



February 14, 2023

File 22-93

Murrin Construction
PO Box 91908
West Vancouver, BC
V7V 4S4

Attention: Joe McInnis

RE: Feasibility Assessment for Proposed On-Site Wastewater Treatment System, DL 1748 Porteau Cove, Squamish, BC

Further to your request, Arden Consulting Engineers Ltd. (ACE) has completed a preliminary review and assessment of the subsurface conditions at DL 1748 Porteau Cove for the purpose of assessing the parcel's ability to support an onsite wastewater treatment system (septic system) for a future campground.

BACKGROUND

The site is predominately undeveloped, however at one time supported a gravel mining operation and has since been reclaimed. The site currently contains a water well with an elevated above ground reservoir and a large septic field. The well, reservoir and septic field belong to BC Parks and service the neighboring Porteau cove provincial park campground. The infrastructure is owned by BC Parks and is protected by an easement. It is now proposed to re-develop the site into a private campground consisting of RVs and single room cabins. Sanitary sewer is not available in the area and as such, the wastewater from the facility must be treated and discharged on site. The corresponding design sewage flow rate is calculated in Table A below:

Table A – Estimated Maximum Daily Sewage Flow

Unit	# of units	Occupants per unit	Flow per Unit (L)	Flow (L/day)
RV Sites	52	-	170	8,840
Single Room Cabins	75	2	450	33,750
Total	127	2		42,590

The total cumulative design flow exceeds that maximum allowable flow under the *Sewerage System Regulation (SSR)* and would fall under the jurisdiction of the *Municipal Wastewater Regulation (MWR)*. Discharges exceeding 22,700 Lpd are governed by the MWR and administered by the Ministry of Environment (MOE).

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Registration under the MWR is an onerous and expensive process. It requires the preparation of an Environmental Impact Study report along with the installation of several monitoring wells in order to determine groundwater depth and direction of flow. Once all the documentation is in order, approval times can be upwards of 12 months.

As the discharge would likely occur within 300m of a water well, the discharge would be required to meet Class A standards which are as follows:

- Carbonaceous Biochemical Oxygen Demand < 10mg/L
- Total Suspended Solids < 10mg/L
- Fecal coliform - Median < 2.2 MPN per 100mL
- Nitrate < 10mg/L
- Total Nitrogen < 20 mg/L
- Turbidity 2 NTU average, maximum of 5 NTU

It is our opinion that the capital expense along with the operation and maintenance expenses of operating a Class A Sewage Treatment Plant would be cost prohibitive. As such this option is not recommended.

The discharge could instead be broken up into two or more smaller discharges that are not hydraulically connected in order to fall under the jurisdiction of the SSR. This would also allow the system to be constructed in phases if desired.

SUBSURFACE INVESTIGATION FOR SEWAGE DISPOSAL

An initial subsurface investigation and site reconnaissance was conducted by ACE on February 3, 2023 with percolation testing occurring on February 8, 2022. The testing consisted of the following:

- Site reconnaissance to evaluate physical features, topography and potential site constraints;
- Advancement of test pits using a tracked excavator to a depth of approximately 2m Below Ground Surface (BGS) to evaluate the subsurface conditions;
- Percolation testing;

Site Reconnaissance

The subject site is approximately 18 acres in size; however, steep topography and previous mining and reclamation activities along with the deposition of fill, limit the area available for construction of a septic system. The site is bounded by CN rail to the west, Highway 99 to the east and BC parks property to the north. The northern lower bench portion of the property contains the BC parks well and septic system along with a surface water course bisecting the property running east west. There is limited opportunity to develop a septic system in this area due to site disturbance and steep slopes to the east and south of the BC Parks septic system, as well as the 30m water course setback to the north (note the BC parks septic field ends at the 30m setback). A single test pit was advanced in this area to evaluate the subsurface conditions.

Similarly, the southern portion of the site has no opportunity for development of a septic system due to steep terrain and large boulders. The subsurface investigation was limited to areas where the slope was less than 30%. Slopes greater than 30% are



generally considered too steep for the development of a septic system. No test holes were advanced within 30m of the existing well or any water courses. A 30m setback is required from the well and from a water course to any future septic system. The majority of the test holes were advanced at the toe of the slope along the middle bench and along the upper bench in the forested area.

SUBSURFACE INVESTIGATION FOR SEWAGE DISPOSAL

A total of 10 test pits were advanced using a tracked excavator on the useable portion of the property. The testpits were logged by a member of our engineering staff and the GPS coordinates recorded prior to backfilling. Additionally, 3 percolation tests were performed to assess the soil permeability in the areas previously deemed to exhibit favourable subsurface conditions. This information was collected to support sizing of the dispersal field area. The locations of the test pits and percolation tests are shown on the attached site plan. For discussion purposes, the property has been divided up into 3 separate locations (Areas 1-3). The locations are shown on the attached site plan and listed in Table B below.

In general, only testpits 4-7 excavated along the middle bench (Area 2) and test pits 8-10 located on the upper bench (Area 3) were judged to be suitable for receiving effluent.

Test pit 1 located at the north end of the property (Area 1) and immediately west of the existing BC parks septic field consisted of the following:

0-300mm Silty sand, dark brown, organics, loose overlying:

300-1200mm Silt, sand, gravel, frequent cobbles, rounded, grey, dense (till like)

Heavy iron mottling was present and perched water was later encountered within approximately 200mm of the ground surface. As such, it was not possible to complete a percolation test at this location.

This area was judged to be unsuitable for receiving effluent due to the presence of a shallow restrictive layer. No further investigation was conducted in this area due to site disturbance.



Figure 1 - Photo showing Test pit 1 – Note perched water table

Area 2 was located south of the water course on the middle bench. Testpits 2-3 were excavated near the north end of this area on the access road just prior to reaching the top of the bench (see figure 2 below and attached site plan). Till like clayey silt and gravel was encountered at a depth of 400mm Below Ground Surface (BGS) in testpit 2 and 1200mm BGS in testpit 3.



Figure 2 - Testhole 2 looking south (north end Area 2)



Clean loose grey sand and gravel were encountered to depths of 1.9m in each of testpits 4-7 which were excavated along the toe of the bank. Some overburden silt was observed in testpits 4-6 extending from 200 - 900mm BGS. No seepage was encountered in any of the testpits excavated in Area 2. This limited area at the toe of the slope consisting of loose native sand and gravel identified in testpits 4-7 is judged to be very favourable for receiving effluent. The native sand and gravel is judged to dive downwards at approximately the same angle as the slope (65%) to the west of the toe. It has been reported by Murrin Construction that the native sand and gravel west of the toe slope was previously mined and replaced by heterogeneous imported fill. As such, the area to the west of the toe slope was not investigated.



Figure 3 - Testpit 4 Looking South (Area 2). Native sand and gravel is visible along the slope



Figure 4 – Photo looking east towards toe of slope where TPs 4-7 were excavated (Area 2). The forested area above the top of bank represents Area 3



Figure 5 – View east towards TPs 6 & 7 (Area 2). The forested area visible at the top of the slope represents Area 3



Area 3 is located on the forested upper bench east and immediately upslope of Area 2. Testpits 8-10 were excavated along this bench and consisted of the following:

0-750mm silty sand, granular, loose, reddish brown, abundant roots overlying;

750-2000m Sand, grey to light brown, trace to some gravel, loose to medium dense, occasional cobbles.

This area is also considered to be very favourable for receiving effluent.



Figure 6 – Hand excavated Testhole on upper bench (Area 3)

Detailed logs of the test pits are attached.

Permeability Testing

Three percolation tests were conducted in Area 2 on February 8, 2023. Shallow perched water precluded percolation testing in Area 1 and Area 3 was not accessible for pumping water required for pre-soaking percolation holes. Based on testpit logs, percolation rates are anticipated to be favourable in Area 3 and unfavourable in Area 1. The percolation holes were presoaked for approximately 4 hours prior to timing. The percolation test results are presented in Table B below:

Table B- Percolation Test Results

Perc Hole #	Testpit #'s	Area #	Rate (min/inch)	Depth Below Ground Surface (mm)
	4-5	2		
1			1	840
2			0.8	840
3			0.75	900

The average percolation rate within Area 2 was less than 1 minute per inch and was very consistent throughout this area as would be expected given the clean sand and gravel encountered. Although, it was not possible to pump water up to Area 3 as it was not accessible by our water truck, it is anticipated, based on the testpit logs, that the percolation rates would be in the range of 2-4 minutes per inch. Percolation testing



would need to be conducted in order to confirm the actual percolation rates once access is available.

OPTIONS FOR EFFLUENT DISPERSAL

Only areas 2 & 3 are suitable for construction of a future septic system based on the subsurface conditions encountered. There is no opportunity to expand the existing BC Parks septic field due to the topography to the east and south as well as the 30m water course setback to the north. The subsurface conditions revealed in testhole 1 advanced to the west indicate this area is also unfavourable. ACE contacted Ms. Zsana Tulesik of BC Parks to enquire about the capacity of their existing septic field. She indicated that the existing septic field was currently at maximum capacity and that they were having issues with its performance and as such would not entertain the possibility of any additional connections.

Area 2 along the toe of the slope is severely restricted by topography. Any development of a septic field at this location would have to be long, narrow and oriented north-south parallel to the toe of the slope. The western boundary would start at the current toe of slope at the elevation of the current road and be extended horizontally east 3m cutting into the toe of the slope, thereby requiring the upslope toe to be retained (see figure 3). This would create an area of approximately 3m x 60m. It may be possible to extend the length further to the south by cutting into the road leading to the upper bench as the road consists of native sand and gravel, however, the slope toe to the south would also need to be retained in order to create a level area. The effluent dispersal area would be in ground or subsurface.

More real-estate is potentially available on the upper bench (Area 3) to create an effluent dispersal field, as the subsurface conditions are very favourable and the topography is fairly uniform. Based on the subsurface conditions observed, this site would support an in-ground or subsurface effluent dispersal area. The area, however, is heavily forested and would need to be cleared as well as potentially graded to a uniform elevation (+/-0.3m) in order to create an area(s) for effluent dispersal. Further, a geotechnical investigation would be required to establish an appropriate safe setback distance from the edge of the dispersal area to the top of bank to ensure the release of effluent would not result in slope instability.

Given the large design flow rate and somewhat limited remaining area available for effluent dispersal, a higher level of treatment resulting in a smaller dispersal field area was considered. The treatment level applied would be either Type 2 or Type 3 under the *Sewerage System Regulation* (SSR). Type 2 effluent has the following requirements:

- 5 day Biochemical Oxygen Demand (BOD₅) < 45 mg/L
- Total Suspended Solids (TSS) < 45 mg/L

Type 3 effluent has the following requirements:

- 5 day Biochemical Oxygen Demand (BOD₅) < 10 mg/L
- Total Suspended Solids (TSS) < 10 mg/L
- Fecal Coliform Bacteria – 400 CFU per 100mL

Based on conversations with Mr. Joe McInnis, it is our understanding that it would be desirable to construct the campground in several phases with each phase having its own



decentralized septic system consisting of treatment works and an effluent dispersal area or septic field. It would be necessary to ensure that no one phase would result in a discharge exceeding 22,699 Lpd in order to remain under the jurisdiction of the SSR. Constructing the campground in phases would result in the following benefits as opposed to constructing it in a single phase using a single centralized septic system:

- Discharge would be governed by the SSR as opposed to MWR
- Smaller less expensive sanitary sewer collection system
- Lower initial capital cost for construction of a smaller decentralized septic system.
- Initial phases will provide insight as to the actual sewage flow rate which may benefit future phases as the code values in which the theoretical flow rates are derived are often overly conservative.

ACE has calculated the areas required for the effluent dispersal field based on the projected design flow rate for both Type 2 and 3 effluent.

Table C – Summary of Area Required for Effluent Dispersal

Location	Area Available	Design Flow Serviced (Type 2 effluent)	Design Flow Serviced (Type 3 effluent)
Area 2	(3m x 60m) 180m ²	11,700 Lpd (69 RVs or 26 cabins)	23,400 Lpd (52 cabins)
Area 3	~2 x (3m x 100m) 600m ²	39,000 Lpd (75 cabins +30 RVs)	60,000 Lpd

Biological Treatment of Wastewater

The treatment and renovation of the wastewater required to achieve Type 2 or 3 standards relies on an aerobic biological treatment processes to remove organics from the wastewater. Dedicated servicing and maintenance of the treatment works are required to be performed by qualified personal on a monthly to quarterly basis to ensure successful operation. If the wastewater treatment plant is unable to produce the required effluent quality, the septic field may eventually blind off and fail as a result of biomat formation causing effluent to surface.

NEIGHBORING WELLS

The septic field areas being considered are located at least 200m from the current BC parks well.

FURTHER STEPS

Murrin construction will need to determine the size of the phases in terms of the number and types of sites to be serviced. Should you wish to explore Area 3 as an option for locating the dispersal field, then a geotechnical assessment will need to be undertaken to establish the proximity to the top of bank. This will impact the area available and the number of sites that can be serviced. Detailed permeability testing will also need to be conducted in Area 3 in order to confirm the assumed hydraulic loading rates.



CLOSURE

This letter has been prepared by ACE exclusively for Murrin Construction and is intended to provide an assessment of the parcel's ability to accommodate a future septic system as described herein. The conclusions made in this report reflect ACE's best judgement in light of the information available at the time of testing. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ACE accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this letter.

The findings and conclusions documented in this report have been prepared for specific application to this site and have been developed in a manner consistent with that level of care normally exercised by septic design professionals currently practicing under similar conditions in the area.

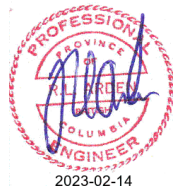
We trust that this provides the information you currently require. If you have any questions or require comment, please feel free to contact the undersigned.

Yours truly,

ARDEN CONSULTING ENGINEERS LTD.

PER:

Rob Arden, P.Eng.



Encl Site Plan
Test Pit Logs



Appendix 1

Test Pit Logs –

Test Pit 1

0-12" Silty Sand, dark brown, organics, loose
12-48" Silt, sand and gravel, grey, dense, iron mottled (till like), frequent cobbles, rounded
No Seepage

Test Pit 2

0-16" Sand, grey, loose, medium grained
16" + Clayey silt and gravel, very stiff (Till like)
38-44" Clayey Silt, brown, stiff
No Seepage

Test Pit 3

0-48" Sand, grey, loose to medium dense
48"+ Clayey silt and gravel, very stiff (Till like)
No Seepage

Test Pit 4

0-16" Silt, sand and gravel, (fill), grey
16-48" Silty sand and gravel, light grey to light brown, occasional cobbles, rounded, wet, medium dense
48-75" Sand, some gravel, grey, loose, coarse grained
No Seepage

Test Pit 5

0-8" Silt, brown (fill)
8-72" Sand and Gravel, grey, loose, rounded gravel
No Seepage

Test Pit 6

0-36" Sandy silt, brownish grey, firm
36-64" Sand, some gravel, grey, loose,
No Seepage



Test Pit 7

0-72" Sand and Gravel, loose, grey, occasional cobbles, sub rounded
No Seepage

Test Pit 8

0-72" Sand, grey, medium dense @ 48" seam of brown gravel
No Seepage

Test Pit 9

0-24" Silty sand, dark brown, loose, dry, abundant roots
24-60" Colour change to reddish brown, increasing gravel
60-84" Sand, grey, loose, some gravel
No Seepage

Test Pit 10

0-6" Organics, dark brown
6-32" Silty Sand, reddish brown, loose, abundant roots
32-76" Sand, some silt, light brown, trace gravel, occasional cobbles,
subrounded
No Seepage






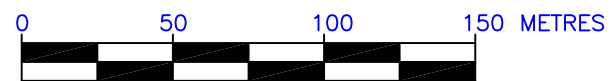
HOWE SOUND

HOWE SOUND

Montagu Channel

LEGEND

-  LOCATION OF TEST PIT
-  LOCATION OF PERCOLATION TEST
-  LOCATION OF WELL



SCALE 1:2000

PERMIT TO PRACTICE 1000248

SEAL



CLIENT: **MURRIN CONSTRUCTION**

PROJECT PORTEAU COVE, SQUAMISH
TITLE SITE PLAN

DATE OF ISSUE FEB 13/23	PROJECT No. 22-93	DWG. No. 1 OF 1	REV. 00
DWN BY: MD			

CANCEL PRINTS BEARING EARLIER NUMBER

