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TECHNICAL MEMORANDUM

Comox Valley Regional District
South Region LWMP

Feasibility of Continuing to Use Private Septic Systems as Primary Wastewater Strategy

April 2015

ASSOCIATED ENGINEERING
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Comox Valley Regional District
South Region Liquid Waste Management Plan

Feasibility of Continuing to Use Private Septic Systems as Primary Wastewater Strategy

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1 Introduction and Goals

1.1 INTRODUCTION

The Comox Valley Regional District (CVRD) is currently preparing the Liquid Waste Management Plan (LWMP) for the southern part of the region, which includes the communities of Royston and Union Bay. As part of the LWMP, a number of different scenarios are under consideration to replace the current system of primarily individual, private on-site systems, most of which are standard septic tank and drain field combinations (referred to here as the "status quo"). All of the alternative options being considered would see a modern wastewater treatment facility (WWTF) constructed in the South Region, with the treated wastewater being returned to the environment through either an ocean outfall or by discharge to ground.

In addition to the WWTF scenarios, one of the scenarios that is being considered would be to continue the practice of treating and dispersing effluent through the on-site private septic disposal systems (PSDS) that currently service the South Region, but to also take steps to ensure that the on-site systems are constructed, operated, and maintained in such a way as to better protect the receiving environment and human health. Specifically it would involve CVRD taking on an education and enforcement role by enacting a bylaw that enables such oversight. Other local governments in B.C. have taken this step to augment the requirements of the B.C. Sewerage System Regulation (see Section 3.1). For example, the Capital Regional District (CRD) implemented Bylaw 3479 in 2008, which requires system maintenance according to a specified schedule and record-keeping, and empowers a bylaw officer to enforce the bylaw and issue fines for non-compliance. This option (referred to as the **"Enhanced PSDS")** would differ from and improve upon the status quo by bringing in local enforcement of the Sewerage System Regulation (SSR) and providing greater assurance the systems are properly designed, installed, and maintained.

In October 2014, the Technical Advisory Committee (TAC) and Public Advisory Committee (PAC) that are advising CVRD on the LWMP reviewed the nine wastewater management options that were under consideration and determined that the Enhanced PSDS Scenario would not be considered further for the South Region. This memorandum summarizes the factors that led to that decision.

1.2 SCOPE OF WORK

The evaluation of the Enhanced PSDS scenario involved six tasks:

1. A desktop review of existing published information, including reports on the performance of PSDS in the study area and risks to human health and the environment;
2. A review of the current regulatory requirements for the construction, operation and maintenance of onsite PSDS;
3. Telephone and in-person discussions with the local Environmental Health Officer (Island Health), CVRD staff, and other knowledgeable persons to identify issues of concern related to on-site wastewater systems.
4. Review information on lot sizes (including Official Community Plan requirements) and projected growth for the study area, and evaluate the potential for PSDS to meet current and projected future septic loads;
5. Estimate typical life-cycle costs for on-site wastewater systems based on published information; and
6. Preparation of this technical memorandum that presents the findings.

2 Summary of Previous Studies and Status of Existing Systems

2.1 SOIL AND GROUNDWATER CAPACITY

Several previous studies have examined the capability of soils in the South Region to support conventional private and community septic systems. The following two engineering reports specifically looked at surface infiltrative capacity:

- Royston and Union Bay Sewage Project: Feasibility of Soil-Based Treatment of Wastewater (Payne 2005); and
- Regional Potential for Waste Water Ground Disposal, Comox Valley Regional District Liquid Waste Management Plan (EBA 2008).

The rural communities of Royston and Union Bay are about 8 km apart, on the east coast of Vancouver Island. Each community consists of a compact higher-density area, some medium density residential development, and a large, low-density rural surround area (Payne 2005). The communities are currently mostly serviced by individual private septic disposal systems, located on each land parcel. There are a small number of community on-site systems in the South Region, but none service more than about three to five homes.

The 2005 study by Payne Engineering Geology (Payne 2005) assessed the feasibility of ground dispersal of wastewater via infiltration basins or trenches. The results indicated that groundwater levels in the study area are shallow. Soil textures were generally sandy to loamy, but with finer-grained sediments (silt and/or clay) encountered towards the bottom of the test pits (2.75 m bgs). In many of the parcels investigated, water was observed to pond at surface. This means that mounding of any additional water could be a major issue for the conventional discharge-to-ground technologies. However, the surface soil characteristics varied within relatively small distances between test pits. Overall, the author concluded that ground discharge is not a feasible solution for the entire Royston and Union Bay service area, based on the design population of 3500 to 7000 that was under consideration (Payne 2005). Six areas with the potential to serve clusters of populations between 200 and 2,000 people were identified.

The EBA (2008) report was a desktop study for the CVRD was mostly based on available soil, geology, hydrogeology, and topographical maps and reports. A composite map was created using GIS to classify the whole Regional District into four categories of potential for wastewater disposal: good, moderate, poor and very poor. The criteria for these categories were based on the requirements of the B.C. Sewerage System Regulation and the B.C. Municipal Sewage Regulation (see Section 3.1). Set-backs of 30 m were also placed around registered water wells, coastline, streams, and problem areas previously identified by Island Health (formerly Vancouver Island Health Authority, or VIHA). The resulting map [Figure 6 in the EBA (2008) report] indicates almost a complete lack of any “Good Potential” in the South Region except on alluvial fans, which by definition are too close to marine waters to be used for septic systems. There is a reasonable amount of “Moderate Potential” land in the South Region, but most of the land within about three kilometres the centres of Royston and Union Bay and two kilometres of Baynes Sound were rated as either “Poor Potential” or “Very Poor Potential”.

According to the findings, the “Poor” to “Very Poor” potential ratings in the Royston to Union Bay area results from a combination of imperfectly-drained soils, relatively shallow soils above confining clay-rich layers, and proximity to the coast or streams. The report also noted the presence of some sensitive wetland areas, indicating high water tables, with predominantly poor wastewater-to-ground disposal potential. The authors note, however, that given the regional scale of the study, areas mapped as “poor” or “very poor” may still have potential on-site wastewater systems depending on site-specific conditions, the type of system, and degree of treatment (EBA 2008).

2.2 SURFACE WATER MONITORING

Concerns over the effectiveness of on-site sewage systems are related in part to the findings of water quality monitoring in Baynes Sound and its in-flowing streams related to assessing potential hazards to shellfish. In 1994, almost 25% of shellfish harvesting areas in Baynes Sound were closed due to fecal coliform contamination (Project Watershed 1999), and a number of shellfish closures have occurred in Baynes Sound since then owing to high concentrations of fecal coliforms that exceed allowable limits (Joughin 2001; Associated Engineering 2011). The B.C. Water Quality Guideline for **fecal coliform density in marine waters used for the growing and harvesting of shellfish for human consumption is that the median density should not exceed 14/100 mL MPN over 30 days, and at least 90% of the samples in a 30-day period should not exceed 43/100 mL MPN (Ministry of Environment 2014).** Under the Canadian Shellfish Sanitation Program (2011), areas that exceed these guidelines are closed for shellfish harvesting and areas that exceed 88 MPN/100 mL or the percentage of samples that exceed 260 MPN/100 mL is greater than 10% are prohibited for shellfish harvesting.

In the 1990s, deteriorating water quality from multiple non-point source pollution created an impetus for water quality monitoring and education programs in Baynes Sound. Many stakeholders and local groups formed the Baynes Sound Round Table on Water Quality Management and began to work together to gather information, identify sources of pollution, and undertake actions to reduce non-point source pollution into Baynes Sound (Project Watershed 2001). For example, water quality monitoring of stormwater discharges between 1996 and 1998 revealed that many storm drain discharges posed a risk for fecal coliform contamination. In response, the City of Courtenay repaired a total of 74 combined sewer outflows, and the Town of Comox repaired eight.

Monitoring of streams and ditches that enter Baynes Sound in the Union Bay area indicated that these waters had persistently high levels of fecal coliform counts with the presence of *E. coli* that were likely associated with septic fields (Cross 1996).

Due to the sensitivity of shellfish to the presence of fecal coliforms, Environment Canada monitors water quality (fecal coliforms and salinity) in areas where shellfish are harvested as part of the Canadian Shellfish Sanitation Program. There are 33 water quality monitoring stations in Baynes Sound (Figure 2-1). Fecal coliform and salinity data collected from each monitoring station from February 2004 to March 2014 are summarized in Table 2-1, arranged by general sampling location. Samples collected from along the east shore of Baynes Sound had the highest average fecal coliform count at 22.2 MPN/100 mL compared to 7.4 MPN/100 mL at Denman Island, 7.2 MPN/100 mL from open water areas at the north end of the Sound, and 4.8 MPN/100 mL at Sandy Island. The maximum recorded values along the East shore are also higher than those at the other locations (Table 2-1).

The comparatively high fecal coliform counts along the east shore of Baynes Sound cannot be attributed only to on-site septic systems because there are a number of other potential sources of fecal contamination, such as surface runoff. However, the documented evidence of failing septic systems in the study area (Section 2.3 and 3.2 below) supports the conclusion that at least some of the elevated coliform counts on the east side of Baynes Sound can be attributed to septic inputs.

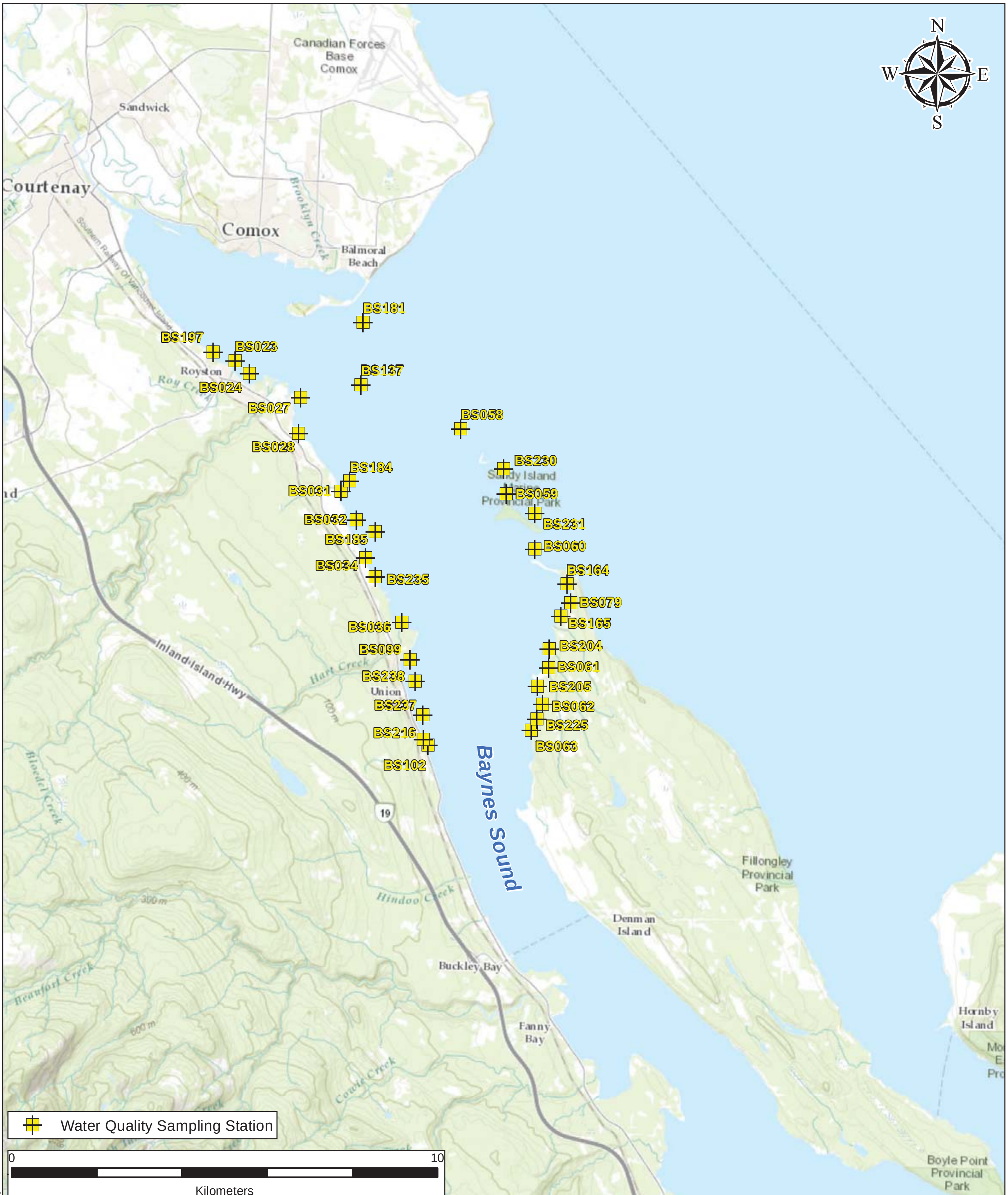

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FIGURE 2-1:LOCATIONS OF ENVIRONMENT CANADA MONITORING STATIONS IN BAYNES SOUND

Comox Valley Regional District

CVRD Liquid Waste Management Plan

Table 2-1
Results of Water Quality Sampling in Baynes Sound by General Sampling Area: 2004-2014

Station ID	Location*	Salinity (ppt)					Fecal Coliforms (MPN/100 mL)				
		No of Samples	Mean**	Max	Min	St. Dev.	No of Samples	Mean**	Max	Min	St. Dev.
BS061	D	60	24	31	8	5	60	12	350	<2	46
BS062	D	60	25	30	8	4	60	11	170	<2	28
BS063	D	59	25	30	12	4	59	6	79	<2	16
BS204	D	51	24	31	6	5	51	7	49	<2	13
BS205	D	51	25	31	8	4	51	3	33	<2	6
BS225	D	38	25	30	16	3	38	3	49	<2	8
Denman Island			24.7	31	6			7.4	350	<2	
BS023	E	93	17	33	2	8	93	71	1600	<2	202
BS024	E	93	18	32	0	8	93	62	920	<2	163
BS027	E	52	21	29	5	6	52	10	79	<2	17
BS028	E	56	24	32	8	6	56	10	110	<2	18
BS031	E	44	23	32	8	5	44	8	49	<2	12
BS032	E	38	24	32	8	5	38	6	49	<2	11
BS034	E	53	24	30	8	5	53	14	240	<2	37
BS036	E	126	24	34	7	5	126	9	170	<2	22
BS099	E	122	25	33	11	4	122	4	79	<2	11
BS102	E	122	26	34	11	4	122	9	540	<2	50
BS184	E	10	25	30	12	6	10	15	49	<2	18
BS185	E	10	24	30	8	7	10	107	920	<2	287
BS197	E	57	17	30	4	7	57	29	350	<2	58
BS216	E	40	25	31	15	4	40	4	33	<2	7
BS235	E	4	29	30	27	1	4	7	23	<2	11
BS237	E	4	29	30	28	1	4	1	1	<2	0
BS238	E	4	29	29	28	1	4	1	1	<2	0

Station ID	Location*	Salinity (ppt)					Fecal Coliforms (MPN/100 mL)				
		No of Samples	Mean**	Max	Min	St. Dev.	No of Samples	Mean**	Max	Min	St. Dev.
East Shore			22.6	34	0			22.2	1,600	<2	
BS058	OW	49	26	31	14	4	49	4	49	<2	9
BS137	OW	47	24	33	6	6	47	7	79	<2	15
BS181	OW	43	27	33	7	5	43	11	170	<2	29
Open Water			25.6	33	6			7.2	170	<2	
BS059	SI	42	25	32	10	5	42	5	130	<2	20
BS060	SI	59	26	33	10	5	59	5	130	<2	17
BS079	SI	69	25	31	5	5	69	4	49	<2	9
BS164	SI	43	24	30	4	5	43	4	33	<2	8
BS165	SI	43	24	31	8	5	43	6	130	<2	20
BS230	SI	11	28	31	25	2	11	4	13	<2	4
BS231	SI	11	27	30	20	3	11	7	46	<2	14
Sandy Island			25.1	33	4			4.8	130	<2	
Overall		1664	24	34	0	6	1664	16	1600	<2	72

*General location – E (East shore of Baynes Sound); D (Denman Island); OW (open water at north end of Sound); SI (Sandy Island. See Figure 1.
**Weighted mean of all sites in that area.

Source: Data from Environment Canada.

2.3 GROUNDWATER MONITORING

In 2009 Payne Engineering Geology completed a field sampling program in the Union Bay and Royston Areas. A total of 23 test holes with shallow monitoring wells (50 mm diameter) were completed down-gradient from properties with on-site wastewater systems. The monitoring wells were considered to be representative of areas with between 55 and 75 properties. The wells were sampled over two days in early April and the water analyzed for nitrate-N and *E. coli*, two common indicators of domestic wastewater. A well "failed" (i.e. was considered unacceptable for septic discharge) if the *E. coli* count was more than 14 MPN/100 mL or the nitrate-N was more than 10 mg N/L.

Eighteen of the wells had sufficient water for sampling, and in two the water table was judged to be at a deeper depth and therefore considered suitable for on-site disposal. The overall failure rate from the April 2009 sampling was 25%. The failure rate varied between residential areas, with the highest failure rate (50%) found in Union Bay. By comparison, there were zero failures in an earlier study in the Cape Lazo area (Payne 2009). The author noted that the winter of 2008-2009 was relatively dry, and estimated that an overall failure rate of 35% to 50% would be expected after a typical winter.

3 Regulatory Regime for On-Site Private Septic Disposal Systems

3.1 PROVINCIAL REGULATIONS

3.1.1 B.C. Sewerage System Regulation

The Sewerage System Regulation (the SSR) of the *Public Health Act*[1] came into effect in 2004 and was last amended in June 2010. The SSR is the regulation that applies to the construction and maintenance of holding tanks, sewerage systems that serve a single family residence or duplex, and sewerage systems with a domestic sewage flow of up to 22,700 litres per day that service a single lot or lots with a shared interest (via covenant). Wastewater systems that service flows over 22,700 L/day are regulated by the Municipal Wastewater Regulation (MWR), regardless of whether the treated wastewater is discharged to ground or to a surface water body.

Section 2.1 of the SSR prescribes the following activities as health hazards:

a) The discharge of domestic sewage into drinking water, surface water or tidal water;
b) The discharge of domestic sewage onto land;
c) The discharge of domestic sewage into a sewerage system not capable of containing or treating domestic sewage (in the opinion of a health officer, which for CVRD is a representative from Island Health); and
d) The proposed construction or maintenance of a sewerage system that may cause a health hazard if operated or maintained as designed (unfit design, in the opinion of a health officer).

[1] Part 3, Section 15

The remaining SSR outlines how to minimize/eliminate exposure to these health hazards. For instance:

- Section 3.1 pertains to minimum recommended setbacks from water wells (holding tank >15m from a well, remaining sewerage system >30m from a well).
- Sections 6 and 7 identify who is authorized to design, construct, and maintain onsite wastewater facilities (a registered onsite wastewater practitioner [ROWP] or other qualified professional [for flows over 9,100 L per day]).
- Section 8 specifies that information on new or upgraded systems must be filed with the Health Authority before construction.
- Section 9 specified that the ROWP or professional must provide a letter to the Health Authority certifying that the work is complete according to the SSR.

Under the SSR the authorized person (ROWP or professional engineer) determines the type of treatment method that is needed to protect human health and the environment at the site. There are three types of treatment methods (SSR Section 1):

- Type 1 – treatment by septic tank only.
- Type 2 – treatment that produces an effluent consistently containing less than 45 mg/L total suspended solids (TSS) and having a 5-day biochemical oxygen demand (BOD) of less than 45 mg/L.
- Type 3 – treatment that produces an effluent consistently containing less than 10 mg/L of TSS and i) a BOD of less than 10 mg/L, and ii) a median fecal coliform density of less than 400 colony forming units (CFU) per 100 mL.

Additional restrictions on on-site systems are specified in the B.C. Sewerage System Standard Practice Manual (see next section).

3.1.2 B.C. Sewerage System Standard Practice Manual

In September 2014, the most recent Sewerage System Standard Practice Manual (Version 3, or SPMv3) was adopted in B.C., bringing into effect new requirements for private septic (Ministry of Health 2014). To allow the industry a transition period from the old manual (Version 2) to the new; systems that were in development before September 2014 can be based on the former version until December 31, 2015. The SPMv3 is an extension of the SSR, and owners, ROWPs, and professionals should follow the standards specified in the manual.

The SPMv3 identifies technical constraints and considerations to be identified and addressed when designing, operating and maintaining on-site wastewater systems. This document is a technical manual that relates how the ground conditions present at a site, and the treatment type (Type 1, 2 or 3) selected influences the dispersal area standards that will be used and the overall design criterion required for effective dispersal. Sewerage systems must be designed following the principles of the SPMv3 and any additional local regulatory requirements (refer to section 3.2), and any deviation from the standard practices contained within must not compromise health and environmental protection and be documented.

To summarize, the standards for private on-site systems have increased with the newest versions of the SSR and SPMv3. As a result, sites and systems that were acceptable or borderline acceptable in the past may no longer be acceptable in the South Region.

3.2 VANCOUVER ISLAND HEALTH AUTHORITY

Since 2002, the Island Health has periodically reviewed and amalgamated the previous standards for subdivision of lots serviced by on-site sewerage systems. The most recent Subdivision Standards issued by Island Health (VIHA 2013) to ensure that new lots created within the boundaries of VIHA will support both a primary and reserve sewerage system. The intent is to address the cumulative detrimental impact associated with increased development density using on-site sewerage systems (VIHA 2013). The VIHA standards are minimums for Vancouver Island; and local governments and other agencies may have additional (i.e. more stringent) requirements.

The Subdivision Standards outline site assessment and reporting requirements required as part of a Subdivision Plan, reviewable by Island Health officers. These standards also include setback distances to wells and open water that in some cases exceed those stipulated by the B.C. SSR (i.e. setback from holding or septic tank to well >15m [SSR] versus >30.5m [VIHA]). In these instances, the more stringent setback must apply for locations within VIHA jurisdiction. The VIHA standards also set minimum lot sizes and effluent discharge areas based on slope and mineral soil depth (Table A in VIHA 2013). For example, if the slope of the discharge area on the property is less than 15% and the native mineral soil depth is more than 1.2 m, the minimum lot size is 0.2 hectares (0.5 acre). With the same slope, if the native soil is between 0.46 m and 0.60 m, the minimum lot size is 2 hectares (5 acres). The absolute minimum lot size for on-site wastewater is 0.2 hectares (VIHA 2013).

In addition, the Standards also spell out conditions in which a more detailed hydrogeological assessment may be required (i.e. potential for surface water/groundwater contamination, steep slopes, high density development areas or historical problem areas). In these instances, the assessment should be completed by a qualified professional.

Since 2006, Island Health has consistently recommended a centralized sewerage system for the Royston and Union Bay areas (VIHA 2006a, 2009, 2011) due to the prevalence of small lots with no area for a replacement field, shallow soils, silty-clay soils, and high winter water tables. Malfunctioning systems generate complaints from neighbours about sewage odours on a routine basis (VIHA 2006b), and 152 permits were issued by Island Health in the 15 years up to 2011 for sewerage repairs, alterations, and/or disposal due to malfunctioning systems (VIHA 2011).

3.3 LOCAL REGULATIONS

CVRD Zoning Bylaw, 2005 (Bylaw No. 2781) is an overview bylaw that codifies and outlines servicing requirements for the different zoned areas. Part 500 – Subdivision Regulations, outlines the general provisions and standards for a subdivision permit or plan submission. Section 503.6 outlines the subdivision standards pertaining to works and services for a lot within the district.

As sewerage servicing is primarily by on-site PSDS currently, there is no formalized Subdivision Servicing Bylaw in place for the CVRD at this time; one would be recommended should lot servicing by on-site PSDS continue. Currently, subdivision approval includes a review by the local Environmental Health Officer from VIHA, who reviews applications comparing to the Subdivision Standards they have adopted.

4 Constraints and Opportunities for On-site Private Septic Disposal Systems

4.1 SUMMARY OF BIOPHYSICAL CONSTRAINTS AND OPPORTUNITIES

Based on the information summarized in Section 2.1 and the correspondence from Island Health (Section 3.2), it is apparent that there are significant constraints on the continued use of private on-site wastewater systems, especially for new developments and in existing developed areas with relatively small lots. The primary challenges relate to the presence of "tight" soils, shallow water tables, and proximity of streams, wetlands, the coastline, and domestic wells. A significant portion of the Royston and Union Bay area is underlain by shallow till, fine-grained marine sediments, or shallow bedrock (Payne Engineering Geology 2005), and test pits and drilled wells often reveal the presence of clay and silt layers near the surface. The shallow water tables are a particular concern during the winter when rainfall is high and evapotranspiration rates are low.

Although there are pockets of acceptable areas for Type 1 systems, there is significant spatial variability in soils and groundwater throughout the Royston-Union Bay area and increasingly only the more expensive Types 2 and 3 systems would be feasible given the soil and groundwater limitations.

4.2 LAND USE AND LOCAL PLANNING

4.2.1 Regional Growth Strategy Guidance on Wastewater Systems

The CVRD Regional Growth Strategy (RGS) provides direction for future sanitary sewage servicing in the South Region. This direction is based on a number of key goals in the RGS including environmental protection and restoration, support for the aquaculture industry, support for KFN's economic objectives, and water and energy conservation. In general, these goals reflect public interest in environmental protection (including freshwater and marine resources) and the understanding that a significant number of the on-site systems in the South Region are not performing to current standards.

The major objectives and strategies with implications for private on-site ground disposal systems are:

- Future growth in *Settlement Nodes* will be accommodated by appropriate publically-owned sewer systems (MG Policy 1C-1).

- For *Settlement Expansion Areas* (MG Policy 1C-1) and *Rural Settlement Areas* (Policy 5D-4), where there are demonstrated on-site health related issues, publically-owned sewer systems should be made available.
- Shoreline areas are to be protected for existing and future aquaculture activities (Objective 6-B). Sewer services will be considered for areas with documented public health issues to protect marine environmental health (Objective 6B-5).

4.2.2 Lot Sizes and Property Setbacks

The Rural Comox Valley Official Community Plan (OCP) (Bylaw No. 337, 2014) sets policies for the Settlement Nodes (including Union Bay), the Settlement expansion areas, and Rural Settlement Areas. The OCP calls for the provision of sewer services in the Settlement Nodes, where possible, to meet the needs of existing residents and to protect human health and the environment where on-site and private systems are deemed to be insufficient ([Section 35(2)]. Lot size minimums are not set because most of the Settlement Nodes are already developed. In the Settlement Expansion Areas the minimum parcel size is four hectares [Section 36(1)], which is intended, in part, to accommodate the VIHA subdivision standards for on-site wastewater. In Rural Settlement Areas the prescribed minimum lot size is between four and 20 hectares depending on the capacity for on-site wastewater, fire hazards, and other factors [Section 43]; but 20 hectares is the basic permitted lot size unless the developer makes prescribed community amenity contributions (e.g. public dedication of greenspace or environmental protection).

In all areas the set-backs for septic tanks and discharge areas are established in the OCP as the VIHA subdivision standards.

5 Typical Costs of Private On-Site Systems

5.1 INSTALLATION AND MAINTENANCE

If the South Region was to continue to rely on on-site wastewater treatment systems, the collective cost of maintaining and/or upgrading existing systems and installing new private systems at new residences is significant. The costs to install a new system depend on a number of site-specific factors like soil characteristics, drainage, lot size, and ease of access for machinery. Table 5-1 provides typical, low end and high end costs for the installation of new Type 1, Type 2, and Type 3 private wastewater systems in B.C. (in 2014 dollars).

Table 5-1
Typical installation costs for new Type 1, 2 and 3 on-site wastewater systems in B.C.

Type	Typical Cost	Low End Estimate	High End Estimate
1	$12,850	$10,200	$15,500
2	$24,050	$18,700	$29,400
3	$48,100	$40,100	$56,100

Source: The range in costs were taken from Robson (2010) and adjusted for inflation using the Bank of Canada (2014) inflation calculator. They were then reviewed by a Registered On-Site Wastewater Practitioner and adjusted to reflect current typical planning and site preparation costs, as well as costs to file the system with Island Health.

Private on-site wastewater systems must be maintained to function properly. Publications from the Capital Regional District (CRD 2014a, 2014b) outline typical costs for Vancouver Island as:

- Pumping out a septic tank: $180 - $600 (depending on tank size)[2]
- Maintenance and monitoring $100 - $800 per year
- Inspection by qualified contractor $350 - $650

The typical costs for maintenance/monitoring and inspection in the CRD (2014) publication represent the requirements of CRD Bylaw 3479, which requires all systems to be maintained least at annually, with Type 2 and Type 3 systems being maintained more frequently based on manufacturer's guidelines. At present, CVRD does not have an equivalent bylaw. However, a sewerage system bylaw with similar inspection, monitoring, and maintenance requirements would be a core component of the Enhanced PSDS scenario.

5.2 ESTIMATED LIFE CYCLE COSTS

The typical life-cycle costs of on-site wastewater systems depend on the combination of the site, the type and design of the system, the number of people using the system, and, perhaps most importantly, the level of maintenance carried out by the property owner. On average, on-site wastewater system can last for 25-30 years (Regional District of Nanaimo 2014), but modern well-designed and well maintained systems can last longer.

Table 5-2 presents estimated life-cycle costs assuming 1) the 25 year low-end life span for a typical system and 2) a 40-year life span representing the likely upper range before replacement is needed. The 40-year time-frame is consistent with the design horizon that will be used for developing costs of the short-listed alternative scenarios. These estimates have been developed for informational purposes, based on the following assumptions: the range of installation costs shown in Table 5-1; that the septic tanks are pumped

[2] A survey by the Applied Science Technologists & Technicians of B.C. of five Vancouver Island pump-out contractors in 2011 found an average cost of $335 (in 2014 dollars) to clean out a 2,700 L (600 gallon) tank located within town limits and with the lid exposed (range $273-$384). Disposal fees are included but tax is not. Costs in rural areas would be more.

out every three years, on average; and that they are maintained annually, consistent with the CRD bylaw requirements (which could be a model for a future CVRD bylaw).

Table 5-2
Estimated Typical Life-Cycle Costs for On-Site Wastewater Systems

	25 Year Life Span		40 Year Life Span	
System Type	Range	Annual average of mid-range*	Range	Annual average of mid-range*
Type 1	$15,600 - $23,400	$780	$18,900 - $28,200	$590
Type 2	$34,100 - $47,300	$1,630	$43,400 – 58,100	$1,270
Type 3	$55,500 - $79,000	$2,960	$64,800 - $92,800	$1,970

*Includes original installation cost spread out over life span plus maintenance and pump-outs.

These estimated costs are in 2014 dollars and would be expected to rise with inflation. As outlined in Section 4-1, it is likely that the proportion of home sites that must be serviced by either a Type 2 or a Type 3 system would increase significantly under the Enhanced PSDS scenario. As such, homeowners on small to medium-sized lots in the South Region could anticipate the Type 2 and 3 life-cycle expenditures listed above because of the need to replace existing Type 1 systems.

6 Summary and Conclusions

This memo reviews the feasibility for the South Region of CVRD to continue to rely treating and dispersing effluent through the on-site private septic disposal systems (PSDS) that currently service the region, but to also take steps to ensure that the on-site systems are constructed, operated, and maintained to better protect the receiving environment and human health. This scenario is referred to as the Enhanced PSDS and would likely see the B.C. Sewerage System Regulation augmented with a CVRD Bylaw that requires inspections and enforcement, similar to the CRD and other municipalities. This scenario does not appear to be feasible for the following reasons:

There are challenges with “tight” soils and shallow water tables such as:

- Test pits and drilled wells show clay and silt layers near the surface.
- Much (80-90%) of the area is underlain by shallow till, fine-grained marine sediments, or shallow bedrock (Payne Engineering Geology 2005).
- These soils lead to a shallow, perched water table during the wet season.
- There are pockets of acceptable areas, but significant spatial variability presents a challenge for this option to serve the South Region without on-going human health and environmental hazards.

There is evidence that existing on-site systems are not functioning correctly in Royston and Union Bay as follows:

- A Payne Engineering Geology (2009) study found that 25% of areas tested showed evidence of failing systems (i.e. down-gradient groundwater contamination). This sampling occurred after a dry winter; the author predicted a higher failure rate would occur during a typical winter.
- By comparison, a similar study by the same author of private on-site wastewater systems in the Cape Lazo area found zero failures.
- Since 2006 Island Health has consistently expressed the opinion that Royston and Union Bay should have a community sewer system because of observations about poor septic system performance and the number of complaints received.

There is evidence of elevated fecal coliform counts in Baynes Sound as follows:

- Water quality monitoring has shown elevated fecal coliform counts in Baynes Sound near the shoreline.
- This is both a hazard to shellfish farms and a human health hazard.

Regulations on private on-site wastewater systems are becoming more stringent, with increasing future restrictions likely as follows:

- The B.C. Sewerage System Regulation (2010) and Standard Practice Manual (2014) were recently updated, setting higher standards for design, construction, and operation of septic systems, especially when compared to those that were in place when many of the systems in the South Region were installed.
- Design and maintenance standards are more restrictive than in the past. (The Enhanced PSDS scenario would require compliance with both the provincial regulation and the VIHA subdivision standards.)
- Horizontal separation constrains smaller properties – e.g. dispersal field must be more than 30 m from a well and more than 3 m from a property line. Also, there must be least 1.5 m vertical distance from the seasonal high water table.
- New *Water Sustainability Act* will increase groundwater protection in B.C. when implemented in 2016.

On-site wastewater treatment costs are significant for the following reasons:

- The Enhanced PSDS scenario would likely require more Type 2 or Type 3 systems to serve residential properties in the South Region, and fewer Type 1 (conventional) systems than currently in place.
- Typical current (2014) installation and registration cost ranges for Type 1, Type 2 and Type 3 systems are estimated at $10,200-$15,500, $18,700-$29,400 and $40,100-$56,100 respectively.
- Life-cycle costs, assuming a 25-year system life span, range from approximately $15,600 for a Type 1 system on a well-suited site, up to $79,000 for a Type 3 system on a more challenging site. This is equivalent to typical average expenditures of between $780 and $2,960 per residential property.

7 Recommendations

Given the combination of biophysical constraints, regulatory restrictions, potential health hazards, and evidence of environmental effects from poorly functioning septic systems described in this memo, the Technical Advisory Committee (TAC) and Public Advisory Committee (PAC) that are advising CVRD on the LWMP recommended that the Enhanced PSDS Scenario would not be considered further for the South Region.

References

Applied Science Technologists and Technicians of British Columbia. 2011. Tank Cleaning Fee Survey. Onsite Wastewater Registration Program. December 2011. 4 pp.

Associated Engineering. 2011. South region sewage collection, treatment and discharge study. Prepared for Comox Valley Regional District.

Bank of Canada. 2014. Inflation calculator. On-line at: http://www.bankofcanada.ca/rates/related/inflation-calculator/. Accessed January 2015.

Canadian Shellfish Sanitation Program. 2011. Manual of Operations. Version 1. Environment Canada and Fisheries and Oceans Canada. Ottawa.

Capital Regional District (CRD). 2014a. Septic System Maintenance Bylaw Information: Frequently Asked Questions for Type 1 Systems. No. 1272448. Updated July 2014.

Capital Regional District (CRD). 2014b. Septic System Maintenance Bylaw Information: Frequently Asked Questions for Type 2 and 3 Systems. No. 1272559. Updated July 2014.

Comox Valley Regional District. 2014. Rural Comox Valley Official Community Plan (OCP) Bylaw No. 337, 2014.

Cross, S.F. 1996. Water Quality in Baynes Sound: A Monitoring and Research program to investigate Spatial and Temporal Variability in Bacterial Contamination. Prepared by Aquametrix Research Ltd. for B.C. Shellfish Growers Association.

EBA 2008. Regional Potential for Waste Water Ground Disposal, Comox Valley Regional District, Liquid Waste Management Plan. Prepared for the CVRD. EBA File No. N23101297.

Joughin, B. 2001. State of the sound GIS project, Phase 2 – Data analysis and interpretation, Interim report. Prepared for the Comox Valley Project Watershed Society.

Robson, P.A. 2010. Advanced Septic Systems: New Technology allows septic systems to be installed in smaller and smaller spaces. Cottage Magazine. July/August 2010.

Ministry of Environment. 2014. Approved Water Quality Guidelines. On-line at: http://www2.gov.bc.ca/gov/topic.page?id=044DD64C7E24415D83D07430964113C9&title=Approved%20Water%20Quality%20Guidelines. Accessed March 2015.

Ministry of Health. 2014. Sewerage System Standard Practice Manual. Version 3. Health Protection Branch. September 2014. On-line at: http://www2.gov.bc.ca/gov/topic.page?id=C2F3DBA2AF8C4B9DAB7FC2C3A87D63E3. Accessed March 2015.

Payne Engineering Geology. 2005. Royston and Union Bay Sewage Project: Feasibility of Soil-Based Treatment of Wastewater. Prepared for Regional District of Comox–Strathcona. PEG File CSR-1. 13 pp. plus appendices.

Payne Engineering Geology. 2009. Royston and Union Bay Sewage Study: Effects on Onsite Sewage Systems on Water Quality. Prepared for Comox Valley Regional District. May 30, 2009. 12 pp. plus appendices.

Regional District of Nanaimo. 2014. SepticSmart Website: Care and Maintenance. On-line at: http://www.rdn.bc.ca/cms.asp?wpID=1866. Accessed April 2015.

Vancouver Island Health Authority (VIHA). 2006a. Letter from C.L. Enns, Medical Health Officer, to J. Duff, Director, Local Government Infrastructure & Finance Division, Ministry of Government Services. October 18, 2006.

Vancouver Island Health Authority (VIHA). 2006b. Letter from D. Stroh, Supervisor, Health Protection & Environmental Services, to R. Hotsenpillar, Comox Valley Regional District. October 25, 2006.

Vancouver Island Health Authority (VIHA). 2009. Letter from D. Stroh, Supervisor, Health Protection & Environmental Services, to M. Zbarsky, Comox Valley Regional District. March 16, 2009.

Vancouver Island Health Authority (VIHA). 2011. Letter from C, MacKinnon for D. Stroh, Supervisor, Health Protection & Environmental Services, to D. Kempling, Comox Valley Regional District. April 20, 2011.

Vancouver Island Health Authority (VIHA). 2013. Subdivision Standards. 23 pp. On-line at: http://www.viha.ca/NR/rdonlyres/67C5EDB3-9439-42B2-8E9D-E84965B62D31/0/VIHASubdivStandardsJuly172013.pdf Accessed January 2015.

TECHNICAL MEMORANDUM

Certification Page

This report presents our findings regarding the Comox Valley Regional District South Region LWMP Feasibility of Continuing to Use Private Septic Systems as Primary Wastewater Strategy.

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