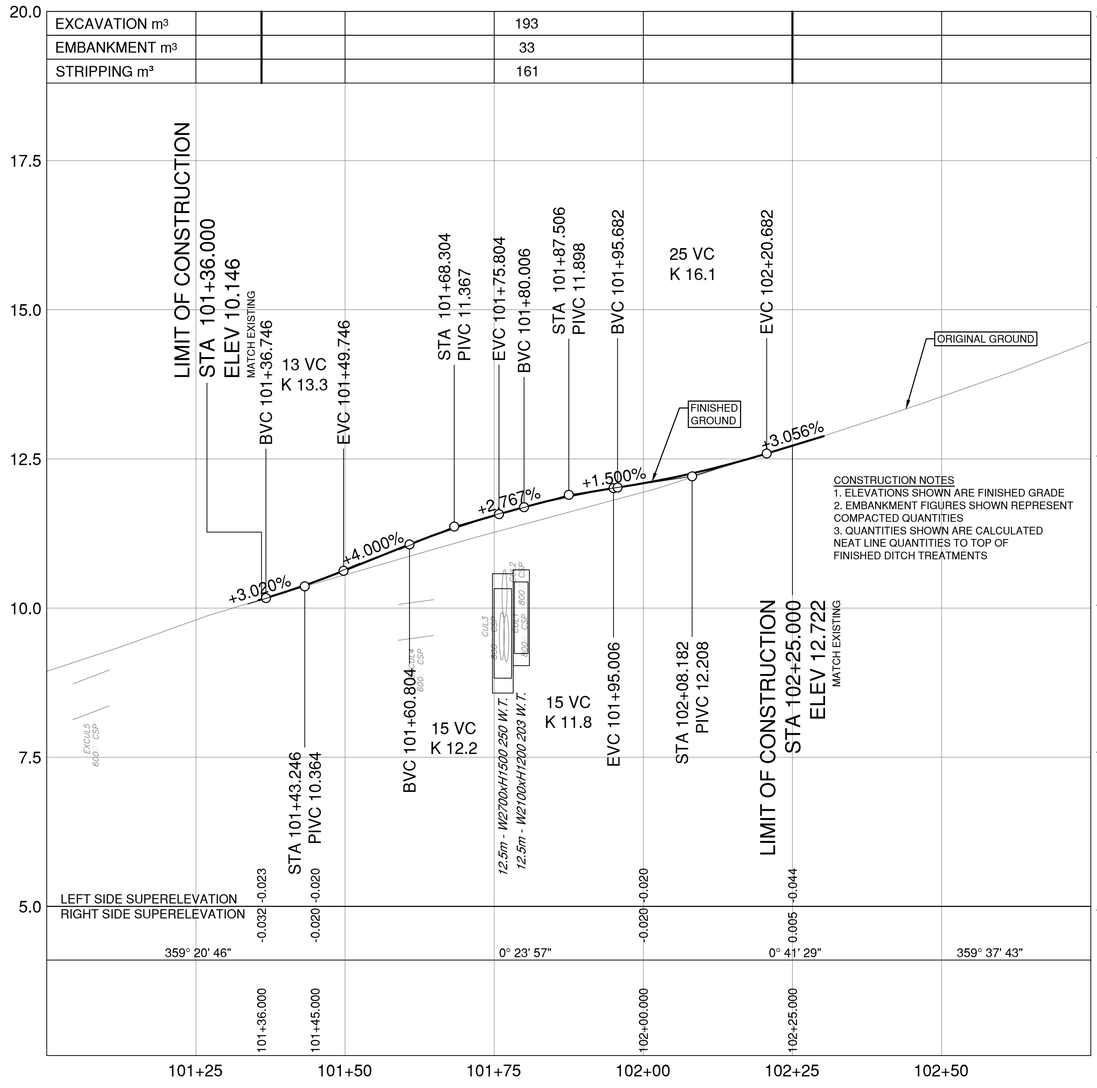
DESIGNED	S.CAVASINNI	DATE	2022-12-02
QUALITY CONTROL	S.ROOSMA	DATE	2022-12-02
QUALITY ASSURANCE	C.BAGG	DATE	2022-12-02
DRAWN	S.CAVASINNI	DATE	2022-12-02

PLAN
FLUME CREEK
DFAA FLOOD DAMAGE
STA. 200+60.000 TO 202+50.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-102	

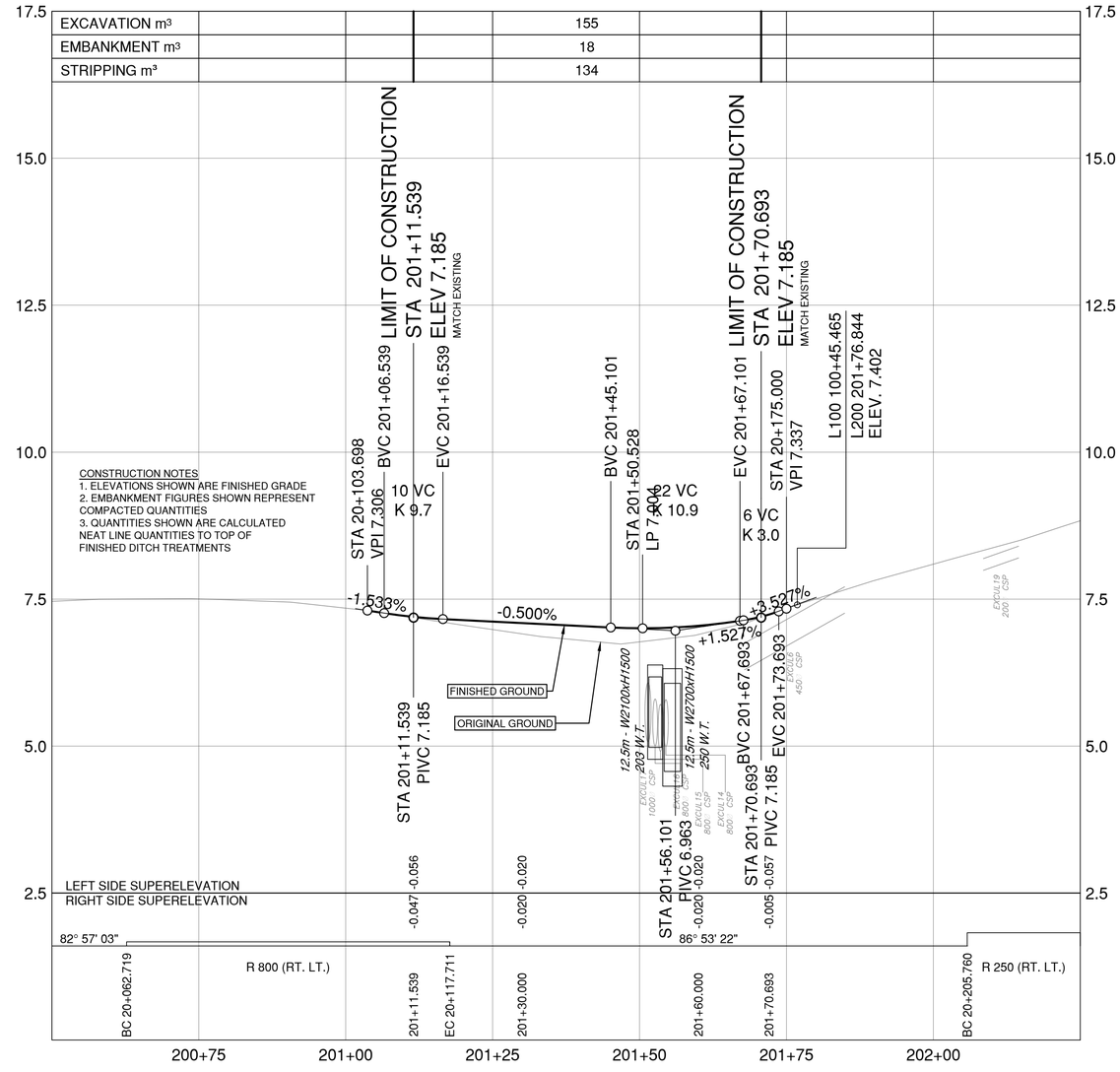
PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\100_Plans\R1-1027-100.dwg

EXCAVATION m³				193			
EMBANKMENT m³				33			
STRIPPING m³				161			



L100 - MARGARET RD

EXCAVATION m³				155			
EMBANKMENT m³				18			
STRIPPING m³				134			



L200 - BEACH AVE

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

DESIGN SPEED 50 km/h

URBAN SYSTEMS

SCALE 0 5 H 1:500 25m
0 0.5 V 1:50 2.5m

CAD FILENAME R1-1027-200
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED S.CAVASINNI DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN S.CAVASINNI DATE 2022-12-02

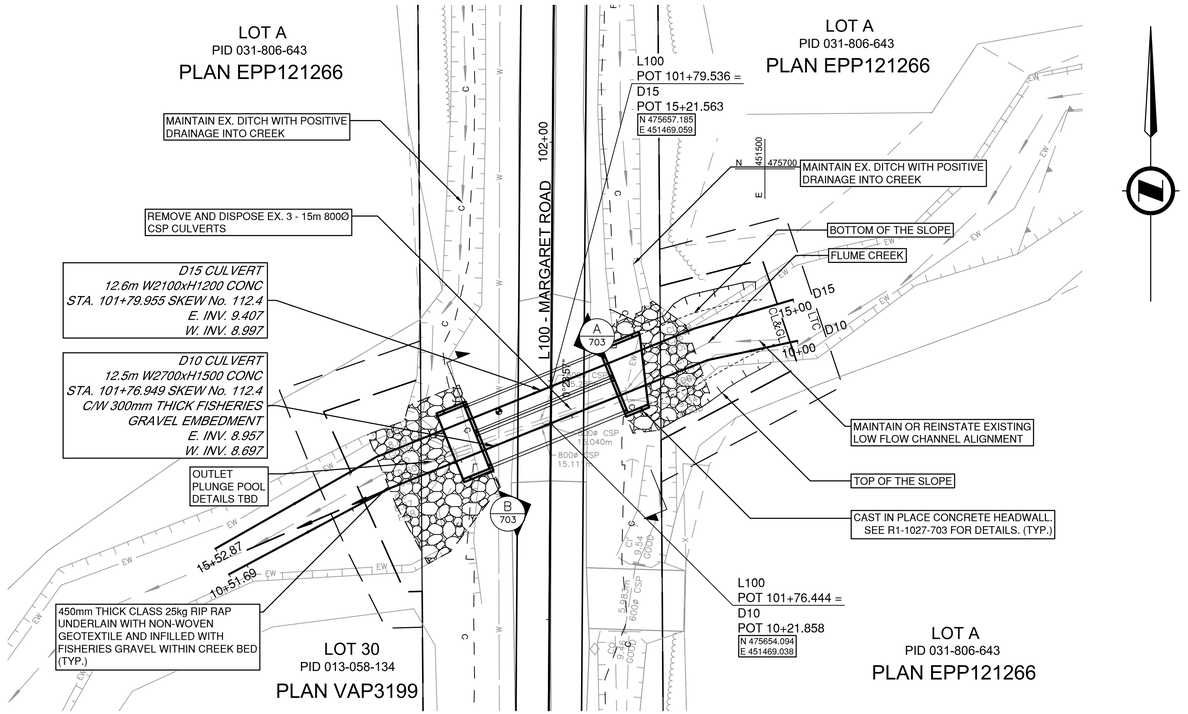
PROFILE

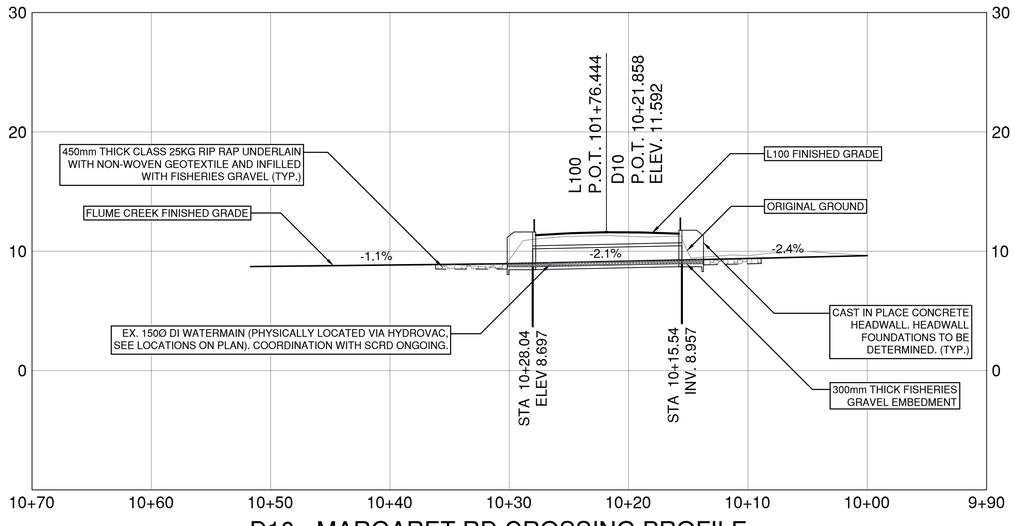
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-201	

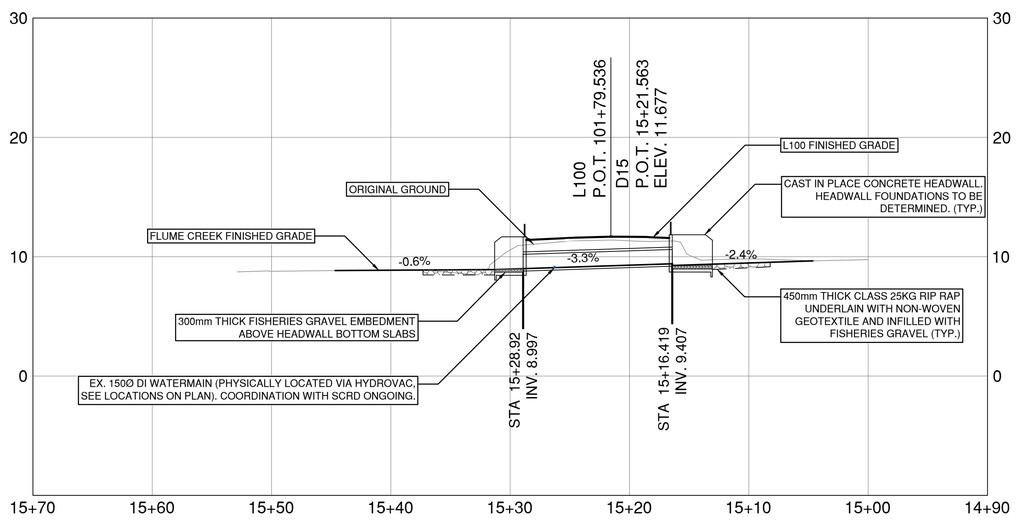
PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\200_Profiles\R1-1027-200.dwg

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca





D10 - MARGARET RD CROSSING PROFILE



D15 - MARGARET RD CROSSING PROFILE

FOR PLANS SEE DWG
R1-1027-101 to -102

FOR PROFILES SEE DWG
R1-1027-201

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
-TACK POINT: GCM 08H2546
-ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
-ROTATION: NOT APPLIED
-TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREON IS APPROXIMATE ONLY AND PREDOMINANTLY BASED ON AS-BUILT INFORMATION. THE CONTRACTOR WILL CONFIRM THE FIELD LOCATIONS OF THESE UTILITIES WITH THE UTILITY STAKEHOLDERS.

URBAN SYSTEMS

SCALE 0 2 1:250 12m

CAD FILENAME R1-1027-700
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
NORTHERN REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED A.BIPARVA DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN A.BIPARVA DATE 2022-12-02

MARGARET ROAD CULVERT CROSSING
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-701	

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\700_DrainageUtilities\R1-1027-700.dwg

ISSUED FOR
50% DESIGN
2022-12-02
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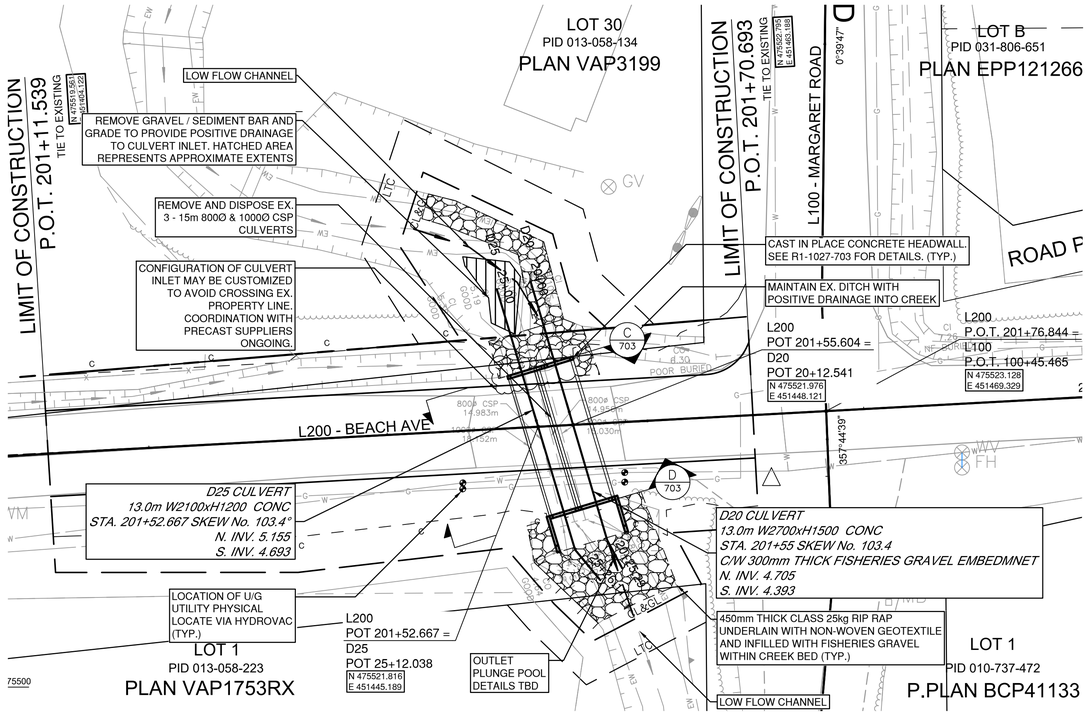
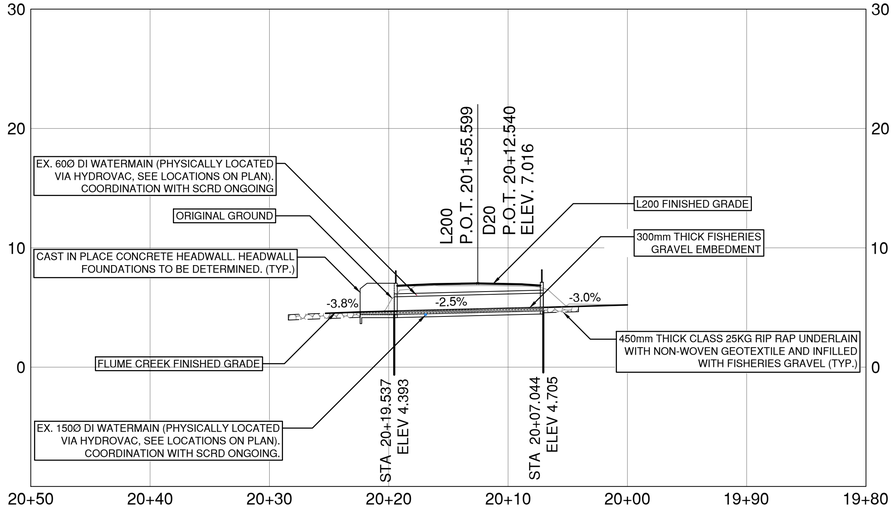
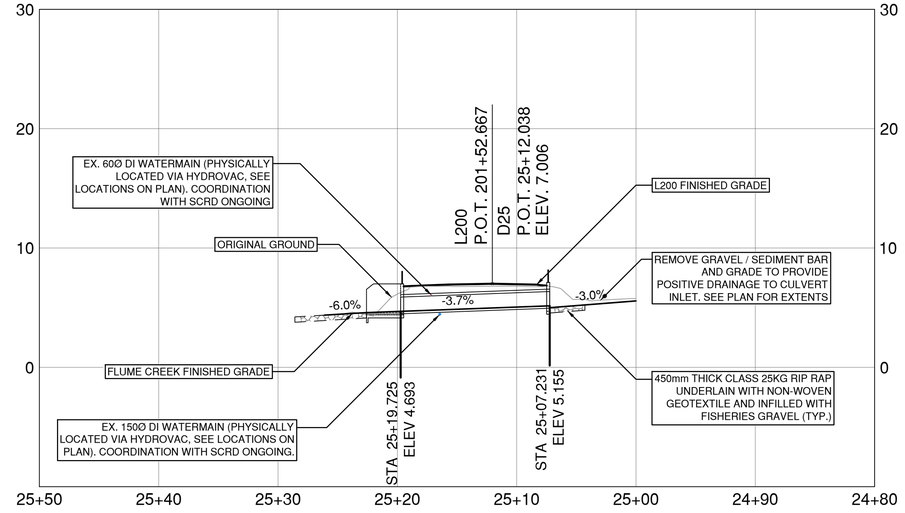




D20 - BEACH AVE CROSSING PROFILE



D25 - BEACH AVE CROSSING PROFILE

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
-TACK POINT: GCM 08H2546
-ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
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-TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

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FOR PLANS SEE DWG R1-1027-101 to -102

FOR PROFILES SEE DWG R1-1027-201

URBAN SYSTEMS

SCALE 0 2 1:250 12m

CAD FILENAME R1-1027-700

PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
NORTHERN REGION
HIGHWAY ENGINEERING AND GEOMATICS

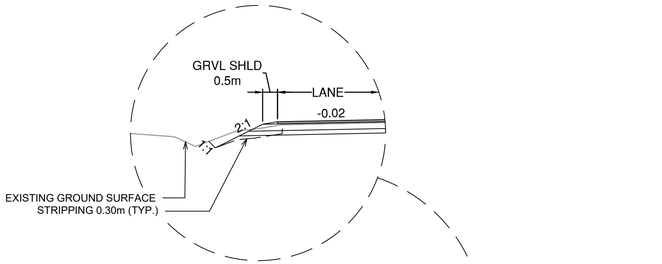
CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED A.BIPARVA DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN A.BIPARVA DATE 2022-12-02

BEACH AVENUE CULVERT CROSSING
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-702	

PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\700_DrainageUtilities\R1-1027-700.dwg



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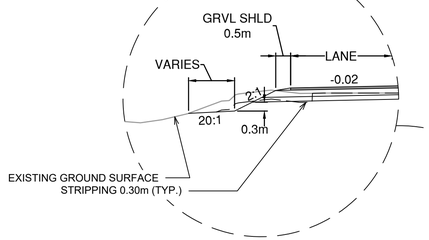
STA. 201+63.000 TO STA. 201+65.000



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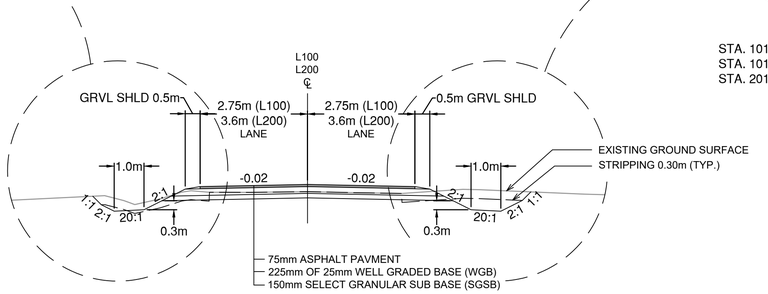

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STA. 201+70.000 TO STA. 201+70.693

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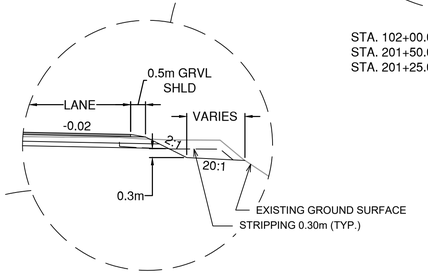

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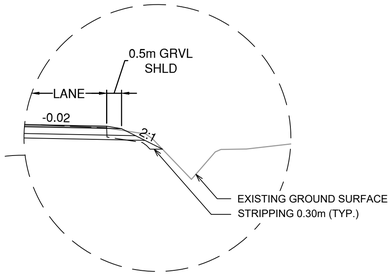

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STA. 201+50.000 TO STA. 201+52.000
STA. 201+25.010 TO STA. 201+35.000

L100 (MARGARET RD) AND L200 (BEACH AVE)

REFER TO PLANS FOR LOCATIONS AND DEFINITION OF LANE WIDTHS

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

URBAN SYSTEMS

SCALE 0 1 1:100 5m

CAD FILENAME R1-1027-300
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

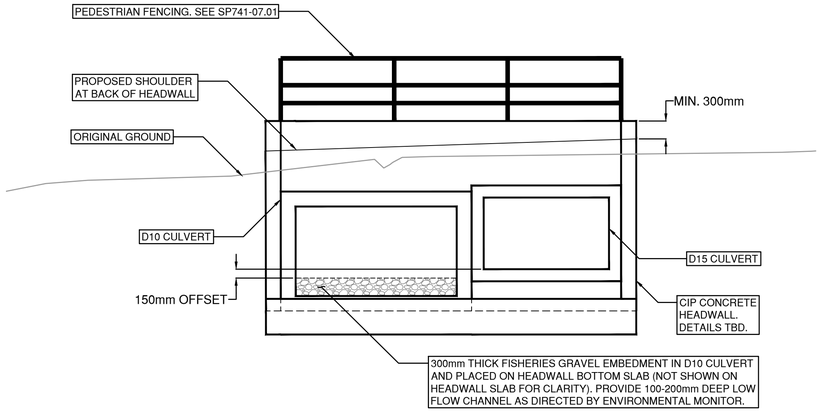
DESIGNED S.CAVASINNI DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN E.POULX DATE 2022-12-02

TYPICAL SECTIONS

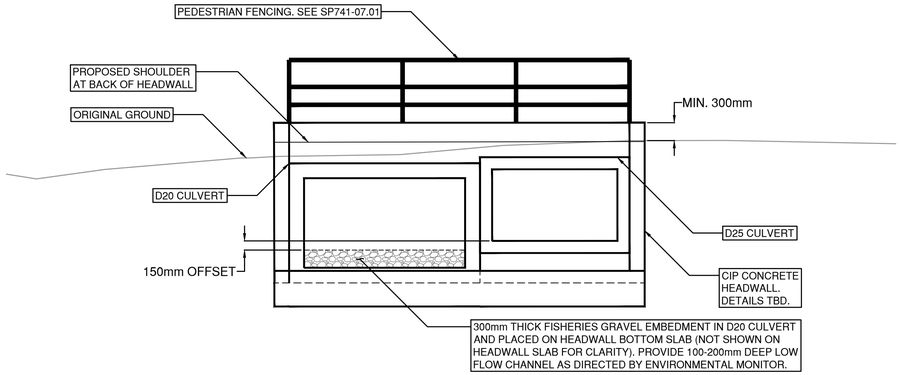
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-301	

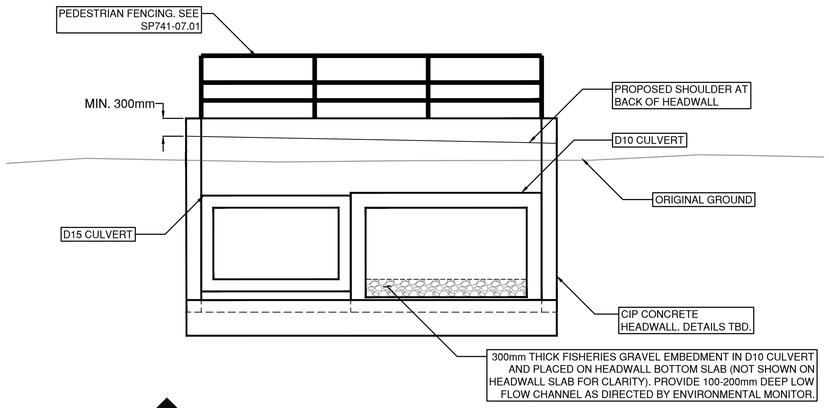
PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\300_TypicalSections\R1-1027-300.dwg



A 701 MARGARET RD CROSSING
D10 & D15 INLET SECTION



C 702 BEACH AVE CROSSING
D20 & D25 INLET SECTION



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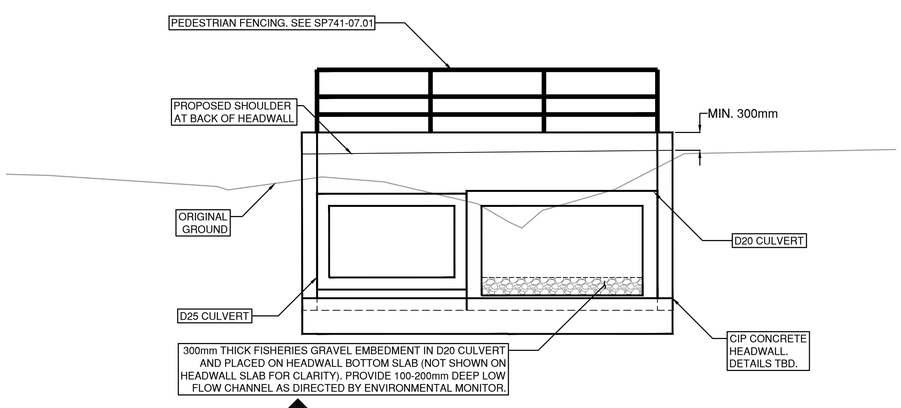
D10 & D15 OUTLET SECTION



D 702 BEACH AVE CROSSING
D20 & D25 OUTLET SECTION

ISSUED FOR
50% DESIGN
2022-12-02
urbansystems.ca

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
-TACK POINT: GCM 08H2546
-ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
-ROTATION: NOT APPLIED
-TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREON IS APPROXIMATE ONLY AND PREDOMINANTLY BASED ON AS-BUILT INFORMATION. THE CONTRACTOR WILL CONFIRM THE FIELD LOCATIONS OF THESE UTILITIES WITH THE UTILITY STAKEHOLDERS.

FOR PLANS SEE DWG R1-1027-101 to -102
FOR PROFILES SEE DWG R1-1027-201

URBAN SYSTEMS

SCALE 0 0.5 1:50 2.5m
CAD FILENAME R1-1027-700
PLOT DATE 2022-12-02

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
NORTHERN REGION
HIGHWAY ENGINEERING AND GEOMATICS

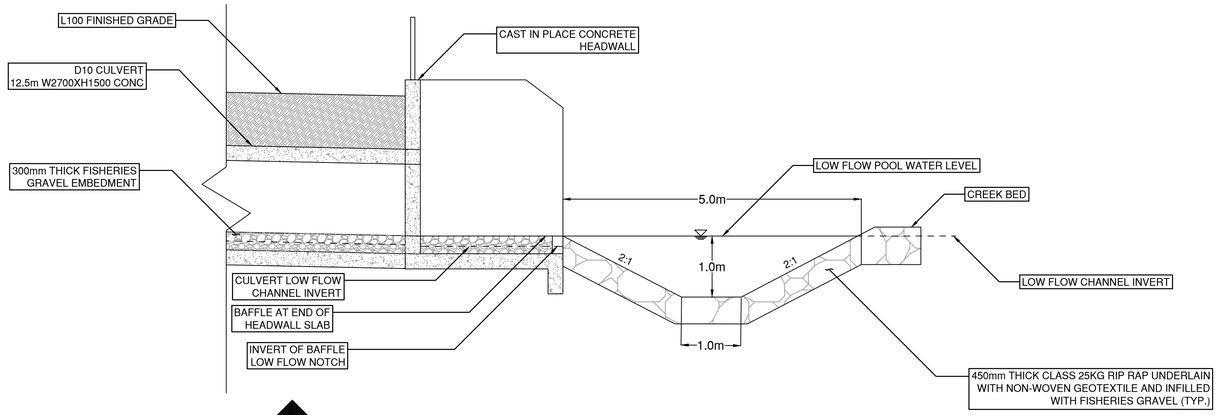
CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED A.BIPARVA DATE 2022-12-02
QUALITY CONTROL S.ROOSMA DATE 2022-12-02
QUALITY ASSURANCE C.BAGG DATE 2022-12-02
DRAWN A.BIPARVA DATE 2022-12-02

SECTIONS
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-703	

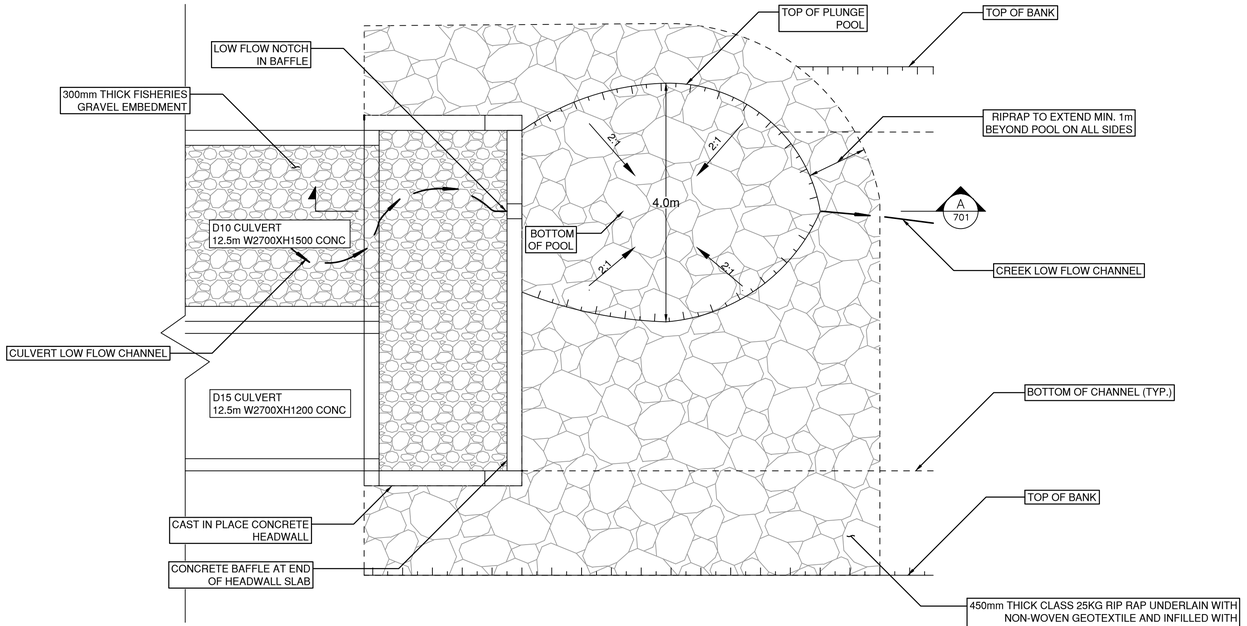
PLOT DATE: 2022/12/02 U:\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\700_DrainageUtilities\R1-1027-700.dwg



A
701

CULVERT OUTLET PLUNGE POOL PROFILE

1:50



ISSUED FOR
DISCUSSION
2023-01-12
urbansystems.ca

SURVEY NOTE:
COORDINATES ARE AT GROUND LEVEL AND BASED ON THE FOLLOWING CONVERSION FACTORS FROM UTM Z10 NAD 83 (CSRS), CGVD28 (HT2.0):
-TACK POINT: GCM 08H2546
-ADJUSTED COORDINATES WERE DIVIDED BY GIVEN SCALE FACTOR OF : 0.9996343
-ROTATION: NOT APPLIED
-TRANSLATION: SHIFT NORTH (-5000000.000), SHIFT EAST (0.000)

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FOR PLANS SEE DWG
R1-1027-101 to -102

FOR PROFILES SEE DWG
R1-1027-201

URBAN SYSTEMS

SCALE 0 0.5 1:50 2.5m

CAD FILENAME R1-1027-700
PLOT DATE 2023-01-12

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

CODY BAGG, P.ENG.
SENIOR DESIGNER
DATE

DESIGNED A.BIPARVA DATE 2023-01-12
QUALITY CONTROL S.ROOSMA DATE 2023-01-12
QUALITY ASSURANCE C.BAGG DATE 2023-01-12
DRAWN A.BIPARVA DATE 2023-01-12

MARGARET ROAD PLUNGE POOL
FLUME CREEK
DFAA FLOOD DAMAGE

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
872CS1714	14005	1	R1-1027-704	

PLOT DATE: 2023/01/12 \\usl.urban-systems.com\projects\Projects_SUR\1961\0480\14\D-Design\CAD\DrawingProduction\700_DrainageUtilities\R1-1027-700.dwg