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Technical memorandum: Explanation of sewerage system performance, compliance in relation to siting

Project: Ocean Estuary

Client: Merchant House

Date: November 23, 2021

Introduction

The client has retained TRAX to design onsite sewerage systems for redevelopment of a brownfield site in Fulford, Salt Spring Island, 2661 and 2621 Fulford Ganges Road.

The purpose of this memo is to clarify regulatory context and design guidelines for sewerage systems in BC, and to respond to questions raised by the Islands Trust planner.

Limitations

This report is subject to TRAX's standard statement of general conditions as attached to our Memo 2.

Section A is largely not engineering opinion, and is provided for convenience based on information presented in our Memo 2 and reports by other project professionals. Section B-3 is for information only, based on information received from the project geotechnical engineers and does not represent geotechnical opinion by TRAX. The seal and signature of Ian Ralston appended to this document excludes non engineering opinion related information in Section A and geotechnical information in Section B-3.

A. Regulatory context and applicable standards of practice

A- 1 PROVINCIAL SEWERAGE SYSTEM REGULATION

The planned sewerage systems are to be filed with Island Health under the *Health Act* Sewerage System Regulation (SSR). The SSR requires that design, construction and operation of the sewerage systems follow "standard practice" in order to avoid causing or contributing to a health hazard.

The SSR recommends the Ministry of Health BC Sewerage System Standard Practice Manual (SPM) as a source of standard practice. The Ministry of Health and EGBC also provide the EGBC Professional Practice Guideline, Onsite Sewerage Systems, which include recommended approaches for design to meet SSR standards and to consider protection of the receiving environment.

As described in the TRAX Memo 2 (Summary of Conceptual Design Rationale for Onsite Sewerage System Servicing), system conceptual design has followed the rationale, calculation procedures and technical references utilized to develop the SPM in accordance with the EGBC guidelines on performance-based design.

This approach will continue to be utilized at detailed design, and the final design and filing will be consistent with the TRAX Memo 2, with the intent of the constructed system providing superior performance to one designed to the minimum standards of the SPM, with performance supporting the objectives of the Islands Trust Salt Spring Island Official Community Plan (OCP).

A- 2 PROVINCIAL RIPARIAN AREA PROTECTION REGULATION

The site includes Soule Creek and a tributary ditch, which fall under the RAPR. All sewerage system components are to be located outside the Streamside Protection & Enhancement Areas (SPEA). Refer to Swell Environmental reports.

A- 3 ISLANDS TRUST SALTSPRING ISLAND LAND USE BYLAW

The local Salt Spring Island Land Use Bylaw establishes in Section 4.5.1 a setback from any water body to a septic field of 30 m. A development variance permit (DVP) was therefore required for dispersal area construction for the 2661 site.

This DVP has been approved by the Local Trust Committee, allowing siting of the dispersal area and other components as shown in the TRAX conceptual design drawings. This approval was granted based on the TRAX Memo 2, with clarifications provided at that time.

The DVP includes conditions that require adherence to the proposed performance-based water quality design approach and a requirement for monitoring to meet the performance objectives established by TRAX in Memo 2. Information from the TRAX Memo 2 is, as we understand it, attached to the DVP as a Schedule.

A- 4 CONCLUSION

Per the TRAX Memo 2, the proposed onsite sewerage system servicing is to be compliant with relevant provincial regulation.

System performance-based water quality design objectives are significantly more protective than the minimums recommended by provincial guidelines and standards.

The siting and conceptual design of the onsite sewerage systems, together with the proposed performance objectives, have been approved by the Local Trust Committee in the Development Variance Permit.

B. Questions from November 15th Email

B- 1 QUESTIONS REGARDING SOULE CREEK

The Islands Trust planner has asked the following question: **#1***"Why is treated effluent going to be discharged into the exfiltration wetland, and ultimately Soule Creek?"* And two further questions: **#2** *"The foregoing question leads into this one, which is what sort of volumes of treated effluent are you anticipating will be entering Soule Creek? Will it be a steady trickle, or periodic bursts? Do you anticipate that these flows will change the hydrology of the creek (eg. increase its flows during the dry season)? What about the temperature?"* And **#3** *"On a similar subject, have your environmental professionals turned their attention to any potential cumulative impacts of the effluent discharge into Soule Creek on the beach receiving environment? As you know, the tide is often a long ways out in the harbour, and so Soule Creek basically just trickles out on to the beach. While you are anticipating low fecal coliform and other loads in the effluent, is there a risk that pathogen or nutrient loads will accumulate at the creek mouth over time?"*

The design concept, with exfiltration wetland for shallow groundwater drainage flows, was approved by the Islands Trust as part of the DVP. However, after earlier questions related to the planned swale within the stream SPEA, in order to avoid delay and simplify approvals, we have revised our conceptual design to remove this drainage exfiltration wetland and associated vegetated swale at Soule Creek.

The questions relate to flow of shallow groundwater from the proposed dispersal area toward Soule Creek ditch. Originally, in addition to flow via the water table to Soule Creek ditch, the receiving area relief drainage near the dispersal bed was to convey collected shallow groundwater to an exfiltration wetland near Soule Creek ditch, with a vegetated swale toward the ditch. The intent was not to discharge treated effluent to this wetland or to the creek.

As discussed in the TRAX Memo 2, the intent of this wetland exfiltration of shallow groundwater was to mitigate the risk of impact on shallow groundwater flow and to enhance potential benefits to Soule Creek and its riparian area while mimicking a natural spring line. This approach was developed with Swell Environmental and was supported by the Local Trust Committee when the DVP was granted.

B- 2 QUESTION REGARDING POINT DISCHARGE OF EFFLUENT

The Islands Trust planner has asked the following question: **#1** *"What is the reason that the proposed sewage treatment system at 2161 F-G Road results in a single post-treatment discharge point?"* and stated that *"By which I mean, effluent dispersed into my septic field at home does not converge at a single point (to the best of my knowledge), but rather is dispersed and absorbed throughout the whole field."*

The sewerage system at 2161 Fulford Ganges Road will not result in a point discharge of effluent. Highly treated effluent is planned to be dispersed to a custom designed subsurface drip dispersal bed system with engineered sand media.

The question appears to be a misunderstanding related to relief drains in the receiving area near the dispersal beds, these relief drains are planned to collect shallow groundwater and control vertical separation. The drains are planned to flow to an exfiltration wetland in the lower part of the site. This wetland system concept was developed in order to mimic exfiltration of shallow groundwater in a spring line, after discussion with Islands Trust staff. TRAX Memo 2 provides further information.

To explain the purpose of sewerage systems, the fate of water from systems and the difference between effluent on the one hand and shallow groundwater that includes percolate from dispersal fields on the other, the reader is referred to Section C , below.

B- 3 QUESTION REGARDING SEISMIC EVENT IMPACT ON SEWERAGE SYSTEM

The Islands Trust planner has asked the following question: **#4** *"Your geotechnical report speaks to the steps required (excavation and installation of a rock mat) to guard against liquefaction risk that could compromise buildings on site. Have your geotechnical engineers considered liquefaction risks to the proposed sewage dispersal system? What are the predicted impacts of seismic activity on the proposed sewerage system?"*

In BC, onsite sewerage system design standards and provincial policy do not include a requirement for systems to be designed to be functional after a major seismic event. And I am not aware of any small (under 22.7 cmpd design flow) systems that have included seismic considerations in their design except in terms of slope stability.

In my understanding, and that of the project geotechnical engineers in our discussions, risk of environmental impact due to seismic events acting on the onsite sewerage system at the site is expected to be low.

I am not aware of an Islands Trust policy that requires seismic design of onsite sewerage systems. However, if this is a condition of development permissions, then at detailed design we will work with the project geotechnical engineer to mitigate risk to the sewerage system components and environment from seismic activity.

C. Onsite Sewerage System Performance and Design

While the TRAX Memo 2 and supporting documents provide information on the sewerage system conceptual design and the basis for that design, greater clarity may be needed with respect to the concepts behind sewerage systems. Including their purpose, the difference between effluent and water, the fate of water from a system and system design to meet performance objectives.

C- 1 ONSITE SEWERAGE SYSTEMS PURPOSE AND PERFORMANCE

Modern onsite sewerage systems are planned to result in protection of health and receiving environments through application of science-based standards and guidelines. They are, essentially, systems for sustainably recycling of wastewater back into the watershed.

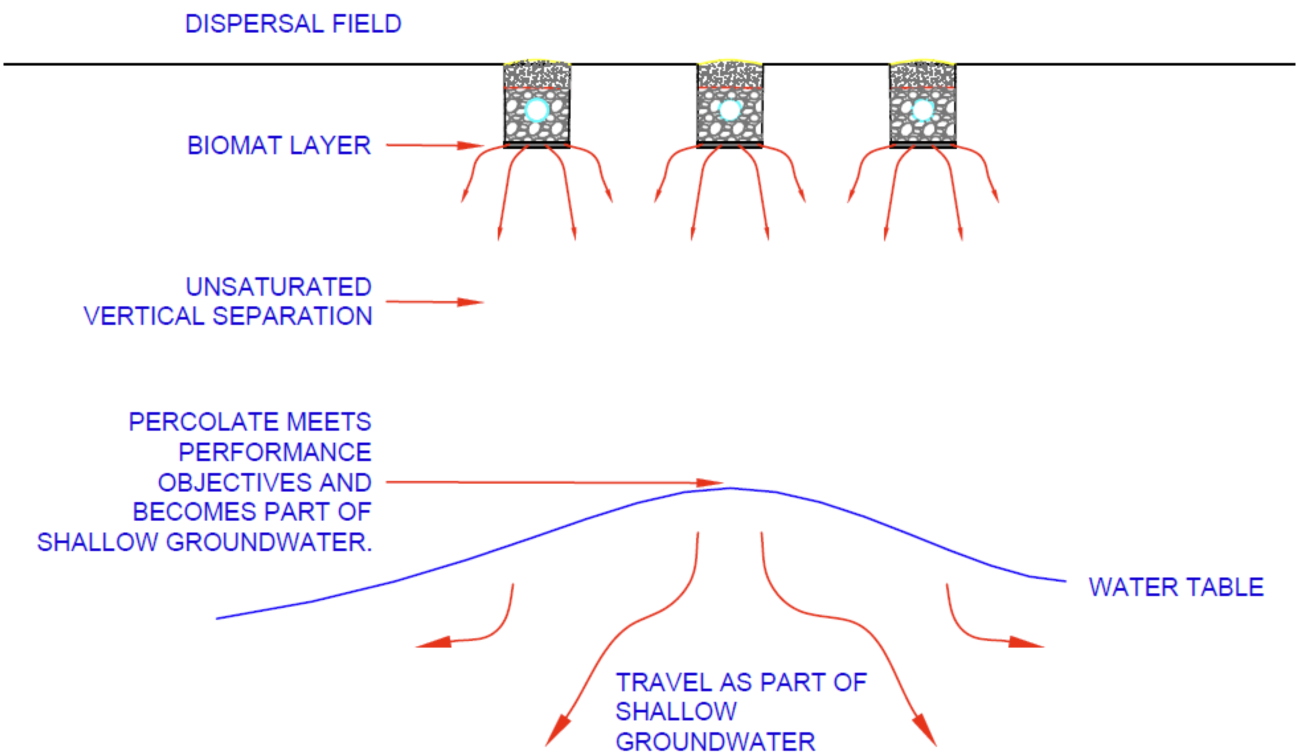
A simple onsite sewerage system consists of the following treatment steps between raw sewage from a building and water in the receiving environment:

- Primary settling and treatment, in a septic tank
- Distribution to the dispersal area, with biological treatment in a biomat layer
- Dispersal to soil and or sand media, with polishing treatment in the unsaturated media and soil below the distribution system

One of the most critical factors in this process is the maintenance of adequate unsaturated soil (or sand media) depth below the distribution system. Ministry of Health BC Sewerage System Standard Practice Manual (SPM) standards work together to result in systems that maintain this "vertical separation".

SPM standards are based on reliably achieving BC recreational water quality objectives at the base of this vertical separation. At this point "wastewater effluent" becomes "water" or "percolate" and moves toward the receiving environment.

The selection of performance objectives at the base of the vertical separation, and the definition of where effluent becomes water is articulated in the SPM as Ministry of Health policy. The following diagram shows a schematic section of a dispersal field to illustrate.



C- 2 ONSITE SEWERAGE SYSTEMS AND THE RECEIVING ENVIRONMENT

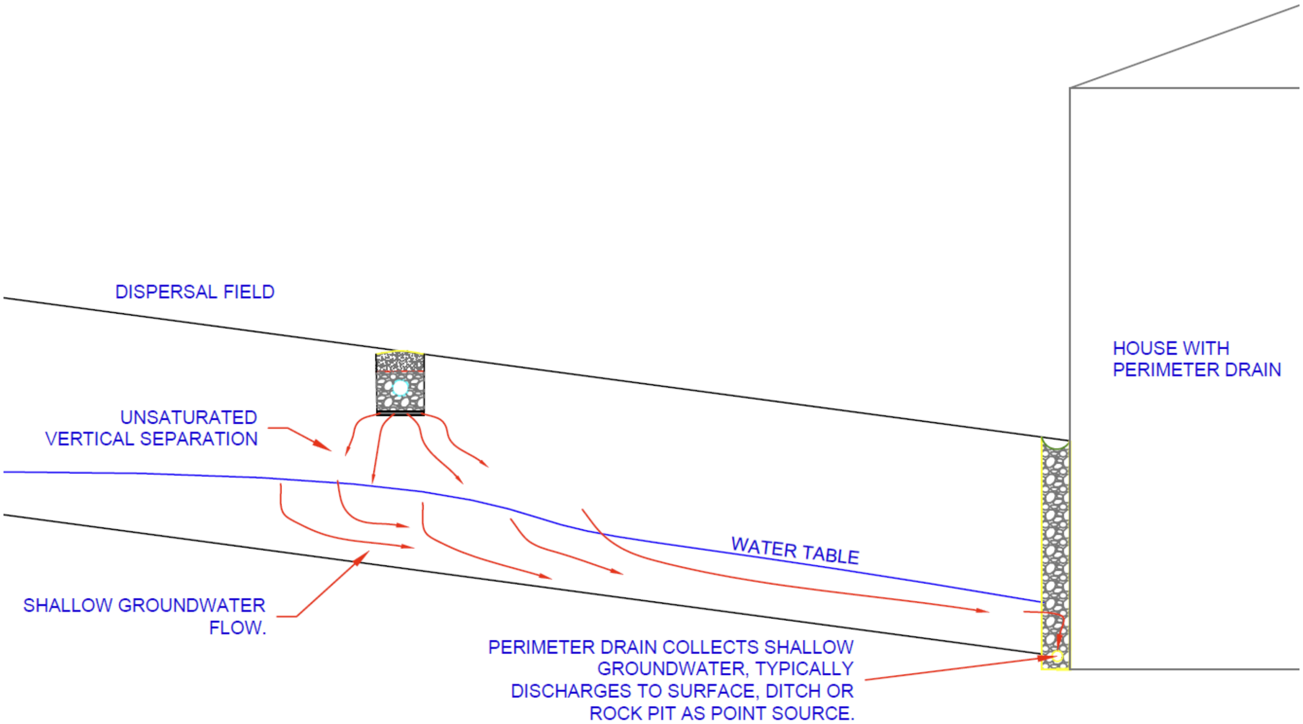
Water moves from the dispersal area to the environment. After reaching water quality objectives and becoming "percolate" it does not disappear but becomes part of the water cycle within the watershed. In most cases in coastal BC the percolate joins other shallow groundwater from rainfall or from upslope areas in moving toward a down gradient receptor within the receiving environment. This may mean percolate from one or many systems combine with shallow groundwater flow toward a receptor.

Two very common receptors for shallow groundwater and onsite system percolate are building perimeter drains, relief drains (drains used to lower the water table, e.g. agricultural field drains) and road ditches. Other common receptors include fresh water bodies and aquifers, or the ocean.

Some receptors concentrate shallow groundwater flow, for example perimeter drains, relief drains, ditches or water wells.

Others allow a more diffuse exfiltration of shallow groundwater to the receptor, such as a lake or the ocean. However, even in those cases, the percolate resulting from an onsite system or systems will typically join shallow groundwater and flow into the receptor in a "plume" that does not spread laterally to any great extent.

The following diagram shows a schematic section of a dispersal field and nearby house perimeter drain to illustrate.



C- 3 SENSITIVE RECEIVING ENVIRONMENTS

Some receiving environments can be particularly sensitive to impact from nutrients in shallow groundwater. These environments include some aquifers, some lakes and streams. These environments may need special care to manage risk of impact from shallow groundwater that may include nutrients from an onsite sewerage system or systems.

Although the Sewerage System Regulation focuses on human health impact, professional practice is to include mitigation of risk to these sensitive receiving environments. The SPM considers that for simple systems, and the EGBC Professional Practice Guideline: Onsite Sewerage Systems provides guidance for design in more complex situations as well as for larger systems.

Local government regulation may also require special care in these cases, for example requiring professional design of systems in certain development permit areas, or establishing setbacks to control density.

C- 4 ONSITE SEWERAGE SYSTEMS AT OCEAN ESTUARY

At the Fulford Ocean Estuary site our conceptual design has been based on a custom, performance based, design approach as recommended by the EGBC guideline. The design is based on performance objectives intended for protection of both human health and the receiving environments on and around the site. These objectives and the conceptual design have been reviewed and approved by the project biologists, and also the Islands Trust Local Trust Committee in granting the existing DVP.

To provide a robust level of risk management the Ocean Estuary onsite sewerage system will include the following steps between wastewater and water in the receiving environment:

- Primary treatment in septic tanks
- Flow equalization
- Advanced secondary treatment with additional nitrogen removal step

- Micro dosing to subsurface drip dispersal in engineered sand media
- Polishing treatment in the sand media and native or existing fill soils

Risk management will be enhanced by:

- Professional design and oversight of construction
- Continuous vertical separation monitoring
- Monitoring of treated effluent prior to dispersal, and percolate after soil based polishing treatment
- Professional oversight of maintenance and monitoring

Please refer to page 7 of the TRAX Memo 2 with regard to BC Water Quality Guidelines for Aquatic Life and monitoring during operations.

As part of the design of sewerage systems, control of water table is necessary to ensure vertical separation is maintained. This in turn results in improved system performance. The SPM and EGBC guideline include guidance on the use of interception and relief drainage for this purpose.

As discussed in TRAX Memo 2 and attached as a schedule to the DVP, for the Ocean Estuary site maintenance of vertical separation will be supported by receiving area relief drains, which will collect shallow groundwater (**not** effluent).

To mitigate impact on natural shallow groundwater movement patterns, and to enhance riparian areas, this shallow groundwater may be exfiltrated using a wetland system to mimic spring line flows and avoid point source discharge of drainage water.

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