

Water Management Plan

CRYSTAL MOUNTAIN SPIRITUAL EDUCATION CENTRE

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V1.4

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1 Introduction

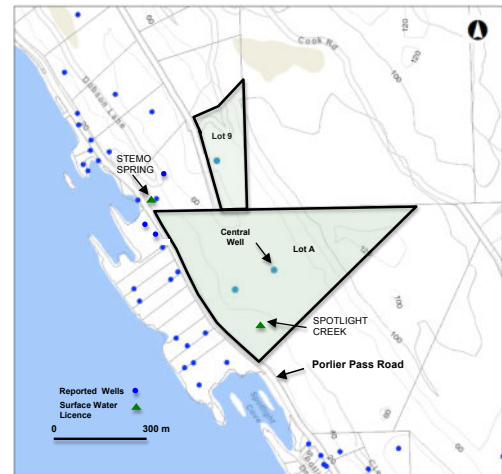
Crystal Mountain Spiritual Education Centre (CMSEC) is located adjacent to and east of Porlier Pass Road at the north end of the island near Spotlight Cove (Figure 1). The Crystal Mountain lands include Lot A, District Lots 88 and 89, Plan VIP68079 and Lot 9, District Lot 90, Plan 31200, Galiano Island, Cowichan District. Lot A is zoned Forest 1 (F1) and Lot 9 is zoned Rural 2 (R2) in the Galiano Land Use Bylaw (Islands Trust Staff Report, 2015).

The Society has applied to rezone the two lots to create a nature protection area comprising 75% of the combined total lot area along with a spiritual education retreat centre on the remaining 25%. This report summarizes an overall water management plan covering the use of groundwater and rainwater to meet the potable and non-potable water needs for year-round usage of the spiritual education centre portion that includes retreat participants and fulltime caretaker occupancy.

Included are summaries of:

- Groundwater
- Stormwater
- Water demand
- Potable Water Safety Plan
- Fire Suppression
- Waste Water
- Rainwater

Figure 1 Subject area



1.1 Site Plan

The changes from the existing land use (Figure 2) to the proposed rezoning (Figure 3) are provided for reference. The proposed plan includes two defined areas – Area '1' and Area '2' and the amenity transfer demarcation to Islands Trust Conservancy (ITC). See Appendix A and B for larger versions of Figure 2 and Figure 3

Lot A, District Lots 88 and 89, Plan VIP68079 will be comprised of two retreat areas:

- *Primary Retreat Area '1'* (Figure 3)
 - Central Kitchen (existing)
 - 14 meditation/sleeping huts (no plumbing)
 - Rainwater collection system
 - Water treatment system
 - Central Washroom
 - Caretaker Building
 - 1 Meditation Hall (no plumbing)
 - Central Well (WID# 23227) – 125 ft depth; currently in use
 - Observation Well (WID# 23229) – 183 ft depth; not in use
- *Upper Ridge Retreat Area '2'* (Figure 3)
 - Left undeveloped until a new well is drilled and registered
 - Future Upper Bathroom and Kitchen
 - Future 3 sleeping huts (no plumbing)
 - No existing well – planned to have new well developed

Lot 9, District Lot 90, Plan 31200 is undeveloped – comprises part of the amenity transfer to ITC

- Well (WID#23228, WTN56538) – 280 ft depth; not in use

Figure 2 Existing Land-use (larger version found in Appendix A)

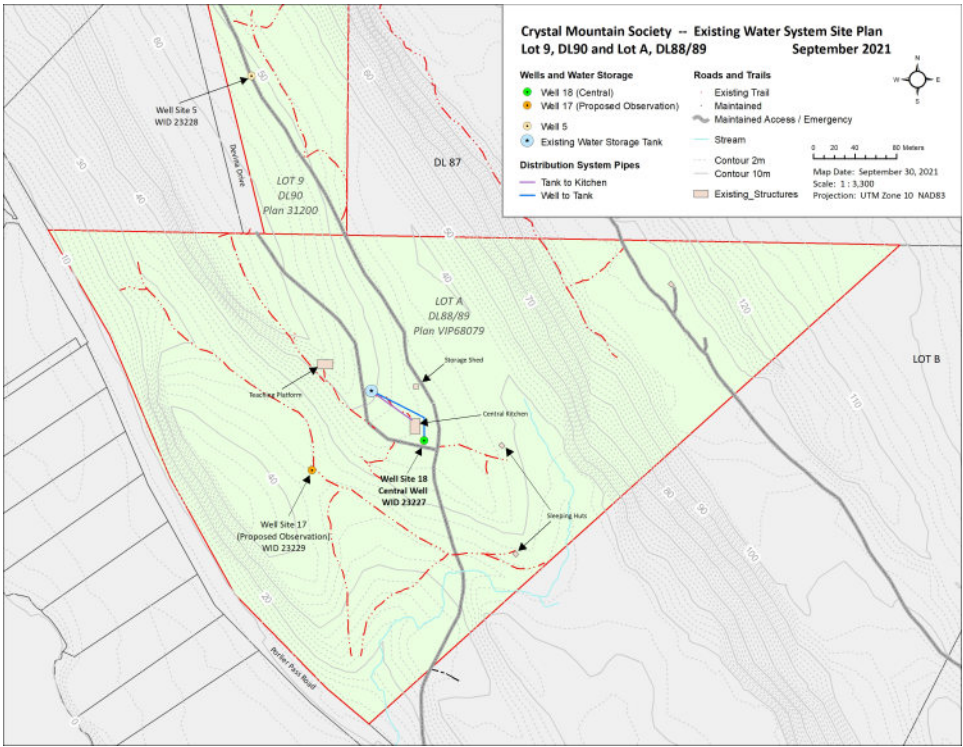
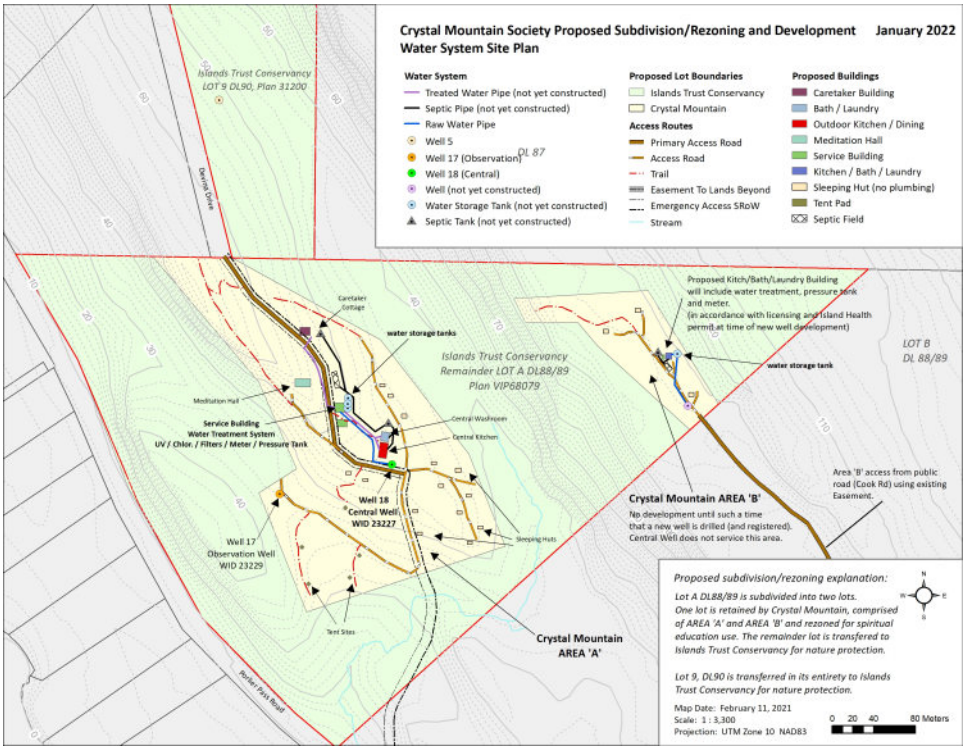


Figure 3 Proposed Land-use with Rezoning (larger version found in Appendix B)



2 Site Stormwater

Proposed development has been restricted to two areas of the property Area 1, which is approximately 5.1 hectares in size and Area 2, which is approximately 1 hectare in size. Both areas are forested and naturally vegetated, they are characterized by gentle to moderate slopes and well-drained soils over permeable fractured sandstone bedrock.

The primary disturbance in these areas is logging. They were logged at least twice. MacMillan Bloedel records suggest that Area 2 was cut for the first time in the late 1870's while Area 1 was cut in the early 1920's. More recently, both areas were clearcut between 1993 and 1996 (by the owner previous to Crystal Mountain). It appears that the cut area was not planted and is regenerating naturally with mixed vegetation. The clearcut was intensive and appears to have been completed with excavators and skidders resulting in significant impacts to the soils, especially in moist and seasonally flooded areas outside of the development areas. Dirt roads were constructed in association with the logging. Crystal Mountain has used and maintained these roads and has not constructed any additional routes.

Except for building footprints, no impervious surfaces are proposed. All roads and parking areas will remain unpaved. The total allowed building footprint is 842m² in Area '1' (1.6% of area) and 109m² in Area '2' (1% of area). New buildings will be situated within the natural forest with minimal clearing. Where clearing around buildings occurs, surfaces will be vegetated with grass and other landscaping vegetation. Gravel or mineral soil may be maintained within a 1.5m perimeter around buildings in compliance with Firesmart recommendations. A large, maintained grass clearing will be maintained around the Kitchen and Washhouse site in Area 1 to accommodate a solar PV system.

Crystal Mountain access routes utilize existing logging roads through well-drained areas where no significant surface flow has been observed, including during high intensity storm events such as those occurring in November 2021. The one exception is the portion of proposed emergency access road where it crosses the creek (see Figure 4). This portion is being transferred to the Islands Trust Conservancy for nature protection purposes. Prior to transfer, Crystal Mountain has agreed to complete minor road upgrades to bring it up to standard for emergency vehicles. This will include the creation of bioswales alongside the road, to capture surface water, slow its velocity to allow for absorption into soil, and in the case of high intensity storm events, discharge excess surface flow into the creek across rubble to prevent scouring.

Crystal Mountain has also committed to rehabilitating old logging roads that currently provide access to sleeping hut sites outside of the development area, slated for decommissioning. They will use the "rough and loose" method, restoring soil permeability, reducing surface runoff, and improving groundwater contribution (see Figure 4).

2.1 Description of Soils and Ecology.

Soils Overview

Soils in both the upper and lower sites have been generally classified as "Saturna" (Soils of the Gulf Islands of British Columbia Vol 3 Soils of Galiano, Valdes, Thetis, Kuper and lesser islands (1989); Report No. 43, BC Soil Survey. Agriculture Canada). Saturna soils are well drained and droughty during the summer. They have developed on shallow deposits of channery, sandy loam to channery, loamy sand textured, colluvial and glacial drift materials over sandstone bedrock within 100cm of the surface. Areas of the property are characterized by very shallow lithic Saturna soils often associated with bedrock exposures or very thin mineral soil layers less than 50 cm deep. Coarse fragment content varies between 20 and 50%.

2.1.1 Area '1'

Natural forest characterized by a regenerating Douglas-fir – salal (CDFmm/01) young stand. Arbutus, red alder, and bitter cherry remain in the stand (though will be shaded out over the next few decades). The ecosystem includes scattered larger diameter, dominant bigleaf maples, Douglas-firs and the odd western redcedar that were likely left as seed trees after the last logging. Areas towards the lower slope and proposed lot boundary include a higher density of grand fir and slightly moister and richer soils more representative of a CDFmm/04 ecosystem.

- Slope: 10-20%
- Aspect: 180-210°
- Structural Stage: YFc
- Mesoslope Position: Mid to upper slope
- Site Series: CDFmm/01
- Soil Nutrient Regime: M
- Soil Moisture Regime: 2-4
- Cover by Layer (%) Tree: 70 Shrub: 20 Herb: 7 Moss: 5

Soils: Silty loam over top of a silty clay loam with approximately 25 to 35% coarse fragment content. Some orange/red mottles observed between 30 and 40 cm deep. Coarse fragments increase towards the upper slope areas. Well drained. Moister richer areas are moderately well drained silty clay loam with 25% coarse fragments and moder humus form.

Disturbance History: Clearcut approximately in 1993 or 1994. Slash burn is indicated by scattered patches of charred material in soils and remaining coarse woody debris on site is charred. The site appears to have been left to naturally regenerate. Machine use on the site has disturbed the soils in general and has left scattered areas of higher disturbance where staging areas or access routes were located.

2.1.2 Area '2'

Natural forest characterized by Douglas-fir, western redcedar naturally regenerating young forest (CDFmm/01 – 90%, CDFmm/04 – 10%) approximately 25 years in age with scattered young 60 to 70 year old seed trees. There are a number of microsites of varying slope, aspect and mesoslope character ranging from moister micro depressions to dryer rock outcrops. Soils are generally well drained silty loams with moderate coarse fragment content and vary in depth between 30 centimeters to greater than 80 cm.

- Slope: Variable, generally 5%
- Aspect: Concave - southwest to northeast
- Structural Stage: PSc
- Mesoslope Position: Flat / Bench
- Site Series: CDFmm/01 (90%), CDFmm/04 (10%)
- Soil Nutrient Regime: M-R
- Soil Moisture Regime: 2-4
- Cover by Layer (%) Tree: 50 Shrub: 60 Herb: 10 Moss: 10

Soils: Silty loam with 25-50% coarse fragment content, well drained to moderately well drained. Soil depth varies from 30 to greater than 80cm.

Disturbance History: The area was logged 25 to 30 years ago leaving a variety of scattered young seed trees that may not have been worth removing at the time of logging. Area is regenerating naturally. Char marks on cwd and stumps indicates low intensity slash burn after logging.

Photo 1 Current meditation platform (to be replaced by ≤ 125 m² structure)



Photo 2 The view out from the meditation platform across the road



Photos 1 and 2 show the current meditation platform and related clearing. Photo 1 (left) is looking at the platform from the road, and Photo 2 (right) is looking out over the road from the platform. This structure is to be replaced with a 125m² (max) meditation hall.

Photo 3 Open air kitchen and landscape



Photo 3 shows the current open kitchen and surrounding cleared area. Access roads branch both to the left and to the right of the photo. Roads are permeable and landscaping is permeable.

Photo 4 Forested area leading to the kitchen - uphill from kitchen



Photo 4 shows the main access road running down from the end of Devina Road to the Kitchen site. A septic field will be constructed amongst the maple trees on the right. A hydro power line will run down the side of the road and water/electrical lines will be buried underneath. The landscape is rough, undulating, absorbent with no signs of scouring from overland flows of stormwater.

Photo 5 An existing meditation hut and the 'trail' located in Area '2'



Photo 6 Updated meditation hut design being considered for future construction



Photo 7 Emergency access road to be transferred to ITC



Photo 7 shows the portion of the emergency access road to be transferred to the Islands Trust Conservancy and brought up to standard. The creek flows under the road from right to left below the depression. A stepped bioswale will be constructed on the right side.

Photo 8 Access road from kitchen toward Devina Dr. (traveling north)

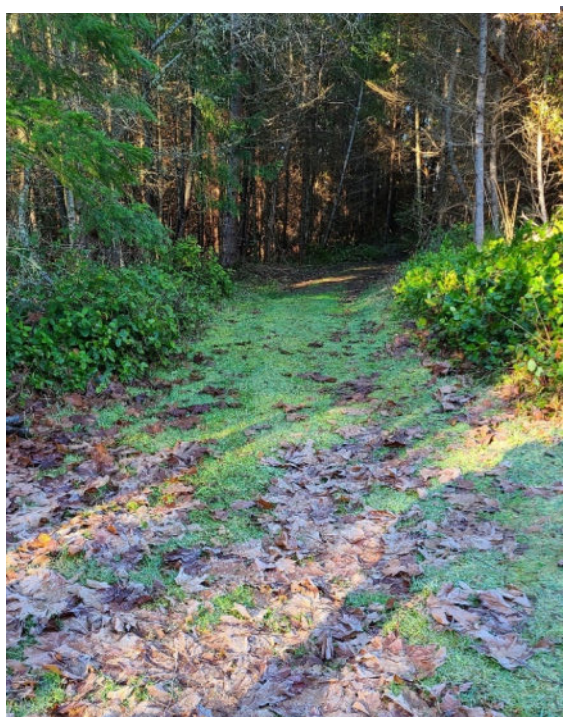


Photo 9 Access road from kitchen toward creek (traveling south)

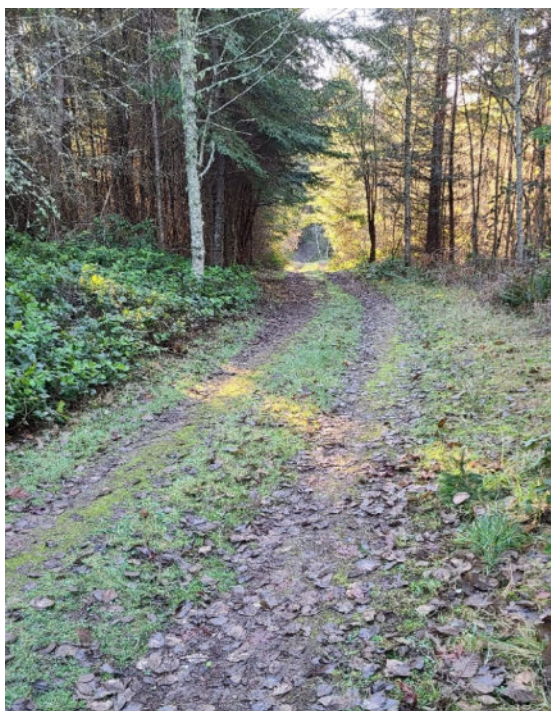
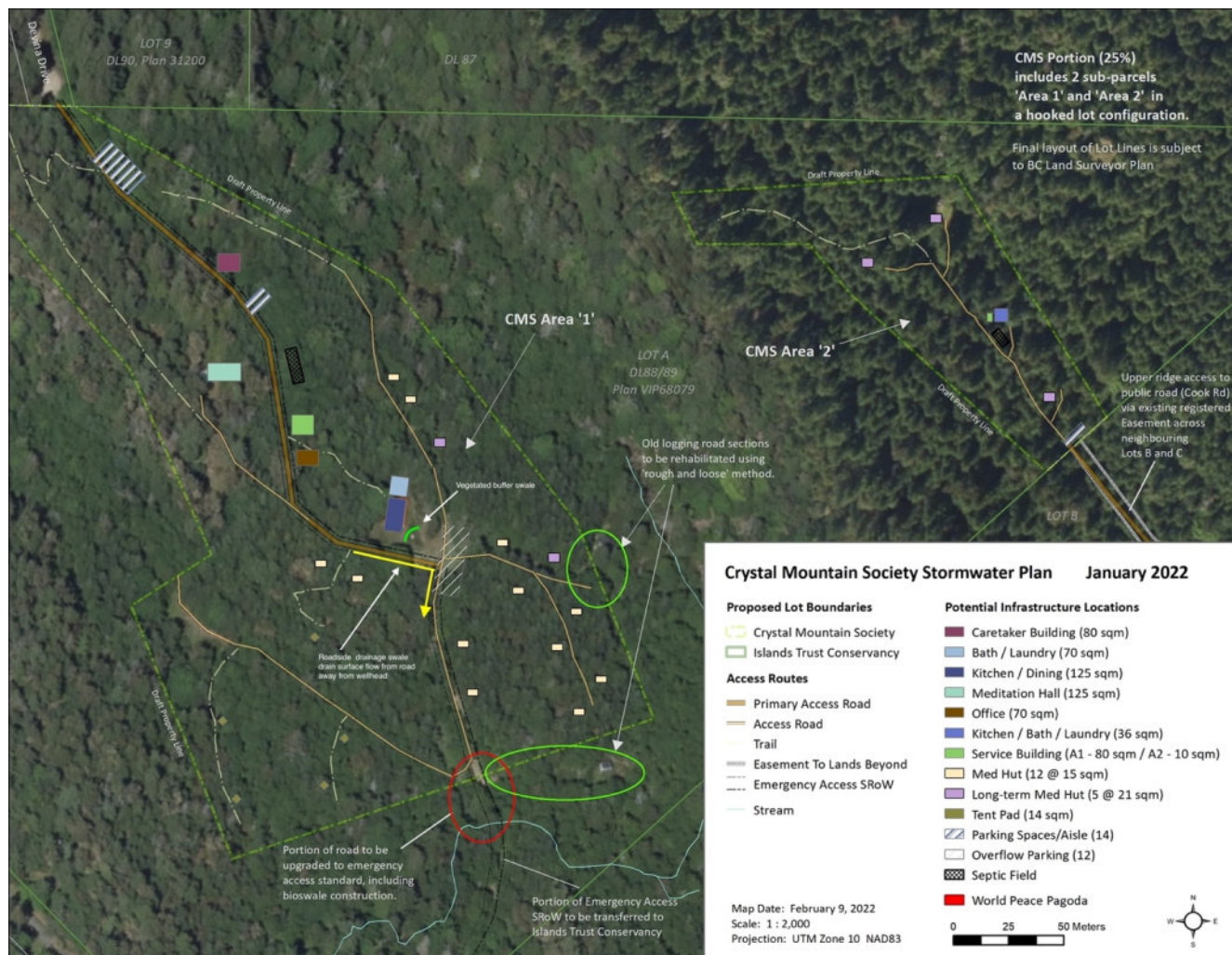


Photo 8 (left) shows the primary access road leaving the kitchen site up towards Devina Dr.
Photo 9 (right) shows the access road leaving the kitchen site down towards the creek.

Figure 4 Aerial map of vegetation, proposed development footprint, and stormwater management



2.2 Stormwater Management Summary

Summarizing the site characteristics, the proposed development will not be changing the soils or existing drainage noticeably from pre-development. The history shows exceptional ability to naturally absorb rainfalls even in the extremes experienced in 2021. The additional footprints of the buildings will be designed in accordance with the BC Building code with some potentially serviced by independent small rainwater capture for non-potable use and standard perimeter drainage (refer to Section 7). Roadways will continue to be permeable surfaces.

Modifications will be made that will further enhance absorption and provide wellhead protection.

- Two sections of logging roads will be rehabilitated to for conservation measures – with added benefit of increased absorption
- Vegetated swale across the north west of the Central Well in Area 1 between the well and the kitchen will act as a natural exclusion boundary to the Central Well and mitigate for overland surface flows
- Upgrade to a portion of the emergency access road prior to transfer to the Islands Trust Conservancy (the only area onsite that has shown impact from excess rain events) (Photo 7).
- All buildings subject to building permits will have perimeter drainage as per the BC Building code, with those within the 30 metre buffer zone of the Central Well to drain/infiltrate outside the buffer.

3 Groundwater

3.1 Summary

CMSEC has a comprehensive history documenting groundwater beginning with the initial groundwater assessment in 2015 that assessed sustainable yield, initial water demand assessments in 2021, and the initial ground water level monitoring January 2022. Alan Kohut the senior hydrologist of Hy-Geo Consulting has authored all the reports.

- Appendix C – Groundwater Assessment Report for Crystal Mountain Spiritual Education Centre, Galiano Island, A. Kohut (2015)
- Appendix D – Revised Estimated Water Supply Demand, A. Kohut (June 2021)
- Appendix E – Groundwater Level Monitoring, Crystal Mountain Spiritual Education Centre, Observation Well WID 23229 and Central Well WID 23227, Galiano Island, A. Kohut (January 2022)

Table 1 Well Summary Table

	Central Well WID 23227	Observation Well WID 23229	Observation Well Lot 9 WID23228/WTN56583
	<ul style="list-style-type: none"> • 6 inch (15.24 cm) dia. • 125 ft (38.10 m) depth • Est. flow 18.9 l/m (5 USgpm) • Tested flow 1.06 USgpm (4.035 L/m)² • Sustainable Yield 2.826 L/m (70% of 4.035 L/m) • Static level 68 ft (20.73 m) btoc at drilling; 8.96 m Jan. 2022 • Surface Casing extends 28 ft (8.5m) 	<ul style="list-style-type: none"> • 6 inch (15.24 cm) dia. • 183 ft (55.78 m) depth • Est. flow 26.5 l/m (7 USgpm) • Static level 68 ft (20.73 m) btoc at time of drilling; 14.77 m Jan. 2022 • Surface Casing extends 28 ft (8.5m) 	<ul style="list-style-type: none"> • 6 inch (15.24 cm) dia. • 280 ft (85.34 m) depth • Est. flow 22.7 l/m (6 USgpm) • Static level 55 ft (16.76 m) btoc
Well Use Status	ACTIVE USE	NOT IN USE To be maintained as a Observation well.	NOT IN USE
Sustainable yield¹	2.826 L/m 4069 L/d	Not evaluated	Not evaluated
Observations from pump test	See Appendix C – report summarizes pump test results and sustainable yield calculation	No effects observed during pumping test. Appendix C has graphical record of pump test	No effects observed during pumping test. Appendix C has graphical record of pump test
Ownership after rezoning	CMSEC	CMSEC	Islands Trust Conservancy
Water Quality 2015	<ul style="list-style-type: none"> • Meets GCDWQ on chemistry • Exceedance on presence of Total Coliforms • GARP Status – due to presence of coliforms, depth shallower than 160 ft • Two forms of disinfection required 	Not Tested	Not Tested

1 – Longterm yield is determined by providing an artificial stress and determining the longterm drawdown rate to safe margins to the water-producing aquifer over a simulated 100 days of pumping. Once this rate is determined then the yield is multiplied by 70% provide a security margin

2 – Testing was performed during the seasonal lowest groundwater availability (mid October)) before fall recharge.

3.2 Sustainable Yield

- 2,826 L/m
- 4069 L/d
- 28,483 L/w
- 1.49 mil. L/y

See Groundwater Assessment Report for Crystal Mountain Spiritual Education Centre, Galiano Island, A. Kohut (2015) (Appendix C)

3.3 Water Quality

Water testing originally performed in 2015 was assessed to the 2015 Guidelines for the Canadian Drinking Water Quality (GCDWQ). Those result have been reassessed to the GCDWQ (2020). Physical and chemical parameters meet and exceed the GCDWQ. Presence of coliforms after disinfection of the well were found in 2015 suggesting influence from surface sources. Subsequent testing that is performed regularly for Island Health has shown a consistent absence of coliforms.

This said, the water system will be designed as GARP (Groundwater At Risk of Pathogens) status due to the historical influence and the location of the well within the contoured landscape and proximity to buildings.

See Groundwater Assessment Report for Crystal Mountain Spiritual Education Centre, Galiano Island, A. Kohut (2015) (Appendix C)

3.4 Wellhead Protection

Upon rezoning, CMSEC will maintain ownership of two wells, the Central Well (WID 23227) for active use, and the Observation Well (WID 23229) for periodic observation.

Maps of the wellhead setbacks and surface water flows in relation the wellheads are found in Figure 5 and Figure 6

3.4.1 Central Well

The central well sits at 45 m elevation with downward gradients radiating away to the east, south and west. North of the well, surface water flows are more prominently directed east and west, except along the crest which is heavily vegetated and buffers surface water flows from the North and Northwest.

Activity within the 30 m setback exists (see wellhead potential source contaminants Table 2). These activities include a road access that passes through, two buildings, overflow parking with vegetated surface that is used 1-2 times a year, and foot trail.

The access road will require a ditch or swale to mitigate and divert surface flows to the east and west at regular intervals to avoid surface flows that could migrate toward the wellhead protection area (30 m setback from the wellhead).

The buildings within the 30 meter buffer will have perimeter drainage extend out beyond the buffer zone to infiltrate down gradient of the wellhead.

A small vegetated buffer will be placed between the wellhead and the central kitchen.

A greywater infiltration system currently servicing a sink in the nearby open 'kitchen' building is located just outside of the 30m buffer. The greywater infiltration system will be decommissioned and removed upon completion of the wastewater system as per Section 6 of this report.

3.4.2 Observation Well

The observation well is set far away from onsite activities. There are no apparent risks to water supply due to land slope, remote location, and locked well cap.

Figure 5 Well Head Protection Map

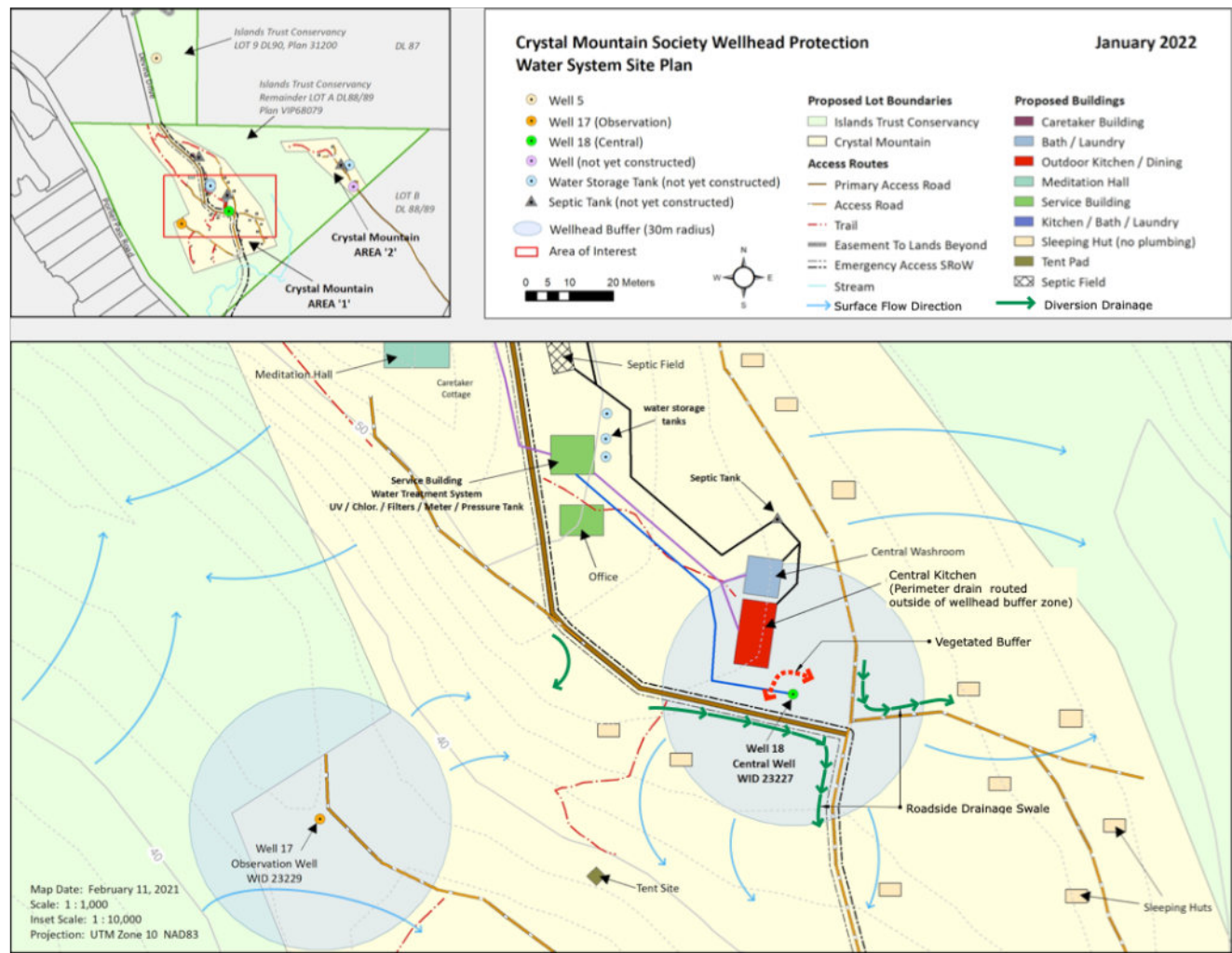
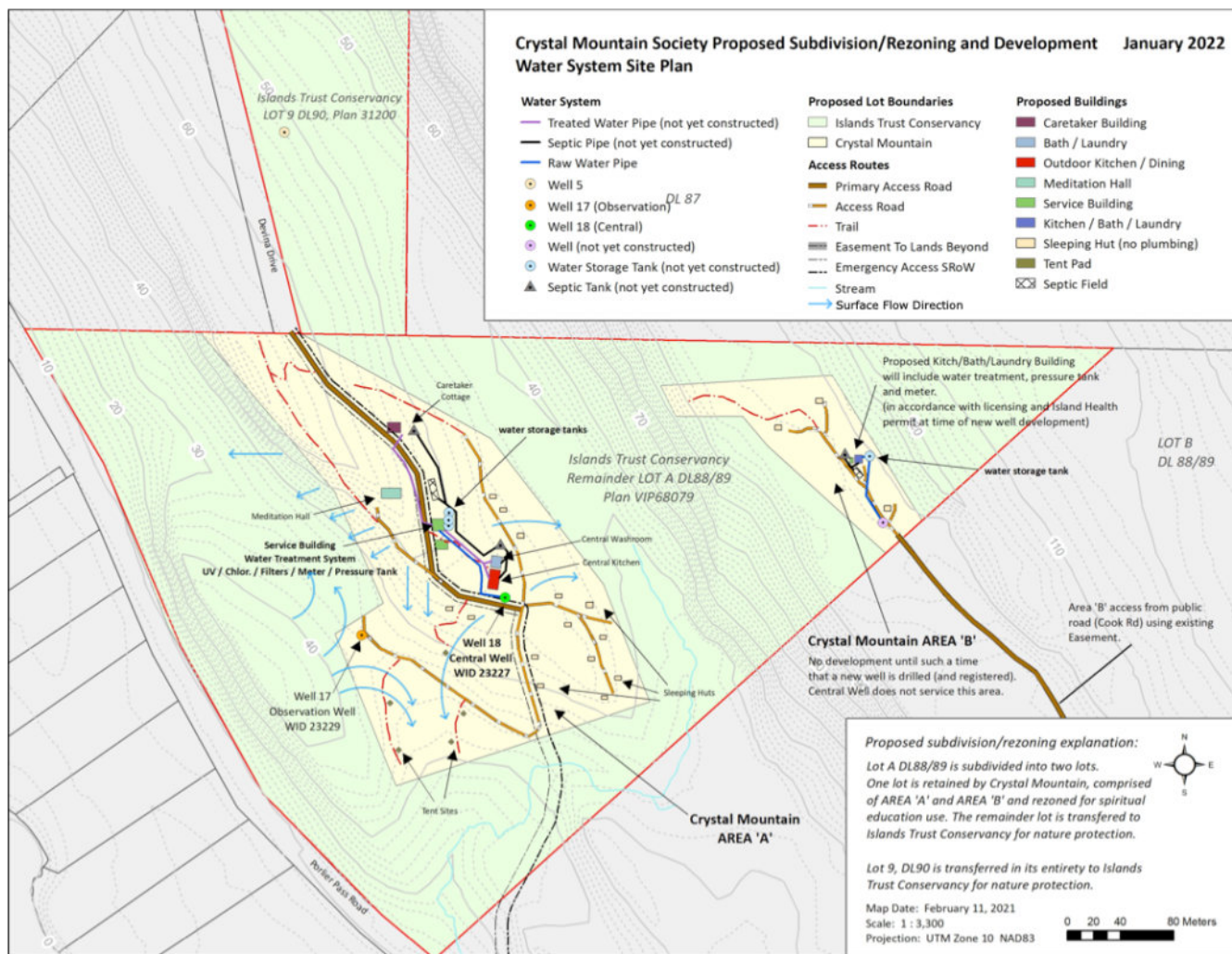


Figure 6 Surface Water Flows in Relation to Wellheads



3.4.3 Groundwater Monitoring

Initial ground water monitoring began in September 2021 for the Observation Well (WID 23229) and October 2021 for the Central Well (WID 23227). The groundwater monitoring report is found in Appendix E.

Observation Well – Static water level 14.77 m below surface.

The water level in the Observation Well was static through September and then gradually rose 3.7 m through to late December. Rainfall events did not cause correlational spikes in levels meaning that waters recharge in a slower gradual fashion tied to cumulative precipitation. This demonstrates that the water infiltration is slower and has more opportunity for filtration potential from the delayed recharge (less potential for short circuiting via cracks and fissures).

Central Well – Static water level 8.96 m below surface

The Central well demonstrated a similar long-term trend rather than rapid responses to rainfall events. Minor fluctuations of 4cm – 8 cm were found and not correlated to tidal fluctuations. The gradual recharge is beneficial for the filtration potential of the well water quality and reduced risks from short circuit recharge via cracks and fissures.

3.4.4 Wellhead Information and contacts

Table 2 Well potential source contaminants

Crystal Mountain Society 20300 Porlier Pass Rd Galiano Island, BC, V0N 1P0 Representative: Keith Erickson			
Health Authority Contact:		Environmental Health Officer 3rd Floor, 6475 Metral Dr Nanaimo, B.C. V9T 2L9 250-755-6215 Fax: 250-755-3372 Email: HPES.Nanaimo@islandhealth.ca	
Water License #		Being processed (refer to Appendix K for application)	
Well ID #23227 (Central Well – active use) WTN# 118140		<ul style="list-style-type: none"> • 6 inch (15.24 cm) dia. • 125 ft (38.10 m) depth • Sustainable Yield 2.826 L/m (70% of 4.035 L/m) • Static level 68 ft (20.73 m) btoc • Surface Casing extends 28 ft (8.5m) 	
Well ID #23229 (Observation Well – not in use) WTN# 118139		<ul style="list-style-type: none"> • 6 inch (15.24 cm) dia. • 183 ft (55.78 m) depth • Est. flow 26.5 l/m (7 USgpm) • Static level 68 ft (20.73 m) btoc • Surface Casing extends 28 ft (8.5m) 	
Potential Source Contamination	Type of Contaminant	Likelihood	Mitigation
Pets and feces	Bacterial	Likely	<ul style="list-style-type: none"> • On Leash policy; dedicated signage restricting pets from well setback area
Sewer line leak	Bacterial, viral	Unlikely though possible	<ul style="list-style-type: none"> • Monthly microbiological monitoring (part of Island Health operating permit)
Road	Chemical (hydrocarbon)	Likely	<ul style="list-style-type: none"> • Swale, ditch or curtain drain to the north of the well head setback area, draining east/west to shunt surface flows downslope and away • Where road is within 30 radius, install swale/ditch along road and drain to the southwest
Overland surface flows	Various	likely	<ul style="list-style-type: none"> • Swale, ditch or curtain drain to the north of the well head setback area, draining east/west to shunt surface flows downslope and away
Waste water infiltration	Bacterial, viral, chemical	unlikely	<ul style="list-style-type: none"> • All wastewater infiltration to meet horizontal separation as per SSR SPM Table III-19; • Historical greywater infiltration to be removed and remediated; • Monthly microbiological monitoring (part of Island Health operating permit)
Access to well head	Various	Potential	<ul style="list-style-type: none"> • Fenced perimeter around well head at 3 m radius • Locked well cap • Signage • Disinfection procedure upon accessing well equipment (data logging, pump, piping)
Overflow Parking (1 to 2 uses per year)	Hydrocarbon	potential	<ul style="list-style-type: none"> • Maintained grassy vegetated surface • Develop spill response protocol for visual leaks (dig out soil, remove to outside buffer, fertilize, cover, wait 1 year)

4 Water Demands & Balance

4.1 Overview

The water balance includes evaluating the site's potable and non-potable needs, sustainable withdrawal from the well, contribution of rainwater, and storage for all uses, in a manner that protects the aquifer. This section is a summary of the hydrological assessment by Al Kohut (2015), and water demand assessment by G. Baird (April 2022).

The CMSEC lands will eventually have two areas (Area 1 and Area 2). Area 1 is the prime focus of this water balance; Area 2 will undergo a more complete water balance assessment at the time of development where an updated water management plan is informed by the future new well's sustainable yield.

Summary of water supply and demand:

Fire Storage	Not required as per Chief Harris correspondence (Appendix G)
Sustainable yield	Area1: <ul style="list-style-type: none"> • 2.826 L/m • 4069 L/d • 28,483 L/w • 1.49 mill. L/y Area 2 – To be determined upon future well installation –in accordance with the Section 219 covenant (demonstrate proof of water and amended water management plan).
Max. Daily Demand (MDD)	Area 1 Potable Water – 2810.6 L/d at peak daily demand Area 1 Non-potable Water – 1241.0 L/d Area 2 Potable Water – 407.4 L/d at peak daily demand Area 2 Non-potable Water – 240 L/d
Potable Demand	Potable water is to be met using groundwater
Non-Potable Demand	Non-potable to be served primarily by rainwater harvesting, with supplemental water provided by groundwater
Trickle top up flow rate (l/m)	Area 1 – ≤2.83 L/m Area 2 –to be determined (well not installed)
Storage volume	Well Supplied Storage (potable water storage): Area 1 – 45,780 L (10,000 IG; 12,000 USG) Area 2 – 4970 L (1100 IG; 1300 USG) Rainwater Supplied Storage (Non-potable water systems): Caretaker Residence ≥6825 L Central Kitchen and Washroom system 91 m ³

4.2 Fire Storage

The Crystal Mountain property is within the service area for firefighting from the Manastee Road water supply and does not need an independent water supply for fire purposes. This is from written correspondence from Chief Harris, dated December 21, 2021. A copy of the correspondence is found in Appendix G.

Fire storage does not factor into water balance evaluation as it is not required.

4.3 Water Demand

This water management plan references a new water needs assessment (APPENDIX L), providing updated maximum daily demand (MDD), daily demand (DD), and recommended minimum storages. This new assessment stems from a new water balance mix that incorporates rainwater harvesting to supply non-potable water demands for toilet flushing and laundry.

The assessment is based on the fixture flow rate/volume per use, category of user, and daily fixture use per person. Additionally, this assessment was checked against the Province of BC Sewerage Systems Regulation (SSR V3) Non-residential Average Daily Flow Rate Guide (Table III.11), for the categories of “Cabin Resort”, “Resident Staff” and “Non-residential conference guest or day camp, including meals”.

Table 3 Daily usage profile per user

Fixture	Caretaker Usage Pattern (L/day)	Overnight Guest Usage Pattern (L/day)	Day Visitor Usage Pattern (L/day)
Toilet ¹	30.0	30.0	12.0
Laundry ²	25.0	25.0	12.5
Shower ³	32.0	64.0	0
Lavatory Sink ⁴	25.0	25.0	10.0
Kitchen Sink ⁵	40.0	40.0	20.0
Dishwashing ⁶	2.8	2.8	2.8
Drinking Water	4.0	4.0	4.0
Usage per day			
Potable	103.8	135.8	36.8
Non-Potable	55.0	55.0	24.5
TOTAL COMBINED	158.8	190.8	61.3
BC SSR Table III.11 Comparison of DDF	170.0 ⁷	225.0 ⁸	60 ⁹

In comparing the detailed daily usage profile for type of user against the Provincial SSR there is very high confidence in our assessment. The values are within a reasonable range, with a slightly lower usage by

¹ Toilet based on 6 L/flush and 5 flushes/day for caretakers and overnight guest, and 2 flushes for day visitor

² Laundry based on 50 L/load with 1 load per caretaker every 2 days, 1/2 load per overnight guest per day, and ¼ load/day-visitor/day

³ Shower based on 8 L/m flow, at 8 minute shower with 1 shower every 2 day for caretakers, 1 per day for overnight guests, and no showers for day-visitors

⁴ Lavatory sinks based on low flow 2.5 L/m faucets at 2 minutes/use for each toilet use

⁵ Kitchen Sink based on 8 L/m at 5 minutes per person per day across caretakers and overnight guests, and 2.5 minutes for day-visitors

⁶ Dishwashing based on 14 L/load with 0.2 of a load/person/day across all categories

⁷ Caretaker was assessed as Resident Staff in the SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

⁸ Overnight Guest was assessed in comparison to Cabin Resort guest in SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

⁹ Day-Visitor was assessed in comparison to Non-Residential Conference Guest or Day-camp, including meals in SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

The months tied to the usage activity are noted in Table 5 *Monthly usage profile - weighted daily demand for user groups for potable and non-potable usage (litres)*.

From this the daily demand is determined for each user category, across each type of water use (potable and non-potable). These DD values are then incorporated in the water balance models for the proposed rainwater/non-potable systems discussed in Section 4.4 of this document.

Table 5 Monthly usage profile - weighted daily demand for user groups for potable and non-potable usage (litres)

Monthly Usage Profile %				WEIGHTED Daily Usage Profile (blue potable, grey non-potable)						
	Caretaker	Overnight	Day Visitor	Caretaker	Overnight	Day Visitor	Caretaker	Overnight	Day Visitor	
January	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	January
February	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	February
March	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6	March
April	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6	April
May	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	May
June	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	June
July	100%	100%	100%	207.6	2308.6	294.4	110	935.0	196	July
August	100%	100%	100%	207.6	2308.6	294.4	110	935.0	196	August
September	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	September
October	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2	October
November	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6	November
December	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6	December

4.4 Rainwater/Non-Potable Water

Crystal Mountain Spiritual Education Centre (CMSEC) intends to use rainwater collection to service the non-potable water (NPW) demands for toilet flushing and laundry. Two Rainwater/NPW water balance assessments are presented below, for the caretaker residence and, for the combined central kitchen/laundry/washroom facilities. Area 2 will be committed to the same principle of using rainwater for non-potable uses but until such a time that development occurs and well data is collected a water balance cannot be performed.

The water balance model is based on daily data, including daily average precipitation, daily usage, and changing daily cistern volumes. This daily data is found in APPENDIX M, but for ease of presentation the following models are shown in a weekly format (summarized data that informs these models is found in *Table 6 Weekly Water Data Table* below).

Water Balance Model Premises:

- The well has a sustainable yield of 2.826 L/m (4069 L/d)
- The well serves all potable water needs
- The rainwater system for the caretaker residence services the non-potable water needs for the caretaker residence
- The rainwater collected from the Central Kitchen and Central Washroom is combined into a consolidated system to serve the non-potable needs of laundry and toilet flushing demands housed within the two buildings
- In event of a shortfall of stored rainwater to serve the non-potable needs of the building (being served), the well would provide supplemental water to cover the non-potable demands.
- The objective is to ensure that at no time under any peak maximum combined daily demand of potable and non-potable waters exceed the daily sustainable yield of the well.

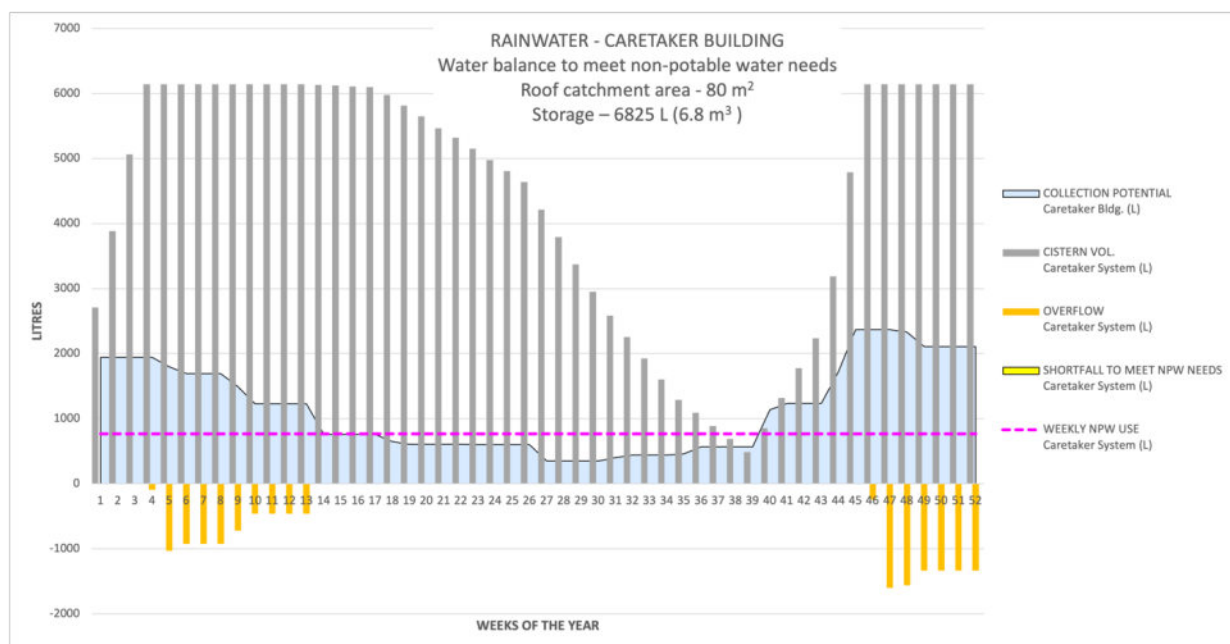
4.4.1 Rainwater System – Caretaker

- Number of caretakers 2
- Daily NPW demand per caretaker 55 L/d
- Total NPW 110 L/d
- Caretaker roof area $\geq 80 \text{ m}^2$ collection area
- Storage size 6825 L

Result

Based on a NPW demand, precipitation and collection area, a storage cistern of $\geq 6825 \text{ L}$ (1500 Imperial Gallons) would serve 100% of the yearly usage. No supplemental potable water is required to top up the caretaker NPW system.

Graph 1 Caretaker Building – Rainwater water balance



4.4.2 Rainwater System – Central Facilities

The Central Kitchen and Central Washrooms are adjacent buildings which together provide a convenient combined collection surface of 231 m^2 . This water is stored for the NPW uses of laundry and toilet flushing within these central facilities.

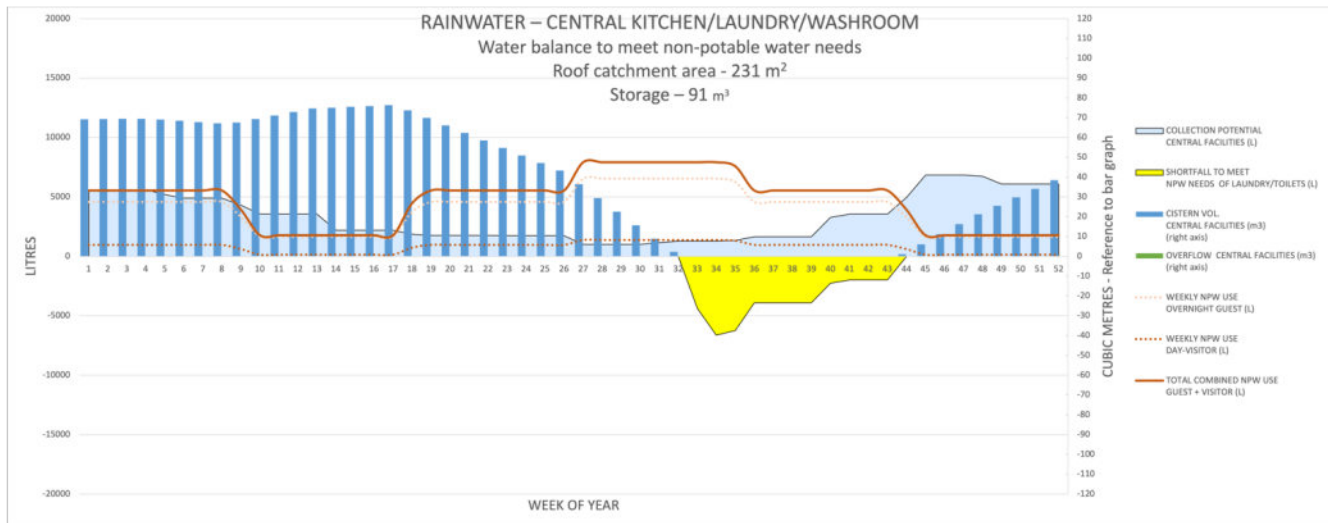
This portion of the facility experiences the largest seasonal fluctuations in demand – refer to *Table 5* for the daily water demand as determined by weighted monthly usage (as a % of peak MDD). The intent is to collect and store rainwater through the wetter months for use in the drier months with relying on the well for supplemental water as little as possible.

- Collection Area 231 m^2
- Storage size 91 m^3

The water balance for the central facilities demonstrates a shortfall of rainwater to meet the NPW demand across several weeks (

Graph 2). All of this shortfall is able to be supplemented within the sustainable well yield (Section 4.4.3 - sustainable well yield).

Graph 2 Central Kitchen/Laundry/Washroom - Rainwater water balance



In the graph above the bar graphs denoting cistern volume and overflow are in cubic metres, while precipitation and water use volumes are expressed in litres.

4.4.3 Sustainable Well Yield

Sustainable Well Yield at 2.826 L/m:

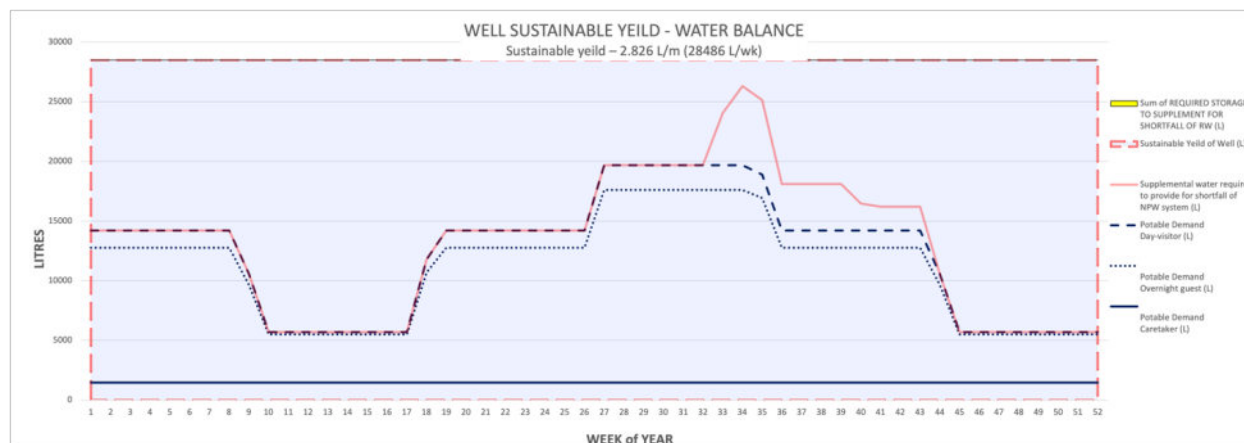
- Daily 4069 L/d
- Weekly 28,486 L/w

The water system as described in the Water Management Plan (section 4.6.2) is designed to limit pumping capacity to a flow rate not exceeding 2.826 L/m. This ensures that the well is not pumped at a rate beyond its sustainable yield. The sustainable yield must be balanced across time to ensure that the demands placed upon it do not result in a lack of water for the operations of the CMSEC.

The draws upon the well include:

- Potable demands for the caretakers
- Potable demands for the overnight guests
- Potable demands for the day visitors
- Supplemental make-up water for any rainwater system that has a shortfall.

The well is able to meet all the potable demands at the peak usage of the CMSEC, and is also able to meet all of the supplemental make-up water for the central facilities rainwater system. At no point is there any set of demands that cannot be readily served by the well's sustainable yield)

Graph 3 Well sustainable yield and water demands

In the graph above all of the supplemental make-up water is able to be supplied within the sustainable yield (within the Sustainable Yield dashed line). No section of the graph is in yellow (which would extend above the sustainable yield dashed line, and would represent the volume that would be required in excess of the sustainable yield).

4.5 Water Demand Assessment Summary

The caretaker building can easily collect and store rainwater to meet the annual non-potable water demands of the caretakers, with a roof size of 80 m² and a storage system of at least 6825 L.

The central kitchen and washroom facilities with a combined collection area of 231 m², with a storage size of 91 m³, can meet a large portion of the non-potable water demands of the toilets and laundry located in these buildings, though during the peak season under maximum demand there would be a shortfall of stored rainwater therefore requiring a draw of well water to supplement this need. All of this supplemented water can be met within the well's sustainable yield. At no time during any period during the year would the MDD demands ever surpass the sustainable yield of the well.

Discussion on the Upper Ridge Retreat "Area 2" is based on the predicted future needs, but it should be clearly stated that at time of development, a revised water management plan will be submitted (as required per the Section 219 covenant) to fully include updated considerations and proof of water. That noted at this time the MDD for Area 2 would be 407.4 L/d for potable water and 165 L/d for non-potable water. Upon development of a new well a hydrological assessment will inform sustainable yield and withdrawal rate.

A schematic representation of the storage systems can be found in APPENDIX N.

Table 6 Weekly Water Data Table

	WEEKLY YIELD	WEEKLY POTABLE CARETAKER	WEEKLY POTABLE GUEST	WEEKLY NON- POTABLE CARETAKER	WEEKLY NON- POTABLE GUEST	WEEKLY TOTAL COMBINED POTABLE	WEEKLY TOTAL COMBINED NON- POTABLE	WEEKLY GUEST + VISITOR	WEEKLY PRECIP.	REQUIRED STORAGE FOR SHORTFALL OF RW (L)	COLLECTION POTENTIAL BIDG (L)	CARETAKER VOL. (L)	CARETAKER CISTERN VOL. (L)	CARETAKER OVERFLOW (L)	SHORTFALL CARETAKER RAW NEEDS (L)	POT. WATER SUPPLEMENT 2 (L)	COLLECTION POTENTIAL BIDG (L)	LAUND/KIT INITIAL VOL. (L)	LAUND/KIT CISTERN VOL. (L)	LAUND/KIT OVERFLOW (L)	SHORTFALL LAUND/KIT RAW NEEDS (L)	LAUND/KIT POT. WATER SUPPLEMENT (L)
1	28486	1453	11312	1443	770	4582	960	14208	6312	5542	0	1946	1536	2711	0	0	5618	69160	69336	0	0	0
2	28486	1453	11312	1443	770	4582	960	14208	6312	5542	0	1946	2711	3887	0	0	5618	69160	69312	0	0	0
3	28486	1453	11312	1443	770	4582	960	14208	6312	5542	0	1946	3887	5062	0	0	5618	69312	69387	0	0	0
4	28486	1453	11312	1443	770	4582	960	14208	6312	5542	0	1946	5062	6243	-95	0	5618	69387	69463	0	0	0
5	28486	1453	11312	1443	770	4582	960	14208	6312	5542	26	1801	6143	6143	-1031	0	5200	69421	69121	0	5200	0
6	28486	1453	11312	1443	770	4582	960	14208	6312	5542	25	1692	6143	6143	-922	0	4887	69121	68466	0	0	0
7	28486	1453	11312	1443	770	4582	960	14208	6312	5542	25	1692	6143	6143	-922	0	4887	68466	67811	0	0	0
8	28486	1453	11312	1443	770	4582	960	14208	6312	5542	25	1692	6143	6143	-922	0	4887	67811	67156	0	0	0
9	28486	1453	11312	1443	770	4582	960	14208	6312	5542	22	1428	6143	6143	-723	0	4312	67156	67491	0	0	0
10	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1228	6143	6143	-458	0	3546	67491	67914	0	0	0
11	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1228	6143	6143	-458	0	3546	67914	71087	0	0	0
12	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1228	6143	6143	-458	0	3546	71087	72860	0	0	0
13	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1228	6143	6143	-458	0	3546	72860	74633	0	0	0
14	28486	1453	11312	1443	770	4582	960	14208	6312	5542	11	759	6143	6131	0	0	2192	74633	75051	0	0	0
15	28486	1453	11312	1443	770	4582	960	14208	6312	5542	11	759	6143	6131	0	0	2192	75051	75469	0	0	0
16	28486	1453	11312	1443	770	4582	960	14208	6312	5542	11	759	6143	6131	0	0	2192	75469	75887	0	0	0
17	28486	1453	11312	1443	770	4582	960	14208	6312	5542	11	759	6143	6131	0	0	2192	75887	76305	0	0	0
18	28486	1453	11312	1443	770	4582	960	14208	6312	5542	10	606	5978	5814	0	0	1876	76305	77176	0	0	0
19	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	606	5978	5814	0	0	1876	77176	77923	0	0	0
20	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	606	5978	5814	0	0	1876	77923	78670	0	0	0
21	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	606	5978	5814	0	0	1876	78670	79417	0	0	0
22	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	606	5978	5814	0	0	1876	79417	80164	0	0	0
23	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	599	5320	5149	0	0	1730	80164	80911	0	0	0
24	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	599	5320	5149	0	0	1730	80911	81658	0	0	0
25	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	599	5320	5149	0	0	1730	81658	82405	0	0	0
26	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	599	4878	4807	0	0	1730	82405	83152	0	0	0
27	28486	1453	11312	1443	770	4582	960	14208	6312	5542	9	599	4878	4807	0	0	1730	83152	83899	0	0	0
28	28486	1453	11312	1443	770	4582	960	14208	6312	5542	5	349	4215	3794	0	0	1007	83899	84646	0	0	0
29	28486	1453	11312	1443	770	4582	960	14208	6312	5542	5	349	4215	3794	0	0	1007	84646	85393	0	0	0
30	28486	1453	11312	1443	770	4582	960	14208	6312	5542	5	349	4215	3794	0	0	1007	85393	86140	0	0	0
31	28486	1453	11312	1443	770	4582	960	14208	6312	5542	6	402	2951	2583	0	0	1163	86140	86887	0	0	0
32	28486	1453	11312	1443	770	4582	960	14208	6312	5542	7	443	2356	1808	0	0	1278	86887	87634	0	0	0
33	28486	1453	11312	1443	770	4582	960	14208	6312	5542	7	443	2356	1808	0	0	1278	87634	88381	0	0	0
34	28486	1453	11312	1443	770	4582	960	14208	6312	5542	7	443	2356	1808	0	0	1278	88381	89128	0	0	0
35	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	89128	89875	0	0	0
36	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	89875	90622	0	0	0
37	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	90622	91369	0	0	0
38	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	91369	92116	0	0	0
39	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	92116	92863	0	0	0
40	28486	1453	11312	1443	770	4582	960	14208	6312	5542	8	461	1601	1292	0	0	1330	92863	93610	0	0	0
41	28486	1453	11312	1443	770	4582	960	14208	6312	5542	17	1137	488	854	0	0	3283	93610	94357	0	0	0
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43	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1231	1316	1777	0	0	3556	95104	95851	0	0	0
44	28486	1453	11312	1443	770	4582	960	14208	6312	5542	18	1231	1316	1777	0	0	3556	95851	96598	0	0	0
45	28486	1453	11312	1443	770	4582	960	14208	6312	5542	25	1719	2339	3188	0	0	4963	96598	97345	0	0	0
46	28486	1453	11312	1443	770	4582	960	14208	6312	5542	35	2369	3188	4787	0	0	6840	97345	98092	0	0	0
47	28486	1453	11312	1443	770	4582	960	14208	6312	5542	35	2369	3188	4787	0	0	6840	98092	98839	0	0	0
48	28486	1453	11312	1443	770	4582	960	14208	6312	5542	35	2369	3188	4787	0	0	6840	98839	99586	0	0	0
49	28486	1453	11312	1443	770	4582	960	14208	6312	5542	34	2331	6143	6143	-1561	0	6731	99586	100333	0	0	0
50	28486	1453	11312	1443	770	4582	960	14208	6312	5542	31	2106	6143	6143	-1336	0	6082	100333	101080	0	0	0
51	28486	1453	11312	1443	770	4582	960	14208	6312	5542	31	2106	6143	6143	-1336	0	6082	101080	101827	0	0	0
52	28486	1453	11312	1443	770	4582	960	14208	6312	5542	31	2106	6143	6143	-1336	0	6082	101827	102574	0	0	0
Total Vtd.											0	0	0	0	0	0	0	0	0	0	0	

4.6 Storage – Area 1

Usage patterns will fluctuate throughout the year and throughout the week with the MDD for Area 1 most likely occurring Friday through Monday. Storage is planned to provide for two weeks supply at the MDD, plus an additional buffer capacity reserved to provide supplemental make-up water to the Rainwater/NPW systems. Well water will be pumped at a constant flow rate limited to 2.8 L/m, to an HDPE above ground tank array. Weekly recording of pumped water volume (well totalizing meter) will be evaluated against the expected modeled demand and the safe (sustainable) weekly yield allowance. The storage also acts as the chlorination contact system, sized to ensure the treatment outcomes for chlorine CT (min•mg/L) are achieved.

4.6.1 Water Systems Storage

Please refer to APPENDIX N for a schematic of the water storage arrays.

4.6.1.1 Potable Water:

- 3 tanks – Premier Plastic 3330 IG HDPE NSF 61 dedicated for 2 weeks buffer capacity
- Total volume is 45,415 L (9990 IG, 12,000 USG)

4.6.1.2 Caretaker Residence Rainwater/NPW system:

- 1 tank – Premier Plastics VW 1660, HDPE NSF 61
- Required volume is 6825 L (1500 IG) – volume of tank specified 7550 L (1660 IG)

4.6.1.3 Central Facilities Rainwater/NPW system

- 5 tanks – Premiere Plastics VW 4160, NSF 61 – dedicated for rainwater storage for laundry/toilet
- Required volume is 91,000 L (20,000 IG) – total volume with tanks specified 94,640 L (20,821 IG)

4.6.2 Managing groundwater withdrawal

- Sustainable yield is 4069 L/d
- Suggested trickle flow rate 2.8 L/m

The method to manage the trickle feed and the well pump cycling rely on both system design and monitoring program.

System Design – storage level control and flow control (see Figure 7 Storage level controls)

Flow Control Valve:

- adjustable to 2.8 L/m
- ensures withdrawal rate does not exceed the rate of sustainable withdrawal

Automated Actuator Valve:

- Controls the well supply feed to the storage system, when valve is off, well pump sees no demand and shuts off.
- Open/close functions are based on float levels in storage

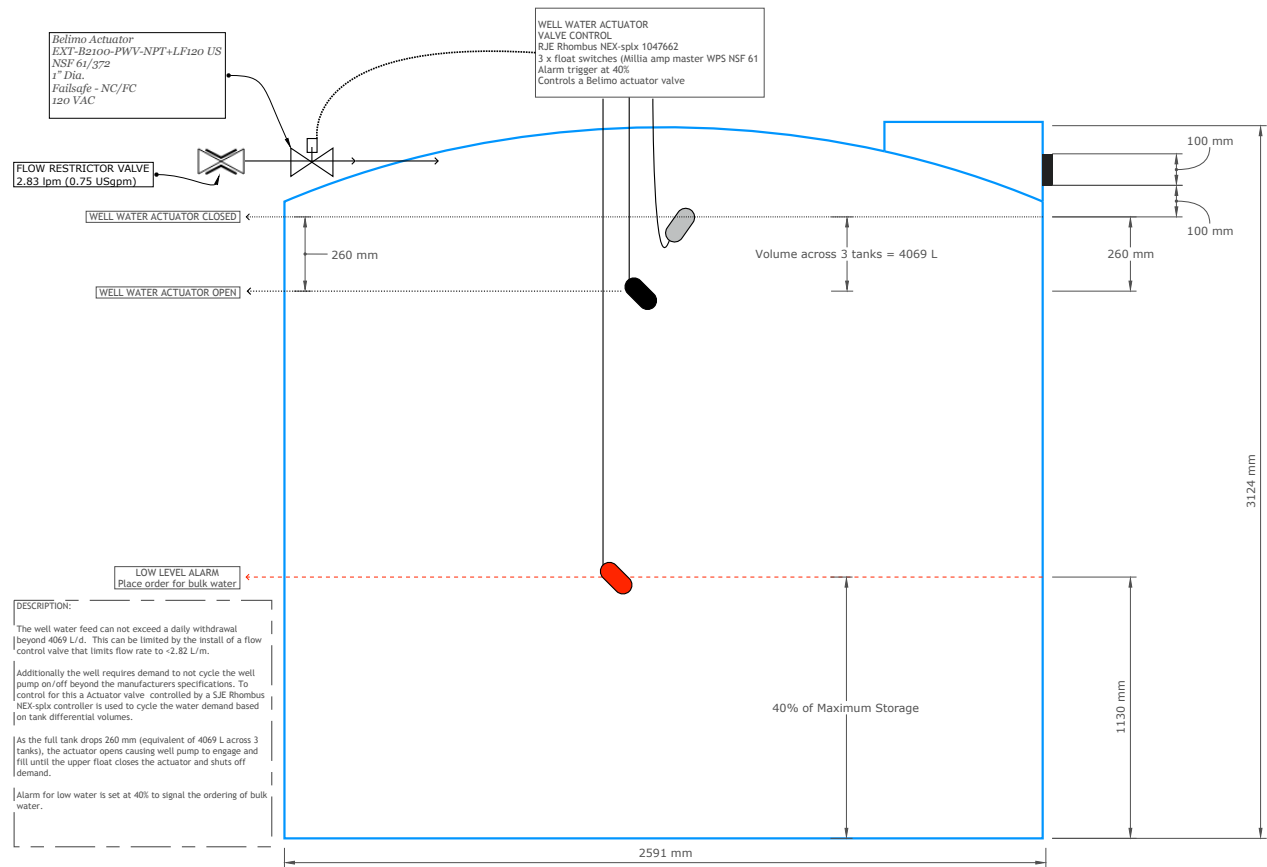
Float Controller:

- SJE Rhombus NEX-splx allows water levels to drop a set volume before engaging the actuator, and to fill a set volume before closing the actuator
- A low-level float is set at the height determined to be an alarm for low water levels and used to inform when bulk water delivery should be sought
- The 'ON' condition would be engaged when water levels drop 260 mm (the equivalent to 4069 L when measured across 3 tanks).

Flow Monitoring – storage level and flow control for potable water storage buffer tanks

Weekly recording of the well's totalizing meter provide a management control to check actual flows against (1) safe allowable weekly yield of 4069 L, and (2) predicted peak weekly demand, and (3) to record the well water withdrawal for Provincial reporting. Weekly withdrawal is not expected to exceed 18,312 L (modelled usage); if weekly withdrawal exceeds 28,483 L (a volume beyond the safe weekly sustainable yield) it is indicative of equipment failure (flow restrictor valve) and allows timely response.

Figure 7 Storage level controls – potable water storage buffer tanks



5 Potable Water Safety Plan – Area 1

The CMSEC's water system serves the public and therefor falls under the regulations as set out under the BC Drinking Water Protection Act & Regulations (DWPA & DWPR). Island Health is delegated authority by the Province to be the regulator and responsible for reviewing designs, issuing construction permits, setting operational conditions, and issuing operating permits.

Island Health requirements:

- All active wells be registered with the Province under the Water Sustainability Act and water usage reported annually (requiring install of totalizing water meters at each service well)
- All wastewater systems be designed in accordance with the Provincial Sewerage System Regulations (SSR) and that proper setbacks are maintained between source water and sewerage components (the DWPR and SSR are aligned in the required setbacks)
- System designs must assess the quantity and quality of the source water, via a water need/balance analysis, and a risk assessment analysis
- Wellhead and source water protection plans,
- Emergency response plans
- Treatment, commissioning, operation & monitoring plans.

5.1 Risk/hazard identification

- Well is drilled in fractured sandstone - risk of quick infiltration of surface water demonstrated to be a low hazard based on the ground water monitoring result showing slow delayed recharge response.
- Variable flow rates due to seasonal use – offers risk of biofilms and legionella in piping and fixtures
- Public facility that could serve immune compromised guests – higher degree of protective measures
- One historical water quality result with coliforms – demonstrates the limited filtration capacity of the sandstone at depth.
- Two buildings within 30 metre buffer setback
- Existence of a greywater infiltration in close proximity to the 30 m buffer setback , but will be decommissioned and replaced by the septic system
- Overflow parking (used 1-2 times per year) within 30 metre buffer setback

5.2 Mitigation (LRT/LRV)

Treatment targets for this water system will be assessed by the health authority. Initial design will be to consider the well water as GARP.

	Cryptosporidium LRV	Giardia LRV	Viruses LRV
5 µm cartridge filtration	0	0	0
1 µm Absolute cartridge	2	2	0
UV – NSF 55 Class A 40 mJ/cm2	3	3	.5
Chlorination @ .5 mg/L at 10°C, pH > 8.0 with CT of 15.1 min¶mg/L	0	0	4
Total LRV Credits	5	5	4.5
Island Health Targets for GARP – virus only sources	3	3	4

5.3 Potable Water Treatment

Potable water requires two types of disinfection and filtration to meet the LRT targets for GARP groundwater. Following is the treatment train to achieve targets:

- Filtration at 5µm for raw well water at flow rate for 2.8 L/m -
- Filtration at 1µm for raw well water at flow rate for 2.8 L/m
- UV treatment >40 mJ/cm² - UV sized at 10 gpm to minimize pressure drop
- Chlorination of stored water at 0.5 mg/L free chlorine residual via a recirculation system
- Recirculation provides 3 changes per day, drawing waters from last tank in tank array, chlorinating and depositing in the first tank, controlled by a ATI Q46H monitor/controller, a Grundfos DDA 7.5-16 dosing pump and recirculated via a Grundfos Magna 3-32 recirc pump.

5.4 Supply system

Well Pump:

- Existing well pump will be utilized to supply water to the new storage tank array by re-routing (and extending) the supply lines.

Flow Control (see Figure 7):

- Flow control valve rated at 2.8 L/m (0.75 USgpm)
- SJE Rhombus NEX-splx 1047662 Float Controller
- Belimo EXT-2100 PWV NPT+LF120, NC/FC failsafe, controlled via SJE Rhombus controller
- Float heights set as per Figure 7

Storage:

- 3 Tanks – Premier Plastic 3330 IG HDPE NSF 61
- Total volume is 45,415 L (9990 IG, 12,000 USG)
- *NOTE: The non-potable water buffer tank is not included in this discussion*

Supply Pump:

- Grundfos CMBE 3-93 – VFD constant pressure
- Operating pressure 40 psi; peak flow rate 64 L/m (16 USgpm)

Monitoring:

- **Well water volume** – weekly reading of the well water totalizing water meter. Water volumes expected to be 18,312 L/w based on 7 days at the MDD of 2616 L/d, warnings of equipment failure if readings exceed 28,483 L/w (suggesting failure of flow control valve)
- **Water volume monitoring for each building** – Each building (caretaker dwelling, central kitchen, central washroom) will have a dedicated water meter wherein monthly reading will be recorded to develop long term base line usage profile.
- **Well water quality** – monthly testing of microbiology for E. Coli, fecal coliforms and total coliforms. Existence of coliforms suggests well influence by surface water contamination, E. Coli suggests infiltration of human wastewater.
- **Treated Water Use** – weekly readings of the water supply totalizing water meter. Difference between the well water and supply water meters indicates system leakage.
- **Treated water quality** – monthly microbiology testing for Island Health to confirm water meets potability requirements as per the Drinking Water Protection Regulation+
- **Daily observation UV Intensity** – ensure UV intensity is stable
- **UV Intensity Alarm** – All recognized UV systems for water small water systems have auto alarms when failures occur; triggering audible sound and automatic solenoid valve to close and shutting down water supply.
- **Chlorine (free chlorine) level** – The chlorination system is automatically controlled via a free chlorine monitor which doses the chlorine injection. Out of spec chlorine levels trigger an audible alarm. Free chlorine to be set between 0.5 mg/L-0.7 mg/L.

- **Monthly chlorine residual sampling** - water samples (grab samples) are taken monthly from the furthest connection point and tested via Hanna HC Colormetric free chlorine checker to ensure residual ≥ 0.2 mg/L

5.5 Operations and Monitoring Overview

5.5.1 Management

The Society will be the operator of the water system (pending VIHA approval). Support for operations is provided by Eco-Sense (system designer).

The society is responsible for preparing an annual report documenting water quality testing results, operations and maintenance history, major incidents, costs, anticipated expenditures for the coming year, and noted changes to any updated plans (i.e. updated emergency response plan contacts). The water system will be allocated as its own cost center for budgeting needs and to observe trends across years.

5.5.2 Scheduled tasks

Daily: daily check on UV intensity, chlorine monitor

Weekly: record volume of flow for each of the well, treated water, and chlorine recirculation, confirm chlorine solution level, record pressure drop across filter housings

Monthly: Monthly water sampling for Island Health

Yearly: Annual filter replacement, UV servicing, system flushing, annual report

5.5.3 Reporting

Health Authority:

Reporting will be set by Island Health and stipulated in the Operating Permit by the Drinking Water Officer as to the reporting requirements they set.

Province:

The society will submit the yearly water usage to the Province as part of the water licensing agreement.

5.6 Emergency Response Plan

The emergency response plan is a requirement of the operating permit under Island Health. The following Emergency response plan is a draft of what will be part of the application package to Island Health. See Appendix J for the draft emergency response plan.

5.6.1 Notices

Pre written signage with notices will be available within the office.,

Do Not Use Water Notice:

Used when a significant health risk or public health threat exists in the water supply system that cannot be adequately addressed by a water quality advisory or boil water notices. (e.g., oil/ pesticide spill).

Boil Water Notice:

If E.Coli is detected in treated water samples from:

- Treated Water Storage Tank
- Monthly microbiology water sampling

If Turbidity > 1NTU downstream of filtration

Used when testing reveals E. coli or other coliform organisms in the water supply, and/or the system fails to meet drinking water treatment objectives, and the associated public health threat from the water supply system can be effectively addressed by boiling the water

Water Quality Advisory:

Used when a public health threat from the water supply system is higher than considered normally acceptable, but is not serious enough to warrant, or will not be resolved by, a boil water notice.

5.6.2 Emergency Contact Information

WHO TO CALL:	ADMINISTRATION:	Name
	WATER SYSTEM OPERATOR:	Phone: (primary and backup) Crystal Mountain Society
	VIHA ENVIRONMENTAL HEALTH OFFICER:	Phone: Anthony Griffin 250-755-6215
	VIHA PUBLIC HEALTH ENGINEER:	Fax: 250-755-3372 Email: HPES.Nanaimo@islandhealth.ca Darrell Bélanger 250-331-8518
	GROUNDWATER SPECIALIST:	Alan Kohut – Hy-Geo Consulting 250-744-7859 Information@hy-geo.com
	INSTALLER: DESIGNING ENGINEER:	Gord Baird ASSE 41612 (Eco-Sense) Sharon McGeorge P.Eng (Integral Group) Phone: Gord Baird 250-818-7986 Email: gord@eco-sense.ca Phone: Sharon McGeorge 250-418-1288 x 5008 Email: smcgeorge@integralgroup.com
	BULK WATER DELIVERY:	South Island Water 250-516-5066 Email: southislandwaterltd@gmail.com

6 Waste Water

CMSEC has received approvals from Island Health for sewerage system designs for both Area 1 and Area 2. The approvals for each system are attached in Appendix H (Area 1) and Appendix I (Area 2). The designing ROWP is Fred Stevens, of Galiano Excavating, and the standards used were the Standard Practices Manual.

The daily design flows used to prepare both filings are based on the water needs analysis provided by Kohut, which have been reviewed and approved by Island Health.

Area 1 summary

Daily Design Flow	3252 L per Day
Septic tank at Caretaker Dwelling	Dan's Precast 600 IG L.P. c/w PL122 filter
Septic tank at kitchen/washroom	Dan's Precast 1700 IG L.P. c/w PL122 filter
Pump chamber at kitchen/washroom	Dan's Precast 300 IG
Pump	Little Giant WS50HM-20
Field Type	Premiere Tech EC 3500 Eco Flow Bio Filter (pressurized)
Piping	100mm CSA Sewer & 50mm CSA SCH 40
Area of Infiltrative Surface	23m ² (8.5 m x 2.7 m)

Area 2 summary

Daily Design Flow	284 L per Day
Septic tank	Dan's Precast 600 IG L.P. c/w PL122 filter
Distribution box	7 hole Dan's Precast
Field Type	7 Eljen modules (gravity fed)
Piping	100mm CSA Sewer & 50mm CSA SCH 40
Area of Infiltrative Surface	10.4m ² (8.5 m x 1.21 m)

7 Rainwater

Rainwater dedicated for non-potable uses (i.e. laundry, toilet flushing) will be implemented. The earlier sections of this Water Management Plan discuss the water balance assessments for two rainwater/NPW systems, (1) the caretakers residence, and (2) the central kitchen/laundry/washroom facilities (sections 4.3 through 4.5).

In summary of those sections the caretaker building can easily collect and store rainwater to meet the annual non-potable water demands of the caretakers, with a roof size of 80 m² and a storage system of at least 6825 L.

The central kitchen and washroom facilities with a combined collection area of 231 m², with a storage size of 91 m³, can meet a large portion of the non-potable water demands of the toilets and laundry located in these buildings, though during the peak season under maximum demand there could be a shortfall of stored rainwater therefore requiring a draw upon well water to supplement this need. All of this supplemented water can be met within the well's sustainable yield.

7.1 Regulations and Standards

7.1.1 CSA B805-18 – Rainwater harvesting Standard of Canada

The Canadian standard sets the standards for design of rainwater harvesting systems for both potable and non-potable uses. Professional design for each rainwater system would be provided based on the standards set for toilet and laundry, classified as “Tier 3” non-potable end uses.

7.1.2 CRD Building Bylaw

The CRD is the authority having jurisdiction over the approval and permitting of rainwater systems tied to buildings. For a non-potable water system Island Health would not be involved and instead CRD would be ensuring the installation meets the requirements of the BC Building and Plumbing code.

7.2 General rainwater design specifications:

- Designed by an ASSE Certified Rainwater Installer/Designer (Gord Baird, Eco-Sense)
- Standard designed to CSA B805-18 Canadian National Rainwater Harvesting Design Standard
- Installation to meet BC Building/Plumbing code
- Gutters screened by 550µm stainless steel gutter guards
- First flush diverter sized to accept 2 minutes of IDF 15 min. rainfall denoted in BC Building Code Division B-Appendix C, Climatic and Seismic Information for Building Design in Canada, Table C-2.
- Storage pre-filter ≤180µm
- Non-potable plumbing to non-potable fixtures as per BC Building code Division B (independent supply piping, purple in colour, not connected to potable, and all outlets labelled with non-removable tags denoting non-potable water)
- Supplemental make-up water to the Non-potable water system is provided via Jobe float operated top-up valves with outlets being ≥100 mm above top of rain storage overflow.
- Overflows to be of equal size as inlet, and exit to perimeter drainage piping with a swing-check backwater valve installed to exclude vermin.
- Tank lids are locked, and tagged with ‘Confined Space – Do Not Enter’
- All aspects design for year round seasonal conditions
- Filtration and disinfection designed to CSA B805-18 Tier 3 End Use (prescriptive design standard)

- Monthly maintenance includes servicing pre-filters, inspecting gutters, recording pressure differentials across filter housing and replacing filters as necessary, servicing NSF 55 Class B UV units.
- All systems come with their own Water Safety Plan, design drawing and operation and maintenance manual.

8 APPENDICES

[Appendix A – Crystal Mountain Existing Water System Site Plan, September 2021](#)

[Appendix B – Crystal Mountain Proposed Water System Site Plan, January 2022](#)

[Appendix C – Groundwater Assessment Report for CMSEC, A. Kohut, November 2015](#)

[Appendix D – Water Demand Analysis, A. Kohut – June 2021/ March 2021](#)

[Appendix E – Crystal Mountain Well Monitoring Report, A. Kohut, January 2022](#)

[Appendix F – Wellhead Protection Map, February 2022](#)

[Appendix G – Chief Harris – correspondence, December 2021](#)

[Appendix H – Septic Filing – Area 1](#)

[Appendix I – Septic Filing Area 2](#)

[Appendix J – Draft Water System Emergency Response Plan February 2022](#)

[Appendix K – Water License Application – consolidated files](#)

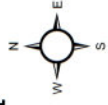
[Appendix L – Water Demand and Water Balance \(G. Baird July 07 2022\)](#)

[Appendix M – Daily Water Data \(G. Baird July 07 2022\)](#)

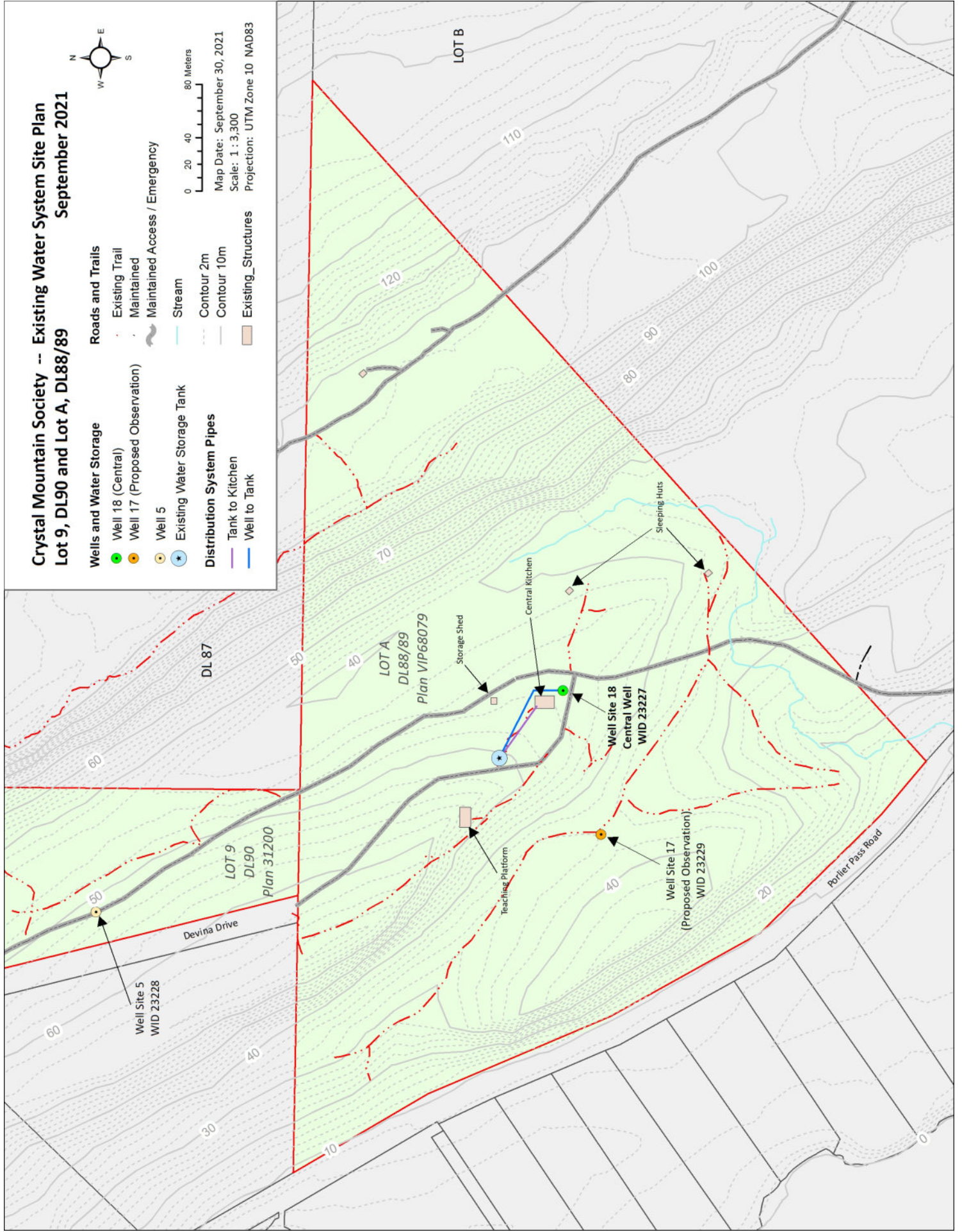
[Appendix N – Schematic of water storage \(July 2022\)](#)

Crystal Mountain Society -- Existing Water System Site Plan Lot 9, DL90 and Lot A, DL88/89 September 2021

- Wells and Water Storage**
- Well 18 (Central)
 - Well 17 (Proposed Observation)
 - Well 5
 - Existing Water Storage Tank
- Distribution System Pipes**
- Tank to Kitchen
 - Well to Tank
- Roads and Trails**
- Existing Trail
 - Maintained
 - Maintained Access / Emergency
- Stream**
- Stream
- Contours**
- Contour 2m
 - Contour 10m
- Existing Structures**
- Existing Structures



0 20 40 80 Meters
Map Date: September 30, 2021
Scale: 1 : 3,300
Projection: UTM Zone 10 NAD83



Crystal Mountain Society Proposed Subdivision/Rezoning and Development January 2022

Water System Site Plan

Water System

- Treated Water Pipe (not yet constructed)
- Septic Pipe (not yet constructed)
- Raw Water Pipe
- Well 5
- Well 17 (Observation) DL 87
- Well 18 (Central)
- Well (not yet constructed)
- Water Storage Tank (not yet constructed)
- Septic Tank (not yet constructed)

Proposed Lot Boundaries

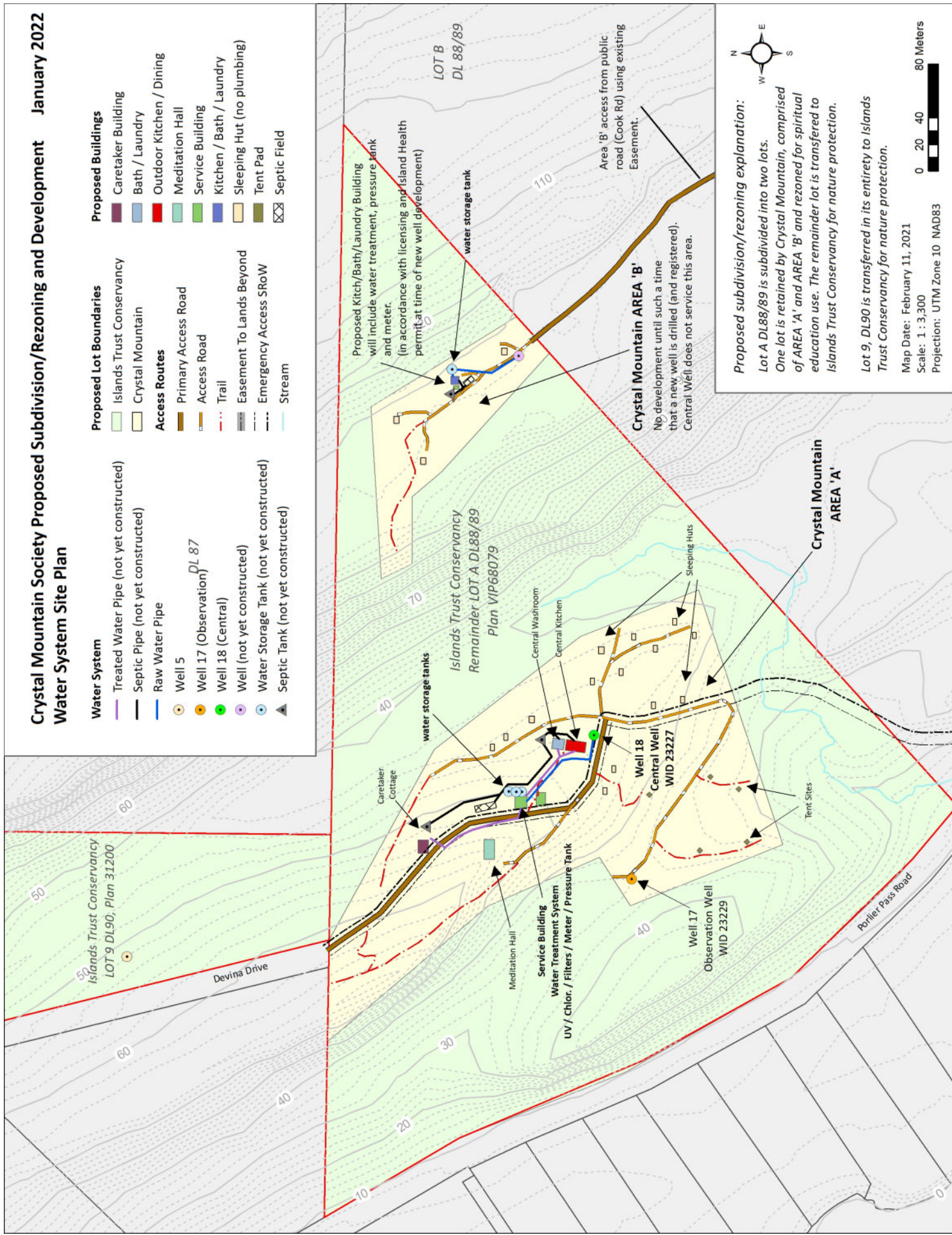
- Islands Trust Conservancy
- Crystal Mountain

Access Routes

- Primary Access Road
- Access Road
- Trail
- Easement To Lands Beyond
- Emergency Access SRoW
- Stream

Proposed Buildings

- Caretaker Building
- Bath / Laundry
- Outdoor Kitchen / Dining
- Meditation Hall
- Service Building
- Kitchen / Bath / Laundry
- Sleeping Hut (no plumbing)
- Tent Pad
- Septic Field



Proposed subdivision/rezoning explanation:

Lot A DL88/89 is subdivided into two lots.
One lot is retained by Crystal Mountain, comprised of AREA 'A' and AREA 'B' and rezoned for spiritual education use. The remainder lot is transferred to Islands Trust Conservancy for nature protection.

Lot 9, DL90 is transferred in its entirety to Islands Trust Conservancy for nature protection.

Map Date: February 11, 2021

Scale: 1 : 3,300

Projection: UTM Zone 10 NAD83

0 20 40 80 Meters

**GROUNDWATER ASSESSMENT REPORT FOR
CRYSTAL MOUNTAIN RETREAT CENTRE,
GALIANO ISLAND**

Lot A, District Lots 88 and 89, Plan VIP68079 and
Lot 9, District Lot 90, Plan 31200
Galiano Island, Cowichan District

Prepared for:

CRYSTAL MOUNTAIN SOCIETY

PO Box 123
Galiano Island,
British Columbia V0N 1P0

Submitted by:

Hy-Geo Consulting
Victoria, British Columbia

November 2, 2015

EXECUTIVE SUMMARY

This report assesses the overall groundwater supply requirements for the Crystal Mountain Retreat Centre and provides an opinion on meeting the water demands from an existing well on the property. The maximum daily requirements or maximum day demand (MDD) that would likely occur at the retreat centre is estimated at 2839 liters/day or 625 Imperial gallons day which would serve a maximum of 30 persons accommodated on site. An existing well at the centre, designated the central well, was pump tested in October 2015 for a minimum period of 12 hours at a constant rate of 8.07 L/min and evaluated to have a long term yield of 2.826 L/min (4069 L/day) with a 70% safety factor. This calculated yield is 43% more than the estimated water supply requirements of 2839 L/day and would amount to a total potential supply of 1.49 million litres/year. Testing was conducted at the optimal time of the year when water levels are at their seasonal lowest.

No discernable pumping effects were observed in two observation wells at the centre that were monitored during the October testing. Based on these monitoring results, use of the central well at a rate of 1.972 L/min (2839 L/day) would have no measureable effect on any of the neighbouring wells or surface water sources in the region.

Water quality testing of the central well (*WID 23227*) indicates that the water meets or exceeds *Guidelines for Canadian Drinking Water* (Federal-Provincial-Territorial Committee on Drinking Water, 2015) for all parameters tested except for total coliforms. Total coliforms of 3 and 1 CFU/100mL were reported for two samples taken after chlorination of the well. No *E.coli* was detected. The source of the coliforms is not known and could be due to grey water discharge in the vicinity of the well and /or natural sources such as decaying vegetation in nearby wetland areas. Previous occurrences of coliform bacteria have been effectively reduced by well chlorination. As a precautionary measure against any future potential sources of coliform bacteria, water from the existing well source should be treated with an appropriately designed and maintained ultraviolet irradiation (UV) or chlorination treatment system.

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Appendix B: Pumping Test Results
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GROUNDWATER ASSESSMENT REPORT FOR CRYSTAL MOUNTAIN RETREAT CENTRE, GALIANO ISLAND

INTRODUCTION

Hy-Geo Consulting was retained by the Crystal Mountain Society (CMS) in August 2015, to provide hydrogeological engineering services to assess the quantity and quality of available groundwater for all proposed uses at their retreat centre on Galiano Island and to identify any potential risks to groundwater or surface waters.

The Crystal Mountain Retreat Centre (CMRC) is located adjacent to and east of Porlier Pass Road at the north end of the island near Spotlight Cove (Figure 1). The retreat centre encompasses Lot A, District Lots 88 and 89, Plan VIP68079 and Lot 9, District Lot 90, Plan 31200, Galiano Island, Cowichan District. Lot A is zoned Forrest 1 (F1) and Lot 9 is zoned Rural 2 (R2) in the *Galiano Land Use Bylaw* (Islands Trust Staff Report, 2015). The society has submitted an application to rezone the two lots to permit a year-round forest retreat centre on both lots. The Crystal Mountain Retreat Centre property is situated directly upslope of several waterfront properties near Spotlight Cove (Figure 1) where residential wells are reported. Three wells are located on the Crystal Mountain property, with the central well currently serving the water requirements of the retreat centre.

This report assesses the overall groundwater supply requirements for the Crystal Mountain Retreat Centre and provides an opinion on meeting the water demands from an existing well on the property. An assessment is also provided on the potential effects of the proposed groundwater use at the CMRC on neighbouring wells and overall groundwater quantity and quality in the region.

Scope of Work

Scope of the work carried out by Hy-Geo-Consulting included:

- (a) reviewing and examining existing hydrogeologic data and reports for the property and adjoining region including topography, geology, climatic and well record information;
- (b) conducting one or more site visits to examine local geology, topography, drainage, surface water sources, existing well conditions, water supply infrastructure, neighbouring wells and land use;
- (c) determining the water uses and total estimated water demands for the retreat centre;

- (d) assessing the quantity and quality of the existing water sources on the property and their uses and determining whether any additional water quantity or water quality testing or monitoring may be required;
- (e) undertaking a minimum 12-hour constant rate pumping test of the central well on the property to determine its long-term capacity to meet the estimated total water demand, including sampling of water quality; This work was planned and completed in conjunction with a qualified pump testing contractor, Red Williams of Red Williams Well Drilling Ltd.
- (f) identifying any potential impacts arising from the proposed use and development of the property on groundwater and surface water;
- (g) reviewing and analyzing the results of the above investigations; and
- (h) preparing a final report suitable for submission to the Local Islands Trust Committee, Vancouver Island Health Authority (VIHA) and Capital Regional District.

Topography and Drainage

The retreat property is situated along an irregular southwest facing slope (Figure 1), comprised of a series of bedrock ridges trending northwest to southeast with elevations rising from 20 metres above sea along Porlier Pass Road to just over 120 metres above sea level at the eastern end of the property. The central portion of the property lies between elevations 40 to 60 m. Towards the east, elevations rise abruptly along an escarpment to above 120 m. Spotlight Creek, appears to originate along the base of the escarpment and is the main drainage feature on the property flowing southeasterly towards the southeast boundary of the property and then southwesterly towards Spotlight Cove. Erickson (2014) reports that Spotlight Creek is intermittent and runs only during peak rainfall months from November through to the spring. No water flow was observed in the creek during the period of field investigations carried out in August, September and early October 2015. An existing surface water licence (No. C058557) for domestic use of 2273 L/day (Figure 1) is registered on Spotlight Creek. An examination of the intake in October 2015 indicated that it does not appear to have been active for some time. Another licence (No. C106042) for domestic use of 682 L/day exists on Stemo Spring. An examination of this source in October 2015 did not show any apparent water flow.

Climate

The climate of Galiano Island is characterized by cool dry summers and humid mild winters. Based on records from 1951 to 1980 (Environment Canada, 198_) the average annual precipitation for a station on Galiano Island was 33.7 inches

(856 mm). Over 90 % of this total annual amount fell as rain with over 60% of the total falling during the period from November to February. Newer data for the 1981-2010 normal period reported by Environment Canada (2015) for Mayne Island and Saturna Island weather stations indicates annual mean precipitation of 842.0 and 812.2 mm., respectively. With the absence of a current climate station on Galiano Island, the Saturna Campon climate station may be considered representative of the general longer-term (monthly) precipitation patterns on Galiano (Figure 2). Global climate models (Allen *et al.*, 2008) suggest precipitation may increase slightly in the future, particularly during the winter months. Table 1 indicates that the cumulative precipitation for the Saturna Campon CS climate station was 90.9 percent of normal from January to end of September 2015. The months of April to July 2015 were particularly dry and well below normal while September 2015 was relatively wet and well above normal.

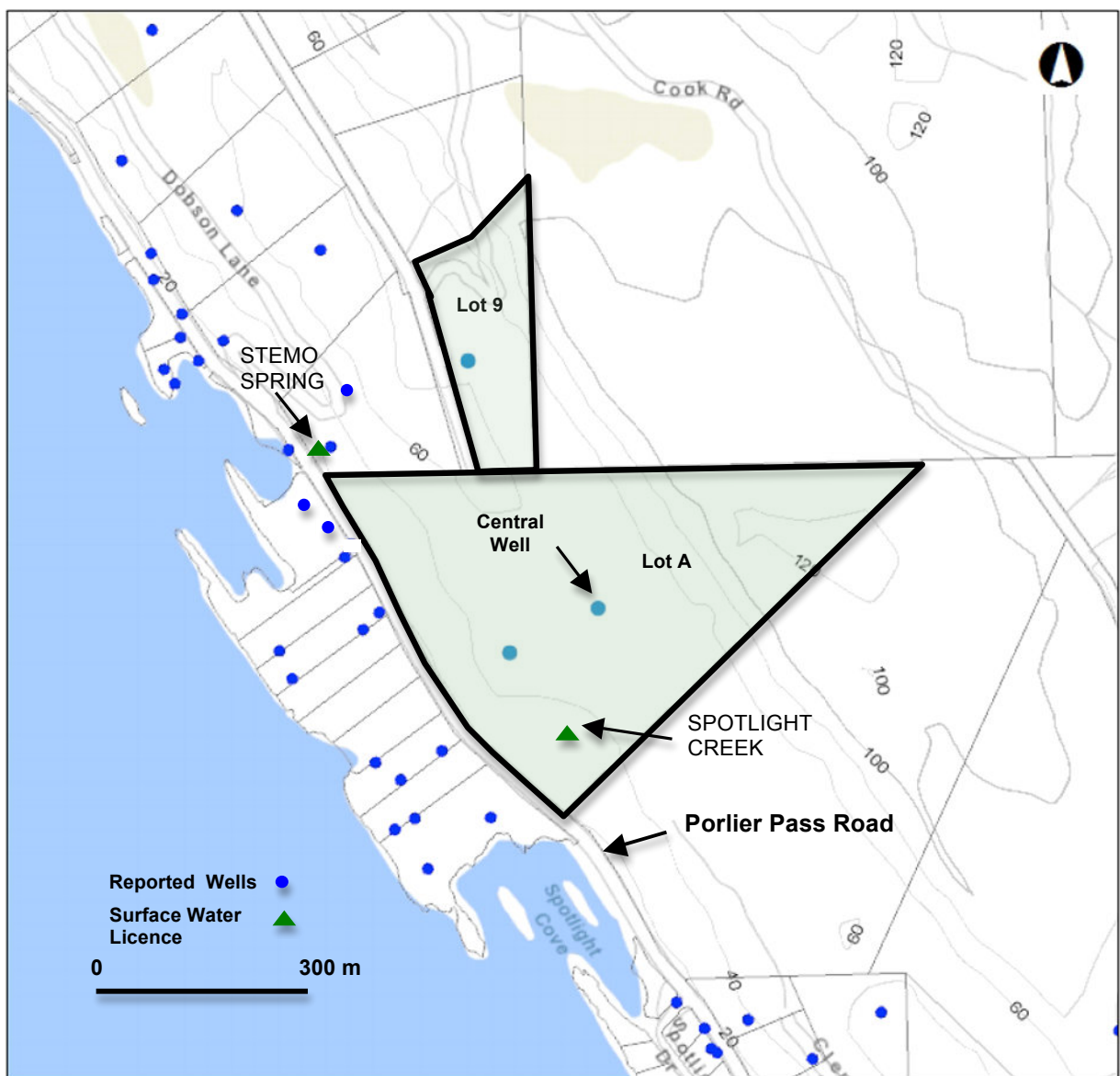


Figure 1. Location of Crystal Mountain properties, wells and water licences. Basemap and from Ministry of Environment (2015a).

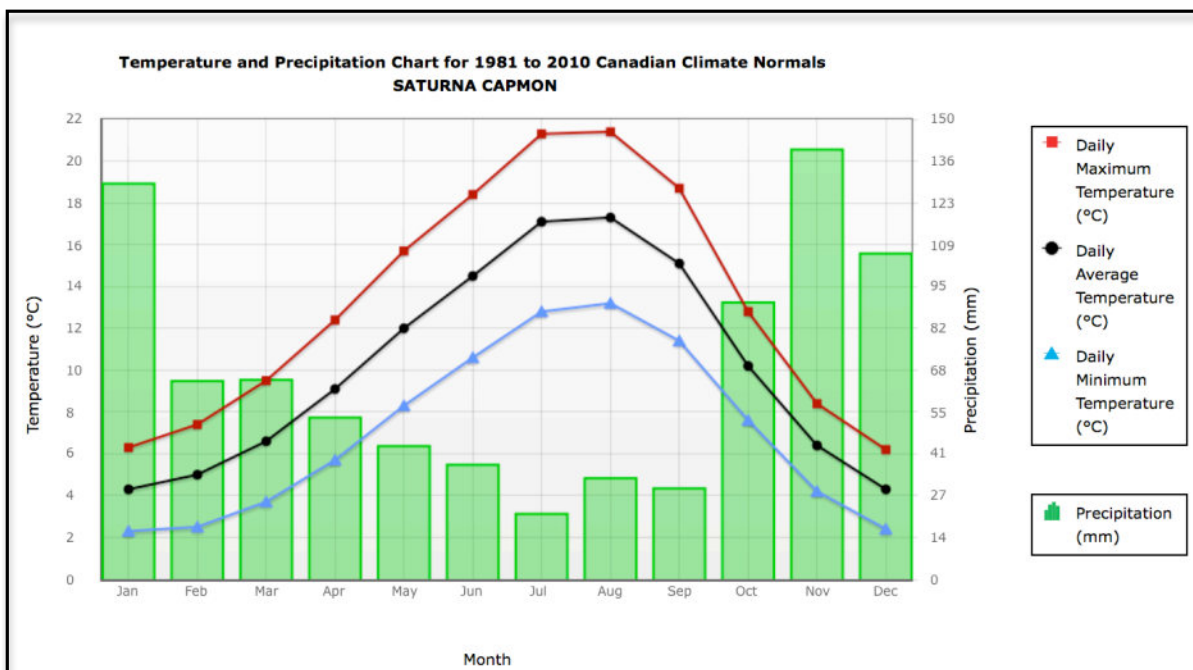


Figure 2. Graph of monthly normal monthly precipitation for Saturna Island Campon station (Climate ID. 1017098). Graph from Government of Canada (2015a).

Table 1. Monthly precipitation data for Saturna Campon CS climate station (Climate ID. 1017098) in 2015 compared to 1981-2010 normals

Month	Precipitation in 2015 (mm)	Precipitation Normal (mm)	Percent of Normal	Cumulative Percent of Normal
January	115.4	129.0	89.5	89.5
February	72.5*	64.6	112.2	97.1
March	107.5	65.0	165.4	114.2
April	16.2*	52.7	30.7	100.1
May	2.6	43.4	6.0	88.6
June	4.8*	37.3	12.9	81.4
July	7.5	21.3	35.2	79.0
August	27.8	32.9	84.5	79.4
September	78.4	29.6	264.9	90.9

* Incomplete data.

Data from Government of Canada (2015b).

Hydrogeologic Conditions

The general groundwater conditions of Galiano Island have been reported by several authors including Harrison (1994), Kohut and Johanson (1998) and Waterline Resources Inc. (2011). Galiano is comprised of sedimentary clastic rocks belonging to the Nanaimo Group of Late Cretaceous age (Muller and Jeletzky, 1970). These consist of alternating interbeds of sandstone, mudstone,

siltstone, shale and some conglomerate. The retreat centre property and surrounding region is principally underlain by the Gabriola Formation that is dominantly sandstone with some shale (mudstone) interbeds.

Groundwater on the island is found primarily in open fractures in the bedrock formations as they are encountered during drilling of water wells. These fractures constitute the major zones for groundwater storage and movement. The retreat centre property lies entirely within the North Trincomali groundwater region as outlined by Kohut and Johanson (1998). In 1998, Kohut and Johanson estimated the demand to groundwater in storage ratio in this region to be relatively low at 0.11. Existing well density at that time was also determined to be low to medium at 0.077 wells/acre. The current well density based on the number of wells reported in the Ministry of Environment WELL database (Ministry of Environment, 2015) is 0.086 wells/acre. Higher well densities also occur locally along the coastline.

From historic observation well data in the Gulf Islands, groundwater levels in bedrock wells generally rise and fall with the seasons, in response to available precipitation, becoming highest during the late fall and winter months. Water levels then normally decline during the dry summer months reaching seasonal lows in the late fall months (Kohut *et al.*, 1984). Figure 3 shows the groundwater level trend for 2015 falling below historic mean levels from May to September as shown in the graph of provincial observation well 258.

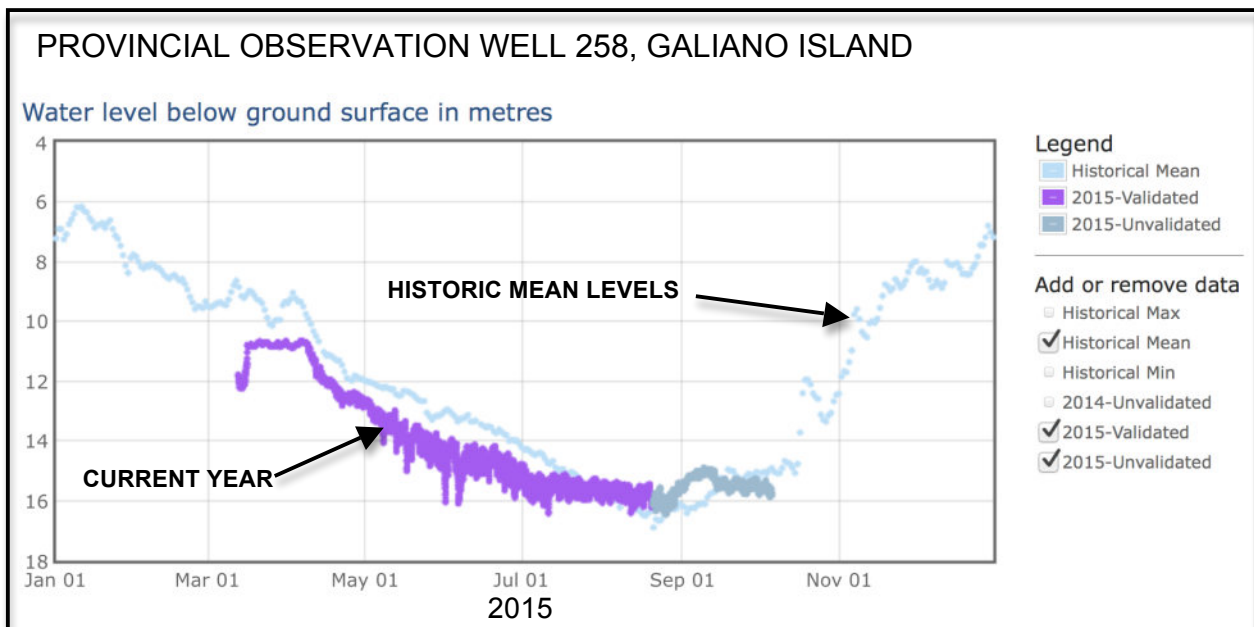


Figure 3. Groundwater level trend in 2015 compared to historic mean data for Observation Well 258. From Ministry of Environment (2015b).

EXISTING WELLS

Figure 4 shows the location of 30 known and reported water wells and springs within 0.64 km. of the central well on the Crystal Mountain property. It should be noted that all well locations have not been verified in the field. Table 2 provides a brief description of the wells within the 0.64 km radius of the central well. Wells currently within the Ministry of Environment's database are identified in Table 2 with a Ministry well tag number (WTN) that is a unique computer generated identification number. In recent years, the Ministry has also provided well identification plate (WID) numbers to well drillers for attaching to the casing of new wells for their identification in the field.

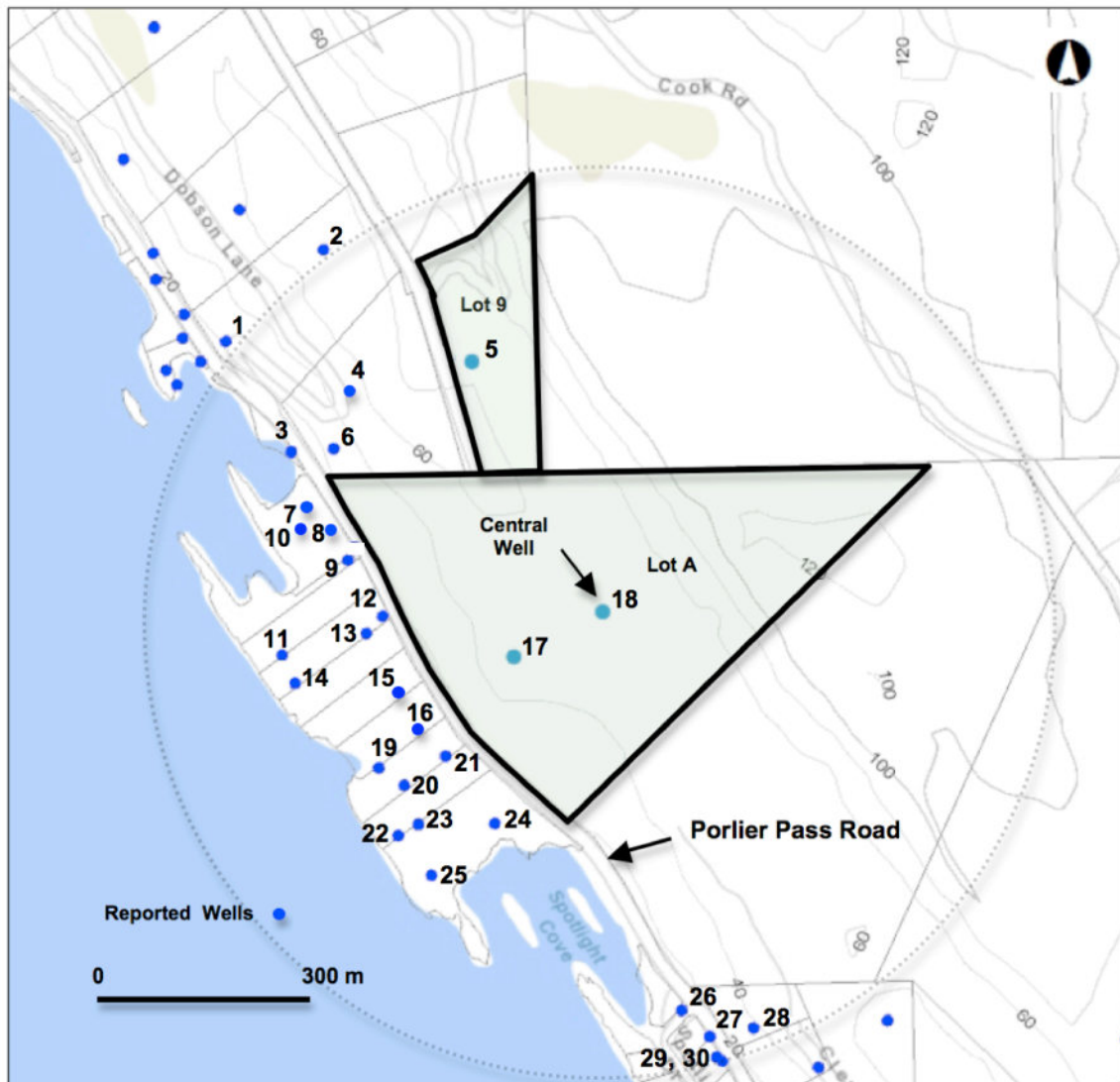


Figure 4. Existing wells and springs within 0.64 km of the central well on Crystal Mountain property.

Table 2. Summary of reported water wells and springs at and in vicinity of Crystal Mountain Retreat Centre.

Site Number on Map	Well Tag No. (WTN)	Well Identification No. (WID)	Address	Depth Drilled/ Dug (feet)	Depth Well Drilled/ Dug (m)	Diameter (in)	Diameter (cm)	Driller's Estimated Yield Value	Yield Unit Description	Water Depth (feet)	Water Depth (m)	Depth to Bedrock (feet)	Depth to Bedrock (m)	Construction Start Date	General Remarks	Legal District Lot	Legal Plan	Lot No.	Owner When Constructed	Well Use
1	49351			172	52.43	6	15.24	4	GPM			14	4.27	14-Oct-81	4 gpm at 158-164 feet	90	31200	7	Brian Preston	Private Domestic
2	97038			400	121.92			6	GPM			6	1.83	04/15/(2008)	0.5 gpm at 95 feet, 1.5 gpm at 345 feet, 4 gpm at 375	90	31200	7	Harding & Nation	Private Domestic
3	13409			50	15.24			8 ?	GPM	45	13.72			01/01/1950*		90	4164	5	Halling	Unknown Well Use
4		26548				6	15.24													
5	56583	23228		280	85.34	6	15.24	6	GPM	55	16.76	9	2.74	30-Sep-86		90	31200	9	Crystal Mountain Retreat Centre	Private Domestic
6	13368							150	GPD	0				01/01/1950*	spring, from crack in sandstone beside road, east side, Licence C.L. 24457	90			Stafford	Drinking Water
7	13358		21035 Porlier Pass Road	14	4.27									01/01/1950*		89	12139	A	W.J. Stafford	Garden
8	18719		21035 Porlier Pass Road	80	24.38	5	12.70	5	GPM	8	2.44	20	6.10	01-Jun-64		89	12139	A	W.J. Stafford	Private Domestic
9	105861		20925 Porlier Pass Road	100	30.48			5	GPM			13	3.96	05/14/(2009)					Gray	Private Domestic
10	96239			84	25.60	6	15.24	2	GPM	11	3.35			04-Dec-92	well unstable, requires well liner, pitless unit welded	89	12139	A	Grey	Water Supply System
11	27570			97	29.57	6	15.24	5	GPM	11	3.35	15	4.57	24-Jan-73	15 gph at 35 feet, 5 gpm at 89 feet	89	22608	1	Stewart	Private Domestic
12	42140			146	44.50	6	15.24	5	GPM	10	3.05	13	3.96	20-Apr-79		89	22608	2	E. Scott	Unknown Well Use
13	40306			115	35.05	6	15.24	0.66	GPM	7	2.13	12	3.66	09-Aug-78	20 gph at 58, 20 gph at 75 and 6 gph at 106 ft	89	22608	2	E. Scott	Unknown Well Use
14	31547			110	33.53	6	15.24	4	GPM	18	5.49	12	3.66	09-Oct-74		89	22608	2	E. Scott	Unknown Well Use
15			20775 Porlier Pass Road			6	15.24													
16			20705 Porlier Pass Road			6	15.24													
17		23229		183	55.78	6	15.24	7	GPM	68	20.73	24	7.32	25-Nov-94	7 gpm at 177 feet				Fibermax	Private Domestic
18		23227		125	38.10	6	15.24	5	GPM	60	18.29	4	1.22	19-Aug-94	Well # 2, 1 gpm at 100 feet and 5 gpm at 120 feet				Fibermax	Private Domestic
19	32075			80	24.38	6	15.24	3	GPM	11	3.35	15	4.57	07-Feb-75	1 gpm at 22 ft, 2 gpm at 36 feet	89	22608	5	John Innes	Unknown Well Use
20	37329			70	21.34	6	15.24	2	GPM	19	5.79	12	3.66	22-Jun-77	1 gpm at 58 ft, 2 gpm at 63 feet	89	22608	6	N. Ritchie	Unknown Well Use
21	52553			182	55.47	6	15.24	2	GPM	10	3.05	10	3.05	03-Aug-83	80 gph at 82 ft, 40 gph at 175 feet	89	22608	6	Alice Alexander & Nora Ritchie	Private Domestic
22	35507			55	16.76	6	15.24	0.33	GPM			1	0.30	19-Aug-76	10 gph at 40 ft, 10 gph at 55 feet, salt water well	89	22608	7	Alistair F. Ross	Unknown Well Use
23	35516			80	24.38	6	15.24	3	GPM	16	4.88	19	5.79	22-Aug-76	15 gph at 30 ft, 45 gph at 48 feet and 2 gpm at 73 feet	89	22608	7	Alistair F. Ross	Unknown Well Use
24	39464		20445 Porlier Pass Road	166	50.60	6	15.24	4	GPM	14	4.27	22	6.71	17-Apr-78	5 gph at 37 ft, 35 gph at 85 feet, 20 gph at 120 ft, 1 gpm at 135 feet and 2 gpm at well reported not in use in 1996	89	22608	8	P.N. Thornsteinsson	Unknown Well Use
25	23428			60	18.29	6	15.24	2	GPM			8	2.44	03-Apr-70		89	22608	8	Whittale	Unknown Well Use
26	45829			92	28.04	6	15.24	4	GPM	14	4.27	20	6.10	15-Aug-80	1 gpm at 60 feet, 3 gpm at 65 feet	89	22690	1	Lee Kolossoff	Private Domestic
27	50413			82	24.99	6	15.24	12	GPM	25	7.62	7	2.13	09-Jun-82	4 gpm at 55 feet, 8 gpm at 72 feet	89	20266	7	Bill Patey	Private Domestic
28	58986			180	54.86	6	15.24	4	GPM	70	21.34	0	0	27-Jul-89	4 gpm at 165 feet	89	21465	1	John Ince	Private Domestic
29	59848			164	49.99	6	15.24	4	GPM	25	7.62	9	2.74	25-Sep-91	2 gpm at 55 feet, 1 gpm at 75 feet and 1gpm at 110 feet, deepened in 1998	89	20266	8	Spotlight Cove Community Well	Water Supply System
30	43162			75	22.86	6	15.24	3	GPM	17	5.18	19	5.79	16-Aug-79	1.5 gpm at 35 and 58 feet	89	20266	8	A. Haksi	Unknown Well Use

Data from BC Water Resources Atlas (Ministry of Environment, 2015), copies of original well records filed with Ministry of Environment, Victoria, Crystal Mountain Retreat Centre and field checking.

Note that data has not been field verified in all instances.

* Ministry assumed construction date for computer database.

ESTIMATED WATER SUPPLY DEMAND

The proposed retreat centre development is to be comprised of the following units connected to a small water supply system served by the central well:

- 1 single detached residence (caretakers dwelling) to be occupied year-round for up to 2 persons;
- 1 main kitchen facility serving up to 30 persons including drinking water and hand washing needs;
- 1 utility building with 4 shower units, 4 toilets, sinks and limited laundry facilities to serve short-term and long-term visitors.

In addition, water would also be provided in containers (e.g. 20 to 40 liters) for drinking water and hand washing needs for up to 15 forestry hut sites, accommodating up to 28 persons at any one time.

It is anticipated that the maximum number of persons to be accommodated at the centre over any long-term intervals of one to two months duration would not exceed 30 persons. Occasionally for some weekend day events (e.g. 1 to 3 per year) up to 60 persons may be in attendance at the centre.

Table 3 outlines the estimated maximum daily water demand anticipated for the retreat centre based on a number of assumptions. Maximum Day Demand (MDD) is the single highest total 24-hour daily water consumption occurring over a one-year period. MDD for a water system is generally comprised of a number of subcomponents including indoor usage, a water loss allowance and irrigation demand. In the case of the retreat centre, potential water losses and irrigation demands would be insignificant given the small size of the water system. There are also no plans to include watering of lawns or gardens on the property.

Indoor water use for conventional water systems, based on the *Design Guidelines for Rural Residential Community Systems* (Ministry of Forests, Lands & Natural Resource Operations, 2012) suggests that a minimum of 230 L/capita/day or 50.6 Imperial gallons/capita/day would need to be considered for a water system design. Environment Canada (2015) reports a similar water use figure of 251 L/day per capita for metered urban household water systems monitored across Canada in 2011. Using a per capita demand figure of 230 L/day suggests 30 persons could possibly require up to maximum of 6900 L/day or 1518 Imperial gallons per day (IGPD).

Apart from water use at the one, year-round caretaker dwelling, it is unlikely, however, that visitors to the retreat centre would be using water at a rate as high as 230 L/day/person for all their needs. It is anticipated that visitors would follow water conservation practices. In addition, the water system will incorporate water-saving appliances such as dual-flush toilets, coin-metered showers, high efficiency washing machines, low flow fixtures, and faucet aerators to reduce

water consumption. Water use would also be metered to monitor water use. Table 3 outlines a more detailed estimate of the anticipated maximum day demand (2839 liters/day or 625 IGPD) that may likely occur at the centre. This estimate is regarded as conservative. Actual reported water use during the period July 4 to August 2, 2015, for example, ranged from 75 to 225 US gals/day (284 to 852 liters/day) to provide water for 12 to 22 persons on the property for kitchen, hand washing and drinking water purposes (pers. comm., K. Lenglet, August 2015). During special event days (2 to 3 per year) when up to 60 persons maybe in attendance at the centre, kitchen and bathroom water use could approach 720 liters/day based on 12 liters/day/person. During these days, however, the maximum day demand of (2839 liters/day or 625 IGPD) would remain unchanged as it unlikely that there would be any significant shower or laundry use on these days.

Table 3. Estimates of maximum day demands (MDD) for retreat centre.

Number of Persons Served	Facilities Used	Period	Estimated MDD (liters/day)	Comments
2	caretaker dwelling septic system	year-round	460	residential use
28	15 forestry hut sites compost toilets	July-August	560 700 84	washing ¹ showers ² drinking water ³
30	main kitchen, 3 meals/day/person septic system	July-August	360	food preparation, dish washing and limited toilet use ⁴
30	laundry septic system	July-August	675	periodic use ⁵
Total:			2839	

¹ based on 20 liters/day/person

² based on 50 liters/person and 50 % of guests with alternate day use

³ based on 3 liters/day/person

⁴ based on 12 liters/day/person

⁵ based on 45 liters/load and 50 % alternate day use

The largest potential use of water on any day would be for laundry and shower facilities. Overall water demands could be readily reduced, if necessary by utilizing off site laundry facilities and limiting shower use to less than half of the guests, every other day.

WATER SUPPLY SOURCES

There are three wells at the centre which could conceivably provide water for the facility. These are indicated as well site numbers 5, 17 and 18 in Figure 4 and Table 2. A brief description of these wells is outlined below and copies of the available well records are provided in Appendix A.

Well Site 5, (WTN 56583/WID 23228)

This is a 6 inch (15.24 cm) diameter bedrock well, that was drilled to a depth of 280 feet (85.34 m) in 1986. It was reported to yield 6 gpm at the time of drilling with a non-pumping water level of 55 feet (16.76 m). The well has been used to supply the retreat centre in the past and reported to provide adequate quantities, although it produced water with elevated turbidity (pers. comm., S. Foster, August 2015). Depth to bedrock was reported at 9 feet (2.74 m). Currently, the well is not being used.

Well Site 17, (WID 23229)

This is a 6 inch (15.24 cm) diameter bedrock well, that was drilled in 1994 to a depth of 183 feet (55.78 m) and completed in grey sandstone. It was reported to yield 7 gpm from a depth of 177 feet (53.95 m) at the time of drilling with a non-pumping water level of 68 feet (20.73 m). Depth to bedrock was reported at 24 feet (7.32 m) with the well completed with 28 feet (8.53 m) of surface casing. Currently, the well is not being used.

Well Site 18, Central Well (WID 23227)

This is a 6 inch (15.24 cm) diameter bedrock well, that was drilled in 1994 to a depth of 125 feet (38.10 m) and completed in shaley and grey sandstone. It was reported to yield 5 gpm from a depth of 120 feet (36.58 m) at the time of drilling with a non-pumping water level of 60 feet (18.29 m). Depth to bedrock was reported at 4 feet (1.22 m) with the well completed with 20 feet (6.10 m) of surface casing and 125 feet (38.10 m) of 4-inch (10.2 cm) diameter PVC well liner.

This central well located on the property near the outdoor kitchen, is currently being used to supply water for the retreat centre. Water is pumped to a small 1137 L (300 USgal) storage tank (cistern) situated about 65 m northwest of the well. Grey water from the kitchen and outdoor shower is currently discharged to a drainage pit situated 20 to 25 m from the central well. An outhouse (pit latrine) serving the kitchen also exists 30.5 m south of the central well.

Since the central well was equipped with a pump and already serving the retreat centre, it was decided to carry out a constant rate pumping test on this well for a minimum period of 12 hours duration to assess its capacity for meeting the projected water demands of the retreat centre. The methodology employed and results of the testing are provided in the next sections.

PUMP TESTING METHODOGY FOR THE CENTRAL WELL

Given the relatively low water demands of the retreat centre, a constant rate pumping test of 12 hours duration was considered sufficient for determining the yield of the central well as the well driller's record had indicated a potential yield of 0.315 L/s (5 USgpm). Testing was conducted at the optimal time of the year when water levels are at their seasonal lowest (Figure 3). Only 0.2 mm of precipitation was recorded at the Saturna Campon CS climate station during the 10 days prior to the testing. Initially the well was tested on October 5, 2015 (Test 1) at a rate of 0.285 L/s (4.52 USgpm) but it soon became apparent within 2 hours that the well was being over-pumped at that rate since excessive drawdown was occurring. A second test (Test 2) was therefore started on the well on October 6, 2015 at a reduced rate of 0.135 L/s (2.14 USgpm). Water levels were monitored in the pumped well with a pressure transducer at one minute intervals prior to testing, during the testing and for 16.7 hours after pumping. Manual water level readings were also taken in the pumped well during the testing at frequent intervals following general standards for pump testing. Pumped water was discharged down slope 75 m away from the wellhead towards the east. Water level dataloggers were also employed at *Well Site 5, (WTN 56583/WID 23228)* and *Well Site 17, (WID 23229)* which were used as observation wells to record any well interference effects during the testing.

Pumped water samples were taken from the central well after 7.5 hours of pumping and delivered with cooler packs to the Maxxam Analytics laboratory in Saanich for analysis of chemical and bacteriological parameters. All samples were unadulterated and delivered to the laboratory within 24 hours of sampling.

PUMP TESTING RESULTS

Pumping test data for the second test including drawdown and recovery plots are provided in Appendix B. The drawdown plot is also shown in Figure 5. A copy of the analytical laboratory report from Maxxam Analytics is provided in Appendix C and Table 4 provides a summary of the water quality results. Figures 6 and 7 show the water levels in the two observation wells, *Well Site 5, (WTN 56583/WID 23228)* and *Well Site 17, (WID 23229)* which were monitored prior to, during and after the pumping tests.

During the pumping test (Test 2) drawdown in the pumped well (Figure 5) reached a level of 20.505 m below the pre-pumping level of 13.290 m, utilizing 86.7 percent of the available drawdown of 23.65 m to the major water-bearing fracture at a depth of 36.58 m (120 feet). Specific capacity at the end of the test of was 0.3936 L/min per meter. As the drawdown showed no evidence of stabilization at the pumping rate of 8.07 L/min it is evident that the well would not be able to sustain this rate for a period of 100 days without recharge. Reducing the pumping rate by 50% to 4.035 L/min as shown in Figure 5 would result in the drawdown reaching the main water-producing fracture after 100 days of pumping. Applying a 70% safety factor (i.e. utilizing only 70 percent of the

available drawdown in the well) would indicate a potential long-term well yield of 2.826 L/min (4069 L/day). This calculated yield is 43% more than the estimated water supply requirements of 2839 L/day and would amount to a total potential supply of 1.49 million litres/year. Water level in the well recovered to within 95% of the pre-pumping level after 1000 minutes following pump shutdown. The recovery graph (Figure 2, Appendix B) indicates that the well would fully recover within a reasonable time.

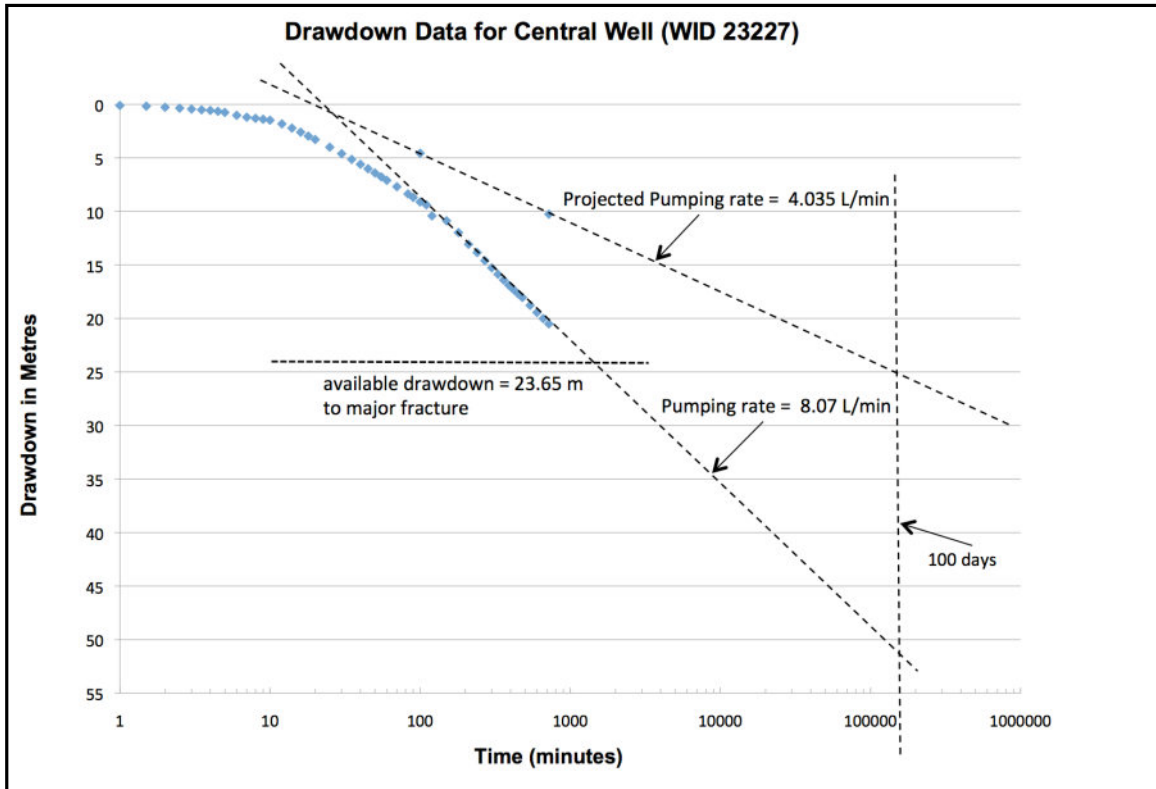


Figure 5. Drawdown in the central well observed during pumping at 8.07 L/min and projected drawdown at a pumping rate of 4.035 L/min.

No discernable pumping effects were observed in the two observation wells monitored during the October 5 pumping test as water levels were rising slightly in these wells at the time (Figures 6 and 7). Similarly, well site 17 showed a rising trend during the October 6 pumping test while well site 5 showed a slight declining trend, dropping less than 5 cm during the test. This minor decline was likely due mainly to tidal effects. Both wells show daily water level changes that range from 3 to 7 cm due to tidal effects. During the period September 23 to October 7, the water level in well site 17 showed an overall downward trend falling about 15 cm. During the same period the water level in well site 5 showed an initial rising trend over 3 days, followed by a declining trend for 6 days and then rising again for 5 days before declining again. Total water level variation was about 20 cm. The longer term variations shown at well site 5 suggest some pumping effects of a nearby well, likely down-slope, but these effects are not due to any pumping of the central well. The above data indicates that pumping the central well at a rate of 1.972 L/min (2839 L/day) would have no measureable effect on any of the neighbouring wells or surface water sources in the region.

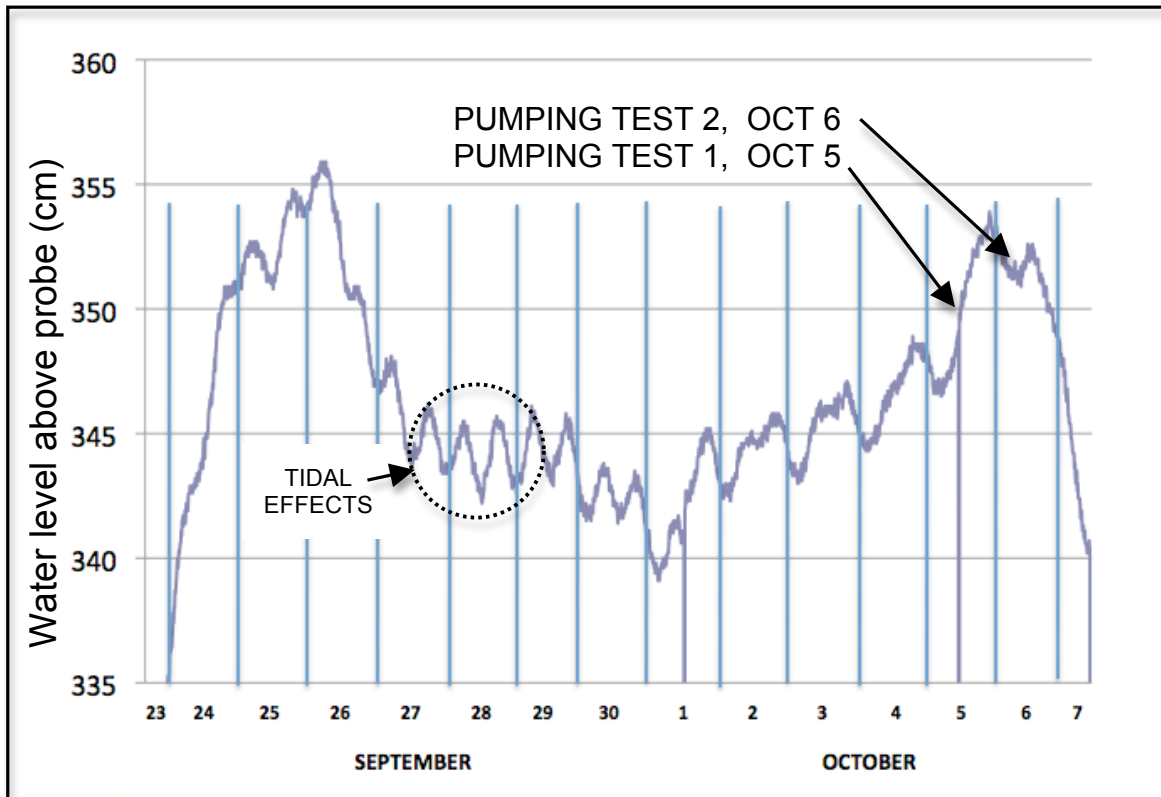


Figure 6. Water levels in observation well site 5, (WTN 56583/WID 23228).

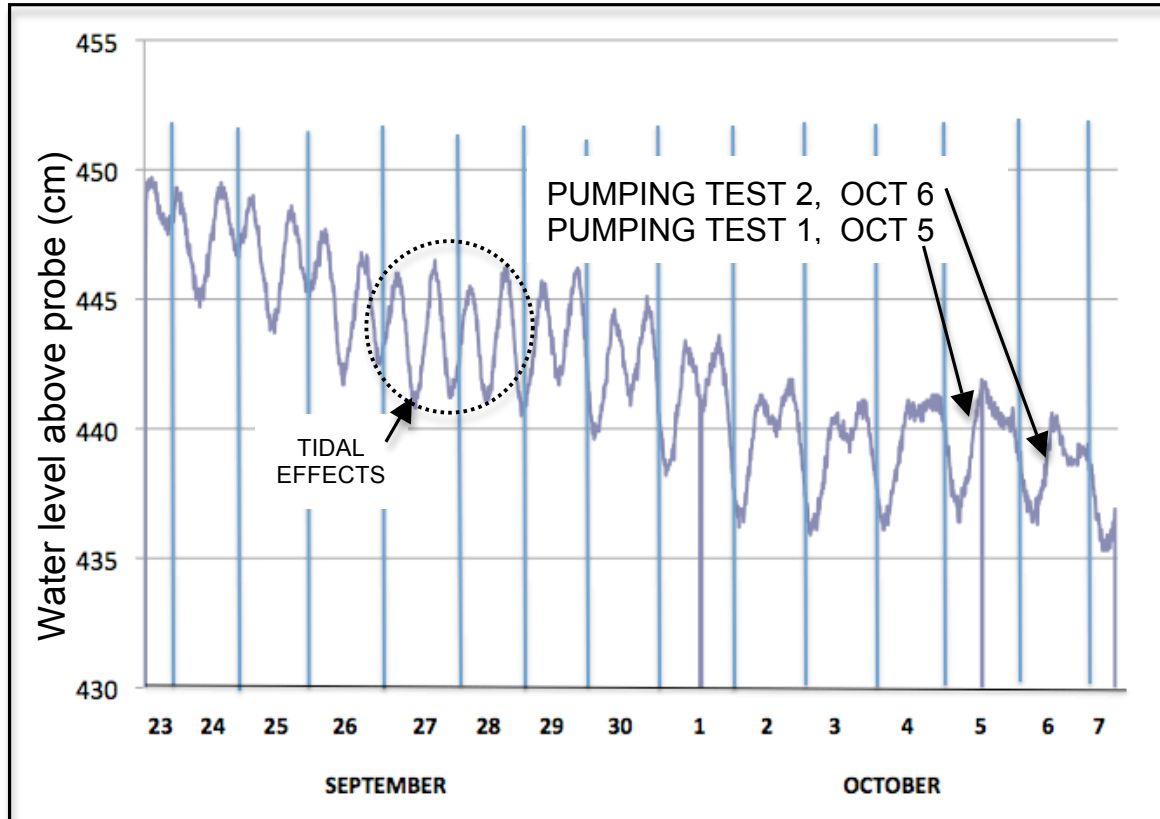


Figure 7. Water levels in observation well site 17, (WID 23229).

WATER QUALITY RESULTS

Based on the laboratory results of the October 6, 2015 samples (Table 4) the water quality of the central well (WID 23227) met or exceeded the *Guidelines for Canadian Drinking Water* (Federal-Provincial-Territorial Committee on Drinking Water, 2015) for all parameters tested except for total coliforms at 11 CFU/100mL. No E.coli was detected. Previous bacteriological reports for samples taken from a tap at the kitchen showed elevated coliforms of 142, 23 and 4.8 MPN/100mL in September 2015, June and August 2014 respectively, indicating that presence of coliforms may be problematic.

Red Williams subsequently acidized and chlorinated the well on October 26 and 27, 2015. The well was then pumped to remove several well volumes and resampled on October 28, 2015 for bacteriological analysis. Two samples were delivered to Maxxam Analytics laboratory in Saanich within 24 hours of sampling. Results of this last sampling showed totals coliforms of 3 and 1 CFU/100ml with E. Coli in both samples at <1 CFU/ml. A copy of the analytical laboratory report from Maxxam Analytics is provided in Appendix C. Table 5 summarizes the results of the recent bacteriological testing for the central well (WID 23227). The periodic source of the coliforms is not known and could be due to grey water discharge in the vicinity of the well and/or natural sources such as decaying vegetation in nearby wetland areas.

Based on the most recent chemical and physical tests (Table 4), the groundwater accessed by the central well can be classified as a calcium-magnesium-bicarbonate type, low in overall mineralization with total dissolved solids of 265 mg/L. Low mineralization may indicate that the well is situated close to a local groundwater recharge area. A previous analysis in May 2001, showed elevated iron and manganese levels above the *Guidelines for Canadian Drinking Water*. These elevated levels for these parameters do not appear in the most recent testing.

Table 4. Summary of water quality analyses.									
Parameters/Site and Sampling Date	WID 23277 pumped well sample	WID 23277 pumped well sample	WID 23277 (tap sample)	WID 23277 (tap sample)	WID 23277 (tap sample)	WID 23277 (tap sample)	WID 23277 (tap sample)	Canadian DW Guideline 2014	Units
	Oct 6/15	Oct 28/15	Sept 26/15	Jul 09/13	Jun 08/14	Aug 04/14	May 13/01		
PHYSICAL TESTS									
True Colour	<5.0						5	15	TCU
Conductivity	420						304		µS/cm
Total Hardness (CaCO ₃)	131						51		mg/L
pH	8.23						6.91	6.5-8.5	pH units
Total Dissolved solids (TDS)	265						209	500	mg/L
Turbidity	1.7						52.0		
DISSOLVED ANIONS									
Alkalinity (Total as CaCO ₃)	198						154		mg/L
Alkalinity (PP as CaCO ₃)	<0.50								
Bicarbonate	241								mg/L
Carbonate	<0.50								mg/L
Hydroxide	<0.50								mg/L
Chloride	12.1						7.8	250	mg/L
Fluoride	0.193						0.22	1.5	mg/L
Nitrate (N)	<0.010						0.33	10	mg/L
Nitrite (N)	<0.010						0.005	1	mg/L
Sulphate	14.7						11.3	500	mg/L
TOTAL METALS									
Aluminum	55.5							100	µg/L
Antimony	<0.50							6	µg/L
Arsenic	3.04							10	µg/L
Barium	2.9							1000	µg/L
Beryllium	<0.10								
Bismuth	<1.0								
Boron	84							5000	µg/L
Cadmium	<0.010							5	µg/L
Chromium	<1.0							50	µg/L
Cobalt	<0.50								µg/L
Copper	9.16							1000	µg/L
Iron	79.3						4140	300	µg/L
Lead	0.6							10	µg/L
Manganese	14.2						93	50	µg/L
Mercury	<0.010							1	µg/L
Molybdenum	<1.0								µg/L
Nickel	<1.0								µg/L
Selenium	<0.10							50	µg/L
Silicon	12400						15800		µg/L
Silver	<0.020								µg/L
Strontium	109								µg/L
Thallium	<0.050								µg/L
Tin	<5.0								µg/L
Titanium	<5.0								
Uranium	0.29							20	µg/L
Vanadium	<5.0								µg/L
Zinc	9.1							5000	µg/L
Zirconium	<0.50								
Calcium	29.2						16.2		mg/L
Magnesium	14.0						5.72		mg/L
Potassium	0.310						1.47		mg/L
Sodium	43.4						47.4	200	mg/L
Sulphur	4.0								mg/L
MICROBIOLOGICAL									
Total Coliforms	11	3, 1	142*, <1	0	23	4.8	<1	<1	CFU/100 mL
Escherichia Coli (E.Coli)	<1	<1, <1	<1		<1	<1		<1	CFU/100 mL
Fecal Coliforms			<1	0			<1	<1	CFU/100 mL
Red font indicates exceedances. * before chlorinating well									

Table 5. Summary of bacteriological sampling of central well (WID 23227).

Sampling Date	E. coli (CPU/100ml)	Total Coliforms (CPU/100ml)	Comments
September 26, 2015	<1	142	kitchen tap before chlorination
September 26, 2015	<1	<1	kitchen tap after well chlorination
October 6, 2015	<1	11	after pumping
October 28, 2015	<1, <1	3, 1	after well acidizing, chlorination and pumping

CONCLUSIONS

1. The maximum daily requirements or maximum day demand (MDD) that would likely occur at the retreat centre is estimated at 2839 liters/day or 625 Imperial gallons day which would serve a maximum of 30 persons accommodated on site.
2. There are three bedrock wells on the retreat centre properties. Two of the wells are not currently being used. A central well, designated (WID 23227) that currently supplies the retreat centre was pump tested on October 6, 2015 for 12 hours at a constant rate of 8.07 L/min. The other wells on the property were used as observation wells during the test. Based on the results of this testing the potential long-term well yield of the well is estimated at 2.826 L/min (4069 L/day) with a 70% safety factor. This calculated yield exceeds the estimated water supply requirements of 2839 L/day by 43%.
3. No discernable pumping effects were observed in the two observation wells monitored during the October testing. Based on these monitoring results use of the central well at a rate of 1.972 L/min (2839 L/day) would have no measureable effect on any of the neighbouring wells or surface water sources in the region.
4. Water quality testing of the central well (WID 23227) indicates that the water meets or exceeds *Guidelines for Canadian Drinking Water* (Federal-Provincial-Territorial Committee on Drinking Water, 2015) for all parameters tested except for total coliforms. Total coliforms of 3 and 1 CFU/100mL were reported for two samples after chlorination of the well. No E.coli was detected. The source of the coliforms is not known and could be due to grey water discharge in the vicinity of the well and /or natural sources such as decaying vegetation in nearby wetland areas. Previous occurrences of coliform bacteria have been effectively reduced by well chlorination.

5. Based on the most recent chemical and physical testing, the groundwater accessed by the central well can be classified as a calcium-magnesium-bicarbonate type, low in overall mineralization with total dissolved solids of 265 mg/L. Low mineralization may indicate that the well is situated close to a local groundwater recharge area.

RECOMMENDATIONS

The following recommendations are provided for consideration.

1. All potential sources of contamination in the vicinity of the central well such as grey water discharge from the kitchen, the existing outdoor shower and the outhouse (pit latrine) should be removed and any remaining excavation filled in with clean fill, such as sand and gravel, glacial till or clay, with no boulders.
2. When put into operation for the new facilities, the central well (*WID 23227*) should be equipped with a totalizing flow meter and records should be kept of the total amount of water produced each month. These records should also be reviewed on an annual basis to ensure that no excessive water demands are being placed on the well.
3. The other two wells at the centre should be retained as observation wells and water levels in these wells taken and compiled on a minimum monthly basis. Wells that are no longer being used, for example, would need to be deactivated or closed in compliance with the *Ground Water Protection Regulation* (Ministry of Environment, 2015c). This would require filling the well with clean materials such as sand, clay and an effective sealant.
4. As a precautionary measure against any future potential sources of coliform bacteria, water from the existing well source should be treated with an appropriately designed and maintained ultraviolet irradiation (UV) or chlorination treatment system.
5. Water quality from the well should be monitored for bacteria and chemical quality on a regular basis (minimum of once a year) and as directed by the local health authority to detect any changes that might occur with time that may require additional treatment.

CLOSURE

This report was prepared in accordance with generally accepted engineering, hydrogeological and consulting practices. It is intended for the prime use of Crystal Mountain Society, in connection with its purpose as outlined under the scope of work for this project. This report is based on data and information available to the author from various sources at the time of its preparation and the

findings of this report may therefore be subject to revision. Data and information supplied by others has not been independently confirmed or verified to be correct or accurate in all cases. Any errors, omissions or issues requiring clarification should be brought to the attention of the author. The author retains full copyright of the material contained in the report. The author and Hy-Geo Consulting accepts no responsibility for damages suffered by any third party as a result of any unauthorized use of this report.

Respectfully submitted:



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Senior Hydrogeologist

Hy-Geo Consulting

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APPENDIX A

Water Well Records, Crystal Mountain Properties

005

PAGE 1

P.001

Well Site 17, (WID 23229)

11/20/98 15:30 FAX 1 250 539 2097

WINDERMERE GALIA

006

08/25 '98 14:15

ID:LANIERFAX3800

FAX:

PAGE 2



Province of British Columbia

BC Environment

Water Management Division

WATER WELL RECORD

Date 08/18/98

NTS MAP

WELL No.

ELEV

Location Accuracy

Owners Name & Address Fibermax Timber Corp. c/o W.H. Stobart, P.O. Box 219, Station E, V10B 2M1

Descriptive Location Portler Pass Road Well #2

1. TYPE OF WORK 1 ☒ New Well 2 ☐ Reconditioned 3 ☐ Deepened 4 ☐ Abandoned

2. WORK METHOD 1 ☐ Cable tool 2 ☐ Bored 3 ☐ Jetted 4 ☒ Rotary a ☐ Mud b ☒ Air c ☐ Reverse

3. WATER WELL USE 1 ☒ Domestic 2 ☐ Municipal 3 ☐ Irrigation 4 ☐ Comm. & Ind. 5 ☐ Other

4. DRILLING ADDITIVES

5. MEASUREMENTS from 1 ☒ ground level 2 ☐ top of casing casing height above ground level 12.1 ft

FROM	TO	6. WELL LOG DESCRIPTION	SWL
0	4	Brown gravelly soil	
4	12	Brown crumbly sandstone	
12	14	Grey sandstone	
14	17	Brown crumbly sandstone	
17	42	Grey sandstone	
42	45	Brown crumbly sandstone	
45	50	Grey sandstone	
50	53	Shale sandstone	
53	125	Grey sandstone	

Water source

1 gpm @ 100 ft

4 gpm @ 120 ft

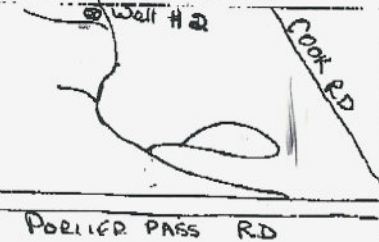
Total yield 5 gpm

One 125 ft 4" PVC liner installed also 135 ft 3/8" safety rope

7. CONSULTANT

Address

8. WELL LOCATION SKETCH



Portler Pass Road

9. CASING Materials 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Wood 4 ☐ Plastic 5 ☐ Concrete 6 ☐ Other

Diameter	from	to	Thickness	Weight	units
6	12	12	1/8		ins
					ft
					ins
					lb/ft

Piercing units 1 ☐ ft 1 ☐ above 2 ☐ below ground level 1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded 4 ☐ New 5 ☐ Used

Perforations: Shoe(s) No Open hole from 19.2' to 125' ft Diameter 6' Ins Grout:

10. SCREEN: 1 ☐ Nominal (Telescope) 2 ☐ Pipe Size Type 1 ☐ Continuous Slot 2 ☐ Perforated 3 ☐ Louvre 4 ☐ Other

Material 1 ☐ Stainless Steel 2 ☐ Plastic 3 ☐ Other Set from 10' to 125' ft below ground level

Length	Diam. ID	Slot Size	from	to	units
					ft
					ins
					ins
					ft

Fittings, top Gravel Pack bottom

11. DEVELOPED BY: 1 ☐ Surging 2 ☐ Jetting 3 ☐ Air 4 ☐ Bailing 5 ☐ Pumping 6 ☐ Other

12. TEST 1 ☐ Pump 2 ☐ Ball 3 ☐ Air Date 10/10/98 Rate 1 USgpm Temp 10 C SWL before test 125 ft Water Level 125 ft after test of 125 hrs

DRAWDOWN in ft				RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13. RECOMMENDED PUMP TYPE RECOMMENDED PUMP SIZE (hp) RECOMMENDED PUMP RATE USgpm

14. WATER TYPE: 1 ☒ Fresh 2 ☐ Salty 3 ☐ Clear 4 ☐ Cloudy colour small 1 ☐ yes 2 ☐ no

15. WATER ANALYSIS: 1 Hardness 100 mg/L 2 Iron 1 mg/L 3 Chloride 100 mg/L 4 pH 7.0 Field Date 10/10/98 Lab Date 10/10/98

SITE ID No

16. FINAL WELL COMPLETION DATA

Well Depth 125 ft Well Yield 5 USgpm Static Water Level 125 ft Pressure Head 125 ft Back filled Rock chip slurry Well Head Completion

17. DRILLER NEFFERIS

Signature Address 248-5552 980 PRATT ROAD 539-5339 QUALICUM BEACH, BC, V9K 1W5

18. CONTRACTOR RED WILLIAMS WELL DRILLING LTD

Member, BCWDA Yes

08/25/98 13:11

TX/RX NO.7715

P.002



Report 1 - Detailed Well Record

Well Tag Number: 56583	Construction Date: 1986-09-30 00:00:00
Owner: CRYSTAL MOUNTAIN ENT	Driller: Island Well Drilling
Address: DIVINA DRIVE	Well Identification Plate Number:
Area:	Plate Attached By:
WELL LOCATION:	Where Plate Attached:
COWICHAN Land District	PRODUCTION DATA AT TIME OF DRILLING:
District Lot: 90 Plan: 31200 Lot: 9	Well Yield: 6 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
Township: Section: Range:	Development Method:
Indian Reserve: Meridian: Block:	Pump Test Info Flag:
Quarter:	Artesian Flow:
Island: GALIANO	Artesian Pressure (ft):
BCGS Number (NAD 83): 092B093332 Well: 20	Static Level: 55 feet
Class of Well:	WATER QUALITY:
Subclass of Well:	Character:
Orientation of Well:	Colour:
Status of Well: New	Odour:
Licence General Status: UNLICENSED	Well Disinfected: N
Well Use: Private Domestic	EMS ID:
Observation Well Number:	Water Chemistry Info Flag:
Observation Well Status:	Field Chemistry Info Flag:
Construction Method: Drilled	Site Info (SEAM):
Diameter: 6.0 inches	Water Utility:
Casing drive shoe:	Water Supply System Name:
Well Depth: 280 feet	Water Supply System Well Name:
Elevation: 0 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Bedrock Depth: 9 feet	Method:
	Depth (ft):

Lithology Info Flag:	Thickness (in):
File Info Flag:	
Sieve Info Flag:	WELL CLOSURE INFORMATION:
Screen Info Flag:	Reason For Closure:
	Method of Closure:
Site Info Details:	Closure Sealant Material:
Other Info Flag:	Closure Backfill Material:
Other Info Details:	Details of Closure:

Screen from	to feet	Type	Slot Size	
Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From	0 to	9 Ft.	STONEY BROWN CLAY
From	9 to	11 Ft.	BROWN SANDSTONE
From	11 to	28 Ft.	GRAY SANDSTONE WITH BROWN SANDSTONE LENS
From	28 to	36 Ft.	GRAY SANDSTONE
From	36 to	48 Ft.	SHALEY SANDSTONE
From	48 to	125 Ft.	GRAY SANDSTONE WITH SHALEY SANDSTONE LEN
From	125 to	130 Ft.	SHALEY SANDSTONE
From	130 to	136 Ft.	VERY SHALEY SANDSTONE
From	136 to	142 Ft.	GRAY SANDSTONE
From	142 to	200 Ft.	GREY SANDSTONE WITH SHALEY SANDSTONE LEN
From	200 to	245 Ft.	GREY SANDSTONE
From	245 to	280 Ft.	GRAY SANDSTONE WITH SHALEY SANDSTONE LEN

Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

APPENDIX B

PUMPING TEST RESULTS

Pumping Test Data for Central Well (WID 23227)

Project: Crystal Mountain Retreat Centre
Client: as above]
Location: Galiano Island
Date of Test: 06-Oct-15
Test Conducted by: Red Williams Well Drilling
Pumped Well: WID 23277
Pumping Rate: 8.07 L/min (0.135L/s)
Static Water Level: 13.290 m.

Reference: all readings from top of sounding tube
Stick up: 36 cm
Observation Wells: WID 23228 and WID 23229
Pump Start Time: 9:00 AM
Pump End Time: 9:00 PM
Analysis by: A. Kohut, P.Eng.

Drawdown Data:

Recovery Data:

Time (minutes)	Water Level (metres)	Drawdown (metres)	Time t (minutes)	Time t' (minutes)	Water Level (metres)	t/t'	Residual Drawdown (metres)
0.5	13.34	0.05	720.5	0.5	33.560	1441.0	20.27
1	13.39	0.1	721	1	33.349	721.0	20.06
1.5	13.453	0.163	721.5	1.5	33.130	481.0	19.84
2	13.558	0.268	722	2	32.914	361.0	19.62
2.5	13.641	0.351	722.5	2.5	32.720	289.0	19.43
3	13.726	0.436	723	3	32.520	241.0	19.23
3.5	13.798	0.508	723.5	3.5	32.320	206.7	19.03
4	13.852	0.562	724	4	32.160	181.0	18.87
4.5	13.93	0.64	724.5	4.5	31.920	161.0	18.63
5	14.036	0.746	725	5	31.740	145.0	18.45
6	14.31	1.02	726	6	31.380	121.0	18.09
7	14.485	1.195	727	7	31.050	103.9	17.76
8	14.59	1.3	728	8	30.720	91.0	17.43
9	14.675	1.385	729	9	30.403	81.0	17.11
10	14.763	1.473	730	10	30.098	73.0	16.81
12	15.108	1.818	732	12	29.506	61.0	16.22
14	15.503	2.213	734	14	28.960	52.4	15.67
16	15.884	2.594	736	16	28.452	46.0	15.16
18	16.245	2.955	738	18	27.967	41.0	14.68
20	16.57	3.28	740	20	27.518	37.0	14.23
25	17.287	3.997	745	25	26.448	29.8	13.16
30	17.89	4.6	750	30	25.783	25.0	12.49
35	18.422	5.132	755	35	24.622	21.6	11.33
40	18.884	5.594	760	40	23.878	19.0	10.59
45	19.3	6.01	765	45	23.317	17.0	10.03
50	19.69	6.4	770	50	22.670	15.4	9.38
55	20.051	6.761	775	55	22.235	14.1	8.94
60	20.383	7.093	780	60	21.776	13.0	8.49
70	20.977	7.687	790	70	21.045	11.3	7.75
83	21.652	8.362	800	80	20.467	10.0	7.18
90	21.979	8.689	810	90	19.985	9.0	6.69
100	22.405	9.115	820	100	19.57	8.2	6.28
110	22.673	9.383	830	110	19.21	7.5	5.92
120	23.7	10.41	840	120	18.895	7.0	5.60
150	24.164	10.874	870	150	18.113	5.8	4.82
180	25.262	11.972	900	180	17.526	5.0	4.24

Time (minutes)	Water Level (metres)	Drawdown (metres)	Time t (minutes)	Time t' (minutes)	Water Level (metres)	t/t'	Residual Drawdown (metres)
210	26.357	13.067	950	230	16.749	4.1	3.46
240	27.133	13.843	1000	280	16.204	3.6	2.91
270	27.885	14.595	1050	330	15.784	3.2	2.49
300	28.56	15.27	1100	380	15.444	2.9	2.15
330	29.158	15.868	1200	480	14.96	2.5	1.67
360	29.697	16.407	1300	580	14.664	2.2	1.37
390	30.182	16.892	1400	680	14.442	2.1	1.15
420	30.603	17.313	1500	780	14.217	1.9	0.93
450	30.99	17.7	1600	880	14.085	1.8	0.79
480	31.328	18.038	1670	950	14.006	1.8	0.72
540	32.063	18.773	1720	1000	13.958	1.7	0.67
600	32.73	19.44					
660	33.299	20.009					
720	33.795	20.505					

Note: Data in red font from transducer.

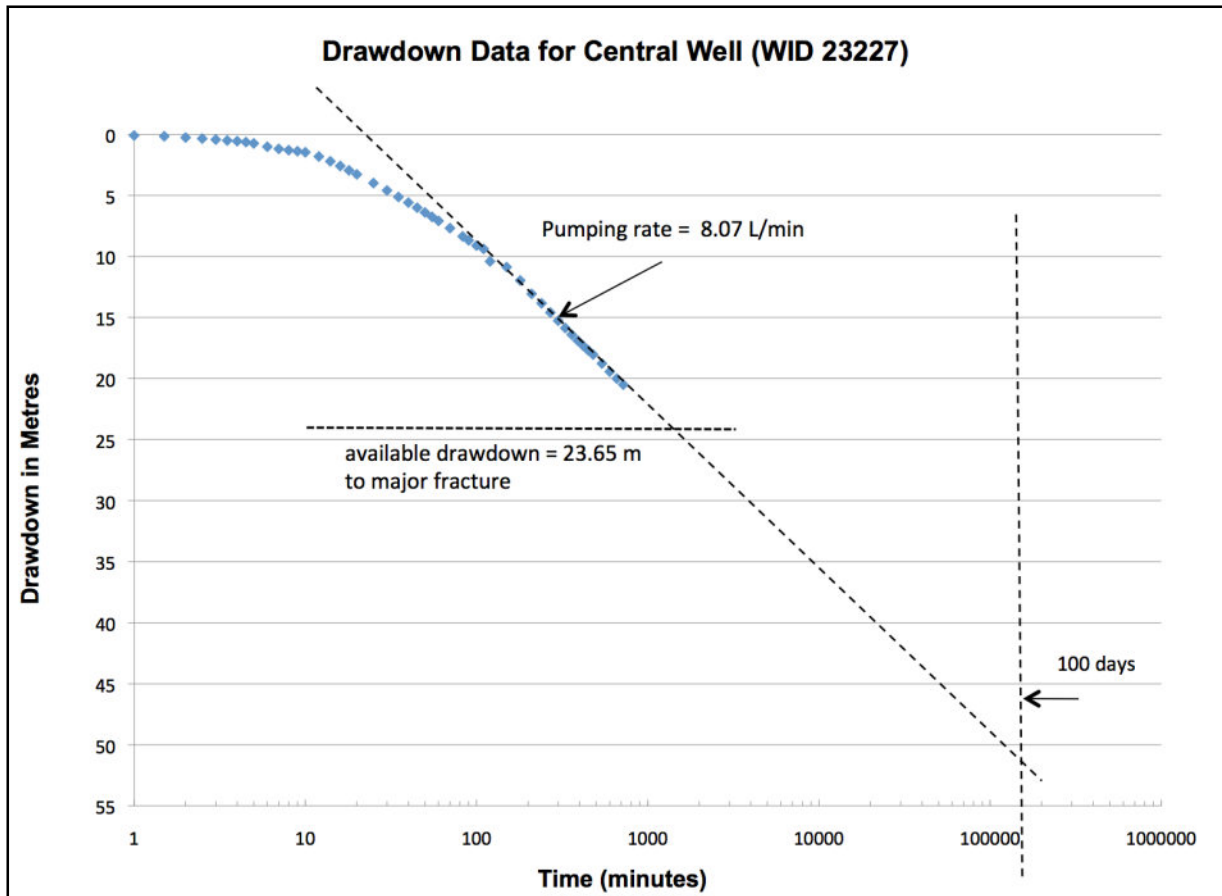


Figure 1. Drawdown graph for central well, pumped October 6, 2015.

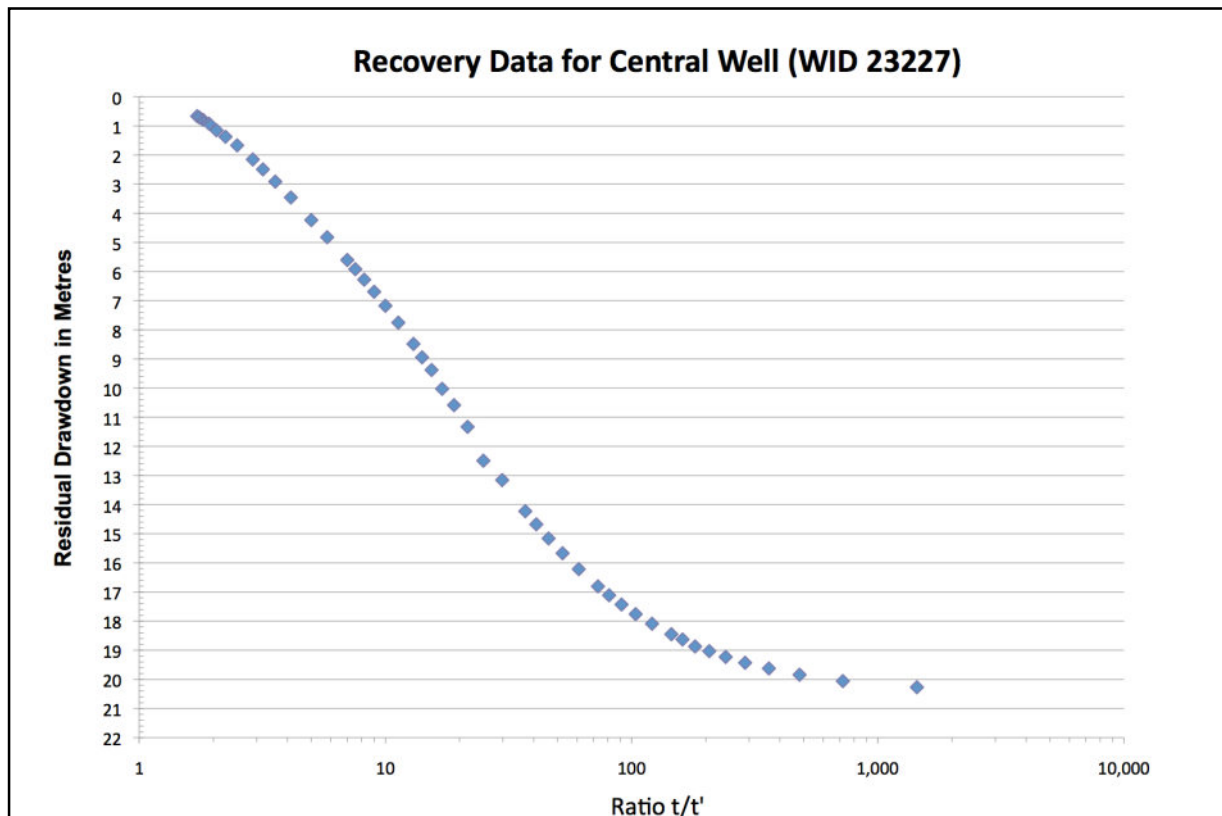


Figure 2. Recovery graph for central well, pumped October 6, 2015.

APPENDIX C

Water Quality Analyses

Your C.O.C. #: WI000401

Attention: Al Kohut

Hy-Geo Consulting
1041 Laburnum Rd
Victoria, BC
Canada V8Z 2M9

Report Date: 2015/10/20

Report #: R2061237

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B588378

Received: 2015/10/07, 11:06

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2015/10/17	2015/10/17	BBY6SOP-00026	SM 22 2320 B m
Anions in Water by Ion Chromatography (1, 2)	1	N/A	2015/10/07	VIC SOP-00020	Based on SM-4110B
True Colour (Single Wavelength) (1)	1	N/A	2015/10/09	VIC SOP-00010	Based on SM-2120 C
Conductance - water	1	N/A	2015/10/17	BBY6SOP-00026	SM 22 2510 B m
Hardness Total (calculated as CaCO ₃)	1	N/A	2015/10/20	BBY7SOP-00002	EPA 6020a R1 m
Mercury (Total) by CVAf	1	2015/10/16	2015/10/18	BBY7SOP-00015	BCMOE BCLM Oct2013 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	1	N/A	2015/10/20	BBY7SOP-00002	EPA 6020A R1 m
Elements by CRC ICPMS (total)	1	N/A	2015/10/20	BBY7SOP-00002	EPA 6020A R1 m
Nitrate + Nitrite (N) (calculated) (1)	1	N/A	2015/10/16	VIC-SOP-00005	Based SM-4500 NO ₂ E
pH Water (3)	1	N/A	2015/10/17	BBY6SOP-00026	SM 22 4500-H+ B m
Total Dissolved Solids (Filt. Residue) (1)	1	N/A	2015/10/15	VIC SOP-00008	Based on SM 2540C
Total coliform and E. by MF (Chromocult) (1)	1	N/A	2015/10/07	VIC SOP 00112	Based on SM-9222
Turbidity (1)	1	N/A	2015/10/09	VIC SOP-00011	Based on SM - 2130

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Victoria

(2) Anions in Water by Ion Chromatography: The samples were received and analyzed in Maxxam Victoria. The data was processed and approved in Maxxam Burnaby.

(3) The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Debbie Nordbruket, Project Manager

Email: DNordbruket@maxxam.ca

Phone# (250)385-6112

=====

This report has been generated and distributed using a secure automated process.

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B588378
Report Date: 2015/10/20

Hy-Geo Consulting

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID					NI0755		
Sampling Date					2015/10/06 16:25		
COC Number					WI000401		
	UNITS	MAC	AO	OG	WID 23227	RDL	QC Batch
CONVENTIONALS							
Dissolved Nitrate (N)	mg/L	10	-	-	<0.010	0.010	8065824
Dissolved Nitrite (N)	mg/L	1	-	-	<0.010	0.010	8065824
Misc. Inorganics							
Dissolved Chloride (Cl)	mg/L	-	250	-	12.1	0.50	8065824
Dissolved Fluoride (F)	mg/L	1.5	-	-	0.193	0.010	8065824
Dissolved Sulphate (SO ₄)	mg/L	-	500	-	14.7	0.50	8065824
Alkalinity (Total as CaCO ₃)	mg/L	-	-	-	198	0.50	8078038
Alkalinity (PP as CaCO ₃)	mg/L	-	-	-	<0.50	0.50	8078038
Bicarbonate (HCO ₃)	mg/L	-	-	-	241	0.50	8078038
Carbonate (CO ₃)	mg/L	-	-	-	<0.50	0.50	8078038
Hydroxide (OH)	mg/L	-	-	-	<0.50	0.50	8078038
MISCELLANEOUS							
True Colour	Col. Unit	-	15	-	<5	5	8073503
Nutrients							
Nitrate plus Nitrite (N)	mg/L	-	-	-	<0.010	0.010	8069236
Physical Properties							
Conductivity	uS/cm	-	-	-	420	1.0	8078041
pH	pH	-	6.5:8.5	-	8.23	N/A	8078042
Physical Properties							
Total Dissolved Solids	mg/L	-	500	-	265	10	8075415
Turbidity	NTU	see remark	see remark	see remark	1.7	0.1	8072031
RDL = Reportable Detection Limit N/A = Not Applicable							

Maxxam Job #: B588378
Report Date: 2015/10/20

Hy-Geo Consulting

MICROBIOLOGY (WATER)

Maxxam ID			NI0755		
Sampling Date			2015/10/06 16:25		
COC Number			WI000401		
	UNITS	MAC	WID 23227	RDL	QC Batch
Microbiological Param.					
Total Coliforms	CFU/100mL	1	11	1	8073379
E. coli	CFU/100mL	1	<1	1	8073379
RDL = Reportable Detection Limit					

Maxxam Job #: B588378
Report Date: 2015/10/20

Hy-Geo Consulting

TOT. METALS W/ CV HG FOR DRINKING WATER (WATER)

Maxxam ID					NI0755		
Sampling Date					2015/10/06 16:25		
COC Number					WI000401		
	UNITS	MAC	AO	OG	WID 23227	RDL	QC Batch
Calculated Parameters							
Total Hardness (CaCO ₃)	mg/L	-	-	-	131	0.50	8068356
Elements							
Total Mercury (Hg)	ug/L	1	-	-	<0.010	0.010	8076829
Total Metals by ICPMS							
Total Aluminum (Al)	ug/L	-	-	100	55.5	3.0	8080659
Total Antimony (Sb)	ug/L	6	-	-	<0.50	0.50	8080659
Total Arsenic (As)	ug/L	10	-	-	3.04	0.10	8080659
Total Barium (Ba)	ug/L	1000	-	-	2.9	1.0	8080659
Total Beryllium (Be)	ug/L	-	-	-	<0.10	0.10	8080659
Total Bismuth (Bi)	ug/L	-	-	-	<1.0	1.0	8080659
Total Boron (B)	ug/L	5000	-	-	84	50	8080659
Total Cadmium (Cd)	ug/L	5	-	-	<0.010	0.010	8080659
Total Chromium (Cr)	ug/L	50	-	-	<1.0	1.0	8080659
Total Cobalt (Co)	ug/L	-	-	-	<0.50	0.50	8080659
Total Copper (Cu)	ug/L	-	1000	-	9.16	0.20	8080659
Total Iron (Fe)	ug/L	-	300	-	79.3	5.0	8080659
Total Lead (Pb)	ug/L	10	-	-	0.60	0.20	8080659
Total Manganese (Mn)	ug/L	-	50	-	14.2	1.0	8080659
Total Molybdenum (Mo)	ug/L	-	-	-	<1.0	1.0	8080659
Total Nickel (Ni)	ug/L	-	-	-	<1.0	1.0	8080659
Total Selenium (Se)	ug/L	50	-	-	<0.10	0.10	8080659
Total Silicon (Si)	ug/L	-	-	-	12400	100	8080659
Total Silver (Ag)	ug/L	-	-	-	<0.020	0.020	8080659
Total Strontium (Sr)	ug/L	-	-	-	109	1.0	8080659
Total Thallium (Tl)	ug/L	-	-	-	<0.050	0.050	8080659
Total Tin (Sn)	ug/L	-	-	-	<5.0	5.0	8080659
Total Titanium (Ti)	ug/L	-	-	-	<5.0	5.0	8080659
Total Uranium (U)	ug/L	20	-	-	0.29	0.10	8080659
Total Vanadium (V)	ug/L	-	-	-	<5.0	5.0	8080659
Total Zinc (Zn)	ug/L	-	5000	-	9.1	5.0	8080659
Total Zirconium (Zr)	ug/L	-	-	-	<0.50	0.50	8080659
Total Calcium (Ca)	mg/L	-	-	-	29.2	0.050	8069234
Total Magnesium (Mg)	mg/L	-	-	-	14.0	0.050	8069234
Total Potassium (K)	mg/L	-	-	-	0.310	0.050	8069234
Total Sodium (Na)	mg/L	-	200	-	43.4	0.050	8069234
Total Sulphur (S)	mg/L	-	-	-	4.0	3.0	8069234
RDL = Reportable Detection Limit							

Maxxam Job #: B588378
Report Date: 2015/10/20

Hy-Geo Consulting

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	8.3°C
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MAC,AO,OG: The guidelines that have been included in this report have been taken from the Canadian Drinking Water Quality Summary Table, October 2014.

Criteria A = Maximum Acceptable Concentration (MAC) / Criteria B = Aesthetic Objectives (AO) / Criteria C = Operational Guidance Values (OG)
It is recommended to consult these guidelines when interpreting your data since there are non-numerical guidelines that are not included on this report.

Turbidity Guidelines:

1. Chemically assisted filtration: less than or equal to 0.3 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 1.0 NTU at any time.
2. Slow sand / diatomaceous earth filtration: less than or equal to 1.0 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 3.0 NTU at any time.
3. Membrane filtration: less than or equal to 0.1 NTU in 99% of the measurements made or at least 99% of the time each calendar month. Shall not exceed 0.3 NTU at any time.

Results relate only to the items tested.

Maxxam Job #: B588378
Report Date: 2015/10/20

QUALITY ASSURANCE REPORT

Hy-Geo Consulting

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8065824	Dissolved Chloride (Cl)	2015/10/07	NC	80 - 120	106	80 - 120	<0.50	mg/L		
8065824	Dissolved Fluoride (F)	2015/10/07	109	80 - 120	109	80 - 120	<0.010	mg/L	NC	20
8065824	Dissolved Nitrate (N)	2015/10/07	99	80 - 120	109	80 - 120	<0.010	mg/L		
8065824	Dissolved Nitrite (N)	2015/10/07	102	80 - 120	107	80 - 120	<0.010	mg/L		
8065824	Dissolved Sulphate (SO4)	2015/10/07	106	80 - 120	107	80 - 120	<0.50	mg/L		
8072031	Turbidity	2015/10/09			99	80 - 120	<0.1	NTU	0	20
8073503	True Colour	2015/10/09			100	80 - 120	<5	Col. Unit	NC	10
8075415	Total Dissolved Solids	2015/10/15			113	80 - 120	15, RDL=10	mg/L	7.8	20
8076829	Total Mercury (Hg)	2015/10/18	90	80 - 120	93	80 - 120	<0.010	ug/L	NC	20
8078038	Alkalinity (PP as CaCO3)	2015/10/17					<0.50	mg/L	NC	20
8078038	Alkalinity (Total as CaCO3)	2015/10/17	NC	80 - 120	97	80 - 120	<0.50	mg/L	0.58	20
8078038	Bicarbonate (HCO3)	2015/10/17					<0.50	mg/L	0.58	20
8078038	Carbonate (CO3)	2015/10/17					<0.50	mg/L	NC	20
8078038	Hydroxide (OH)	2015/10/17					<0.50	mg/L	NC	20
8078041	Conductivity	2015/10/17			99	80 - 120	<1.0	uS/cm	0.083	20
8078042	pH	2015/10/17			101	97 - 103			0.13	N/A
8080659	Total Aluminum (Al)	2015/10/20	NC	80 - 120	102	80 - 120	<3.0	ug/L		
8080659	Total Antimony (Sb)	2015/10/20	104	80 - 120	98	80 - 120	<0.50	ug/L		
8080659	Total Arsenic (As)	2015/10/20	98	80 - 120	101	80 - 120	<0.10	ug/L		
8080659	Total Barium (Ba)	2015/10/20	98	80 - 120	97	80 - 120	<1.0	ug/L		
8080659	Total Beryllium (Be)	2015/10/20	98	80 - 120	91	80 - 120	<0.10	ug/L		
8080659	Total Bismuth (Bi)	2015/10/20	103	80 - 120	96	80 - 120	<1.0	ug/L		
8080659	Total Boron (B)	2015/10/20					<50	ug/L		
8080659	Total Cadmium (Cd)	2015/10/20	98	80 - 120	94	80 - 120	<0.010	ug/L		
8080659	Total Chromium (Cr)	2015/10/20	95	80 - 120	101	80 - 120	<1.0	ug/L		
8080659	Total Cobalt (Co)	2015/10/20	94	80 - 120	101	80 - 120	<0.50	ug/L		
8080659	Total Copper (Cu)	2015/10/20	NC	80 - 120	102	80 - 120	<0.20	ug/L		
8080659	Total Iron (Fe)	2015/10/20	NC	80 - 120	113	80 - 120	<5.0	ug/L		
8080659	Total Lead (Pb)	2015/10/20	100	80 - 120	96	80 - 120	<0.20	ug/L		
8080659	Total Manganese (Mn)	2015/10/20	NC	80 - 120	102	80 - 120	<1.0	ug/L		
8080659	Total Molybdenum (Mo)	2015/10/20	101	80 - 120	97	80 - 120	<1.0	ug/L		
8080659	Total Nickel (Ni)	2015/10/20	95	80 - 120	102	80 - 120	<1.0	ug/L		

Maxxam Job #: B588378
Report Date: 2015/10/20

QUALITY ASSURANCE REPORT(CONT'D)

Hy-Geo Consulting

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8080659	Total Selenium (Se)	2015/10/20	97	80 - 120	99	80 - 120	<0.10	ug/L		
8080659	Total Silicon (Si)	2015/10/20					<100	ug/L		
8080659	Total Silver (Ag)	2015/10/20	101	80 - 120	97	80 - 120	<0.020	ug/L		
8080659	Total Strontium (Sr)	2015/10/20	NC	80 - 120	94	80 - 120	<1.0	ug/L		
8080659	Total Thallium (Tl)	2015/10/20	91	80 - 120	89	80 - 120	<0.050	ug/L		
8080659	Total Tin (Sn)	2015/10/20	104	80 - 120	94	80 - 120	<5.0	ug/L		
8080659	Total Titanium (Ti)	2015/10/20	87	80 - 120	109	80 - 120	<5.0	ug/L		
8080659	Total Uranium (U)	2015/10/20	104	80 - 120	97	80 - 120	<0.10	ug/L		
8080659	Total Vanadium (V)	2015/10/20	99	80 - 120	98	80 - 120	<5.0	ug/L		
8080659	Total Zinc (Zn)	2015/10/20	NC	80 - 120	106	80 - 120	<5.0	ug/L		
8080659	Total Zirconium (Zr)	2015/10/20					<0.50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam Job #: B588378
Report Date: 2015/10/20

Hy-Geo Consulting

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



David Nadler, AASc, Victoria Operations Manager



Rob Reinert, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your C.O.C. #: V014603

Attention: EILEEN JENNETT

RED WILLIAMS WELL DRILLING LTD.
980 PRATT RD
QUALICUM BEACH, BC
CANADA V9K 1W5

Report Date: 2015/10/30

Report #: R2068261

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B596362

Received: 2015/10/29, 08:00

Sample Matrix: DRINKING WATER
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total coliform and E. by MF (Chromocult) (1)	2	N/A	2015/10/29	VIC SOP 00112	Based on SM-9222

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Victoria

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Debbie Nordbruget, Project Manager

Email: DNordbruget@maxxam.ca

Phone# (250)385-6112

=====

This report has been generated and distributed using a secure automated process.

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B596362
Report Date: 2015/10/30

RED WILLIAMS WELL DRILLING LTD.

MICROBIOLOGY (DRINKING WATER)

Maxxam ID			NN0484	NN0485		
Sampling Date			2015/10/28 18:35	2015/10/28 18:40		
COC Number			V014603	V014603		
	UNITS	MAC	CRYSTAL MNT. #1	NEW WELL #2	RDL	QC Batch
Microbiological Param.						
Total Coliforms	CFU/100mL	<1	3	1	1	8095999
E. coli	CFU/100mL	<1	<1	<1	1	8095999
RDL = Reportable Detection Limit						

Maxxam Job #: B596362
Report Date: 2015/10/30

RED WILLIAMS WELL DRILLING LTD.

GENERAL COMMENTS

MAC: The guidelines that have been included in this report have been taken from the Canadian Drinking Water Quality Summary Table, October 2014.

Criteria A = Maximum Acceptable Concentration (MAC) / Criteria B = Aesthetic Objectives (AO) / Criteria C = Operational Guidance Values (OG)

It is recommended to consult these guidelines when interpreting your data since there are non-numerical guidelines that are not included on this report.

Turbidity Guidelines:

1. Chemically assisted filtration: less than or equal to 0.3 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 1.0 NTU at any time.
2. Slow sand / diatomaceous earth filtration: less than or equal to 1.0 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 3.0 NTU at any time.
3. Membrane filtration: less than or equal to 0.1 NTU in 99% of the measurements made or at least 99% of the time each calendar month. Shall not exceed 0.3 NTU at any time.

Results relate only to the items tested.

Maxxam Job #: B596362
Report Date: 2015/10/30

QUALITY ASSURANCE REPORT

RED WILLIAMS WELL DRILLING LTD.

QC Batch	Parameter	Date	RPD	
			Value (%)	QC Limits
8095999	E. coli	2015/10/29	NC	N/A
8095999	Total Coliforms	2015/10/29	NC	N/A

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam Job #: B596362
Report Date: 2015/10/30

RED WILLIAMS WELL DRILLING LTD.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Rob Reinert, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

REVISED ESTIMATED WATER SUPPLY DEMAND (June 2021)

Proposed two stage development comprised of:

1. A *Primary Retreat Centre* to be serviced by the existing “Central Well”, and
2. A *Long Term Retreat Centre* to be serviced by a future well to be drilled at the upper ridge location.

The Maximum Daily Demand (MDD) requirements for each stage are provided in Table 1 and 2 respectively.

Table 1. Estimated Water Requirements for Primary Retreat Centre

PRIMARY RETREAT CENTRE – Serviced by existing “Central Well”, lower plateau area				
Number of persons Served	Facilities Used	Period	Estimated MDD (litres/day)	Comments
2	Caretaker dwelling	Year round	700	Residential use
14	14 Meditation Huts (no plumbing)	May – Oct (100%) Nov-Apr (10%)	N/A	Sleeping / meditation use only
5	Tent sites	July – Aug (100%)	N/A	Sleeping / meditation use only
19	Main Kitchen, 3 meals/day/person	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	285	Food preparation, dish washing, hand washing station, drinking water and limited toilet use ¹
19	Laundry (located in either kitchen or washroom)	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	428	1 washer / dryer, periodic use ²
19	Shared Central Washroom	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	1083	2 showers ³ , 4 washbasins ⁴ , 2 toilets ⁵
8	Shared Central Washroom and Kitchen for additional day-use persons and teacher	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	120	Food preparation, dish washing, hand washing station, drinking water and limited toilet use ¹
TOTAL			2616	

¹ based on 15 liters/day/person

² based on 45 liters/load and 50 % alternate day use

³ based on 50 liters/person and 50 % of guests with alternate day use

⁴ based on 20 liters/day/person

⁵ based on 12 liters/day/person

Table 2. Estimated Water Requirements for Long Term Retreat Centre

LONG TERM RETREAT AREA – Serviced by future drilled well, upper ridge location				
Number of persons Served	Facilities Used	Period	Estimated MDD (litres/day)	Comments
3	3 Meditation Huts (no plumbing)	Year round	N/A	Sleeping / meditation use only
3	Shared Central Kitchen, 3 meals/day/person	Year round	45	Food preparation, dish washing, hand washing station, drinking water and limited toilet use ¹
3	Shared Central Laundry	Year round	68	1 washer / dryer, periodic use ²
3	Shared Central Washroom	Year round	171	1 showers ³ , 1 washbasin ⁴ , 1 toilet ⁵
TOTAL			284	

¹ based on 15 liters/day/person

² based on 45 liters/load and 50 % alternate day use

³ based on 50 liters/person and 50 % of guests with alternate day use

⁴ based on 20 liters/day/person

⁵ based on 12 liters/day/person

The largest potential use of water on any day would be for the washroom facilities including showers.

Superseded by
June 2021
Water Supply
Demand dated
March 18 2021

File: 1508141

March 18, 2021

Crystal Mountain Society
Galiano Island BC V0N 1P0

Re: Addendum Letter on Estimated Water Supply Demands for Crystal Mountain Rezoning Proposal, 2021

As requested, Hy-Geo Consulting has reviewed the estimated water supply demands for the above proposal on Galiano Island. This letter replaces the previous estimated water supply demands outlined in the 2015 report titled, *Groundwater Assessment Report For Crystal Mountain Retreat Centre, Galiano Island* prepared by Hy-Geo Consulting for the Crystal Mountain Society.

REVISED ESTIMATED WATER SUPPLY DEMAND

The proposed retreat centre development is now being revised to be developed in two stages namely:

1. A *Primary Retreat Centre* to be serviced by the existing "Central Well", and
2. A *Long Term Retreat Centre* to be serviced by a future well to be drilled at the upper ridge location.

The Maximum Daily Demand (MDD) requirements for each stage are provided in Table 1 and 2 respectively.

The largest potential use of water on any day would be for the washroom facilities including showers.

Respectfully submitted,


A.P. Kohut
Mar 18/21

Alan P. Kohut PEng.
Principal and Senior Hydrogeologist

HY-GEO CONSULTING

Table 1. Estimated Water Requirements for Primary Retreat Centre

PRIMARY RETREAT CENTRE – Serviced by existing “Central Well”, lower plateau area				
Number of persons Served	Facilities Used	Period	Estimated MDD (litres/day)	Comments
2	Caretaker dwelling	Year round	700	Residential use
19	19 Meditation Huts (no plumbing)	May – Oct (100%) Nov-Apr (10%)	N/A	Sleeping / meditation use only
8	Tent sites	July – Aug (100%)	N/A	Sleeping / meditation use only
27	Main Kitchen, 3 meals/day/person	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	405	Food preparation, dish washing, hand washing station, drinking water and limited toilet use ¹
27	Laundry (located in either kitchen or washroom)	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	608	1 washer / dryer, periodic use ²
27	Shared Central Washroom	July – Aug (100%) May/June (70%) Sept/Oct (70%) Nov-Apr (10%)	1539	2 showers ³ , 4 washbasins ⁴ , 2 toilets ⁵
TOTAL			3252	

¹ based on 15 liters/day/person

² based on 45 liters/load and 50 % alternate day use

³ based on 50 liters/person and 50 % of guests with alternate day use

⁴ based on 20 liters/day/person

⁵ based on 12 liters/day/person

Table 2. Estimated Water Requirements for Long Term Retreat Centre

LONG TERM RETREAT AREA – Serviced by future drilled well, upper ridge location				
Number of persons Served	Facilities Used	Period	Estimated MDD (litres/day)	Comments
3	3 Meditation Huts (no plumbing)	Year round	N/A	Sleeping / meditation use only
3	Shared Central Kitchen, 3 meals/day/person	Year round	45	Food preparation, dish washing, hand washing station, drinking water and limited toilet use ¹
3	Shared Central Laundry	Year round	68	1 washer / dryer, periodic use ²
3	Shared Central Washroom	Year round	171	1 shower ³ , 1 washbasin ⁴ , 1 toilet ⁵
TOTAL			284	

¹ based on 15 liters/day/person

² based on 45 liters/load and 50 % alternate day use

³ based on 50 liters/person and 50 % of guests with alternate day use

⁴ based on 20 liters/day/person

⁵ based on 12 liters/day/person

File: 1508141

January 20, 2022

Crystal Mountain Society
Galiano Island BC V0N 1P0

Re: Groundwater Level Monitoring, Crystal Mountain Retreat Centre, Observation Well WID 23229 and Central Well WID 23227, Galiano Island

Monitoring Installation

As requested, arrangements were initially made to install a datalogger in the Central Well WID 23227 on September 17, 2021. Due to a blockage of pump wiring near the top of the well it was not possible to safely install the instrument in WID 23227. It was subsequently decided to install the datalogger in Observation Well WID 23229. A sounding tube was eventually installed in the Central Well WID 23227 later that month to enable a datalogger installation.

Observation Well WID 23229

A Diver™ datalogger Serial No. DG945 was installed in the above well on September 17, 2021 by Hy-Geo Consulting. Well WID 23229 is a 6 inch (15.24 cm) diameter bedrock well, that was drilled in 1994 to a depth of 183 feet (55.78 m) and completed in grey sandstone. The recording interval was set at 10 minutes to detect any water level variations from neighbouring pumping wells and tidal effects. The corrected water level in the well at 9:50 am on September 17, 2021 was 18.460 m below ground. A second Diver™ datalogger Serial No. DF612 was also set near the well to record variations in barometric pressure at the same recording interval of 10 minutes synchronized with datalogger Serial No. DG945.

On January 3, 2022 the above dataloggers were retrieved by Keith Erickson at 11:35 am and delivered to Hy-Geo Consulting on January 4 for downloading, data analysis and interpretation. The corrected water level in the well at 11:30 am on January 3, 2022 was 14.773 m below ground.

Central Well WID 23227

A Diver™ datalogger Serial No. A4482 was installed in the above well on October 7, 2021

by Hy-Geo Consulting. This is a 6 inch (15.24 cm) diameter bedrock well, that was drilled in 1994 to a depth of 125 feet (38.10 m) and completed in shaley and grey sandstone. It is the prime production well for the facility and is equipped with a pump. The recording interval was set at 10 minutes to detect any water level variations from neighbouring pumping wells and tidal effects. The corrected water level in the well at 8:00 am on October 7, 2021 was 12.248 m below ground. The Diver™ datalogger Serial No. DF612 on site was utilized to record variations in barometric pressure at the same recording interval of 10 minutes synchronized with datalogger Serial No. A4482.

On January 3, 2022 datalogger Serial No. A4482 was retrieved by Keith Erickson at 11:15 am and delivered to Hy-Geo Consulting on January 4 for downloading, data analysis and interpretation. The corrected water level in the well at 11:10 am on January 3, 2022 was 8.956 m below ground.

Precipitation Data 2021-22

With the absence of a current climate station on Galiano Island, the Mayne Island climate station may be considered representative of the general longer-term (monthly) precipitation patterns on Galiano Island (Government of Canada, 2022a). The most recent (2021-22) precipitation data for the region is available for climate station 1015638 on North Pender Island (Government of Canada, 2022b).

Precipitation in 2021 as observed at climate station 1015638 on North Pender Island was well below normal from February to August as shown in Table 1.

Table 1. Monthly 2021 precipitation data for North Pender climate station (Climate ID.1015638) compared to 1981-2010 normals for Mayne Island.

Month	Precipitation in 2021 (mm)	Monthly Precipitation Normal (mm)	Percent of Normal	Cumulative Percent of Normal
January	134.1	129.9	103.2	103.2
February	63	87.7	71.8	90.6
March	15	75.4	19.9	72.4
April	17.4	55.3	31.5	65.9
May	22.4	44	50.9	64.2
June	23.9	36.9	64.8	64.3
July	0	21.2	0	61.2
August	10.6	23.8	44.5	60.4
September	66.0	28	235.7	70.2
October	91.8	79.9	114.9	76.3
November	252.1	135.4	186.2	97.0
December	93.3	124.5	74.9	93.8
Total:	789.6	842		

Data from Government of Canada (2022a and 2022b).

Heavy rains beginning in September through November resulted in above normal monthly precipitation. Overall precipitation in 2021 of 789.6 mm was 93.8 percent of the annual normal (842 mm) for Mayne Island.

Monitoring Results

Observation Well WID 23229, September 17, 2021 to January 3, 2022

Given the frequent recording interval of 10 minutes chosen for the monitoring project, a large dataset of over 15,560 water level readings was generated for the above period. A separate hydrograph for this period was prepared to process the large data set and precipitation data was subsequently plotted on a separate graph for comparative purposes.

Figure 1 shows the water level below ground in Well WID 23229 from September 17 to January 3, 2022 compared with precipitation data from the North Pender Island climate station (Climate ID.1015638). Water level data shown has been corrected for barometric effects. The raw data for the September 17 to January 3, 2022 monitoring period is provided in Excel[®] spreadsheet titled “Crystal Mtn Obs Well September to Jan2022.csv”.

The hydrograph in Figure 1 shows water levels relatively static in September and then rising steadily about 3.7 m through October to late December. Individual rain events do not appear evident in the water level hydrograph. Water levels in the well likely respond to the cumulative effects of the fall rainfall events.

Figure 2 in more detail, shows the water level fluctuations and trend in Observation well WID 23229 from September 30 to October 7, 2021 compared with predicted tidal fluctuations. There is a good visual correlation between the rising water levels and daily tidal fluctuations. The effect of the tidal fluctuation on the water level in the well is only about 5 cm. This relationship in well WID 23229 was reported previously (Kohut, 2015).

Central Well WID 23227, October 7, 2021 to January 3, 2022

Given the frequent recording interval of 10 minutes chosen for the monitoring project, a large dataset of over 12,600 water level readings was generated for the above period. A separate hydrograph for this period was prepared to process the large data set and precipitation data was subsequently plotted on a separate graph for comparative purposes.

Figure 3 shows the water level below ground in Well WID 23227 from October 7, 2021 to January 3, 2022 compared with precipitation data from the North Pender Island climate station (Climate ID.1015638). Water level data shown has been corrected for barometric effects. The raw data for the October 7, 2021 to January 3, 2022 monitoring period is provided in Excel[®] spreadsheet titled “Crystal Mtn Central Well October to Jan2022.csv”.

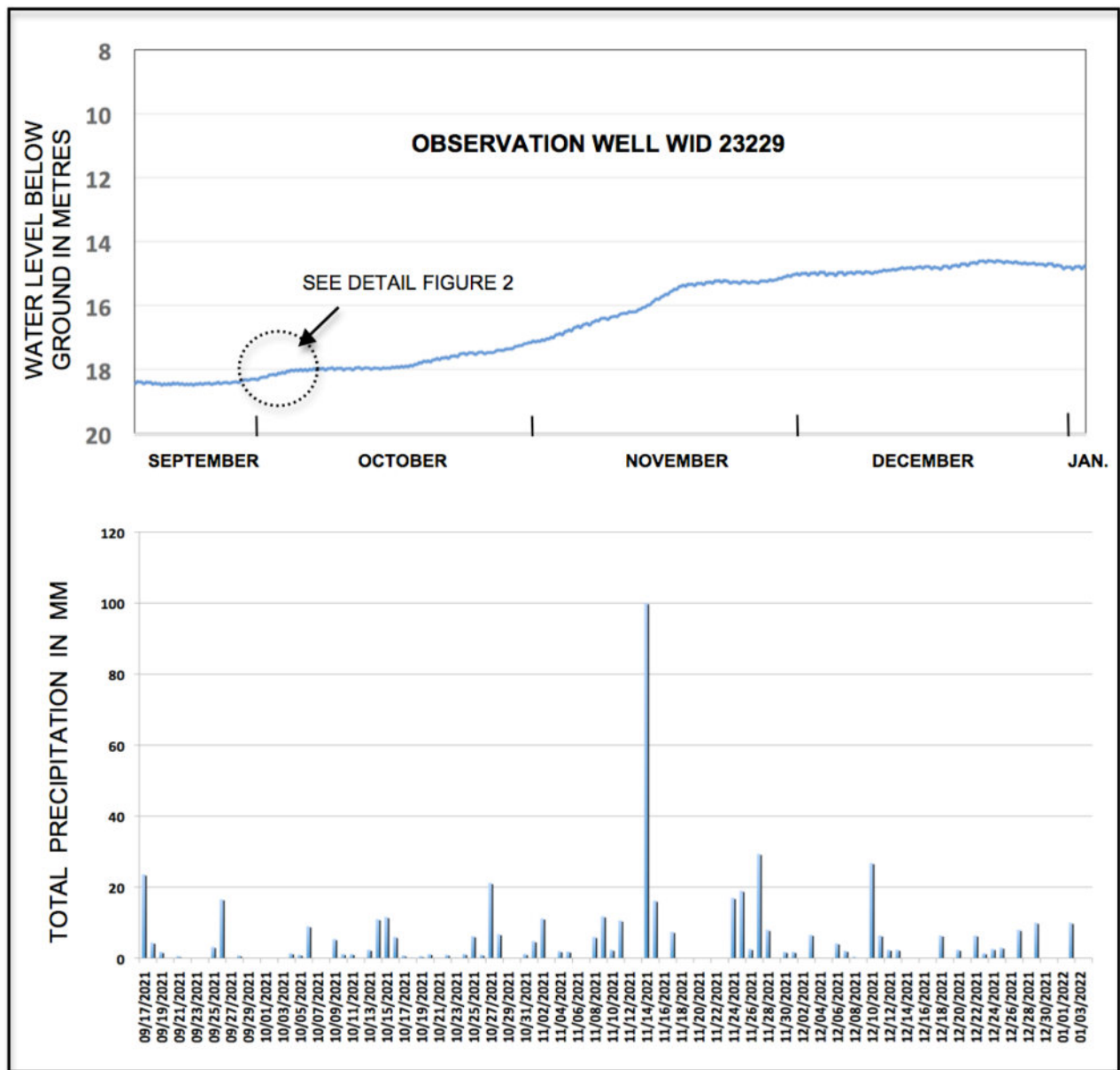


Figure 1. Water level below ground in Observation Well WID 23229 from September 17 to January 3, 2022 compared with precipitation data from North Pender Island climate station (Climate ID.1015638).

The hydrograph in Figure 3 for the Central well shows a very similar long-term trend with the water levels in the Observation well with water levels rising steadily about 3.5 m through October to late December. Individual rain events do not appear evident in the water level hydrograph. Water levels in the well likely respond to the cumulative effects of the fall rainfall events.

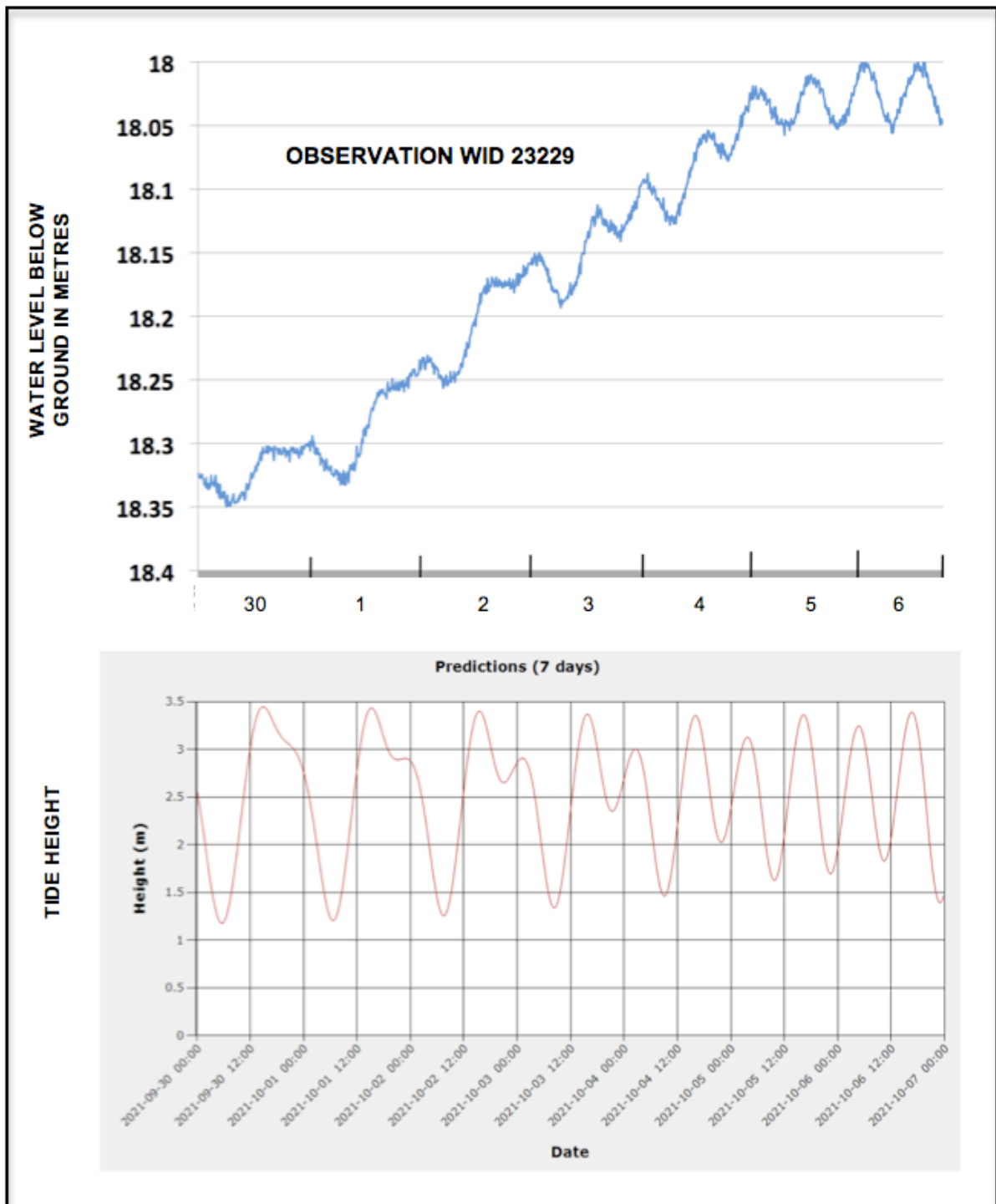


Figure 2. Comparison of water level fluctuations in Observation Well WID 23299 from September 30 to October 7, 2021 with predicted tidal fluctuations at Montague Harbour. Tidal graph adapted from Government of Canada, 2022c.

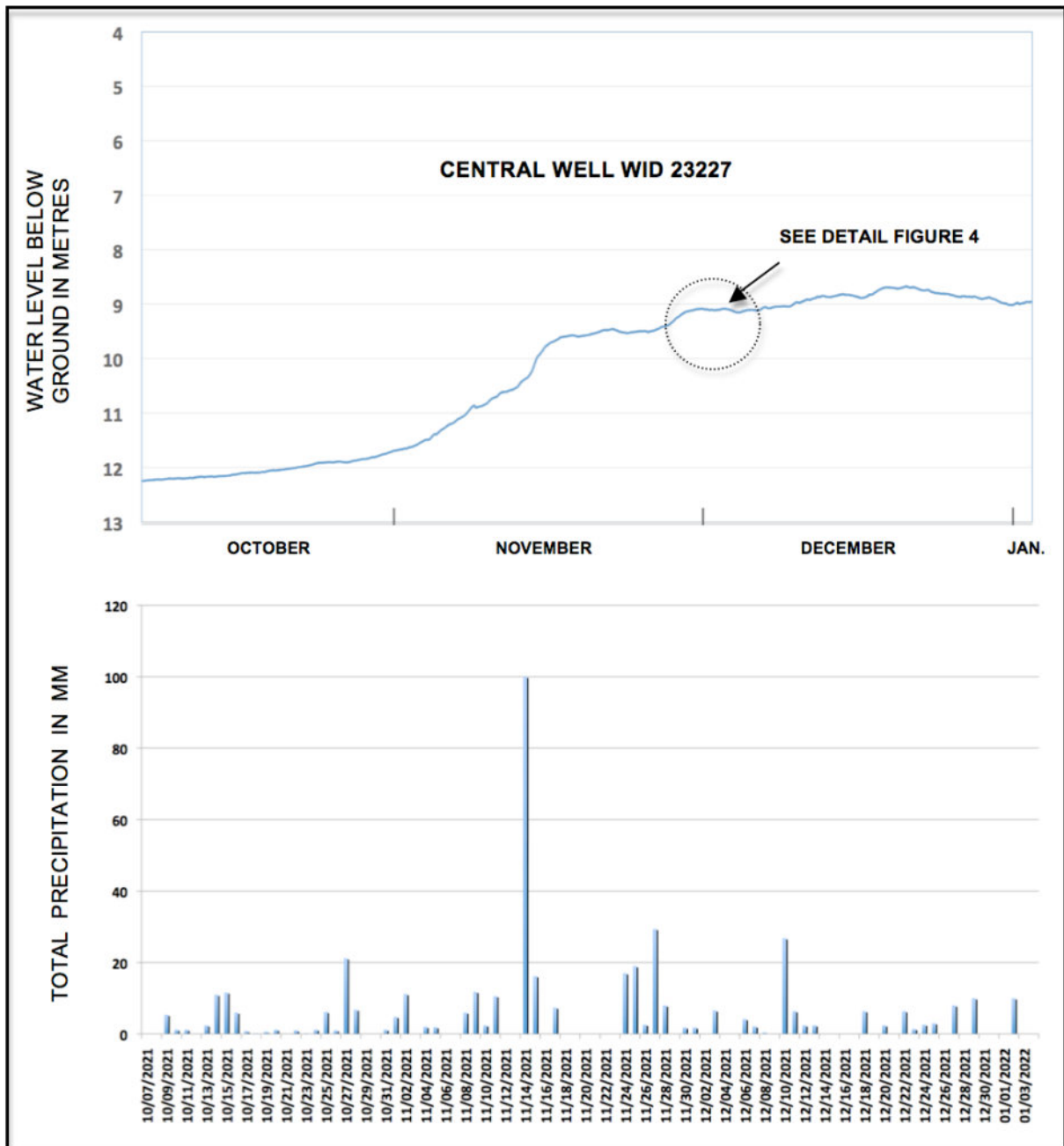


Figure 3. Water level below ground in Central Well WID 23227 from October 7 to January 3, 2022 compared with precipitation data from North Pender Island climate station (Climate ID.1015638).

Figure 4 in more detail, shows the water level fluctuations and trend in the Central well from November 30 to December 7, 2021 compared with predicted tidal fluctuations for the same period. There appears to be some periodic fluctuations ranging from 4 to 8 cm in the water levels although they do not correspond to any tidal influence. The cyclic nature of these fluctuations may reflect minor effects of pumping from neighbouring wells in the region.

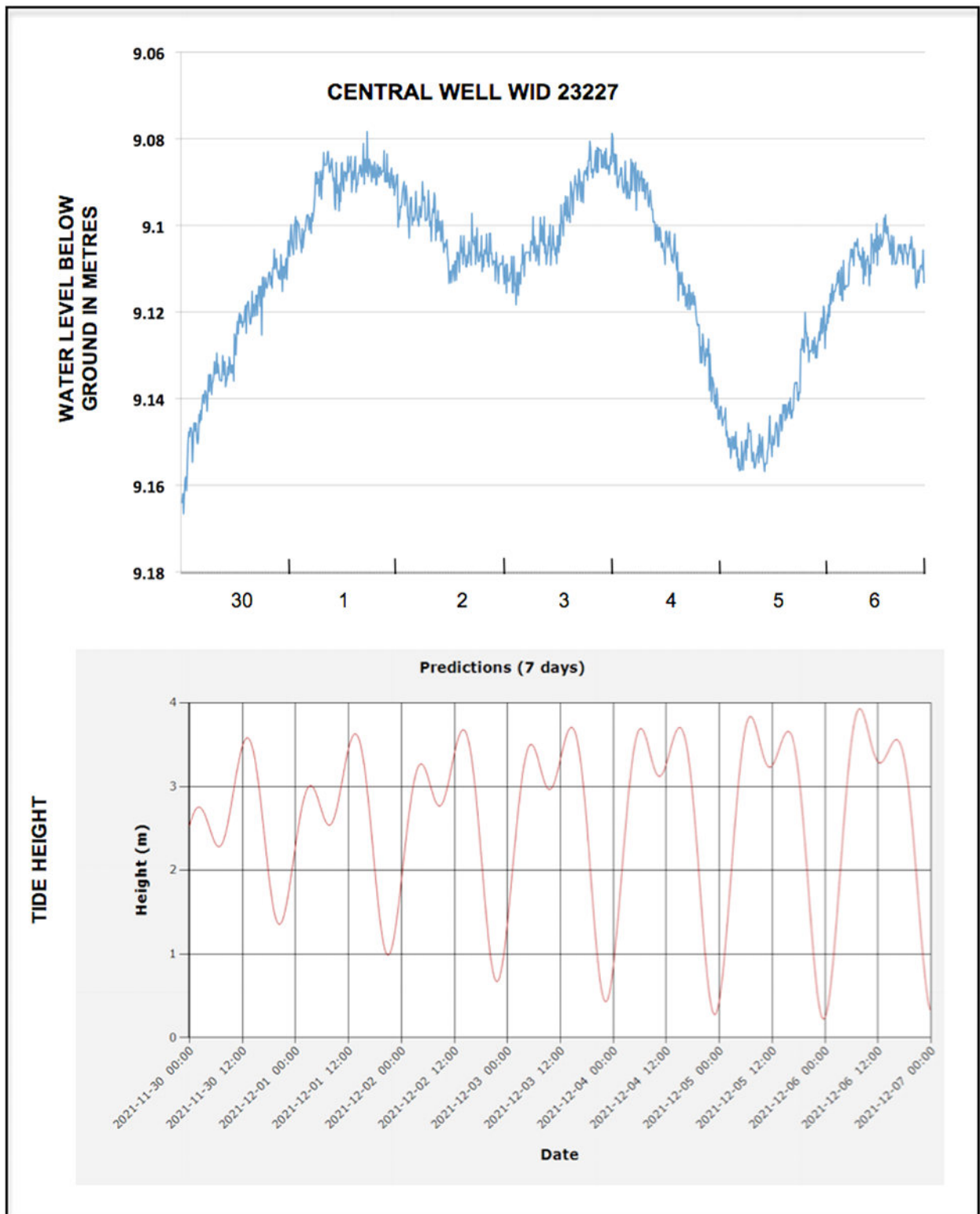


Figure 4. Comparison of water level fluctuations in Central Well WID 23227 from November 30 to December 7, 2021 with predicted tidal fluctuations at Montague Harbour. Tidal graph adapted from Government of Canada, 2022c.

The overall, non-pumping behaviour of the water level in Observation Well WID 23229 and the Central Well WID 23227 during the September 2021 to January 2022 monitoring period is consistent with previous monitoring observed at this site (Kohut, 2015). The monitoring results obtained above are also consistent with the observations, assumptions and results reported on the pumping test carried out on the Central Well WID 23227 in 2015 (Kohut, 2015).

Conclusions

Based on the water level monitoring conducted on Observation Well WID 23229 and the Central Well WID 23227 between September 2021 and January 3, 2022, the following conclusions can be made:

1. Water levels in both wells behaved in a similar fashion rising approximately 3.5 m during the monitoring period in response to the cumulative effects of fall and early winter rains. Individual precipitation events do not appear evident in the water level hydrographs.
2. Water levels in Observation Well WID 23229 showed periodic tidal effects of about 5 cm.
3. On close examination, water levels in the Central Well WID 23227 showed periodic variations with fluctuations ranging from 4 to 8 cm. These did not correspond to any tidal influence. The cyclic nature of these fluctuations may reflect minor effects of pumping from neighbouring wells in the region.
4. The monitoring results obtained are consistent with the observations, assumptions and results reported on the pumping test carried out on the Central Well WID 23227 in 2015.

Respectfully submitted:



A.P. Kohut
Jan 20/22

PROFESSIONAL
ENGINEER
PROVINCE OF
BRITISH COLUMBIA
A. P. KOHUT
#10194

Alan P. Kohut, PEng
Senior Hydrogeologist

Hy-Geo Consulting
Permit to Practice Number: 1001034

References

Government of Canada. 2022a. *Canadian Climate Normals*. 1981-2010 Climate Normals & Averages. Internet website http://climate.weather.gc.ca/climate_normals/index_e.html

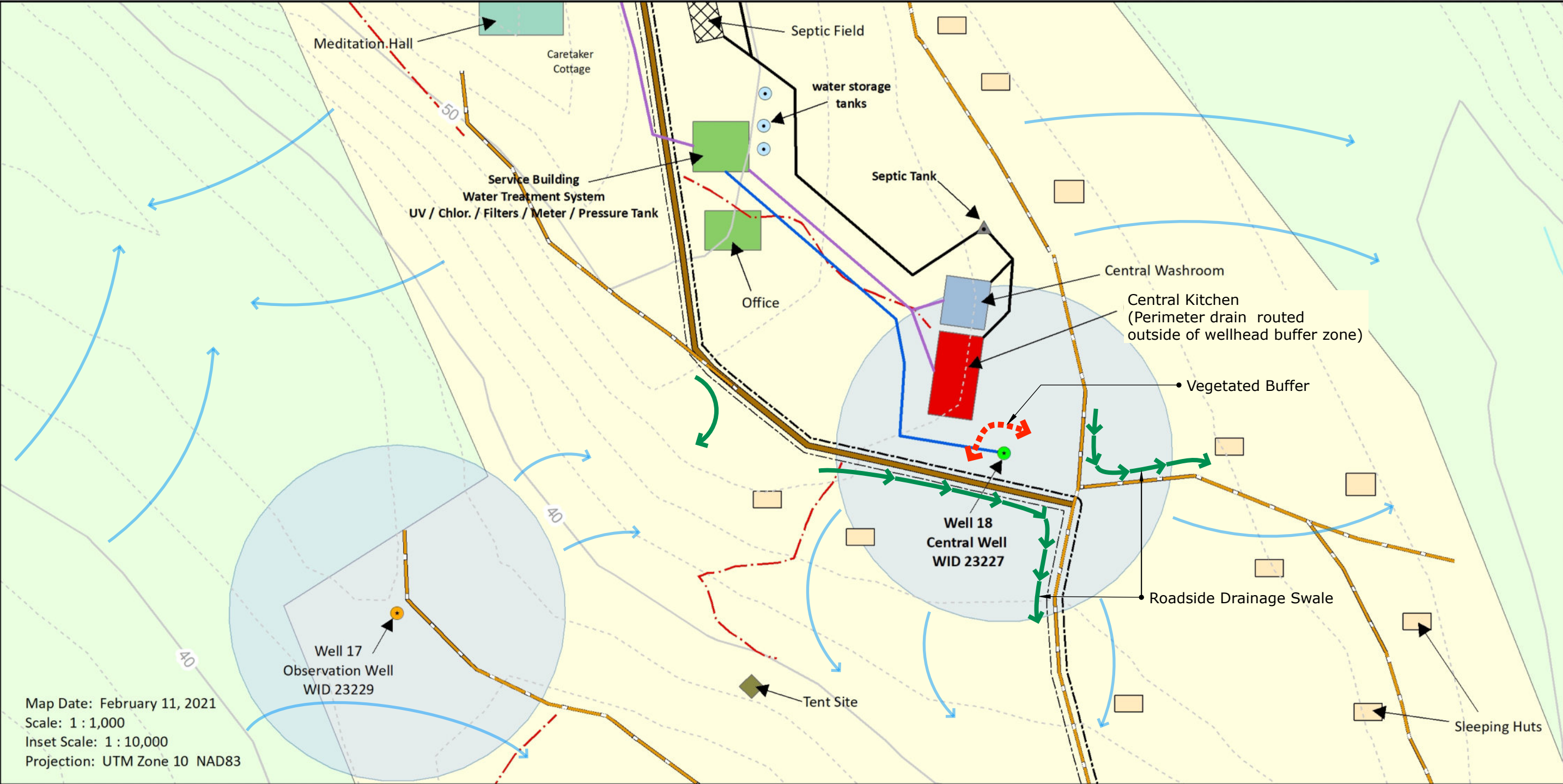
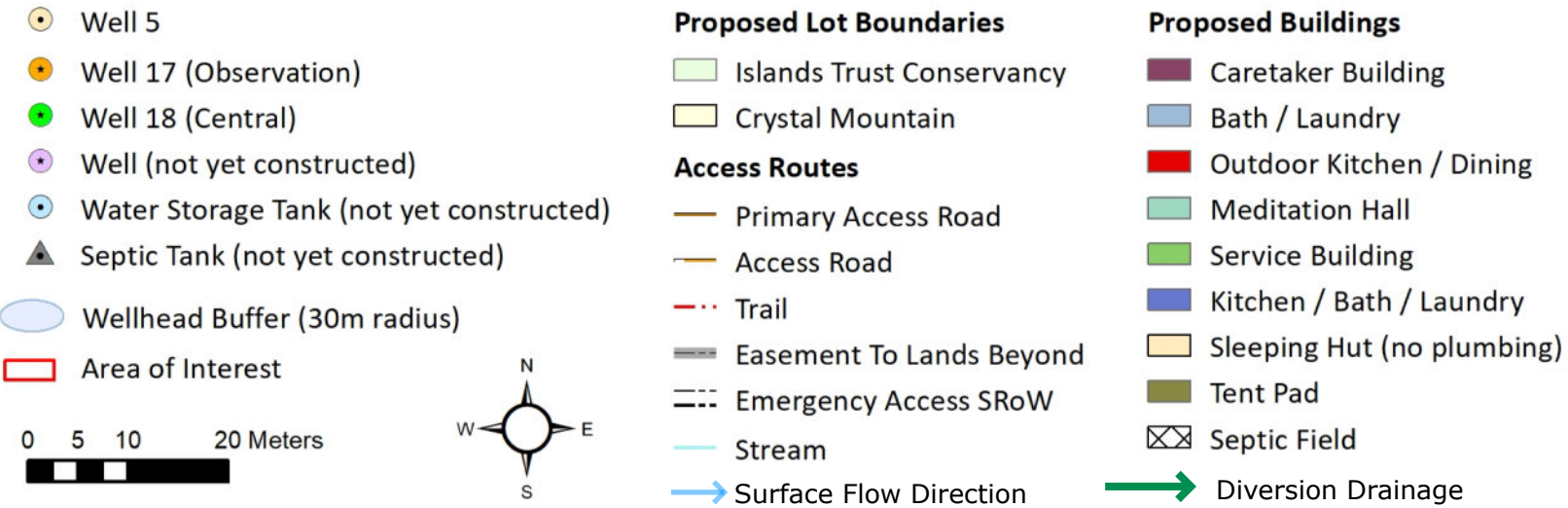
Government of Canada. 2022b. *Historical Climate Data*. Internet website <http://climate.weather.gc.ca/>

Government of Canada. 2022c. *7 Days Tidal Predictions*. Fisheries and Oceans Canada. Internet website <https://www.tides.gc.ca/eng/station?type=0&date=2021%2F07%2F29&sid=7420&tz=PST&pres=0>

Kohut, A.P. 2015. *Groundwater Assessment Report For Crystal Mountain Retreat Centre, Galiano Island*. Report prepared of Crystal Mountain Society. Hy-Geo Consulting, Victoria, British Columbia.

Crystal Mountain Society Wellhead Protection
Water System Site Plan

January 2022



Crystal Mountain Emergency Access

Chief NGVFD <chiefngvfd@gmail.com>

Tue, Dec 21, 2021 at 4:01 PM

Reply-To: chief.ngvfd@gmail.com

To: Keith Erickson <kericksongaliano@gmail.com>

Hi Keith,

If you have some time tomorrow, that would work for me. Please let me know when the best time would be for you, as I am trying to schedule a zoom call sometime as well.

I can confirm that the Crystal Mountain property is within the service area for firefighting from our Manastee Road water supply and does not need an independent water supply for fire purposes.

Karen Harris,
Fire Chief,
North Galiano Volunteer Fire Department,
19400 Porlier Pass Road, Galiano Island BC V0N 1P0
250-539-5453; 250-539-0204
chief.ngvfd@gmail.com

[Quoted text hidden]



RECORD OF SEWERAGE SYSTEM

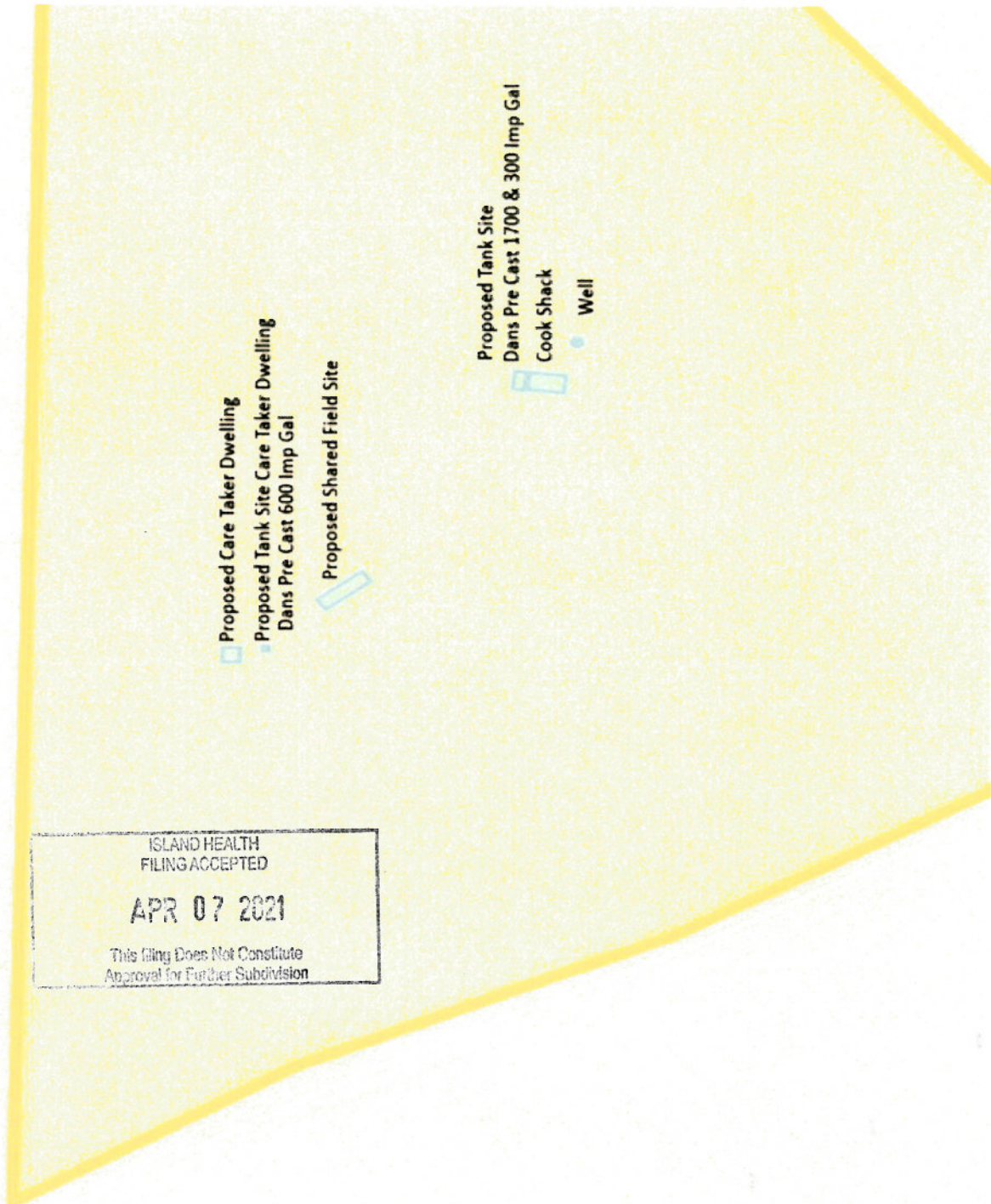
Filing # (OFFICE USE ONLY)

GV21/155

1. Property Information	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Alteration		<input type="checkbox"/> Repair		<input type="checkbox"/> Amendment – Original Filing #	
	Tax Assessment Roll # 01-764-02279.110				PID # 024 351 041	
	Legal Description (Plan, Lot, District Lot, Block Numbers) Lot A, D.L. 88 & 89, GALIANO ISLAND, COWICHAN DISTRICT, PLAN VIP68079					
	Street (Civic) Address or General Location 20300 Porlier Pass Road				City Galiano Island	
2. Owner Information	Name of Legal Owner Crystal Mountain Retreat Centre			Mailing Address 6370 Alma Street		
	Phone 250-539-3481	City Vancouver		Prov BC	Postal Code V6N 1Y6	
3. Authorized Person Information	Name of Authorized Person Fred Stevens			Mailing Address PO BOX 246		
	Phone 250.588.7535	City Galiano Island		Prov BC	Postal Code VON 1P0	
	Registration # OW0025		Email galianoex@gmail.com			
4. Structure Information	Sewerage System Will Serve: Kitchen / Dining Hall / Washrooms					
	<input checked="" type="checkbox"/> Single Family Dwelling <input checked="" type="checkbox"/> Other Structure (specify) _____ <input type="checkbox"/> Other Dwelling (specify) _____					
5. Site Information	The sewerage system is designed for an estimated minimum daily domestic sewage flow of (check one)					
	<input checked="" type="checkbox"/> Less than or equal to 9,100 litres <input type="checkbox"/> More than 9,100 litres but less than 22,700 litres					
	Depth of native soil to seasonal high water table or restrictive layer (cm) 150			Information respecting the type, depth and porosity of the soil is attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
6. Drinking Water Protection	Will the sewerage system be located less than 30 m from a well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			If yes, attach a professional's report and specify the intended distance _____ (m)		
	Distance of proposed sewerage system to the closest body of surface water 80+ _____ (m)			GPS Location of System (decimal degrees) Latitude 48.98410 Longitude 123.56892		
7. System Information	Horizontal Accuracy (m) 3 <input checked="" type="checkbox"/> Recreational GPS <input type="checkbox"/> Differential GPS					
	Sewerage treatment method <input type="checkbox"/> Type 1 <input checked="" type="checkbox"/> Type 2 <input type="checkbox"/> Type 3					
8. Legal or Regulatory Considerations	<input checked="" type="checkbox"/> Construction of the proposed sewerage system will not conflict with legal instruments registered on the property.			Is this filing submitted as the result of an order from the Health Authority? <input type="checkbox"/> Yes (attach a copy of the order) <input checked="" type="checkbox"/> No		
	Plot Plan (to scale) and specifications are attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
9. Plot Plan and Specifications	<input checked="" type="checkbox"/> The plans and specifications are consistent with Standard Practice					
	Source of Standard Practice: <input checked="" type="checkbox"/> Ministry of Health Standard Practice Manual <input type="checkbox"/> Other					
10. Authorized Person's Signature	Signature 			OFFICE USE ONLY		
	Date March 31, 2021			Filing Accepted Date April 7, 2021 Receipt Number 2104RAB66152		



Site Plan



Fred Stevens - ROWP
Galiano Excavating
PO Box 246 Galiano Island B.C. Canada V0N1P0
Office 250.539.2526
Email galianoexc@gmail.com





Health Authority Initial Filing For Construction of Sewerage System

Site investigation report, record of design and specifications

Date: March 31, 2021

Client/Owner/Site Information:

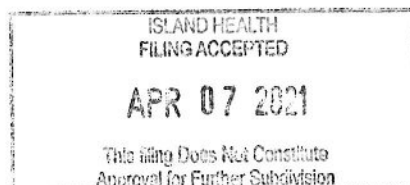
Client Name: <i>Crystal Mountain Retreat Centre</i>	Site Civic Address: <i>20300 Porlier Pass Rd "Lower Plateau Area"</i>
Parcel Identification Number: <i>024 351 041</i>	Legal Description: <i>Lot A, District Lots 88 and 89, Plan VIP68079 and Lot 9, District Lot 90, Plan 31200 Galiano Island, Cowichan District</i>

Property Information:

Lot Size: <i>50.65 Acres or 20.49 Hec</i>	Hydrogeologist Site DDF: <i>3252 (see supplements)</i>	Consultant <i>Alan P. Kohut, PEng Senior Hydrogeologist</i>
Potable Water Source: <i>Drilled Well</i>	Well to Sewerage System: <i>Greater than 30 meters</i>	Sewerage System to Foreshore: <i>Greater than 30 meters</i>
Topography: <i>The dispersal system area (and downslope receiving area) has approximately 0% slope perpendicular to the longitudinal centerline of the proposed dispersal system.</i>		

Structures Serviced:

<i>This proposed wastewater system will service a Caretaker Dwelling, 19 Meditation Huts, Tent sites, Main Kitchen, Laundry and Shared Central Washroom. No garburator, no water softeners or water treatment with backflush discharge to the sewerage system. This DDF has been supplied by Alan P. Kohut, PEng Senior Hydrogeologist</i>
--



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Septic System Design & Specifications for 20300 Porlier Pass Rd



Soil Evaluation:

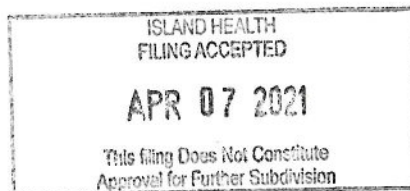
Perc Test Results		Test Pit #1	Test Pit # 2
Hole # 1	4 min/inch	150 cm Fine to Course, Loamy Course Sand No Mottling Dry down to Limiting Bedrock	160 cm Fine to Course, Loamy Course Sand No Mottling Dry down to Limiting Bedrock
Hole # 2	5 min/inch		
Hole # 3	5 min/inch		
Hole # 4	6 min/inch		

Principal Design Specification

Daily Design Flow	3252 L per Day
Septic Tank at Caretaker Dwelling	Dan's Pre Cast 600 Imp Gal L.P. c/w PL 122 Filter
Septic Tank at Kitchen / Washroom Area	Dan's Pre Cast 1700 Imp Gal L.P. c/w PL 122 Filter
Pump Chamber at Kitchen / Washroom Area	Dan's Pre Cast 300 Imp Gal
Pump	Little Giant WS50HM-20
Field Type	Premier Tech EC 3500 Eco Flo Bio Filter
Piping	100mm CSA Sewer & 50mm CSA SCH 40
Area of Infiltrative Surface	23 m ² (8.5 m x 2.7 m)

Distribution Field Specification

Premier Tech EC 3500 Eco Flo Bio Filter Treatment System on a bed of 19 mm drain rock. 35 mm deep with a bed area of 640 ft² (59.4 m²) bed dimensions 32 ft x 20 ft (9.75 m x 6.01 m). The "Caretaker's Dwelling" 600 Imp. Gal. septic tank will gravity feed into the "Kitchen / Washroom" 1700 Imp Gal septic tank and be pumped up to a shared septic field through a 300 Imp. Gal. Pump Chamber located next to the Kitchen / Washroom site.



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RECORD OF SEWERAGE SYSTEM

Filing # (OFFICE USE ONLY)

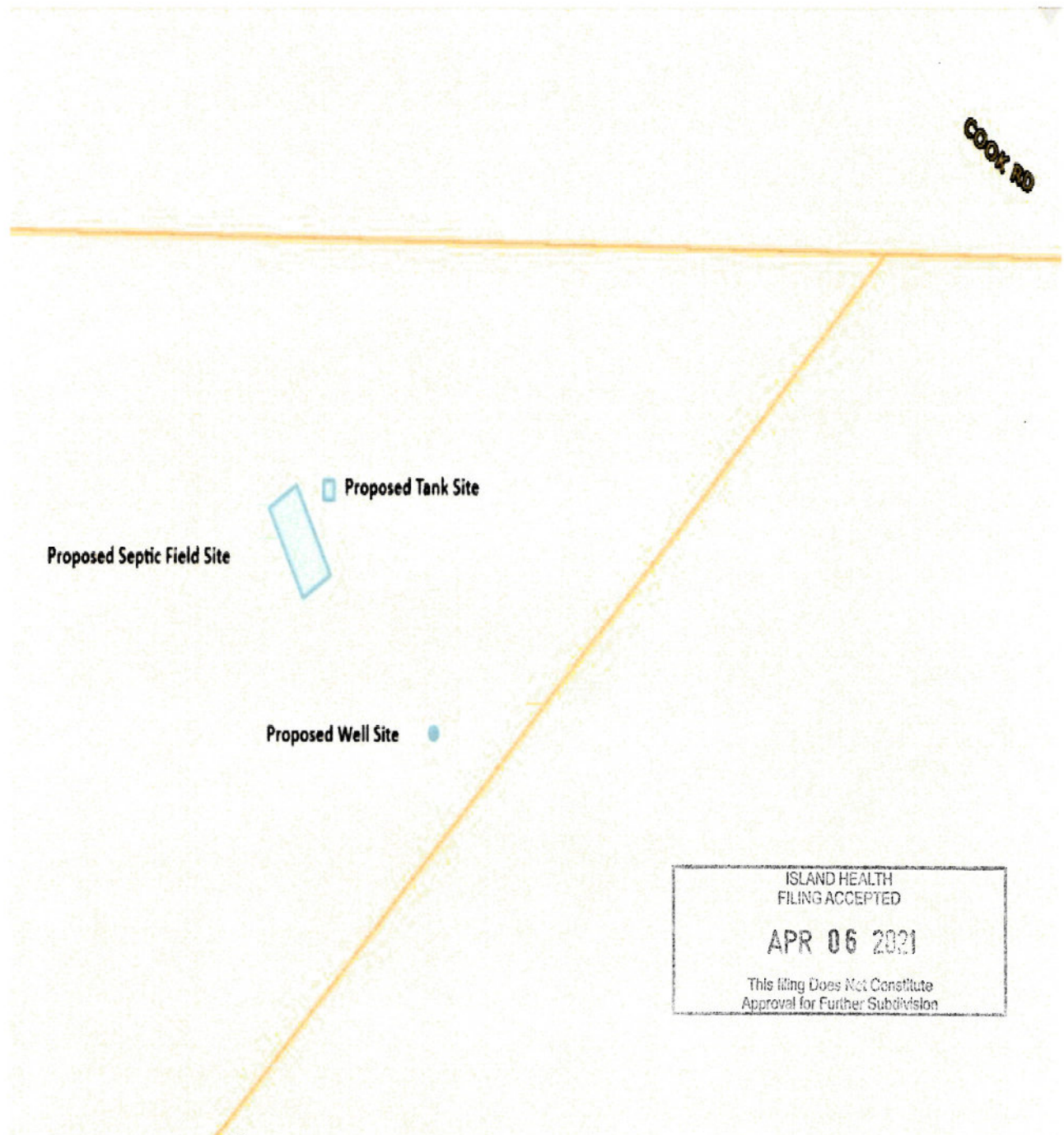
GV21/153

1. Property Information	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Alteration <input type="checkbox"/> Repair <input type="checkbox"/> Amendment – Original Filing #	
	Tax Assessment Roll # 01-764-02279.110	
	PID # 024 351 041	
	Legal Description (Plan, Lot, District Lot, Block Numbers) Lot A, D.L. 88 & 89, GALIANO ISLAND, COWICHAN DISTRICT, PLAN VIP68079	
Street (Civic) Address or General Location 20300 Porlier Pass Road		City Galiano Island
2. Owner Information	Name of Legal Owner Crystal Mountain Retreat Centre	
	Mailing Address 6370 Alma Street	
3. Authorized Person Information	Name of Authorized Person Fred Stevens	
	Mailing Address PO BOX 246	
	Phone 250-539-3481	City Vancouver
	Prov BC	Postal Code V6N 1Y6
4. Structure Information	Sewerage System Will Serve: <div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Single Family Dwelling <input checked="" type="checkbox"/> Other Structure (specify) Kitchen/Washroom <input type="checkbox"/> Other Dwelling (specify) </div>	
	The sewerage system is designed for an estimated minimum daily domestic sewage flow of (check one) <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Less than or equal to 9,100 litres <input type="checkbox"/> More than 9,100 litres but less than 22,700 litres </div>	
	Depth of native soil to seasonal high water table or restrictive layer (cm) 155	
	Information respecting the type, depth and porosity of the soil is attached <div style="display: flex; justify-content: flex-end;"> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No </div>	
5. Site Information	GPS Location of System (decimal degrees) Latitude 48.98446 Longitude 123.56576	
	Horizontal Accuracy (m) 3	
	<input checked="" type="checkbox"/> Recreational GPS <input type="checkbox"/> Differential GPS	
6. Drinking Water Protection	Will the sewerage system be located less than 30 m from a well? <div style="display: flex; justify-content: flex-end;"> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No </div>	
	If yes, attach a professional's report and specify the intended distance _____ (m)	
	Distance of proposed sewerage system to the closest body of surface water 80+ (m)	
7. System Information	Sewerage treatment method <input type="checkbox"/> Type 1 <input checked="" type="checkbox"/> Type 2 <input type="checkbox"/> Type 3	
8. Legal or Regulatory Considerations	<input checked="" type="checkbox"/> Construction of the proposed sewerage system will not conflict with legal instruments registered on the property.	
	Is this filing submitted as the result of an order from the Health Authority? <input type="checkbox"/> Yes (attach a copy of the order) <input checked="" type="checkbox"/> No	
9. Plot Plan and Specifications	Plot Plan (to scale) and specifications are attached <div style="display: flex; justify-content: flex-end;"> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No </div>	
	<input checked="" type="checkbox"/> The plans and specifications are consistent with Standard Practice Source of Standard Practice: <input checked="" type="checkbox"/> Ministry of Health Standard Practice Manual <input type="checkbox"/> Other	
10. Authorized Person's Signature	Signature 	OFFICE USE ONLY Filing Accepted Date April 6, 2021
	Date March 31, 2021	Receipt Number 2104RAB65697

Septic System Design & Specifications for 20300 Porlier Pass Rd



Site Plan



Fred Stevens - ROWP
Galiano Excavating
PO Box 246 Galiano Island B.C. Canada V0N1P0
Office 250.539.2526
Email galianoexc@gmail.com





Health Authority Initial Filing For Construction of Sewerage System

Site investigation report, record of design and specifications

Date: March 31, 2021

Client/Owner/Site Information:

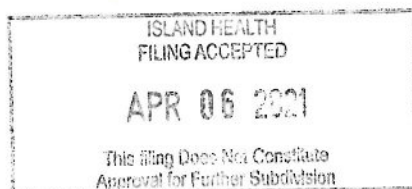
Client Name: <i>Crystal Mountain Retreat Centre</i>	Site Civic Address: <i>20300 Porlier Pass Rd</i> <i>"Upper Ridge Area"</i>
Parcel Identification Number: <i>024 351 041</i>	Legal Description: <i>Lot A, District Lots 88 and 89, Plan VIP68079 and Lot 9, District Lot 90, Plan 31200 Galiano Island, Cowichan District</i>

Property Information:

Lot Size: <i>50.65 Acres or 20.49 Hec</i>	Hydrogeologist Site DDF: <i>284</i> <i>(see supplements)</i>	Consultant <i>Alan P. Kohut, PEng Senior</i> <i>Hydrogeologist</i>
Potable Water Source: <i>Drilled Well (To be Drilled)</i>	Well to Sewerage System: <i>To be Drilled</i>	Sewerage System to Foreshore: <i>Greater than 30 meters</i>
Topography: <i>The dispersal system area (and downslope receiving area) has approximately 0% slope perpendicular to the longitudinal centerline of the proposed dispersal system.</i>		

Structures Serviced:

This proposed wastewater system will service 3 Meditation Huts (No Plumbing), Kitchen, Laundry and Shared Central Washroom. No garburator, no water softeners or water treatment with backflush discharge to the sewerage system. This DDF has been supplied by Alan P. Kohut, PEng Senior Hydrogeologist



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Septic System Design & Specifications for 20300 Porlier Pass Rd



Soil Evaluation:

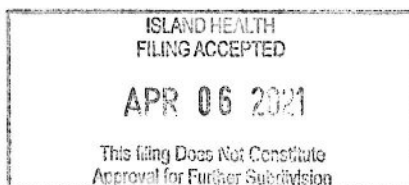
Perc Test Results		Test Pit #1	Test Pit #2
Hole # 1	4 min/inch		
Hole # 2	5 min/inch		
Hole # 3	5 min/inch		
Hole # 4	6 min/inch		
		155 cm Fine to Course, Loamy Course Sand No Mottling Dry down to Limiting Bedrock	165 cm Fine to Course, Loamy Course Sand No Mottling Dry down to Limiting Bedrock

Principal Design Specification

Daily Design Flow	284 L per Day
Septic Tank	Dan's Pre Cast 600 Imp Gal L.P. c/w PL 122 Filter
Field Type	7 Eljen Modules
Distribution Box	7 Hole Dan's Pre Cast
Piping	100mm CSA Sewer & 50mm CSA SCH 40
Area of Infiltrative Surface	10.4m ² (112 ft ²) 8.52 m x 1.21 m (28 ft x 4 ft)

Distribution Field Specification

7 Eljen modules on a bed of C33 Sand, 35 cm deep with a bed area of 112 ft² (10.4 m²) bed dimensions 28 ft x 4 ft (8.52 m x 1.21 m). The 600 Imp. Gal. septic tank will gravity feed into a distribution box that flows to 7 Eljen Modules.



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Email galianoexc@gmail.com



1 EMERGENCY RESPONSE PLAN

In the event of an emergency PERSONAL SAFETY first.

1. Shut off water supply if threat is from pesticides, petroleum, or chemical source.
2. Contact Appropriate person from the list of Emergency Numbers
3. Administration Staff will notify affected water users in person & by phone.
4. Administration will post warnings on doors – or direct an individual to do so.
5. Administration will notify appropriate Health Officers
6. Administration will co-ordinate repair including contacting designers, and contractors.
7. Alternate source of safe drinking water listed below under the situations that may arise.

ALTERNATIVE WATER SOURCE

If water is deemed as “DO NOT DRINK” then the Retreat Centre *will be closed* until such a time that TREATED STORAGE TANKS and DISTRIBUTION SYSTEM can be assured safe and accept bulk water delivery to supply facility.

If the well pump ceases operation and is unable to fill the TREATED WATER STORAGE tanks, then a Bulk Water Delivery can top-up the TREATED WATER STORAGE tanks, and water conservation measure can be used to reduce water draws until the well pump is functioning.

If the well becomes contaminated through changing chemistry, then an alternate water source (as noted above) would be used until water quality issues are remedied and/or treatment systems can be upgraded and treated waters deemed safe by the Environmental Health Officer.

FAILED WATER TEST

Contact the Administration office.

Post signage on all Retreat Centr’s doors with ACTION TO TAKE:

- DO NOT DRINK/BOIL WATER/ADVISORY
- What the issue is
- Where alternative water can be found
- Who to contact for information

CONTACT VIHA Environmental Health Officer immediately in cases of Do Not Drink or Boil Water Advisory.

MECHANICAL FAILURE

Contact the Administration office

Post Advisory on all residents doors of ACTION TO TAKE.

INTERRUPTED SUPPLY (shut off) – then inform staff and students where alternative water can be found.

POWER LOSS – Call Administration

WATER LEAK – offers potential intrusion of contaminants; shut water off to the area with the leak; call Administration; post WATER ADVISORY

WELL PUMP or WELL issue – GW Solutions

FOREST FIRE RETARDANT

In case of forest fire activities in the area – test for fire retardant.

Contact VIHA to confirm the list of chemicals to screen for.

Contact Registered Lab for water sampling and/or rooftop particulate sampling protocol - required to test for fire retardants.

CHLORINATION SYSTEM FAILURE

- Post BOIL WATER NOTICE
- Test chlorine residual in treated water tank
- Calculate on dose tanks to raise free chlorine residual to 0.5 mg/L
- Arrange potable bulk water delivery to treated storage tanks until Chlorination system is functional

2 COMMUNICATIONS PRTOCOL

UPON

- **FAILED WATER TEST NOTIFICATION or**
- **DO NOT DRINK or BOIL WATER ADVISORY**
- **WATER QUALITY ADVISORY**

Contact Administration. They will immediately post signage and contacts staff participants/visitors/guests in person, and by phone and email.

ALL advisories need to be communicated to VIHA

3 EMERGENCY CONTACT INFORMATION

WHO TO CALL:	ADMINISTRATION:	Name Phone (primary and backup)
	WATER SYSTEM OPERATOR:	Phone
	VIHA ENVIRONMENTAL HEALTH OFFICER:	Anthony Griffin 250-755-6215 Fax: 250-755-3372 Email: HPES.Nanaimo@islandhealth.ca
	VIHA PUBLIC HEALTH ENGINEER:	Darrell Bélanger 250-331-8518
	GROUNDWATER SPECIALIST:	Alan Kohut – Hy-Geo Consulting 250-744-7859 Information@hy-geo.com
	INSTALLER:	
	DESIGNING ENGINEER:	Company - TBD Contact - TBD Phone: Email:
	BULK WATER DELIVERY:	South Island Water 250-516-5066 Email: southislandwaterltd@gmail.com

4 NOTICES

Do Not Use Water Notice:

Used when a significant health risk or public health threat exists in the water supply system that cannot be adequately addressed by a water quality advisory or boil water notices. (e.g., oil/ pesticide spill).

Boil Water Notice:

If E.Coli is detected in treated water samples from:

- Treated Water Storage Tank
- Monthly microbiology water sampling

If Turbidity > 1NTU downstream of filtration

Used when testing reveals E. coli or other coliform organisms in the water supply, and/or the system fails to meet drinking water treatment objectives, and the associated public health threat from the water supply system can be effectively addressed by boiling the water

Water Quality Advisory:

Used when a public health threat from the water supply system is higher than considered normally acceptable, but is not serious enough to warrant, or will not be resolved by, a boil water notice.

Well Summary

Well Tag Number: 118140	Well Status: New	Observation Well Number:
Well Identification Plate Number: 23227	Well Class: Water Supply	Observation Well Status:
Owner Name: CRYSTAL MOUNTAIN SOCIETY FOR EASTERN & WESTERN STUDIES	Well Subclass: Not Applicable	Environmental Monitoring System (EMS) ID:
Intended Water Use: Private Domestic	Aquifer Number:	Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed	Licence Number:
------------------------------------	------------------------

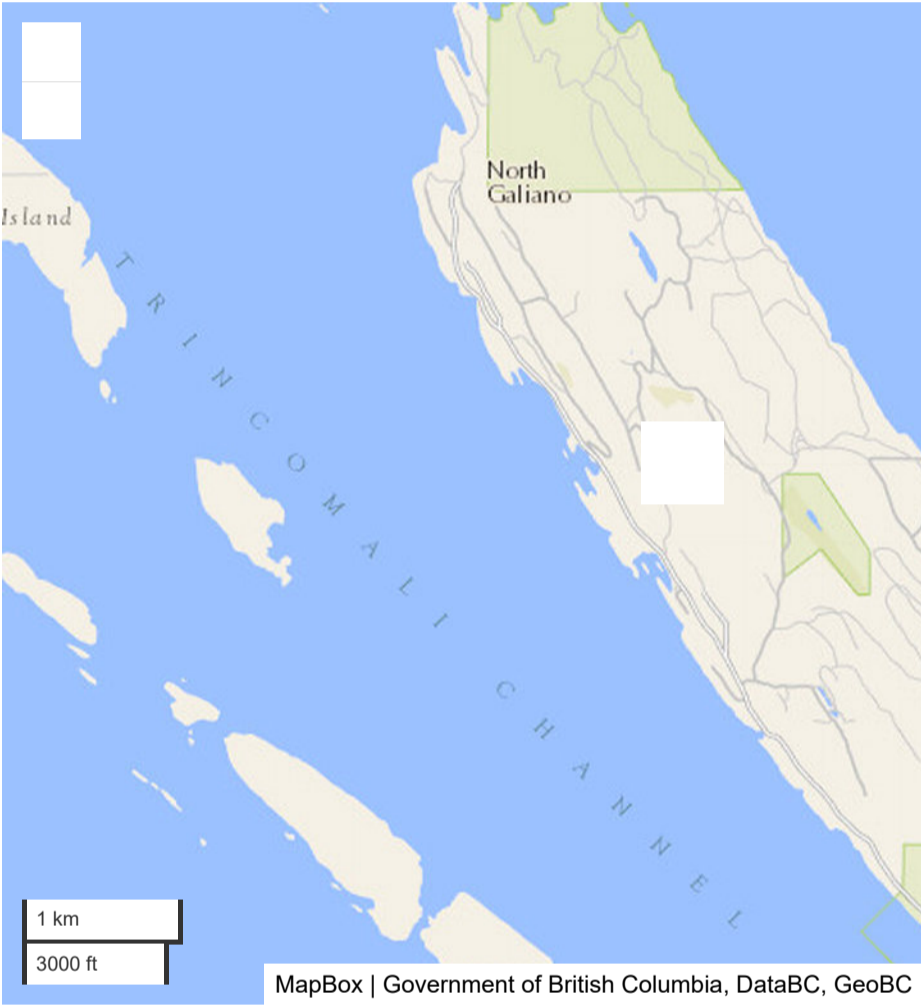
Location Information

Street Address: 20300 PORLIER PASS
Town/City: GALIANO ISLAND

Legal Description:

Lot	A
Plan	VIP68079
District Lot	88 & 89
Block	
Section	
Township	
Range	
Land District	16
Property Identification Description (PID)	024351041

Description of Well Location: NEAR OUTDOOR KITCHEN



Geographic Coordinates - North American Datum of 1983 (NAD 83)

Latitude: 48.98355	Longitude: -123.56793
UTM Easting: 458447	UTM Northing: 5425783
Zone: 10	Coordinate Acquisition Code: (10 m accuracy) ICF cadastre and good location sketch

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Construction report	1994-08-19	1994-08-19	Red Williams Well Drilling Ltd.	September 27th 2019 at 5:05 PM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1994-08-19	1994-08-19				

Well Completion Data

Total Depth Drilled: 125 feet	Static Water Level: 60 feet btoc	Well Cap:
Finished Well Depth: 125 ft bgl	Estimated Well Yield: 5 USgpm	Well Disinfected Status:
Final Casing Stick Up: 10 inches	Artesian Flow:	Drilling Method:
Depth to Bedrock:	Artesian Pressure:	Orientation of Well: VERTICAL
Ground elevation:	Method of determining elevation:	

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
53	125	GREY SANDSTONE			grey		1 GPM @ 100 FEET; 4 GPM @ 120 FEET	5
50	53	SHALEY SANDSTONE						
45	50	GREY SANDSTONE			grey			
42	45	BROWN CRUMBLY SANDSTONE			brown			
17	42	GREY SANDSTONE			grey			
14	17	BROWN CRUMBLY SANDSTONE			brown			
12	14	GRAY SANDSTONE			grey			
4	12	BROWN CRUMBLY SANDSTONE			brown			
0	4	BROWN GRAVELLY SOIL			brown			

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
0	19.12			6	0.188	Not Installed
19.12	125	Open hole	Open hole	6		

Surface Seal and Backfill Details

Surface Seal Material:	Backfill Material Above Surface Seal:
Surface Seal Installation Method:	Backfill Depth:
Surface Seal Thickness:	
Surface Seal Depth:	

Liner Details

Liner Material: PVC		Liner perforations	
Liner Diameter: 4 inches	Liner Thickness:	From (ft bgl)	To (ft bgl)
Liner from: 0 (ft bgl)	Liner to: 125 (ft bgl)	There are no records to show	

Screen Details

Intake Method:

Type:

Material:

Opening:

Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:	Development Total Duration:
---------------	-----------------------------

Well Yield

Estimation Method:	Estimation Rate:	Estimation Duration:
Static Water Level Before Test:	Drawdown:	
Hydrofracturing Performed: No	Increase in Yield Due to Hydrofracturing:	

Well Decommission Information

Reason for Decommission:	Method of Decommission:
Sealant Material:	Backfill Material:
Decommission Details:	

Comments

ROCK CHIP SLURRY; NO GAS SMELL; 135 FEET 3/8 SAFETY ROPE

Alternative Specs Submitted: No

Documents

No additional documentation available for this well.

Disclaimer

The information provided should not be used as a basis for making financial or any other commitments. The Government of British Columbia accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data or graphical depictions rendered from the data.



Lot A

Domestic Well Registration Form

This form is intended for registering groundwater wells that are used for domestic water use purpose only. Domestic use of groundwater is exempt from the requirement for obtaining a water license or use approval and paying provincial fees and rentals. Registering your well creates a record of the location of your well and your water use. It helps to ensure that your use is considered by decision makers when dealing with other licence applications.

Domestic purpose is defined in Section 2 of the Water Sustainability Act as water used for the occupants of a private residence for household uses (e.g., not a multi-family apartment building, hotel, strata or cooperative building) including: drinking water, food preparation, sanitation, fire prevention, water for animals kept for household use or as pets, or irrigation of a garden not exceeding 1000m².

If unsure whether your use is considered to be domestic purpose, or to start your licence application if the well is used for any other purpose, please visit Front Counter BC (<http://www.frontcounterbc.ca/Start/ground-water/>).

Owner Information

Well Owner Name: Crystal Mountain Society for Eastern & Western Studies
Mailing Address: 536 Rockmayne Pl. Town Bowen Isld. Prov. BC Postal Code V0N 1G2
Email Address: crystalmountain@yahoo.ca or Phone No.: 604-947-0276

Well Location Information

If the address of the well location is the same as above, please check ☐

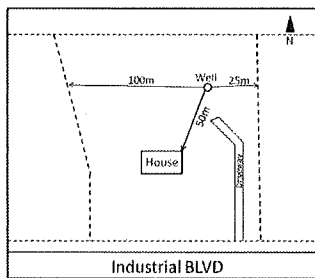
If not, at least one of the three following property descriptors must be provided

- 1) Address: 20300 Portier Pass Town Galiano Island V0N 1P0
2) Legal description (available from the property tax assessment notice):

Lot: <u>A</u>	Block: _____	Range: _____
Plan: <u>V1P68079</u>	Section: _____	Land District: <u>16 Portion</u>
District Lot: <u>88139</u>	Township: <u>Cowichan</u>	<u>Galiano Island</u>

- 3) PID: 024-361-041

Description of well location on the property _____



Well location map. Attach with the well registration form a sketch or diagram (e.g., property assessment drawing) showing where the well is located on the property relative to the property boundaries, a road or any other structures on the land.

Example Sketch

GPS Coordinates of the Well

Coordinates for the well can be determined by using a GPS unit, a cell phone app, or by using a mapping application such as iMapBC or Google Earth.

Latitude (e.g., 49.20184°): 48.9831796 Longitude (e.g., 122.58376°): 123.5693257

OR

UTM Zone (NAD83): _____ UTM Easting: _____ UTM Northing: _____

Source of coordinates (check one): GPS ☐ Google Earth ☐ Other (please specify) Google Maps

Well Information

If the well construction report is available, please attach to this form. Attached ☒ Not Available ☐

If no well construction report is available, complete the following information:

Well Identification Plate Number (steel plate attached to some wells): 23229

Date well drilled (YYYY/MM/DD): 1994 11 25

If the date the well was drilled is unknown, provide the date you took possession of the property (YYY/MM/DD): _____

Drilling Company: Red Williams Drilling Ltd.

Method of Drilling: ☐ Drilled ☐ Excavated or Dug

Well depth (ft): 186 ft Well Diameter (in): 6 in

Disclaimer

Red lettering indicates information that must be provided for the well and the domestic use to be registered.

The information provided on this form, including personal information, will be added to the Provincial WELLS Database, which is accessible to the public at <http://a100.gov.bc.ca/pub/wells/public/>.

Information relating to the well and well owner submitted to the Deputy Comptroller in this form shall be considered part of the Provincial Government records and subject to the *Freedom of Information and Protection of Privacy Act*.

For more information related to the Water Sustainability Act or Groundwater Protection Regulation, please visit <http://gov.bc.ca/water>.

Signature of Declaration

I have read and understand the above and declare that the information provided on this form is true to the best of my knowledge. I understand and consent that the information on this form will be published and made publically available. Digital signatures are acceptable.

Signed: [Signature] Date (YYYY/MM/DD): Jan 19, 2017

Send Completed Forms To

Before Submitting:

- ☒ Ensure your well is used for domestic purposes only.
- ☒ Complete all required information.
- ☒ Attach a sketch or map depicting where the well is located on the property.
- ☒ Provide any supporting documentation (e.g., well construction report) if available.
- ☒ Sign the well registration form.

Mailing Address:

Deputy Comptroller
Ministry of Environment
PO Box 9362 Stn Prov Govt
Victoria BC V8W 9M2

Email:

GroundWater@gov.bc.ca



Lot A

Domestic Well Registration Form

This form is intended for registering groundwater wells that are used for domestic water use purpose only. Domestic use of groundwater is exempt from the requirement for obtaining a water license or use approval and paying provincial fees and rentals. Registering your well creates a record of the location of your well and your water use. It helps to ensure that your use is considered by decision makers when dealing with other licence applications.

Domestic purpose is defined in Section 2 of the Water Sustainability Act as water used for the occupants of a private residence for household uses (e.g., not a multi-family apartment building, hotel, strata or cooperative building) including: drinking water, food preparation, sanitation, fire prevention, water for animals kept for household use or as pets, or irrigation of a garden not exceeding 1000m².

If unsure whether your use is considered to be domestic purpose, or to start your licence application if the well is used for any other purpose, please visit Front Counter BC (<http://www.frontcounterbc.ca/Start/ground-water/>).

Owner Information

Well Owner Name: Crystal Mountain Society for Eastern & Western Studies
Mailing Address: 536 Rockmoynne Town Bowen Isld. Prov. BC Postal Code V0N 1G2
Email Address: crystalmountain@yahoo.ca or Phone No.: 604-947-0276

Well Location Information

If the address of the well location is the same as above, please check ☐

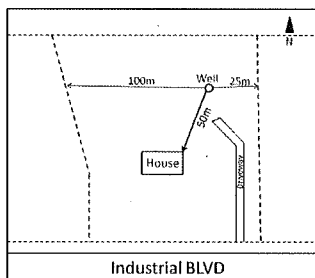
If not, at least one of the three following property descriptors must be provided

- 1) Address: 20300 Portlier Pass Town Galiano Island BC
V0N 1P0
- 2) Legal description (available from the property tax assessment notice):

Lot: <u>A</u>	Block: _____	Range: _____
Plan: <u>V1P68079</u>	Section: _____	Land District: <u>16 Portlier</u>
District Lot: <u>88189</u>	Township: <u>Cowichan</u>	<u>Galiano Island</u>

- 3) PID: 024-351-041

Description of well location on the property attached



Well location map. Attach with the well registration form a sketch or diagram (e.g., property assessment drawing) showing where the well is located on the property relative to the property boundaries, a road or any other structures on the land.

Example Sketch

GPS Coordinates of the Well

Coordinates for the well can be determined by using a GPS unit, a cell phone app, or by using a mapping application such as iMapBC or Google Earth.

Latitude (e.g., 49.20184°): 48.9835479 Longitude (e.g., 122.58376°): 123.5679337

OR

UTM Zone (NAD83): _____ UTM Easting: _____ UTM Northing: _____

Source of coordinates (check one): GPS ☐ Google Earth ☐ Other (please specify) [Google Maps]

Well Information

If the well construction report is available, please attach to this form. Attached ☒ Not Available ☐

If no well construction report is available, complete the following information:

Well Identification Plate Number (steel plate attached to some wells): 23227

Date well drilled (YYYY/MM/DD): 1994 08 19

If the date the well was drilled is unknown, provide the date you took possession of the property (YYY/MM/DD): _____

Drilling Company: Red Williams Well Drilling Ltd.

Method of Drilling: ☒ Drilled ☐ Excavated or Dug

Well depth (ft): 125 Well Diameter (in): 6

Disclaimer

Red lettering indicates information that must be provided for the well and the domestic use to be registered.

The information provided on this form, including personal information, will be added to the Provincial WELLS Database, which is accessible to the public at <http://a100.gov.bc.ca/pub/wells/public/>.

Information relating to the well and well owner submitted to the Deputy Comptroller in this form shall be considered part of the Provincial Government records and subject to the *Freedom of Information and Protection of Privacy Act*.

For more information related to the Water Sustainability Act or Groundwater Protection Regulation, please visit <http://gov.bc.ca/water>.

Signature of Declaration

I have read and understand the above and declare that the information provided on this form is true to the best of my knowledge. I understand and consent that the information on this form will be published and made publically available. Digital signatures are acceptable.

Signed: [Signature]

Date (YYYY/MM/DD): Jan. 19 2017

Send Completed Forms To

Before Submitting:

- ☒ Ensure your well is used for domestic purposes only.
- ☒ Complete all required information.
- ☒ Attach a sketch or map depicting where the well is located on the property.
- ☒ Provide any supporting documentation (e.g., well construction report) if available.
- ☒ Sign the well registration form.

Mailing Address:

Deputy Comptroller
Ministry of Environment
PO Box 9362 Stn Prov Govt
Victoria BC V8W 9M2

Email:

GroundWater@gov.bc.ca

08/25 '98 14:15

ID:LANIERFAX3800

FAX:

PAGE 2



Province of British Columbia

BCIA
Environment

Water Management Division

WATER WELL RECORD

Date 04-10-1998

NTS MAP

WELL No.

ELEV

Location Accuracy

 Owners Name & Address: Fibremax Timber Corp. 72 W.H. Stobbsart, P.O. Box 219, Station E, Viola
 Legal Description & Address: N3W 2M

Descriptive Location: Parker Pass Road Well #2

 1. TYPE 1 ☒ New Well 2 ☐ Reconditioned
 OF WORK 3 ☐ Deepened 4 ☐ Abandoned

 2. WORK METHOD 1 ☐ Cable tool 2 ☐ Bored 3 ☐ Jetted
 4 ☐ Rotary 5 ☐ Mud 6 ☒ Air 7 ☐ Reverse
☐ Other

 3. WATER WELL USE 1 ☒ Domestic 2 ☐ Municipal 3 ☐ Irrigation
 4 ☐ Comm. & Ind. ☐ Other

4. DRILLING ADDITIVES

 5. MEASUREMENTS from 1 ☒ ground level 2 ☐ top of casing
 casing height above ground level... 10.1 ft

FROM	TO	6. WELL LOG DESCRIPTION	SWL
0	4	Brown gravelly soil	
4	12	Brown crumbly sandstone	
12	14	Grey sandstone	
14	17	Brown crumbly sandstone	
17	42	Grey sandstone	
42	48	Brown crumbly sandstone	
48	50	Grey sandstone	
50	52	Shale sandstone	
52	125	Grey sandstone	

Water source:

 1 gpm @ 100 ft
 4 gpm @ 120 ft

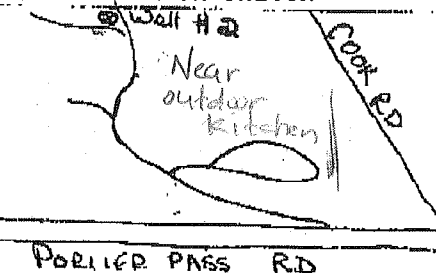
Total yield 5 gpm

 One 125 ft 4" PVC
 liner installed also
 125 ft 3/8" safety rope

CONSULTANT

Address

1. WELL LOCATION SKETCH



PARKER PASS RD

 9. CASING Materials 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Wood
 4 ☐ Plastic 5 ☐ Concrete ☐ Other

units
Diameter in
from in
to in
Thickness in
Weight lb/ft

 Pileless unit... ft 1 ☐ above 2 ☐ below ground level
 1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded 1 ☐ New 2 ☐ Used
 Perforations:

 Shoe(s): No
 Open hole, from 19'2" to 125 ft Diameter 6 in
 Grout:

 10. SCREEN: 1 ☐ Nominal (Telescope) 2 ☐ Pipe Size
 Type 1 ☐ Continuous Slot 2 ☐ Perforated 3 ☐ Louvre
☐ Other

 Material 1 ☐ Stainless Steel 2 ☐ Plastic ☐ Other
 Set from... ft below ground level

units
Length ft
Diam. ID in
Slot Size in
from ft
to ft

 Fittings, top... bottom
 Gravel Pack

 11. DEVELOPED BY: 1 ☐ Surging 2 ☐ Jetting 3 ☐ Air
 4 ☐ Bailing 5 ☐ Pumping ☐ Other

 12. TEST 1 ☐ Pump 2 ☐ Ball 3 ☐ Air Date...
 Rate... USgpm Temp... °C SWL before test... ft
 Water Level... ft after test of... hrs

DRAWDOWN in ft				RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

 13. RECOMMENDED PUMP TYPE... RECOMMENDED PUMP SETTING... RECOMMENDED PUMP RATE...
 USgpm

 14. WATER TYPE: 1 ☒ Fresh 2 ☐ Salty 3 ☐ Clear 4 ☐ Cloudy
 colour... smell... gas 1 ☐ yes 2 ☒ no

 15. WATER ANALYSIS: 1 Hardness... mg/L
 2 Iron... mg/L 3 Chloride... mg/L
 4 pH... Field Date... Lab Date...

SITE ID No

16. FINAL WELL COMPLETION DATA

 Well Depth 113.15 ft Well Yield 5 US gpm
 Static Water Level 16.10 ft Annular Flow US gpm
 Back Filled Rock chip slurry
 Well Head Completion

17. DRILLER NEGGERS

Signature

18. CONTRACTOR

 Address RED WILLIAMS WELL DRILLING LTD
 248-6552 980 PRATT ROAD
 539-5339 QUAILCUM BEACH, BC, V9K 1W5
Member, BCWDA Yes ☐ No ☐

Lot A



Lot 9

Domestic Well Registration Form

This form is intended for registering groundwater wells that are used for domestic water use purpose only. Domestic use of groundwater is exempt from the requirement for obtaining a water license or use approval and paying provincial fees and rentals. Registering your well creates a record of the location of your well and your water use. It helps to ensure that your use is considered by decision makers when dealing with other licence applications.

Domestic purpose is defined in Section 2 of the Water Sustainability Act as water used for the occupants of a private residence for household uses (e.g., not a multi-family apartment building, hotel, strata or cooperative building) including: drinking water, food preparation, sanitation, fire prevention, water for animals kept for household use or as pets, or irrigation of a garden not exceeding 1000m².

If unsure whether your use is considered to be domestic purpose, or to start your licence application if the well is used for any other purpose, please visit Front Counter BC (<http://www.frontcounterbc.ca/Start/ground-water/>).

Owner Information

Well Owner Name: Crystal Mountain Society for Eastern & Western Studies
 Mailing Address: 536 Hockmayer Pl. Town Bowen Isld. Prov. BC Postal Code V0N 1G2
 Email Address: crystalmountain@yahoo.ca or Phone No.: 604-947-0276

Well Location Information

If the address of the well location is the same as above, please check ☐

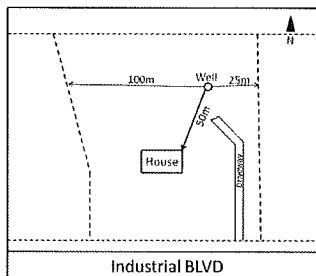
If not, at least one of the three following property descriptors must be provided

- 1) Address: 1915 Devina Dr. Town Galiano Island BC
V0N 1P0
- 2) Legal description (available from the property tax assessment notice):

Lot: <u>9</u>	Block: _____	Range: _____
Plan: <u>3120</u>	Section: _____	Land District: <u>16 Portion</u>
District Lot: <u>90</u>	Township: <u>Cowichan</u>	<u>Galiano Island</u>

- 3) PID: 000-851-035

Description of well location on the property attached



Well location map. Attach with the well registration form a sketch or diagram (e.g., property assessment drawing) showing where the well is located on the property relative to the property boundaries, a road or any other structures on the land.

Example Sketch

GPS Coordinates of the Well

Coordinates for the well can be determined by using a GPS unit, a cell phone app or by using a mapping application such as iMapBC or Google Earth.

Latitude (e.g., 49.20184°): 48.9890703 Longitude (e.g., 122.58376°): 123.5696275

OR

UTM Zone (NAD83): _____ UTM Easting: _____ UTM Northing: _____

Source of coordinates (check one): GPS ☐ Google Earth ☐ Other (please specify) Google Maps

Well Information

If the well construction report is available, please attach to this form. Attached ☐ Not Available ☒

If no well construction report is available, complete the following information:

Well Identification Plate Number (steel plate attached to some wells): 23228

Date well drilled (YYYY/MM/DD): 1986 09 30

If the date the well was drilled is unknown, provide the date you took possession of the property (YYYY/MM/DD): _____

Drilling Company: _____

Method of Drilling: ☒ Drilled ☐ Excavated or Dug

Well depth (ft): 280 ft Well Diameter (in): 6 in

Disclaimer

Red lettering indicates information that must be provided for the well and the domestic use to be registered.

The information provided on this form, including personal information, will be added to the Provincial WELLS Database, which is accessible to the public at <http://a100.gov.bc.ca/pub/wells/public/>.

Information relating to the well and well owner submitted to the Deputy Comptroller in this form shall be considered part of the Provincial Government records and subject to the *Freedom of Information and Protection of Privacy Act*.

For more information related to the Water Sustainability Act or Groundwater Protection Regulation, please visit <http://gov.bc.ca/water>.

Signature of Declaration

I have read and understand the above and declare that the information provided on this form is true to the best of my knowledge. I understand and consent that the information on this form will be published and made publically available. Digital signatures are acceptable.

Signed: Leslie A. Carr

Date (YYYY/MM/DD): Jan 19 2017

Send Completed Forms To

Before Submitting:

- ☒ Ensure your well is used for domestic purposes only.
- ☒ Complete all required information.
- ☒ Attach a sketch or map depicting where the well is located on the property.
- ☐ Provide any supporting documentation (e.g., well construction report) if available.
- ☒ Sign the well registration form.

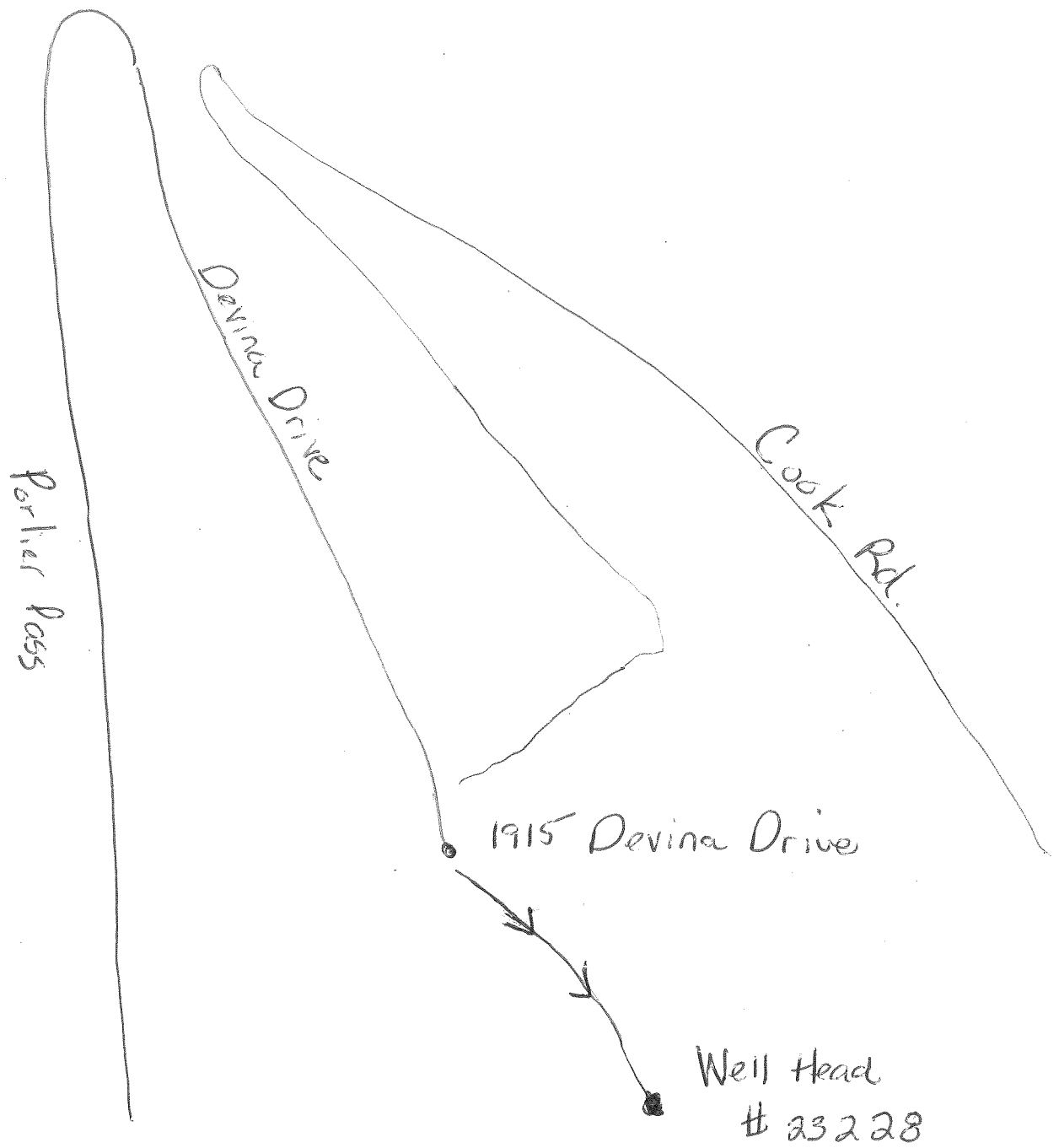
Mailing Address:

Deputy Comptroller
Ministry of Environment
PO Box 9362 Stn Prov Govt
Victoria BC V8W 9M2

Email:

GroundWater@gov.bc.ca

Galiano Island
(North End)





Water Licence Application

Tracking Number: 100358322

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization? Company/Organization
What is your relationship to the company/organization? Agent

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization will be issued, if approved

Name: Crystal Mountain - A Society for Eastern and Western Studies
Doing Business As: Crystal Mountain Society
Phone: 250-539-3783
Fax:
Email: crystalmountain@yahoo.ca
BC Incorporation Number:
Extra Provincial Inc. No:
Society Number: S12799
GST Registration Number:
Contact Name: Elizabeth McClelland
Mailing Address: 300B-2555 Cook Road
Galiano Island BC V0N 1P0

AGENT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name: Keith Erickson
Phone: 250-539-3481
Daytime Phone:
Fax:
Email: kericksongaliano@gmail.com
Mailing Address: 355 Melissa Road
Galiano Island BC V0N 1P0

Letter(s) Attached: Yes (Keith Erickson - Letter of Authorization.pdf)

ELIGIBILITY

If you answer yes to any ONE of the following questions, you are eligible to apply for a water licence.

Question	Answer	Warning
- Are you the owner of land or a mine in British Columbia where the water will be used?	Yes	
- Are you entitled to possession of land or a mine in British Columbia where the water will be used?		
- Do you have a substantial interest in the land, mine, or an undertaking in British Columbia where the water will be used?		
- Are you a holder of a certificate of public convenience and necessity issued under the Public Utilities Act, the Utilities Commission Act or the Water Utility Act?		
- Are you a municipality, regional district, improvement district, development district or water users' community?		
- Are you representing the government of British Columbia or		

Canada?

- Are you representing a commission, board or person having charge of the administration of Crown land or a mine or an undertaking on Crown land, administered by British Columbia or Canada or controlled by a ministry, department, branch or other subdivision of the government of British Columbia or Canada?
- Are you representing the Greater Vancouver Water District or any other water district incorporated by an Act?
- Are you representing the British Columbia Hydro and Power Authority?
- Are you applying as an agent on behalf of an eligible applicant as described above?

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you:

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

No

WATER DIVERSION

Do you currently hold a valid Water Licence? No

Select the source of the new water diversion being applied for: Groundwater

PURPOSES OF WATER USE

Please select the purpose for which the diverted water will be used. Please note that the purpose you indicate may be changed during the application review process to better reflect the use of the water, in which case you will be notified of the change. For definitions of Water Use Purpose, click here.

NOTE: A water licence is not required for groundwater that is used for a domestic purpose. Domestic groundwater users have deemed rights for domestic use of up to 2000 litres per day under the Water Sustainability Act and it is therefore not possible to submit an application for a licence.

Purpose	Quantity	Use of Water	Comments	Fee
Camps & Public Facilities	2.616 m3/day	Year Round	Based on maximum daily demand (MDD) for proposed use calculated by Al Kohut (Senior Hydrogeologist, Hy-Geo Consulting, March 18, 2021) in	\$250.00

"Second Addendum Letter on Estimated Water Supply Demands for Crystal Mountain Rezoning Proposal, 2021" (see attached). MDD would only be relevant seasonally with much less water required during winter and shoulder seasons.

Total: \$250.00

WORKS

Works are the physical equipment used to move the water from its source to where it will be used. For example, works can include a screened intake, pump, pipeline, irrigation system, dugout, storage structure etc. Scroll down the list provided to see all the options available for selection. For a formal definition of “works”, refer to Section 1(1) of the Water Sustainability Act.

NOTE: For works not on the list, please describe them in the box below. Hover over the works list to see a quick definition of the work.

Works	Status
Distribution system	Partly Constructed
Meter	Not Constructed
Pipe	Partly Constructed
Pressure tank	Not Constructed
Pump	Fully Constructed
Tank	Partly Constructed
Treatment facility/system	Not Constructed

Please provide details about the works selected above, and your water system:

Existing components of the water system and all proposed components are located on, and will only be used on Lot A, DL88/89. Lot A is currently the subject of an Islands Trust rezoning process and is proposed to be subdivided into two lots - one that will be retained by Crystal Mountain for spiritual education use, and the remainder to be transferred to the Islands Trust Conservancy for nature protection (see attached map 'Crystal Mountain Proposed Water System Site Plan September 2021). Water use, along with all existing and proposed works are entirely located within the proposed Crystal Mountain lot.

The existing water system is serviced by the "Central Well" and includes a generator powered well pump that feeds a 2000 gal. HDPE polyethylene storage tank. From the tank the water is gravity fed through a drop pipe to a central outdoor kitchen and washing station. Potable water is currently imported.

The proposed system will be serviced by the existing “Central Well” and integrated rainwater harvesting system with water storage in excess of 54,600 L (12,000 IG).

A storage system of 54,600L (12,000 IG) is proposed. This would allow for a functional capacity of 43,680L as not 100% of the water in a storage cistern is available. The top up system would employ a part fill valve that would engage refill after 6500L (equivalent to 2 1/2 days usage at peak times) thus allowing >48

hours (2880 minutes) for recovery between top-up events.

Storage is designed to serve 2 weeks worth of daily demand during the peak months of July and August plus an additional 16% buffer against the functional storage capacity:

- 2 ½ days usage ----- 6,540L
- 2 weeks usage ----- 36,624L
- Functional Storage Capacity ----- 43,680L
- Buffer between 2 weeks usage and Functional capacity 7,000L
- Rated Storage Capacity ----- 54,600L

Top-up trickle feed will not exceed 2.8 L/minute, as recommended by Kohut (2015)

There has been consistent yearly water sampling/testing program. Results consistently demonstrate the water from Central Well (ID#23227) meets the Canadian Drinking Water Quality Guidelines for chemistry, and water samples from the kitchen tap consistent show microbiology results of no Fecal Coliforms or E. Coli for tests dating back to 2013. A new water treatment system will be built, and Island Health will revise the operating conditions and water sampling program as they deem necessary.

The system is serviced by the Central Well (WID23227) and rainwater will employ filtration down to 1µ absolute, chlorination and UV sterilization – with chlorination set at 1.5>0.5 mg/L free chlorine residual, and UV at >40 mJ/cm² via NSF 55 Class A UV system. Monthly water testing is required as part of the operating certificate, with monthly test results sent to Island Health – a requirement under the regulation.

Water will be distributed to three buildings: a central kitchen/dining building (partially constructed) and a washroom (toilet/shower/sink) building (to be constructed) that are designed to service up to 19 campers/participants, as well as a caretaker accommodation (2 person cottage - to be constructed).

SOURCE OF WATER FOR APPLICATION

WELL WORKS

Is the water you are applying for coming from a well? Yes

If your works are not fully constructed, (e.g. under repair), please provide details in the "Comments" field below.

Works	Common Well Name	Status	Comments
Well	Central Well	Fully Constructed	
Well Tag Number:	118140	Well ID Plate Number:	23227
Depth of Well:	125 feet		
Location of well:	Latitude: 48.98355 Longitude: -123.56793 Decimal Degrees		
Method of location measurement:	GPS Device		
Is the well a flowing artesian well at any time of the year?	No		
Is the well head in a pit or a sump?	No		
Are there other wells on the property that are not in use?	Yes		

PROXIMITY TO SURFACE WATER

In order to consider all relevant factors concerning your licence application, it is necessary to understand any potential connections between the aquifer from which you propose to withdraw water and connected surface water.

Does any documentation, such as a well construction report, indicate that there is a hydraulic connection between the well and a surface water source? No

JOINT WORKS

Are your works connected to the works of another person or group of persons?

If you share or are connected to another person's works, it is recommended that a Joint Works Agreement-outlining each party's role and responsibilities-be completed and uploaded

Do you share or are you connected to another person's works? No

PERMIT OVER CROWN LAND

For any works that cross or otherwise affect (e.g. flood) Crown land, you will require permission. A Permit Over Crown Land (PCL) means an authority issued under the Water Sustainability Act which allows you to construct, maintain, or operate works on Crown land or to flood Crown land.

Please answer the following questions to determine whether an authorization to occupy Crown Land will be required with your Water application. If a Permit Over Crown land is required, the applicable fee, if any, will be automatically calculated and added to your application.

You should indicate 'Yes' to the following question if any of the following circumstances apply to your application:

- any of your works will be located on or crossing Crown land
- your well is or will be located on Crown Land
- you are proposing to flood Crown Land

Do any of the above apply to your application? No

Based on your answer you do not appear to be affecting or flooding Crown land and neither a Permit over Crown land nor a Crown land tenure appears to be required.

ADDITIONAL QUESTIONS

In many cases you might require other authorizations or permits in order to complete your project. In order to make that determination and point you in the right direction, please answer the questions below. More information can also be found on the Government Water website. In addition, your application may be referred to other agencies for comments.

Are you planning to cut timber on Crown Land? No

Are you planning to use an open fire to burn timber or other materials? No

Are you supplying potable water to consumers?	No
Will fish or wildlife habitat be affected?	No
Are you planning to undertake mineral exploration?	No
Do you need to construct a road to the dam (if there are no existing roads)?	No
Do you want to construct works within an existing forest road right-of-way on Crown land?	No
Do you want to transport heavy equipment or materials on an existing forest road?	No
Do you want to use the water for livestock watering on Crown land?	No
Does any work occur within the public road allowance or has to cross a public road?	No

LOCATION INFORMATION

LAND DETAILS

List all parcels of land where the water will be used. Click "Add Land Information" button to add each parcel of land.

Description

Private Land

Parcel ID: 024351041

Legal Description: Lot A, DL88 and 89, Galiano Island, Cowichan District, VIP68079

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☒ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description	Filename
Site plan showing all existing works and current property boundaries.	Crystal Mountain Existing W...
Site plan showing proposed subdivision and proposed water system and development.	Crystal Mountain Proposed W...

☒ I have created my map(s) using my own Geographic Information System (GIS)

SPATIAL FILES

Do you have a spatial file from your GIS system? You can upload it here.

NOTE: When uploading a shapefile, we require the .dbf, shp and .shx files at minimum. Please ensure that it is a polygon that has been projected in BC Albers in NAD83 format. For more information, refer to Commonly Used Spatial File Formats.

Description	Filename
Crystal Mountain Society Property Boundaries	Proposed Lot Boundaries- BC...
Crystal Mountain Society Property Boundaries	Proposed Lot Boundaries- BC...
Crystal Mountain Society Property Boundaries	Proposed Lot Boundaries- BC...
Crystal Mountain Society Property Boundaries	Proposed Lot Boundaries- BC...

ATTACHED DOCUMENTS

Document Type	Description	Filename
Drawing to Scale	Site plan showing all existing works and property boundaries.	Crystal Mountain Existing W...
Drawing to Scale	Site plan showing proposed subdivision and proposed water system and development.	Crystal Mountain Proposed W...
Other	BC Well Summary - Central Well 118140	Central Well Summary - Prov...
Other	Existing Water Use License Application that was submitted April 9, 2021	Existing Use Water License ...
Other	Ground Water Assessment Report for Crystal Mountain Retreat Centre, Galiano Island (Hy-Geo Consulting, Nov 2 2015)	2015-11 - Groundwater Asses...
Other	Letter explaining context of New Water License application and link to Existing Use Application	Water License Application C...
Other	Second Addendum Letter on Estimated Water Supply Demands for Crystal Mountain Rezoning Proposal, 2021 (Hy-Geo Consulting, July 19, 2021)	July 19_21Crystal Mountain ...

Other	Water Management Plan (Gord Baird, EcoSense, July 6, 2021	CMRC Water Management Plan ...
Other	Well registration documents for WID23227 and WID 23229	CrystalMountainWellRegistra...
Other	photo of well tag WID 23227	WID 23227 Tag.jpg
Other	photo of well tag WID 23229	WID 23229 Tag.jpg

PRIVACY DECLARATION

PRIVACY NOTE FOR THE COLLECTION, USE AND DISCLOSURE OF PERSONAL INFORMATION

Personal information is collected by FrontCounter BC under the legal authority of section 26 (c) and 27 (1)(a)(i) of the Freedom of Information and Protection of Privacy Act (the Act).

The collection, use, and disclosure of personal information is subject to the provisions of the Act. The personal information collected by FrontCounter BC will be used to process your inquiry or application(s). It may also be shared when strictly necessary with partner agencies that are also subject to the provisions of the Act. The personal information supplied in the application package may be used for referrals or notifications as required. Personal information may be used by FrontCounter BC for survey purposes.

For more information regarding the collection, use, and/or disclosure of your personal information by FrontCounter BC, please contact FrontCounter BC at 1-877-855-3222 or at:

FrontCounter BC Program Director
FrontCounter BC, Provincial Operation
441 Columbia Street
Kamloops, BC V2C 2T3

☒ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company /

Organization:

Contact Name:

Contact Address:

Contact Phone:

Contact Email:

Crystal Mountain - A Society for Eastern and Western Studies

Keith Erickson

355 Melissa Road

Galiano Island, BC V0N 1P0

250-539-3481

kericksongaliano@gmail.com

☒ I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this water licence application does not provide authority under the Water Sustainability Act to divert, use or store water other than to test the quality or quantity of water or to conduct a flow test in accordance with Section 6(2)(b) of the Water Sustainability Act. I understand that the submission of this water licence does not provide authority under the Water Sustainability Act to divert, use or store water from a well or other ground water sources to construct works. I also understand that my application must first be investigated and a decision made on the application as to whether a water licence may be granted and, as part of that review, additional information may be requested of me.

- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada's "Projects Near Water" webpage (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) for information on how to ensure your project complies with the Fisheries Act.
- Once you click 'Next' the application will be locked down and you will NOT be able to edit it any more.

DECLARATION

☒ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know?

This application is time sensitive. The subject property is currently in a Local Government rezoning process under the Islands Trust (Application GL-RZ-2014.1 - Crystal Mountain) . Local Government representatives are considering requiring that a water license be in place as part of the process. Any opportunities for expediency in the review of this water license application will aid local government decision making and are greatly appreciated.

APPLICATION AND ASSOCIATED FEES

Item	Amount	Taxes	Total	Outstanding Balance
WSA02-APP 954.84 m3/y - Camps & Public Facilities	\$250.00		\$250.00	\$0.00

OFFICE

Office to submit application to: Nanaimo

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource authorization from the Province of BC? No

APPLICANT SIGNATURE

Applicant Signature

Date

OFFICE USE ONLY

Office Nanaimo	File Number	Project Number
	Disposition ID	Client Number



Water Licence Application

Tracking Number: 100358322

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization? Company/Organization
What is your relationship to the company/organization? Agent

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization will be issued, if approved

Name: Crystal Mountain - A Society for Eastern and Western Studies
Doing Business As: Crystal Mountain Society
Phone: 250-539-3783
Fax:
Email: crystalmountain@yahoo.ca
BC Incorporation Number:
Extra Provincial Inc. No:
Society Number: S12799
GST Registration Number:
Contact Name: Elizabeth McClelland
Mailing Address: 300B-2555 Cook Road
Galiano Island BC V0N 1P0

AGENT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name: Keith Erickson
Phone: 250-539-3481
Daytime Phone:
Fax:
Email: kericksongaliano@gmail.com
Mailing Address: 355 Melissa Road
Galiano Island BC V0N 1P0

Letter(s) Attached: Yes (Keith Erickson - Letter of Authorization.pdf)

ELIGIBILITY

If you answer yes to any ONE of the following questions, you are eligible to apply for a water licence.

Question	Answer	Warning
- Are you the owner of land or a mine in British Columbia where the water will be used?	Yes	
- Are you entitled to possession of land or a mine in British Columbia where the water will be used?		
- Do you have a substantial interest in the land, mine, or an undertaking in British Columbia where the water will be used?		
- Are you a holder of a certificate of public convenience and necessity issued under the Public Utilities Act, the Utilities Commission Act or the Water Utility Act?		
- Are you a municipality, regional district, improvement district, development district or water users' community?		
- Are you representing the government of British Columbia or		

Canada?

- Are you representing a commission, board or person having charge of the administration of Crown land or a mine or an undertaking on Crown land, administered by British Columbia or Canada or controlled by a ministry, department, branch or other subdivision of the government of British Columbia or Canada?
- Are you representing the Greater Vancouver Water District or any other water district incorporated by an Act?
- Are you representing the British Columbia Hydro and Power Authority?
- Are you applying as an agent on behalf of an eligible applicant as described above?

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you:

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

No

WATER DIVERSION

Do you currently hold a valid Water Licence? No

Select the source of the new water diversion being applied for: Groundwater

PURPOSES OF WATER USE

Please select the purpose for which the diverted water will be used. Please note that the purpose you indicate may be changed during the application review process to better reflect the use of the water, in which case you will be notified of the change. For definitions of Water Use Purpose, click here.

NOTE: A water licence is not required for groundwater that is used for a domestic purpose. Domestic groundwater users have deemed rights for domestic use of up to 2000 litres per day under the Water Sustainability Act and it is therefore not possible to submit an application for a licence.

Purpose	Quantity	Use of Water	Comments	Fee
Camps & Public Facilities	2.616 m3/day	Year Round	Based on maximum daily demand (MDD) for proposed use calculated by Al Kohut (Senior Hydrogeologist, Hy-Geo Consulting, March 18, 2021) in	\$250.00

"Second Addendum Letter on Estimated Water Supply Demands for Crystal Mountain Rezoning Proposal, 2021" (see attached). MDD would only be relevant seasonally with much less water required during winter and shoulder seasons.

Total: \$250.00

WORKS

Works are the physical equipment used to move the water from its source to where it will be used. For example, works can include a screened intake, pump, pipeline, irrigation system, dugout, storage structure etc. Scroll down the list provided to see all the options available for selection. For a formal definition of “works”, refer to Section 1(1) of the Water Sustainability Act.

NOTE: For works not on the list, please describe them in the box below. Hover over the works list to see a quick definition of the work.

Works	Status
Distribution system	Partly Constructed
Meter	Not Constructed
Pipe	Partly Constructed
Pressure tank	Not Constructed
Pump	Fully Constructed
Tank	Partly Constructed
Treatment facility/system	Not Constructed

Please provide details about the works selected above, and your water system:

The system will be serviced by the existing “Central Well” and integrated rainwater harvesting system with water storage in excess of 54,600 L (12,000 IG).

A storage system of 54,600L (12,000 IG) is proposed. This would allow for a functional capacity of 43,680L as not 100% of the water in a storage cistern is available. The top up system would employ a part fill valve that would engage refill after 6500L (equivalent to 2 1/2 days usage at peak times) thus allowing >48 hours (2880 minutes) for recovery between top-up events.

Storage is designed to serve 2 weeks worth of daily demand during the peak months of July and August plus an additional 16% buffer against the functional storage capacity:

- 2 ½ days usage ----- 6,540L
- 2 weeks usage ----- 36,624L
- Functional Storage Capacity ----- 43,680L
- Buffer between 2 weeks usage and Functional capacity 7,000L
- Rated Storage Capacity ----- 54,600L

Top-up trickle feed will not exceed 2.8 L/minute, as recommended by Kohut (2015)

There has been consistent yearly water sampling/testing program. Results consistently demonstrate the water from Central Well (ID#23227) meets the Canadian Drinking Water Quality Guidelines for chemistry, and water samples from the

kitchen tap consistent show microbiology results of no Fecal Coliforms or E. Coli for tests dating back to 2013. A new water treatment system will be built, and Island Health will revise the operating conditions and water sampling program as they deem necessary.

The system is serviced by the Central Well (WID23227) and rainwater will employ filtration down to 1µ absolute, chlorination and UV sterilization – with chlorination set at 1.5>0.5 mg/L free chlorine residual, and UV at >40 mJ/cm2 via NSF 55 Class A UV system. Monthly water testing is required as part of the operating certificate, with monthly test results sent to Island Health – a requirement under the regulation.

Water will be distributed to three buildings: a central kitchen/dining building (partially constructed) and a washroom (toilet/shower/sink) building (to be constructed) that are designed to service up to 19 campers/participants, as well as a caretaker accommodation (2 person cottage - to be constructed).

SOURCE OF WATER FOR APPLICATION

WELL WORKS

Is the water you are applying for coming from a well? Yes

If your works are not fully constructed, (e.g. under repair), please provide details in the "Comments" field below.

Works	Common Well Name	Status	Comments
Well	Central Well	Fully Constructed	
Well Tag Number:	118140	Well ID Plate Number:	23227
Depth of Well:	125 feet		
Location of well:	Latitude: 48.98355 Longitude: -123.56793 Decimal Degrees		
Method of location measurement:	GPS Device		
Is the well a flowing artesian well at any time of the year?	No		
Is the well head in a pit or a sump?	No		
Are there other wells on the property that are not in use?	Yes		

PROXIMITY TO SURFACE WATER

In order to consider all relevant factors concerning your licence application, it is necessary to understand any potential connections between the aquifer from which you propose to withdraw water and connected surface water.

Does any documentation, such as a well construction report, indicate that there is a hydraulic connection between the well and a surface water source? No

JOINT WORKS

Are your works connected to the works of another person or group of persons?

If you share or are connected to another person's works, it is recommended that a Joint Works Agreement-outlining each party's role and responsibilities-be completed and uploaded

Do you share or are you connected to another person's works? No

PERMIT OVER CROWN LAND

For any works that cross or otherwise affect (e.g. flood) Crown land, you will require permission. A Permit Over Crown Land (PCL) means an authority issued under the Water Sustainability Act which allows you to construct, maintain, or operate works on Crown land or to flood Crown land.

Please answer the following questions to determine whether an authorization to occupy Crown Land will be required with your Water application. If a Permit Over Crown land is required, the applicable fee, if any, will be automatically calculated and added to your application.

You should indicate 'Yes' to the following question if any of the following circumstances apply to your application:

- any of your works will be located on or crossing Crown land
- your well is or will be located on Crown Land
- you are proposing to flood Crown Land

Do any of the above apply to your application?

No

Based on your answer you do not appear to be affecting or flooding Crown land and neither a Permit over Crown land nor a Crown land tenure appears to be required.

ADDITIONAL QUESTIONS

In many cases you might require other authorizations or permits in order to complete your project. In order to make that determination and point you in the right direction, please answer the questions below. More information can also be found on the Government Water website. In addition, your application may be referred to other agencies for comments.

Are you planning to cut timber on Crown Land?

No

Are you planning to use an open fire to burn timber or other materials?

No

Are you supplying potable water to consumers?

No

Will fish or wildlife habitat be affected?

No

Are you planning to undertake mineral exploration?

No

Do you need to construct a road to the dam (if there are no existing roads)?

No

Do you want to construct works within an existing forest road right-of-way on Crown land?

No

Do you want to transport heavy equipment or materials on an existing forest road? No

Do you want to use the water for livestock watering on Crown land? No

Does any work occur within the public road allowance or has to cross a public road? No

LOCATION INFORMATION

LAND DETAILS

List all parcels of land where the water will be used. Click "Add Land Information" button to add each parcel of land.

Description

Private Land

Parcel ID: 024351041

Legal Description: Lot A, DL88 and 89, Galiano Island, Cowichan District, VIP68079

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☒ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description

Crystal Mountain Water System Site Plan

Filename

Crystal Mountain Water Syst...

☒ I have created my map(s) using my own Geographic Information System (GIS)

SPATIAL FILES

Do you have a spatial file from your GIS system? You can upload it here.

NOTE: When uploading a shapefile, we require the .dbf, shp and .shx files at minimum. Please ensure that it is a polygon that has been projected in BC Albers in NAD83 format. For more information, refer to Commonly Used Spatial File Formats.

Description

Crystal Mountain Society Property Boundaries

Filename

Proposed Lot Boundaries- BC...

Crystal Mountain Society Property Boundaries

Proposed Lot Boundaries- BC...

ATTACHED DOCUMENTS

Document Type	Description	Filename
Drawing to Scale	Site Plan	Crystal Mountain Water Syst...
Other	BC Well Summary - Central Well 118140	Central Well Summary - Prov...
Other	Existing Water Use License Application that was submitted April 9, 2021	Existing Use Water License ...
Other	Ground Water Assessment Report for Crystal Mountain Retreat Centre, Galiano Island (Hy-Geo Consulting, Nov 2 2015)	2015-11 - Groundwater Asses...
Other	Letter explaining context of New Water License application and link to Existing Use Application	Water License Application C...
Other	Second Addendum Letter on Estimated Water Supply Demands for Crystal Mountain Rezoning Proposal, 2021 (Hy-Geo Consulting, July 19, 2021)	July 19_21Crystal Mountain ...
Other	Water Management Plan (Gord Baird, EcoSense, July 6, 2021	CMRC Water Management Plan ...

PRIVACY DECLARATION**PRIVACY NOTE FOR THE COLLECTION, USE AND DISCLOSURE OF PERSONAL INFORMATION**

Personal information is collected by FrontCounter BC under the legal authority of section 26 (c) and 27 (1)(a)(i) of the Freedom of Information and Protection of Privacy Act (the Act).

The collection, use, and disclosure of personal information is subject to the provisions of the Act. The personal information collected by FrontCounter BC will be used to process your inquiry or application(s). It may also be shared when strictly necessary with partner agencies that are also subject to the provisions of the Act. The personal information supplied in the application package may be used for referrals or notifications as required. Personal information may be used by FrontCounter BC for survey purposes.

For more information regarding the collection, use, and/or disclosure of your personal information by FrontCounter BC, please contact FrontCounter BC at 1-877-855-3222 or at:

FrontCounter BC Program Director
FrontCounter BC, Provincial Operation
441 Columbia Street
Kamloops, BC V2C 2T3

☒ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company /
Organization:
Contact Name:
Contact Address:

Contact Phone:
Contact Email:

Crystal Mountain - A Society for Eastern and Western
Studies
Keith Erickson
355 Melissa Road
Galiano Island, BC V0N 1P0
250-539-3481
kericksongaliano@gmail.com

☒ I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this water licence application does not provide authority under the Water Sustainability Act to divert, use or store water other than to test the quality or quantity of water or to conduct a flow test in accordance with Section 6(2)(b) of the Water Sustainability Act. I understand that the submission of this water licence does not provide authority under the Water Sustainability Act to divert, use or store water from a well or other ground water sources to construct works. I also understand that my application must first be investigated and a decision made on the application as to whether a water licence may be granted and, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada's "Projects Near Water" webpage (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) for information on how to ensure your project complies with the Fisheries Act.
- Once you click 'Next' the application will be locked down and you will NOT be able to edit it any more.

DECLARATION

☒ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know?

This application is time sensitive. The subject property is currently in a Local Government rezoning process under the Islands Trust (Application GL-RZ-2014.1 - Crystal Mountain) . Local Government representatives are considering requiring that a water license be in place as part of the process. Any opportunities for expediency in the review of this water license application will aid local government decision making and are greatly appreciated.

APPLICATION AND ASSOCIATED FEES

Item	Amount	Taxes	Total	Outstanding Balance
WSA02-APP 954.84 m3/y - Camps & Public Facilities	\$250.00		\$250.00	\$0.00

OFFICE

Office to submit application to: Nanaimo

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource authorization from the Province of BC? No

APPLICANT SIGNATURE

Applicant Signature

Date

OFFICE USE ONLY		
Office Nanaimo	File Number	Project Number
	Disposition ID	Client Number

Water License Application Context

This Water License Application is being made in advance of anticipated new (additional) water use from the identified well.

The Central Well (118140) has been used for the stated purpose (Camps and Public Facilities) since July 01, 2000. An Existing Use Groundwater Application (Tr# 100344802) was submitted on April 9, 2021.

The subject property where the well is located and where the water use occurs, is currently the subject of a local rezoning process which, if successful, will result in additional water use (compared to historical and current use). In a conversation with Ben Robinson (Senior Water Officer, FLNRO), it was advised that Crystal Mountain Society apply for a new water license for this reason.

Sincerely,

Keith Erickson
Agent
Crystal Mountain Society

1. Water Demand Assessment

Islands Trust planning staff had requested a second evaluation of the maximum daily water demand. An independent assessment is provided, using a different set of premises for daily water demand than those used by A. Kohut in his water demand analyses (2015, March 2021 & June 2021).

The following assessment was based on the fixture flow rate/volume per use, category of user, and daily fixture use per person. Additionally, this assessment was checked against the Province of BC Sewerage Systems Regulation (SSR V3) Non-residential Average Daily Flow Rate Guide (Table III.11). for the categories of “Cabin Resort”, “Resident Staff” and “Non-residential conference guest or day camp, including meals”.

Table 1 Daily usage profile per user

Fixture	Caretaker Usage Pattern (L/day)	Overnight Guest Usage Pattern (L/day)	Day Visitor Usage Pattern (L/day)
Toilet ¹	30.0	30.0	12.0
Laundry ²	25.0	25.0	12.5
Shower ³	32.0	64.0	0
Lavatory Sink ⁴	25.0	25.0	10.0
Kitchen Sink ⁵	40.0	40.0	20.0
Dishwashing ⁶	2.8	2.8	2.8
Drinking Water	4.0	4.0	4.0
Usage per day			
Potable	103.8	135.8	36.8
Non-Potable	55.0	55	24.5
TOTAL COMBINED	158.8	190.8	61.3
BC SSR Table III.11 Comparison of DDF	170.0 ⁷	225.0 ⁸	60 ⁹

In comparing the detailed daily usage profile for type of user against the Provincial SSR there is very high confidence in our assessment. The values are within a reasonable range, with a slightly lower usage by “overnight guest” being tied to use of centralized facilities rather than what would be found with cabins serviced by full water services.

¹ Toilet based on 6 L/flush and 5 flushes/day for caretakers and overnight guest, and 2 flushes for day visitor

² Laundry based on 50 L/load with 1 load per caretaker every 2 days, 1/2 load per overnight guest per day, and ¼ load/day-visitor/day

³ Shower based on 8 L/m flow, at 8 minute shower with 1 shower every 2 day for caretakers, 1 per day for overnight guests, and no showers for day-visitors

⁴ Lavatory sinks based on low flow 2.5 L/m faucets at 2 minutes/use for each toilet use

⁵ Kitchen Sink based on 8 L/m at 5 minutes per person per day across all caretakers and overnight guests, and 2.5 minutes for day-visitors

⁶ Dishwashing based on 14 L/load with 0.2 of a load/person/day across all categories

⁷ Caretaker was assessed as Resident Staff in the SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

⁸ Overnight Guest was assessed in comparison to Cabin Resort guest in SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

⁹ Day-Visitor was assessed in comparison to Non-Residential Conference Guest or Day-camp, including meals in SSR(V3) Table III.11 Non-Residential Average Daily Flow Guide

1.1.Demand

Based on the Daily Usage Profile (Table 1) of user groups both Maximum Daily Demand (MDD) and Daily Demand (DD) can be determined.

1.1.1.Maximum Daily Demands (MDD)

Maximum Daily Demand is the maximum peak usage by the various user groups. This would be experienced during times when the facility is fully utilized. Following is a table that defines the MDD usage.

Table 2 User demand profile for potable, non-potable and total combined volume per day

		AREA 1								AREA 2					
		Caretaker	Overnight	Day Visit						Caretaker	Overnight	Day Visit			
		2	17	8						0	3	0			
Usage Profile per user															
	Toilet	30	30	12						30	30	12			
	Laundry	25	25	12.5						25	25	12.5			
	Shower	32	64	0						64	64	0			
	Lavatory Sink	25	25	10						25	25	10			
	Kitchen Sink	40	40	20						40	40	20			
	Dishwashing	2.8	2.8	2.8						2.8	2.8	2.8			
	Drinking Water	4	4	4						4	4	4			
Usage per Day/User															
	Potable	103.8	135.8	36.8						135.8	135.8	36.8			
	non-potable	55	55	24.5						55	55	24.5			
	Per User Combined	158.8	190.8	61.3						190.8	190.8	61.3			
Percentage Mix															
	Potable	65%	71%	60%						71%	71%	60%			
	non-potable	35%	29%	40%						29%	29%	40%			
Total Combined Usage/day		317.6	3243.6	490.4	4051.6						0	572.4	0	572.4	
	Potable/day	207.6	2308.6	294.4	2810.6	69%					0	407.4	0	407.4	71%
	Non-potable/day	110	935	196	1241	31%					0	165	0	165	29%

Maximum daily demand summary by area and water end-use:

- Area 1 MDD – Potable Water - 2810.6 L/d
- Area 1 MDD – NPW - 1241.0 L/d
- Area 2 MDD – Potable Water - 407.4 L/d
- Area 2 MDD – NPW - 165 L/d

1.1.2.Daily Demand (DD)

Daily demand varies across the year as a consequence of seasonal activities with the lowest DD during off-peak winter months increasing to full DD (or MDD) at the peak summer season during 100% capacity. The DD usage profile is based on the percentage ratings provided in the initial groundwater and water needs analysis by A. Kohut (2015).

- Low season (caretaker usage 100%, 25% overnight and day visitors 10%)
- Mid season (caretaker usage 100%, overnight and day visitors 70% each)
- Peak season (100% usage across all user types)

The months tied to the usage activity are noted in Table 3 *Monthly usage profile - weighted daily demand for user groups for potable and non-potable usage (litres)*.

From this the daily demand is able to be determined for each user category, across each type of water use (potable and non-potable). These DD values are then incorporated in the water balance models for the proposed rainwater/non-potable systems discussed in Section 2 of this document.

Table 3 Monthly usage profile - weighted daily demand for user groups for potable and non-potable usage (litres)

Monthly Usage Profile %				WEIGHTED Daily Usage Profile (blue potable, grey non-potable)					
	Caretaker	Overnight	Day Visitor	Caretaker	Overnight	Day Visitor	Caretaker	Overnight	Day Visitor
January	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
February	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
March	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6
April	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6
May	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
June	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
July	100%	100%	100%	207.6	2308.6	294.4	110	935.0	196
August	100%	100%	100%	207.6	2308.6	294.4	110	935.0	196
September	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
October	100%	70%	70%	207.6	1616.0	206.08	110	654.5	137.2
November	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6
December	100%	25%	10%	207.6	577.2	29.44	110	233.8	19.6

2. Rainwater/Non-Potable Water

Crystal Mountain Spiritual Education Centre (CMSEC) intends to use rainwater collection to service the non-potable water (NPW) demands for toilet flushing and laundry. Two Rainwater/NPW water balance assessments are presented, (2.1) for the caretaker residence and, (2.2) for the combined central kitchen/laundry/washroom facilities.

The water balance model is based on daily data, including daily average precipitation, daily usage, and changing daily cistern volumes – for ease of presentation the following models are shown in a weekly format – the summarized data that informs these models is found in Table 4 *Weekly Water Data Table* at the end of this report.

Water Balance Model Premises:

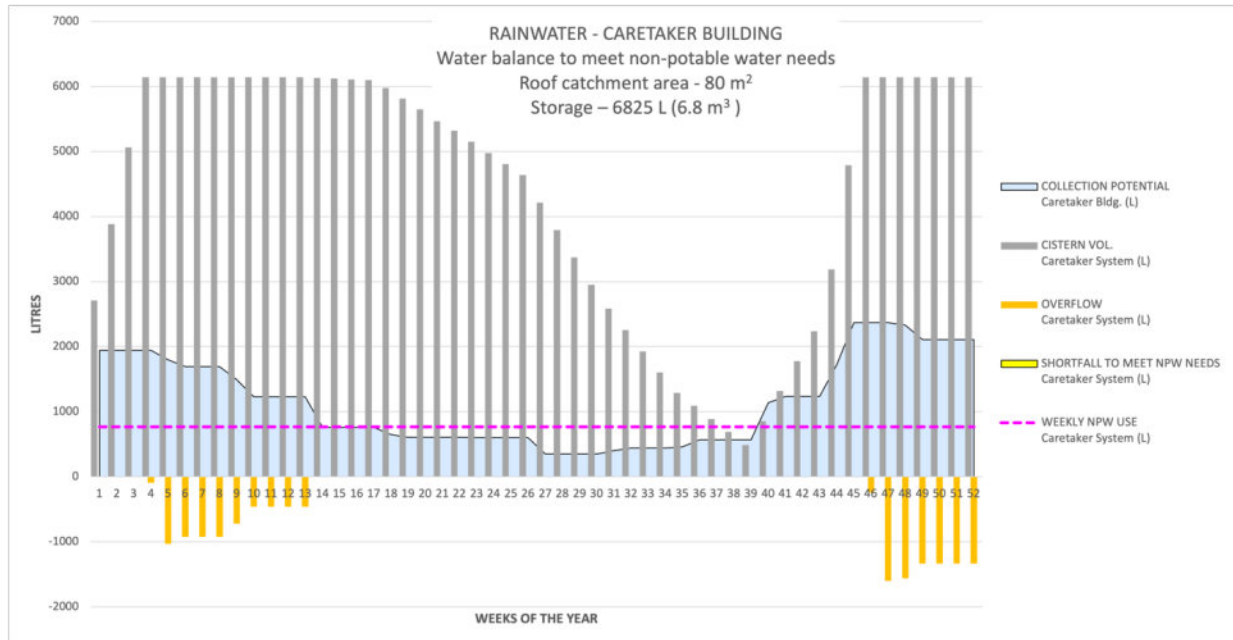
- The well has a sustainable yield of 2.826 L/m (4069 L/d)
- The well serves all potable water needs
- The rainwater system for the caretaker residence services the non-potable water needs for the caretaker residence
- The rainwater collected from the Central Kitchen and Central Washroom is combined into a consolidated system to serve the non-potable needs of laundry and toilet flushing demands housed within the two buildings
- In event of a shortfall of stored rainwater to serve the non-potable needs of the building (being served), the well would provide supplemental water to cover the non-potable demands.
- If supplemental water demands create an exceedance of the wells sustainable yield, that additional storage for the well supply exists that is equivalent to the combined exceedance, and this storage is filled during periods outside of the peak season.

2.1. Rainwater System – Caretaker

Number of caretakers	2
Daily NPW demand per caretaker	55 L/d
Total NPW	110 L/d
Caretaker roof area	≥80 m ² collection area
Storage size	6825 L
Result	

Based on a NPW demand, precipitation and collection area, a storage cistern of ≥ 6825 L (1500 Imperial Gallons) would serve 100% of the yearly usage. No supplemental potable water is required to top up the caretaker NPW system.

Graph 1 Caretaker Building – Rainwater water balance



2.2. Rainwater System – Central Facilities

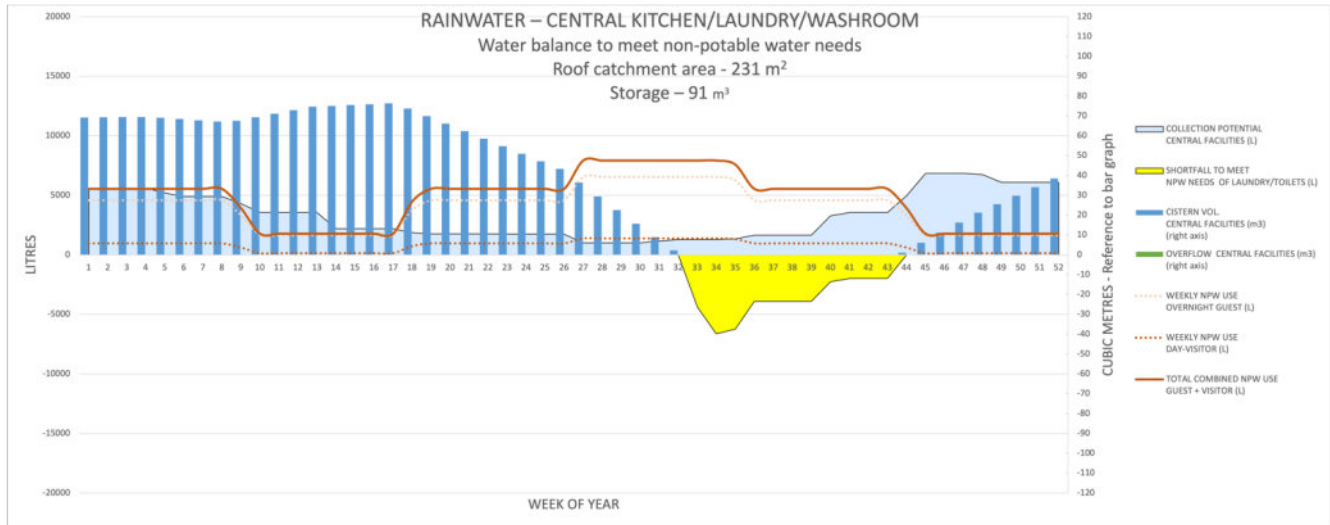
The Central Kitchen and Central Washrooms are adjacent buildings which together provide a convenient combined collection surface of 231 m². This water is stored for the NPW uses of laundry and toilet flushing within these central facilities.

This portion of the facility experiences the largest seasonal fluctuations in demand – refer to Table 3 for the daily water demand figures. The intent is to collect and store rainwater through the wetter months for use in the drier months with relying on the well for supplemental water as little as possible.

Collection Area	231 m ²
Storage size	91 m ³

The water balance for the central facilities demonstrates a shortfall of rainwater to meet the NPW demand across several weeks (Graph 2). All of this shortfall is able to be supplemented within the sustainable well yield (Section 3 will provide a discussion on sustainable well yield).

Graph 2 Central Kitchen/Laundry/Washroom - Rainwater water balance



In the graph above the bar graphs denoting cistern volume and overflow are in cubic metres, while precipitation and water use volumes are expressed in litres.

3. Sustainable Well Yield

Sustainable Well Yield at 2.826 L/m:

Daily	4069 L/d
Weekly	28,486 L/w

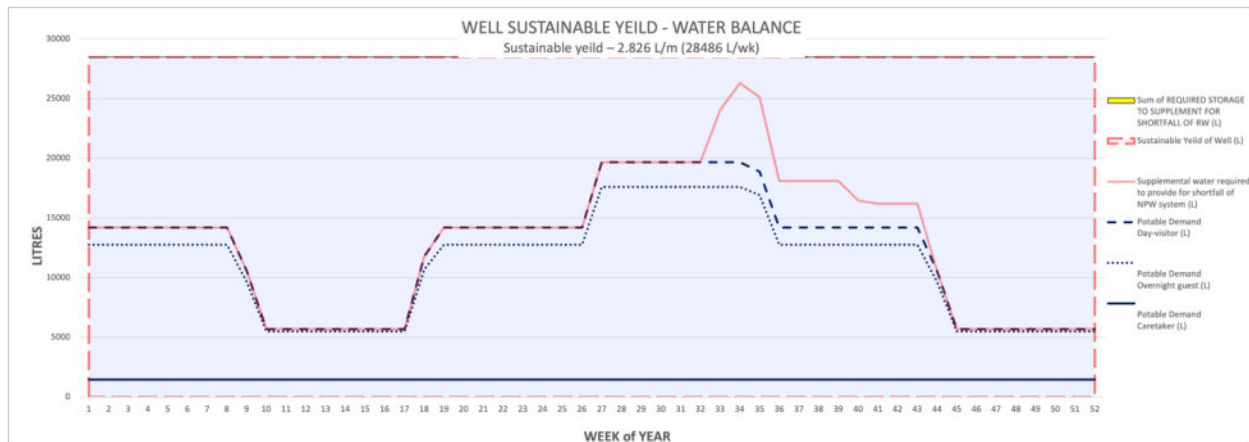
The water system as described in the Water Management Plan is designed to limit pumping capacity to a flow rate not exceeding 2.826 L/m. This ensures that the well is not pumped at a rate beyond its sustainable yield. The sustainable yield must be balanced across time to ensure that the demands placed upon it do not result in a lack of water for the operations of the CMSEC.

The draws upon the well include:

- Potable demands for the caretakers
- Potable demands for the overnight guests
- Potable demands for the day visitors
- Supplemental make-up water for any rainwater system that has a shortfall.

The well is able to meet all the potable demands at the peak usage of the CMSEC, and is also able to meet all of the supplemental make-up water for the central facilities rainwater system within the wells sustainable yield. At no point is there any set of demands that cannot be readily served by the well's sustainable yield.

Graph 3 Well sustainable yield and water demands



In the graph above all of the supplemental make-up water is able to be supplied within the sustainable yield (within the Sustainable Yield dashed line). No section of the graph is in yellow (which would represent the volume that would be required in excess of the sustainable yield).

4. Summary

The caretaker building can easily collect and store rainwater to meets the annual non-potable water demands of the caretakers, with a roof size of 80 m² and a storage system of at least 6825 L.

The central kitchen and washroom facilities with a combined collection area of 231 m², with a storage size of 91 m³, can meet a large portion of the non-potable water demands of the toilets and laundry located in these buildings, though during the peak season under maximum demand there would be a shortfall of stored rainwater therefore requiring a draw of well water to supplement this need. All of this supplemented water can be met within the well's sustainable yield. At no time during any time during the year would the MDD demands ever surpass the sustainable yield of the well.

Table 4 Weekly Water Data Table

[illegible]

DATE	#	WELL	POT. WATER		NON-POTABLE	NON-POTABLE	NON-POTABLE	TOTAL COMBINED	GUEST & NON-VISITOR		DAILY AVE.	null 1	Collection Potential		START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS	WATER TO MEET	CARETAKER	NPW NEEDS	2	null 2	Laund/Kitch	CSTERN H	CSTERN L	H	L	NPW	NEEDS	START BALANCE	CSTERN BALANCE	OVERFLOW	CSTERN NPW	NPW NEEDS
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2020-05-19	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5673	5650	0	0	0	0	249.9	66673	66131	0	0	0
2020-05-20	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5650	5626	0	0	0	0	249.9	66131	65589	0	0	0
2020-05-21	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5650	5603	5579	0	0	0	249.9	65589	65047	0	0	0
2020-05-22	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5603	5579	5550	0	0	0	249.9	65047	64506	0	0	0
2020-05-23	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5579	5556	5533	0	0	0	249.9	64506	63964	0	0	0
2020-05-24	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5556	5533	5509	0	0	0	249.9	63964	63422	0	0	0
2020-05-25	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5533	5509	5486	0	0	0	249.9	63422	62880	0	0	0
2020-05-26	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5509	5486	5462	0	0	0	249.9	62880	62338	0	0	0
2020-05-27	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5486	5462	5439	0	0	0	249.9	62338	61797	0	0	0
2020-05-28	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5462	5439	5415	0	0	0	249.9	61797	61255	0	0	0
2020-05-29	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5439	5415	5392	0	0	0	249.9	61255	60713	0	0	0
2020-05-30	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5415	5392	5368	0	0	0	249.9	60713	60171	0	0	0
2020-05-31	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	86.6	5392	5368	5344	0	0	0	249.9	60171	59630	0	0	0
2020-06-01	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5368	5344	5320	0	0	0	247.2	59630	59085	0	0	0
2020-06-02	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5344	5320	5295	0	0	0	247.2	59085	58541	0	0	0
2020-06-03	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5320	5295	5271	0	0	0	247.2	58541	57996	0	0	0
2020-06-04	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5295	5271	5246	0	0	0	247.2	57996	57452	0	0	0
2020-06-05	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5271	5246	5222	0	0	0	247.2	57452	56907	0	0	0
2020-06-06	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5246	5222	5198	0	0	0	247.2	56907	56363	0	0	0
2020-06-07	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5222	5198	5173	0	0	0	247.2	56363	55818	0	0	0
2020-06-08	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5198	5173	5149	0	0	0	247.2	55818	55274	0	0	0
2020-06-09	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5173	5149	5125	0	0	0	247.2	55274	54729	0	0	0
2020-06-10	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5149	5125	5100	0	0	0	247.2	54729	54185	0	0	0
2020-06-11	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5125	5100	5076	0	0	0	247.2	54185	53640	0	0	0
2020-06-12	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5100	5076	5051	0	0	0	247.2	53640	53096	0	0	0
2020-06-13	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5076	5051	5027	0	0	0	247.2	53096	52551	0	0	0
2020-06-14	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5051	5027	5003	0	0	0	247.2	52551	52007	0	0	0
2020-06-15	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5027	5003	4978	0	0	0	247.2	52007	51462	0	0	0
2020-06-16	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	5003	4978	4954	0	0	0	247.2	51462	50918	0	0	0
2020-06-17	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4978	4954	4929	0	0	0	247.2	50918	50373	0	0	0
2020-06-18	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4954	4929	4905	0	0	0	247.2	50373	49829	0	0	0
2020-06-19	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4929	4905	4881	0	0	0	247.2	49829	49284	0	0	0
2020-06-20	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4905	4881	4856	0	0	0	247.2	49284	48740	0	0	0
2020-06-21	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4881	4856	4832	0	0	0	247.2	48740	48195	0	0	0
2020-06-22	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4856	4832	4807	0	0	0	247.2	48195	47651	0	0	0
2020-06-23	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4832	4807	4783	0	0	0	247.2	47651	47106	0	0	0
2020-06-24	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4807	4783	4759	0	0	0	247.2	47106	46562	0	0	0
2020-06-25	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4783	4759	4734	0	0	0	247.2	46562	46017	0	0	0
2020-06-26	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4759	4734	4710	0	0	0	247.2	46017	45473	0	0	0
2020-06-27	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4734	4710	4686	0	0	0	247.2	45473	44928	0	0	0
2020-06-28	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4710	4686	4661	0	0	0	247.2	44928	44384	0	0	0
2020-06-29	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4686	4661	4637	0	0	0	247.2	44384	43839	0	0	0
2020-06-30	4069	2076	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	1.3	0	85.6	4661	4637	4613	0	0	0	247.2	43839	43295	0	0	0
2020-07-01	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4637	4577	4516	0	0	0	143.8	43295	42707	0	0	0
2020-07-02	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4577	4516	4456	0	0	0	143.8	42707	42130	0	0	0
2020-07-03	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4516	4456	4396	0	0	0	143.8	42130	41533	0	0	0
2020-07-04	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4456	4396	4336	0	0	0	143.8	41533	40936	0	0	0
2020-07-05	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4396	4336	4276	0	0	0	143.8	40936	40339	0	0	0
2020-07-06	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4336	4276	4215	0	0	0	143.8	40339	39741	0	0	0
2020-07-07	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4276	4215	4155	0	0	0	143.8	39741	39144	0	0	0
2020-07-08	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4215	4155	4095	0	0	0	143.8	39144	38547	0	0	0
2020-07-09	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4155	4095	4035	0	0	0	143.8	38547	37950	0	0	0
2020-07-10	4069	2076	2308.6	294.4	110	935	196	2810.6	1241	1131	0.7	0	49.8	4095	4035	3975	0	0	0	143.8	37950	37353	0	0	

2020-10-13	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1250	1316	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-14	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1316	1382	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-15	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1382	1448	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-16	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1448	1514	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-17	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1514	1580	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-18	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1580	1646	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-19	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1646	1712	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-20	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1712	1777	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-21	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1777	1843	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-22	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1843	1909	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-23	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1909	1975	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-24	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	1975	2041	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-25	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2041	2107	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-26	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2107	2173	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-27	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2173	2239	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-28	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2239	2305	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-29	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2305	2371	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-30	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2371	2437	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-10-31	4069	207.6	1616.02	206.08	110	654.5	137.2	2029.7	901.7	791.7	2.6	0	175.9	2437	2503	0	0	0	0	508.0	0	0	0	-284	283.714892
2020-11-01	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	2503	2731	0	0	0	0	977.1	724	1447	0	0	0
2020-11-02	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	2731	2959	0	0	0	0	977.1	1447	2171	0	0	0
2020-11-03	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	2959	3188	0	0	0	0	977.1	2171	2895	0	0	0
2020-11-04	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	3188	3416	0	0	0	0	977.1	2895	3619	0	0	0
2020-11-05	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	3416	3645	0	0	0	0	977.1	3619	4342	0	0	0
2020-11-06	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	3645	3873	0	0	0	0	977.1	4342	5066	0	0	0
2020-11-07	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	3873	4101	0	0	0	0	977.1	5066	5790	0	0	0
2020-11-08	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	4101	4330	0	0	0	0	977.1	5790	6514	0	0	0
2020-11-09	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	4330	4558	0	0	0	0	977.1	6514	7237	0	0	0
2020-11-10	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	4558	4787	0	0	0	0	977.1	7237	7961	0	0	0
2020-11-11	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	4787	5015	0	0	0	0	977.1	7961	8685	0	0	0
2020-11-12	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	5015	5243	0	0	0	0	977.1	8685	9409	0	0	0
2020-11-13	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	5243	5472	0	0	0	0	977.1	9409	10132	0	0	0
2020-11-14	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	5472	5700	0	0	0	0	977.1	10132	10856	0	0	0
2020-11-15	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	5700	5928	0	0	0	0	977.1	10856	11580	0	0	0
2020-11-16	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	5928	6143	-14	0	0	0	977.1	11580	12304	0	0	0
2020-11-17	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	12304	13027	0	0	0
2020-11-18	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	13027	13751	0	0	0
2020-11-19	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	13751	14475	0	0	0
2020-11-20	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	14475	15199	0	0	0
2020-11-21	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	15199	15922	0	0	0
2020-11-22	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	15922	16646	0	0	0
2020-11-23	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	16646	17370	0	0	0
2020-11-24	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	17370	18094	0	0	0
2020-11-25	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	18094	18817	0	0	0
2020-11-26	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	18817	19541	0	0	0
2020-11-27	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	19541	20265	0	0	0
2020-11-28	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	20265	20989	0	0	0
2020-11-29	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	5.0	0	338.4	6143	6143	-228	0	0	0	977.1	20989	21712	0	0	0
2020-12-01	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	4.4	0	300.9	6143	6143	-191	0	0	0	868.9	21712	22328	0	0	0
2020-12-02	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	4.4	0	300.9	6143	6143	-191	0	0	0	868.9	22328	22943	0	0	0
2020-12-03	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	4.4	0	300.9	6143	6143	-191	0	0	0	868.9	22943	23559	0	0	0
2020-12-04	4069	207.6	577.15	29.44	110	233.75	19.6	814.19	363.35	253.35	4.4	0	300.9	6143	6143	-191	0	0	0	868.9	23559	24174	0	0	0
2020-12-05	4069	207.6	577.15	29.44	110	233																			

