

2035012 Final Report for
**Sunshine Coast
Regional District**

**Feasibility Studies - Replacement/Upgrade
of Three Wastewater Systems**

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File: 2021.02

DATE: July 28, 2021
To: Kyle Doyle, Manager – Asset Management
Re: 2035012 (Feasibility Studies - Replacement/Upgrade of Three (3) Wastewater Systems)

Mr. Doyle;

It is with great pleasure that Aurora Professional Group Inc. (“APG”), working with Jim Andersen Ltd. (“JAL”), hereby submits this report to the Sunshine Coast Regional District (the “District”). Within, we have provided our analyses and conceptual costing for the renewal of the Greaves, Merrill, and Langdale wastewater facilities, pursuant to the scope of work.

Should you have any queries, please do not hesitate to get in touch. Your business is appreciated. We thank you for the opportunity to assist you in your long-term asset planning.

Kind Regards,



Bradley Fossen, P.Eng.

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1 EXECUTIVE SUMMARY

The Sunshine Coast Regional District (SCRD) has retained Aurora Professional Group (APG) to perform replacement feasibility studies for wastewater systems at three locations: “Greaves Road,” “Merrill Crescent,” & “Langdale.” The objective of our study is to assess the current performance of each system and provide recommendations for repairs, upgrades, or replacements if required. Our recommendations are provided with Class ‘D’ conceptual estimates for each option.

The study scope of work includes:

- A desktop review of background documentation provided by the SCRD.
- Formal and informal discussions with operations staff.
- Field activities, including site assessments.
- Conceptual design assessments.
- Conceptual costing assessments (+/-30% in all cases).

Our results are summarized as follows:

Greaves Road

We have found the Greaves Road system to be operating with performance malfunctions. However, these malfunctions can be readily repaired for a projected cost of \$15,000 that will extend the life of the system for an estimated 10-30 years and potentially longer. The life of the system can be further extended with routine inspection and maintenance. We have estimated yearly operations costs for these inspection and maintenance costs at \$5,000.

Should the system require a complete replacement, we have estimated the total design and installation costs at \$70,000. This estimate is based on current flows of residential sewage quality and does not include costs for future studies, conveyance modifications or repairs, or other considerations not directly related to onsite wastewater disposal.

Merrill Crescent

We have found the Merrill Crescent system to be functioning as designed. While the treatment system tanks are near their design life, the structural condition appears satisfactory, based on observable surfaces. Pumps, control systems, and the ground dispersal field have already been replaced. Effluent quality has been sampled and tested and found to be within Type 2 standards, with less than 45 mg/L of total suspended solids and having a 5-day biochemical oxygen demand of less than 45 mg/L.

With influent source control and routine inspection and maintenance, we estimate the treatment system should perform as designed for an estimated 5 to 10 years. We have estimated yearly operations and maintenance costs to be \$11,000, in the current configuration. However, this projection would be similar if the system were to be replaced as well.

With routine inspection and maintenance, ground dispersal systems have been found to perform adequately for up to 30 years and sometimes longer. For that reason, we have projected conceptual costs for the Type 2 treatment system alone, should the sewerage system

require renewal. This projected cost is \$80,000. This estimate is based on current flows of residential sewage quality and does not include costs for future studies, conveyance modifications or repairs, or other considerations not directly related to onsite wastewater disposal.

Langdale

The Langdale system is currently operating in a bypass capacity, and residential sewage is being transferred to the YMCA treatment facility adjacent to the Langdale WWT site.

Our assessment of Langdale indicated that, while the treatment facility requires replacement, the drainfield components remained in satisfactory condition. However, the current ground dispersal design is likely undersized, and the site, in general, requires storm and groundwater drainage improvements.

Based on our findings, there are three potential options for Langdale. Each of which is priced conceptually.

- 1) Permanently process sewage via the YMCA treatment facility. In this scenario, we have suggested replacement and remedial activities that are projected to cost \$119,500. Operations costs in this scenario would remain the same as current.
- 2) Repair the Landale treatment system and resume processing sewage. Pursuing this option would require a new treatment system and drainage relief measures, with projected costs of \$547,000. Yearly operations costs in this scenario are projected to be \$16,000.
- 3) Replace the Langdale Wastewater Facility. The scope of this option is the same as (2) above, however, with the complete replacement of the ground dispersal system. The projected costs, in this case, are \$590,000. Yearly operations costs would be the same as option (2), \$16,000.

2 SUMMARY OF FIELD PROGRAM RESULTS

Individual field assessments of each facility have been attached to this report. The most relevant findings have been summarized here for convenience.

Greaves Road

Our field activities for Greaves required considerable excavation efforts, owing to vegetation encroachment and lack of access to system components. The inspection results were positive. Key assessments are as follows.

- The syphon chamber has a performance malfunction and is currently operating via overflow. The syphon mechanism should be replaced. A replacement floating outlet configuration may offer additional usable life for the existing dispersal field.
- The settling tank has a cracked lid which should be replaced for integrity and to prevent rainwater infiltration.
- The effluent manifold, providing flow to two distribution boxes, is uneven. As a result, flow to each distribution box, and its respective dispersal field, is uneven.
- The Eastmost drainfield has been resting for a satisfactory period. Inspection of the dispersal laterals and biomat indicated considerable remaining life, with little indication of clogging or root intrusion.
- The Westmost drainfield is experiencing a performance malfunction. There are indications of severe root intrusion and clogging. Flushing, jetting, and root cutting is expected to return this drainfield to a satisfactory condition, however it will benefit with period of rest.
- There are no flow monitoring devices installed. A flow monitoring device should be installed and monitored for operational considerations and to better inform future detailed design efforts.
- There are no alarm systems installed. An alarm system should be installed, considering there is, at current, minimal “alarm” or “reserve” volume for the system. Solar powered alarm systems are available.
- Vegetation encroachment, primarily Western Red Cedar and Alder trees, is significant. All trees within 3m-5m of the dispersal area should be felled and the stumps removed. Ongoing vegetation management is recommended.
- Test pits and soils assessments indicated approximately 130 cm of soil depth, with a most restrictive layer of favourable loamy sand of single grain / loose consistency, with no indication of a seasonal high water table.
- The existing system is nominally compliant with historical standards and site conditions are favourable for renewal options that meet current day standards.
- A renewed dispersal system should maximize vertical soil separation and include trenches that are constructed at a shallower depth.

- At present, the system is operating without posing a health risk. However, performance malfunctions should be promptly repaired and the maintenance program should be adjusted according to regular inspections.

Merrill Crescent

The Merrill system was found to be operating as designed, producing effluent meeting Type 2 standards. Type 2 standards require less than 45 mg/L of total suspended solids and having a 5-day biochemical oxygen demand of less than 45 mg/L. The drainfield, replaced in 2018, was performing as designed with no indications of overloading or malfunctions. As such, our activities were primarily focussed on the treatment system.

The treatment system was likely installed in 1981 or 1982 and is a legacy NPS (N.P.S. Wastewater Systems) aerated model with sludge return. While it is approaching the end of its design life, its structural condition appeared satisfactory and it has benefited from ongoing component replacements. Key assessments are as follows.

- Areas around the treatment tank indicated periods of surface water ponding and the system hatches do not have a sufficient seal to prevent surface water infiltration. The contact chamber is currently not in use, though it is full of rainwater. While these indications are not conclusive, it is likely that the system experiences surface water intrusion, which could place additional demands on the pumps and drainfield. The tanks should be properly sealed and the drainage around the tanks should be corrected.
- The discharge pump assembly is free-floating. It should be continuously monitored for torque effects or vibration that could result in pump or piping damage.
- The service water point near the treatment system should be labelled as non-potable, if the supply line is within 3m of the treatment system and has not been sleeved.
- The venting is free to atmosphere. Odours were not prevalent. However, if odours are observed, the vents could be readily directed to natural scrubber system.
- While the system is currently performing adequately, it has previously malfunctioned due to influent quality issues. This issue could be prevented in the future with the addition of a small trash tank, situated between the lifting station and treatment system.

Langdale

The Langdale treatment system had previously been assessed as unrepairable. As such, our field assessments of the Langdale facility focussed primarily on the ground dispersal system. Key assessments are as follows.

- The YMCA treatment system and outflow are performing as designed, however there have been periods where effluent testing results for biochemical oxygen demand (BOD) and total suspended solids (TSS) have exceeded prescribed requirements. This could indicate that there are occasions when the system has become overloaded, or has experienced a performance malfunction, diminishing the treatment efficacy.
- The Langdale facility parcel is within two SCRD development permit areas: "DPA 4 – Stream Riparian Assessment Area" & "DPA 5 – Aquifer Protection and Stormwater Management." A renewal plan may require additional consideration in regards to riparian areas and hydrogeology.

- Preliminary flow analyses indicate that:
 - there is a high likelihood that the original parameters of the permit can be maintained, should the existing system be renewed.
 - average dry weather daily flows increased from 8.6 cubic meters/day in 2015 to 23.0 cubic meters/day by 2020. This trend is considerable and should be further investigated.
 - storm and groundwater infiltration may be a large contributor to treatment flows. Comparing maximum flow events to the dry month average daily flow, indicates that there were wet month recorded daily flows that exceeded the dry weather average flow in a range of 103% to 197%. This can unnecessarily overload the treatment system and could result in diminished treatment.
 - average wet weather daily flows increased from 14.4 cubic meters/day in 2015 to 25.2 cubic meters/day by 2020, with an infiltration rate that ranged from 9% to 69%. Recorded maximum flow events were as high as 52 cubic meters/day.
- The site perimeter has indications of significant surface water runoff. The ditch South of the parcel should be cleared in order to allow stormwater to freely flow.
- The trench dispersal system is nominally compliant with historical standards. However, we have found that the dispersal volumes directed solely to one field or the other, significantly exceed current day standards for linear loading. This could be a contributing factor for breakout incidents that were previously experienced during the operation of the dispersal system. Excessive linear loading can create a groundwater mounding effect, eventually saturating the dispersal soils.
- Coupled with surface runoff, maximum flow events, and drainage issues, the dispersal system may have experienced periods of overloading, potentially contributing to breakout.
- The condition of the laterals and infiltrative surface indicates that there may be significant usable life remaining within the drainfield. The dispersal laterals that were exposed could readily disperse effluent, if required, though regular flushing and jetting is recommended. There were no indications of clogging within the infiltrative surface.
- Test pits and soils assessments indicated approximately 130 cm of soil depth before a limiting layer, with a most restrictive layer of favourable loamy sand of single grain / loose consistency and no indication of a seasonal high water table.
- It is recommended that the existing, decommissioned treatment system is demolished and remediated, regardless of the renewal option selected.
- It is recommended that a vegetation and stormwater management plan (relating to the dispersal area and transmission infiltration) is enacted, as part of the maintenance plan already in place.

3 SUMMARY OF CONCEPTUAL ESTIMATES

Table 1: Greaves - Summary of Conceptual Costs

Option	Conceptual Cost (+/- 30%)	Cost per Parcel
Short-term Renewal (repairs)	\$15,000	\$2,500
Long-term Renewal (replacement)	\$70,000	\$11,667
Yearly Average Operational Costs	\$5,000	\$833

Table 2: Merrill - Summary of Conceptual Costs

Option	Conceptual Cost (+/- 30%)	Cost per Parcel
Short-term Renewal (repairs)	\$20,000	\$1,429
Long-term Renewal (treatment system replacement)	\$80,000	\$5,714
Yearly Average Operational Costs	\$11,000	\$786

Table 3: Langdale - Summary of Conceptual Costs

Option	Conceptual Cost (+/- 30%)	Cost per Parcel
Permanent YMCA Tie-in	\$119,500	\$2,988
Replace Treatment System and Repair Existing Dispersal System	\$547,000	\$13,675
Replace Treatment System and Replace Existing Dispersal System	\$590,000	\$14,750
Yearly Average Additional Operational Costs (YMCA Tie-In)	\$8,000	\$200
Yearly Average Operational Costs (renewal)	\$16,000	\$400

4 LIMITATIONS AND DISCLAIMERS

- This report relates only to conceptual estimates for sewerage systems regarding the subject parcels and is valid only at its issuance.
- Our advice may include specific operating and maintenance requirements to be followed by the Owner. The Owner's legal obligation is to operate their sewerage system per the most up-to-date maintenance plan for their sewerage system. If one is not available, the Owner is responsible to have one developed by an authorized person.
- Our investigations and assessments rely on public information that has the potential to be inaccurate. Further, our testing of soils cannot reveal all underground conditions. We endeavour to make all reasonable efforts to manage this uncertainty; however, it cannot be eliminated.
- Should site conditions, flow volumes and characteristics, or owner requirements change, this report becomes void.
- The use of this report shall be in its entirety; that is, assessments can not be used piece-meal.
- Any design drawings or constructed works that are based on the assessments and conclusions in this report should be provided to its author for review.

5 ATTACHMENTS

1. **2021.02-40-STY-001** (Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility)
2. **2021.02-40-STY-002** (Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility)
3. **2021.02-40-STY-003** (Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility)

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Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility

PROJECT No: 2021.02

SITE NAME: GREAVES

DOCUMENT No.: 2021.02-16-STY-001

FORM No. APG-40-FRM-009

1: Form Revision Log

Revision #	Date	By	Description
0	31-Oct-2020	BJGF	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-001	Revision: R.0

Table 2: Summary Information

Project No.	2021.02	Site Name:	Greaves
Study Type:	<input type="checkbox"/> New Construction <input checked="" type="checkbox"/> Replacement <input type="checkbox"/> Repair / Alteration	Prepared by:	Bradley Fossen Jim Andersen
Owners / Client:	SCRD	Jurisdiction:	Vancouver Coastal Health / SCRD
Legal Description	Lot 6 Of Lot A Block D District Lot 1391 Plan 17397	PID # (Parcel Identifier Number)	007-282-966
Common Address	12545 Greaves Rd, Madeira Park, BC	Folio. # (Tax Assessment Roll #)	746.03486.030
Engineer of Record	Bradley Fossen	Project Stage:	Existing
Influent Type	<input checked="" type="checkbox"/> Typical Residential <input type="checkbox"/> Other _____	Parcels:	6
Year of Construction	1977 (est.)	Design Flow: (Estimated, BC SPM)	7800 L/day
Purpose of Report:	<ul style="list-style-type: none"> • Assess system performance requirements. • Provide guidance on factors that may affect onsite wastewater treatment system (OSWTS) renewal options. • Assess current system performance and limitations. • Conceptualize OSWTS renewal options. • Conceptualize major cost items for an OSWTS renewal. 		
Methodology	<ul style="list-style-type: none"> • Per scope of work, perform document reviews, attend the site, and perform activities to determine “known and potential existing site constraints,” including: <ul style="list-style-type: none"> ○ Exposing system components and undertaking performance assessments. ○ Assessing current system performance and limitations. ○ Reviewing elements of the facility site and ground conditions that may impede or constrict OSWTS renewal options. 		
Summary of Activities:	<ul style="list-style-type: none"> • Document reviews as part of ongoing exchanges with the SCRD. • Site activities and assessments on 08-Mar-2021 and 09-Mar-2021, including: <ul style="list-style-type: none"> ○ Excavation and locating of site components, including assessments of infiltrative layer and soil conditions. ○ Identification of any design or operational issues, with the current, as-built system. ○ Remediation of any issues that could be immediately addressed. ○ Identification of any current maintenance challenges. ○ Flow testing of components for operational capacity and indications of any potential issues. • Formal and informal discussions with SCRD staff. • Analysis and compilation of results. • Interpretation of results to identify the most practical renewal options. • Cost estimation and report reviews. 		

Document Revision #	Date	By	Review By	Description
A	06-Mar-2021	BJGF	JA	Issued for Review
B	21-May-2021	BJGF	JA	Issued for Review
0	28-Jul-2021	BJGF	JA	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-001	Revision: R.0

1 SUMMARY

This report conveys findings and assessments resulting from activities performed onsite and from a review of existing data. While our activities meet or exceed standard practice for inspection, this report should not be considered a substitute for regular inspection activities required of system owners, by regulation. Nor should this report be construed as a basis for detailed design. It has been prepared to aid conceptual design and costing.

Key observations:

- Septic tanks, which reside on individual parcels, are an important part of the wastewater treatment process and should be regularly inspected as part of an updated maintenance plan.
- The syphon chamber has a performance malfunction and is currently operating via the overflow. The syphon mechanism should be replaced. A replacement floating outlet configuration may offer reduced maintenance and additional usable life for the existing dispersal field.
- The settling tank has a cracked lid which should be replaced for integrity and to prevent rainwater infiltration.
- The effluent manifold, providing flow to two distribution boxes, is uneven. As a result, flow to each distribution box, and its respective dispersal field, is uneven.
- The Eastmost drainfield has been resting for a satisfactory period. Inspection of the dispersal laterals and biomat indicated considerable remaining life, with little indication of clogging or root intrusion.
- The Westmost drainfield is experiencing a performance malfunction. There are indications of severe root intrusion and clogging. Flushing, jetting, and root cutting are expected to return this drainfield to a satisfactory condition. However, it will benefit with a period of rest. The West field should be returned to operation in tandem with the East field once flushing, jetting, and root cutting have been performed, and intrusive vegetation has been removed.
- There are no flow monitoring devices installed. A flow monitoring device should be installed and monitored for operational considerations and to better inform future detailed design efforts.
- There are no alarm systems installed. An alarm system should be installed, considering there is, at current, minimal “alarm” or “reserve” volume for the system. Solar-powered alarm systems are available.
- Vegetation encroachment, primarily Western Red Cedar and Alder trees, is significant. All trees within 3m-5m of the dispersal area should be felled and the stumps removed. Ongoing vegetation management is recommended.
- Test pits and soil assessments indicated approximately 130 cm of unsaturated and permeable soil, with favourable loamy sand of single grain / loose consistency, with no indication of a seasonal high-water table.
- The existing system is nominally compliant with historical sewerage design standards, and site conditions are favourable for renewal options that meet current day standards.
- At present, the system is operating without posing a health risk. However, performance malfunctions should be promptly repaired and the maintenance program should be adjusted according to regular inspections.

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- Assessment of the infiltrative layer and biomat were favourable for continued use of the dispersal system. We estimate the usable life between 10-20 years, with proper operations and maintenance, including inspection of on-parcel septic tanks and vegetation management.
- A renewed dispersal system, when required, should maximize vertical soil separation and include trenches that are constructed at a shallower depth.
- Renewal options and conceptual costs have been tabulated and can be found in Section 5.

2 GENERAL DESIGN CONSTRAINTS

System renewal options must satisfy the following general design constraints:

- Compliance with the applicable regulation, the BC Sewerage System Regulation, as design flows are less than 22,700 liters per day.
- The system must also comply with the Health Act, Land Use Bylaws, Strata, and other acts and regulations that may be impacted by an OSWTS.
- The system must provide effective wastewater treatment for 6 residential parcels.
 - Daily design flow is estimated as 7800 L/day, based on 1300 L/day per parcel, in accordance with the BC Standard Practice Manual, V.3.
 - The residences connected to the system vary in size between two and three bedrooms, with one four-bedroom residence, as noted on BC Assessment.
- Raw influent quality is assumed to fall within parameters characterized as raw residential sewage, as defined by the BC SPM.
- Effluent must undergo soil-based treatment via ground dispersal.

3 SITE OBSERVATIONS AND ASSESSMENTS

Table 3: Greaves - General Site Observations and Assessments

Element	Assessment	Constraints
Previous or Supplementary Professional Reviews	Previous professional reviews have not been provided.	
Recent Inspections and Maintenance	Previous inspection or maintenance reports have not been provided.	
Site and System History	The subdivision system is assumed to be constructed in 1977, or thereabouts, indicating an approximate age of 44 years.	
Future Site Development	5 parcels are currently developed, with a 6 th parcel currently in development.	
Neighbouring Property Features	<p>The system is bordered at North by Lot A, at East by Greaves Rd, and at West and South by the Baker Rd right of way.</p> <p>The neighbouring properties do not have any features that would restrict or impede an OSWTS renewal.</p>	
Title and Land Data	<ul style="list-style-type: none"> • Land Owner: SCRD 	

Element	Assessment	Constraints
	<ul style="list-style-type: none"> • PID: 007-282-966 • Folio: 746.03486.030 • Lot: 6 • Block: D • District Lot: 1391 • Plan: VAP17397 • Approximate Lot Size: 0.154 hectare <p>Land title information was reviewed and there appeared to be no legal instruments that may restrict or impede an OSWTS renewal.</p>	
Protected Areas	Protected Areas potential was reviewed via the SCRD Maps Service. There are no Protected Areas designated on or near the subject property that would restrict or impeded an OSWTS renewal.	
Development Permit Areas	Development Permit Area potential was reviewed via the SCRD Maps Service. There are no development permit area considerations that would restrict or impede an OSWTS renewal.	
Climate Considerations	Climate is classified as Warm-Summer Mediterranean. Marine weather conditions exist, with warm summers and periods of high rainfall and occasional freezing. Significant cold weather freeze protection is not required, though components should be covered.	
Topography	The general area is East of Bargain Bay, within the Cordillera / Georgia Lowland physiographic region, developed, and generally sloping towards the bay. The dispersal area itself is a constructed level bench, above a bank that slopes down to Greaves Rd.	
Well Registry	BC Water Resources was consulted to indicate whether any water wells were in the area. There are no registered wells within 30m of the subject property.	
Riparian Areas	No inland water bodies or watercourses that would provide fish habitat were observed on the subject property at the time of this report.	
Nitrogen and Phosphorous Reduction	There are no downgrade wells, water bodies at risk of eutrophication, or short-distance up-grade wells in proximity to this dispersal area. Nutrient removal requirements, in this regard, are do not appear to be required.	
Buried Infrastructure	Besides sewer distribution, there are no utilities directly within the dispersal area that would prevent or constrain an OSWTS renewal.	
Boundary Conditions, Exposure Pathways, and Breakout Risks	Breakout risk is the potential of effluent to “surface.” Potential breakout risks are: <ul style="list-style-type: none"> • Bank at East. 	Maintain appropriate distance from the bank as part of any future designs.

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Element	Assessment	Constraints
Vegetation	The current dispersal area is grass/herbaceous and is surrounded at West and North by Cedar, Alder, and Fir trees.	Alder and Cedar should be cut back 3-5m from the dispersal area. A vegetation management plan should be enacted.

4 SYSTEM OBSERVATIONS AND ASSESSMENTS

Table 4: Greaves - System Observations and Assessments

Element	Assessment	Observations and Recommendations
Current Configuration Type	The system receives pumped effluent from residential septic tanks from each parcel. Flow is directed to a settling tank at the facility site, which overflows into a siphon chamber. The siphon chamber is designed to provide regular doses to a trench infiltration system via gravity distribution.	An important part of the treatment system, the septic tank, resides on individual residents' properties. Because the overall system efficacy can be affected by the maintenance and performance of an individual septic tank, it is recommended that septic tanks are regularly inspected as part of a maintenance plan. For example, to ensure suitable constituents and septage pump out frequency, along with dosing mechanisms.
Flow Data	No flow data was available for analysis.	
Primary Treatment	As communicated by the SCRd, each parcel has its own septic tank, which pumps to the OSWTS.	The new parcel under development requires a septic tank as well. The OSWTS, as configured, does not manage raw sewage influent. SCRd should ensure that the septic tank and dosing system is properly configured once it is operational.
Effluent Transmission	Effluent transmission from individual parcels, to the system, was not inspected or assessed.	It is recommended that the transmission network is regularly inspected.
Storage and Treatment	Settling Tank: Estimated volume of 1860 L (~400 I.G.)	
	<ul style="list-style-type: none"> By current standards, this tank could be considered undersized. 	A renewed system should include a larger settling tank that meets current standards, as determined by detailed design.
	<ul style="list-style-type: none"> The settling tank has a broken lid. 	Fix lid to: <ul style="list-style-type: none"> prevent rainwater infiltration prevent odours mitigate risk to the general public
	<ul style="list-style-type: none"> Inlet and outlet heights appear to be properly configured. Structural degradation appears minimal, as indicated from observable surfaces 	
	Siphon Tank: Estimated volume of 700 L (~155 I.G.)	

Element	Assessment	Observations and Recommendations
	<ul style="list-style-type: none"> By current standards, this tank could be considered undersized. There is inadequate “reserve” or “alarm” volume. The siphon is experiencing a performance malfunction. Flow is being directed through the overflow to the drainfield. Overflow height appears to be properly configured. Structural degradation appears minimal, as indicated from observable surfaces 	<p>A renewed system should include a dosing tank that meets current standards, as determined by detailed design.</p> <p>As configured, should the dispersal field have a performance malfunction, there is minimal reserve volume to allow time for rectifying a performance malfunction. Meaning, the system could overflow relatively quickly should the dispersal system begin to back up.</p> <p>The siphon should be inspected and fixed or replaced. A floating outlet device may be a more suitable, robust component for this application. Floating outlets do not require power and are typically more reliable than siphons.</p>
Flow Monitoring	<ul style="list-style-type: none"> There are no flow monitoring devices installed. 	A flow monitoring device should be installed.
Alarms	<ul style="list-style-type: none"> There are no alarm systems installed. 	An alarm system should be installed, considering there is, at current, minimal “alarm” or “reserve” volume for the system. Solar-powered alarm systems are available.
Ground Dispersal	<p>The system is configured with two distribution boxes, 1 supplying 4 laterals and the other supplying 3 laterals. Each distribution box is controlled with an isolation valve. Laterals are approximately 30 m in length and are constructed of 3” PVC perforated pipe.</p> <p>Effluent is directed to a trench infiltration system. The nominal trench infiltrative surface is at approximately 100 cm. The trenches have been constructed with suitable aggregate type and depth below and above the dispersal laterals and backfilled with sand and cover soil. The trench dispersal system is nominally compliant with historical standards. •A renewed dispersal system should maximize vertical soil separation and include trenches that are constructed at a shallower depth.</p>	
Effluent Manifold		
	<p>The effluent manifold is constructed with 4” Sch. 40 PVC, complete with a 4” isolation valve for each distribution box.</p> <ul style="list-style-type: none"> The valves operate freely. The manifold has been constructed out of level. As such, an estimated 95% of flow will be through the East distribution box when both valves are open. 	The manifold should be reconstructed so that it is level and provides equal distribution to both distribution boxes.
Distribution Boxes		

Element	Assessment	Observations and Recommendations
	<p>The distribution box at West is a 5-hole/4-out configuration.</p> <ul style="list-style-type: none"> There were no indications of significant structural degradation. However, the baffles have indications of minor degradation. Laterals 1 & 2 were root bound; the distribution box is experiencing a performance malfunction. Flow testing for 1-hour indicated 100% flow to laterals 3 & 4. 	<p>Flushing, jetting, and root cutting are recommended to dispersal laterals of roots and build up.</p>
	<p>The distribution box at East is a 4-hole/3-out configuration</p> <ul style="list-style-type: none"> There were no indications of significant structural degradation. There were no indications of root infiltration or backup. 	<p>This distribution box, and its respective portion of the dispersal field, have had an extended period of rest. It is recommended that flow be directed to this side of the field while the West portion of the field rests.</p>
Dispersal Laterals: Dispersal Area Approximately 30m x 13m		
	<p>West Laterals</p> <ul style="list-style-type: none"> West laterals were inspected and found to be experiencing a performance malfunction. Significant root intrusion exists; the trees at West (primarily Cedar) have encroached over time into the drainfield area. 	<p>Trees should be cut back at 3m-5m from the drainfield area and maintained as such, with a vegetation management plan.</p>
	<p>East Laterals</p> <ul style="list-style-type: none"> East laterals were inspected and found to be in satisfactory condition, with minimal indications of root intrusion or other blockages. 	
Vegetation	<p>The West portion of the dispersal field has significant tree encroachment. This has resulted in root intrusion into the distribution box and dispersal laterals at West.</p>	<p>Trees should be cut back at 3m – 5m from the drainfield area and maintained as such, with a vegetation management plan.</p>
Effluent & Performance	<p>Effluent quality appeared satisfactory, with no irregular odours and no visible indications of treatment failure. Solids sizing may potentially indicate a potential of raw sewage influent. No further sampling was conducted.</p>	<p>It is recommended that septic tanks are regularly inspected as part of a maintenance plan.</p>
Soils Capability	<p>Soils were inspected via excavation of several locations within the dispersal area. Inspection of soils indicated the area is primarily loose grain, structureless sand, with approximately</p>	<p>These are favourable conditions for a renewed dispersal system in compliance with current day standards.</p>

	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-001	Revision: R.0

Element	Assessment	Observations and Recommendations
	130 cm of suitable soils until a likely limiting layer.	
Infiltrative Layer	The infiltrative layer and biomat condition were inspected via excavation of several locations within the dispersal area. The infiltrative layer was found to be satisfactory, with no indications of excessive clogging.	These results are favourable for continued use of the dispersal field. We estimate the usable life between 10-20 years, with proper operations and maintenance, including inspection of septic tanks and vegetation management.
Reserve Area	The system does not have provisions for a reserve area. However, the areas in between the existing trenches offer an opportunity for use as a reserve area.	
General System Comments	<ul style="list-style-type: none"> • “As-built” system drawings do not exist. It is recommended that an as-built drawing set is created, to assist future operations and maintenance. • In the current configuration, there is minimum elevation difference between the dosing tank and dispersal field. As such, without pumped dosing, the dispersal cannot be considered “uniform”. Pumped dosing generally provides better uniformity of dispersal, improved soil-based treatment and can improve the longevity of a ground dispersal system. • There are no signs of breakout or backup. The system appears to be performing in a manner that does not currently pose a health risk. However, it should be repaired to address current performance malfunctions. • With suitable repairs and adequate operations and maintenance, this system may continue to perform well for a reasonable time. • The existing system is nominally compliant with historical standards. • Site and soil conditions are favourable for renewal options that meet current day standards. • An OSWTS renewal, whether an alteration or replacement, will need to be designed by an authorized person and the design will need to be filed with the health authority. 	

	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-001	Revision: R.0

5 RECOMMENDATIONS FOR SYSTEM RENEWAL & CONCEPTUAL ESTIMATE OF COSTS

Our assessment of the Greaves Wastewater facility has provided for two main options for renewal: 1) Repair the system in the short-term; and 2) replace the system in the long term.

We have also provided an estimate of operations and maintenance costs should short-term repairs be performed.

Estimated costs have been presented in the nearest thousand-dollar value. Cost items such as permitting, application fees, and taxes, have not been included.

5.1 GREAVES – SHORT-TERM SYSTEM RENEWAL

Table 5: Greaves – Conceptual Costs for the Short-Term

Item	Description	Costs (+/-30%)
Flushing, jetting, root-cutting	Flushing, jetting and root cutting, along with a period of rest for the West portion of the field, should allow for it to be reinstated.	\$3,000
Siphon Replacement	Replacing the siphon system will return the dosing system to a functioning state. It is recommended that the dosing chamber is replaced with a larger tank to improve alarm reserve volume and to use a floating outlet system in a dosed-gravity configuration, which should be more reliable. The estimate includes tank decommissioning/removal temporary sewer management, provisions for manifold rework, and the addition of a flow monitoring device and solar alarm system.	\$12,000
Total		\$15,000
Cost Per Parcel		\$2,500

5.2 GREAVES – LONG-TERM SYSTEM RENEWAL

Table 6: Greaves – Conceptual Costs for the Long-Term

Item	Description	Costs (+/-30%)
Replacement System	Design and install of a replacement settling, dosing, and dispersal system, not in consideration of any short-term repairs. This cost includes decommissioning/equipment removal, upgrading the system to include a more suitably sized settling tank, a pump-chamber and duplex pumps, and an alarm system.	\$67,000
Temporary Sewer Management	Pumping on standby, for 2 days, while the settling tank is replaced.	\$3,000
Total		\$70,000
Cost Per Parcel		\$11,667

	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-001	Revision: R.0

5.3 GREAVES – ONGOING OPERATIONS

The following operational costs are estimated for maintaining the system as-is, with short-term repairs. These activities should provide considerable usable life to the existing dispersal field. These costs would also be applicable for a complete system replacement. However, the maintenance plan for a system replacement will be specified by the system designer.

These cost estimates do not include power costs, nor allowances for amortized costs for long-term replacement, which should also be addressed.

Table 7: Greaves – Conceptual Costs for Operations and Maintenance (Yearly Costs)

Item	Description	Costs (+/- 30%)
Yearly Inspection	Yearly inspection for maintenance, per maintenance plan meeting regulatory requirements.	\$2,000
Operations	2-year pump out frequency and minor repairs.	\$2,000
Maintenance	3-year frequency for dispersal field flushing and jetting, yearly average.	\$1,000
<u>Yearly Average</u>		\$5,000
<u>Cost Per Parcel, Per Year</u>		\$833

 Aurora PROFESSIONAL GROUP Inc.	Onsite Wastewater Treatment and Dispersal System Assessment – Greaves Wastewater Treatment Facility	Project: 2021.02
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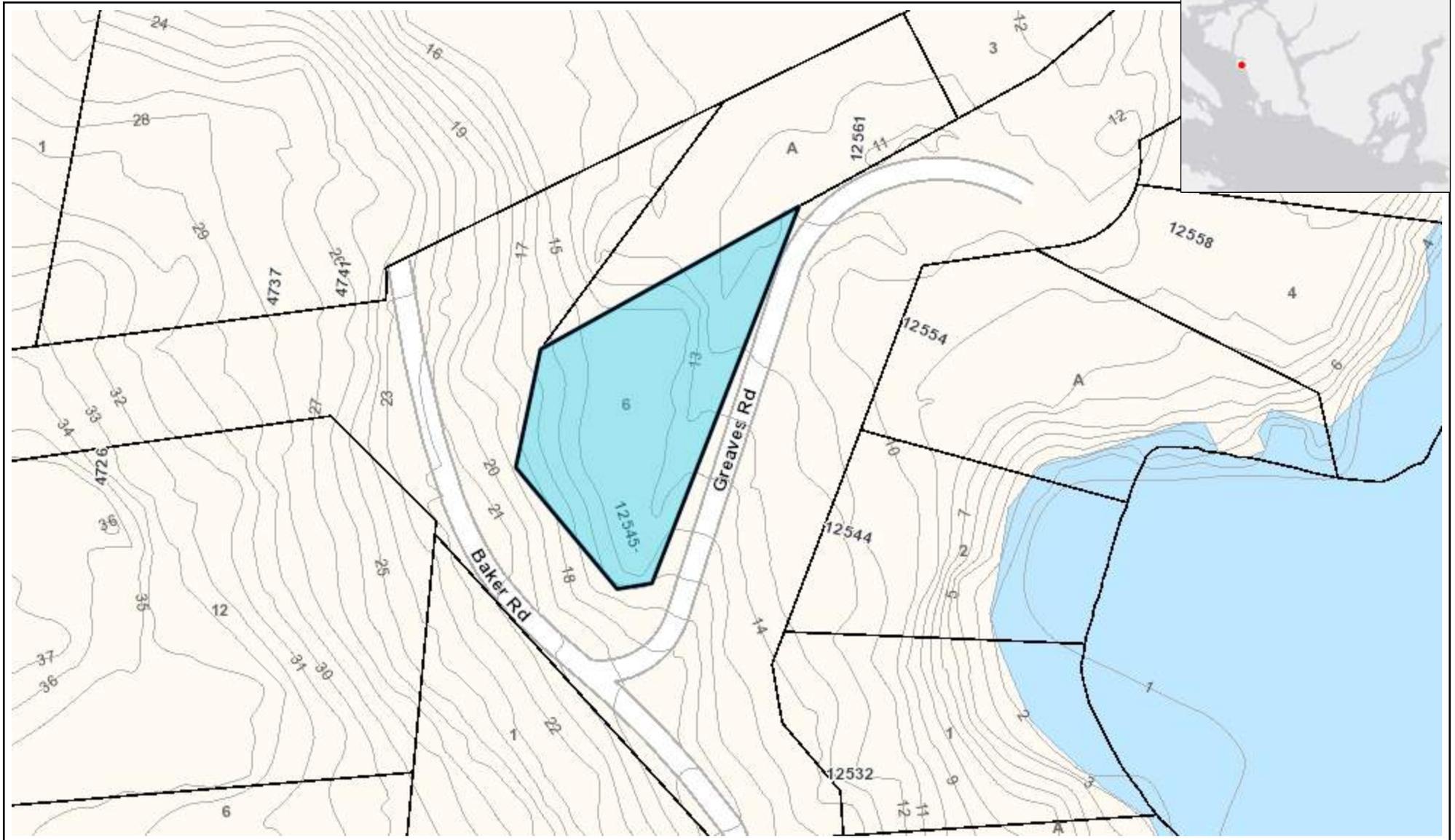
6 ATTACHMENTS

1. Greaves Parcel Map
2. Greaves Property Report
3. Greaves Original Construction Drawing
4. Field Record & Photo Log

Greaves



Index Map



75.6 0 37.78 75.6Meters

This information has been compiled by the Sunshine Coast Regional District (SCRD) using data derived from a number of sources with varying levels of accuracy. The SCRD disclaims all responsibility for the accuracy or completeness of this information.



4/26/2021
1: 1,487

Legend

-  Parcel Boundaries
- Sensitive Ecosystems Inventory**
 -  Cliffs
 -  Herbaceous
 -  Mature Forest
 -  Older Forest
 -  Riparian
 -  Seasonally Flooded Agricultural Fields
 -  Wetland
 -  Woodland
-  Contours
-  Unconstructed Roads
-  Golf Courses
- Parks**
 -  SCRD Park
 -  Recreation Site
 -  Municipal Park
 -  Provincial Park
 -  Wharf
 -  Cemetery
-  Band Lands



SCRD Maps

Property Report

4/25/2021

Folio: 746.03486.030

PID: 007-282-966

Address:

Jurisdiction: SCR D

Lot: 6

Block: D

Plan: VAP17397

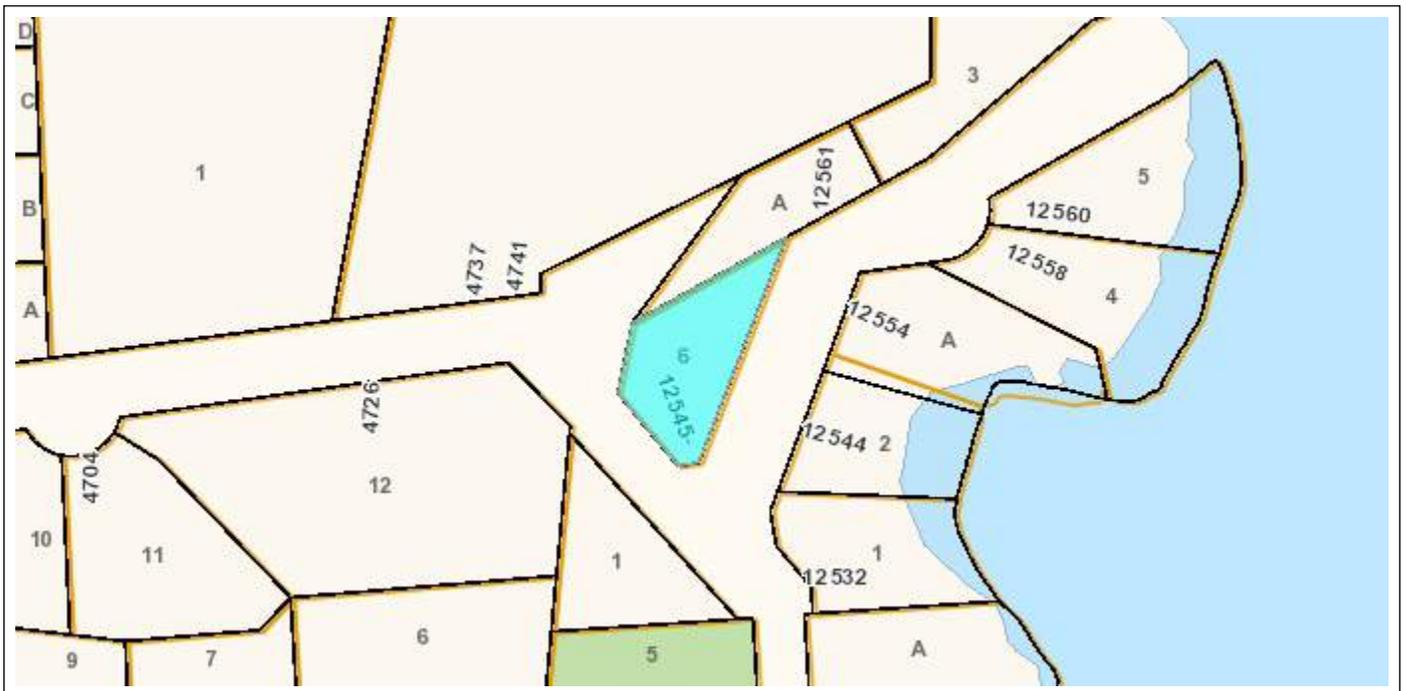
District Lot: 1391

2021 Assessed Value: 182000

Land Value: 182000

Improvement Value: 0

Approximate Lot Size (BC Assessment): 16553 SQUARE FEET



12545 Greaves Rd
 PID: 007-282-966
 Folio: 746.03486.030
 Lot: 6
 Block: D
 District Lot: 1391
 Plan: VAP17397
 Approximate Lot Size: 16553 SQUARE FEET

WARNOCK ROAD

DAVIS ROAD (Dedicated)

Trovelled Road #12 Gravel

probable rock

4" PERFORATED PIPE
 7 ROWS OF 100' AT 6" O.C.
 2" WATER LINE
 SETTLING TANK
 SYPHON CHAMBER

347 sq m
 26.63 m

for Approval
 of a System to
 become Property of S.S.C.P.D.

2" pressure line
 check valve @ each service connection

#12544 2

#12532

BEAVER ISLAND
 DISPOSAL FIELD
 SITE PLAN

DATE: AUG 16/77
 SCALE: 1" = 50'
 DRAWN BY: TUF
 CHECKED BY:
 REVISED:

APPROVED Date: SEP 30 1977
 for Minister of Health
 William Bailey
 REGIONAL ENGINEER
 Environmental Engineering Division No. 11187(2)

D.H. SHUTTLEWORTH & ASSOCIATES LTD.
 Consulting Engineers
 P.O. BOX 515, SECHelt, B.C. V0N 3A0

LOT 3 PLAN 12567

ROAD

HARBOUR

BARGAIN



#12560 5

#12558 4

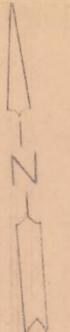
#12554 3

PLAN 9760

power pole

power pole

Building



SITE ASSESSMENT - GREAVES

Created: 07-28-2021

Creator: Bradley Fossen (@BFO)

Status:

Dates: 04-13-2021 - 07-28-2021

Recipients

brad@thinkapg.com

Description

Site field activities for the purposes of conceptual system renewal.

Sheets

**2021.02 GREAVES (12545
GREAVES RD)**
Greaves Construction Drawing

Table of contents

#	Description	Category	Plan	Assignee	Status	Page
19	DBOX 1 AND FLOW TEST	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	3
20	DBOX 2 AND FLOW TEST	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	4
16	GENERAL SITE OBSERVATIONS	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	5
21	MANIFOLD AND VALVES	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	6
18	SETTLING TANK	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	7
17	SIPHON CHAMBER	01. OBSERVATION	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	8
22	TEST PIT 1 AND LATERAL EXPOSURE	01. TEST PIT	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	9
23	TEST PIT 2 AND LATERAL EXPOSURE	01. TEST PIT	Greaves Construction Drawing	@BFO	Completed - 07-28- 2021	10

#19 - DBOX 1 AND FLOW TEST
 Completed | Bradley Fossen | 01. OBSERVATION
 Plan: Greaves Construction Drawing

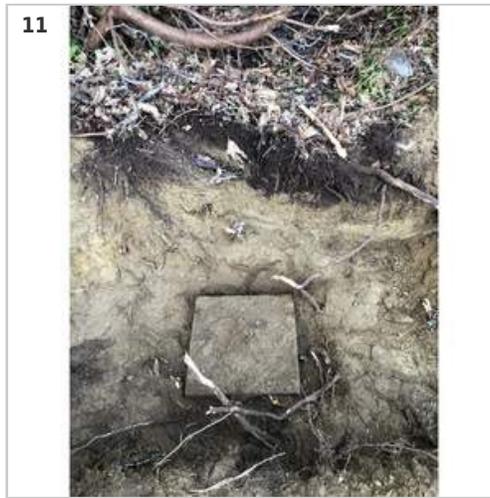


Task messages (time in MDT)

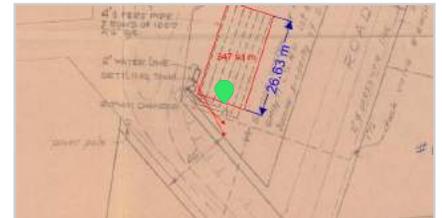
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Bradley Fossen	Photo 3	28 Jul 11:36 AM
Bradley Fossen	Photo 4	28 Jul 11:36 AM
Bradley Fossen	Photo 5	28 Jul 11:36 AM
Bradley Fossen	Photo 6	28 Jul 11:36 AM
Bradley Fossen	Photo 7	28 Jul 11:36 AM
Bradley Fossen	Photo 8	28 Jul 11:36 AM
Bradley Fossen	Photo 9	28 Jul 11:36 AM
Bradley Fossen	Photo 10	28 Jul 11:36 AM
Bradley Fossen	Photo 11	28 Jul 11:36 AM

Photos





#20 - DBOX 2 AND FLOW TEST
 Completed | Bradley Fossen | 01. OBSERVATION
 Plan: Greaves Construction Drawing



Task messages (time in MDT)

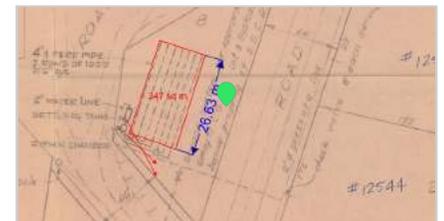
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Bradley Fossen	Photo 3	28 Jul 11:38 AM
Bradley Fossen	Photo 4	28 Jul 11:38 AM
Bradley Fossen	Photo 5	28 Jul 11:38 AM

Photos



#16 - GENERAL SITE OBSERVATIONS

Completed | Bradley Fossen | 01. OBSERVATION
Plan: Greaves Construction Drawing



Task messages (time in MDT)

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Bradley Fossen	Photo 3	28 Jul 11:29 AM
Bradley Fossen	Photo 4	28 Jul 11:29 AM
Bradley Fossen	Photo 5	28 Jul 11:29 AM

Photos



#21 - MANIFOLD AND VALVES
 Completed | Bradley Fossen | 01. OBSERVATION
 Plan: Greaves Construction Drawing



Task messages (time in MDT)

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Bradley Fossen	Photo 3	28 Jul 11:42 AM
Bradley Fossen	Photo 4	28 Jul 11:42 AM

Photos



#18 - SETTLING TANK

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Plan: Greaves Construction Drawing



Task messages (time in MDT)

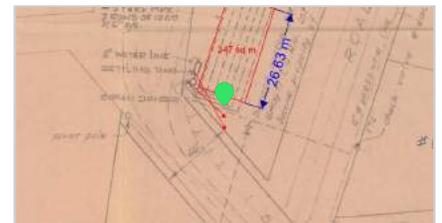
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Bradley Fossen	Photo 3	28 Jul 11:32 AM
Bradley Fossen	Photo 4	28 Jul 11:32 AM

Photos



#17 - SIPHON CHAMBER

Completed | Bradley Fossen | 01. OBSERVATION
Plan: Greaves Construction Drawing



Task messages (time in MDT)

Bradley Fossen Photo 1

28 Jul 11:31 AM

Bradley Fossen Photo 2

28 Jul 11:31 AM

Photos



#22 - TEST PIT 1 AND LATERAL EXPOSURE

Completed | Bradley Fossen | 01. TEST PIT
Plan: Greaves Construction Drawing

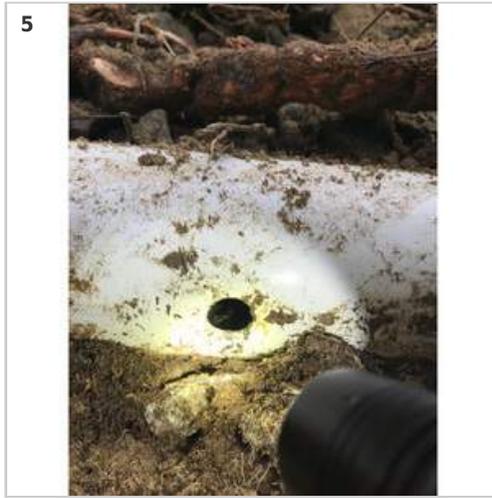


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Bradley Fossen	Photo 9	28 Jul 11:46 AM

Photos

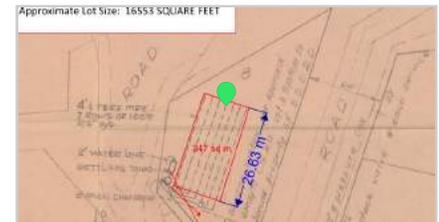




#23 - TEST PIT 2 AND LATERAL EXPOSURE

Completed | Bradley Fossen | 01. TEST PIT

Plan: Greaves Construction Drawing



Task messages (time in MDT)

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Bradley Fossen	Photo 4	28 Jul 11:51 AM
Bradley Fossen	Photo 5	28 Jul 11:51 AM
Bradley Fossen	Photo 6	28 Jul 11:51 AM
Bradley Fossen	Photo 7	28 Jul 11:51 AM

Photos

1



2



3



4



5



6



7



12545 Greaves Rd
 PID: 007-282-966
 Folio: 746.03486.030
 Lot: 6
 Block: D
 District Lot: 1391
 Plan: VAP17397
 Approximate Lot Size: 16553 SQUARE FEET

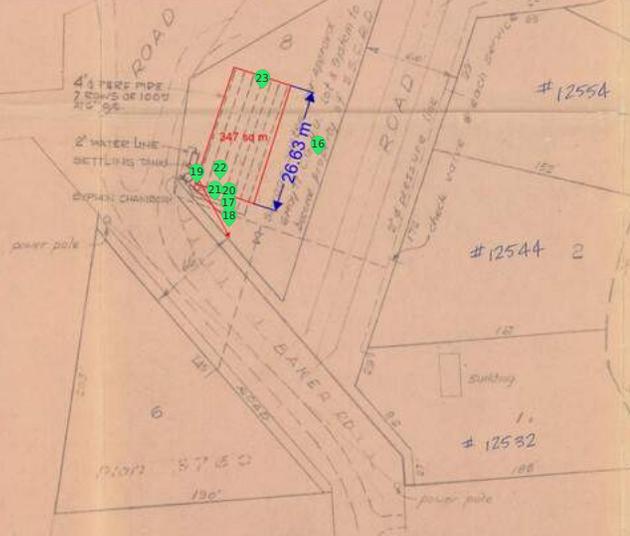
MARNOCK ROAD

DAVIS ROAD (Dedicated)

LOT 3 PLAN 12567

ROAD

HARBOUR



APPROVED Date: SEP. 3 0 1977
 for Minister of Health
William Bailey
 REGIONAL ENGINEER
 Environmental Engineering Division No. 111872

BEAVER ISLAND DISPOSAL FIELD SITE PLAN	DATE: AUG 1977	B.M. ENGINEERING & ASSOCIATES LTD. Consulting Engineers P.O. BOX 212, ST. CATHARINES, ONT. L9A 2H8
	SCALE: 1" = 50'	
	DRAWN BY: T.M.P.	
	CHECKED BY:	
	REVISION:	



Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility

PROJECT No: 2021.02

SITE NAME: MERRILL

DOCUMENT No.: 2021.02-16-STY-002

FORM No. APG-40-FRM-009

1: Form Revision Log

Revision #	Date	By	Description
0	31-Oct-2020	BJGF	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

Table 2: Summary Information

Project No.	2021.02	Site Name:	Merrill
Study Type:	<input type="checkbox"/> New Construction <input checked="" type="checkbox"/> Replacement <input type="checkbox"/> Repair / Alteration	Prepared by:	Bradley Fossen Jim Andersen
Owners / Client:	SCRD	Jurisdiction:	Vancouver Coastal Health / SCR D
Legal Description	Treatment: LOT 107 BLOCK 2 DISTRICT LOT 1362 PLAN 19110 Dispersal: LOT 106 BLOCK 2 DISTRICT LOT 1362 PLAN 19110	PID # (Parcel Identifier Number)	Treatment: 007-084-536 Dispersal: 007-084-528
Common Address	Treatment: 12683UF MERRILL CRES, Madeira Park, BC Dispersal: 4561 MERRILL RD, Madeira Park, BC	Folio. # (Tax Assessment Roll #)	Treatment: 746.03283.286 Dispersal: 746.03283.284
Engineer of Record	Bradley Fossen	Project Stage:	Existing
Influent Type	<input checked="" type="checkbox"/> Typical Residential <input type="checkbox"/> Other _____	Parcels:	14
Year of Construction	1982 (Treatment) 2018 (Dispersal)	Design Flow: (Estimated)	18,200 L/day
Purpose of Report:	<ul style="list-style-type: none"> Assess system performance requirements. Provide guidance on factors that may affect onsite wastewater treatment system (OSWTS) renewal options. Assess current system performance and limitations. Conceptualize OSWTS renewal options. Conceptualize major cost items for an OSWTS renewal. 		
Methodology	<ul style="list-style-type: none"> Per scope of work, perform document reviews, attend the site, and perform activities to determine "known and potential existing site constraints," including: <ul style="list-style-type: none"> Undertaking performance assessments. Assessing current system performance and limitations. Reviewing elements of the facility site and ground conditions that may impede or constrict OSWTS renewal options. 		
Summary of Activities:	<ul style="list-style-type: none"> Document reviews as part of ongoing exchanges with the SCR D. Site activities and assessments on 08-Mar-2021 and 09-Mar-2021, including: <ul style="list-style-type: none"> Locating of site components Identification of any design or operational issues, with the current, as-built system. Remediation of any issues that could be immediately addressed. Identification of any current maintenance challenges. Flow testing of components for operational capacity and indications of any potential issues. Formal and informal discussions with SCR D staff. Analysis and compilation of results. Interpretation of results to identify the most practical renewal options. Cost estimation and report reviews. 		

Document Revision #	Date	By	Review By	Description
A	06-Mar-2021	BJGF	JA	Issued for Review
B	21-May-2021	BJGF	JA	Issued for Review
C	28-Jul-2021	BJGF	JA	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

1 SUMMARY

This report conveys findings and assessments resulting from activities performed onsite and from a review of existing data. While our activities meet or exceed standard practice for inspection, this report should not be considered a substitute for regular inspection activities required of system owners by regulation. Nor should this report be construed as a basis for detailed design. It has been prepared to aid conceptual design and costing.

Key observations:

- The treatment system is a legacy NPS (N.P.S. Wastewater Systems) sequencing batch reactor that uses aeration and a sludge return process. While it is approaching the end of its design life, its structural condition appears satisfactory, and it has benefited from ongoing component replacements.
- Areas around the treatment tank indicated periods of surface water ponding, and the system hatches do not have a sufficient seal to prevent surface water infiltration. The third chamber is currently not in use, though it is full of rainwater. While these indications are not conclusive, it is likely that the system experiences surface water intrusion, which could place additional demands on the pumps and drainfield. The tanks should be properly sealed, and the drainage around the tanks should be corrected.
- The discharge pump assembly is free-floating. Consideration should be given to installing bracing to minimize torque effects or vibration.
- The venting is free to the atmosphere. Odours were not prevalent. However, if odours are observed, the vents could be readily directed to an inground natural scrubber system.
- While the system is currently performing adequately, it has previously malfunctioned due to influent quality issues. This issue could be prevented in the future with the addition of a trash tank situated between the lifting station and the treatment system.

The facility benefited from a dispersal replacement in 2018. Flow tests and other assessments of the dispersal system were performed, concluding that it is operating in its normal manner.

2 GENERAL DESIGN CONSTRAINTS

System renewal options must satisfy the following general design constraints:

- The system must comply with the BC Sewerage System Regulation, as design flows are less than 22,700 liters per day.
- The system must also comply with the Health Act, Land Use Bylaws, Strata, and other acts and regulations that may be impacted by an OSWTS.
- The system must provide effective wastewater treatment for 14 residential parcels.
 - Daily design flow is estimated as 18,200 L/day, based on 1300 L/day per parcel, in accordance with the BC Standard Practice Manual, V.3.
- Raw influent quality is assumed to fall within parameters characterized as raw residential sewage, as defined by the BC SPM.
- Effluent must undergo soil-based treatment via ground dispersal.

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

3 SITE OBSERVATIONS AND ASSESSMENTS

Table 3: Merrill - General Site Observations and Assessments

Element	Assessment	Constraints
Previous or Supplementary Professional Reviews	Previous professional reviews have not been provided.	
Recent Inspections and Maintenance	Previous inspection or maintenance reports have not been provided.	
Site and System History	The subdivision system is assumed to be constructed in 1981, or thereabouts, indicating an approximate treatment system age of 39.	
Future Site Development	12 parcels are currently developed; the development status of the remaining 2 parcels is not known.	
Neighbouring Property Features	<p>The treatment system is bordered all around by the residences of Merrill Rd and Merrill Crescent.</p> <p>The neighbouring properties at Northwest border the treatment area in close proximity.</p>	
Title and Land Data	<ul style="list-style-type: none"> • 12683 Merrill Cres (Treatment Area) <ul style="list-style-type: none"> ○ Pid: 007-084-536 ○ Folio: 746.03283.286 ○ Lot: 107 ○ Block: 2 ○ District Lot: 1362 ○ Plan: Vap19110 ○ Approximate Lot Size: 19166 Square Feet • 4561 Merrill Rd (Dispersal Area) <ul style="list-style-type: none"> ○ Pid: 007-084-528 ○ Folio: 746.03283.284 ○ Lot: 106 ○ Block: 2 ○ District Lot: 1362 ○ Plan: Vap19110 ○ Approximate Lot Size: .8 Acres <p>Land title information was reviewed and there appeared to be no entitlement matters that may restrict or impede an OSWTS renewal.</p>	
Protected Areas	Protected Areas potential was reviewed via the SCRD Maps Service. There are no Protected Areas designated on or near the subject property that would restrict or impeded an OSWTS renewal.	
Development Permit Areas	<p>Development Permit Area potential was reviewed via the SCRD Maps Service.</p> <p>There are no development permit area considerations that would restrict or impede an OSWTS renewal.</p>	
Climate Considerations	Climate is classified as Warm-Summer Mediterranean. Marine weather conditions exist, with warm summers	

Element	Assessment	Constraints
	and periods of high rainfall and occasional freezing. Significant cold weather freeze protection is not required, though components should be covered.	
Topography	The general area is adjacent to the Malaspina Strait, straddling a landform between Francis Bay and Gerrans Bay, within the Cordillera / Georgia Lowland physiographic region, and generally developed. The dispersal area itself is downward sloping towards Merrill Rd. The treatment system is in a low-lying depression, receiving gravity flow from the neighbouring residences.	
Well Registry	BC Water Resources was consulted to indicate whether any water wells were in the area. 1 well was noted in the vicinity of the treatment system area. This well was not physically observed during the site assessment, and it is possible that the well location is erroneous, as is common with the well registry.	The proximity of nearby drinking wells would be determined as part of any detailed design. A setback of 30m is required by regulation. If a well exists in this area, additional design measures are required.
Riparian Areas	No inland water bodies or watercourses that would provide fish habitat were observed on the subject property at the time of this report.	
Nitrogen and Phosphorous Reduction	There are no downgrade wells, water bodies at risk of eutrophication, or short-distance up-grade wells in proximity to this dispersal area. Nutrient removal requirements, in this regard, are do not appear to be required.	
Buried Infrastructure	Besides sewer distribution, both electrical and water service lines are buried within the treatment system area.	
Boundary Conditions, Exposure Pathways, and Breakout Risks	Breakout risk is the potential of effluent to “surface.” Relating to the treatment system, potential breakout risks are: <ul style="list-style-type: none"> • Treatment tanks – hatches are not water-tight 	Tanks hatches should be made water-tight.
Vegetation	The dispersal area is grassy/herbaceous and is bordered by alder and cedar trees. Relating to the treatment system, there are no vegetation concerns that would restrict or impede an OSWTS renewal.	Trees should be maintained at a distance of 5m from the dispersal area as part of a vegetation management program.

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

4 SYSTEM OBSERVATIONS AND ASSESSMENTS

Table 4: Merrill - System Observations and Assessments

Element	Assessment	Observations and Recommendations
Current Configuration Type	<p>The system collects raw sewage via gravity collection to a lifting station. The lifting station has duplex pumps that convey raw sewage to an NPS (NPS Wastewater Systems Ltd.) Type 2 treatment system. The treatment system is a 3 chamber, aerated process with sludge return and uses duplex pumps to discharge to a double floating outlet dosing system. The “flout” system provides a significant dose volume which improves distribution each trench dispersal system.</p>	
Flow Data	<p>1 month of flow data was available for analysis. While this does not provide a sufficiently large sample set, it does provide some indications of flows. Within January 2021, effluent flows ranged from 1.5 to 8 cubic meters per day, which appears to be within the capabilities of the ground dispersal system.</p> <p>Both the floating outlet chamber and treatment system control panel are capable of providing flow data.</p>	<p>Flows should be regularly recorded on an ongoing basis prior to an OWSTS renewal. This data will assist the designer in properly sizing a treatment system.</p> <p>Flow data also assists in providing indications of surface/groundwater intrusion.</p> <p>The use of flow data should be incorporated into the system operations and maintenance plan.</p>
Primary Treatment	<p>As communicated by the SCR D, there is no primary treatment, such as on-parcel septic tanks prior to the treatment system.</p> <p>The trash tank that is part of the treatment system is significantly undersized.</p>	<p>It is recommended that a suitably sized trash tank is installed.</p>
Effluent Transmission	<p>Effluent transmission from individual homes to the system was not inspected or assessed.</p>	
Storage and Treatment	<p style="text-align: center;">Chambers and Clarifiers</p> <ul style="list-style-type: none"> • Chamber #2 is not in use and is full of rainwater. • Hatches are not water-tight. • Areas around the treatment tank indicate periods of surface water ponding. 	<p>It is likely that the system experiences surface water intrusion, which could place additional demands on the pumps and drainfield. The tanks should be properly sealed, and the drainage around the tanks should be corrected.</p>
	<ul style="list-style-type: none"> • The treatment system has a broken hinge on its Eastmost hatch cover. 	<p>Fix hatch to mitigate risk to the general public.</p>
	<ul style="list-style-type: none"> • Discharge pumps are free-floating. 	<p>Pumps should be secured.</p>
	<ul style="list-style-type: none"> • The treatment system currently vents to the atmosphere. 	<p>It is recommended that vents should be directed to a peat or mulch scrubber if odours pose an issue with neighbours.</p>

Element	Assessment	Observations and Recommendations
Flow Monitoring	<ul style="list-style-type: none"> Flow monitoring, both at the control panel and at the dosing chamber, appears to be functioning as designed. 	<p>Flows should be regularly recorded on an ongoing basis prior to an OWSTS renewal. This data will assist the designer in properly sizing a treatment system.</p> <p>Flow data also assists in providing indications of surface/groundwater intrusion.</p> <p>Logging and use of flow data should be incorporated into the system operations and maintenance plan.</p>
Alarms	Alarm systems appear to be functioning as designed.	
Dosing Chambers	A flow test was performed by filling the treatment system with water and engaging the discharge pumps to fill the dosing chambers. The floating outlet devices performed as designed and the flow monitoring counter correctly incremented.	
Ground Dispersal	<p>The system is configured with two distribution boxes, both supplying six laterals. Each distribution box is controlled with an isolation valve. Laterals are approximately 24 m in length and are constructed of 3" PVC perforated pipe.</p> <p>Effluent is directed to a trench infiltration system. The system was installed in 2018, and there were no indications of any performance malfunctions. As such, excavation of dispersal components was not warranted.</p>	
Distribution Boxes	<p>Both distribution boxes were noted to be in satisfactory condition, with no indications of root intrusion or backup.</p> <p>The distribution boxes were monitored during the flow test and performed as per design. The dispersal laterals were receiving effluent appropriately.</p>	
Effluent & Performance	<p>Effluent quality appeared satisfactory, with no irregular odours and no visible indications of treatment failure. One effluent sample was drawn and sent for testing, confirming the system is producing Type 2 quality effluent (containing less than 45 mg/L of total suspended solids and having a 5-day biochemical oxygen demand of less than 45 mg/L.).</p> <p>There have been previous performance malfunctions due to problematic influent constituents.</p>	<p>It is recommended that a suitably sized trash tank is incorporated into a treatment system renewal. This will assist in managing influent quality concerns.</p> <p>Further, additional settling can promote better treatment performance. This becomes more relevant when sewage influent is pumped, as is the case with the Merrill configuration.</p>
Reserve Area	The system is currently utilizing its reserve area.	

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

Element	Assessment	Observations and Recommendations
General System Comments	<ul style="list-style-type: none"> • There are no signs of breakout or backup. The system appears to be performing as intended. • The existing system is nominally compliant with current-day standards. • A treatment system renewal will need to be designed by an authorized person, and the design will need to be filed with the health authority. The design will need to be completed by a professional engineer, per the BC SSR, due to the 9100 per the BC SSR, as the flow is in excess of 9100 L/day. 	

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

5 RECOMMENDATIONS FOR SYSTEM RENEWAL & CONCEPTUAL ESTIMATE OF COSTS

Our assessment of the Merrill Wastewater facility has provided for two main courses of action: 1) Repair the system in the short term, and 2) replace the treatment system in the long term.

We have also provided an estimate of operations and maintenance costs should short-term repairs be performed.

Estimated costs have been presented in the nearest thousand-dollar value. Cost items such as permitting, application fees, and taxes, have not been included.

5.1 MERRILL – SHORT-TERM SYSTEM RENEWAL

Table 5: Merrill – Conceptual Costs for the Short-Term

Item	Description	Costs (+/- 30%)
Grade Work	Improving the grade around the treatment tanks will assist in diverting surface water away from the top of the tanks.	\$1,000
Seal Treatment Tank Hatches	Sealing the hatch assembly to the top of the concrete tank will assist in preventing surface water and rainwater from infiltrating the system.	\$2,000
Operational Improvements	Design and install of trash tank (2000 IG); Provide additional support for pumps; Inspect and improve mains in treatment area. Including temporary sewer management.	\$17,000
Total		\$20,000
Cost Per Parcel		\$1,429

5.2 MERRILL – LONG-TERM SYSTEM RENEWAL

For estimation purposes, a moving bed bioreactor wastewater treatment system was used as the reference treatment system, while leaving the dispersal field as-is.

Table 6: Merrill – Conceptual Costs for the Long-Term

Item	Description	Costs (+/-30%)
Replacement System	Design, supply, and install of a replacement treatment system, complete with trash tank and pump chamber, without consideration of any short-term repairs. Including existing equipment removal and temporary sewerage management.	\$80,000
Total		\$80,000
Cost Per Parcel		\$5,714

	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

5.3 MERRILL – ONGOING OPERATIONS

The following operational costs are estimated for maintaining the system after performing short-term repairs and in idealized conditions. These costs would also be applicable for a complete system replacement. However, the maintenance plan for a system replacement will be specified by the system designer.

These cost estimates do not include power costs, nor allowances for amortized costs for long-term replacement, which should also be addressed.

Table 7: Merrill – Conceptual Costs for Operations and Maintenance (Yearly Costs)

Item	Description	Costs (+/-30%)
Yearly Inspection	Regular inspection for maintenance, per maintenance plan meeting regulatory requirements, including minor repairs.	\$3,000
Operations	6-month pump-out frequency of recommended trash tank, including regular inspection and effluent sampling of the treatment plant. Yearly average.	\$6,000
Maintenance	2-year frequency for solids removal from dosing chamber and d-boxes 5-year frequency for dispersal field flushing and jetting	\$2,000
<u>Yearly Average</u>		\$11,000
<u>Cost Per Parcel, Per Year</u>		\$786

 Aurora PROFESSIONAL GROUP Inc.	Onsite Wastewater Treatment and Dispersal System Assessment – Merrill Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-002	Revision: R.0

6 ATTACHMENTS

1. Merrill Parcel Map
2. Merrill Property Report
3. Merrill Original Construction Drawing
4. Field Record & Photo Log

Legend

-  Parcel Boundaries
- Sensitive Ecosystems Inventory**
 -  Cliffs
 -  Herbaceous
 -  Mature Forest
 -  Older Forest
 -  Riparian
 -  Seasonally Flooded Agricultural Fields
 -  Wetland
 -  Woodland
-  Contours
-  Unconstructed Roads
-  Golf Courses
- Parks**
 -  SCRD Park
 -  Recreation Site
 -  Municipal Park
 -  Provincial Park
 -  Wharf
 -  Cemetery
-  Band Lands



SCRD Maps

Property Report

4561 MERRILL RD

4/26/2021

Folio: 746.03283.284 PID: 007-084-528

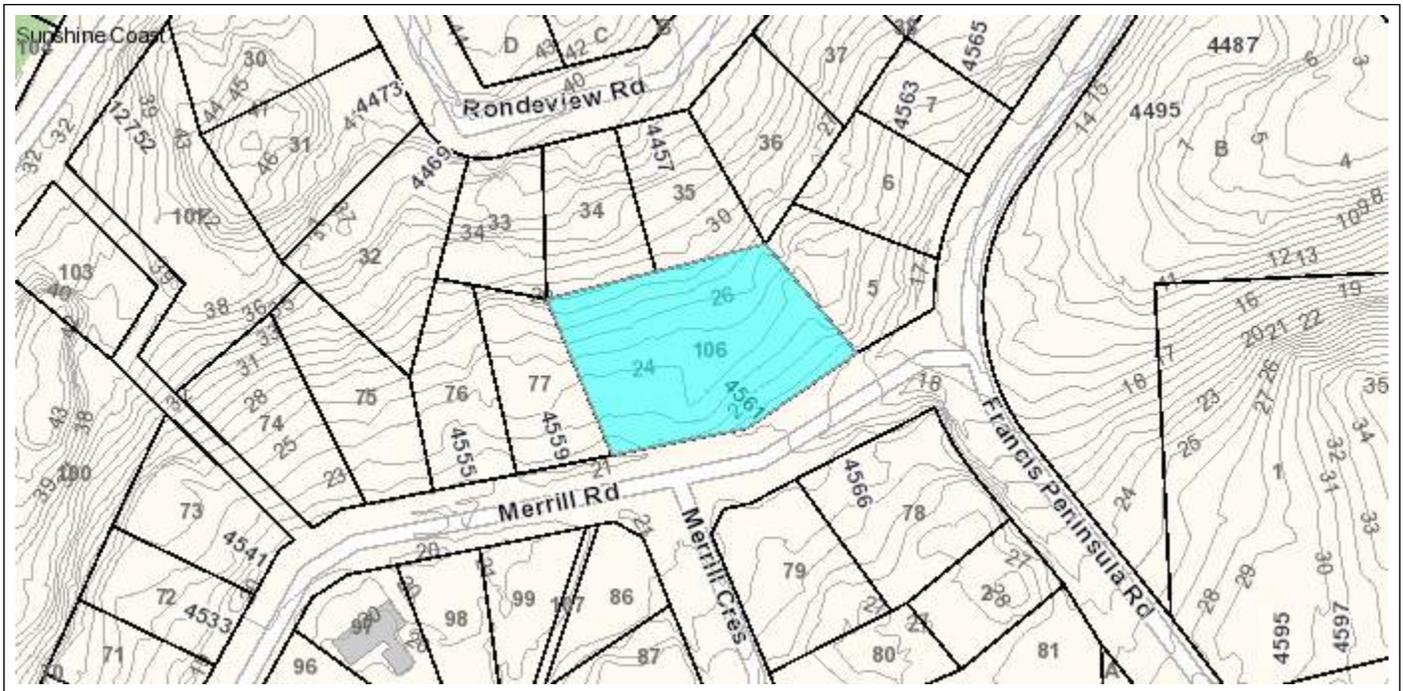
Address: 4561 MERRILL RD

Jurisdiction: SCR D

Lot: 106 Block: 2 Plan: VAP19110 District Lot: 1362

2021 Assessed Value: 161000 Land Value: 161000 Improvement Value: 0

Approximate Lot Size (BC Assessment): .8 ACRES





SCRD Maps

Property Report

12683UF MERRILL CRES

4/26/2021

Folio: 746.03283.286 PID: 007-084-536

Address: 12683UF MERRILL CRES

Jurisdiction: SCR D

Lot: 107 Block: 2 Plan: VAP19110 District Lot: 1362

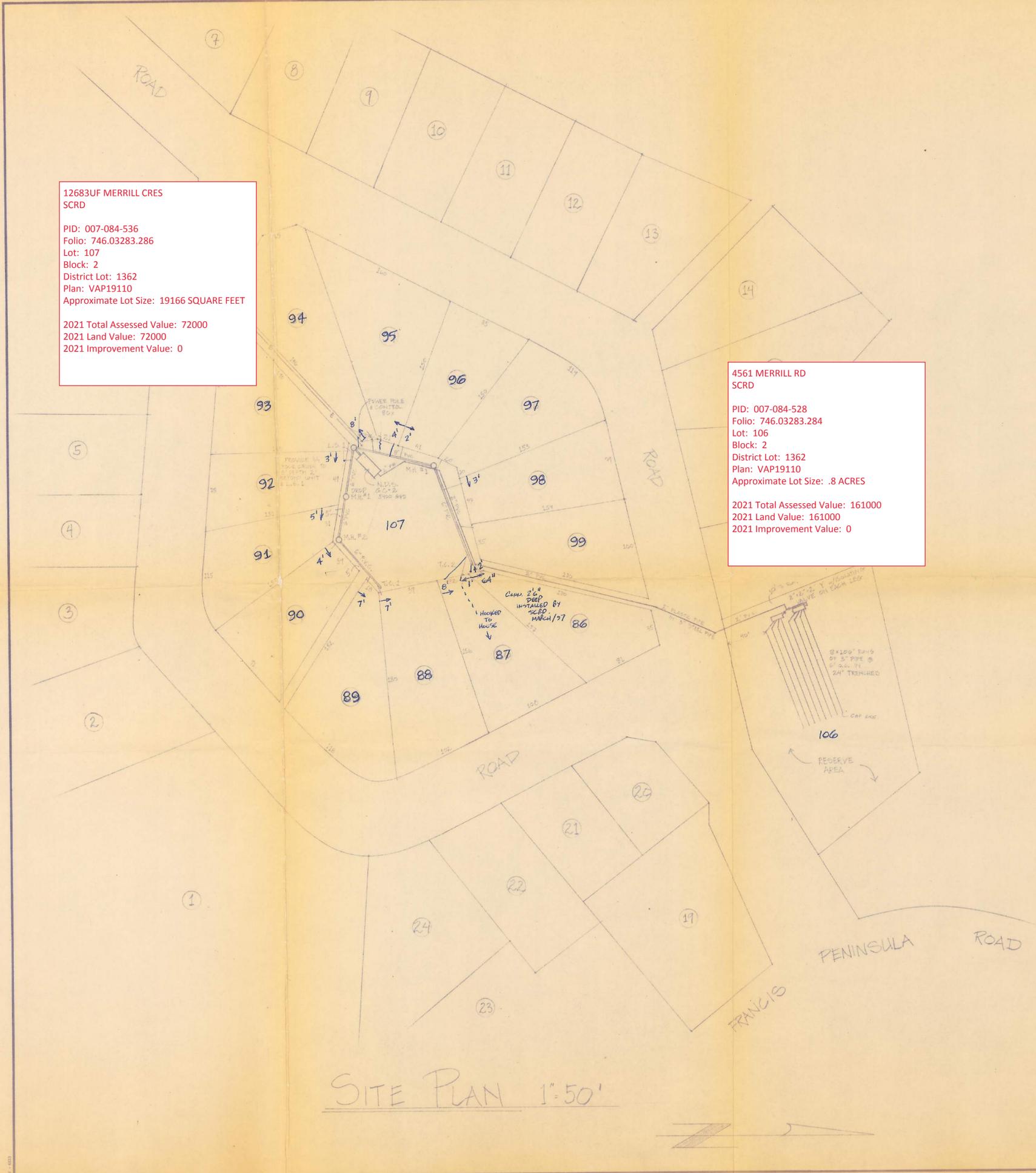
2021 Assessed Value: 72000 Land Value: 72000 Improvement Value: 0

Approximate Lot Size (BC Assessment): 19166 SQUARE FEET

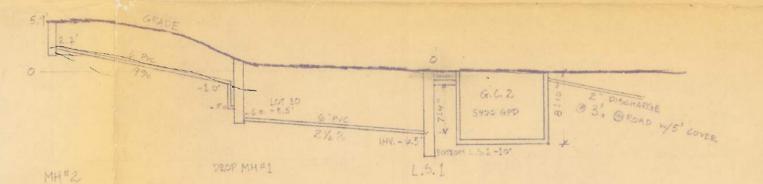
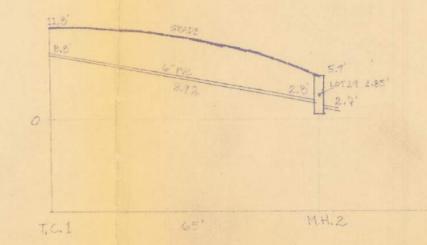
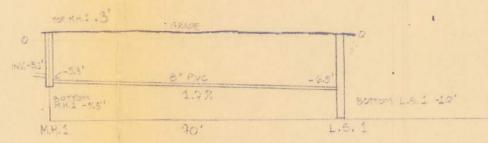
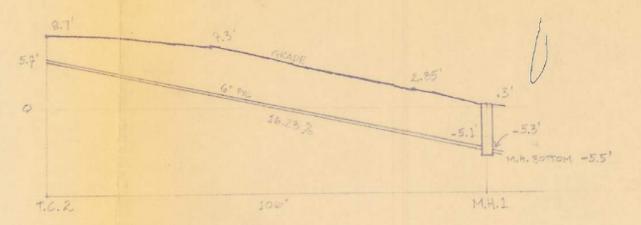


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 PID: 007-084-536
 Folio: 746.03283.286
 Lot: 107
 Block: 2
 District Lot: 1362
 Plan: VAP19110
 Approximate Lot Size: 19166 SQUARE FEET
 2021 Total Assessed Value: 72000
 2021 Land Value: 72000
 2021 Improvement Value: 0

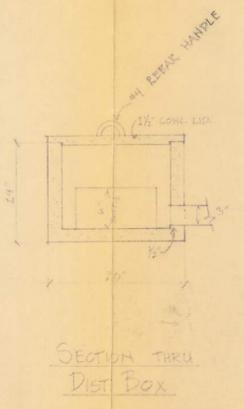
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 SCRD
 PID: 007-084-528
 Folio: 746.03283.284
 Lot: 106
 Block: 2
 District Lot: 1362
 Plan: VAP19110
 Approximate Lot Size: .8 ACRES
 2021 Total Assessed Value: 161000
 2021 Land Value: 161000
 2021 Improvement Value: 0



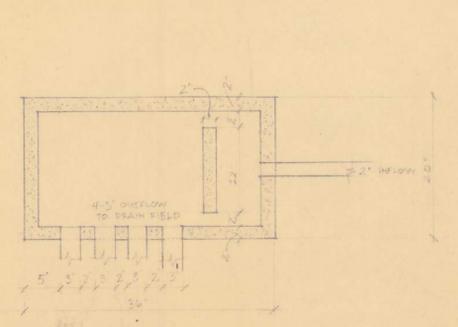
SITE PLAN 1"=50'



SECTIONS HORIZONTAL SCALE: 1"=20'
 VERTICAL SCALE: 1"=10'



SECTION THRU DIST. BOX



DIST. BOX PLAN



D. H. SHUTTLEWORTH & ASSOCIATES
 P.O. BOX 515, SECHelt B.C. V0N3A0
 PROPOSED SUBDIVISION SEWER LAYOUT 1/2
 PANEL B OF LOT 3, BLOCK 2, 4 PART OF LOT 2, BLOCK 2, ALL OF D.L. 1362, PL. 19091 & LOT E, D.L. 1362, PL. 19091

SITE ASSESSMENT - MERRILL

Created: 07-28-2021

Creator: Bradley Fossen (@BFO)

Status:

Dates: 04-13-2021 - 07-28-2021

Recipients

brad@thinkapg.com

Description

Site field activities for the purposes of conceptual system renewal.

Sheets

**2021.02 MERRILL (12683
MERRILL CRES.)**

Merrill Construction Drawing

Table of contents

#	Description	Category	Plan	Assignee	Status	Page
24	GROUND DISPERSAL OBSERVATIONS AND FLOW TEST	01. OBSERVATION	Merrill Construction Drawing	@BFO	Completed - 07-28-2021	3
26	TREATMENT SYSTEM OBSERVATIONS, FLOW TEST, AND SAMPLE	01. OBSERVATION	Merrill Construction Drawing	@BFO	Completed - 07-28-2021	7

#24 - GROUND DISPERSAL OBSERVATIONS AND FLOW TEST

Completed | Bradley Fossen | 01. OBSERVATION

Plan: Merrill Construction Drawing



Task messages (time in MDT)

Bradley Fossen	Photo 1	28 Jul 11:54 AM
Bradley Fossen	Photo 2	28 Jul 11:54 AM
Bradley Fossen	Photo 3	28 Jul 11:54 AM
Bradley Fossen	Photo 4	28 Jul 11:54 AM
Bradley Fossen	Photo 5	28 Jul 11:54 AM
Bradley Fossen	Photo 6	28 Jul 11:54 AM
Bradley Fossen	Photo 7	28 Jul 11:55 AM
Bradley Fossen	Photo 8	28 Jul 11:55 AM
Bradley Fossen	Photo 9	28 Jul 11:55 AM
Bradley Fossen	Photo 10	28 Jul 11:55 AM
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Bradley Fossen	Photo 12	28 Jul 11:55 AM
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Bradley Fossen	Photo 14	28 Jul 11:55 AM
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Bradley Fossen	Photo 16	28 Jul 11:55 AM
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Bradley Fossen	Photo 24	28 Jul 11:55 AM
Bradley Fossen	Photo 25	28 Jul 11:55 AM
Bradley Fossen	Photo 26	28 Jul 11:55 AM
Bradley Fossen	Photo 27	28 Jul 11:55 AM
Bradley Fossen	Photo 28	28 Jul 11:55 AM

Photos



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#26 - TREATMENT SYSTEM OBSERVATIONS, FLOW TEST, AND SAMPLE

Completed | Bradley Fossen | 01. OBSERVATION
 Plan: Merrill Construction Drawing



Task messages (time in MDT)

Bradley Fossen	Photo 1	28 Jul 12:05 PM
Bradley Fossen	Photo 2	28 Jul 12:05 PM
Bradley Fossen	Photo 3	28 Jul 12:05 PM
Bradley Fossen	Photo 4	28 Jul 12:05 PM
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Photos



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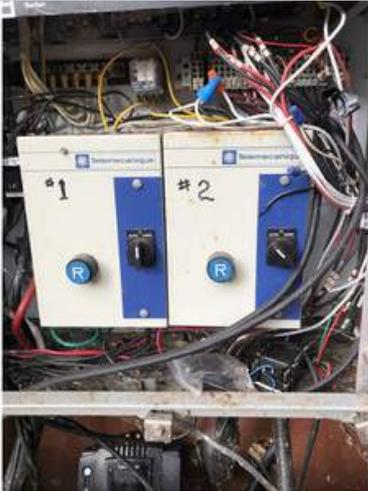
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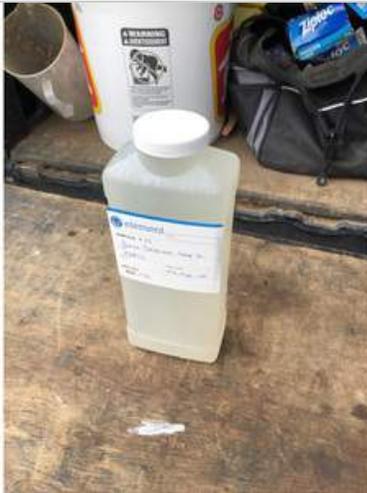
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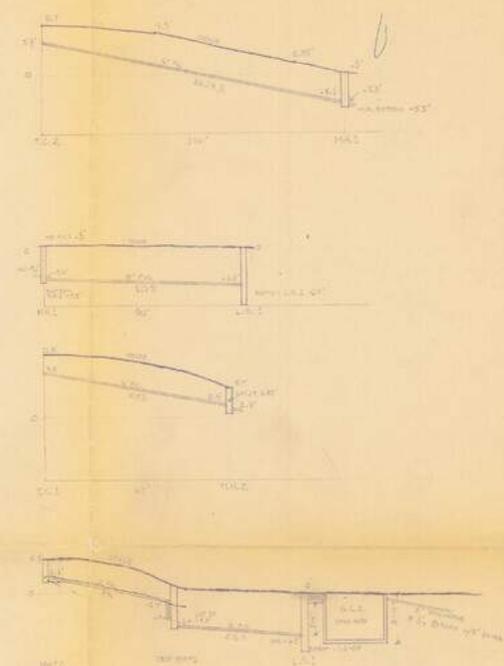
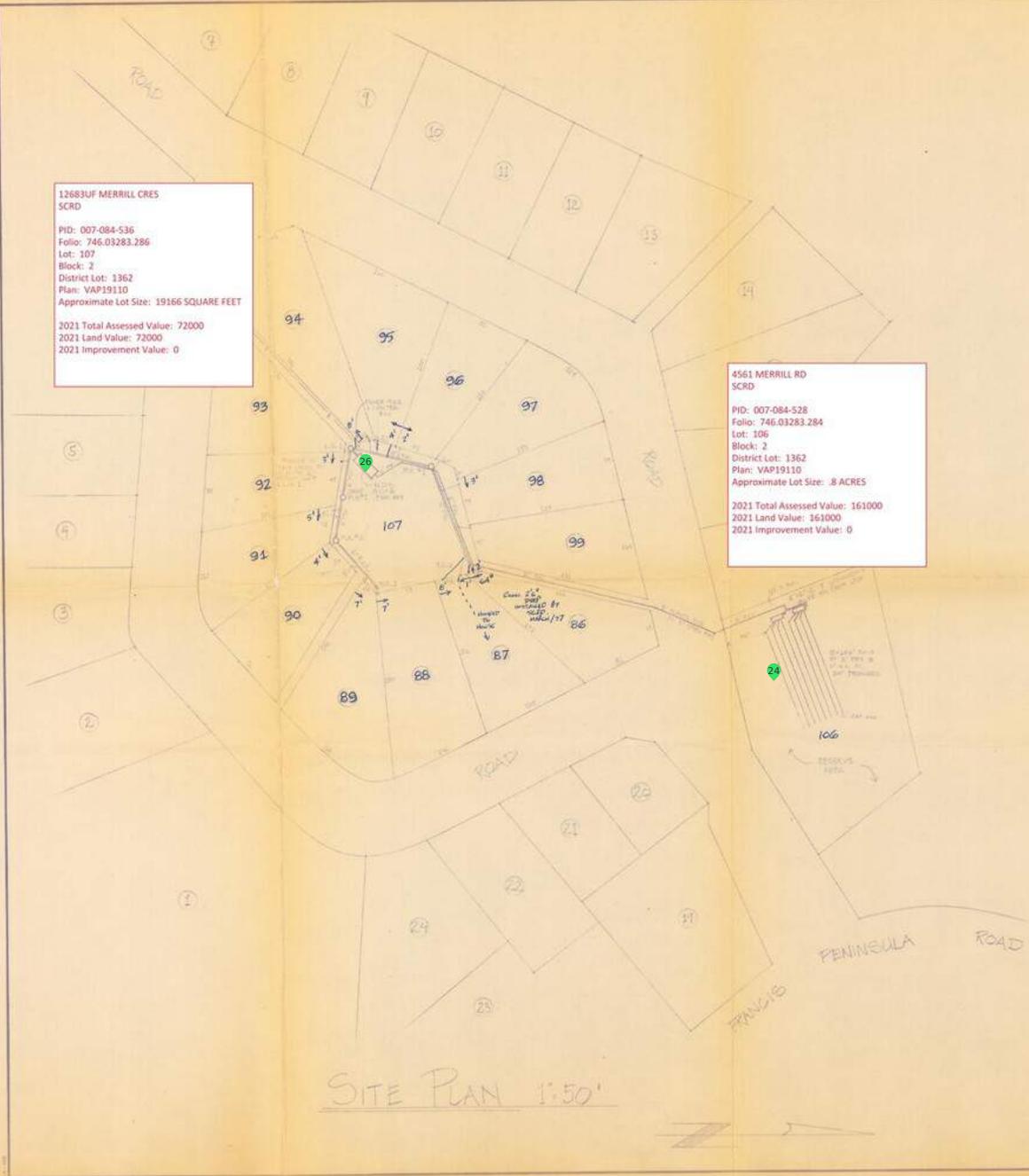


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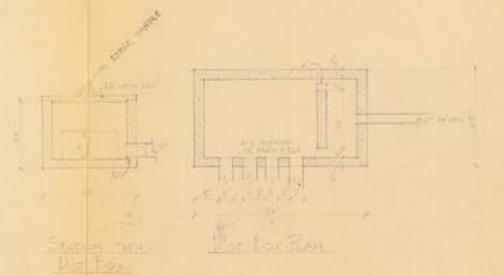


12683UF MERRILL CRES
 SCRD
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SECTIONS HORIZONTAL SCALE: 1"=20'
 VERTICAL SCALE: 1"=10'



D.H. SHUTTLEWORTH & ASSOCIATES
 10 BOX RD, TROY, N.Y. 12180
 PROPOSED SUBDIVISION
 SEWER LAYOUT
 1/2
 THIS IS OF LOT 1, BLOCK 2, & PART OF
 127 & 128 OF LOT 1, ALL OF 127 & 128, 129, 130



Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility

PROJECT No: 2021.02

SITE NAME: LANGDALE

DOCUMENT No.: 2021.02-16-STY-003

FORM No. APG-40-FRM-009

1: Form Revision Log

Revision #	Date	By	Description
0	31-Oct-2020	BJGF	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-003	Revision: R.0

Table 2: Summary Information

Project No.	2021.02	Site Name:	Langdale
Study Type:	<input type="checkbox"/> New Construction <input checked="" type="checkbox"/> Replacement <input type="checkbox"/> Repair / Alteration	Prepared by:	Bradley Fossen Jim Andersen
Owners / Client:	SCRD	Jurisdiction:	Ministry of Environment / SCRD
Legal Description	Lot 41 District Lot 1398 Plan 21531	PID # (Parcel Identifier Number)	009-922-385
Common Address	42 Newman Rd, Gibsons, BC	Folio. # (Tax Assessment Roll #)	746.03486.030
Engineer of Record	Bradley Fossen	Project Stage:	Existing
Influent Type	<input checked="" type="checkbox"/> Typical Residential <input type="checkbox"/> Other _____	Parcels:	40
Year of Construction	1981 (est.)	Design Flow: (Estimated)	52,000 L/day (estimated) 54,600 L/day (permitted)
Purpose of Report:	<ul style="list-style-type: none"> Assess system performance requirements. Provide guidance on factors that may affect onsite wastewater treatment system (OSWTS) renewal options. Assess current system performance and limitations. Conceptualize OSWTS renewal options. Conceptualize major cost items for an OSWTS renewal. 		
Methodology	<ul style="list-style-type: none"> Per scope of work, perform document reviews, attend the site, and perform activities to determine “known and potential existing site constraints,” including: <ul style="list-style-type: none"> Exposing system components and undertaking performance assessments. Assessing current system performance and limitations. Reviewing elements of the facility site and ground conditions that may impede or constrict OSWTS renewal options. Reviewing elements of the current configuration, as coupled with the YMCA wastewater treatment facility. 		
Summary of Activities:	<ul style="list-style-type: none"> Document reviews as part of ongoing exchanges with the SCRD. Site activities and assessments on 09-Mar-2021, including: <ul style="list-style-type: none"> Excavation and locating of site components, including assessments of infiltrative layer and soil conditions. Identification of any design or operational issues, with the current, as-built system. Assessment of current configuration of transport to the YMCA treatment plant Identification of any legacy maintenance challenges. Flow testing of dispersal system components for operational capacity and indications of any potential issues. Formal and informal discussions with SCRD staff. Analysis and compilation of results. Interpretation of results to identify the most practical renewal options. Cost estimation and report reviews. 		

Document Revision #	Date	By	Review By	Description
A	06-Mar-2021	BJGF	JA	Issued for Review
B	21-May-2021	BJGF	JA	Issued for Review
C	02-Jun-2021	BJGF	JA	Issued for Review
0	28-Jul-2021	BJGF	JA	Issued for Use

	Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-003	Revision: R.0

1 SUMMARY

This report conveys findings and assessments resulting from activities performed onsite and from a review of existing data. While our activities meet or exceed standard practice for inspection, this report should not be considered a substitute for regular inspection activities required of system owners, by regulation. Nor should this report be construed as a basis for detailed design. It has been prepared to aid conceptual design and costing. The sewage treatment system was previously inspected in 2019 and found to be unsalvageable. For that reason, assessment efforts disregarded the existing, decommissioned treatment system.

Key observations:

- The YMCA treatment system appears to be performing as designed. However, there have been periods where effluent testing results for biochemical oxygen demand (BOD) and total suspended solids (TSS) have exceeded prescribed requirements. This could indicate that there are occasions when the system has become overloaded or has experienced a performance malfunction, diminishing the treatment efficacy.
- The Langdale facility parcel is within two SCRD development permit areas: “DPA 4 – Stream Riparian Assessment Area” & “DPA 5 – Aquifer Protection and Stormwater Management.” A renewal plan may require additional consideration in regard to riparian areas and hydrogeology.
- Preliminary flow analyses indicate that:
 - there is a high likelihood that the flow parameters of the permit can be maintained, should the existing system be renewed.
 - average dry weather daily flows increased from 8.6 cubic meters/day in 2015 to 23.0 cubic meters/day by 2020. This trend is considerable and should be further investigated.
 - storm and groundwater infiltration may be a large contributor to treatment flows. Comparing maximum flow events to the dry month average daily flow indicates that there was wet month recorded daily flows that exceeded the dry weather average flow in a range of 103% to 197%. This can unnecessarily overload the treatment system and could result in diminished treatment.
 - average wet weather daily flows increased from 14.4 cubic meters/day in 2015 to 25.2 cubic meters/day by 2020, with an infiltration rate that ranged from 9% to 69%. Recorded maximum flow events were as high as 52 cubic meters/day.
- The site perimeter has indications of significant surface water runoff. The ditch South of the parcel should have vegetation removed and should be re-constructed with maximum depth, relative to the outlet culvert, in order to allow stormwater to flow freely.
- The trench dispersal system is nominally compliant with historical standards. However, we have found that the dispersal volumes directed solely to one field or the other significantly exceed current day standards for linear loading. This could be a contributing factor for breakout incidents that were previously experienced during the operation of the dispersal system. Excessive linear loading can create a groundwater mounding effect, eventually saturating the dispersal soils.
- Coupled with surface runoff, maximum flow events, and drainage issues, the dispersal system may have experienced periods of overloading, potentially contributing to breakout. Groundwater monitoring ports should be installed in order to observe seasonal

	Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-003	Revision: R.0

high water levels during the rainy season. This will assist in the design of a replacement dispersal system. It is also recommended that a groundwater interception drain is placed at South on the parcel.

- The laterals and infiltrative surface condition indicates that there may be significant usable life remaining within the drainfield. The dispersal laterals exposed could readily disperse effluent, if required, though regular flushing and jetting are recommended. There were no indications of clogging within the infiltrative surface.
- Test pits and soil assessments indicated approximately 130 cm of suitable soil before a limiting layer, with a most restrictive layer of favourable loamy sand of single grain / loose consistency and no indication of a seasonal high water table.
- It is recommended that the existing, decommissioned treatment system is demolished and remediated, regardless of the renewal option selected.
- It is recommended that a vegetation and stormwater management plan (relating to the dispersal area and transmission infiltration) is enacted as part of the maintenance plan already in place.
- Renewal options and conceptual costs have been tabulated and can be found in Section 6.

2 GENERAL DESIGN CONSTRAINTS

System renewal options must satisfy the following general design constraints:

- The system must comply with the BC Municipal Wastewater Regulation, as design flows exceed 22,700 litres per day. Two SSR systems could also potentially be suitable.
- The system must also comply with the Health Act, Environmental Management Act, Land Use Bylaws, Strata, and other acts and regulations that may be impacted by an OSWTS or influence its design.
- The system must comply with permitted maximum discharges of 54.6 m³/day, with an effluent containing less than 45 mg/L BOD and 60 mg/L TSS. However, the SCRDP needs to inform the permitting authority of any expected changes to the system and determine what parameters may change on the discharge authorization.
- The system must provide effective wastewater treatment for 40 residential parcels.
- Raw influent quality is assumed to fall within parameters characterized as raw residential sewage.
- For the Langdale site, the effluent must undergo soil-based treatment via ground dispersal unless flows are continued to be directed to the YMCA wastewater treatment facility.

3 SITE OBSERVATIONS AND ASSESSMENTS

Table 3: Langdale - General Site Observations and Assessments

Element	Assessment	Constraints
Previous or Supplementary Professional Reviews	Previous professional reviews have not been provided.	

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Element	Assessment	Constraints
Recent Inspections and Maintenance	Hannah Environmental Equipment Inc. (2019), indicating that the RBC treatment system has reached its end of life.	
Site and System History	The subdivision system is assumed to be constructed in 1981, or thereabouts, indicating an approximate age of 39 years.	
Future Site Development	No further subdivision development efforts have been communicated by the SCRD.	
Neighbouring Property Features	<p>The facility parcel is bordered at North by the YMCA wastewater treatment facility, at West by a residence, at East by YMCA Rd., and at South by Newman Rd.</p> <p>The neighbouring properties do not have any features that would restrict or impede an OSWTS renewal.</p> <p>However, the ditch serving Newman Rd shows indications of occasional ponding and flow may be impeded as a result of erosion and vegetation.</p>	Ditches around the perimeter of the facility parcel should be remediated to properly manage stormwater flow. These ditches should be regularly inspected as part of an ongoing maintenance and operations plan.
Title and Land Data	<ul style="list-style-type: none"> • PID: 009-922-385 • Folio: 746.03652.051 • Lot: 41 • Block: • District Lot: 1398 • Plan: VAP21531 • Approximate Lot Size: 1.51 ACRE • Land title information was reviewed and there appeared to be no entitlement matters that may restrict or impede an OSWTS renewal. 	
Protected Areas	Protected Areas potential was reviewed via the SCRD Maps Service. There were no reported Protected Areas designated on or near the subject property that would restrict or impede an OSWTS renewal.	
Official Community Plans (OCP) & Development Permit Areas (DPA)	<p>Development Permit Area potential was reviewed via the SCRD Maps Service.</p> <p>According to the SCRD Maps service, the facility parcel is within two SCRD development permit areas: “DPA 4 – Stream Riparian Assessment Area” & “DPA 5 – Aquifer Protection and Stormwater Management.”</p> <p>However, when reviewing the West Howe Sound Official Community Plan (Bylaw 640), Map 2 – Development Permit Areas, it appears the facility may only fall within the DPA 5 boundary.</p> <p>Regardless, each DPA has its own requirements, which may impact an OSWTS renewal. They are as follows:</p> <p>DPA 4</p>	<p>OCP and DPA requirements should be incorporated in any detailed design studies in order to meet the goals intended by the community plan.</p> <p>Regarding DPA 4, Confirmation of the 30m stream setback at the Northwest of the parcel should be confirmed by a qualified environmental professional prior to</p>

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Element	Assessment	Constraints
	<ul style="list-style-type: none"> - The installation of a septic field requires a development permit. The development permit application requires an assessment report prepared by a qualified environmental professional, confirming the width of the streamside protection and enhancement area (SPEA) and measures to protect the integrity of the SPEA. <p>DPA 5</p> <ul style="list-style-type: none"> - The construction of an industrial or commercial building requires a development permit. <p>Further, the OCP provides general guidance on sewage disposal.</p> <p>OCP Section 8.3b.4 Sewage Disposal / Liquid Waste Management</p> <ul style="list-style-type: none"> - “Common septic fields shall be permitted when: The system proposed is a ‘large community system,’ i.e. designed for the effluent treatment of greater than 22,700 litres per day and is designed and constructed to SCRD standards, including a treatment level of 10BOD/10TSS, and subject to review by the Ministry of Environment...” 	<p>detailed design if a proposed drainfield renewal encroaches on this area.</p> <p>Regarding DPA 5, it is not clear whether any new facilities, such as a treatment system building, would constitute an industrial or commercial building. This should be confirmed within the SCRD for any implications.</p> <p>Regarding OCP Section 8.3b.4, the treatment level prescribed in the bylaw is more rigorous than is currently prescribed by the Ministry of Environment Permit. It should be confirmed within the SCRD whether this policy is enforced and what implications it may have on an OSWTS renewal.</p>
Climate Considerations	<p>Climate is classified as Warm-Summer Mediterranean. Marine weather conditions exist, with warm summers and periods of high rainfall and occasional freezing. Significant cold weather freeze protection is not required, though components should be covered.</p>	
Topography	<p>The general area is West of Thornbrough Channel, within the Cordillera / Georgia Lowland physiographic region, and is a mature development. The dispersal area itself slopes downward from South to North at approximately 4%.</p>	
Well Registry	<p>BC Water Resources was consulted to indicate whether any water wells were in the area. There are no registered wells reported within 30m of the subject property.</p>	
Riparian Areas	<p>As reported in the Development Permit Applications section, a portion of the facility parcel falls within DPA 4 - Stream Riparian Assessment Area. While the area is not substantial, it may prevent some use of the parcel for ground dispersal.</p>	<p>The riparian area SPEA should be confirmed with a QEP prior to the detailed design of a dispersal system renewal.</p>

Element	Assessment	Constraints
	 <p>It is worth noting that while this water body is indicated on the SCR D Mapping Service and within West Howe Sound Official Community Plan (Bylaw 640), Map 2 – Development Permit Areas, it is not listed on other resources, such as iMapBC or BC Geographical Names. The adjacent lot 19 has been developed.</p>	
<p>Nitrogen and Phosphorous Reduction</p>	<p>As reported in the Riparian Areas section, there is one un-named water body in proximity to the facilities dispersal area. Nutrient removal requirements are to be determined.</p>	<p>Following the QEP’s assessment, a hydrogeological assessment may be required. If the QEP restates that the un-named stream supports fish or fish habitat, it may have implications on the system’s treatment performance requirements.</p>
<p>Buried Infrastructure</p>	<p>Besides sewer distribution, there are utility water and power utilities directly within or near the facility parcel.</p>	<p>Setback distances should be incorporated into any detailed design studies.</p>
<p>Boundary Conditions, Exposure Pathways, and Breakout Risks</p>	<p>Breakout risk is the potential of effluent to “surface”. The dispersal area does not have any physical transitions, such as banks or outcrops, that would pose a breakout risk. The ditch along Newman Rd is upslope of the dispersal area.</p>	
<p>Vegetation</p>	<p>The current dispersal area is grassland and is surrounded at the North by primarily Alder trees and blackberry shrubs.</p>	

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4 SYSTEM OBSERVATIONS AND ASSESSMENTS

Table 4: Langdale - System Observations and Assessments

Element	Assessment	Observations and Recommendations																												
Current Configuration Type	<p>In its original configuration, residential sewage is transmitted into an Rotating Biological Contactor (RBC) treatment system. Treated effluent is directed to two distribution boxes that disperse effluent to two dispersal fields.</p> <p>In its current configuration, the system utilizes the RBC as a settling tank and pumps raw sewage influent to the YMCA wastewater treatment facility. The YCMA facility treats the sewage via a MicroFAST proprietary system, with further UV treatment before being dispersed to a marine outfall.</p>	<p>Should the Langdale dispersal system be renewed, it is recommended that the system incorporate uniform dispersal, such as pressurized laterals. This promotes better soil-based treatment, including more uniform dispersal, promoting further longevity.</p>																												
Flow Data	<p>Raw flow data was provided for dates 01-Feb-2015 through to 30-Dec-2020. While we do not feel this is a sufficiently large data set to make any firm conclusions, we are able to use the data anecdotally to help understand general flow averages and maximum flow events.</p> <p>Our analysis is preliminary only and should not be considered a statistically robust examination of the facility.</p> <p>The data were categorized into wet months (October through April) and dry months (May through September). Daily flows were averaged per month, and wet and dry averages were compared year over year.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>2015</th> <th>2016</th> <th>2017</th> <th>2018</th> <th>2019</th> <th>2020</th> </tr> </thead> <tbody> <tr> <td>Dry Months (m3/day)</td> <td>9</td> <td>9</td> <td>19</td> <td>19</td> <td>22</td> <td>23</td> </tr> <tr> <td>Wet Months (m3/day)</td> <td>14</td> <td>14</td> <td>19</td> <td>24</td> <td>24</td> <td>25</td> </tr> <tr> <td>% Difference</td> <td>69%</td> <td>46%</td> <td>-4%</td> <td>24%</td> <td>11%</td> <td>9%</td> </tr> </tbody> </table> <p>The daily data were further sorted and separated, such that the mean and standard deviation could be determined for dry and wet month days. The data indicates that there were 23 recorded events in the data set when daily flows exceeded the 95% percentile of the mean account of flows. These maximum flow events ranged from 35 m³/day to 52 m³/day.</p> <p>The data also indicates that the average daily flow during dry months within the dataset is 17 m³/day. Comparing maximum flow events to the dry month average daily flow indicates that there was wet month recorded daily flows that exceeded the dry weather average flow in a range of 103% to 197%.</p>		2015	2016	2017	2018	2019	2020	Dry Months (m3/day)	9	9	19	19	22	23	Wet Months (m3/day)	14	14	19	24	24	25	% Difference	69%	46%	-4%	24%	11%	9%	<p>The flow analysis indicates there is a high likelihood that the original flow parameters of the permit can be maintained.</p> <p>While this is a preliminary analysis only, it suggests that storm and groundwater infiltration may be a large contributor to treatment flows. This can unnecessarily overload the treatment system and could result in diminished treatment.</p> <p>While the system may potentially be in compliance with MWR section 44, it is recommended that efforts are made to</p>
	2015	2016	2017	2018	2019	2020																								
Dry Months (m3/day)	9	9	19	19	22	23																								
Wet Months (m3/day)	14	14	19	24	24	25																								
% Difference	69%	46%	-4%	24%	11%	9%																								

Element	Assessment	Observations and Recommendations
	<p>The MWR, Section 44, “Inflow and Infiltration,” states that if the flow exceeds two times the average dry weather flow at the treatment plant, during storm or rainfall events with a less than 5-year return period, that the permit holder either develops a liquid waste management plan or develops and implements measures to reduce inflow and infiltration. As previously mentioned, we feel this data set not sufficiently large enough to make this determination, nor were weather events used in this analysis. However, it does provide valuable anecdotal insights.</p> <p>For reference, as estimation of flows using an average value of 750 L/day, per household results in a daily average flow estimate of 26 m³/day for the facility. Including a peaking factor of 2 results in a daily design flow of 52 m³/day.</p>	<p>reduce stormwater and groundwater infiltration. This can improve treatment efficacy, potentially reducing loading on pumps and other components, and in the case of ground dispersal, provide for improved longevity of the dispersal system.</p>
Primary Treatment	<p>As communicated by the SCRD, there is no primary treatment, such as on-parcel septic tanks, prior to the treatment system.</p>	
Effluent Transmission	<p>Effluent transmission from individual homes to the system was not inspected or assessed.</p>	
Storage and Treatment	Existing Treatment System	
	<ul style="list-style-type: none"> The existing treatment system was previously inspected and noted as unsalvageable. For this reason, it was not assessed. Based on our preliminary flow analysis, suitable replacement systems must be capable of handling average dry weather flows of 23 cubic m³/day, average wet weather flows of 25 m³/day, and handling peak flows within the maximum authorized rate of discharge, 54.6 m³/day. This is in line with the latest year of flow data. Treatment requirements, per the Ministry of Environment permit, are 45 mg/L BOD and 60 mg/L TSS. 	<p>Conceptual estimates for treatment systems will be based on these flow rates and treatment requirements.</p>
	YMCA Wastewater Treatment Facility	
	<ul style="list-style-type: none"> This facility was visited to better understand the current configuration of flows from the Langdale facility. 	
	<ul style="list-style-type: none"> The Langdale-YMCA tie-in traverses the property line. It is not clear whether the owners have applied any legal instruments in regards to easements or other land and asset ownership concerns. 	<p>It is recommended that the SCRD confirm any entitlement matters.</p>
<ul style="list-style-type: none"> Raw sewage is pumped from the decommissioned RBC unit at the Langdale facility to the YMCA. The RBC building is considered a confined space and is no longer serving its intended use. 	<p>It is recommended that this building and tank are demolished and replaced by a fit-for-purpose tank as part of</p>	

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Element	Assessment	Observations and Recommendations
	<ul style="list-style-type: none"> The tie-in drawings indicate that piping is 37.5mm diameter PVC and transitions to 50 mm PVC. Considering the large flow volumes being transferred, this could potentially be creating a high-velocity flow condition. The available drawings were not as-built, and line sizing could not be confirmed. 	<p>a permanent tie-in solution option.</p> <p>A permanent tie-in solution should re-evaluate pump and line sizing.</p> <p>As-built documentation should be maintained.</p>
Ground Dispersal	<p>A general summary of the ground dispersal is as follows. Additional details have been provided in subsequent sections.</p> <ul style="list-style-type: none"> The system is configured with two distribution boxes, 1 supplying the 15 laterals of the East drainfield and the other supplying 17 laterals of the West drainfield. Each distribution box and its respective drainfield are controlled with an isolation valve. Laterals are approximately 30 m in length and are constructed of 3" PVC perforated pipe. The overall length of each system is approximately 60 m (East drainfield) and 60 m (West drainfield), both in a centre-feed configuration. Effluent is directed to infiltration trenches. The trenches have been constructed with a suitable aggregate type, and depth, both below and above the dispersal laterals, and the infiltrative surface was prepared with a blinding layer of sand. The trenches were backfilled with sand/loamy-sand and cover soil. The system, as designed, is intended to disperse to a single zone over a specified duration, allowing the other zone a period of rest. The trench dispersal system is nominally compliant with historical standards. However, we have found that the dispersal volumes directed solely to one field or the other significantly exceed current day standards. This could be a contributing factor for breakout incidents that were previously experienced during the operation of the dispersal system. For example, excessive linear loading, or effluent dispersal over a unit length, can create a groundwater mounding effect, eventually saturating the dispersal soils. <p style="text-align: center;">Distribution Boxes</p> <p>Distribution box at East is a 16-hole/ 15-out configuration.</p> <ul style="list-style-type: none"> There were no indications of significant structural degradation. However, the lid was cracked and chipped, though still intact. Flow testing was performed for 3-hours and 20 minutes, using the service water line on site. There were no indications of a flow backup; the laterals freely accepted the full volume of the flow test. <p>Distribution box at East is a 18-hole/ 17-out configuration</p> <ul style="list-style-type: none"> There were no indications of significant structural degradation. However, the lid is cracked, though still intact. There were no indications of root infiltration or backup. <p style="text-align: center;">Dispersal Laterals</p>	

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Element	Assessment	Observations and Recommendations
	<p>Dispersal laterals in two locations were exposed and assessed.</p> <ul style="list-style-type: none"> The laterals were in satisfactory condition, showing only minimal indications of root intrusion or blockages. The laterals were found at a depth ranging from 50 cm to 75 cm. The laterals were installed on top of approximately 20 cm of aggregate and were covered with approximately 15 cm of aggregate. While not physically observed, it is likely that recent YMCA tie-in work required would have bisected portions of the East drainfield, damaging the laterals in place. 	<p>The condition of the laterals indicates that there may be significant usable life remaining within the drainfield.</p> <p>Flushing and jetting of all laterals is recommended, followed by a complete pipe camera inspection to verify the integrity of the laterals and confirm which laterals may require repairs or reconstruction as a result of the YMCA tie-in work.</p>
Infiltrative Layer	<p>The infiltrative layer was constructed with a blinding layer of approximately 10 cm of coarse sand. The infiltrative layer and biomat condition were inspected via excavation of several locations within the dispersal area.</p> <ul style="list-style-type: none"> The blinding layer was found to be in good condition with no indications of clogging 	<p>The condition of the infiltrative layer indicates that there may be significant usable life remaining within the drainfield.</p>
Vegetation	<p>The current dispersal area is grassy/herbaceous and is surrounded in the North by primarily Alder trees and blackberry shrubs. Satellite imagery indicates that the vegetation has encroached approximately 6m-10m in from the parcel boundary at North.</p> 	<p>Aggressive tree and shrub species should be cleared at least 5m from the dispersal area. A vegetation management plan should be enacted.</p>
Effluent & Performance	<p>Effluent testing results were provided for dates between 15-Jan-2015 through 06-Feb-2020, for both the Langdale and YMCA flows.</p> <ul style="list-style-type: none"> The data reports that prior to the Langdale-YMCA tie-in, the YMCA facility consistently produced effluent containing less 	<p>Effluent testing results potentially indicate that while the YMCA treatment system</p>

Element	Assessment	Observations and Recommendations
	<p>than 45 mg/L BOD and 45 mg/L TSS, with a median fecal coliform density of less than 14 colony forming units per 100 ml.</p> <ul style="list-style-type: none"> Subsequent to the Landale-YMCA tie-in, the YMCA facility may have encountered treatment upsets that resulted in effluent quality containing BOD, TSS, and total fecal coliforms in excess of the Langdale effluent requirements stated above. BOD was reported as high as 63.3 mg/L in the most extreme cases, TSS was reported as high as 83.0 mg/L, and total coliforms were reported as high as 1,000,000. The majority of these upsets were reported during a period between April and October of 2017. These results have not been vetted for data quality, nor have they been corroborated against operations records, so they should be not be considered definitive. November 2017 onward, the overall YMCA facility treatment performance appears to have stabilized, and effluent quality normalizes within required effluent concentrations of BOD and TSS. However, fecal coliforms have consistently been reported in concentrations of more than 14 colony-forming units per 100 ml. 	<p>initially had difficulty managing new sewage inflows, that it has since normalized.</p> <p>Without further investigation and testing, it is not possible to further assess the performance of the overall YMCA facility. However, qualitatively, the results may suggest that, at times, the additional influent from Langdale can affect the performance of the YMCA facility such that permit discharge parameters are exceeded.</p> <p>This may indicate the system experiences periods of overloading or could possibly be experiencing performance malfunctions.</p>
<p>Soils Capability</p>	<p>Soils were inspected via excavation of several locations within the dispersal areas. Soil assessments indicated the area is primarily loose grain, structureless, medium to coarse sand, with approximately 130 cm of available depth of soils until a likely limiting layer.</p> <p>Excavations outside of the dispersal area in the Southwest portion of the parcel indicated a likely limiting layer at approximately 80 cm.</p> <p>Excavations outside of the dispersal area and in the Southeast reserve portion of the parcel indicated a seasonal high water table and limiting condition at approximately 90cm.</p>	<p>These are favourable conditions for a renewed dispersal system in compliance with current day standards.</p> <p>However, it is likely more cost-effective to re-use the dispersal system as-is, considering the positive assessments noted by the inspections of laterals and the limiting layer.</p>

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Element	Assessment	Observations and Recommendations
Reserve Area	The system has reserve areas in two places. The first reserve area is in the Southeast portion of the parcel. A second reserve area is noted on the original design drawings, West of Lot 18. The status of this reserve area has not been confirmed.	If a dispersal renewal option is pursued, it is preferential to maintain the reserve areas as-is. This is supported by the positive assessments noted by the inspections of laterals and the infiltrative layer.

5 GENERAL SYSTEM COMMENTS

In consideration of our above assessments, we offer the following general comments on the system as a whole.

- “As-built” system drawings do not exist. It is recommended that an as-built drawing set is created to assist future operations and maintenance as part of any future design efforts.
- The existing system is nominally compliant with historical standards. However, there are indications that linear loading is in excess of current day standards. This can result in groundwater mounding beneath the dispersal area and be a contributing factor to performance malfunctions.
- There is a high likelihood that surface water infiltration and other inflows have contributed additional flow volumes to the original Langdale system during its operation through wet seasons. These inflows would also be currently contributing to the YMCA treatment facility since it was tied in.
- The existing, decommissioned treatment system should be demolished.
- A replacement treatment system should be capable of managing average flows of 25 m³/day, with peak flows ranging as high as 54.6 m³/day (the current permit maximum rate of discharge), meeting effluent concentrations of 45 mg/L BOD and 60 mg/L. A detailed design should include further discussions with the permit authority regarding treatment requirements and confirm that a permit revision alone is sufficient for dispersal system renewal.
- With suitable repairs and adequate operations and maintenance, the existing dispersal system can be expected to have a considerable amount of remaining usable life.
- Improving stormwater and shallow groundwater flow conditions around the perimeter of the facility will likely assist in reducing groundwater mounding effects. This can promote improved soil-based treatment and mitigate conditions that have previously contributed to performance malfunctions.
- Site and soil conditions are favourable for renewal options that meet current-day standards.
- A riparian assessment, completed by a QEP, should be budgeted for as part of any dispersal renewal options. The Riparian study can advise on any setback considerations in relation to DPA 4 – “Stream Riparian Assessment Area.”
- A hydrogeological assessment should be budgeted for as part of any dispersal renewal options. The hydrogeological assessment will inform any design constraints relating to the riparian area

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and nitrogen or phosphorous reduction requirements. Further, a hydrogeological assessment could potentially prescribe a fit-for-purpose loading rate for the dispersal area, based on field flow and stress tests and water table monitoring.

- An environmental impact study may not be required if the system renewal maintains the parameters of the permit. However, the permitting authority should be kept abreast of planning efforts and will be able to guide the SCRD regarding that requirement.
- A repaired dispersal system option should include the following activities and components.
 - Groundwater monitoring ports should be installed and regularly checked to confirm fluctuations in the seasonal highwater table. An interceptor drain placed at South on the parcel may be required to relieve shallow groundwater flows.
 - The existing field should undergo a complete flushing and jetting program.
 - A complete pipe camera inspection should be performed to confirm what repairs may be required.
 - Repair any laterals damaged as part of the YMCA tie-in.
 - The dispersal system should be converted to a uniform pressure dispersal configuration. This would involve running pressure laterals within the existing perforated pipe laterals. These pressure laterals would receive effluent from newly constructed manifolds that would receive flow from the new treatment system.
 - The repaired system should direct flow to the entire length of the combined dispersal area, alternating between North and South portions. This can be achieved either by a duplex pump and valve configuration or through the use of an indexing valve. In this configuration, the drainfields would not experience alternating periods of long-term rest, and the permit would need to be amended.
- An improved or renewed dispersal system would involve a complete reconstruction of the dispersal components.
 - Groundwater monitoring ports should be installed and regularly checked to confirm fluctuations in the seasonal highwater table. An interceptor drain placed at South on the parcel may be required to relieve shallow groundwater flows.
 - A replacement dispersal system should maximize vertical soil separation and include trenches that are constructed at a shallower depth.
 - Effluent Flows should be distributed over a longer contour, taking advantage of the length of the parcel as much as is allowable considering any riparian considerations.
 - The dispersal system should utilize uniform, pumped distribution.
 - The dispersal system should be configured into North and South dispersal areas, which would be regularly alternated between, either in short or long periods, depending on the conditions of the permit.

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6 RECOMMENDATIONS FOR SYSTEM RENEWAL & CONCEPTUAL ESTIMATE OF COSTS

Our assessment of the Langdale Wastewater facility has resulted in the following three options for consideration.

- 1) Permanently tie into the YMCA Treatment Facility. Any future improvements to the YMCA facility have not been considered.
- 2) Replace the sewage treatment system and repair the existing drainfield.
- 3) Replace the sewage treatment system and replace the existing drainfield.

The projected cost of these options is estimated below, presented in the nearest thousand dollar value. Cost items such as permitting, application fees, and taxes have not been included.

The replacement treatment systems considered have varying costs based on operational controls and other secondary features. For estimation purposes, the reference treatment system used was similar to the quality of the YMCA facility. We note that simpler system configurations can be considered to offer significant cost efficiencies, though potentially with a compromise to features required by the SCR.D.

Maintenance and operations costs have also been provided. These costs are estimated for maintaining the system if the Langdale facility is placed back into service and in idealized conditions. However, these are provided with no consideration to previous or future operations costs related to the YMCA facility.

Estimates do not include power costs, nor allowances for amortized costs for long-term replacement, which should also be addressed.

6.1 LANGDALE – PERMANENT YMCA TIE-IN

Table 5: Langdale – Permanent YMCA Tie-in

Item	Description	Costs (+/-30%)
Demolition	Pump out RBC, demolish building and foundation, properly dispose of hazardous materials.	\$11,500
Tankage	Design/Supply/Install: Supply and Installation of a settling and equalization tank configuration and duplex pumping system, including costs for temporary sewer management and tie point reconfiguration.	\$108,000
Total		\$119,500
Cost Per Parcel		\$2,988

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6.2 LANGDALE – REPLACE TREATMENT SYSTEM AND REPAIR EXISTING DISPERSAL SYSTEM

Table 6: Langdale – Replace Treatment System and Repair Existing Dispersal System

Item	Description	Costs (+/-30%)
Replacement Treatment System & Repair/Upgrade Dispersal System	Studies/Design/Supply/Install: Treatment system capable of managing 25 m ³ /day, with peak flows ranging as high as 54.6 m ³ /day (the current permit maximum rate of discharge), meeting effluent concentrations of 45 mg/L BOD and 60 mg/L TSS, repair dispersal system after complete flushing and camera inspection and upgrade to pressure distribution, including costs for existing equipment removal and temporary sewer management.	\$503,000
Drainage Improvements	Installation of a parcel interceptor drain, at South, to manage shallow groundwater flows.	\$44,000
Total		\$547,000
Cost Per Parcel		\$13,675

6.3 LANGDALE – REPLACE TREATMENT SYSTEM AND DISPERSAL FIELD

Table 7: Langdale – Replace Treatment System and Dispersal Field

Item	Description	Costs (+/-30%)
Replacement Treatment System & Replace Dispersal System	Studies/Design/Supply/Install: Treatment system capable of managing 25 m ³ /day, with peak flows ranging as high as 54.6 m ³ /day (the current permit maximum rate of discharge), meeting effluent concentrations of 45 mg/L BOD and 60 mg/L TSS, replace dispersal system, including costs for existing equipment removal and temporary sewer management.	\$546,000
Drainage Improvements	Installation of a parcel interceptor drain, at South, to manage shallow groundwater flows.	\$44,000
Total		\$590,000
Cost Per Parcel		\$14,750

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6.4 LANGDALE – ONGOING OPERATIONS WITH PERMANENT YMCA TIE-IN

Table 8: Langdale – Conceptual Costs for Operations and Maintenance (Yearly Costs) – Permanent YMCA Tie-in

Item	Description	Costs (+/-30%)
Semi Annual Inspection	Assessment of solids, usage issues, settling tank components and functionality.	\$2,000
Pumping	6-month partial pump outs.	\$6,000
Yearly Average		\$8,000
Cost Per Parcel, Per Year		\$200

6.5 LANGDALE – RESUMING OPERATIONS WITH LANGDALE FACILITY

Table 9: Langdale – Conceptual Costs for Operations and Maintenance (Yearly Costs) – Resuming Operations with Langdale Facility

Item	Description	Costs (+/-30%)
Yearly Inspection	Yearly inspection and regular effluent testing for maintenance, per maintenance plan meeting regulatory requirements.	\$5,000
Operations	6-month pump-out frequency, including inspection and sampling, until inspection supports a longer interval.	\$7,000
Maintenance	1-year frequency for dispersal field flushing and jetting until inspection supports a longer interval.	\$4,000
Yearly Average		\$16,000
Cost Per Parcel, Per Year		\$400

	Onsite Wastewater Treatment and Dispersal System Assessment – Langdale Wastewater Treatment Facility	Project: 2021.02
Form No.: APG-40-FRM-009	Doc No.: 2021.02-16-STY-003	Revision: R.0

7 ATTACHMENTS

1. Langdale Parcel Map
2. Langdale Property Report
3. SCR D West Howe OCP Map
4. Langdale Original Construction Drawing
5. Field Record & Photo Log

Landale



Index Map



91.5 0 45.73 91.5 Meters

This information has been compiled by the Sunshine Coast Regional District (SCRD) using data derived from a number of sources with varying levels of accuracy. The SCRD disclaims all responsibility for the accuracy or completeness of this information.



4/27/2021
1: 1,801

Legend

-  Parcel Boundaries
- Development Permit Areas**
 -  Agricultural Buffering
 -  Environment
 -  Flood
 -  Form and Character
 -  Hazard
 -  Shoreline
 -  Stormwater Management
-  Water Mains
-  Fire Hydrants
-  Contours
-  Unconstructed Roads
-  Golf Courses
- Parks**
 -  SCRD Park
 -  Recreation Site
 -  Municipal Park
 -  Provincial Park
 -  Wharf
 -  Cemetery
-  Band Lands



SCRD Maps

Property Report

4/27/2021

Folio: 746.03652.051

PID: 009-922-385

Address:

Jurisdiction: SCR D

Lot: 41

Block:

Plan: VAP21531

District Lot: 1398

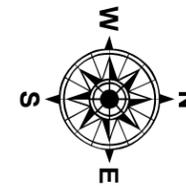
2021 Assessed Value: 437000

Land Value: 437000

Improvement Value: 0

Approximate Lot Size (BC Assessment): 1.51 ACRES





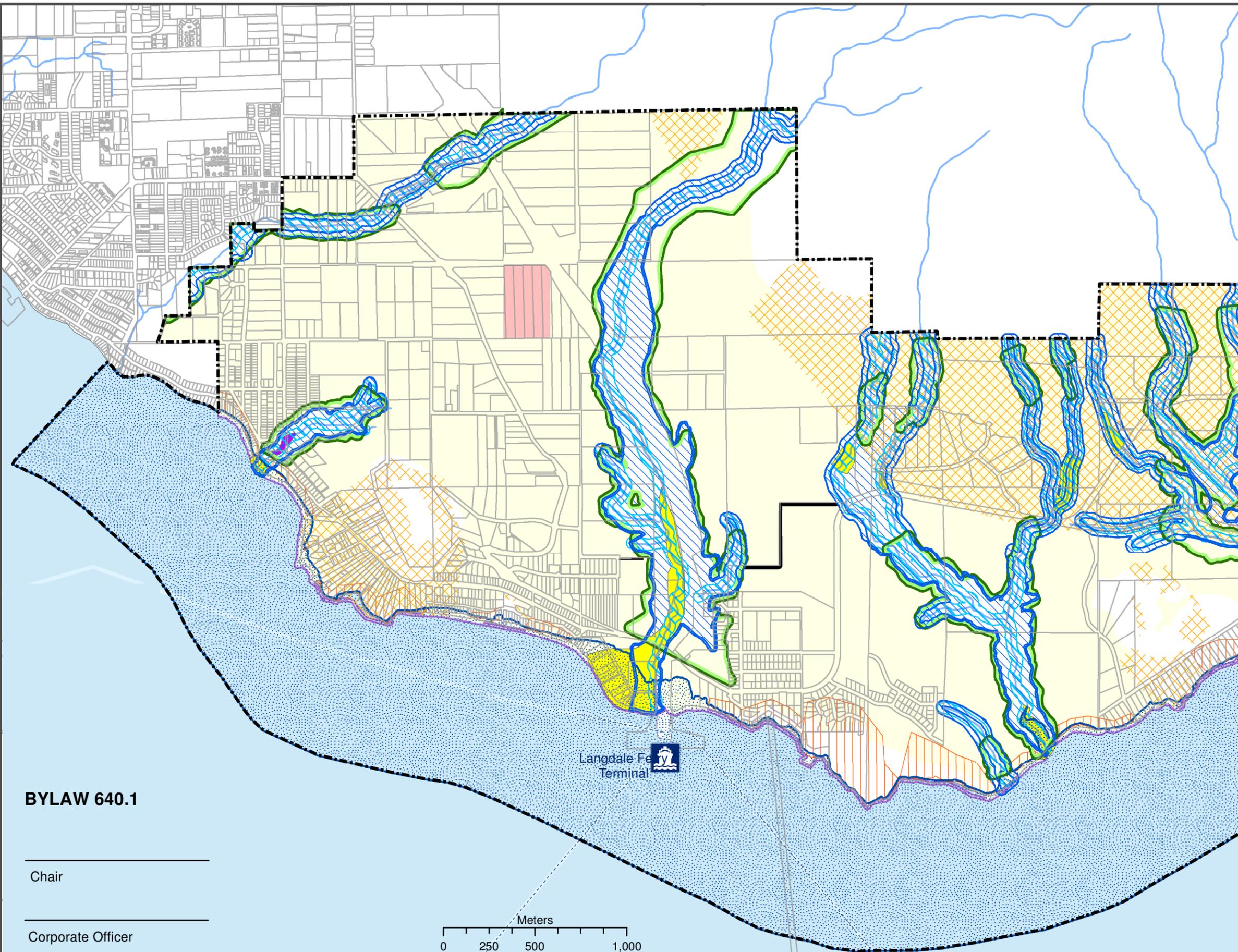
Legend

-  Plan Area Boundary
-  Stream
-  Land Parcels
-  Local Roads
-  BC Ferries Route
-  DPA #1A - Coastal Flooding
-  DPA #1B - Coastal Slopes
-  DPA #2A - Creek/River Corridor
-  DPA #2B - Ravines (15m)
-  DPA #2B - Ravines (30m)
-  DPA #2C - Floodplain
-  DPA #2D - Low Channel Confinement
-  DPA #3 - Slope Hazards
-  DPA #4 - Stream Riparian Assessment Areas
-  DPA #5 - Aquifer Protection and Stormwater Management
-  DPA #6 - Shoreline Protection Management
-  DPA #7 - Residential Agricultural Buffering
-  DPA #8 - Stewart Road Light Industrial

All mapped and unmapped streams are designated DPA No. 4.



Sunshine Coast
Regional District

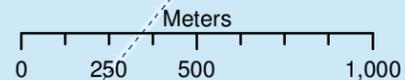


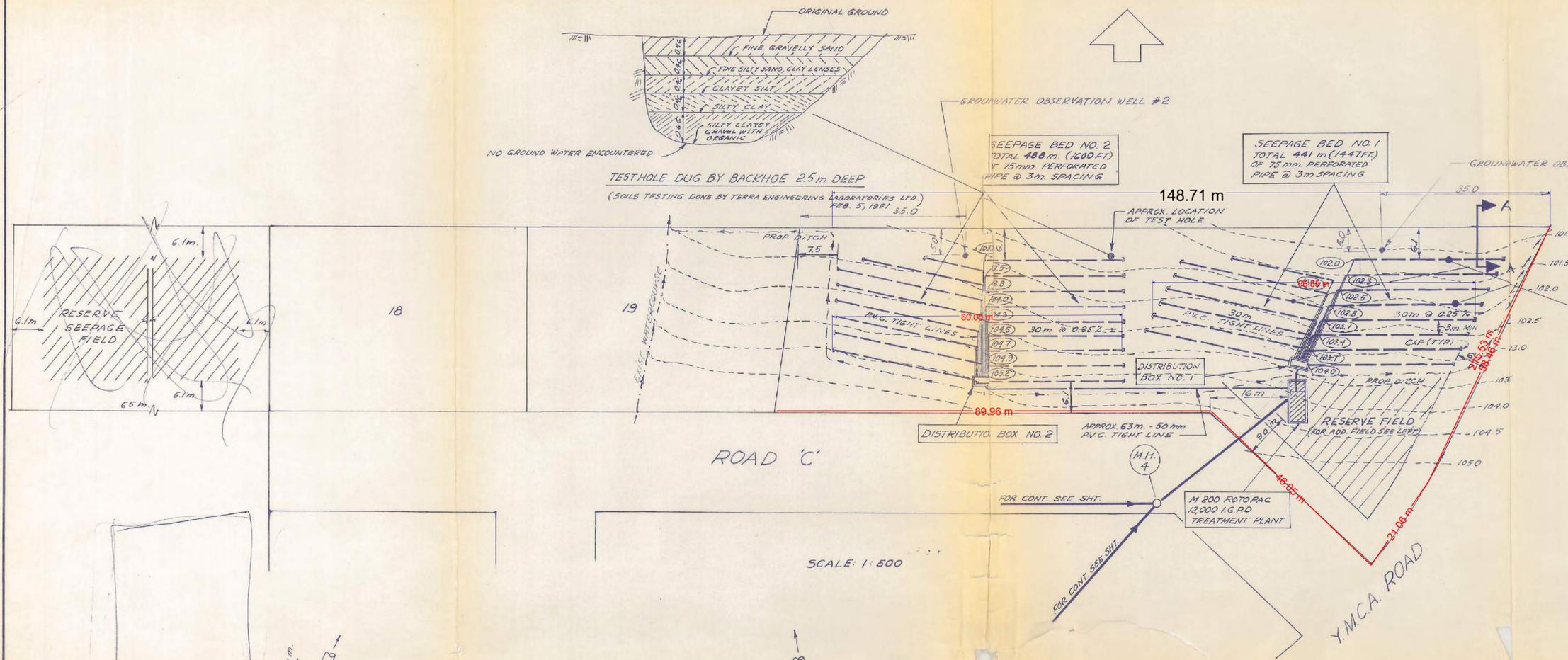
Langdale Ferry Terminal

BYLAW 640.1

Chair

Corporate Officer



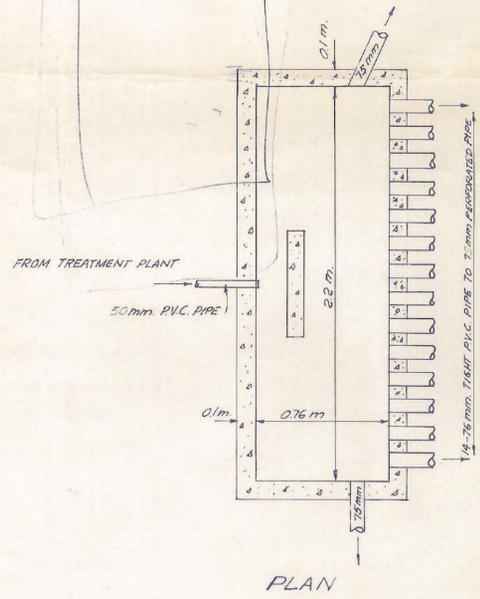


ESTIMATED DAILY SEWAGE FLOW — 12,000 I.G.P.D.
 AEROBIC TREATMENT UNIT — M 200 ROTOPAC
 PERCOLATION RATE — 5 MIN. PER 1 INCH
 TOTAL TILE FIELD — 1447 + 1600 = 3047
 POLLUTION CONTROL PERMIT NO PE-6209 DATED OCT 23/81

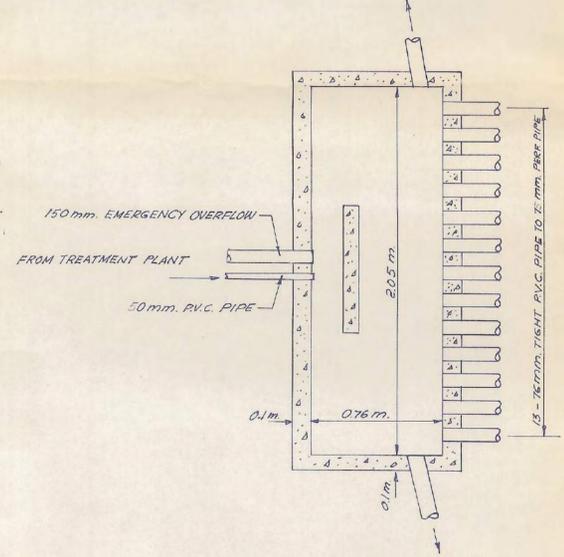
INSTALL OBSERVATION TEES ON AT LEAST TWO TILE RUNS IN EACH GROUND ABSORPTION DISPOSAL FIELD TOGETHER WITH A MAXIMUM OF TWO GROUNDWATER OBSERVATION WELLS AS SPECIFIED BY THE REGIONAL MANAGER.

SCRD
 42 NEWMAN RD, GIBSONS
 PID: 009-922-385
 Folio: 746.03652.051
 Lot: 41
 Block:
 District Lot: 1398
 Plan: VAP21531
 Approximate Lot Size: 1.51 ACRES
 2021 Total Assessed Value: 437000
 2021 Land Value: 437000
 2021 Improvement Value: 0

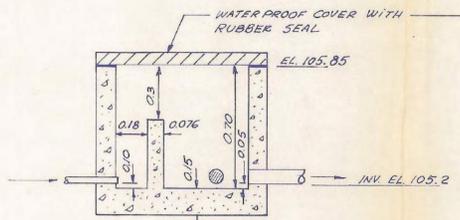
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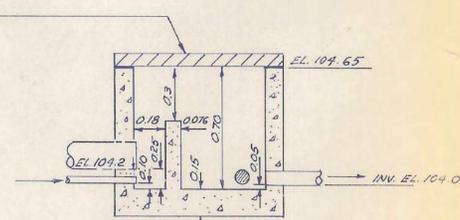
PLAN
DISTRIBUTION BOX NO. 2



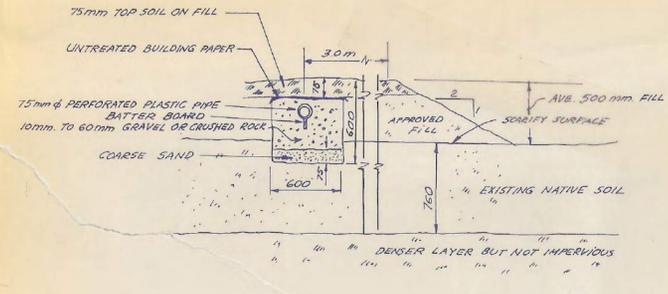
PLAN
DISTRIBUTION BOX NO. 1



ELEVATION
DISTRIBUTION BOX NO. 2



ELEVATION
DISTRIBUTION BOX NO. 1



SECTION A-A

- NOTES:
- ALL WORKS SHALL BE INSTALLED IN ACCORDANCE WITH THESE DWGS, THE MANUFACTURER'S RECOMMENDED INSTALLATION PROCEDURES AND IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE B.C. POLLUTION CONTROL ACT AND PERMIT NO PE-6209 AND THE WASTE MANAGEMENT OFFICIALS OF THE SUNSHINE COAST REGIONAL DISTRICT, INCLUDING ANY FILL PLACED AT DISPOSAL FIELD.
 - TREATMENT PLANT STRUCTURE TO BE CONSTRUCTED WITH ACCORDANCE WITH MANUFACTURER'S SPEC'S AND DETAILED DRAWINGS.
 - TREATMENT PLANT SHALL BE EQUIPPED WITH AN ALARM SYSTEM WHICH WILL ACTIVATE IN CASE OF BREAK-DOWN OR POWER FAILURE OF THE PLANT. LOCAL WASTE MANAGEMENT OFFICIALS SHALL BE NOTIFIED IMMEDIATELY FOLLOWING SUCH STOPPAGE OF THE PLANT.

REVISION No.	REVISIONS	DATE	MADE BY	CHKD BY



RANNALA & ASSOC. ENG. (1979) LTD.
 • SURVEYORS • ENGINEERS
 14649-108th AVENUE TELEPHONE: 584-6828 SURREY, B.C. V3V9R9

DEVELOPER
LAKE NEWELL DEVELOPMENTS
 204 - 1046 AUSTIN AVE. COQUITLAM, B.C.
 ENGINEERING DEPT.

TITLE
SEEPAGE BED

DESIGNED BY: PE
 DRAWN BY: PE
 CHECKED BY: BB
 APPROVED BY: BB
 SCALE: HOR. 1: AS SHOWN
 VERT. 1:
 DATE: NOV. 21/81
 DWG. No: 81064
 SHEET No: 9 of 9
 R-

SITE ASSESSMENT - LANGDALE

Created: 07-28-2021

Creator: Bradley Fossen (@BFO)

Status:

Dates: 04-13-2021 - 07-28-2021

Recipients

brad@thinkapg.com

Description

Site field activities for the purposes of conceptual system renewal.

Sheets

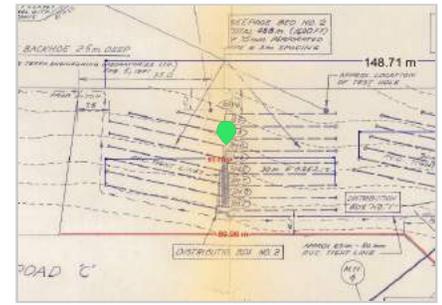
**2021.02 LANGDALE (42
NEWMAN RD, GIBSONS)**
Langdale Construction Drawing

Table of contents

#	Description	Category	Plan	Assignee	Status	Page
35	DBOX 1	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	3
36	DBOX 2 AND FLOW TEST	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	4
28	DISTRIBUTION VALVE BOXES	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	5
27	GENERAL SITE OBSERVATIONS	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	6
30	TEST PIT 1 AND LATERAL EXPOSURE	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	7
32	TEST PIT 2 AND LATERAL EXPOSURE	01. TEST PIT	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	8
33	TEST PIT 3	01. TEST PIT	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	9
34	TEST PIT 4	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	9
29	YMCA GENERAL OBSERVATIONS	01. OBSERVATION	Langdale Construction Drawing	@BFO	Completed - 07-28- 2021	10

#35 - DBOX 1

Completed | Bradley Fossen | 01. OBSERVATION
Plan: Langdale Construction Drawing



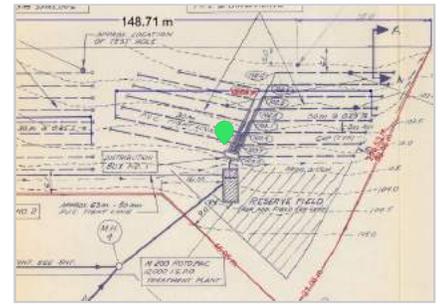
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Bradley Fossen	Photo 5	28 Jul 12:28 PM
Bradley Fossen	Photo 6	28 Jul 12:28 PM

Photos



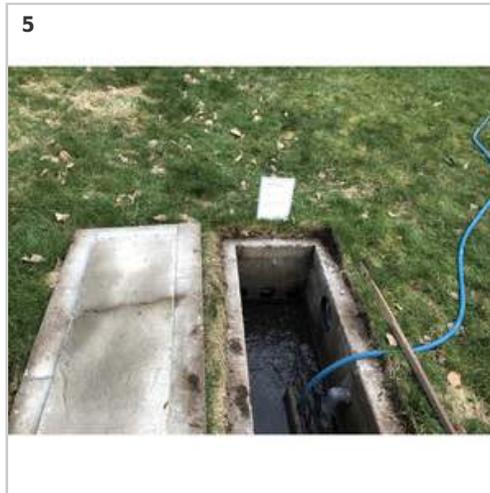
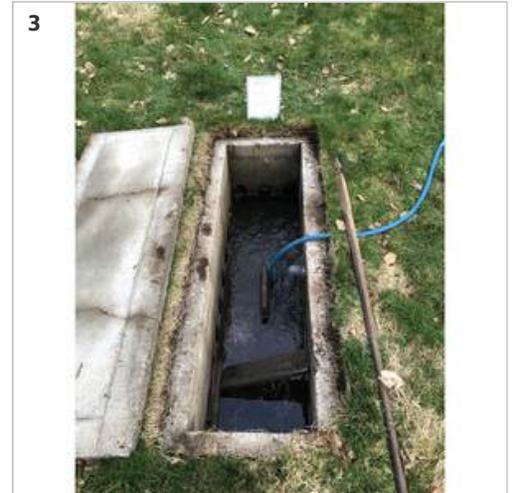
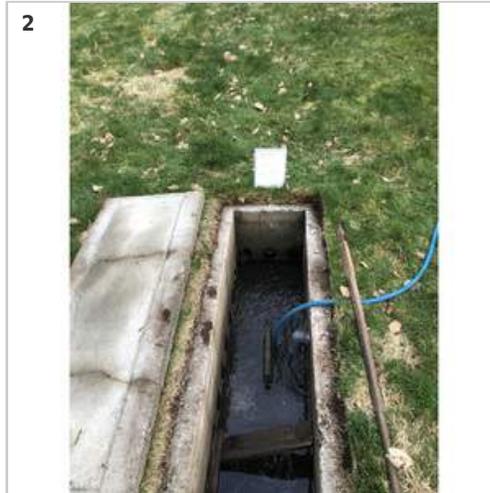
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 Plan: Langdale Construction Drawing



Task messages (time in MDT)

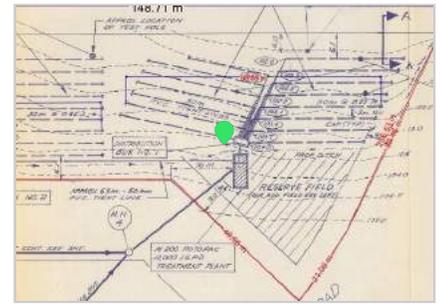
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Bradley Fossen	Photo 5	28 Jul 12:30 PM
Bradley Fossen	Photo 6	28 Jul 12:30 PM

Photos



#28 - DISTRIBUTION VALVE BOXES

Completed | Bradley Fossen | 01. OBSERVATION
Plan: Langdale Construction Drawing



Task messages (time in MDT)

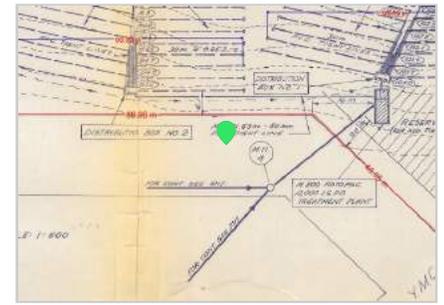
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Photos



#27 - GENERAL SITE OBSERVATIONS

Completed | Bradley Fossen | 01. OBSERVATION
 Plan: Langdale Construction Drawing



Task messages (time in MDT)

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Photos

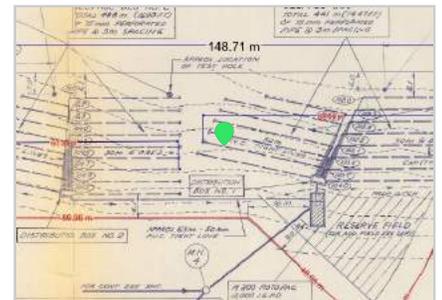




#30 - TEST PIT 1 AND LATERAL EXPOSURE

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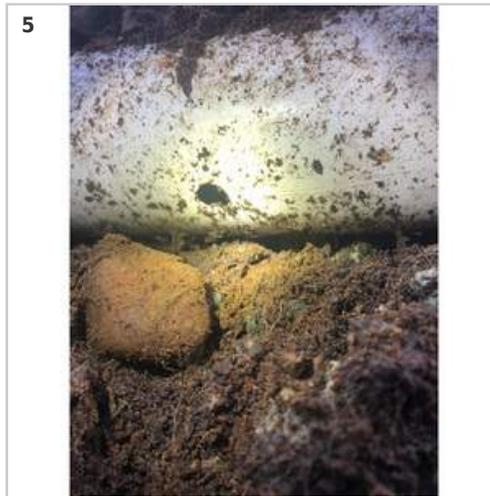
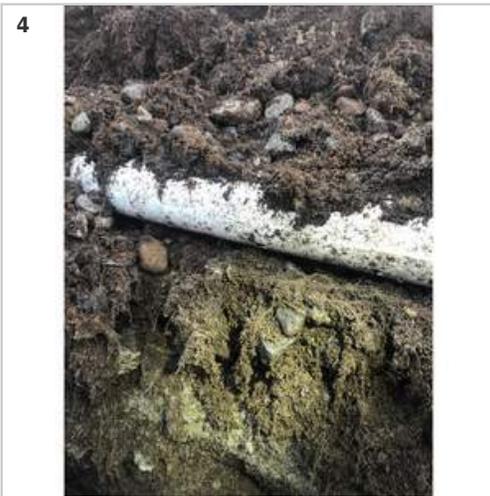
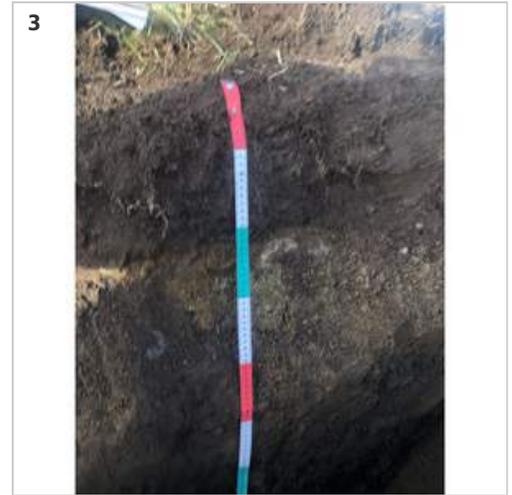
Plan: Langdale Construction Drawing



Task messages (time in MDT)

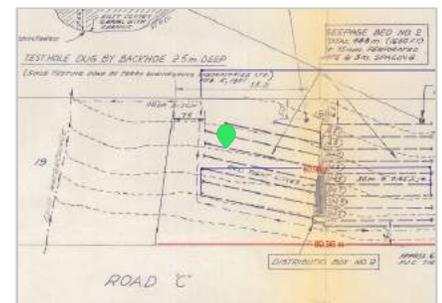
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Bradley Fossen	Photo 4	28 Jul 12:21 PM
Bradley Fossen	Photo 5	28 Jul 12:21 PM

Photos



#32 - TEST PIT 2 AND LATERAL EXPOSURE

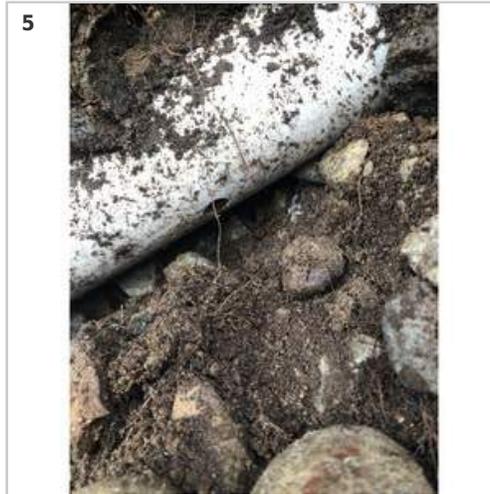
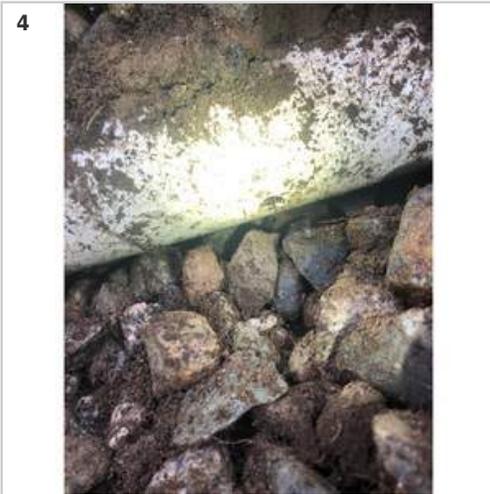
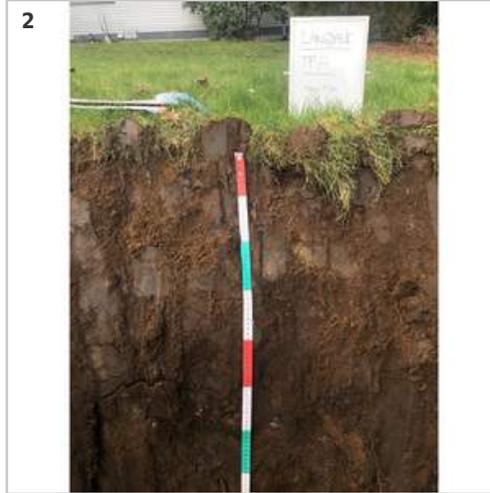
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Plan: Langdale Construction Drawing



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Bradley Fossen	Photo 5	28 Jul 12:23 PM

Photos



#33 - TEST PIT 3

Completed | Bradley Fossen | 01. TEST PIT
Plan: Langdale Construction Drawing



#34 - TEST PIT 4

Completed | Bradley Fossen | 01. OBSERVATION
Plan: Langdale Construction Drawing



Task messages (time in MDT)

Photos



#29 - YMCA GENERAL OBSERVATIONS

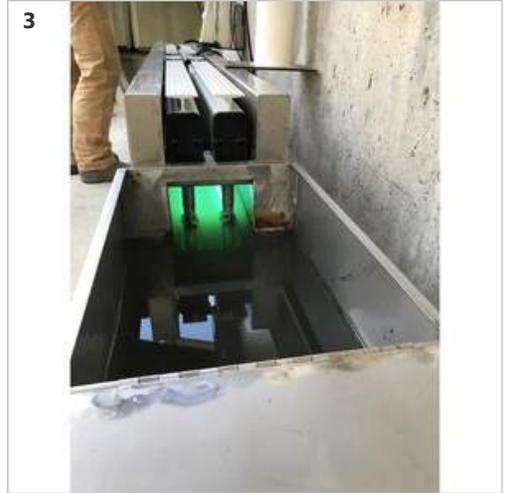
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Plan: Langdale Construction Drawing



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Bradley Fossen	Photo 11	28 Jul 12:13 PM
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Bradley Fossen	Photo 13	28 Jul 12:13 PM
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Photos



10



11



12



13

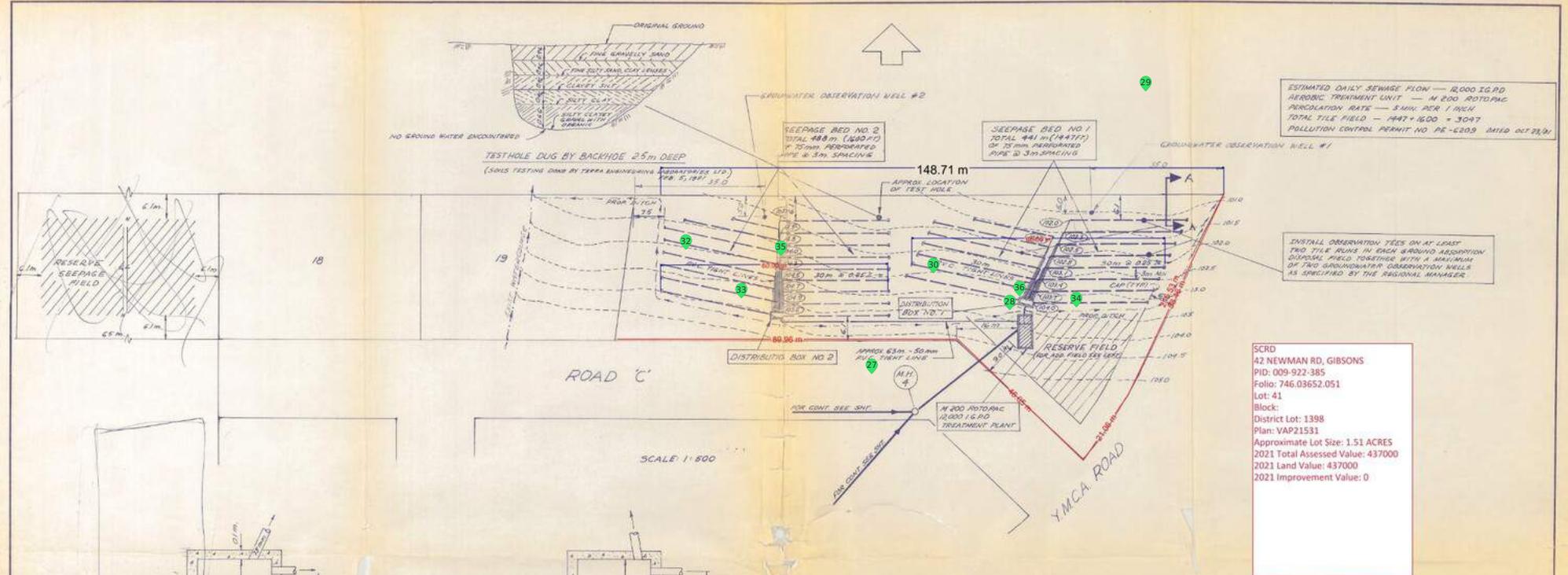


14



15



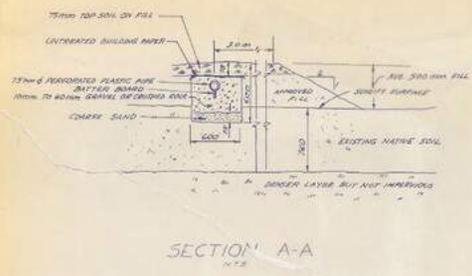
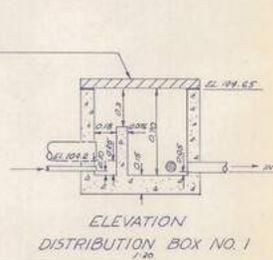
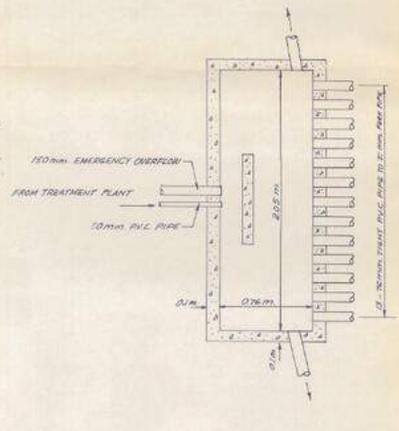
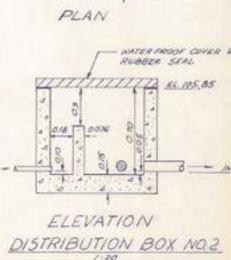
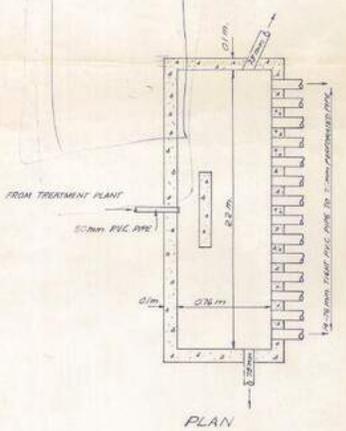


ESTIMATED DAILY SEWAGE FLOW — 1000 IG PD
 AEROBIC TREATMENT UNIT — M 200 ROTOPAC
 PENETRATION RATE — 2.4M PER 1 FEET
 TOTAL FILL FIELD — 1947.1 BDO = 3047
 POLLUTION CONTROL PERMIT NO PE-E209 ISSUED OCT 22, 81

INSTALL OBSERVATION TIES ON AT LEAST TWO TIE RUNS IN EACH GROUND OBSERVATION FIELD TOGETHER WITH A MAXIMUM OF TWO GROUNDWATER OBSERVATION WELLS AS SPECIFIED BY THE REGIONAL MANAGER

SCRD
 42 NEWMAN RD, GIBSONS
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SCALE: 1:500



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REVISION	DATE	MADE BY	CHKD BY



RANNALA & ASSOC. ENG. (1979) LTD
 • SURVEYORS • ENGINEERS
 14649-108th AVENUE TEL: 584-9820 SURREY, B.C. V3W 2Y9

DEVELOPER
LAKE NEWELL DEVELOPMENTS
 204-1046 AUSTIN AVE. COQUITLAM, B.C.

TITLE
SEEPAGE BED

DESIGNED BY: PE	SCALE: HOR. 1 AS SHOWN
DRAWN BY: PE	VERT. 1 AS SHOWN
CHECKED BY: BB	DATE: NOV 21, 81
APPROVED BY: [Signature]	DWG. NO: 81064
	SHEET NO: 9 OF 9

DESTROY ALL PRINTS PRIOR TO