COAST MOUNTAIN EARTH SCIENCES

Onsite Sewage Inspection Industry Background

prepared for BCCDC and Environmental Transmission of Norovirus into Oysters Working Group

2017 August 15
(updated 2017 Aug 25-BCCDC)

***Purpose*:**

This information is being provided to BCCDC staff as a potential aid in an investigation into outbreaks of norovirus within the BC Shellfish industry. The information by Coast Mountain staff focuses on conditions found during 51 inspections of onsite sewage systems, combining both booking information and a summary of findings for each system, as well as a general insight into the wastewater industry.

Region:

These inspections were predominately conducted throughout BC's Lower Mainland/Fraser Valley region between April 3 and June 23, 2017. The inspections were mostly for prospective buyers who were informed of our services through realtors, home inspectors, mortgage vendors or recommendations from friends. Homeowners also used our services wishing to add onto the home or make other changes around the property but didn't know the location, condition or suitability for a change in system use. The examples in this report vary in type, age, location and purpose and make for a very random selection of sewage system being inspected.

Our Business:

Coast Mountain is a family owned business focusing primarily on the inspection of onsite sewage systems. Started in 1990, over 5,000 systems around the province were inspected to date and the findings within this report are consistent with what was found elsewhere in the province in the past. The 2 Registered Onsite Waste Water Practitioners (ROWPs) within the business, along with technical and support staff, all have extensive field experience and meet or exceed industry standards for the inspection of onsite sewage systems.

Due to the large number of malfunctioning onsite sewage systems, restoration services are available through our Coast Mountain Earthworks division. Just as our inspection equipment is specialized for the inspection task, so is the equipment used to attempt restoration of system often using customized devices based on testing and research in the field.

***Personal Background*:**

While working for engineering firms supervising projects, Principal Ron Hein's focus was water, wastewater, soils and habitat restoration. Types of projects gravitated from larger sewage treatment plants and related infrastructure to smaller scale and residential sized systems due to problems becoming apparent through legal action.

During the late 1990’s, Ron was invited by Ministry of Health staff to participate in a committee struck to shape what was to become the BC Sewerage System Regulation now in effect since May 2005. In 2004, Ron was retained by the Applied Science Technologists & Technicians of BC (ASTTBC) as a technical specialist adviser for the development of their program to create Registered Onsite Wastewater Practitioners (ROWPs) for this new provincial regulation. In the process, Ron became the first person in BC to be granted certification by this association. In 2007, he was asked to become the first manager of the wastewater program for approximately 580 ROWPs, and in 2014, shifted to become the Chief Compliance Officer for the 10,000 plus members of ASTTBC overall. Ron continues with ASTTBC under a part time contract to provide this role currently.

In 2005, Ron was invited to become the Chair of the Education Committee as well as an instructor for the wastewater program within the Environmental Sciences department of Royal Roads University. He continued in this role until 2009 when work commitments with Coast Mountain and ASTTBC demanded more time. In 2014, Ron was invited by staff of Thompson Rivers University (TRU) to develop an onsite wastewater training program for First Nations students which continues to this day.

With Ron’s involvement from a regulatory, instruction and inspection role in the wastewater industry, he also acts as an expert witness 3 to 5 times per year up to BC Supreme Court on matters related to wastewater.

Terminology Used:

The descriptions for describing the performance of an onsite sewage system is based on inspection guidelines as set out by the *Applied Science Technologists & Technicians of BC* (ASTTBC), a professional association that regulates *Registered Onsite Wastewater Practitioners* (ROWPs) throughout BC. A copy of the guidelines can be obtained from: http://owrp.asttbc.org/wp-content/uploads/2017/03/OWCB-Policy-Jan-26-2017-.pdf

A copy of the standard terminology terms and explanation of when to use them is included in Appendix 1 at the end of this report.

What is an Onsite Sewage System:

Often referred to in the past as septic systems, the components and treatment concepts in the past 20 years has evolved these systems from a simple concept to performance-based processes and technologies. These are soil-based treatment systems using various components to pre-treat the effluent before the soils do the final work.

Most sewage systems mentioned in this report are those that fall under the Ministry of Health jurisdiction, and in particular, the Sewerage System Regulation (SSR). This regulation focuses on residential strength wastewater with daily flow rates <22,700 lpd/<5,000 Igpd. Some systems within the report are under Ministry of Environment jurisdiction where daily wastewater flows are 22,700 lpd/5,000 Igpd or greater, or where industrial/non-residential sources of wastewater are present.

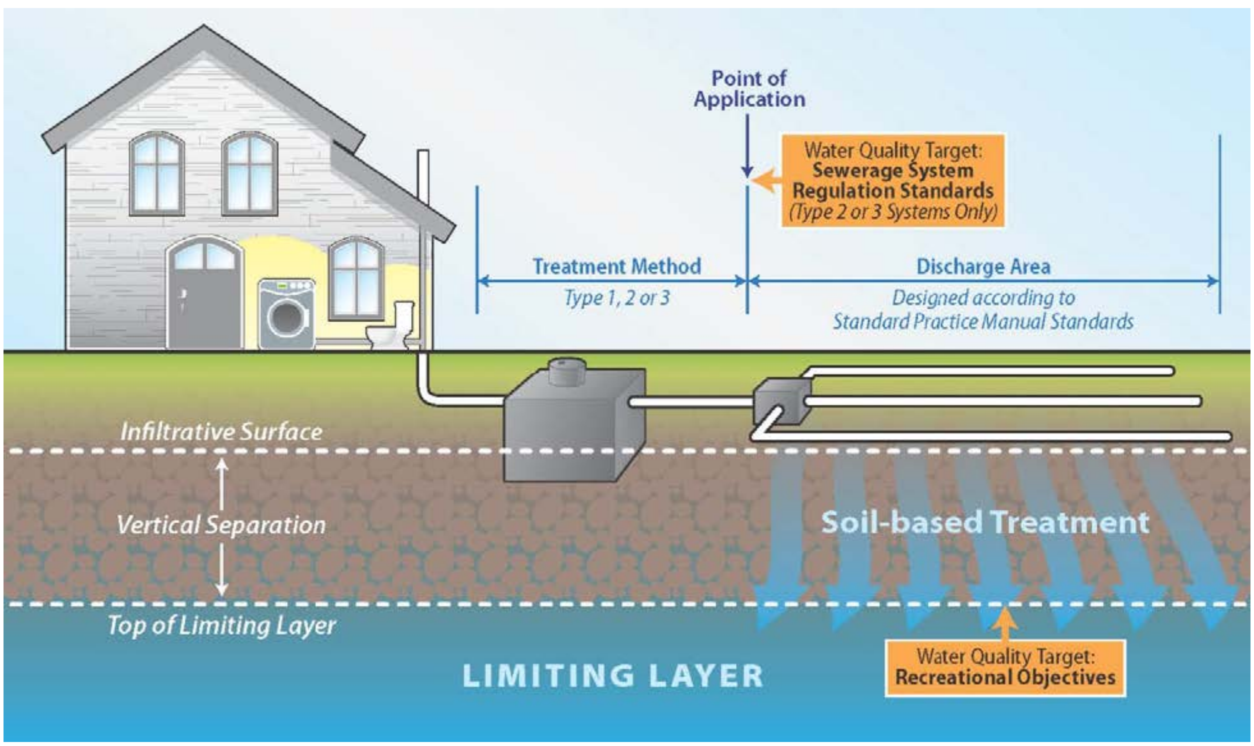
When we are inspecting larger onsite sewage systems under MoE regulations, we work in conjunction with a professional engineer or engineering consulting firm often who are aware of existing problems and need to determine the degree of impact or extent for aiding their work. Of those being inspected, we noted many were not being regularly maintained by a certified person (EOCP) as required by MoE regulations, or we found conflicting conditions than stated in reports by others. Most commonly, favourable reporting on the performance of treatment plants while grease traps and collection systems were severely affected by grease from restaurant operations, alarms on lift stations not functioning, substantial accumulation of sewage solids into the dispersal pipes of the absorption field creating irregular distribution patterns within the field, etc. Persons monitoring the system did not have equipment or knowledge on how to assess liquid dispersal areas.

Types of Sewage Systems under the SSR:

Under the SSR, B.C. has implemented three levels of sewage system treatment:

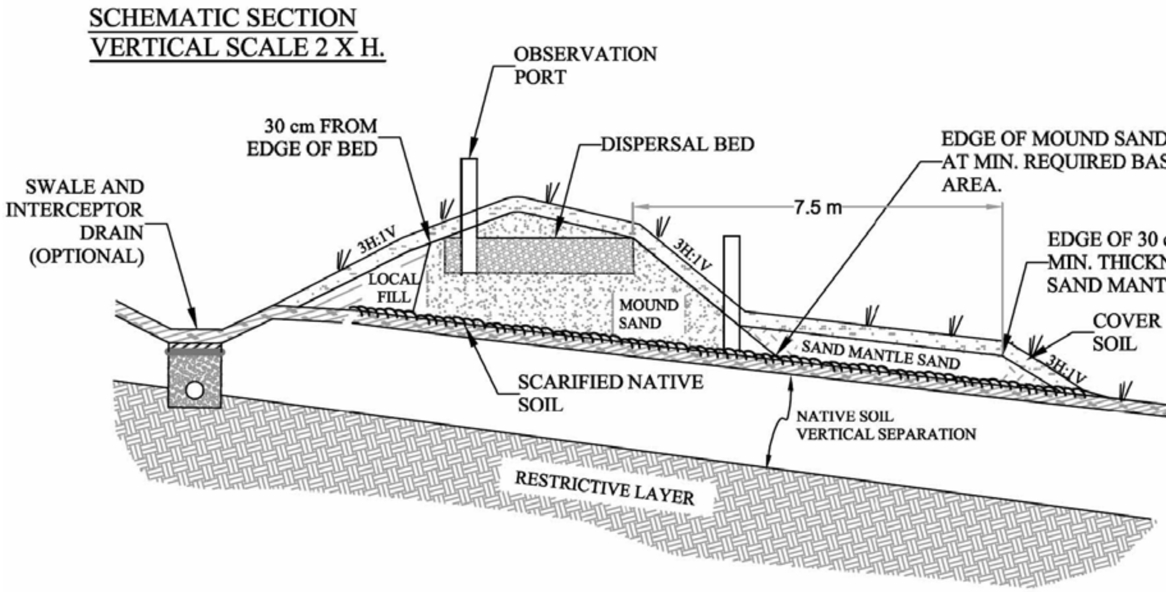
Type 1: The most basic type, this consists of a septic tank and a soil-based absorption field using a network of dispersal pipes buried in the ground. Most systems constructed until 2005 consisted of this style, with effluent flowing by gravity through the field.

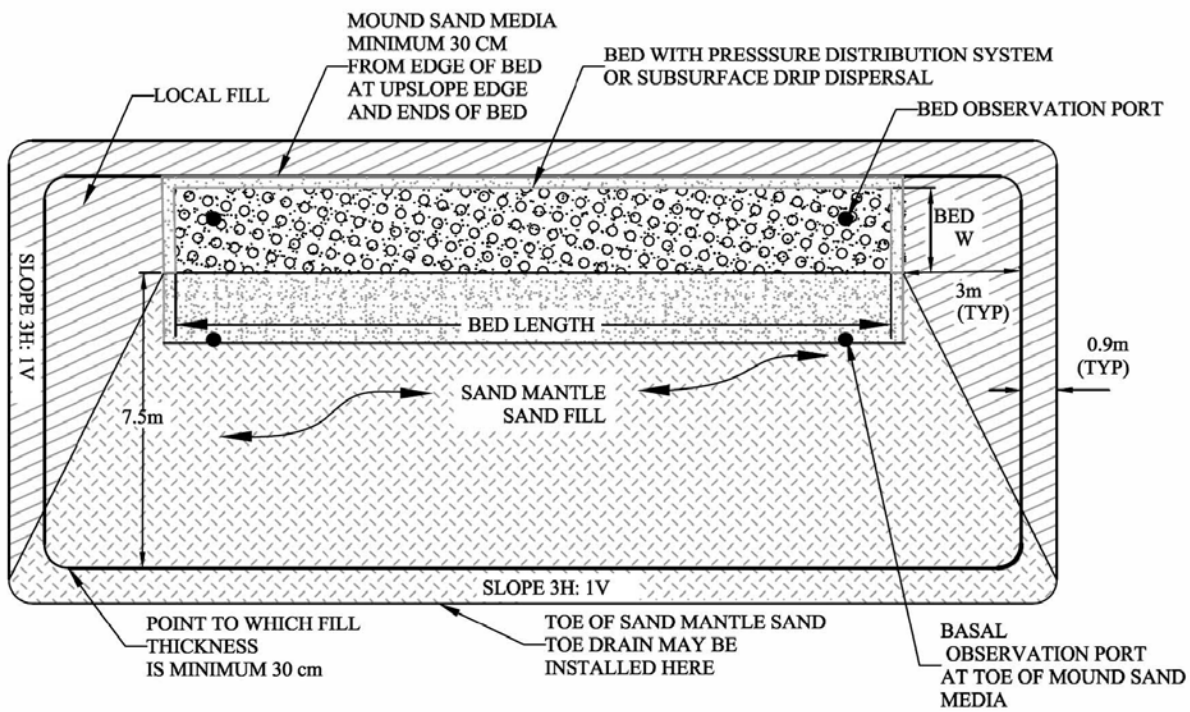
As the role of the septic tank is predominately a physical separation of sewage solids from liquids, the effluent quality often ranges from 120 to 350 mg/L for Biochemical Oxygen Demand over 5 days (BOD5) and slightly lower levels for Total Suspended Solids (TSS). For residential sources of wastewater, these values range from about ½ to 1/3 the influent quality when sewage solids can settle out within the septic tank.



More recently, mounds constructed with a specific grade of sand (ASTM C-33) and pressure distribution pipes are used to squirt the effluent uniformly through the top of the mound for additional treatment before the effluent reaches the native soil under the mound.

Cross Section (top photo) and Top View (bottom photo) of a Sand Mound:





Type 2: When site and soil conditions don't allow for a Type 1 system, this level of pre-treatment is much more commonly encountered. A package treatment plant or treatment process is used after a septic tank and before the dispersal area that are intended to achieve <45 mg/L for both BOD and TSS.

Type 3: When even more challenging site and soil conditions are present, an even higher level of pre-treatment is required. Using higher performing package treatment plants, combined with disinfection devices, these systems are expected to achieve <10mg/L for both BOD and TSS as well as <400 CFUs/100mL.

Application of Standards:

The SSR refers to the BC Standard Practice Manual (SPM) as a primary source of standard practice in B.C. ROWPs are required by their professional association to adhere to the SPM and only utilize another recognized standard when the SPM doesn't have information on a particular topic or another standard offers improved performance, long lifespan, or some other defendable advantage to deviate from using the SPM.

As the SSR and SPM are to be uniformly applied throughout B.C., the only variable that may impact onsite sewage systems is when a local bylaw has enhanced requirements beyond what the SPM specifies. This is more likely to mean greater setback distances to wells, lakes or other sensitive locations.

Maintenance Requirements:

Not only are the costs to construct these systems related to the type required, so too is the frequency and cost to maintain. A type 1 system may start off as an annual monitoring and maintenance (M & M) visit, but this can be extended up to once every 5 years according to the BC Standard Practice Manual. Typically, no effluent samples are tested unless a Maintenance Provider becomes concerned about some aspect of the system's performance.

A type 2 system may start out as twice per year for M & M with a recommendation that an effluent sample be done once per year. This sample would be for BOD and TSS only, unless the Maintenance Provider believes other parameters are necessary. Type 3 systems can be 2 or 3 times per year with one sample during the year for BOD, TSS and fecal coliform. Very minimal tests are conducted and discretion for in and when is provided mainly due to reduce the costs of M & M on a homeowner.

In contrast, even small wastewater systems under MoE regulations have more frequent M & M performed and include BOD, TSS, pH, dissolved oxygen (DO), phosphorus, temperature and ammonia-nitrogen. Since these systems are serving multiple buildings or properties, the cost to conduct more frequent or more parameters in testing the quality is shared by more users, unlike systems under the SSR predominately serving a single homeowner.

It is important to note that a type 2 or 3 system requires more effort to monitor and maintain them than a type 1, but if they are not maintained, they become nothing more than a type 1 system with an undersized absorption area. Lack of maintenance for a type 2 or 3 system has a greater impact on the soils of the dispersal area with more risk of irreversible damage than a type 1 system.

Number of Onsite Sewage Systems in BC:

The actual number of sewage systems under Ministry of Health regulations is not known. Best estimates suggest there are more than 350,000 systems around the province. Records of sewage systems are retained by regional health authorities and records prior to 1986 are often not available or retained. Records since 1986 do vary with some loss noted when offices were relocated, but overall are quite good. Some regions have moved to on-line registry of sewage system documents. On-line retrieval or a centralized registry has yet to be implemented across the province.

The number of systems is also difficult to determine due to illegal systems being installed. We have noted this occurring for many years and continues today, mainly due to people who have malfunctioning sewage systems trying to avoid the costs to replace systems in the quickest, cheapest way possible. Contrary to what we sometimes hear in the industry that this has become a greater problem than under the previous regulation with health officers issuing permits to homeowners, we do not find any evidence to support this claim.

We did notice an increase of illegal installations late 2004 and into early 2006, primarily due to the change from the Sewage Disposal Regulations to the Sewerage System Regulations as the latter was more stringent and requiring larger components than the former regulations. We have seen an increase of property owners taking plumbers and tank cleaning companies to court over misrepresentation by companies offering to replace sewage systems only for the property owner to later find out it was not installed according to provincial regulations and laws. In a case last year which we were involved with the investigation, the plumbing company settled out of court and issued the property owner a full refund for the installation they did.

We have noticed an increase in the number of realtors encouraging clients to not include a sewage system inspection as a subject of a sale and did not attempt to seek records from the health authority for the benefit of their clients. This appears mainly due to the fast pace of the real estate market where multiple bidding on a property does not allow for many, and sometimes any, inspections (building, well water, sewage systems, etc.) as this could risk the buyer being bumped out by another party offering a higher price and no or fewer subjects to the sale. Since the SSR has specific legal duties imposed on a property owner with a sewage system, the lack of knowledge what those duties are, is of great concern to us.

Of interest, our inspection business has noted an increase in new homeowners seeking an inspection after they have purchased, including an increase in the number of homeowners considering legal action on past owners and realtors for failing to disclose defects or known problems.

[Please refer to summary of inspection results for details of three months of inspections]

Reasons for these Results:

Design **–** Substandard designs play a role in 10 to 20% of the systems inspected. Incorrect site and/or soil assessments, whether due to lack of knowledge or lack of diligence in order to get the job. Prior to May 2005, Environmental Health Officers attended sites to verify conditions prior to issuing a permit, then re-attended during the installation to confirm work met provincial standards. Applications to construct a system were routinely made by property owners who would also be able to install the system themselves.

In May 2005, the new regulation created a professional-reliance model in which only professional engineers or Registered Onsite Wastewater Practitioners holding a Planner certification can design sewage systems. They are to conduct all site and soil assessments, create a design best suited for the location and property owner's needs, and register the documents with the health authority. No Health Officers or other third-party involvement to verify any aspect of the sewage system.

ROWP Planners often hold Installer certification so they can also construct a sewage system. Costs for planning work varies but $2,000 to $2,500 is not uncommon. As one means of encouraging a property owner to use a particular ROWP, some may offer the property owner a reduced rate ($1,000 or $1,500) if they also get to install the system.

Installation – As noted above, the homeowner can no longer apply for permission to construct a sewage system and must all either an engineer or a ROWP Installer construct the system. An engineer can allow anybody to install the system under their supervision whereas the ROWP is considerably more limited by their professional association policies requiring direct supervision.

With a greater level of supervision required by the ROWP of non-ROWP/homeowners doing installations, increasingly more people are using an engineer who may, or may not, attend the site for any inspection/reviews. This is but one reasons for some ROWPs cutting corners to be competitive with engineers.

Competency & Ethics Issues with Authorized Persons:

As the SSR mentions, only Authorized Persons can construct or maintain sewage systems. Problems with competency or ethics has occurred with professional engineers and ROWPs, and results of disciplinary actions by the respective associations against their members can be at:

For the Association of Professional Engineers & Geoscientists of BC, refer to the following website - https://www.apeg.bc.ca/For-Members/Complaints/Disciplinary-Actions for actions against Victor Proctor (2015), Elwyn Burch (2015), Richard Bartel (2012), Phillip Reid (2012), Alfred Trask (2012), Joseph Thorburn (2010), Jerry Lay (2010), Gerald Ortner (2010).

For the Applied Science Technologists & Technicians of BC, refer to the following website - https://asttbc.org/practice/complaints/findings/ for actions against ROWPs. Since ROWPs were registered in 2005, over 200 complaints are noted within the complaint summaries posted by ASTTBC. Do note that this registry has gaps (2005 to 2006, Nov 2011 to Dec 2013, and March 2015 to Dec 2016) which substantially adds to this total. Around the province there are less than 600 ROWPs on the registry and some ROWPs had multiple complaints made against them.

Monitoring & Maintenance **–** the current regulation requires engineer/Planner to create an Operating & Maintenance Plan which is registered with the health authority at the completion of the installation. This is a legal document requiring the property owner to ensure regular maintenance is performed specific to the type of system and expected usage of the occupants within the building. While the regulation doesn't allow the property owner to do the maintenance, they are required to have the work done by either a professional engineer or a ROWP Maintenance Provider. Once the work is done, a report is to be given to the property owner who is required to retain such records to demonstrate compliance with the regulation.

Few property owners recall or wish to pay for regular monitoring and maintenance since this can range from $300 to $700, or more per year, depending on the type of system constructed. We are also seeing an increase in the number of occupants in the home which is adding additional demands upon the sewage system. Rental suites as mortgage helpers, "granny" suites to care for aging parents who are not ready for, or can not afford to, move into a care home, and home-based businesses where employees may be working from all can lead to an overuse of the system. Combined with damage from constructing patios, landscaping, in-ground irrigation, swimming pools, riding rings, parking lots, vehicle and material storage, home extensions and many other ways people have damaged these systems. Overuse, abuse, and neglect amount for the remainder of the problems found.

Examples of problems found:

A series of photographs are provided to show the more common examples of various problems found during inspections. The following details are intended to help explain the nature and reasons for these conditions.

Leaking Septic Tanks - Photo shows a septic tank being pumped out which confirmed from where leakage at a seam was occurring. Leakage in or out of a tank can occur at mid-seams, inlet and outlet pipes, electrical wire entry points, and similar points. They have also occurred from concrete tanks insufficiently cured by concrete pre-cast companies before being installed resulting in stress cracks, especially across the floor of a tank. Main reasons for leakage are due to incorrect installation practices.

Leakage is not limited to septic tanks only. Even pump chambers, treatment plants, clarifiers, sand/peat/foam filters, and other components within a system can have leakage. If the soils around these tanks are dense and compacted, minimal leakage beyond the tank may occur. However, sand, pea gravel and similar free-draining material used to bed these components can cause effluent to travel much greater distances. As these components are often installed near a home, leakage can migrate into perimeter drains around a home where it can emerge at ditches, steams, or other discharge points not intended to receive wastewater.

Distribution Box Filled With Soil - Simple gravity-fed dispersal pipes in an absorption field are usually connected to a distribution box. When effluent from a septic tank is directed to the field, it arrives by a pipe into the distribution box for uniform distribution into whatever number of dispersal pipes exit the box.

These boxes are mostly constructed with concrete and suffer deterioration from the effects of sewage gases, especially hydrogen sulfide. As the concrete deteriorates, the box lid and sides crumble resulting in soil surrounding the box to collapse or wash into the box. The resulting obstruction often creates an overloading of one dispersal pipe while the others are clogged.

Many styles of plastic boxes are also susceptible to soil migration due to the flexible nature of the plastic, lack of ribbing or other features intended to provide structural support, and flimsy lids that can buckle when backfilled. These problems are primarily due to improper installation and/or inappropriate selection of component make/models for a system.

Ponding Around a Dispersal Pipe - Whether a gravity-fed or pressurized dispersal pipe, both are used to transport and disperse effluent through the soils of an absorption area. These pipes may be installed in drain-rock filled trenches or gravelless trenches using plastic chambers but either way, the effluent must freely seep out of the pipes and continue traveling vertically down through unsaturated soils for final treatment. Excess migration of sewage solids out to the absorption area results in effluent becoming perched within the dispersal trenches or bed with no effective treatment taking place.

Effluent Escaping to the Surface - When sewage solids clog the soils around or under dispersal pipes, incoming effluent is more likely to escape to the surface or breakout out at the lowest point of a dispersal area. Other factors that contribute to this can include soils with high silt, clay, peat or organic content due to inaccurate or no proper assessment of the site and soil conditions when planning a sewage system.

Heaving Conditions Inside a Septic Tank - Ponding conditions within an absorption area may be noted when wastewater begins backing up inside a septic tank. When this happens, sewage solids floating on top of the wastewater cracks, folds, and even heaves as fluid levels rise and fall through the day. This can be spotted by monitoring conditions within a sewage system if regular monitoring and maintenance is being done.

Outlet Baffle Clogged - Sewage solids can migrate out of septic tanks during periods of heaving, heavy use within the home/building, leakage from toilets when flappers and valves wear, large quantities of oil and grease are washed into the system, insufficient pumping out of the tank occurs, etc. These solids can clog the outlet baffle causing a backup of sewage into the home or an escape of sewage from access lids over top of the septic tank.

Dispersal Pipes & Tiles Clogged - Further migration of sewage solids from a septic tank can result in clogging of pipes and tiles within any portion of the sewage system. Most commonly due to deterioration of outlet baffles in the septic tank, overuse of the system and/or insufficient pumping out of the septic tank in relation to usage.

Structures Over Top System Components - From extensions on homes, constructing garages, above and in-ground swimming pools, riding rings, truck parking areas, decks, concrete patios and scores of other reasons, these prevent access to key components of the system for monitoring & maintenance, and during the course of construction, can damage the components underneath.

This usually happens because the homeowner is not aware of what sewage systems are and the care needed of them. This is further compounded when few building departments even require the sewage system be assessed for potential impact prior to issuing building permits. We can provide a list of building departments we contacted earlier this spring and the subsequent statements made by staff regarding sewage systems not being a concern to them.

[photos from May 24, 2017 inspection]

Damage and Debris within Dispersal Pipes - Often resulting from construction work over top or next to dispersal pipes within an absorption area. Can also occur during the construction of the sewage system, especially when backfilling or grading the area with machines.

Garage over dispersal field

Garage over absorption field

Septic lids exposed

Illegal Diversions - As systems malfunction, homeowners may not have the financial ability to correct the problem and take the simplest approach to dealing with effluent. A pipe installed to a ditch, stream or any other discharge point becomes the quick and simple solution. We find this more commonly in rural areas where it is less likely to be noticed by neighbours or others.

[photos from Apr 20, 2017 inspections]

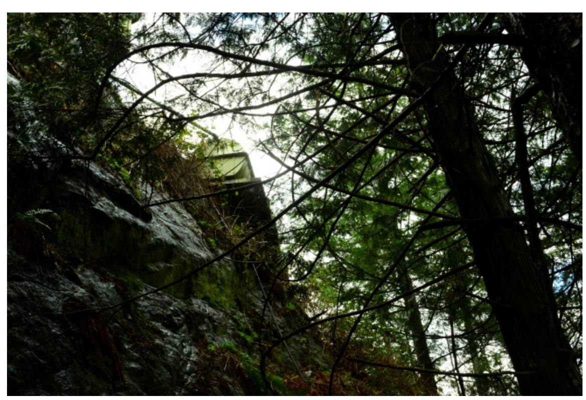
Drainage ditch installed along mound to divert to illegal pipe

Hidden illegal discharge pipe

Discharge pipe to ditch

Unsafe Conditions - From damaged access lids, improper electrical connections, or limited access to components, a variety of unsafe conditions can exist. We find about 1 to 3 such conditions per month regardless of location around the province.

No access, unsafe conditions to service package treatment plant (by rock bluff)



Unsafe conditions

Potential electrical hazard at pump chamber [photo from Jun 1, 2017 inspection]

Onsite Sewage Systems Near ECCC Emergency Closure Areas:

Royston, Union Bay, Buckley Bay, Fanny Bay – These areas are well known to me for malfunctioning sewage systems primarily from having conducted investigations into the practice of some ROWPs working in that area. Many pockets of older homes are on very small properties in a dense configuration and soils through these areas are typical of alluvial fan deposits. Gravel and sand with seasonal high water tables due to the influence of snow melt and/or heavy rains coming down creeks and streams that connect upslope of these communities.

New systems often required Type 2 or 3 treatment plants with pressure distribution systems whiles some ROWPs and non-Authorized Persons constructed undersized Type 1 gravity systems. These simple systems cost significantly less than the more complex systems and became enticing as many homeowners can’t afford them even though site conditions require them.

Okeover Inlet – My co-instructor for a First Nations wastewater system installer course at Thompson Rivers University is from the Powell River/Sunshine Coast region and we have discussed problems within this area for some years. Varied terrain and soil conditions resulted in more complex systems being required for new homes and older homes in need of replacing their existing systems, especially near Penrose Bay.

Some campgrounds, resorts and a large restaurant had malfunctioning systems in the recent past with some repairs or upgrades made or planned, but no idea if these were followed through in all cases. We are aware of significant purchasing of homes, businesses, and even oyster leases by off-shore investors in recent years where no inspection of the sewage system was considered necessary as a subject for the transaction.

Large areas of this region do not have building inspection bylaws so home construction or renovations are not regulated and an “anything goes” attitude is prevalent. This extends to dealing with sewage. An example of this is an area referred to as Malaspina Estates where ground conditions are predominately rock and privy/outhouse is more commonly found than a sewage system.

Virus Reduction with Onsite Sewage Systems:

References used when developing industry best practices within the BC Standard Practice Manual had minimal research focusing on virus retention or reduction. One of the best references that I came across was from the University of Florida and have attached information from that source to this report.

While all information may be of value to the group, refer to the site and soil conditions mentioned on pages 3 to 4 as this is significant to the discussion. Soil-based wastewater treatment must have non-saturated soils but the amount of vertical soil or sand depth varies based on the type of system be selected for a site. Some sites, such as near shorelines where alluvial deposits of sands and gravels may be present, create very fast percolation rates, or minimal soil cover over rocks would result in minimal treatment. When combined in areas where seasonal high rainfall or groundwater conditions exist, the potential for virus migration from the wastewater absorption/dispersal field may be occurring.

How much soil is required to treatment wastewater, and especially, viruses, becomes the question. Regulatory standards, such as setback distances to water wells and other drinking water sources, may be more arbitrarily set than based on science. Since the B.C. Sanitary Regulation became into effect in 1917, subsequent regulations regarding onsite wastewater systems has prescribed distances but these are also subject to legal tests. One of the more important court case decisions in B.C. (Wilkinson vs Vancouver Island Health Authority, BCSC 2008) around risk of wastewater to wells. Just what is a safe distance is open for debate.

In my professional opinion, I believe that for some of the sites affected by the norovirus the more probable source of human sewage contamination is from onsite sewage systems in the area.

Ron Hein, ROWP, RULT
Private Inspector
Residential & Commercial Onsite Wastewater Systems

Coast Mountain Earth Sciences
PO Box 123 - Stn. Whonnock, Maple Ridge, BC V2W1V9
Mainland Tel: 604 462 7106
Email: rhein@septicscience.ca
http://septicscience.ca

Appendix 1:

The following is an extract from the ASTTBC Guidelines for Inspection of Onsite Wastewater Systems, and in particular, the terminology to be used by a ROWP when conducting an inspection.

8.4.2 The following terminology is to be included and explained within the report:

a) ***This system is operating in a normal manner as intended by its design -*** this is when:

- All wastewater was confirmed to arrive at each component and travel through the system in a normal manner without wastewater backing up or being diverted;
- In a gravity distribution system, all dispersal pipes receive approximately equal flows, or, flows with variations not exceeding 10% for any one pipe;
- In a pressurized distribution system, all laterals receive approximately equal flows and the squirt height as measured at the ends of all laterals does not vary by more than approximately 10% from the original squirt height recorded at time of commissioning, or as compared to all other laterals;
- The effluent sample(s) taken from the treatment plant/process meet the permit/Filing document standards;
- For a lagoon, the effluent level is below the design freeboard;
- Where a treatment plant or process is installed, the results of laboratory testing will determine whether the effluent quality meets the requirements of the design. Even if all other aspects of the system are or appear in good order, where effluent strength exceeds the requirements, the system is identified to be experiencing a "performance malfunction."

b) ***This system is operating, but a partial restriction or backing up is occurring -*** this is when:

- All wastewater was confirmed to arrive at each component but was found to partially back up or was restricted at any component. This can be evident as a fluid level higher than the invert of the outlet pipe but not reaching the mid-point of an inlet or outlet pipe;
- In a gravity distribution system, all dispersal pipes receive flows however variations exceeding 10% but less than 25% for any one pipe was observed inside and along the runs of any dispersal pipe;
- At the end of a pump cycle or flow test, effluent is observed to flow backward into the distribution box from one or more distribution pipes;
- In a pressurized distribution system, flows are visible from all laterals, but one or more laterals had a variation greater than 10% from the original squirt height recorded in the system commissioning or as compared to the other laterals;
- For a lagoon, the effluent level is approximately at the designed freeboard.

c) ***Performance malfunction -*** this is when:

- The dispersal area has less Vertical Separation than required by the standards at the time of construction
- The fluid level is at or above the mid-point of any inlet or outlet pipe of any component;
- Any backing up is found in a pump chamber, siphon or other dosing device contrary to the normal operating level for that component;
- Wastewater is escaping or groundwater is entering from any point in the system contrary to plan/design;

- In a gravity distribution system, one or more dispersal pipes have no visible flow or variations of 25% or more are observed inside and along the runs of any dispersal pipe;
- In a pressurized distribution system, one or more laterals have no visible flow or variations of 25% or more are observed in any lateral during a squirt test;
- Effluent or monitoring port samples do not meet the requirements of the original permit or Filing document;
- Intrusion of solids into the dispersal area (high BOD due to inadequate septic tank maintenance) and diminished performance of CTDS, type 2 or type 3 technologies (no longer meeting the SSR performance standards);
- For a lagoon, the effluent level is above the design freeboard of the lagoon (normally 0.6 m below the top of berm).

d) ***System operation could not be fully determined*** **-** this is when:

- The ROWP could not gain access to the building to confirm where all wastewater flows travel to.
- The system has not been in use for several weeks and the ROWP has concerns that observations may not reasonably reflect behaviour and/or performance of the system when in actual use;
- The water supply into the building was not functioning;
- One or more components could not be accessed, potentially due to:
    - Depth of hand digging required is more than 60 cm below the surface resulting in a large excavation not anticipated or normally encountered,
    - Soils are very compacted and breaking through this layer could result in damage to a component below,
    - Soils contain large rocks, cobble, building debris, that may result in a large excavation not anticipated or normally encountered
    - High groundwater conditions over top of a component,
    - Landscaped areas where the disturbance required for gaining access to a component may upset the property owner and/or require additional restoration work that would add an unforeseen expense to the client’s budget,
    - The component is inaccessible due to asphalt, concrete or other paving materials, a structure or other obstruction
    - The effluent sample is about to be submitted to the lab. If an effluent sample could not be obtained, the reason should be explained in the report

e) ***Illegal or prohibited feature*** **-** this is when:

- It is suspected or confirmed that the system was installed without a permit or completed Filing document. This should be clarified in the report with all details given to substantiate the claim;
- There is an intentional or non-intentional diversion that could or is allowing effluent to escape continuously or seasonally from the system;
- The number of bedrooms or building floor space exceeds the original design of the system or the permit or Filing document issued;
- A second residence or building is connected which exceeds the original design of the system or the permit or Filing document issued;
- A sani-dump or other connection is installed that permits wastewater from sources other than this building to enter the system;
- A garbourator or other device is installed in the building and connected to the system if the permit or Filing documents state they are not allowed for this system;
- Backwash from, or floor drain around, a swimming pool or hot tub is connected to the system;
- Backwash or drain from water treatment equipment is connected to the system;

- A building, or extension to the building, was made over top a component;
- The system is partially/fully within a neighbouring property;

  Note: Only permitted if both property owners make a legal agreement that is registered on the land titles;

- Some or all of the system was modified, reducing horizontal setback standards as required at the time of construction;
- One or more components do not meet required setbacks;
- A residential system is receiving high strength and/or high volumes of wastewater; and,
- The type and/or volume is contrary to the intended design and is not permitted unless prior permission from the Authorized Person/Health Authority was obtained.

f) ***Potential health or safety hazard* -** this is when:

A Biological Hazard may be present:
- Effluent is or appears to be escaping the system to the surface;
- Effluent is backing up into the building where the effluent is or could likely overflow at some point within a plumbing fixture or appliance; and,
- Effluent is or has the potential of coming into contact with people in any manner that is or could pose a Health Hazard as defined under the Sewerage System Regulations, provincial *Health Act*, or any other regulation or act that may be applicable.

An Electrical Hazard may be present:
- An electrical health hazard is suspected or has been identified.

A Physical Hazard may be present:
- A severely broken, damaged, or unsecured lid, or a structurally unsound component that could pose a physical health hazard has been identified.