ATTACHMENT 7

# 1935 Maple Bay Road Unnamed Tributaries to Quamichan Lake

## *Riparian Areas Protection Regulation Assessment Report*

***Prepared for: Mr. Len Thew & Donna Chadwick***

**December 15, 2022**

**Prepared by:** Wm. Patrick Lucey, M.Sc., RP Bio, CBiol, MRSB
**Assisted by**: Jacob McCurdy, B. Eng., EIT

Aqua-Tex Scientific Consulting Ltd. (1993)

COOPERATIVE riparian RESTORATION

## Riparian Areas Protection Regulation: Assessment Report

Date: December 15, 2022

### I. Primary QEP Information

| | | | | |
|---|---|---|---|---|
| First Name | William | Middle Name | Patrick | |
| Last Name | Lucey | | | |
| Designation | R.P. Bio | Company | Aqua-Tex Scientific Consulting Ltd. | |
| Registration # | 1467 | Email | aqua-tex@islandnet.com | |
| Address | 390 7th Avenue | | | |
| City | Kimberley | Postal/Zip | V1A 2Z7 | Phone # 1-(250) 427-5906 |
| Prov/state | BC | Country | Canada | |

### II. Secondary QEP Information (use Form 2 for other QEPs)

| | | | |
|---|---|---|---|
| First Name | | Middle Name | |
| Last Name | | | |
| Designation | | Company | |
| Registration # | | Email | |
| Address | | | |
| City | | Postal/Zip | Phone # |
| Prov/state | | Country Canada | |

### III. Developer Information

| | | | |
|---|---|---|---|
| First Name | Len | Middle Name | |
| Last Name | Thew | | |
| Company | | | |
| Phone # | (778) 674-4329 | Email | lenthew@hotmail.com |
| Address | 1935 Maple Bay Road | | |
| City | Municipality of North Cowichan | Postal/Zip | V9L 5M4 |
| Prov/state | B.C. | Country | Canada |

### IV. Development Information

| | | | |
|---|---|---|---|
| Development Type | Other | | |
| Area of Development (ha) | 0.0095 | Riparian Length (m) | 117 |
| Lot Area (ha) | 0.461 | Nature of Development | New |
| Proposed Start Date | April, 2023 | Proposed End Date | October, 2024 |

### V. Location of Proposed Development

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Street Address (or nearest town) | 1935 Maple Bay Road | | | | | | |
| Local Government | Municipality of North Cowichan | | | City | Duncan | | |
| Stream Name | Unnamed headwater tributaries of Quamichan Lake | | | | | | |
| Legal Description (PID) | 001-526-031 | | | Region | 1-Vancouver Island | | |
| Stream/River Type | Streams and Wetlands | | | DFO Area | 18-Vancouver Island | | |
| Watershed Code | 920-257700-05700-01600 | | | | | | |
| Latitude | 48° | 47’ | 12” | Longitude | 123° | 35’ | 60” |

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# 1. Executive Summary

This report was prepared for Mr. Len Thew and Ms. Donna Chadwick. The proposed development is a small ancillary dwelling (carriage house) on 1935 Maple Bay Road, Duncan (Lot 1, Section 19, Range 1, Cowichan District, Plan 13635; PID 001-526-031) (the Subject Property) (Figure 9).

The subject property is located east of Duncan and southwest of Quamichan Lake (Figure 1 – Figure 3). The property is supplied with municipal drinking water and a new septic treatment system will be constructed on-site, for the ancillary dwelling (carriage house).

A Riparian Areas Protection Regulation (RAPR) Assessment Report is specified in the Municipality of North Cowichan's OCP and Development Permit Area 3 (Watercourses, streams, and wetlands) (Figure 4). The property has two watercourses subject to the RAPR – a municipal drainage ditch and a manmade wetland / stream. The manmade drainage ditch lies on the adjacent property to the west (within an SRW), while the stream begins on the adjacent property to the east, in a small wetland / pond. The discharge from the pond flows across a number of properties, largely through historic culverts, until it discharges from a culvert into the drainage ditch. The stream within the boundaries of the subject property is entirely within a culvert.

The Streamside Protection and Enhancement Area (SPEA) for the municipal drainage ditch on the adjacent property to the west (Figure 10) was determined to be 5 m (minimum width). The open portion of the stream on the property to the south of the subject property has a 10 m SPEA, a small portion of which extends onto the subject property. No SPEA was assigned to that section of stream on the subject property that is contained within a culvert.

Prior to any construction site disturbance, SPEAs shall be fenced and marked in the field. Signage should be erected clearly marking the SPEA as a "no-go" zone during any soil disturbing activities (*i.e.* soil grading). A QEP, or an engineer, shall provide an Erosion & Sediment Control and Pollution Prevention Plan, together with an effectiveness Monitoring Plan, which includes measures to prevent sediment-laden, turbid runoff from flowing across bare soils and into the drainage ditch, stream, and wetland. A final report shall be prepared by the engineer, or QEP, verifying construction activities proceeded as prescribed in the Erosion & Sediment Control Plan and Pollution Prevention Plan, in accordance with measures recommended in the Plan, to ensure the water features have been protected.

# 2. Introduction and Proposed Development

This report was prepared for Mr. Len Thew and Ms. Donna Chadwick. The proposed development is a small ancillary dwelling (carriage house) on 1935 Maple Bay Road, Duncan (Lot 1, Section 19, Range 1, Cowichan District, Plan 13635; PID 001-526-031) (the Subject Property) (Figure 9).

The subject property is located east of Duncan and south of Quamichan Lake (Figure 1 – Figure 3). The property is supplied with municipal drinking water and a new septic treatment system will be constructed on-site, for the ancillary dwelling.

A Riparian Areas Protection Regulation (RAPR) Assessment Report is specified in the Municipality of North Cowichan's OCP and Development Permit Area 3 (Watercourses, streams, and wetlands) (Figure 6 and Figure 7). The subject property has two watercourses subject to the RAPR – a municipal drainage ditch and a manmade stream (Figure 7). The manmade drainage ditch lies on the adjacent property to the west (1949 Maple Bay Road, within an SRW), while the stream begins on the adjacent property to the east, in a small manmade pond (Figure 11). The discharge from the pond flows across a number of properties, largely through historic culverts, until it discharges into the drainage ditch, noted above. Within the boundaries of the subject property, the stream is entirely contained within an historic culvert (Figure 14 and Figure 15).

The Streamside Protection and Enhancement Area (SPEA) for the municipal drainage ditch on the adjacent property to the west (Figure 10) was determined to be 5 m (minimum width). The Water Sustainability Regulation (WSR) (s.31 – s.34) defines "drainage works" as "works belonging to or used by a local government to drain surface runoff" (Table 1. Summary of drainage exemptions under the *WSA* listed in WSR).

The short section (~17m) of recently daylighted stream, immediately south of the subject property subject, has a 10 m SPEA, a small portion of which extends onto the subject property (Figure 10). No SPEA was assigned to that section of stream on the subject property that is contained within a culvert.

# 3. Assessment Team

The field assessment was conducted by Patrick Lucey, R.P. Bio., with assistance from Jacob McCurdy, B. Eng., EIT. This report was prepared by Mr. Lucey. No specialists were engaged to contribute to this report. A site assessment was conducted to characterize the catchments of the two water features on August 18, 2022. The channel measurements and assessment of the riparian plant vegetation (and land uses) was conducted on November 30, 2022.

The experience of the assessment team is included as Appendix 1.

# 4. Watershed Overview

The subject property lies within the Quamichan Lake catchment (Figure 1). The Quamichan Lake average water level is 25.4± metres; the lake flood construction level (FCL)is 27.4 metres. Two water features are associated with the subject property – a wetland/pond / manmade outlet channel (classified under the RAPR as a stream) and a municipal drainage ditch; both these features are headwater drainage channels (Figure 3). The wetland/pond appears in historical air

photographs to have been isolated as there is no visible natural outlet stream channel (Figure 8). The area surrounding the wetland appears to have been farmed as a hay field.

The stream consists of a manmade pond at its upper end (Figure 11); the pond has a very small catchment and overflow from the pond occurs only periodically during winter months when rainfall is sufficient to fill the pond beyond its highwater mark (Figure 12). The pond outlet consists of a concrete headwall which drains into a buried culvert. The culvert flows into a short segment of open drainage channel, then crosses under a driveway in a culvert, and then flows into a recently daylighted section of channel approximately 17 m in length (Figure 13 – Figure 15). The open channel then flows into a buried culvert before flowing into the municipal drainage ditch which lies on the adjacent property to the west (Figure 10). The latter ditch lies within an SRW. The ditch flows north into a field of dense reed canary grass, which then flows into a wetland which, in turn, flows into Quamichan Lake (Figure 10).

The municipal drainage ditch (Figure 5) consists of a narrow, open channel (Figure 16) routing drainage from a subdivision south of Maple Bay Road. The drainage ditch was constructed between 1974 and 1978, based upon a review of high resolution, Provincial Air Photographs (bc7697_050_12n & bc78002_107_12n, respectively) and correspondence with municipal staff. The drainage ditch was constructed specifically to route stormwater runoff, within a narrow SRW, from the subdivision under construction, to Quamichan Lake (Figure 4 – Figure 7). The drainage ditch was assessed, channel attributes measured, and photographed (Figure 16 – Figure 31). The drainage channel is narrow, moderately entrenched, with a predominantly shrub community on the west bank, and a predominantly turf lawn on the east bank. The east bank has a steep, eroding bank face, with some undercutting of the bank, while the channel has been filled with small pieces of concrete, breeze blocks, asphalt, and river rock (~15cm diameter) in an attempt to reduce bank erosion. The in-channel debris has created small weirs that create a step-pool configuration. The low flow in the channel minimizes bank erosion. Large-scale bank erosion would result in a widening of the channel and piles of sediment at the mouth of the channel (upper edge of the reed canarygrass field), neither of which were observed.

Quamichan Lake discharges into Quamichan Creek which, in turn, flows into Somenos Creek, immediately upstream of the Cowichan River.

## *Precipitation*

Precipitation in the Lake Quamichan Lake area is greatest between November and January and typically falls as rain. The drier period historically occurs between April to October. Summer temperatures average 18°C in summer and a mild 3°C in winter.

## *Climate Patterns*

As our climate warms, over the next 2-3 decades, climate modelling predicts the Cowichan Valley region can expect more than a doubling in the number of summer days above 25°C, from an average of 16 days per year to 39 days per year. The 1-in-20 hottest temperature is projected to increase from 33°C to 37°C by the 2050s.

A modest 5% increase in annual precipitation is projected in our region by the 2050s. Projections indicate that fall will see the greatest increase in precipitation. This precipitation is expected during increasingly extreme events, with about 30% more precipitation on very wet days (95$^{th}$ percentile wettest days' indicator) and 65% more on extremely wet days (99$^{th}$ percentile wettest

days' indicator). Despite the projected increased intensity of wet events, the amount of rain in summer is expected to decrease by 17%, and the duration of dry spells will be lengthened by about 20%, from 22 consecutive days to 26 days (Pacific Climate Impacts Consortium (PCIC) at UVic published a 2017 report on Climate Projections for the Cowichan Valley Regional District).

According to Environment Canada (EC) the recent dry summer, on the southeast coast of Vancouver Island (CRD and CVRD), is officially the driest 90-day period since records began to be kept in 1898 (EC noted that the period of no-rain was 106 days).

In summary, the predictions are for warmer temperatures, longer dry spells in summer months, more intense precipitation in fall, winter and spring, a decrease in snowpack and more intense or extreme events. As drier summer periods increase there will be a similar increase in the Forest Fire Risk period. Stream low flow periods, or periods of no open water in streams and shallow wetlands/ponds, will likely also increase in duration, reflecting groundwater levels.

# 5. Study Area and Fisheries Resources

The subject property is 0.461 hectares in size and is located within the Quamichan Lake watershed, at the southeast corner of the lake. The lake drains into Quamichan Creek which, in turn, flows into Somenos Creek, immediately upstream of the Cowichan River.

The historical land uses of the area have been logging and agriculture. The subject property itself has been historically cleared (Figure 2 and Figure 3). There are residential and agricultural land uses on the properties surrounding the lake. Over the past three decades, lands around the lake and on adjacent hillsides have been converted to residential development. The proposed development would provide a small carriage house on an existing residential property.

Quamichan Lake provides habitat for numerous fish species. According to the Freshwater Fisheries Society of BC, the lake is stocked with Coastal Cutthroat Trout (*Oncorhynchus clarkii*) and Rainbow Trout (*Oncorhynchus mykiss*) and it is also home to the following fish species: Prickly Sculpin (*Cottus asper*), Threespine Stickleback (*Gasterosteus aculeatus*), Brown Bullheads (catfish) (*Ameiurus nebulosus*), and Coho Salmon (*Oncorhynchus kisutch*).

# 6. Figures

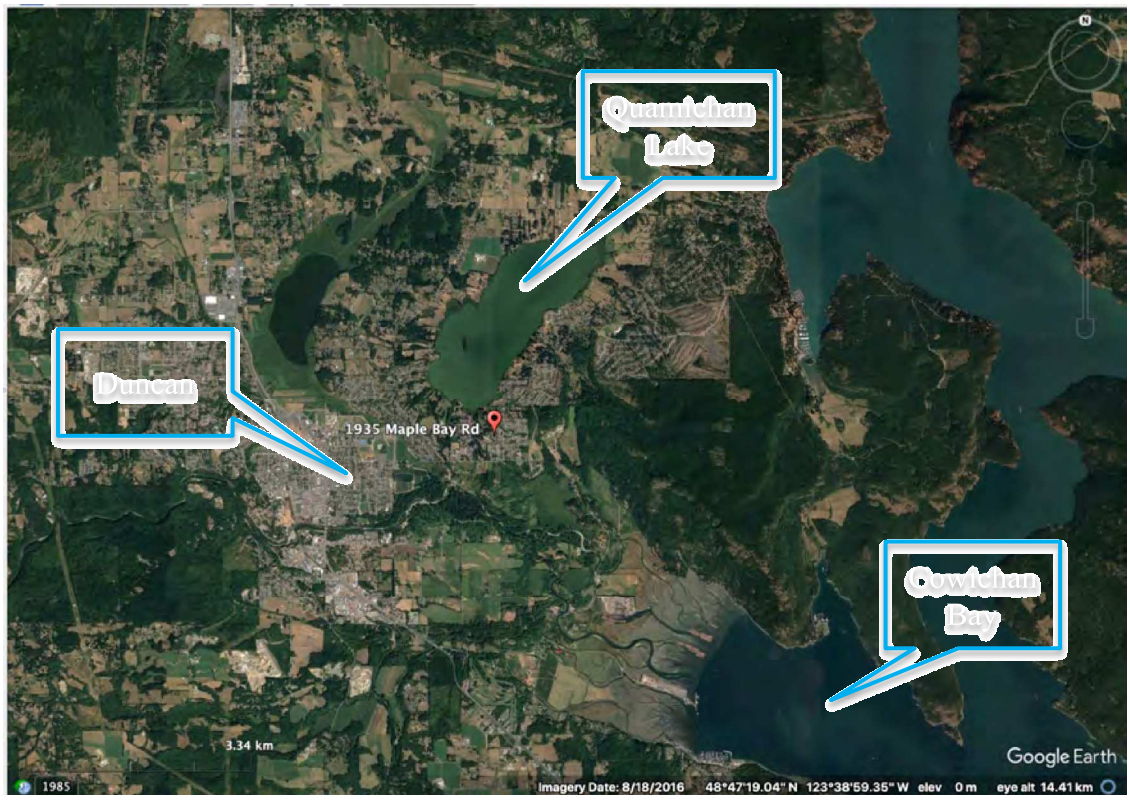


Figure 1. Map of the Southern Vancouver Island with watershed landmarks in relation to the subject property (red dot). Quamichan Lake flows into Cowichan Bay via the Cowichan River.


Figure 2. Subject property (approximate property boundary outlined in red). Imagery date: 2016.

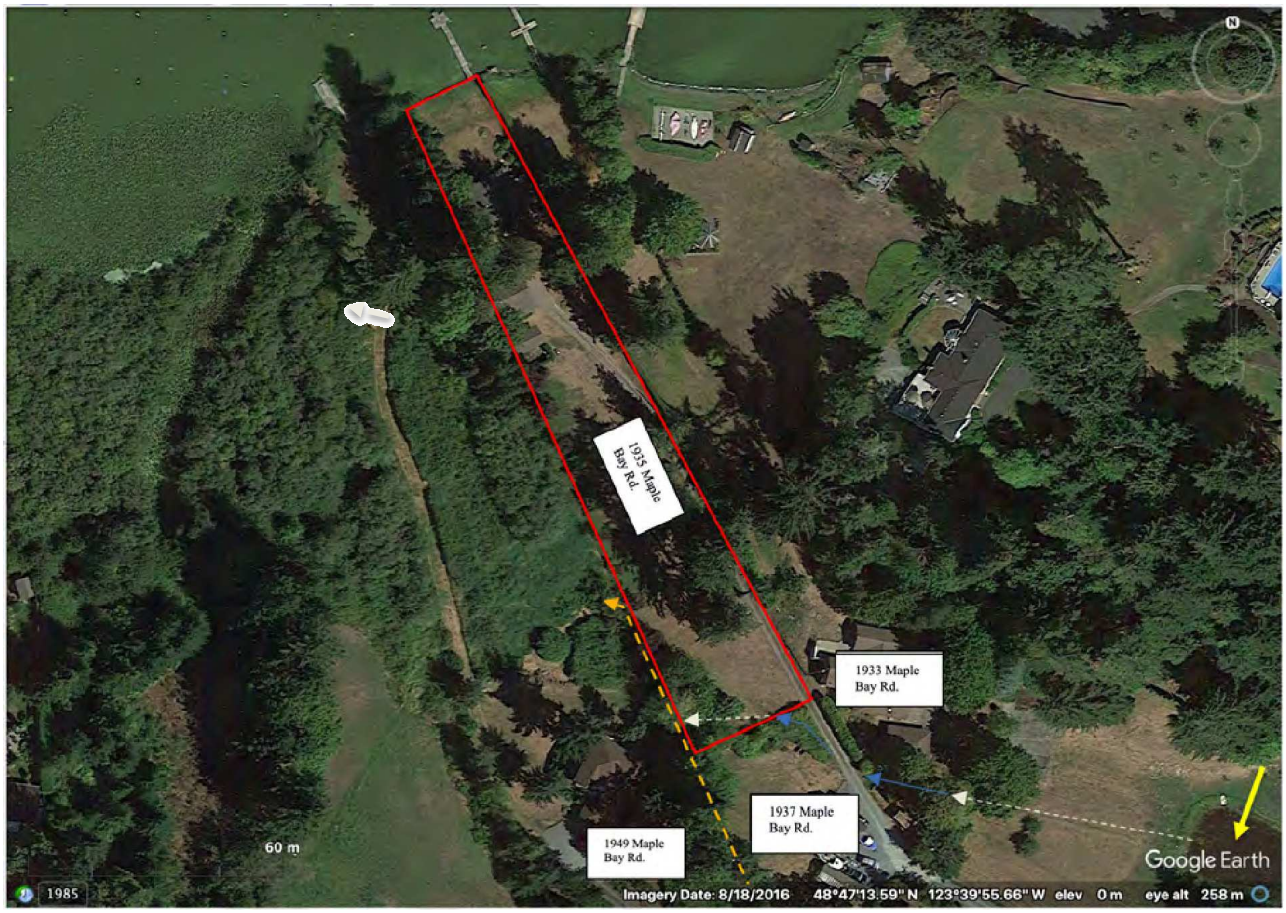


Figure 3. Close-up of subject property (approximate property boundary outlined in red). Note the small pond in the southeast corner of the adjacent property (yellow arrow); this feature is classified as an isolated wetland on municipal drainage maps (Figure 7). The dashed grey lines are historic buried culverts; the solid blue lines are open segments of stream channels. The dashed orange line is a municipal stormwater drainage ditch (Figure 5) constructed between 1974 and 1978; supplemental modifications occurred in 1988. The stream flows into the drainage ditch, with the latter flowing into a wetland (Figure 4). The outflow from the wetland crosses under a footpath (solid grey arrow) into a wetland/flood plain (Figure 6) which drains into Quamichan Lake. The 30m RAA for the drainage ditch in shown in Figure 7. Imagery date: 2016.

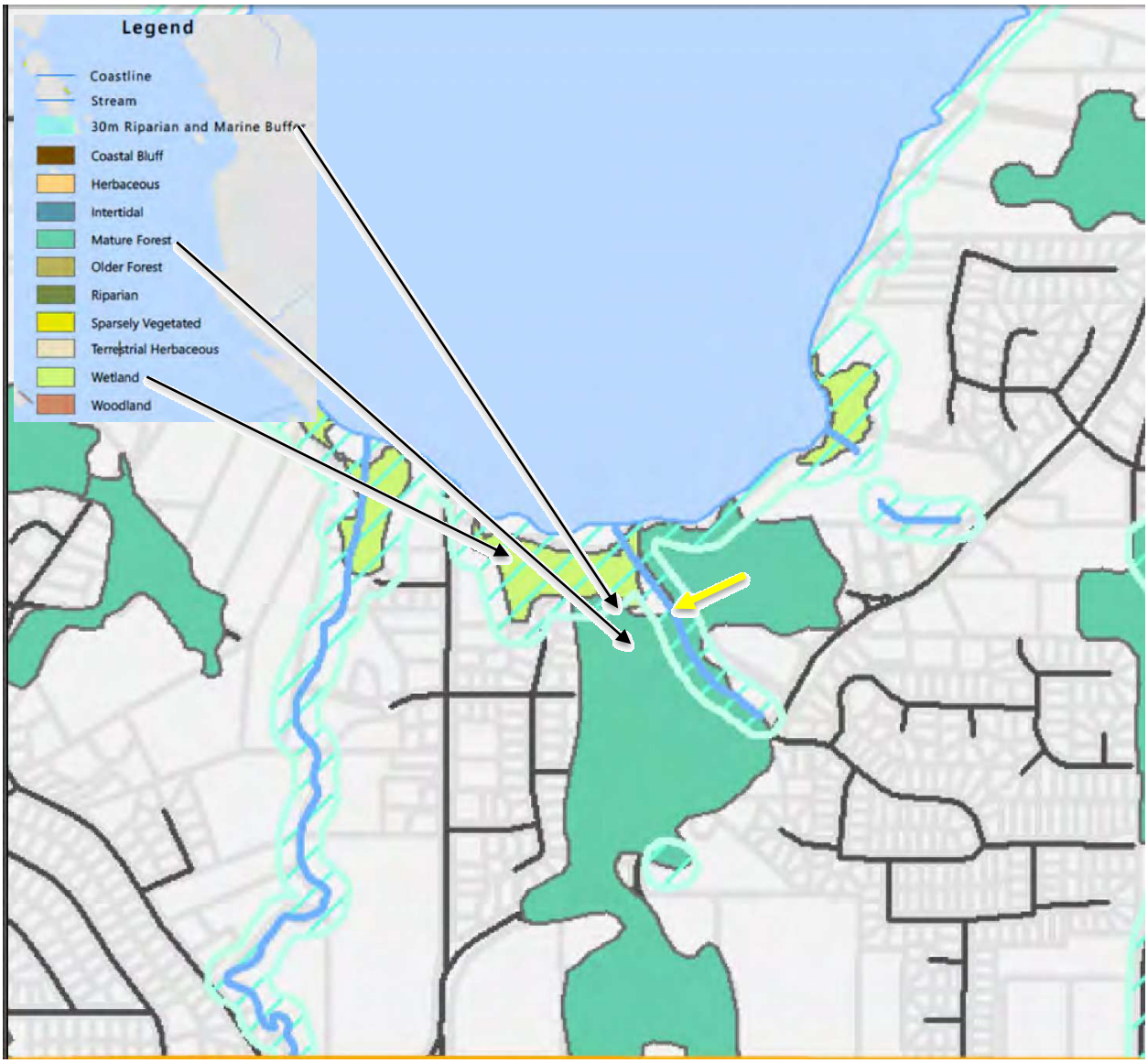


Figure 4. Municipality of North Cowichan Environmentally Sensitive Areas, Map 4, (April 6, 2022). The yellow arrow indicates the municipal drainage ditch; the light green hatched area indicates the 30m Riparian Assessment Area (RAA). This drainage ditch routes stormwater runoff into a wetland (light solid green) and into Quamichan Lake. Note that the Mature Forest designation associated with the subject property consists of a few conifers (Figure 3). Legend alignments shown are approximate.

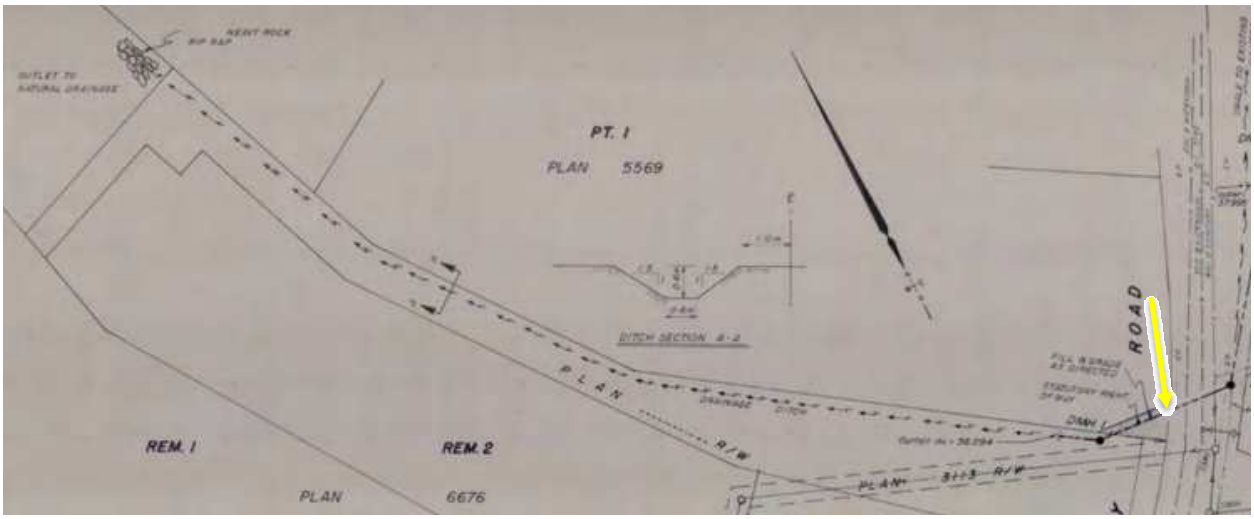

Figure 5. Site map (date unknown) showing the SRW and alignment of the drainage works (ditch), as well as the cross section. Note the culvert under Maple Bay Road (yellow arrow). The drainage flows end in a small rock pile to dissipate potential scouring energy. This rock pile has become a dense field of reed canarygrass, which in turn flows into a wetland. This drawing was supplied by the Engineering staff of the Municipality of North Cowichan.

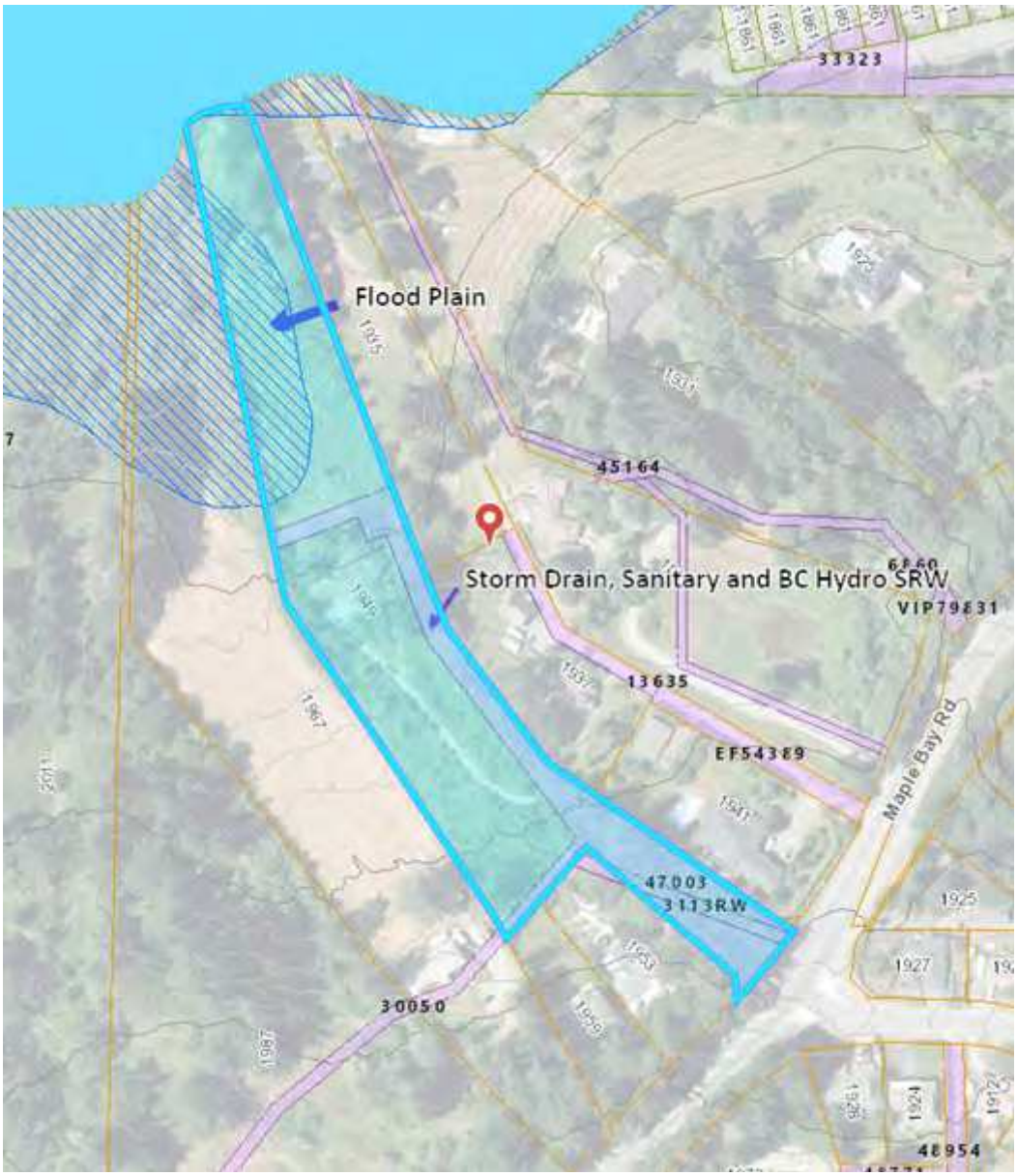

Figure 6. Municipal map of area showing the SRW (shaded blue) within which are contained the municipal storm drain, sanitary sewer, and BC Hydro power pole alignment. The floodplain limit for Quamichan Lake is also shown. 1935 Maple Bay Rd is marked with a red dot on the south property line. Map from Municipality of North Cowichan files.

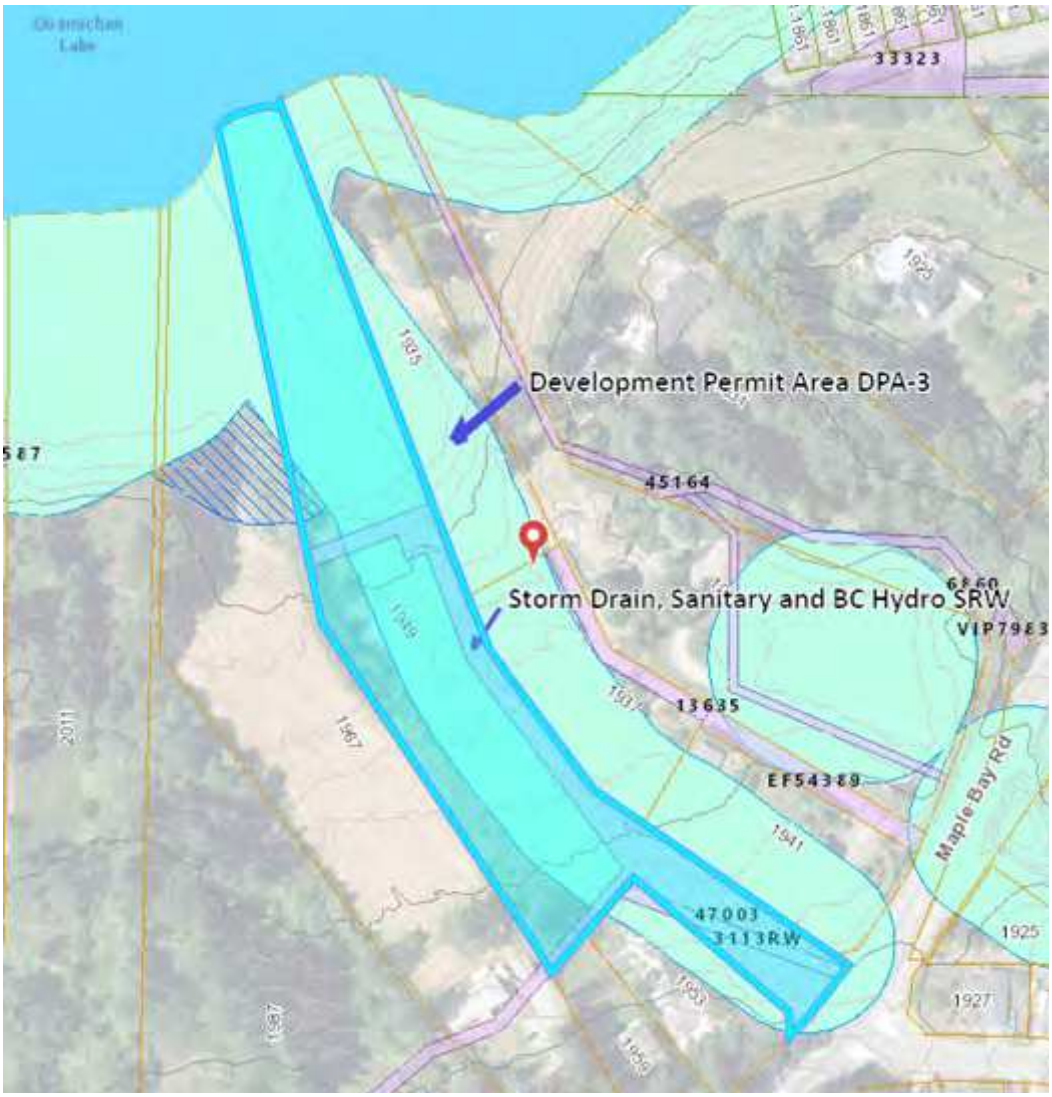


Figure 7. Municipal map of area showing the SRW (shaded blue). The Development Permit Area (DPA-3) associated with the drainage ditch's 30m RAA (light green polygon) is shown. The RAA for the wetland/pond on 1933 Maple Bay Road is marked as a green circle. The connecting culverts and open stream channels are not marked or included in the RAAs. The small RAA zone on the south side of Maple Bay Road is **not** connected by a culvert, under the road, to the wetland RAA on the north side. Maple Bay Road has two catch basins on the south side of the road, in the bottom of the dip in the road, which drain onto the rock ballast of the road, via twin small diameter pipes. The catchment for these twin catch basins is the south side of the road, a distance of ~30m. Map from Municipality of North Cowichan files.

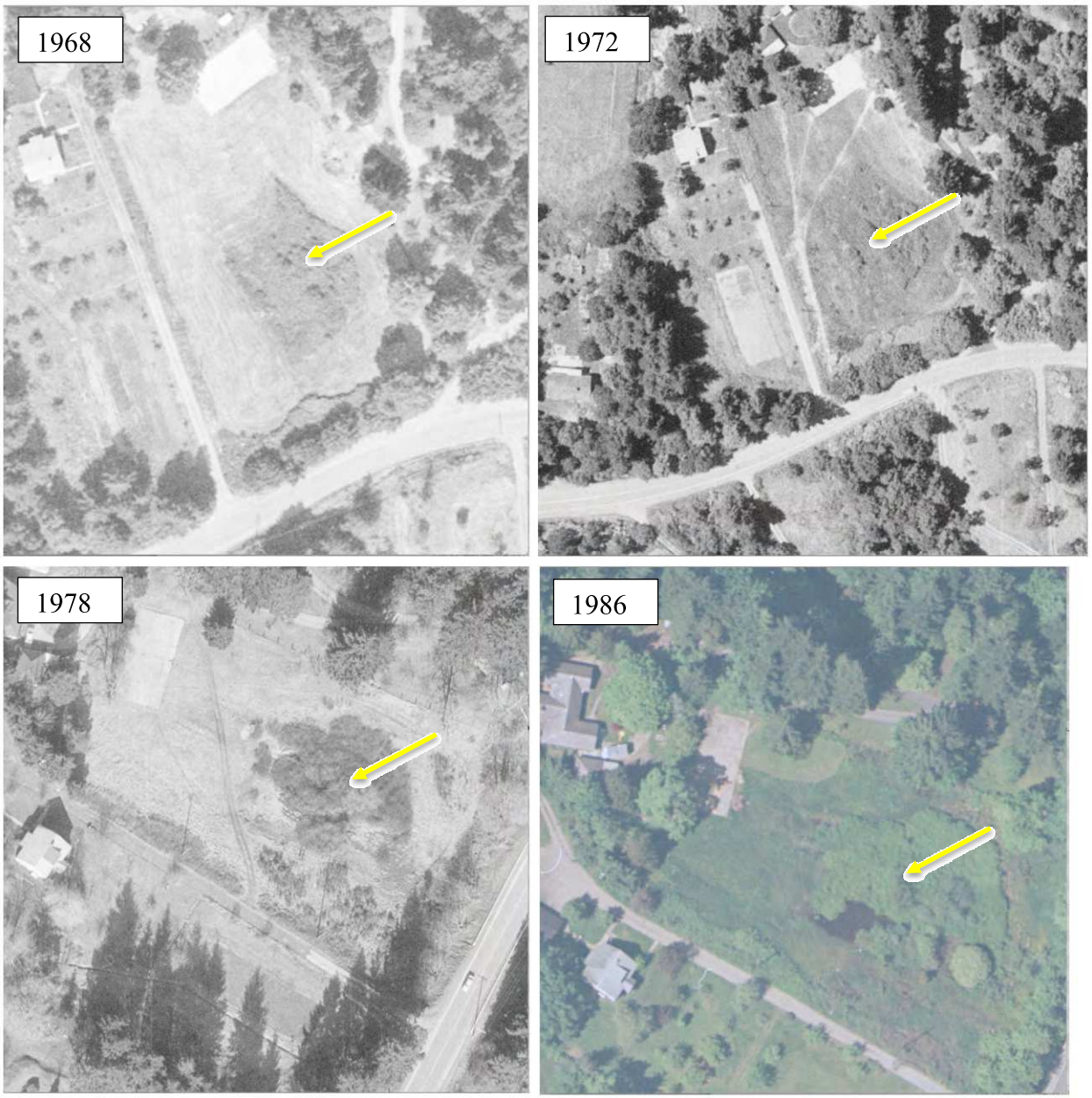


Figure 8. Air photographs showing the isolated wetland (no surface stream channel or pond; 1968 – 1978) and the wetland with a dug pond (1986), with no surface stream channel. Note no surface outlet channel is visible in any of the images. Compare this image with Figure 2 and Figure 3, in which the current pond has no trees surrounding the pond's edge. The date at which the headwall and culvert were installed to convey pond runoff across the three properties (Figure 3) is not known. NB. Air Photograph Index #s: 1968 = bc7076_200_12n; 1972 = bc7399_091_12n; 1978 = bc78002_107_12n; 1986 = bcc394_135_12n.

# 7. Methods

A Riparian Areas Protection Regulation (RAPR) Assessment Report is specified in the Municipality of North Cowichan's OCP and Development Permit Area 3 (Watercourses, streams, and wetlands) (Figure 4). A detailed assessment was conducted for the watercourses (streams and wetlands) located on, or within 30 m of, the subject property, per standard RAPR methods outlined in the Technical Manual (November 2019; V. 1.1). For the stream / ditches, bankfull widths were measured and flagged with irrigation flags on both banks. For the wetland, the HWM downstream of the mouth of the ditch was identified by the surveyor, based upon a riparian plant edge (consisting of sedges), which extended ~1m onto a turf lawn on the subject property (Figure 30 and Figure 31). The drainage ditch located on 1949 Maple Bay Road was assessed from the mouth (north end) to the culvert under Maple By Road.

Slopes were measured periodically along the channel using a clinometer. The riparian vegetation was noted for both watercourses/wetlands. The SPEAs were calculated using the RAPR Technical Manual and RAPR forms (see Section 8). The property was walked on numerous occasions, with the detailed RAPR field assessment conducted on November 30, 2022. There is no discernible stream channel within the reed canary grass field, nor within the shrub canopy downstream of the reed canary field. Runoff flows as sheet flow through the canary grass and shrub areas, with a small culvert under a path leading to the lake, draining northwest into the wetland on the northwest portion of the property at 1949 Maple Bay Road. Drainage through this wetland zone was walked on a number of occasions to verify connections to the lake, confirming the drainage was connected to fisheries habitat. Surveying was conducted by G.W. Lindberg Land Surveyors Inc.

# 8. Field Assessment

The property has two watercourses subject to the RAPR – a municipal drainage ditch (Figure 4) and a manmade stream (Figure 3). The aquatic landscape features were reviewed in the context of a set of high resolution historical air photos: 1968, 1972, 1974, 1975, 1978, 1986, as well as Google Earth images. The municipal drainage ditch lies on the adjacent property to the west (1949 Maple Bay Road, within a SRW; Figure 5); the stream begins on the adjacent property to the east (1935 Maple Bay Road), in a small wetland/pond; the discharge from the pond crosses a number of properties, largely through historic culverts, until it discharges into the drainage ditch, noted above (Figure 3). The stream on the subject property lies entirely within a culvert. The wetland was largely replaced with a dug pond between 1978 and 1986 (based on the air photo review, Figure 8). The latter figure shows that there was no surface outlet channel dug to drain the wetland; it is not known if there was an historical culvert installed to drain the wetland, though the visible presence of dense vegetation in the historical air photographs suggests that was not the case, *i.e.*, there was adequate soil moisture to maintain wetland plants. Drainage culverts were typically installed to drain such depressional wetlands to permit early crop seeding; the presence of the wetland vegetation suggests this area was not put under crop production in recent decades or historical drainage had become non-functional. The wetland/pond did not appear to flood on a frequent basis given there is no visible outlet channel in the air photographs. The present culvert headwall's invert lies

well below the wetland/pond bankfull elevation, ensuring rising pond levels would drain before the pond's water would flood the adjacent turf lawn (Figure 11 and Figure 12).

### Vegetation

The drainage ditch riparian vegetation on the east bank is dominated by turf lawn, with a non-native ornamental cedar hedge downstream of the culvert under Maple Bay Road; Himalayan blackberry (*Rubus armeniacus*) is invading the cedar hedge. A few ornamental conifers have been planted in small clusters or as a short hedge.

On the west bank of the ditch includes there is a mixed conifer/deciduous tree canopy, with a shrub understory. The trees include Douglas fir (*Pseudotsuga menziesii*), English Hawthorn (*Crataegus laevigata*), Garry oak (*Quercus garryana*), red alder (*Alnus rubra*), and western redcedar (*Thuja plicata*); these trees are in small clusters or are singletons. The shrub understory is dominated by blackberry; mixed in with the blackberry are salal (*Gaultheria shallon*), sword ferns (*Polystichum munitum*), Pacific nine-bark (*Physocarpus capitatus*), salal (*Gaulthoria shallon*), Pacific dogwood (*Cornus nuttallii*), snowberry (*Symphoricarpos albus*), June plum (*Oemleria cerasiformis*), and sword fern (*Polystichum munitum*). In the lower western section of the reach, turf lawn grows to the edge of the channel.

The stream channel on the adjacent property has a hedge of a non-native shrubs within which Himalayan blackberry (*Rubus armeniacus*) is invading the hedge; the base of the hedge has agronomic grasses, sword fern (*Polystichum munitum*), and few red alders (*Alnus rubra*) adjacent to the property boundary. The vegetation on the subject property, associated with the small SPEA, consists of turf lawn, adjacent to the private driveway.

The ditch discharges into a dense field of reed canary grass (*Phalaris arundinacea*), the eastern edge of which has a border of sedges (*Carex spp.*); at the base of the slope the reed canary grass gives way to a hardhack (*Spirea douglasii*)/blackberry thicket, with Douglas firs, big leaf maple (*Acer macrophyllum*), and a few western redcedars forming a canopy adjacent to the lake. The reed canarygrass has formed a dense, persistent sod layer that has no discernible channels within the sod. The dense sod functions to trap sediment and slows the flow of water by converting the channelized flow in the ditch into a sheet flow, thereby preventing scouring velocities. Downstream of the reed canarygrass field, the runoff flows through the shrub understory as sheet flow; a small CSP culvert, under the path (Figure 3) connects the two wetland sections.

# 9. Results of Riparian Assessment (SPEA Width)

Refer to Section 3 of Technical Manual

Date: November 30, 2022

| Description of Water bodies involved (number, type) | Stream 1 |
|---|---|
| Stream | X |
| Wetland | |
| Lake | |
| Ditch | |
| Number of reaches | 1 |
| Reach # | 1 |

**Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)**

| | Channel Width(m) | | Gradient (%) |
|---|---|---|---|
| starting point | | | |
| upstream | | | |
| | | | |
| | | | |
| | 0.75 | | |
| downstream | 0.75 | | 4.4 |
| | 0.75 | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Total: minus high /low | 2.25 | | |
| mean | 0.75 | | 4.4 |
| | R/P | C/P | S/P |
| Channel Type | | X | |

I, Wm. Patrick Lucey, R.P. Bio., hereby certify that:

a) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;
c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

**Site Potential Vegetation Type (SPVT)**

| | Yes | No | |
|---|---|---|---|
| SPVT Polygons | | X | Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes |

I, Wm. Patrick Lucey, R.P. Bio, hereby certify that:

a) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;
c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

| Polygon No: | 1 | | |
|---|---|---|---|
| | LC | SH | TR |
| SPVT Type | | | X |

Method employed if other than TR

| Polygon No: | | | |
|---|---|---|---|
| | LC | SH | TR |
| SPVT Type | | | |

Method employed if other than TR

| Polygon No: | | | |
|---|---|---|---|
| SPVT Type | | | |

Method employed if other than TR

## Zone of Sensitivity (ZOS) and resultant SPEA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | 1 | If two sides of a stream involved, each side is a separate segment. For all water bodies, multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | 10.0 | | | | | | | |
| Litter fall and insect drop ZOS (m) | 10.0 | | | | | | | |
| Shade ZOS (m) max | 4.8 | South bank | Yes | X | No | | | |
| Ditch | Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow) | | | | | | | |
| Ditch Fish Bearing | | | No | | If non-fish bearing insert no fish bearing status report | | | |
| **SPEA maximum** | **10.0 m** | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

I, Wm. Patrick Lucey, R.P. Bio , hereby certify that:

a) I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew ;
c) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
d) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

## Comments

- This channel is on the adjacent property but was assessed since the SPEA falls on to the subject property.
- The open stream channel on the adjacent property to the south (1937 Maple Bay Rd) is ~17m in length. It lies upstream of the culvert on the subject property. The stream channel was recently daylighted as the buried, wood stave culvert had decomposed and become filled with sediment (rain event of November 2021).
- Given the very short length, only 3 cross sections of channel were obtained and the average taken; the highest and lowest measurements were not excluded.
- The only other open section of stream channel is on 1933 Maple Bay Road. This section was not measured; however, it appeared from visual assessment that the channel's cross section was similar to the short reach on 1937 Maple Bay Road. Since the stream width was similar on both properties an average channel width of 0.75m was adopted. The average channel width would result in a minimum SPEA of 10m.

- The bankfull measurement was made at the mid-point of the dug channel, given this height was equivalent to the top of the culverts at either end of the short channel length. This short open channel length, lying between two culverts, would function as a ditch cross section, such that the channel would not be able to fill to the top-of-bank, as flows through the channel would be conveyed uninterrupted through the downstream culvert. As noted in Section 8 there is a very small catchment draining into the headwater wetland/pond and there is no evidence of significant flooding events associated with the landscape downslope of the wetland/pond, based upon air photos.
- There is a small manmade pond on the adjacent property to the east (1933 Maple Bay Rd). The MNC classifies the pond as a wetland. This pond was historically an isolated wetland; no discernible stream channel draining the wetland was observable in Provincial air photographs.
- The pond is not connected to the catchment south of Maple Bay Road. The MNC maps show a small, isolated wetland south of Maple Bay Road. An examination of the base of Maple Bay Road, on both sides of the toe-of-slope did not reveal any culverts under the road, indicating the isolated wetland on the south is not directly connected to the pond. It appears to be ponded road drainage with no outlet. There is no stream channel south of the isolated wetland.
- The majority of the stream channel leaving the pond has been buried for a significant period of time, as the section recently uncovered on 1937 Maple Bay Road has the remnants of a wood stave culvert with only the steel ring bands visible.
- The wood stave culvert on 1937 Maple Bay Road had failed (it had decomposed) and the owner dug an open trench to convey periodic flow from the pond.
- The Site Plan shows the ZOSs and SPEA associated with this stream that falls onto the subject property (1935 Maple Bay Road). ZOSs and the SPEA on adjacent properties are not shown.
- No SPEA is applied to the culverted section of drainage channel on the subject property (1935 Maple Bay Road).

| | |
|---|---|
| Date: | November 30, 2022 |
| Description of Water bodies involved (number, type) | Ditch 1 |

| | |
|---|---|
| Stream | |
| Wetland | |
| Lake | |
| Ditch | X |
| Number of reaches | 1 |
| Reach # | 1 |

**Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)**

| | Channel Width(m) | Gradient (%) |
|---|---|---|
| starting point | 0.6 | |
| upstream | ~~0.45~~ | |
| | 0.7 | |
| | 0.7 | |
| | 0.8 | |
| downstream | 0.85 | |
| | ~~1.7~~ | |
| | 1.0 | |
| | 0.7 | |
| | 0.8 | |
| | 0.6 | |
| Total: minus high /low | 6.75 | |
| mean | 0.75 | |

| | R/P | C/P | S/P |
|---|---|---|---|
| Channel Type | | | |

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h) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

**Site Potential Vegetation Type (SPVT)**

| | Yes | No | |
|---|---|---|---|
| SPVT Polygons | | X | Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes |

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| | | LC | SH | TR | Method employed if other than TR |
|---|---|---|---|---|---|
| Polygon No: | 1 | | | | |
| SPVT Type | | | | X | |
| Polygon No: | | | | | |
| SPVT Type | | | | | |
| Polygon No: | | | | | |
| SPVT Type | | | | | |

## Zone of Sensitivity (ZOS) and resultant SPEA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | 1 | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | 5.0 | | | | | | | |
| Litter fall and insect drop ZOS (m) | 5.0 | | | | | | | |
| Shade ZOS (m) max | 5.0 | South bank | Yes | | No | X | | |
| Ditch | Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow) | | | | | | | |
| Ditch Fish Bearing | Yes | X | No | | If non-fish bearing insert no fish bearing status report | | | |
| **SPEA maximum** | **5.0 m** | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

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## Comments

- The ditch a.k.a. “drainage works” as defined by the Water Sustainability Act was constructed between 1974 and 1978 to drain surface stormwater runoff from a development south of Maple Bay Road to Quamichan Lake (WSR s.31 – s.34).
- Michele Gill, AScT (Manager, Development, Engineering Services, MNC) provided information on the history of the drainage ditch. It appears from our air photograph review that supplemental drainage works were constructed in 1988, which appear to have realigned the channel when the original property was subdivided.
- In concert with the municipality, the developer of the original subdivision (early 1970s) purchased an SRW on 1949 Maple Bay Road within which to construct drainage works.
- There are no headwater features in the catchment that drain into the drainage ditch.
- The SRW is identified in VIP47003 for sanitary sewer and storm drainage. While the drainage is manmade it has been identified as a riparian area (Figure 4 and Figure 7).

- The drainage ditch begins at the outlet of a culvert under Maple Bay Road and ends at the top of a gentle slope before it flows through a field of reed canarygrass toward the lake (Figure 5). The reed canarygrass provides a thick filtering bed, within which sediment is trapped and channel flows become sheet flows across the canarygrass field.
- The SRW lies along the east property border on 1949 Maple Bay Road; the lower section of the ditch lies beside 1935 Maple Bay Road; the two properties share a 5m SPEA.
- The ditch discharges into the reed canary grass (see Stream 1 Comments above).
- The ditch has a number of small weirs that create a step-pool configuration within the narrow channel (avg gradient 9.7%).
- The west riparian zone is vegetated with patches of conifers and a shrub understory, dominated in sections with Himalayan blackberry.
- Given the low flow volumes in the channel, there is only minor scouring occurring in short sections of the channel; minor bank instabilities occur where the bank is vertical, predominantly on the east side.
- The east side of the channel has broad sections of turf lawn up to the top-of-bank.

| | |
|---|---|
| Date: | November 30, 2022 |

| | |
|---|---|
| Description of Water bodies involved (number, type) | Wetland 1 |

| | |
|---|---|
| Stream | |
| Wetland | X |
| Lake | |
| Ditch | |
| Number of reaches | 1 |
| Reach # | 1 |

**Channel width and slope and Channel Type (use only if water body is a stream or a ditch, and only provide widths if a ditch)**

| | Channel Width(m) | Gradient (%) |
|---|---|---|
| starting point | | |
| upstream | | |
| | | |
| | | |
| | | |
| downstream | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Total: minus high /low | | |
| mean | | |

| | R/P | C/P | S/P |
|---|---|---|---|
| Channel Type | | | |

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k) I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and
l) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

**Site Potential Vegetation Type (SPVT)**

| | Yes | No | |
|---|---|---|---|
| SPVT Polygons | | X | Tick yes only if multiple polygons, if No then fill in one set of SPVT data boxes |

I, Wm. Patrick Lucey, R.P. Bio, hereby certify that:
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l) In carrying out my assessment of the development proposal, I have followed the technical manual to the Riparian Areas Protection Regulation.

| | | | | |
|---|---|---|---|---|
| Polygon No: | 1 | | | Method employed if other than TR |
| | LC | SH | TR | |
| SPVT Type | | | X | |

| | | | | |
|---|---|---|---|---|
| Polygon No: | | | | Method employed if other than TR |
| | LC | SH | TR | |
| SPVT Type | | | | |

| | | | | |
|---|---|---|---|---|
| Polygon No: | | | | Method employed if other than TR |
| SPVT Type | | | | |

**Zone of Sensitivity (ZOS) and resultant SPEA**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | 1 | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | 15.0 | | | | | | | |
| Litter fall and insect drop ZOS (m) | 15.0 | | | | | | | |
| Shade ZOS (m) max | 30.0 | South bank | Yes | | No | X | | |
| Ditch | Justification description for classifying as a ditch (manmade, no significant headwaters or springs, seasonal flow) | | | | | | | |
| Ditch Fish Bearing | Yes | | No | | If non-fish bearing insert no fish bearing status report | | | |
| **SPEA maximum** | **15.0** | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Segment No: | | If two sides of a stream involved, each side is a separate segment. For all water bodies multiple segments occur where there are multiple SPVT polygons | | | | | | |
| LWD, Bank and Channel Stability ZOS (m) | | | | | | | | |
| Litter fall and insect drop ZOS (m) | | | | | | | | |
| Shade ZOS (m) max | | South bank | Yes | | No | | | |
| **SPEA maximum** | | (For ditch use table3-7) | | | | | | |

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**Comments**

- Wetland is man-made and lies to the west of the subject property
- 15 m SPEA extends on to the subject property
- 30 m shade ZOS does not extend on to the subject property
- Vegetation consists of primarily of reed canarygrass, blackberry, and willow

# 10. Site Plan

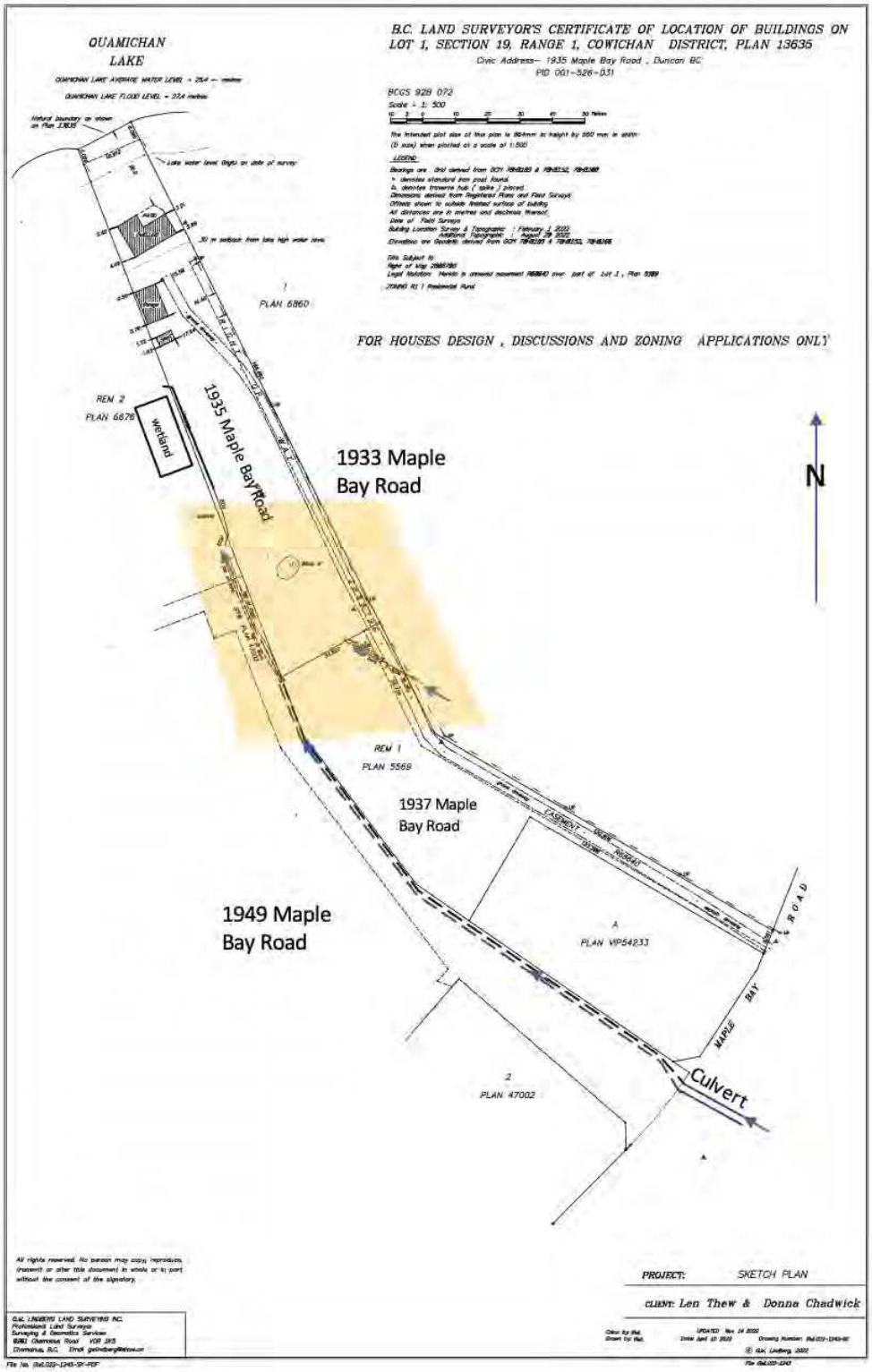


Figure 9. Area wide site plan showing 1935 Maple Bay Road, as well as adjacent properties. The SRW containing the drainage ditch works is shown beginning at the culvert under Maple Bay Road (blue arrows indicate flow direction). The light orange area is shown in greater detail in Figure 10.

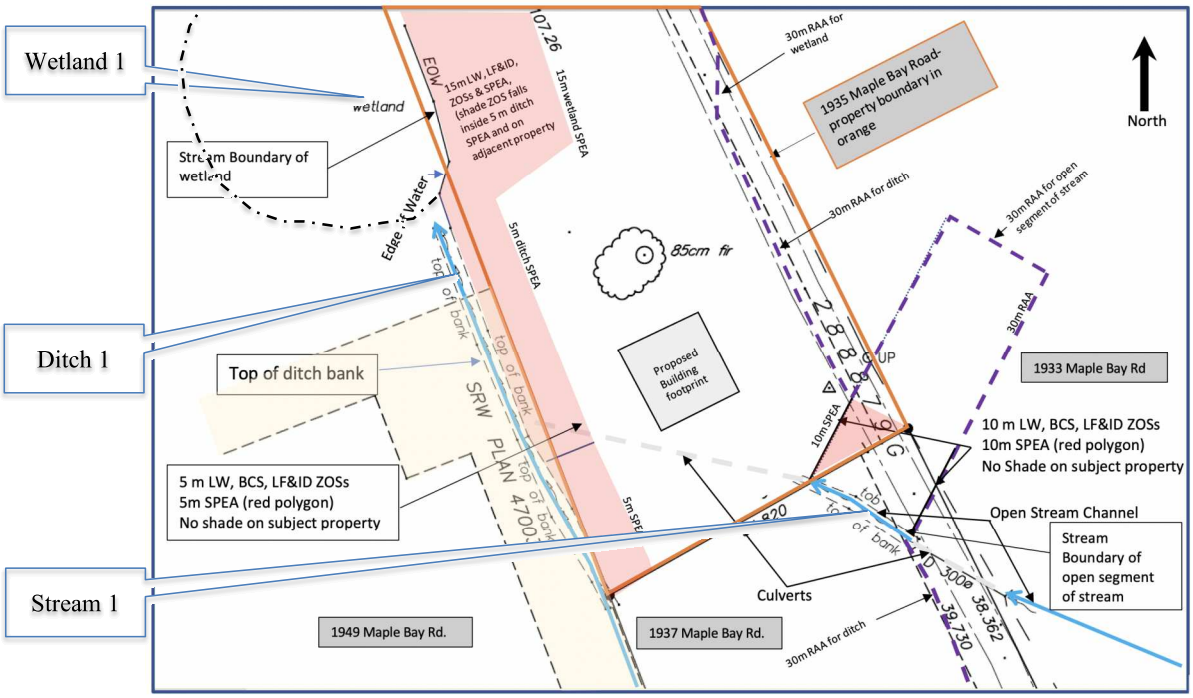


Figure 10. Close-up of Site Plan showing the manmade drainage ditch (blue line within the SRW PLAN 47003) on the adjacent property (1949 Maple Bay Road) flowing into the wetland; the small open stream channel flowing across adjacent properties (1933 and 1937 Maple Bay Rd.) which crosses the subject property in a buried culvert (dashed grey line). There is a small SPEA associated with the short segment of open stream channel (light red polygon), as well as a SPEA associated with the wetland north of the drainage ditch. The SRW is shown shaded in light yellow. RAAs are shown in dark purple dashed lines. Open water (ditch and stream) shown in solid blue. Subject property boundary in orange.

# 11. Measures to Protect and Maintain the SPEA

| 1. Danger Trees |
|---|
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 2. Windthrow |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 3. Slope Stability |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 4. Protection of Trees |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 5. Encroachment |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer, Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 6. Sediment and Erosion Control |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 7. Stormwater Management |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |
| 8. Floodplain Concerns (highly mobile channel) |
| I, Wm. Patrick Lucey, R.P.Bio., hereby certify that:<br>a. I am a qualified environmental professional, as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;<br>b. I am qualified to carry out this part of the assessment of the development proposal made by the developer Len Thew;<br>c. I have carried out an assessment of the development proposal and my assessment is set out in this Assessment Report; and in carrying out my assessment of the development proposal, I have followed the assessment methods set out in the Minister's technical manual to the Riparian Areas Protection Regulation. |

## *Measures – Danger Trees in the SPEA*

The proposed building site has largely been cleared.

- No danger trees have been identified.

## *Measures – Windthrow*

The proposed building site has historically been cleared. Most of the trees on the site had been historically logged by previous owners, leaving a few second growth conifers, red alder, and big leaf maples present.

- There are no windthrow concerns identified.

## *Measures – Slope Stability*

The majority of the property gently slopes to the north towards the lake (Figure 7).

- There are no steep slope concerns on the subject property.

## *Measures – Protection of Trees in the SPEA*

As mentioned previously, the proposed building site has been historically cleared, with a few individual trees located down slope of the building footprint (Figure 3 and Figure 10). These trees are to remain. Riparian vegetation within the adjacent SPEAs consists of shrubs and low grass cover, which will remain untouched.

The vegetation within the SPEA will be fenced off during construction, the fence shall have signs every 5m to indicate this is a Tree/Riparian Vegetation Protection Management Zone, and silt fencing shall be required to be installed, parallel to, and along the edge of the existing vegetation, to prevent turbid / sediment transport into the SPEA. Monitoring of the security fencing and silt fence shall be conducted to ensure these structures are functional. Repairs shall be made as required to maintain their functional condition, until all construction and landscaping is completed to the satisfaction of the local municipal government (Planning and/or Engineering).

## *Measures – Preventing Encroachment in the SPEA*

During construction, all SPEAs will be delineated with orange snow fencing and signage as a visual reminder not to stockpile materials or trample tree roots or vegetation within the SPEA on adjacent Special Measures landscapes

Signage every 5 metres on the orange snow fencing will indicate the SPEA and that it is a non-disturbance management zone. Signage shall be printed using weather proof materials.

## *Measures – Sediment and Erosion Control During Construction*

Measures that shall be implemented prior to any soil disturbing activities or construction shall include:

- Sediment control measures will be implemented on-site to prevent turbid runoff flowing into the drainage ditch on the adjacent property, and into the short open stream channel south of the subject property. Tips on installing silt fences properly are included in Appendix 2.
- A clean and organized work area will be maintained.

- Construction workers shall not wash fresh concrete mortar into any areas that could drain to the stream, drainage ditch, or wetland. Wash water must be contained and pumped out for proper disposal. **Concrete and concrete wash water is HIGHLY TOXIC and must never be permitted to enter freshwater habitat**.
- When using exposed aggregate (if applicable), fines will be washed to the side, away from the SPEAs, or into a sediment basin.
- When building construction of residential dwelling commences, paints, solvents, chemicals, waste containers, and soiled rags must be kept contained and covered.
- Residue such as paint chips must be kept from entering puddles that could be washed to the stream, wetland, or riparian zone.

## *Measures – Stormwater Management*

The project Contractor shall provide a stormwater management plan for the proposed dwelling and small parking area; the Contractor may have a QEP prepare the stormwater management plan. The stormwater management plan shall be included in the DP application submitted to the Municipality of North Cowichan.

- The stormwater management plan shall be designed to meet the standards prescribed by the municipality.

## *Measures – Floodplain Concerns*

There are no floodplain concerns on the property.

# 12. Environmental Monitoring

## Site inspections

Field monitoring should occur prior to any site disturbance to confirm preparatory SPEA protection measures are in place. Photopoint Monitoring photographs should be taken to provide a complete overview of site construction activities, in addition to specific areas of interest (*e.g.* water clarity in the stream and wetland), during construction. The frequency of site inspections / monitoring shall be weekly or at the discretion of the QEP.

## Actions Required & Monitoring Schedule

During construction, monitoring will take place weekly to ensure that the worksite is kept clean, that the SPEA remains well-marked, and that no encroachment into the SPEA occurs (RAPR Section 18(2)(i)). Additional monitoring should be conducted during adverse weather events that have the potential to effect changes on the property that could potentially pose a threat or risk to the health of the riparian plant community or the receiving environments. We recommend using Photopoint Monitoring: marking camera locations and taking a baseline set of photographs prior to construction (Appendix 3).

In addition to Photopoint Monitoring, which may be conducted by the homeowner / building Contractor, if specified and supervised by the QEP, the site should be inspected prior to the initiation of construction (pre-construction meeting on-site with homeowner and contractor) and then periodically at a scheduling frequency determined by the QEP.

## Communications Plan

Prior to any construction site disturbance, SPEAs shall be fenced and marked in the field. Signage should be erected clearly marking the SPEA as a “no-go” zone during any soil disturbing activities (*i.e.* grading, excavation). A QEP, or an engineer, shall provide an Erosion & Sediment Control and Pollution Prevention Plan, together with an effectiveness Monitoring Plan, as well as measures to prevent sediment-laden, turbid runoff from flowing across bare soils and into the drainage ditch, stream, and wetland. A final report shall be prepared by the engineer, or QEP, verifying construction activities proceeded as prescribed in the Erosion & Sediment Control Plan and Pollution Prevention Plan, in accordance with measures recommended in the Plan, to ensure the aquatic landscape features had been protected.

When a deficiency is noted, during regular monitoring, it should immediately be brought to the attention of the owner and construction crew, together with recommended mitigation measures. Post-remedial assessment, by the QEP, shall be conducted to verify deficiencies has been addressed. A post-development report shall be undertaken by a QEP to confirm that the measures outlined in this report were implemented.

## Measures to Protect, Enhance, And Restore Ecosystem Values

It is our professional opinion, that this proposed development will not adversely affect the stream, drainage ditch, or down slope wetland habitat, acknowledging that the drainage ditch feature lies within the municipal SRW. The proposed development, subject to the conditions specified above, will ensure that the SPEA will be protected.

# 13. Photographs

## Stream 1 (1933, 1937, 1935 Maple Bay Road)

Figure 11. This is the headwater wetland/ pond on 1933 Maple Bay Road that provides the water to Stream 1. Photo taken from 1933 Maple Bay Road looking north across the turf lawn at the pond. Note the depression within which the pond lies. There is a narrow fringe of sedge and agronomic grasses around the pond. The yellow arrow indicates the headwall and inlet of the buried culvert that drains the pond during periods of elevated water level. The area surrounding the wetland/pond is higher than the top of the headwall. This feature is on 1933 Maple Bay Road (Figure 10) and does not affect 1935 Maple Bay Road. Image taken in mid-summer, 2022.

Figure 12. Standing on 1937 Maple Bay Road driveway looking southeast across 1933 Maple Bay Road toward the wetland which provides the headwater for Stream 1. Yellow arrow indicates the headwall. Image taken on November 30, 2022.

Figure 13. Looking upstream (southeast) at the recently daylighted stream channel on 1937 Maple Bay Road (Figure 10). Yellow arrow indicates the buried culvert inlet.

Figure 14. Looking northwest across the subject property along the alignment of the buried culvert on 1935 Maple Bay Road, toward the drainage ditch on 1949 Maple Bay Road (Figure 10).

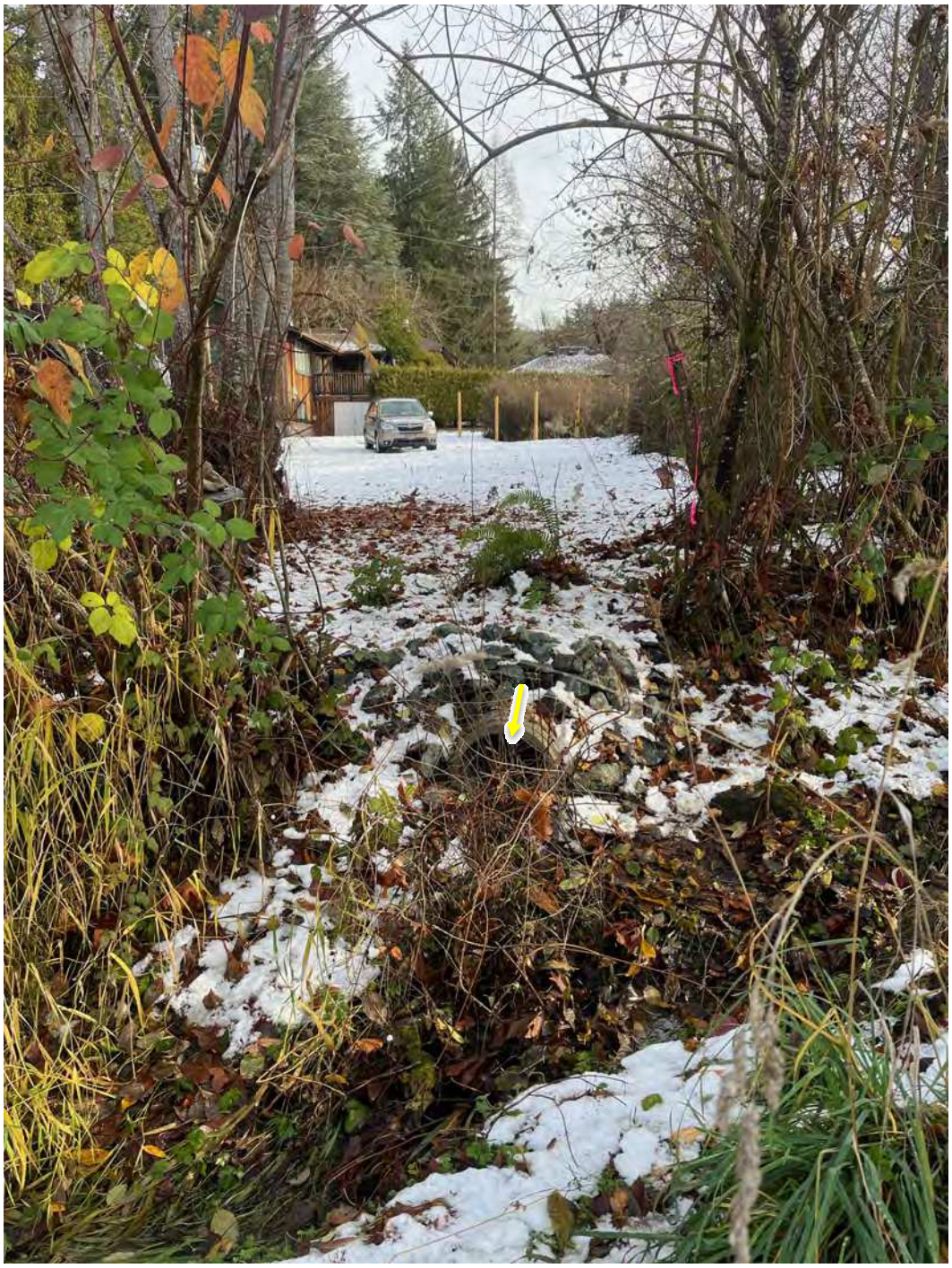

Figure 15. Looking southeast across the subject property along the alignment of the buried culvert on 1935 Maple Bay Road. Yellow arrow indicates the buried culvert outlet. The drainage ditch on 1949 Maple Bay Road (Figure 10) is in the foreground (Figure 10.).

## Ditch 1 (1949 Maple Bay Road)

Figure 16. Looking upstream (south) at the moderately entrenched Ditch 1 on 1949 Maple Bay Road. Note the turf lawn and copse of trees on the west side of the channel. The culvert discharge shown in Figure 15 lies to the left of this image.

Figure 17. Looking downstream (north) at the moderately entrenched drainage ditch (Ditch 1) on 1949 Maple Bay Road. The culvert discharge shown in Figure 15 lies to the right of this image.

Figure 18. Looking downstream across the turf lawn on 1949 Maple Bay Road that lies along the west side of Ditch 1. Yellow arrow indicates the buried culvert outlet.

Figure 19. Looking downstream along Ditch 1 (1937 Maple Bay Road). Note the turf lawn on the east side of the channel, the moderate channel entrenchment, shrub understory on west bank, and the rock armouring placed in the channel to try and arrest bank sloughing on the east side. The yellow arrow indicates the property boundary between 1935 and 1937 Maple Bay Road (Figure 10).

Figure 20. Looking upslope at the moderate entrenchment of Ditch 1 on the east bank and a terraced step on the west bank. Attempts at armouring the east bank have been made but with no success (this is not an appropriate method for protecting the bank). The grasses and small shrubs have stabilized bank soils on the west bank. The concrete, asphalt, and river rock have created small weirs and the flow tumbles over these structures, enhancing oxygen concentrations in the water. The few trees on the east bank do not contribute to bank stability, *i.e.*, their roots are too far from the bank soils to stabilize bank soils.

Figure 21. Looking further upslope along Ditch 1 in a section with moderate entrenchment on both banks. These upslope reaches would benefit from a shrub and tree planting program, to re-establish adequate root masses for stabilizing bank soils, for maintenance and recruitment, and shade.

Figure 22. Looking further upslope along Ditch 1. The east riparian area is dominated by turf lawn, with entrenched banks on both sides of the channel. The vegetation on the west bank provides some shade during the summer months.

Figure 23. The uppermost section of Ditch 1 (~50m downstream of the culvert outlet under Maple Bay Rd) has a non-native cedar hedge on the east bank and a shrub-dominated vegetated west bank. The channel remains entrenched, with agronomic grasses assisting in providing some bank soil stability. This section has considerably more shading of the channel than the reaches downslope. There is moderate blackberry invading the hedge and shrub community.

Figure 24. Approximately 25m downslope of the culvert outlet there is an increase in tree canopy, a mix of red alder and conifers. The channel width is greater in this section than that downslope.

Figure 25. The uppermost section of the drainage channel has a sparsely vegetated east bank (which is fenced) and a mixed shrub / treed canopy on the west bank.

Figure 26. The culvert under Maple Bay Road (yellow arrow) discharges into a small, shallow plunge pool, whose banks are vegetated primarily with blackberry bushes.

Figure 27. The outlet of the culvert under Maple Bay Road and its shallow plunge pool; the shallow plunge pool indicates there are typically insufficient stormwater volumes to scour a deep plunge pool at the outlet.

## Wetland 1 (1949 Maple Bay Road)

Figure 28. Looking downslope at the discharge end of the drainage ditch (Ditch 1) as it discharges into Wetland 1. This section of the channel has a wider channel width than the channel upslope of this section, with the banks being stabilized by a mixed agronomic grass and shrub plant community. The reed canarygrass field can be seen in the background.

Figure 29. Looking northwest across the reed canarygrass field which is the extension of Wetland 1. This field functions to convert concentrated channel flows into sheet flow, functions as a large sediment trap, and stores significant volumes of infiltrated water, in its soils, during drier periods of the summer. The stored water slowly percolates downslope through the moist riparian soils, eventually flowing into Quamichan Lake.

Figure 30. Looking south (upslope/ upstream) along the eastern edge of the drainage ditch (Ditch 1) inside the SPEA on 1935 Maple Bay Road. The plant community is dominated by shrubs, agronomic grasses, with a few red alders. A Douglas fir is just visible at the upper left hand corner of the image. This grass field is mowed on a regular basis, during the summer and early autumn. The undulating riparian plant community is ~5m in width.

Figure 31. Wetland 1. The SPEA from this wetland extends onto the subject property on the right side of the photo. Looking north along the eastern edge of the wetland showing reed canarygrass and turf lawn. The dashed yellow line is the approximate eastern "edge of water" of the wetland (Figure 10). The dashed yellow line is the approximate eastern extent of the winter surface flooding. There are no channels in the reed canarygrass or in the shrub zone beyond the reed canarygrass, as this field functions under sheet flow.

# 14. Riparian Assessment Assurance Statement - Qualified Environmental Professional

To: The Municipality of North Cowichan
7030 Trans-Canada Highway
Duncan, BC V9L 6A1

December 15, 2022

With reference to the Riparian Areas Protection Regulation for the property:

1935 Maple Bay Road PID 001-526-031
Legal description or PID and civic address of the property

The undersigned hereby gives assurance that he/she is a Qualified Environmental Professional:

Wm. Patrick Lucey, R.P. Bio. is a member of the College of Applied Biology of BC

I have signed, sealed and dated, and thereby certified, the attached riparian assessment report on the property in accordance with the *Professional Practice Guidelines – Legislated Riparian Assessments* and with the assessment methods. That report must be read in conjunction with this statement.

In preparing that report I/we have:

- ☒ Collected and reviewed appropriate background information
- ☒ Reviewed the development proposal on the property
- ☒ Conducted field work on and, if required, beyond the property
- ☒ Reported on the results of the field work on and, if required, beyond the property
- ☐ Incorporated recommendations or assessment results from other specialists
- ☒ Prescribed measures to protect and maintain the integrity of the streamside protection and enhancement area
- ☒ Prescribed measures to avoid the occurrence of a HADD*
- ☒ Reported on the requirements for field reviews or environmental monitoring of the property during or following site works for the proposed development and recommended who should conduct those field reviews or environmental monitoring
- ☒ Reviewed the riparian assessment report with the client and explained the content and the measures required to be implemented.

I/we hereby confirm that in my/our professional opinion, based on the conditions contained in the attached riparian assessment report, as required by the Riparian Areas Protection Regulation.

**Check one:**

☐ If the development is implemented as proposed there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area.

☒ If the streamside protection and enhancement areas identified in the report are protected from the development and the measures prescribed in the report as necessary to protect the integrity of those areas from the effects of the development are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area, and

**Check one:**

☐ with one or more recommended registered covenants

☒ without any registered covenant.

Signature, seal and date


December 15, 2022

**HADD – harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes*

# 15. Statement of Limitations

The information presented in this report was compiled and interpreted exclusively for the purposes of complying with the Municipality of North Cowichan OCP (DPA-3 Bylaw, Environmentally Sensitive Area, Map 4, April 6, 2022) with respect to watercourse setbacks and the Riparian Areas Protection Regulation. Aqua-Tex provided this report for the client, Mr. Len Thew and Ms. Donna Chadwick, solely for the purpose noted above.

Aqua-Tex has exercised reasonable professional skill, care and diligence to assess the information acquired during the preparation of this report but makes no guarantees or warranties as to the accuracy or completeness of this information. The information contained in this report is based upon, and limited by, the circumstances and conditions acknowledged herein, and upon information available at the time of its preparation. The information provided by others is believed to be accurate but cannot be guaranteed.

Copying or distribution of this report, in whole or in part, is not permitted without the express permission of the clients. Use or reliance on the information contained in the report, other than by the client or Municipality of North Cowichan, is not permitted without the written permission of Aqua-Tex.

The success of the measures prescribed to protect the riparian area assume diligent work practices and construction methods on the part of the clients and their contractors. If Aqua-Tex, or another qualified QEP, is not retained to carry out field reviews and/or environmental monitoring, Aqua-Tex will be unable to provide assurance that the work was completed to an acceptable standard or to sign a conformance statement (*e.g.* post development completion report) if required by the local government.

This report **remains valid for five years** only if the site conditions remain unaltered and the proposed development remains the same. If the development plans change, or if site conditions change, the report may no longer be valid.

# 16. Professional Opinion

**Qualified Environmental Professional opinion on the development proposal's riparian assessment.**

| Date | December 15, 2022 |
|---|---|

1. I/We Wm. Patrick Lucey, RP Bio. and Jacob McCurdy, B. Eng., EIT

*Please list name(s) of qualified environmental professional(s) and their professional designation that are involved in assessment.)*

hereby certify that:

a) I am/we are qualified environmental professional(s), as defined in the Riparian Areas Protection Regulation made under the *Riparian Areas Protection Act*;
b) I am/we are qualified to carry out the assessment of the proposal made by the developer Mr. Len Thew, which proposal is described in Section 2 of this Assessment Report (the "development proposal"),
c) I have/we have carried out an assessment of the development proposal and my/our assessment is set out in this Assessment Report; and
d) In carrying out my/our assessment of the development proposal, I have/we have followed the specifications of the Riparian Areas Protection Regulation and assessment methodology set out in the minister's manual; and

2. As qualified environmental professional(s), I/we hereby provide my/our professional opinion that:

a) [NA] the site of the proposed development is subject to undue hardship, (**if applicable, indicate N/A otherwise**) and
b) [X] the proposed development will meet the **riparian protection standard** if the development proceeds as proposed in the report and complies with the measures, if any, recommended in the report.

**[NOTE: "Qualified Environmental Professional" means an individual as described in section 21 of the Riparian Areas Protection Regulation.]**

# Appendix 1: Experience of Assessment Team

| | |
|---|---|
| Date: | 2022- Dec-15 |
| Name of Qualified Environmental Professional (QEP): | Wm. Patrick Lucey |
| Professional designation: | R.P. Bio., C. Biol. |
| Professional association: | College of Applied Biology of BC; Royal Society of Biology (UK) |
| Registration number: | 1467; P0119549 |
| **Training in Riparian Areas Protection Regulation assessment methods** | |
| Organization or agency delivery training: | Vancouver Island University |
| Name of trainer: | |
| Date of training sessions: | November 2005 and July 2020 |
| **Other relevant education, training or experience** | |
| RAR Professional Practice Guidelines Training, Nanaimo BC | May 2018 |
| Field Soil Description and Classification, Wayne Blashill, P.Ag. (Instructor). Columbia Mountains Institute, Revelstoke BC | June 2017 |
| Forest and Range Evaluation Program (FREP) riparian protocol training, 3-day course. Mr. Derek Tripp, instructor. Victoria BC | November 2016 |
| BCWF Wetland Institute- Eastern Vancouver Island | September 2014 |
| Riparian Roads Workshop- US National Riparian Roads Team, Portland OR | May 2001 |
| CVRD Development Services RAR Workshop, Duncan BC | April 2015 |
| RAR QEP Workshop, Nanaimo BC | January 2013 |
| RAR QEP Workshop, Victoria BC | January 2013 |
| RAR QEP Workshop, Nanaimo BC | February 2012 |
| Applied Fluvial Geomorphology, Level 1. Dr. Dave Rosgen (Instructor) Wildland Hydrology, Pagosa Springs, CO. | June 2006 |
| Greenline Vegetation Monitoring for Riparian Areas. Dr. Alma Winward (Instructor), Richfield, Utah | July 2000 |
| Instructor Training PFC Train the Trainer- US National Riparian Service Team | May 1999 |
| Proper Functioning Condition (PFC) Assessment Training. US National Riparian Service Team. Whistler, Pemberton and Victoria. | March 1998 |
| Proper Functioning Condition (PFC) Assessment Training. Oregon State University, Klamath Falls, OR | August 1997 |
| M.Sc., Biology, University of Victoria. Thesis: Periphyton functional and structural response, within semi-natural surrogate streams, to artificially induced water quality perturbations | 1994 |
| B.A. Geography, University of Victoria. Aquatic Resource Management | 1990 |

| | | |
|---|---|---|
| **Riparian assessments completed or contributed to** | **Primary QEP** | **Secondary QEP** |
| 1. Lantzville Foothills Estates (Kettle Creek) (2006-02-20) (#52) | Patrick Lucey | Paul DeGreeff, BCSLA |
| 2. 1945 Sooke Road (Colwood Creek) (2006-04) (not uploaded) | Patrick Lucey | Cori Barraclough<br>Don Skinner, RP Bio Arborist |
| 3. 551 Latoria Road ("Madrona Creek"- unnamed tributary of Latoria Creek) (2006-04-09) | Patrick Lucey | |
| 4. Arbutus Mountain Estates - Phase 1 (Shawnigan Creek) (2006-03-29) (#60) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 5. Westlock Rd. Subdivision (Trumpeter Pointe) (Quamichan Lake) (2005-08-18) (#77) | Patrick Lucey | Rick Lloyd P.Eng. |
| 6. 1404 Wild Cherry Drive (Metchosin Creek) (2006-04-15) (#78) | Patrick Lucey | |
| 7. Westlock Rd. Subdivision (Trumpeter Pointe) (Quamichan Lake) (2006-04-25) (#77 revision) | Patrick Lucey | Rick Lloyd P.Eng. |
| 8. Baranti Developments (Mill Bay Tributary) (2007-04-25) (#435) | Patrick Lucey | Lehna Malmkvist, RP Bio., Alec Morse, P.Eng., Don Skinner, RP Bio |
| 9. Waldy Road (Cowichan Bay) (2008-01-08) (#726) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 10. 1545 Cowichan Bay Road (2008-12-08) (#727) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 11. Westhills Community (Langford Lake & tributaries) (2008-06-12) (not submitted- Langford not registered in RAR database) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 12. Oasis Lake (Sooke Lake Road) (2008-06-24) (#972) | Patrick Lucey | |
| 13. 2215 Clearihue Road (Shawnigan Lake) (2008-06-26) (#976) | Patrick Lucey | |
| 14. 3031 Phillips Road (Sooke River) (2008-08-12 updated 2009-01) (#1044) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 15. 3501 Paradise Valley Road (Cheakamus River) (2008-09-23) (#1097) | Patrick Lucey | Lehna Malmkvist, RP Bio.<br>Brian LaCas, P.Eng. |
| 16. 9270 Lochside Drive (Reay Creek) (2008-11-24) (#1157) | Patrick Lucey | Cori Barraclough |

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| 17. Sooke Business Park (3220 Otter Point Rd) (2008-06-05 revised 2008-12-18) (#1180) | Patrick Lucey | Lehna Malmkvist, RP Bio |
| 18. Goldstream Avenue (Millstream Creek) (2010-02-17) (#1557) | Patrick Lucey | |
| 19. Stebbings Road (VanHorne Creek) (2010-04-14; modified 2011-01-11) (#1597) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 20. Morgan Maples RV Park (Chemainus River trib) (2010-04-26) (#1610) | Patrick Lucey | Lehna Malmkvist, RP Bio. |
| 21. Elkington Forest – Comprehensive (Shawnigan Creek tribs) (2010-07-23) (#1712) | Patrick Lucey | |
| 22. 1785 Whiffen Spit Road (Wright Road Creek) (2010-07-27) (#1723) | Patrick Lucey | |
| 23. Elkington Forest (Creek 19B) (2010-12-09)(#1850) | Patrick Lucey | |
| 24. 3055 Phillips Road (Sooke River) (2010-12-17) (#1857) | Patrick Lucey | |
| 25. St. Rose of Lima - 2191 Townsend Road (Knott Creek) (2011-01-10) (#1876) | Patrick Lucey | Cori Barraclough |
| 26. 1585 W. Shawnigan Lake Road (Shawnigan Lake) (2011-01-13) (#1878) | Patrick Lucey | |
| 27. 2585 Selwyn Road (Millstream Creek) (not submitted- Langford not registered in RAR database) | Patrick Lucey | |
| 28. 1609 Keating Cross Road (Graham Creek) (2010-12-03) (not submitted at client request) | Patrick Lucey | Cori Barraclough |
| 29. 2637 Savory Road (Florence Lake) (2011-05-3) (#LANGFORD- NOT UPLOADED TO RARNS) | Patrick Lucey | |
| 30. Goodwin Farms-Munn Road (Fizzle Creek) (2011-06-06) (#2054) | Patrick Lucey | Cori Barraclough |
| 31. 2907 Phillip St Duncan (Holmes Creek) (2011-09-09) (#2131) (note: also submitted as #2112- should be deleted, wrong regional district) | Patrick Lucey | |
| 32. Sahtlam Lodge (Cowichan River) (2011-09-16) (#2145) | Patrick Lucey | |
| 33. Lot 6, Shawnigan Lake Road (Van Horne Creek) (2011-09-16, updated 2011-10-03, updated 2012-02-06) (#2147) | Patrick Lucey | |

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|---|---|---|
| 34. 227 Meadowbrook Road, Saanich BC (OCP revision- not uploaded) (2012-01-25) | Patrick Lucey | |
| 35. Elkington Trailhead Creek #19 (2012-06-19) (#2412) | Patrick Lucey | Shane Moore, P. Geo. |
| 36. Elkington Creek 17 and Lower Elkington Tributary (2012-08-08, revised 2018-09) (#2482) | Patrick Lucey | |
| 37. 288/290 Beecher Bay Road (2013-09-04) (#2877) | Patrick Lucey | |
| 38. 1591 W. Shawnigan Lake Road, Don Calveley (Shawnigan Lake) (#2478) | Patrick Lucey | |
| 39. 2054 Butler Avenue, Gary Henshaw (Shawnigan Lake)(2013-04-12) (#2749) | Patrick Lucey | |
| 40. 5080 Cowichan Lake Road, Deborah Juch (2014-07-10)(Simple Assessment Tributary to Cowichan River) (#3181) | Patrick Lucey | Justin Straker, P.Ag. |
| 41. 875 Whittaker Road, Spectacle Creek & Unnamed Tributary (2015-08-21) (#3689) | Patrick Lucey | |
| 42. 820 Latoria Road, Unnamed Tributary to Pritchard Creek, JTC Investment Group (2015-07-26) (#LANGFORD-NOT UPLOADED TO RARNS) | Patrick Lucey | |
| 43. Craigflower Creek, Fort Victoria RAR, Goodwill Investments Ltd. (2015-07-21) (#3662) | Patrick Lucey | |
| 44. 6244 Rodolph Road, Central Saanich Creek, Aplomado Developments (2014-08-26) (#3226) | Patrick Lucey | Don Skinner RP Bio., Arborist |
| 45. 2000 Renfrew Road, Shawnigan Lake (2014-07-28) (#3182) | Patrick Lucey | |
| 46. Pritchard Creek, TJBS Holdings (Aug. 2012) (#LANGFORD- NOT UPLOADED TO RARNS) | Patrick Lucey | |
| 47. 2219 London Road, Shawnigan Lake (2014-08-26) (#3227) | Patrick Lucey | |
| 48. Dovedale Road; Lot 41, Tributary to Shawnigan Lake (2014-10-22) (#3293) | Patrick Lucey | |
| 49. 2010 Renfrew Road Shawnigan Lake (2014-11-05) (#3304) | Patrick Lucey | |
| 50. 989 Kangaroo Road, Hewitt Creek Wetland & Unnamed Tributary (2015-03-29) (#3461) | Patrick Lucey | |

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|---|---|---|
| 51. 3999 Renfrew Road Koksilah River (2015-07-12) (#3476) | Patrick Lucey | |
| 52. 774 Latoria Road, Pritchard Creek (2015-03-31) (# LANGFORD- NOT UPLOADED) | Patrick Lucey | |
| 53. 1660 Monterey Avenue (2015-05-26) (#3562) | Cori Barraclough | Patrick Lucey |
| 54. 3590 Gilbert Drive (2016-04-27) (#4015) | Patrick Lucey | |
| 55. 2319 Stevenson Road, Shawnigan Lake, (2016-06-22) (#4085) | Patrick Lucey | |
| 56. Lot 4, Ark Road. Roofmart. (2017-04-26) (#4595) | Patrick Lucey | |
| 57. 1939 and 1945 Sooke Road, Brookes Westshore School, Colwood Creek. (2017-03-30) (#4605 | Patrick Lucey | Cori Barraclough |
| 58. 360 Stebbings Road, Goldstream Heights, Tributary to Van Horne Creek. (2017-06-13) (#4637) | Patrick Lucey | |
| 59. 468,474 and 476 Millstream Rd., Millstream Creek, (2017-06-02) (#XXXX). NOT UPLOADED TO RARNS | Patrick Lucey | Tracy Motyer,<br>Richard Brimmel, P.Eng., (Geotechnical)<br>Jan Hoel, P.Eng. (stormwater),<br>Tom Talbot (arborist) |
| 60. 1105 Cypress Road, Tharratt Brook (2017-11-03) (#4879) | Patrick Lucey | Tracy Motyer |
| 61. Horizon Terrace, Pritchard Creek (2018-03-29) (# LANGFORD- NOT UPLOADED) | Patrick Lucey | |
| 62. 6140 Payne Road, Duncan (2018-06-11) (#5215) | Steve Voller | Tracy Motyer |
| 63. YMCA Camp Thunderbird, Glinz Lake, Mark Dodd (2018-10-12) (#5425) | Cori Barraclough | Tracy Motyer |
| 64. Goldstream Heights, Tarras. (2018-12-04) (# 2018) | Patrick Lucey | Cori Barraclough<br>Tracy Motyer |
| 65. 2368 Renfrew Road, Dan Nikirk, Shawnigan Lake (2018-12-13) (#5514) | Patrick Lucey | Cori Barraclough<br>Tracy Motyer |
| 66. 1393 Turner Lane, John Laurie, Cobble Hill (2018-12-31; revised 2019-04-26) (#5542) | Patrick Lucey | Tracy Motyer |
| 67. 7069 East Saanich Road, Darleen Taylor, Saanichton (2019-03-15) (#5632) | Cori Barraclough | |

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| 68. 2222 Renfrew Road, Len Wansbrough, Shawnigan Lake (2019-03-25) (#5549) | Patrick Lucey | Steve Voller |
| 69. 2220 Renfrew Road, Tom Wilson, Shawnigan Lake (2019-04-12) (#Noname 17 – Submitted by email to Charlotte Billingham, FLNRORD) | Patrick Lucey | Cori Barraclough |
| 70. PID 009-861-823, Millstream Road, District of Highlands (CRD Korene Torney, P. Geo., PMP, Supervisor, Geo-Environmental Programs (2019-08-22) (#5868a) | Patrick Lucey | Cori Barraclough |
| 71. PID 009-861-815 & 024-273-163, Millstream Road, District of Highlands (CRD Korene Torney, P. Geo., PMP, Supervisor, Geo-Environmental Programs (2019-08-22) (#5869a) | Patrick Lucey | Cori Barraclough |
| 72. 2201 Clearihue Road (CVRD); Calvin Cook; (#5860) | Patrick Lucey | |
| 73. 2040 Cullin Road (CVRD); Glen MacDonald (#5916) | Patrick Lucey | |
| 74. 4890 Munn Road; Ethan and Natasha Ghidoni, District of Highlands (#5934) | Patrick Lucey | |
| 75. 2054 Butler Ave, CVRD, Gary & Lynn Henshaw (#6500) | Patrick Lucey | |
| 76. 2143 Fulford-Ganges Road, Salt Spring Island (Islands Trust); Suzanne Drzymala; (#6505) | Cori Barraclough | Tracy Motyer |
| 77. 2904 Leigh Road, Langford, Doug & Heidi Foord | Patrick Lucey | Don Skinner |
| 78. 3068 Renfrew Road (Litster) #6997 | Patrick Lucey | |
| 79. Lot 4 Ark Road (Woodsmere) (#7061 A update to #4595) | Patrick Lucey | Tracy Motyer |
| 80. 1996 Renfrew Road (Johnston) (#7300) (#7300A) | Patrick Lucey | Cori Barraclough |
| 81. 5611 Culverton Road (Larry Davidson) (#7347) | Patrick Lucey | Steve Voller |
| 82. 1531 Cowichan Bay Road (Kim Johanssen) (Waldy Road) (#7462) | Patrick Lucey | Cori Barraclough |
| 83. 594 Latoria Road (Moji Shahab) (#7547) | Patrick Lucey | Cori Barraclough |
| 84. Spotswood (Michael Weir) (#7784) | Patrick Lucey | Steve Voller |
| 85. 2104 Butler Road (Jody Large) (#7848) | Patrick Lucey | Tracy Motyer |

# Appendix 2: Silt Fence Installation Method, SPEA Signage, & Photopoint Monitoring

*Temporary Silt Fences*

Silt fences are one of the most common tools for controlling sediment and preventing it from entering waterways. They are also often incorrectly installed and maintained. They are designed to slow down and filter "sheet flow". They are not to be used as dams or to control larger flows of water.

*Installing a silt fence:*

1. Think about the direction of water/sediment flow before you install the fence. The fence needs to be at 90° to the flow.
2. Make sure there is a long enough tail on the fence that it can be adequately buried. Water rarely goes over a silt fence, but often goes under.
3. The tail of the fence faces into the flow, so that sediment cannot wash underneath it. Remember the goal of the fence is to slow down the water and trap sediment so only clean water goes through the fence.
4. The posts anchoring the fence should be on the downstream (clean) side. This allows water to push fabric against the posts, rather than pull it away from the posts which could cause the fence to fail.
5. The fence should be tight. Do not allow the fabric to flop around between the posts.
6. **The bottom of the fence (tail) must be buried at least 20 cm (8") deep so that water cannot flow under it.** If burying is not possible due to hard ground or other obstacles, use clean, washed pea gravel to weight the tail down and conform to the ground (Figure 1).
7. Make sure there are **no gaps under the fence**.
8. Make sure posts are firmly driven into the ground. If a wooden post breaks, replace it with a rebar stake and wire the fence to it.
9. On rough or rocky ground, fences that come with wooden stakes pre-attached are often difficult to use. Instead, obtain a roll of filter fabric and separate bundles of stakes.
10. Hammer the stakes into the ground at approximately 1.5 - 2 m intervals, as ground conditions allow.
11. Unroll the fabric along the fence, leaving a good tail that can be buried. Remember that the water/sediment is likely only a few inches deep and is unlikely to go over the fence.
12. Staple the fabric to the stakes with a heavy duty staple gun.
13. Dig the tail into the ground, or place a generous layer of washed, clean pea gravel on the tail to weight it down.
14. Check for gaps and ensure the fence is tight to the ground.
15. If the sediment fence appears weak, or is on a slope, put straw bales tight behind the fence to support it. Use best your judgement to determine the spacing and number of bales. If the fence collapses, it is useless.

*Maintaining a silt fence:*

1. Check the fence regularly and repair it if needed. Remove built up sediment and dispose of it away from the watercourse and where it cannot be washed into a drain or ditch.
2. Don't forget to dig away sediment for proper disposal and **remove the silt fence when the project is done** and the ground has stabilized. Make a note it on your calendar to check and remove it.

Figure 1. An example of a properly installed silt fence. The fence is tight and the posts are on the downstream (downhill) side. There are no gaps under the fence.

Figure 2. An example of an incorrectly installed silt fence. The posts are on the correct side of the fence, but the tail is not buried at all. The coloured line along the edge of the fence is still clearly visible, and it is less than 5 cm from the bottom. This fence will not control runoff.

**Silt Fence Diagram**

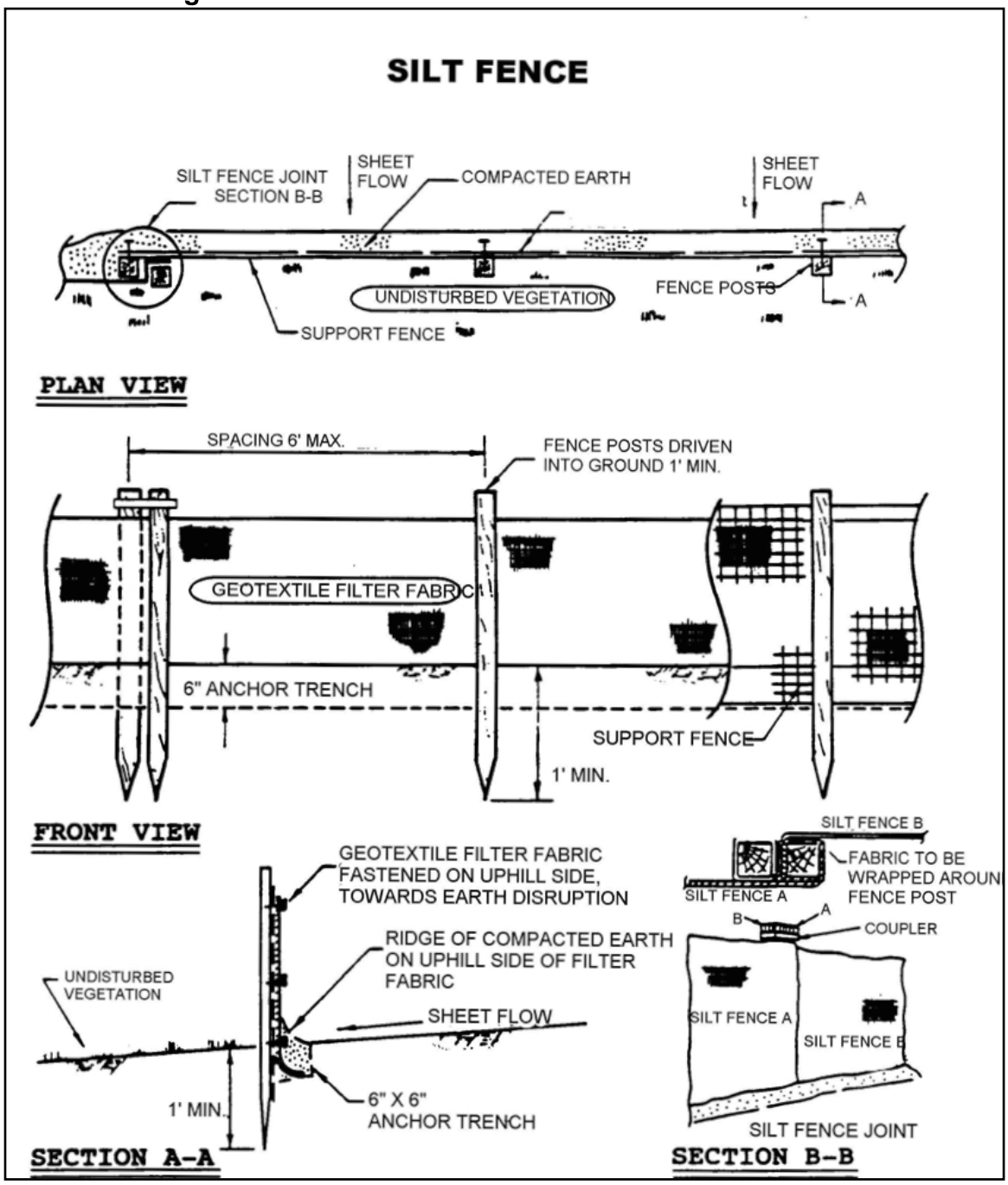



Figure 3. Schematic diagram of silt fence installation. Courtesy Nebraska H2O (www.nebraskaH20.org)


Figure 4. Two examples of silt fences installed with filtering pea gravel berms

Figure 5. An example of a silt fences installed with filtering pea gravel trench.

**SPEA Signage Examples**

# Sensitive Fish and Wildlife Habitat

# Please do not Disturb

This area protected by Riparian Areas Protection Regulation and the Federal Fisheries Act

Recommended wording, for signage, to be placed at intervals along the riparian management boundary.

# Appendix 3: Photopoint Monitoring

# Photo Point Monitoring

## STRENGTHS

*Photo point monitoring:*

- *Uses readily available equipment.*
- *Is an effective communication tool for public education.*
- *Is a method of providing landscape context for a study area.*
- *Is a standardized evaluation procedure for comparing multiple locations.*
- *Is a method to document rates of change.*

## LIMITATIONS

- *Only limited quantitative data can be obtained.*
- *Bias in photo point placement may occur.*
- *It may be difficult to use in dense vegetation.*
- *Photo points can be lost or obscured over time.*
- *Some weeds may be difficult to distinguish from the surrounding vegetation.*

## IMPORTANT

*Clearly document objectives and the monitoring protocol because the person who establishes the photo points often is not the person who does the repeat photography.*


## AUTHOR

***Randy M. Hamilton***
*Remote Sensing Applications Center*
*Salt Lake City, UT*


## Summary


Photo point monitoring is an easy and inexpensive, yet effective, method of monitoring vegetation and ecosystem change (figure 1). It consists of repeat photography of an area of interest over a period of time, with photographs taken from the same location and with the same field of view as the original photo. With appropriate site marking and documentation, photos can be precisely replicated by different people many years apart.

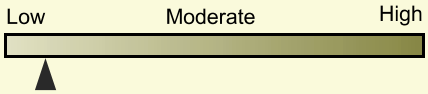

### Major Steps

1. Define the objective.
2. Select and establish photo and camera points.
3. Photograph the scene or subject.
4. Organize and file the data.

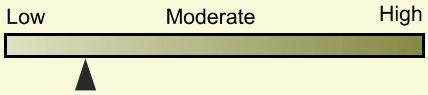
## QUICK LOOK

**Objective:**
This document outlines how to use photo point monitoring in weed management. For a more detailed discussion of methodology, analysis techniques, and other applications of photo point monitoring, refer to the *Photo Point Monitoring Handbook* (Hall 2002).

**Cost:**




**Expertise:**




## Define the Objective

A well defined objective is key to successful photo point monitoring. Photo points may be established for a variety of reasons such as evaluating the efficacy of management activities, assessing the ecological impact of a weed infestation, or determining whether management objectives are being met. Different objectives will generally require different photo points. Therefore, to obtain relevant and accurate information, the objective for monitoring must be carefully considered and defined *before* establishing photo points.

Figure 1—Photo point monitoring of a leafy spurge infestation before (A) and after (B) the introduction of copper leafy spurge flea beetles. *(Photos adapted from Norman E. Rees, USDA ARS, www.forestryimages.org)*

## Select and Establish Photo and Camera Points

A photo point is an established location that defines the orientation of a camera located at a camera point (figure 2). Care should be taken when establishing photo and camera points to ensure that the points chosen address the objectives. The following steps outline items for consideration and procedures for establishing photo points in areas selected for monitoring.

**CAUTION**

*Once a photo point is established, it cannot be changed — use care in choosing locations and subjects for monitoring.*

1. **Identify photo points.** Within selected monitoring areas, identify elements in the landscape that are most critical to document in order to achieve the project objectives. General photography can be used to document a whole scene. Topic photography, on the other hand, narrows the target from a scene to specific elements (subjects) in the landscape. Ensure that enough photo points are established to adequately document changes that are expected to occur.

**TIP—CAMERA PTS.**

*Select camera points from which multiple photo points can be photographed.*

2. **Establish camera points.** Based on the project objective, establish camera points for each photo point. Pay particular attention to the distance between the photo and camera points to ensure that the photographs will adequately document the scene or subject and the expected changes.

3. **Mark photo and camera points.** Photo and camera points should be permanently marked so they can be relocated in the future. Metal fenceposts work well for this purpose. However, if fenceposts are obtrusive or otherwise undesirable, steel rebar driven flush with the ground can be used instead. A metal detector may be needed to relocate rebar markers. Measure the distance and direction from camera points to photo points. Obtaining coordinates of

**CAUTION**

*If a particular photo point is photographed from more than one camera point, the distance between the photo point and all camera points must be the same.*

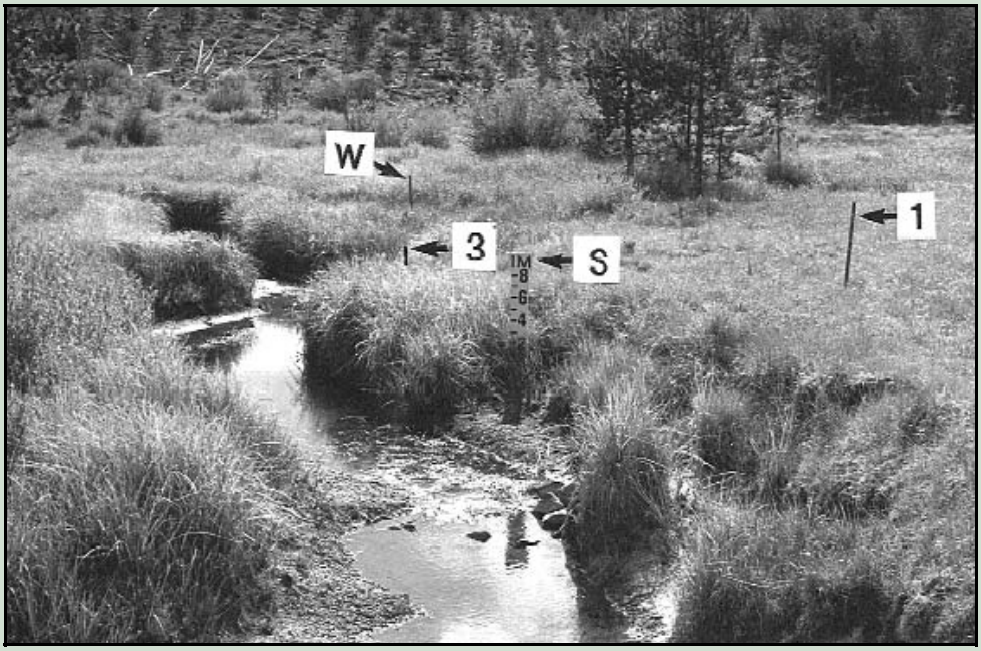



Figure 2—Photo point monitoring site showing photo points (S and W), and camera points (1 and 3), marked by fenceposts. (Adapted from Hall 2002.)

**TIP**

*If photo and camera points are close together, place the camera point to the north of the photo point to avoid shadowing while photographing the photo point.*

**IMPORTANT**

*When recording directions, indicate whether they are magnetic or true degrees.*

**TIP**

*Photo points can be established along a transect to obtain more quantitative information. See the* Photo Point Monitoring Handbook *(Hall 2002), or* Ground Based Photographic Monitoring *(Hall 2001) for additional information.*

the points using a global positioning system (GPS) unit can aid in relocating them in the future.

4. **Identify a witness site.** A witness site is (preferably) an immovable object in the monitoring area that can be easily identified when returning to the area. It serves as a reference to quickly locate the monitoring area and also as a reference point from which the camera and photo points can be located. Measure the distance and direction from the witness site to the camera points, photo points, or both. It is helpful to attach a permanent identification tag to the witness site with the distance and direction to the photo and/or camera points inscribed on the tag.

5. **Assign identification numbers.** Assign identification numbers to all photo and camera points.

6. **Record pertinent site information.** Record pertinent information about the monitoring site on a map, aerial photograph, and/or site description form. A sample "Photographic Site Description and Location" form, developed by Hall (2002), is provided in *A Weed Manager's Guide to Remote Sensing and GIS* for reference. Information such as date, observer, location, site description, objectives, identification numbers, and locations of witness site, photo points, and camera points, including distances and directions between points, should be recorded.

**Equipment Checklist**

- ☐ Camera
  - ☐ Memory cards
  - ☐ Extra batteries
  - ☐ Film
- ☐ Tripod
- ☐ GPS
- ☐ Forms
  - ☐ Site description and location
  - ☐ Camera location and photo points
  - ☐ Photo ID cards
- ☐ Clipboard
- ☐ Compass
- ☐ 100 ft measuring tape
- ☐ Copies of original photos (site locator field book)
- ☐ Fenceposts
- ☐ Steel stakes
- ☐ Hammer
- ☐ Meter board
- ☐ Metal detector
- ☐ Spray paint

**NOTE**: An editable equipment checklist is available for download in *A Weed Manager's Guide to Remote Sensing and GIS*.

7. **Determine when to photograph.** Determine how frequently the photo points should be photographed, the duration of monitoring, as well as the time of year at which photographs should be taken. For example, if the efficacy of a treatment is to be monitored, photographs might be taken immediately before the treatment and two months after the treatment. If weed spread is to be monitored, then the photos might be collected once per year at the time when the weeds are most visible (e.g., during peak flowering).

8. **Create a site locator field book.** It is recommended that a pocket-size site locator field book be created to aid in locating the monitoring location and witness, camera, and photo points during subsequent visits to the area. The field book should contain copies of the original photo point photographs and directions from the witness sites to each camera location and orientation of the photo point.

DATE_____
AREA_____
UNIT_____
CAMERA: 1 2 3 4 5
PHOTO: A B C D
E F G H I J

***Site identification card***—*Identification cards (11" x 8.5") such as this one, placed within the camera's field of view, provide permanent identification information for the photograph.*

**CAUTION**

*Be careful not to trample the vegetation when locating photo points.*

**IMPORTANT**

*Repeat photographs should be taken using the same format camera (and film, if applicable) as used for the original photograph. If a different format camera is used, adjustments must be made to ensure that the view through the camera matches the original photograph.*

## Photograph the Scene or Subject

The following steps outline basic considerations and procedures for photographing the scene or subject of photo points.

1. **Create photo identification cards.** It is recommended that a photo identification card be placed within the camera's field of view each time a photo point is photographed to embed pertinent information about the site into the picture (figure 3). The card should contain the site name, photo point number, camera point identification, and date. Other information such as the photograph number, time of day, and the photographer's initials may also be included. A sample identification card developed by Hall (2002) is available in *A Weed Manager's Guide to Remote Sensing and GIS*. Hall recommends copying the identification card onto blue paper for best visibility. Laminated cards can be reused by writing pertinent information with dry erase markers. Small chalk boards can also be used as photo identification markers.

2. **Locate photo and camera points.** Using site location information (e.g., information found on a "Photographic Site Description and Location" form) and a site locator field book and/or a GPS unit, locate the photo and camera points.

3. **Photograph the scene/subject.** It is recommended that original and repeat photographs be taken using a tripod at a designated height. For repeat photography, point the camera toward the photo point and compare the view through the camera to a copy of the original photograph. Adjust the camera until the view through the camera is the same as the original photograph. You may want to record the aperture, shutter speed, focal length of the lens, and film speed (if not using a digital camera).

Figure 3—Photo point monitoring site showing a photo identification card and a meter board. (Adapted from Hall 2002.)

For topic photography, it may be desirable to place a meter board or other size control object at the photo point or near the subject of interest. A meter board provides a consistent point for camera orientation, a point on which to focus the camera, and a size reference that can be used to quantify change. Directions for constructing a meter board are provided in *A Weed Manager's Guide to Remote Sensing and GIS.* Meter boards are typically not used in general photography of scenes.

4. **Describe the scene/subject.** For each photograph, describe the scene or subject. For example, you might record weed density, condition of desired vegetation, and environmental factors (e.g., drought, hot or cool temperatures) affecting the overall health of the weeds and desired vegetation. A sample form for recording this type of information, "Camera Location and Photo Points," developed by Hall (2002), is provided in *A Weed Manager's Guide to Remote Sensing and GIS.*

## Organize and File the Data

A well-organized, easily accessible filing system is required for photo point monitoring. This may consist of a series of expandable folders (one for each monitoring area), each containing maps, directions, a site locator field book, site descriptions, other descriptive data, prints, slides, negatives, and/or CDs or DVDs containing digital photographs.

If digital cameras are used for photo point monitoring, a computer database may be the ideal system for organizing and filing the data. Databases to organize and archive pictures are available commercially. A simple hypertext markup language (HTML) database can also be developed and used to organize and file the photo point monitoring data. An HTML database allows easy access and updating capabilities using a web browser. In addition to archiving pictures on a database, maps can be scanned and entered into the database. Descriptive information can also be scanned or entered directly into the database. Regardless of the filing system used, a backup archive is recommended in the event that documents or pictures are unintentionally destroyed or databases become corrupted. Ideally, this archive should be kept in a separate location from the original data.

## Sources Cited

Hall, Frederick C. 2001. Ground-based photographic monitoring. Gen. Tech. Rep. PNW-GTR-503. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 340 p.

Hall, Frederick C. 2001. Photo point monitoring handbook. Gen. Tech. Rep. PNW-GTR-526. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 134 p.

**ASSISTANCE?**

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*http://www.fs.fed.us/eng/rsac*

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United States Environmental Protection Agency (EPA). 2007. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites. EPA 833-R-06-004.

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