

5.6 Measures for Controlling Noxious Weeds and Invasive Species.

Noxious weeds and invasive species are strictly prohibited from being deposited at the soil deposit site.

A Clean Fill Declaration will be completed by the soil source representative to confirm there are no noxious weeds and invasive species contained in the soil to be deposited at the soil deposit site.

In the event noxious weeds or invasive species are found at the soil deposit site, they will be immediately removed and disposed of at a proper disposal facility.

6.0 SITE REMEDIATION PLAN

6.1 Reclamation measures to stabilize, landscape and restore the land upon completion of the Soil Deposit Activity

Reclamation measures to stabilize, landscape and restore the fill deposit site will be ongoing throughout the duration of the soil deposit activity.

Once the soil deposit activity has stopped coming to the soil deposit site, the slopes will be contoured and stabilized with grass seed, straw and tree seedling plantings to allow native vegetation to naturally infill the area. If available, alder seed will be added to the seed mix and broadcast over the slopes.

The slope contouring and stabilization will occur as soon as each area is finished to minimize exposed soils as far as possible.

The surface of the final fill slope will be left rough to reduce surface erosion and if logs are available, they will be placed randomly over the fill slope in a horizontal alignment and pushed into the slope.

Restoration areas will be identified as no-go areas for future activities at the soil deposit site until slopes have been stabilized to prevent erosion and sedimentation.

6.2 Measures for Permanent Drainage and Storm Water Management

Existing drainage and storm water management systems constructed and maintained throughout the duration of the soil deposit activity will become the permanent drainage and storm water management systems of the reclaimed soil deposit site.

The deposited soil will be graded so that positive gravity drainage is assured. Ditches will be redirected away from the fill slope and to let fan out through adjacent clear-cut shrub and groundcover vegetation areas.

6.3 Measures for Managing Noxious Weeds and Invasive Species on an Ongoing Basis

Prevention will be the primary weed management strategy implemented for the soil deposit site to protect native plant communities from the negative impact of noxious weeds and invasive species. The critical action to prevent noxious weeds and invasive species from spreading and becoming established at the soil deposit site will be to strictly prohibit the deposit of all incoming soil suspected of containing noxious weeds and invasive species.

A Clean Fill Declaration will be completed by the soil source representative to confirm there are no noxious weeds and invasive species contained in the soil to be deposited at the soil deposit site.

Completed areas of the soil deposit site will be reclaimed as soon as possible to prevent noxious weeds and invasive species from invading the bare soil as noxious weeds and invasive species can germinate earlier than other plants and often germinate under poor growing conditions. A healthy plant community will be allowed to naturally infill the soil deposit site to resist noxious weeds and invasive species.

All machinery and vehicles will be kept clean to prevent the transportation of weeds and mud that may contain weed seeds.

The fill deposit site will be monitored regularly to ensure that no noxious weeds and invasive species are present. Observations about noxious weeds and invasive species, if found at the fill deposit site, will be recorded to capture type of noxious weeds and invasive species, locations in specific areas, and size and abundance of infestations.

In the event noxious weeds or invasive species are found at the soil deposit site, they will be immediately removed and disposed of at a proper disposal facility.



April 23, 2019

Dale Erb
1815 Sooke Lake Road
Shawnigan Lake, BC

Via Email: dalelerb@shaw.ca

**RE: 1815 SOOKE LAKE ROAD, SHAWNIGAN LAKE BC
RIPARIAN IMPACT ASSESSMENT & REMEDIATION PLAN**

1.0 INTRODUCTION & BACKGROUND

Aquaparian Environmental Consulting Ltd. (Aquaparian) was retained by you to assess the environmental impacts from fill placement within 1815 Sooke Lake Road in Shawnigan Lake, BC in Area B of the Cowichan Valley Regional District (CVRD). The legal description of the property is as follows:

- Lot C (DD 25242N), District Lot 9, Newcastle District, Plan 1832, except those parts in Plans 11274, 14223 and 14909.

In 2017, Aqua-Tex Scientific Consulting Ltd (1993) (Aqua-Tex) was retained by you in response to an investigation by Fisheries and Oceans Canada of reported sedimentation of an unnamed tributary of Shawnigan Creek traversing 1815 Sooke Lake Road. Results of the investigation were documented in a letter report dated April 21, 2017. The Aqua-Tex investigation identified the source of sediment to be originating from a fill site accessed from 1875 Sooke Lake Road known as the SLR Quarry and from fill that had also been deposited on 1815 Sooke Lake Road which is outside the SLR Quarry permitted area. Aqua-Tex also identified fill had been placed within the 30m Riparian Assessment Area of unnamed tributaries of Shawnigan Creek within the subject parcel.

Subsequently, the CVRD issued a letter dated December 6, 2018 identifying development occurred without a Development Permit (DP) on 1800 and 1815 Sooke Lake Road (Bylaw Enforcement File 53-B-16BE) and required the submission of a Development Permit which must include a Riparian Assessment Report from a QEP. The DP issue on 1800 Sooke Lake Road was a bridge crossing and has been addressed in a separate letter report.

This report has been prepared to assess the impact of soil deposition/disturbance and vegetation disturbance that has occurred within the Riparian Protection DPA for the unnamed tributary to

Shawnigan Creek and to provide environmental mitigation and restoration measures to be implemented.

In preparation of this report Aquaparian reviewed the CVRD Official Community Plan and area maps, government databases, the Aqua-Tex report and bylaw enforcement letter. Aquaparian completed three site assessments on January 17, 2019, March 20, 2019 and again on April 2, 2019 following the snow melt. A site location map has been included as Figure 1 and site photographs have been included in Appendix A.

2.0 SITE DESCRIPTION

A review of the CVRD on-line map identified the current zoning of the subject parcel is F-1 Primary Forestry. The property is bounded by Sooke Lake Road to the southeast, undeveloped forested land to the northeast and southwest, and a developed fill site to the northwest. A tributary stream to Shawnigan Creek is aligned southwest to northeast within the southeast property boundary. A review of Google Earth images showed the northwest portion of the parcel was clearcut in 2010 leaving riparian forest cover along the tributary stream within the parcel.

The tributary stream within the subject parcel contains small headwater streams and wetland reaches that feed the main channel. The main channel (tributary stream) is fed by two small watercourses that merge within a wetland (Wetland 1) in the southern corner of the lot on the east side of the driveway. The main channel flows northeast along the north side of Sooke Lake Road to a wetland reach (Wetland 2) dominated by red alder, salmonberry and skunk cabbage in the eastern portion of the parcel (refer to Figure 2). Wetland 2 is fed by the main channel and a small drainage watercourse that has been created by ditching of flows within the western neighbouring property (SLR Quarry). This drainage breaks out of the toe of the fill slope before entering the wetland. Wetland 2 pinches into a watercourse channel flowing northeast to a culvert under a driveway of the adjacent parcel. The watercourse continues northeast parallel to Sooke Lake Road to discharge into Shawnigan Creek. The average channel width of the unnamed tributary stream is 1.4m. The streambed material is cobble and gravel.

The riparian vegetation is a second-growth mixed forest with a tree canopy composed of red alder (*Alnus rubra*), grand fir (*Abies grandis*), western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), bigleaf maple (*Acer macrophyllum*). The forest understory vegetation includes sword fern (*Polystichum munitum*), licorice fern (*Polypodium glycyrrhiza*), bracken fern (*Pteridium aquilinum*), deer fern (*Blechnum spicant*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*), dull-Oregon grape (*Mahonia nervosa*), tall-Oregon grape (*Mahonia aquifolium*), trailing blackberry (*Rubus ursinus*), grass and moss species. Invasive species include Himalayan blackberry (*Rubus armeniacus*) and common holly (*Ilex aquifolium*). The

groundwater table is high in many areas with wetland seepage areas characterized by moisture-tolerant species including willow species, slough sedge (*Carex obnupta*), skunk cabbage (*Symplocarpus foetidus*) and salmonberry (*Rubus spectabilis*) within a stand of red alder.

Shawnigan Creek is a significant fish bearing watercourse and the primary inflowing stream to Shawnigan Lake. A review the Ministry of Environment FISS Database indicates Shawnigan Creek supports populations of coho salmon (*Oncorhynchus kisutch*), chum salmon (*Oncorhynchus keta*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarkii clarkia*), kokanee (*Oncorhynchus nerka*), threespine stickleback (*Gasterosteus aculeatus*), pumpkinseed (*Lepomis gibbosus*), prickly sculpin (*Cottus asper*) and brown catfish (*Ameiurus nebulosus*).

Small tributary streams and wetland habitat are important environmental features that provide numerous benefits to fish and to the functioning of Shawnigan Creek. Tributary streams and wetlands in the upper watershed provide fish and wildlife habitat. They also protect and improve water quality. They store floodwaters and slowly release water into the main channel when water levels are low thereby maintaining surface water flow during dry periods. They also release organic material (leaf litter, insect drop, woody debris) and nutrients into the main channel which helps feed fish and wildlife. Protecting the wetland reaches and headwater streams that are tributary to Shawnigan Creek is integral to protecting the health of this significant fish-bearing stream.

3.0 IMPACT ASSESSMENT

At the time of Aquaparian's site survey, fill material had been placed on the east side of the driveway leading to the SLR Quarry within 1815 Sooke Lake Road. The southern extent of the fill slope encroaches into the 30m DPA of Wetland 1 resulting in an impacted area of approximately 1600m². The older fill has formed a stable slope that is naturally vegetating with red alder seedlings and groundcover species. A new pile of fill has recently been placed a few meters back from the top of the old fill area.

A perimeter ditch along the toe of the SLR Quarry fill drains toward the north end of the subject parcel fill area. Fill material at this end appears to be primarily comprised of clay. Red alder saplings growing in the ditch are approximately 5 years old indicating the drainage path has been in existence for that length of time. The drainage goes subsurface and breaks out of the fill slope below the crest of the slope where bedrock is exposed. The remainder of the slope failure area shows evidence of erosion and rilling from surface and subsurface drainage. The drainage appears to have contributed to a slope failure – a crescent shaped section of the slope slumped and migrated downhill to the tree line. The drainage forms a

watercourse starting a few meters beyond the toe of the failed slope and flows through the forest toward Wetland 2. Sedimentation in the upper section of this watercourse comprised of a clay slurry from the slope failure was evident. The clay slurry had settled out in a relatively flat ponded area. The eastern toe of the slumped fill area encroaches into the 30m DPA setback of this watercourse resulting in an impacted area of approximately 400m².

Following the first site assessment, Aquaparian recommended installing erosion and sediment controls to prevent ongoing sediment migration including silt fencing and straw bales in an attempt to prevent downstream sedimentation. The second and third assessments showed the erosion and sediment control measures were in place and were functioning to prevent offsite sedimentation of the main tributary channel.

Silt deposition from previous erosion was observed in the watercourse between Wetland 2 and the adjacent parcel driveway at the time of the site survey on March 20, 2019 however the stream flows were relatively clear (slightly turbid). The slight turbidity appeared to be a result of previous deposition moving through the system. The main channel tributary appeared to be flowing clear (no turbidity) before discharging into Shawnigan Creek. Additional measures were recommended.

4.0 REMEDIATION PLAN

The following recommendations are provided to address erosion and sediment control issues and encroachment issues of the placed fill material in relation to the watercourse and related wetlands and tributaries. The following recommendations are provided to mitigate impacts of the fill within the Watercourse DPA:

Restoration Area 1: ~1600m²

- Survey and flag the 30m riparian setback.
- Improve existing erosion and sediment control measures by installing silt fences or straw bales between the fill slope and the high water mark to prevent sedimentation of watercourse while the site is stabilized.
- In the dry summer period, remove the new fill pile to outside the 30m setback. Apply grass seed and straw mulch over newly exposed soils. Retain the old fill slope as it is stable and has begun to regenerate a large number of red alder seedlings and ground cover species. Allow the existing alder saplings to regenerate and riparian vegetation to naturally infill the impacted area.
- Visually demarcate the 30m setback to prevent future encroachment (i.e. snow fence).

Restoration Area 2: ~1000m²

The following recommendations are intended to control / reduce erosion. This is not a geotechnical assessment of slope stability. If development of this area is planned in the future, a geotechnical assessment will be required to determine if the site is safe for the intended use. If further slope failure occurs, a geotechnical assessment may be necessary.

- Discuss redirecting the SLR Quarry ditch away from the fill slope (I.e toward the north and let it fan out through the adjacent clear-cut shrub and groundcover vegetation area.
- Survey and flag the 30m riparian setback.
- Install silt fences or straw bales between the toe of the fill slope and the start of the watercourse to prevent sedimentation while the site is being stabilized.
- During the dry summer period remove slumped fill material to outside the 30m setback.
- Construct a compacted soil berm at the toe of the fill slope with suitable compactable soils to support the toe of the newly graded slope.
- Re-grade the fill slope to at least 2H:1V (or less) to improve slope stability and prevent future slumping. Install a layer of good soil over the newly graded fill slope. Seed the fill slope and soil berm with grass seed and cover with a layer of straw. Leave the surface of the slope rough to reduce surface erosion. If logs are available, place them randomly over the slope in a horizontal alignment and push them into the slope.
- In the following fall (October), plant the impacted area within the 30m setback and the newly constructed fill slope with native trees to improve sediment and erosion control and to reinstate riparian habitat. Trees should be plugs and spaced at least one every 3m on centre.
- Install clusters of three 1m long willow cuttings (not all are expected to survive) in the upper end of the drainage channel where it is a ponded slurry of clay fines to stabilize this area. Plant clusters approximately 1m apart. The alternative of excavating the slurry would result in more damage than it would be to stabilize it.
- Visually demarcate the 30m setback to prevent future encroachment (snow fencing).
- Allow riparian vegetation to naturally infill the impacted area.

The following table is a summary of the impacted area in relation to the DPA area within the property:

TABLE 1. AREA IMPACT AND RESTORATION CALCULATION

DESCRIPTION	CALCULATION	AREA
DPA Area in parcel	~40% of the total area of the parcel:	~50,000m ²
Impacted area within DPA	Area 1: ~1600m ² of fill placement within the DPA of Wetland 1 Area 2: ~400m ² of fill placement within the DPA of the watercourse that flows towards Wetland 2	~2,000m ²
Restoration Area	Area 1: ~1600m ² of fill removed from the DPA, cover with grass seed and straw mulch and allow to naturally re-vegetate with red alder and ground cover. Area 2: ~400m ² of fill removed from the DPA and planted with native trees, grass seed and straw mulch ~400m ² of the newly graded fill slope planted with native trees + grass seed and straw mulch ~200m ² (20m x 10m) of native willow live stake planting at upper end of drainage to wetland 2	~2,600m ²

Native species selected in this remediation plan were selected based on existing native shrub and tree species present within the property and suitability to the site conditions (see Table 2). Overall planting density to be achieved is a minimum of one tree per 3m² with the goal of 100% cover within 2-3 years. Red alder are expected to seed themselves naturally as evidenced on site on recently disturbed areas. Willow stakes are to be planted in clusters of 3 cuttings and spaced 1m apart. Refer to Figure 3 for a diagram of restoration areas.

TABLE 2. PLANT LIST FOR RESTORATION AREA 2

COMMON NAME	SPECIES	SPACING	SIZE	QUANTITY
Native willow species	<i>Salix sp.</i>	1 m ²	1m long stakes in groups of 3	120
Douglas fir	<i>Pseudotsuga menziesii</i>	3 m ²	Plugs	100
Western redcedar	<i>Thuja plicata</i>	3 m ²	Plugs	100
Grand fir	<i>Abies grandis</i>	3 m ²	Plugs	50
Western hemlock	<i>Tsuga heterophylla</i>	3 m ²	Plugs	50
TOTAL				400 TREES & 120 WILLOW CUTTINGS

4.1 INSTALLATION & MAINTENANCE RECOMMENDATIONS

- Installation of vegetation should be completed in the fall (October) or early spring and must be maintained and irrigated as necessary through at least two summer seasons to optimize survival. Planting in cool wet weather will reduce transplant shock and allow the plants to establish root systems without drought stress.
- A layer of soil should be spread over the planting area with 1" layer of straw spread on top to reduce erosion and improve moisture retention. Tree plugs should be planted by an experienced tree planter at a 3m spacing (Restoration Area 2). Red alder will naturally regenerate in the area as observed by the presence of alder saplings in the adjacent site (Restoration Area 1).
- Add a pinch of bone meal (reduces transplant shock) to the planting hole where native tree species plantings are to occur. Unless rain is imminent, water plantings immediately and as necessary until established.
- Overall tree density should be a minimum of one tree per 3m². Plant placement should mimic a natural growth pattern i.e. clusters of same species.
- Native willow stakes should be planted in the upper section of the drainage channel where the clay slurry has ponded.
 - Collect cuttings and keep cool and moist prior to installation (stout cuttings and at least 1m in length).
 - Install as soon as possible after collection.
 - Install cuttings in cluster groups of three with 1m spacing between clusters.
 - Push two-thirds of the cutting into the ground leaving one-third above ground.
- Visually demarcate the 30m setback with snow fence or tall lathe stakes to prevent future encroachment into the DPA. The restoration areas are to be considered as No-Go zones and left to naturally infill.
- A maintenance period of 2 years is recommended to determine planting success. Dead plants are to be replaced until 100% cover is achieved. Infill is expected to occur from the selected species and from the naturally occurring seed bank.

5.0 ENVIRONMENTAL PROTECTION MEASURES

Environmental protection measures are to be in place prior to the start of restoration works. If additional environmental support is necessary due to an unforeseen event, Aquaparian will be available upon request. Aquaparian will be available to provide a completion inspection with report if required by the CVRD.

The following measures are recommended:

- No further sedimentation of the headwater streams or the wetlands is to be allowed. No deleterious substances are to be allowed to enter any waterbodies or drainages.
- Existing silt fences and straw bales between the toe of fill slopes and the high water mark of waterbodies should be repaired and extended to prevent the migration of fines from fill sites into waterbodies. Silt fencing should remain while restoration areas are stabilized.
- Timing: earthworks including excavation and moving of fill materials, regrading and stabilization of the fill slope and placement of planting medium should occur in the dry summer period. Planting of trees and willow stakes should occur in the fall or early spring.
- Environmental monitoring of erosion and sediment control measures and site soil stability should occur during the wet period of next winter to assess if additional measures are required and to make additional recommendations as necessary.
- Do not stockpile soil piles within 30m of the top of slope of wetlands or watercourses.
- Any new fill placed will require additional erosion controls following final grading.
- No further disturbance is to occur within the DPA. The 30m setback is to be visually demarcated with tall stakes to prevent future encroachment.
- All heavy equipment should be clean and free of leaks and to have a fully stocked spill kit on board.
- Control of site drainage and runoff may be necessary during or following landscaping activities to prevent migration of fines if a heavy rain event occurs. Measures may include: temporarily covering the exposed soils with sheets of poly and weighing it down to prevent it blowing off, containing or redirecting/diversion of runoff with sand bags (or similar), placement of additional silt curtains or straw bales between work areas and riparian areas, or temporary work stoppages.
- Applying straw to the surface of the exposed soils immediately after earthworks and soil placement will help prevent runoff and migration of fines if a heavy rain event occurs.
- Horizontal tracking of any large flat surfaces of newly placed fill will reduce surface erosion.

6.0 CONCLUSION

As required by the Cowichan Valley Regional District (CVRD), Aquaparian Environmental Consulting Ltd. (Aquaparian) was retained by the owner of 1815 Sooke Lake Road to assess the environmental impacts of the placement of fill material within Riparian Protection Development Permit Areas of watercourses and wetlands within the subject property. The DPAs cover the southeast portion of the parcel along Sooke Lake Road. Impacts to the DPA occurred during fill placement without permit. Soil disturbance within the 30m DPAs will require restoration of approximately 1600m² of impacted area within Restoration Area 1 and 1000m² of impacted area within Restoration Area 2 to off-set the impact.

As understood, if this fill site is allowed to continue operating, fill materials will no longer be dumped within Riparian DPAs. If the environmental protection and remediation measures are followed as recommended in this report, impacts to riparian areas and watercourses including vegetation and soil disturbance and sedimentation into watercourses will be remediated and natural riparian habitat re-instated to impacted areas. The DPAs should be considered as No-Go zones and no development or further disturbance should occur without a Development Permit.

This report is intended to provide recommendations for erosion and sediment control and riparian remediation. This report is not to be considered as a geotechnical assessment. If any future work / disturbance is proposed, a Professional Engineer should be retained to provide a geotechnical assessment for the intended work.

If all mitigation measures are implemented as recommended in this report, the risk of further negative impacts to waterbodies and riparian habitat will be minimized and impacted conditions will be improved over existing conditions with the intent of restoring a naturally functioning riparian buffer zone in the long term.

7.0 CLOSURE

This report has been based on site assessments, a review of relevant background information, past project experience and in accordance with generally accepted biological practices. No other warranty is made, either expressed or implied. Aquaparian trusts that the information provided in this report meets your requirements. Any questions regarding information provided in this document, please contact the undersigned at (250) 591-2258.

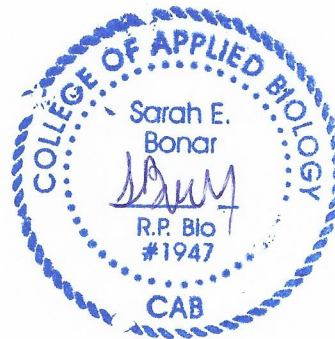
Sincerely,

AQUAPARIAN ENVIRONMENTAL CONSULTING LTD.

Prepared by:

Reviewed/Revised by:


Crystal Campbell
Environmental Technician



Sarah Bonar B.Sc., R.P.Bio
Biologist/Principal

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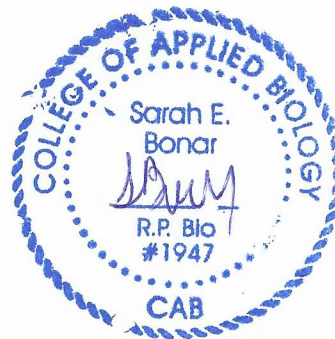
Sincerely,

AQUAPARIAN ENVIRONMENTAL CONSULTING LTD.

Prepared by:

Reviewed/Revised by:


Crystal Campbell
Environmental Technician



Sarah Bonar B.Sc., R.P.Bio
Biologist/Principal

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FIGURE 1
SITE LOCATION MAP

Figure 1. Site Location Map
1815 Sooke Lake Road, Shawnigan Lake BC

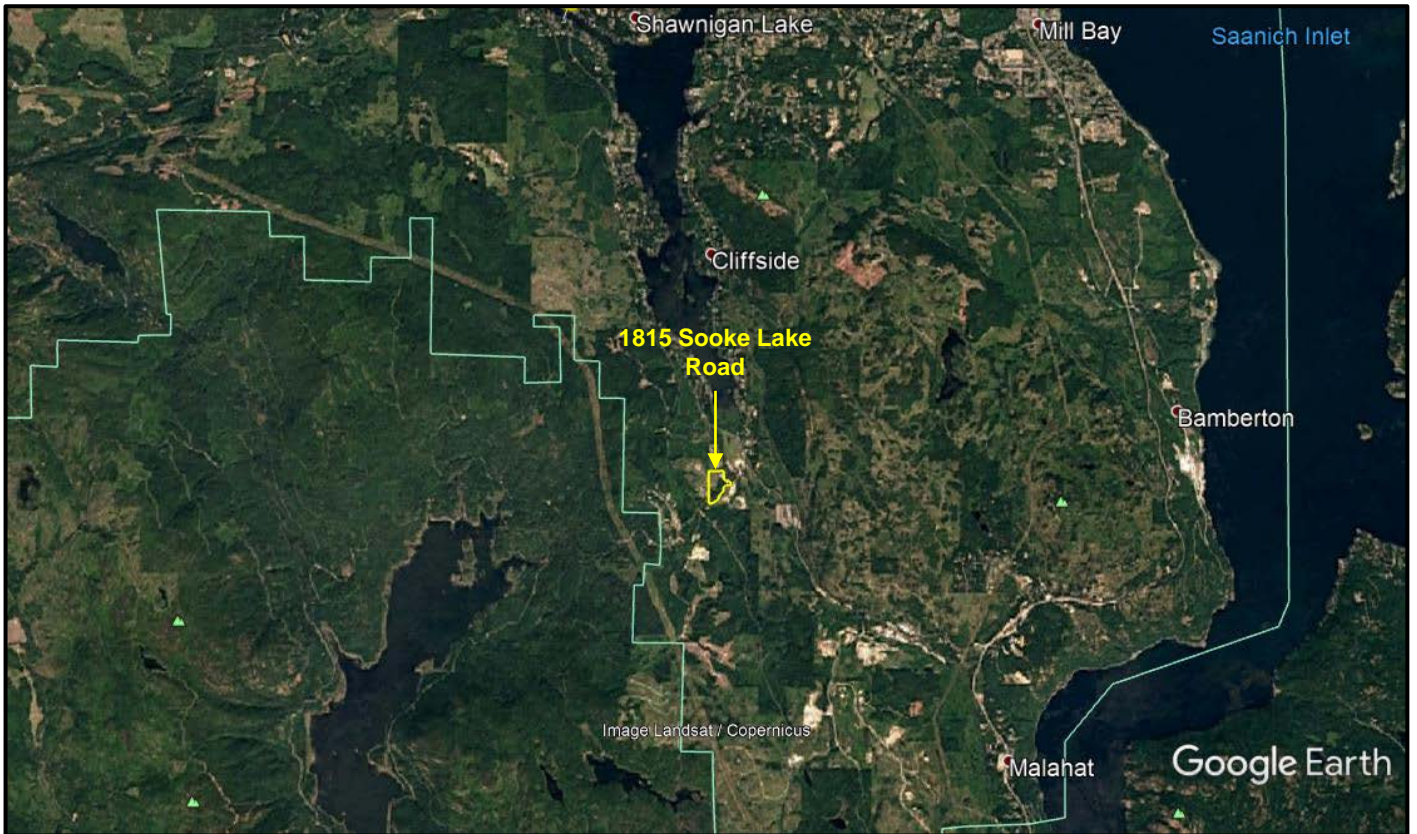
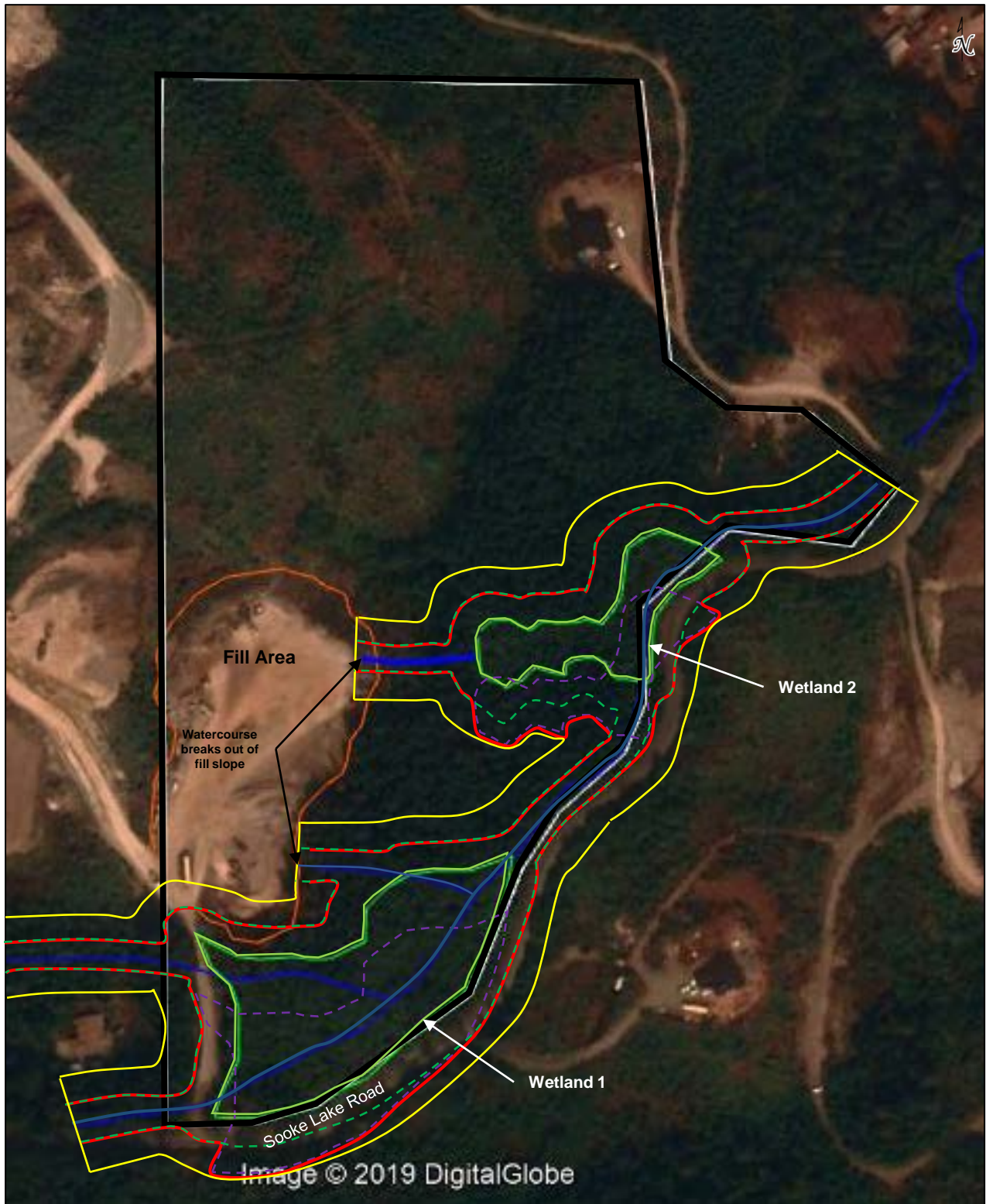


FIGURE 2
DPA BOUNDARIES MAP

**Figure 2. Development Permit Area and Riparian Areas Regulation Site Plan
1815 Sooke Lake Road**



LEGEND:

- Streamside Protection & Enhancement Area
- - - Leaf Litter, Insect Drop & Large Woody Debris ZOS
- - - Shade ZOS
- Watercourse
- Wetland
- Fill Area
- Riparian Assessment Area (30m) (Defines the Development Permit Area)

FIGURE 3
PLANTING PLAN

Figure 3. Planting Plan
1815 Sooke Lake Road



LEGEND:

- Streamside Protection & Enhancement Area
- Riparian Assessment Area (30m) (Defines the Development Permit Area)
- Fill Area
- Restoration Area

Restoration Area 1: Remove recent fill from Riparian DPA and retain older stable fill with existing alder saplings and other riparian species to re-generate and naturally infill in this area (~1600m²).

Remove new fill



Restoration Area 2: remove fill from Riparian DPA; regrade and reduce fill slope and construct a soil berm at the toe of fill slope; place soil over the newly constructed slope and where the fill was pulled back; seed with grass and spread straw over exposed soils; plant new fill slope area (~400m²) and impacted DPA area (~400m²) with native trees.



Restoration Area 2 Drainage:

After the ditch that flows from the SLR Quarry fill slope has been redirected and the area where it currently enters the wetland has dried up somewhat, plant live native willow stakes in this area in the fall (~200m²).



APPENDIX A
SITE PHOTOGRAGHS

1815 SOOKE LAKE ROAD
Photo Sheet 1



Photo1. Looking into the driveway of 1815 Sooke Lake Road at the culvert crossing of the main tributary.



Photo 2&3. Looking upstream and downstream from the driveway crossing the main tributary stream.

Photo Sheet 2



Photo4 & 5 showing the forested swamp wetland (Wetland 1) on the downslope side of the entrance driveway.



Photo 6. Showing the stream reach beside Sooke Lake Road downstream of Wetland 1.

Photo Sheet 3



Photo 7 & 8. The tributary continues along the road edge to Wetland 2. Wetland 2 is also fed from the drainage coming from the slope failure area.



Photo 9. Showing the SLR Quarry ditch directed toward the fill area in 1815 Sooke Lake Road.



Photo 10 & 11. Subsurface flows break out of the fill slope at the north edge of the fill and form a drainage at the bottom of the slope.



Photo Sheet 4



Photo 12 & 13. Showing the driveway crossing culvert at 1815/1805 parcel boundary then the stream follows the road for a while .



Photo 14 & 15. Showing the tributary bends into the forest for a short distance before discharging into Shawnigan Creek just downstream of the water line crossing beside the bridge shown in Photo 15.

