

14 October 2021

Reference No. 20137086-001-L-Rev0

Laura Beckett, Municipal Planner, Deputy Approving Officer

District of Highlands
1980 Millstream Road
Victoria, BC V9B 6H1

RESULTS OF 2020 GROUNDWATER LEVEL MONITORING PROGRAM, DISTRICT OF HIGHLANDS, BC

Dear Ms. Beckett,

As requested by the District of Highlands (the District), Golder Associates Ltd. Member of WSP (Golder) conducted a groundwater level monitoring program in the District of Highlands, BC (the Highlands) for 2020. Golder conducted the groundwater level monitoring program in accordance with our proposal titled “Work Plan and Cost Estimate for 2020 Groundwater Level Monitoring Program, District of Highlands, BC” (Golder Reference No. P20137086-001-P-Rev0) and dated 24 January 2020.

Our letter should be interpreted and used in accordance with the limitations and considerations set out in Golder Associates Ltd.’s *Study Limitations*, provided at the end of this letter.

1.0 BACKGROUND AND OBJECTIVE

The Highlands is one of the 13-member municipalities of the Capital Regional District (CRD), encompassing approximately 37 square km and located northwest of Victoria, BC. The majority of the residential population of approximately 2,225 obtains potable water from private, individual water wells. Commercial groundwater use is limited to the southern portion of the Highlands. The Hanington Estates subdivision, located along the southern portion of the Highlands, obtains water from a water system (“Hanington Estates Water System”) that is supplied by two communal supply wells. Irrigation water for the Bear Mountain Golf Course (Bear Mountain) is sourced from groundwater wells located within the Highlands. Some businesses within the Millstream Industrial Park, located in the Highlands and Langford, had historically used groundwater for commercial purposes; however, the CRD municipal Regional Water Supply System was extended into this area and may represent the primary water supply for businesses in the industrial park. As per the BC *Water Sustainability Act* (WSA), groundwater use for purposes other than domestic supply must apply for and obtain a groundwater license. Groundwater licensing, which is administered by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), establishes rights to groundwater and specifies how much water one can legally use. As of September 2021, no groundwater licences were documented on provincial water rights databases for the Highlands.

1.1 Aquifer Description

Groundwater supplies within the Highlands are derived primarily from drilled wells completed in the Wark-Colquitz Aquifer. This bedrock aquifer is identified as Aquifer No. 680 by the BC Ministry of Environment and Climate Change Strategy (ENV) and is categorized as class IIB under the BC Aquifer Classification System, indicating moderate demand relative to aquifer productivity and moderate vulnerability of the aquifer to contamination from surface sources. Sewage servicing within the Highlands is primarily by individual septic systems.

1.2 Highlands Monitoring Program

On behalf of the District, Golder initiated a groundwater level monitoring program in the Highlands in 2009 in support of the District's Groundwater Protection Study. The water level information was used to assess seasonal groundwater level variations and, in 2012, to refine a numerical groundwater model that Golder developed, calibrated and used to conduct water balance analyses. At the completion of the Groundwater Protection Study, Golder recommended that the District continue to monitor groundwater conditions at select locations in the Highlands to assess long-term trends. If trends were to be observed, the results would provide the basis for guiding implementation of management strategies including conservation and groundwater protection measures, and public education efforts. Further details are provided in Golder's report titled "Phase 3: Groundwater Protection Study District of Highlands, District of Highlands Victoria, BC" (Golder Report No. 0714140014-501-R-Rev2-3000) and dated 18 December 2012.

The groundwater monitoring program has been continued since 2009 to the present. As of the end of 2020, pressure transducers were deployed in five monitoring wells located across the Highlands to collect continuous water level data at strategic locations, and one additional pressure transducer (a "barologger") was deployed to monitor changes in barometric (i.e., atmospheric) pressure. The locations of monitoring wells DOH-01, DOH-03, DOH-04B, DOH-07B and DOH-09A are presented on attached Figure 1. Monitoring Well DOH-02A, which had been included in the monitoring program since 2009, was removed from the monitoring program in February 2018 at the property owner's request. The location of DOH-02A is also shown on Figure 1.

Monitoring wells DOH-02A, DOH-07B and DOH-09A are unused wells that are not equipped with pumps (i.e., are not in operation). Therefore, the water levels in these wells are generally considered to be representative of static groundwater levels in the aquifer in the vicinity of the wells. However, groundwater flow within a bedrock aquifer is variable and through discrete fractures. Therefore, water levels at a given location can be influenced by pumping of wells in the area.

DOH-03 and DOH-04B are equipped with pumps and operated as supply wells for non-potable uses (i.e., not for drinking water). Although DOH-01 is an unused well, the water level in this well is influenced by pumping in an adjacent well. Water levels in DOH-01, DOH-03 and DOH-4B are not considered representative of the water levels in the surrounding aquifer during periods of pumping, but the high water levels that are interpreted to represent static (i.e., non-pumping) periods provide a basis to assess groundwater conditions in the areas of these wells.

1.3 Objective

The objective of the 2020 groundwater level monitoring program was to compile and analyse data from the Highlands and stakeholder monitoring programs to assess regional groundwater conditions and potential long-term trends.

2.0 METHODS

2.1 Groundwater Level Monitoring

The transducers that are installed in the Highlands monitoring wells, including the barologger that is deployed at monitoring location DOH-01, are programmed to collect data every twelve hours. Under the current program, Golder downloaded pressure transducer data and collected a manual depth-to-water measurement at each of the monitoring locations in the Highlands on 29 June 2020, 16 September 2020 and 4 February 2021. Golder also downloaded transducer data and collected water level measurements at the monitoring wells earlier in the year on 10 January 2020 as part of the 2019 monitoring program.

2.2 Data Compilation and Analysis

In addition to the District's monitoring program, Golder also obtained data from other stakeholder monitoring programs in the Highlands including:

- University of Victoria (UVic) School-Based Weather Station Network: data available on-line for UVic weather stations, located at various areas of the Highlands, as described below
- ENV Observation Well Network: water level data available on-line from ENV Well No. 372, located in the western portion of the Highlands
- Hanington Estates Water System: flow data available from Island Flow Control Water Solutions Ltd. (IFCWS) for the Hanington Estates Water System, in the southern portion of the Highlands
- Capital Regional District (CRD) Millstream Meadows: data available from the Millstream Meadows site in the southern portion of the Highlands

The locations of the monitoring wells and weather stations from the various stakeholder monitoring programs are presented on attached Figure 1.

Golder compiled the raw pressure data from the Highlands monitoring wells and corrected the data for variations in barometric pressure, as recorded by the barologger, to calculate depth to groundwater levels for each Highlands monitoring well. Golder also checked the barometrically corrected transducer data with the manual depth to water measurements that were collected during each monitoring event. As discussed in Section 1.2, water levels in the Highlands monitoring wells are influenced either directly by periodic pumping (i.e., DOH-03 and DOH-4B) or, given the bedrock setting, pumping by adjacent wells, particularly at DOH-01. The water level data are estimated to range from plus or minus 0.01 to 0.02 m relative to manual measurements for DOH-07B and DOH-09A to approximately 0.05 to 0.10 m for DOH-03 and DOH-01. This precision is considered appropriate for a regional water monitoring program that assesses seasonal patterns and long-term trends.

Golder also compiled water level data available from ENV Well No. 372. Golder compiled data from the UVic weather stations that have been analysed during previous years; however, limited precipitation data were available for some of the weather stations. Therefore, similar to recent annual monitoring programs, Golder compiled precipitation data from weather stations with available data as follows:

- **Northern Highlands:** Water level data for DOH-07B were compared to precipitation data for the Cal Revelle Nature Sanctuary Weather Station, located approximately 20 m north from DOH-7B.
- **Southern Highlands:** Water level data for DOH-01 and DOH-03 had been compared to precipitation data for the District of Highlands Office Weather Station, adjacent to DOH-03, for the period of 1 January 2012 to 31 January 2016. For the period 1 February 2016 to 31 December 2020, precipitation data from the Millstream Elementary School Weather Station were primarily used.¹ The Millstream Elementary School station is located approximately 1.4 km to the south of, and at an elevation 24 m lower than, the District of Highlands Office station (Figure 1).
- **Western Highlands:** For the period 1 January 2012 to 28 February 2017, water level data for DOH-04B and ENV Well No. 372 were compared to precipitation data from the West Highlands District Firehall weather station, located approximately 200 m northwest from DOH-04B. Beginning in March 2017, data for the West Highlands District Firehall Station were only available for certain periods. Therefore, data from the Cal Revelle Nature Sanctuary Weather Station, located approximately 3.5 km northeast of the West Highlands District Firehall station were compared to water level data from DOH-04B and ENV Well No. 372 for the period 1 March 2017 to 31 December 2020.
- **Eastern Highlands:** Water level data for DOH-09A had been compared to precipitation data for the East Highlands District Firehall weather station from 1 January 2012 until 31 May 2014, after which data were no longer available for the station. For the period 1 June 2014 to 31 December 2020, water level data from DOH-09A were compared to precipitation data from the Cal Revelle Nature Sanctuary Weather Station, located approximately 4 km northwest from DOH-09A.

Data from the Highlands and stakeholder monitoring programs were plotted, and the results analysed to assess seasonal and long-term trends.

Golder also reviewed flow data for the Hanington Estates Water System, as provided by IFCWS, and information from the CRD regarding a monitoring well that was installed near the District office as part of an environmental remediation work that is being conducted for the Millstream Meadows site. In previous years, the Highlands groundwater level monitoring program has also included review of the annual results of the groundwater monitoring program that has been conducted for the Bear Mountain Golf Course; however, the 2020 annual report for Bear Mountain was not available for review at the time of this letter.

¹ Data from Millstream Elementary School Weather Station were not available from 13 July 2019 to 19 September 2019. Therefore, data from the District of Highlands Office

3.0 RESULTS AND DISCUSSION

3.1 District of Highlands Monitoring Program

Detailed water level data for monitoring wells DOH-01, DOH-03, DOH-04B, DOH-07B and DOH-09A for the period from 1 January 2012 through 31 December 2020, together with daily precipitation data from nearby weather stations, are presented on Figures 2 through 6. The precipitation data are provided to illustrate the relationship between precipitation and groundwater levels. As discussed in Section 2.2, data from the District of Highlands Office and East Highlands District Firehall weather stations, which had been used during previous monitoring years to assess precipitation in the southern and eastern portions of the Highlands, respectively, were supplemented with precipitation data from nearby stations within the UVic School-Based Weather Station Network. Although it is expected that there is some variability in precipitation patterns across the Highlands, the precipitation data presented on Figures 2 through 6 are considered suitable for the purposes of assessing general groundwater level patterns across the Highlands. Furthermore, groundwater recharge into the bedrock aquifer is interpreted to be controlled by the properties of the bedrock and not necessarily the intensity of specific precipitation events. Therefore, it is anticipated that minor changes in precipitation in different areas of the Highlands would not necessarily be reflected in groundwater level data.

Similar to previous years, in 2020 the water levels that were recorded in the majority of the Highlands monitoring wells were consistent with seasonal precipitation patterns that were observed in previous years. Groundwater elevations were highest in the wet winter months of December to April, declining to a seasonal low during the dry summer period from May to early September before increasing in response to precipitation between September and December. Seasonal responses in 2020 ranged from approximately 7.5 m in DOH-01 to approximately 4.0 m in DOH-03.

In 2020, the precipitation recorded during the summer was greater than what had been observed in previous monitoring years. The total precipitation of 148.9 mm that was reported for the Cal Reville Nature Sanctuary weather station from May through August 2020 was greater than values for this station that ranged from 36.8 mm in 2018 to 139.5 mm in 2010. As discussed below, water levels in the Highlands monitoring wells during the dry season of 2020 were relatively high compared to previous monitoring years, consistent with greater recharge from precipitation.

As discussed in Section 1.2, the water level in monitoring well DOH-01 is influenced by pumping in one or more nearby wells. The inferred static groundwater level of approximately 11.0 metres below the top of the casing (mbtoc) that was measured in DOH-01 late in the summer of 2020 was similar to values reported for most of the previous monitoring years (Figure 2). The lowest isolated (i.e., pumping induced) water level of approximately 16.6 mbtoc that was recorded for DOH-01 during the summer of 2020 was higher than those that were below 25.9 mbtoc during the summers of 2012, 2016 and 2017; the level of 25.9 mbtoc was the level at which the pressure transducer was set, and the water level is inferred to have declined below this level during isolated pumping events. The patterns observed in the summers of 2018, 2019 and 2020 could potentially reflect less sustained pumping from nearby wells. The seasonal high water level of approximately 9.2 mbtoc that was recorded at DOH-01 early in January of 2020 was generally within the low range of those in previous monitoring years with a seasonal high of approximately 8.5 mbtoc observed in 2012 (Figure 2).

The seasonal low water level of approximately 7.4 mbtoc that was measured in DOH-03 in September 2020 was high relative to previous monitoring years, with the exception of the summer of 2012 when a low of approximately 6.9 mbtoc was recorded (Figure 3). The seasonal high water level of approximately 3.4 mbtoc that was observed in February 2020 was higher than what had been observed in previous monitoring years.

The seasonal low water levels in DOH-04B and DOH-09A were also relatively higher in 2018 to 2020 when compared to previous monitoring years (Figures 4 and 6). The seasonal low water levels in DOH-04B and DOH-09A were as low as 9.5 mbtoc and 5.2 mbtoc, respectively, in 2012. In 2020 the seasonal low water levels were 6.8 mbtoc in DOH-04B and 4.3 mbtoc in DOH-09A. The seasonal high water levels in these wells have generally been consistent during the monitoring period. The seasonal high in DOH-04B has been in the range of approximately 1.9 to 2.2 mbtoc in DOH-04B. The seasonal high in DOH-09A increased slightly between 2012 and 2020 from approximately 0.1 m below to 0.5 m above the former top of the casing of DOH-09A, prior to the casing for this well being extended by approximately 1.24 m in October 2011.

As presented on Figure 5, the seasonal low water level of 10.2 mbtoc that was recorded in DOH-07B in late September 2020 was in the upper end of values that have ranged from 9.8 mbtoc in 2013 to 11.7 mbtoc in 2016; the isolated period of drawdown to 12.1 mbtoc observed on 30 August 2016 corresponded with a period of extended pumping in an adjacent well on the property. Although the seasonal high values for DOH-07B exhibited an apparent declining trend from 5.5 mbtoc in 2012 to 5.9 in 2018, a seasonal high value of 5.6 mbtoc was observed in February 2020. As reported in previous annual reports, the lowest water level recorded in DOH-07B is approximately 140 m higher than the reported depth of the well (152.4 m below ground surface; bgs).

3.2 BC Ministry of Environment and Climate Change Strategy Observation Well

Water level data for ENV Well No. 372 are plotted with precipitation data from the West Highlands District Firehall and Cal Reville Nature Sanctuary weather stations on Figure 7. The water level pattern observed in ENV Well No. 372 was generally consistent with those observed in the Highlands monitoring wells, declining through the spring and summer months and then increasing in response to seasonal precipitation in the fall and winter. The seasonal low water level of 61.8 mbtoc that was reported for ENV Well No. 372 in mid October 2020 was consistent with the low water levels of 61.6 and 61.8 mbtoc that were reported in mid October 2019 and early November 2018, respectively. As presented on Figure 7, periods of consistent low water levels that were reported in the dry seasons of 2015, 2016 and 2017 are inferred to reflect periods when the water level dropped below the pressure transducer that was deployed in the well. Therefore, the low water levels in monitoring years prior to 2018 were lower than what are plotted on Figure 7 and may have been similar to those reported for 2018 to 2020.

The water level in ENV Well No. 372 began increasing in late September 2020 in response to seasonal precipitation. In late 2020, when the water level in the well reflected the seasonal high for the winter, the water level in the well was as high as 44.2 mbtoc. This level is similar to what had been generally recorded for previous winters in 2012 and from 2016 to 2019; variable water levels that were reported for this monitoring well during the period of the Highlands monitoring program may reflect movement of the transducer and potentially placement at different depths that may have affected the data.

3.3 Hanington Estates Water System

Water supply for the Hanington Estates Water System is sourced from two groundwater supply wells. Well 409 (Well Tag No. 85183) is operated as the primary water supply for the Hanington System and Well 500 (Well Tag No. 85184) is operated periodically as a backup supply. During the 233-day period from 25 February 2020 to 15 October 2020, the total flows from Wells 409 and 500 were reported to be 11,764 cubic metres (m³) and 7,163 m³, respectively, for a combined flow of 18,927 m³. Average groundwater use for the Hanington Estates Water System during this period was estimated to be 81.23 m³/day which is higher than the value of 67.64 m³/day that was estimated for 2019; however, the average rate of daily groundwater use for 2019 was calculated for the 449-day period from 3 December 2018 to 25 February 2020 which included relatively more days in the winter period when daily water use is lower and would result in a lower calculated daily average.

IFCWS also provided flow monitoring data for the overall water system. Although considered to be less accurate than the flow data for the individual wells (Well 409 and Well 500), the data for the water system suggest that approximately 49% of the annual use in 2020 occurred between May and September, with the demand in the summer months of June through August approximately double the demand in the winter months. These results, which are inferred to reflect higher irrigation and other outdoor water use during the hotter, drier summer months, are consistent with values of 50% (2019) to 60% (2017) of the annual use occurring between May and September. The lower percentage of water used during May to September of 2019 and 2020 compared to previous years may be due to the increased total precipitation in the summer of 2019 and 2020. As discussed in Section 3.1, precipitation was relatively greater during the summer of 2019 and 2020 compared to 2018 and 2017.

The population in the Hanington Estates subdivision is reported to have been 200 residents in 2020, the same as 2017 to 2019, and up from 190 residents in 2016². Based on this information, the average per capita water use for the Hanington Estates water system was calculated to be approximately 406 litres per person per day (L/p/d) for the period from 25 February 2020 to 15 October 2020. The average per capita estimate for 2020 is slightly higher than the value of 338 L/p/d that was calculated for 2019; however, the average for 2019 was calculated from water usage between 3 December 2018 and 25 February 2020, a period that includes a relatively greater proportion of winter months when water use is typically lower.

Water level data were not provided for Well 409 and Well 500 for 2019.

3.4 Capital Regional District Millstream Meadows Program

The Millstream Meadows site, located in the southern portion of the Highlands at 1965 Millstream Road, was operated as an unregulated landfill for septic discharge from approximately 1941 to 1985. The CRD and the province are currently funding an environmental remediation program and pursuing a Certificate of Compliance (CoC) from ENV that could support re-zoning and public use of the site; further details are provided on the CRD website.³

² Population information, as provided by the District of Highlands in file "Estd Pop_Hanington Creek Estates_2013-2020.docx", that is based on Occupancy Permits, Stats Canada 2011 and 2016 Census data and Building Official's observations.

³ <https://www.crd.bc.ca/project/capital-projects/millstream-meadows-remediation>; accessed September 2021.

The remedial work at Millstream Meadows has involved drilling and installation of monitoring wells to assess groundwater conditions at the site and on adjacent properties. In 2021, the CRD provided the District with information regarding monitoring well MW19-96 that was installed approximately 60 m northeast from DOH-03 and the District office. MW19-96 was drilled in 2019 to a total depth of 97.5 m (320 ft) bgs and was completed with a Waterloo Multilevel Groundwater Monitoring System which enables the collection of water level measurements and groundwater samples from well screens set at depths of approximately 23 m (76 ft), 38 m (125 ft), 58 m (191 ft), 75 m (247 ft), 87 m (285 ft) and 96 m (314 ft) bgs.⁴

Depth to groundwater data for MW19-96 were provided for monitoring events conducted on 9 December 2019 and 11 March, 6 July and 29 September 2020. For the well screens at depths of approximate 23 to 87 m (76 to 285 ft), the depths to groundwater were generally consistent, ranging from approximately 3.8 to 4.0 mbgs in March 2020 to 4.1 to 4.2 mbgs in September 2020, with a slight upward vertical gradient from the screens at depths of 58 to 87 mbgs to the screens at 23 to 38 mbgs. In comparison, the water level for the well screen at 96 mbgs ranged from approximately 3.8 to 0.3 mbgs in December 2019 and March 2020, respectively, indicating that the vertical gradient from this depth is in the upward direction during the wet season. This seasonal fluctuation of approximately 3.5 m is generally consistent with the magnitude of the fluctuation observed at nearby DOH-03.

The District of Highlands Monitoring Program is focused on groundwater levels and does not include scope to assess groundwater quality. The CRD is sharing information regarding the results of groundwater quality monitoring that is being undertaken for the Millstream Meadows site and the District is managing this separately from the current water level monitoring program that is documented in this letter. Further details regarding the Millstream Meadows remediation are documented in the District report dated 13 August 2020.⁵

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The results from the 2020 Highlands groundwater monitoring program were generally consistent with the seasonal patterns reported for previous years. In 2019 and 2020, the total precipitation during the summer months was relatively high compared to summer months in previously monitored years. Consistent with greater precipitation during the summer, the seasonal low groundwater levels observed in Highlands monitoring wells in the summer of 2020 were generally higher than those reported in previous monitoring years. On-going monitoring continues to provide the basis to assess seasonal variability and long-term patterns. The data from the monitoring program also provides a general baseline in the Highlands for comparison if residents were to report concerns with their individual well. Groundwater levels reported for stakeholder monitoring wells were also consistent with the results of the Highlands wells.

The average water use at Hanington Estates was estimated to be approximately 81.2 m³/day for the period February 2020 to October 2020, within the range of values that have been reported since annual well flow data have been provided (2013). When the population of the Hanington Estates subdivision is considered, the per

⁴ SNC Lavalin. 2019. Borehole No.: BH19-96.

⁵ District of Highlands. 2020. RE: Contaminant Migration to 1980 Millstream Road in Relation to Millstream Meadows Remediation. 13 August 2020. File 1980 Millstream Road, X-Ref 1965 Millstream Road.

capita water use for the Hanington Estates water system has declined steadily from an estimated value of 473 L/p/d in 2013 to 338 L/p/d in 2019. In 2020 the per capita water use increased relative to the 2019 use to 406 L/p/d; however, the 2019 value was calculated from a period which included relatively more days in the winter period when daily water use is lower and would result in a lower calculated daily average.

4.2 Recommendations

Golder recommends that the groundwater monitoring program continue in 2021 to document conditions and provide the basis to assess groundwater levels across the Highlands.

It is also recommended that the results of stakeholder programs continue to be reviewed on an annual basis to monitor groundwater conditions in the southern portion of the Highlands where production wells are operated. If annual reports for the Bear Mountain Groundwater Monitoring Program are available in the future, it is recommended that they be reviewed to understand groundwater use and conditions in this area of the Highlands.

5.0 CLOSURE

We trust the above information meets your current needs. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours very truly,

Golder Associates Ltd.



Alanna Umphrey, ASCT
Applied Science Technologist

AU/MB/asd



Mark Bolton, MSc, PGeo
Associate, Senior Hydrogeologist

PERMIT TO PRACTICE #1003064
Engineers & Geoscientists BC

Attachments: Figure 1: Monitoring Locations District of Highlands
Figure 2: Depth to Groundwater Monitoring Well DOH-01 and Precipitation in Southern Highlands
Figure 3: Depth to Groundwater Monitoring Well DOH-03 and Precipitation in Southern Highlands
Figure 4: Depth to Groundwater Monitoring Well DOH-04B and Precipitation in Western Highlands
Figure 5: Depth to Groundwater Monitoring Well DOH-07B and Precipitation in Northern Highlands
Figure 6: Depth to Groundwater Monitoring Well DOH-09A and Precipitation in Eastern Highlands
Figure 7: Depth to Groundwater Monitoring Well MoE Observation Well 372 and Precipitation in Western Highlands

[https://golderassociates.sharepoint.com/sites/121135/project files/6 deliverables/issued to client_for wp/20137086-001-l-rev0/20137086-001-l-rev0-2020 groundwater level monitoring program-14oct_21.docx](https://golderassociates.sharepoint.com/sites/121135/project%20files/6%20deliverables/issued%20to%20client_for%20wp/20137086-001-l-rev0/20137086-001-l-rev0-2020%20groundwater%20level%20monitoring%20program-14oct_21.docx)

6.0 STUDY LIMITATIONS

Golder Associates Ltd. Member of WSP (Golder) has prepared this letter in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and geoscience professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this letter. No other warranty, express or implied is made.

The letter is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other letters prepared by Golder for the Client relative to the specific site described in the letter. In order to properly understand the suggestions, recommendations and opinions expressed in this letter, reference must be made to the whole of the letter.

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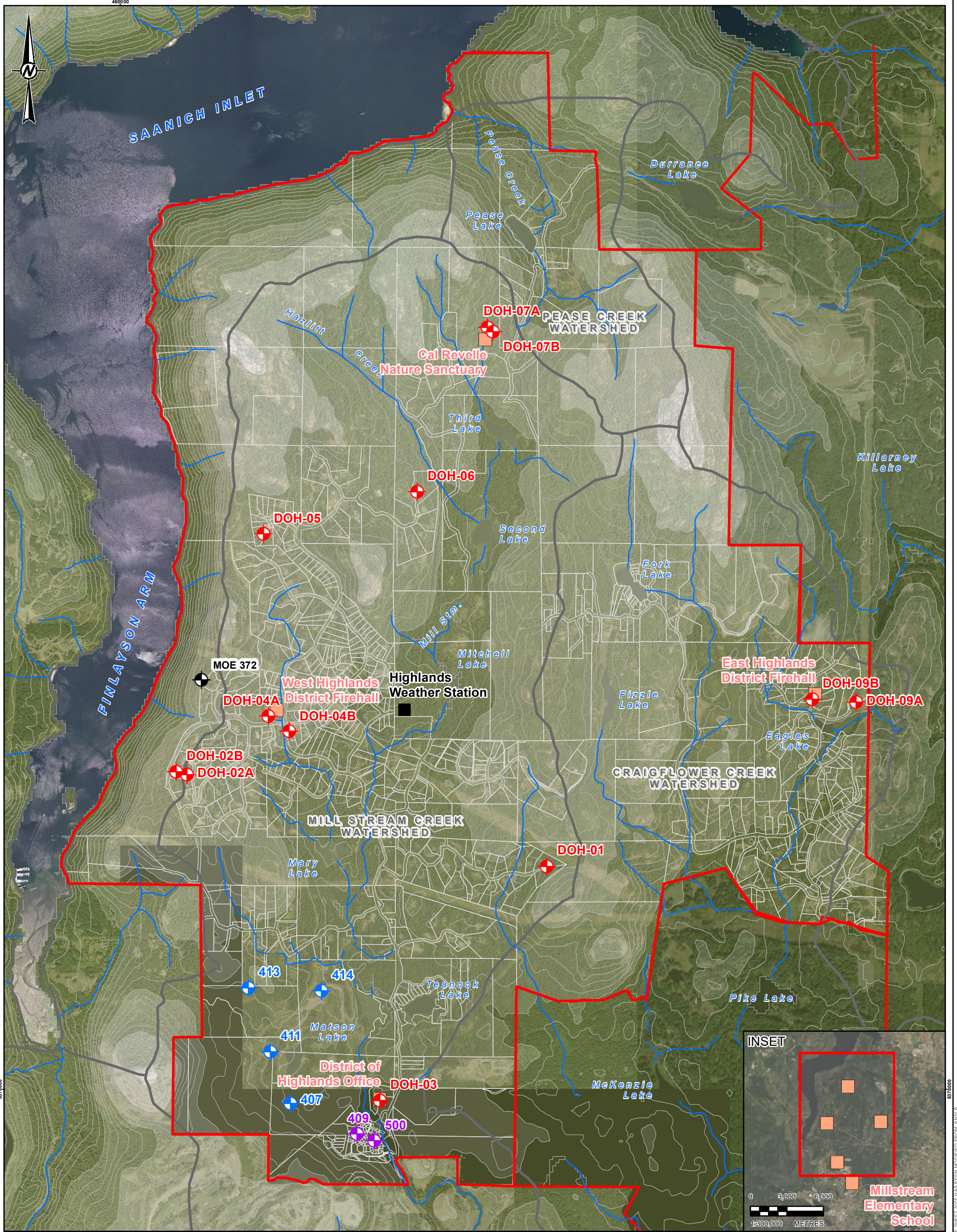
In preparing this letter, Golder has relied in good faith on information provided by the individuals and agencies noted in this letter. We accept no responsibility for any deficiency or inaccuracy contained in this letter as a result of errors, omissions, misinterpretations or fraudulent acts of the persons or agencies contacted.

The information, recommendations and opinions expressed in this letter are for the sole benefit of the Client.

No other party may use or rely on this letter or any portion thereof without Golder's express written consent.

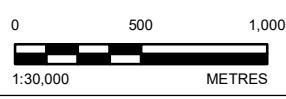
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If new information is discovered in the future, Golder Associates Ltd. should be requested to re-evaluate the content of this letter and provide amendments as required prior to any reliance upon the information presented herein.



- LEGEND**
- District of Highlands Monitoring Well Location
 - Hanington Creek Estates Well
 - Bear Mountain Monitoring Well
 - Ministry of Environment Observation Well No. 372
 - Environment Canada Weather Station
 - University of Victoria Weather Station
 - Contour (20m Interval)
 - Watercourse
 - Waterbody

- ▭ Cadastre Information
 - ▭ Major Watershed Boundary
 - ▭ Municipality Boundary
- Elevation - metres above sea level (masl)**
- 0 - 100
 - 101 - 200
 - 201 - 300
 - 301 - 400
 - 401 - 500



REFERENCES

1. DATA PROVIDED BY THE DISTRICT OF HIGHLAND AND BC ILMB.
2. BASE DATA CONTAIN INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - BRITISH COLUMBIA/CANADA.
3. WEATHER STATIONS OBTAINED FROM ENVIRONMENT CANADA AND THE UNIVERSITY OF VICTORIA SCHOOL-BASED WEATHER STATION NETWORK.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
DISTRICT OF HIGHLANDS

PROJECT
**GROUNDWATER PROTECTION STUDY
HIGHLANDS, B.C.**

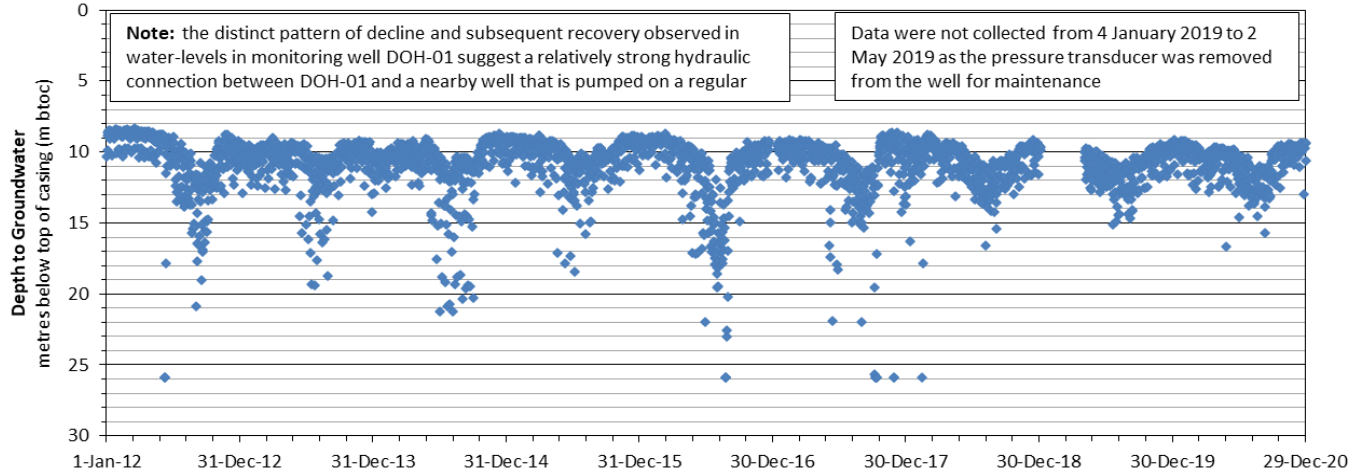
TITLE
MONITORING LOCATIONS

CONSULTANT	YYYY-MM-DD	2021-09-28
GOLDER MEMBER OF WSP	DESIGNED	MB
	PREPARED	DSC/AD
	REVIEWED	AU
	APPROVED	MB

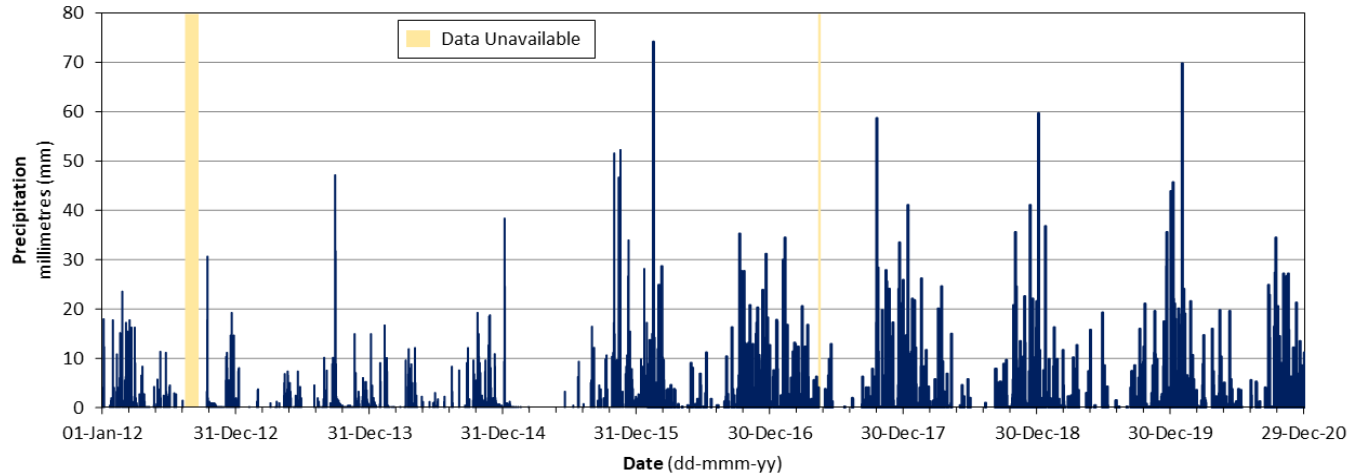
PROJECT NO.	CONTROL	REV.	FIGURE
20137086	1000/1	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4 (1189x841) TO A3 (1189x841) 25mm

District of Highlands Monitoring Well DOH-01



**District of Highlands Office Weather Station (01-Jan-2012 to 31-Jan-2016; 13-Jul-2019 to 19-Sep-2019);
Millstream Elementary School Station (01-Feb-2016 to 12-Jul-2019; 20-Sep-2019 to 31-Dec-2020)**



Notes

Water level data collected under the District of Highlands Groundwater Monitoring Program.

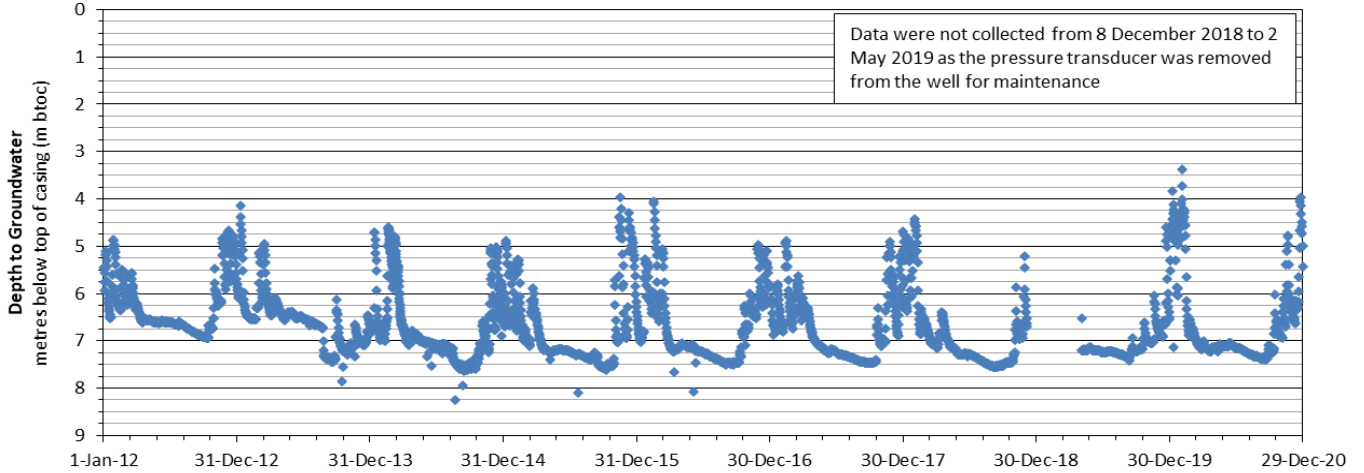
Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

FILE: https://goldeassociates.sharepoint.com/sites/25417g/SitePages/Home.aspx

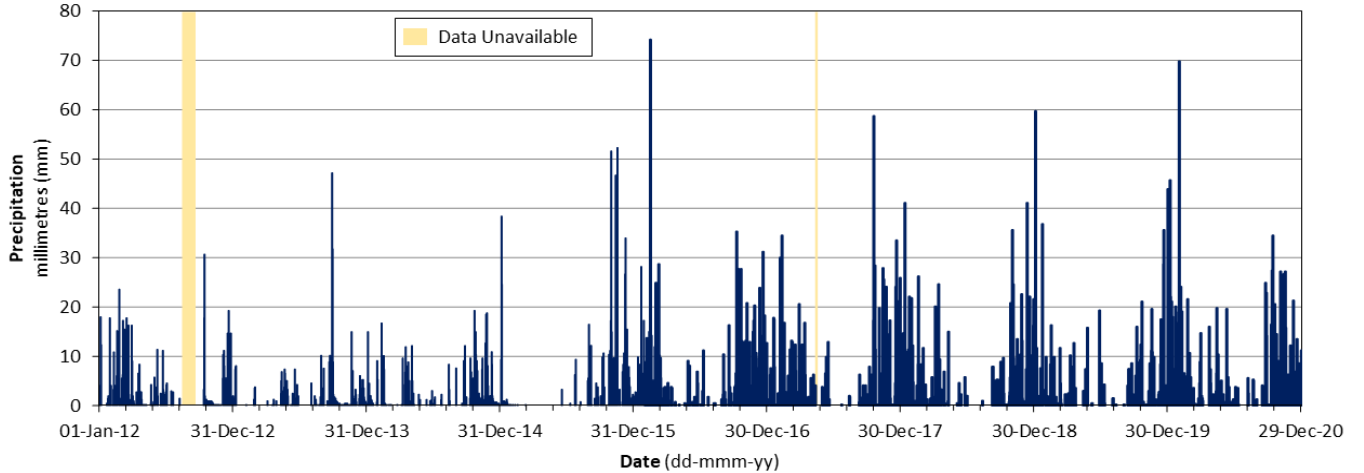
PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MONITORING WELL DOH-01 AND PRECIPITATION IN SOUTHERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ---		DESIGN CB 06NOV14			SCALE NTS		REV. 0
CADD AU 16JUN21					CHECK AU 16JUN21			FIGURE 2		
REVIEW MB JUN21										



District of Highlands Monitoring Well DOH-03



**District of Highlands Office Weather Station (01-Jan-2012 to 31-Jan-2016; 13-Jul-2019 to 19-Sep-2019);
Millstream Elementary School Station (01-Feb-2016 to 12-Jul-2019; 20-Sep-2019 to 31-Dec-2020)**



Notes

Water level data collected under the District of Highlands Groundwater Monitoring Program.

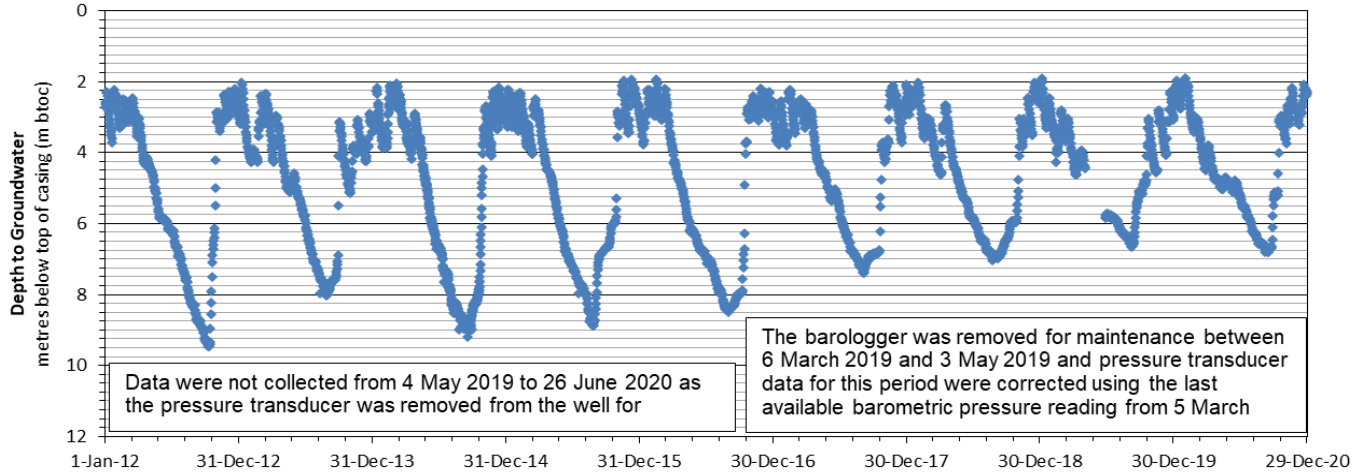
Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

FILE: <https://goldeassociates.sharepoint.com/sites/25417g/SitePages/Home.aspx>

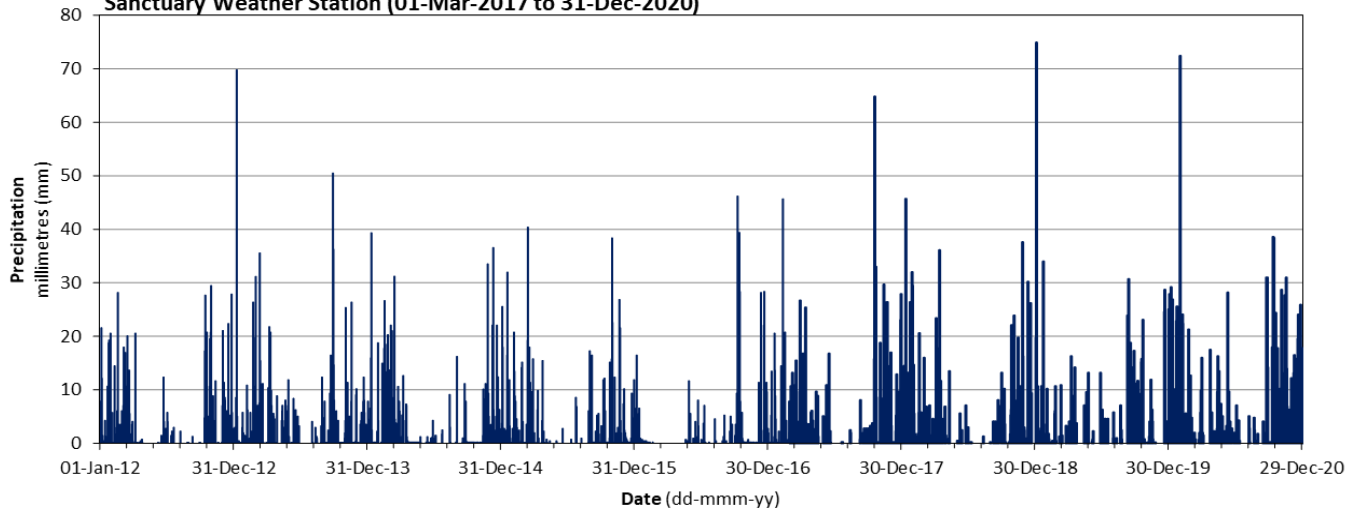
PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MONITORING WELL DOH-03 AND PRECIPITATION IN SOUTHERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ----		DESIGN CB 06NOV14			SCALE NTS		REV.0
CADD AU 16JUN21					CHECK AU 16JUN21			FIGURE 3		
REVIEW MB JUN21					REVIEW MB JUN21					



District of Highlands Monitoring Well DOH-04B



West Highlands District Firehall Weather Station (01-Jan-2012 to 28-Feb-2017); Cal Reville Nature Sanctuary Weather Station (01-Mar-2017 to 31-Dec-2020)



Notes

Water level data collected under the District of Highlands Groundwater Monitoring Program.

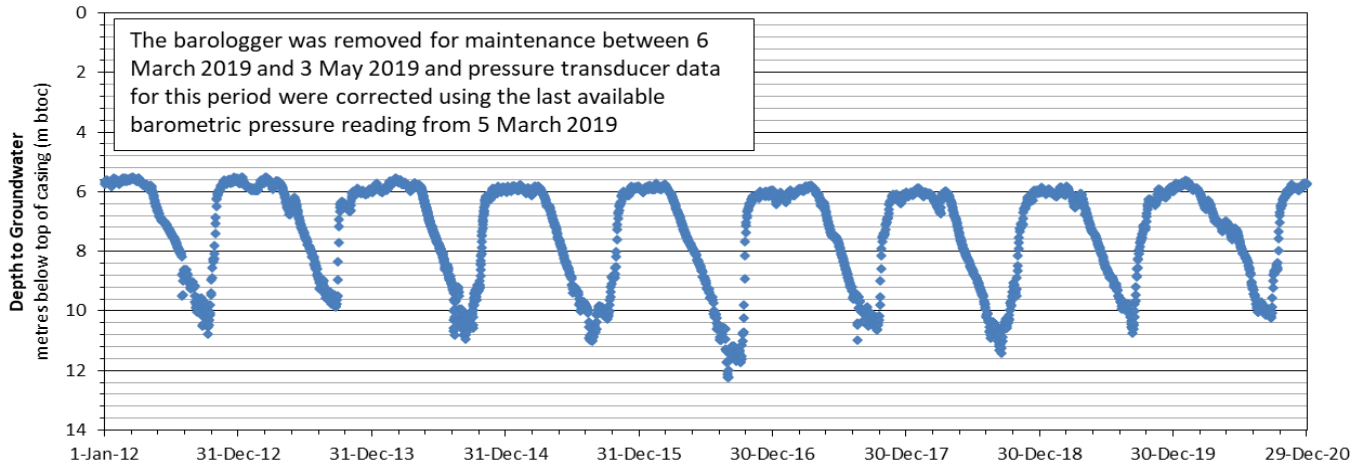
Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

FILE: https://goldeassociates.sharepoint.com/sites/25417g/SitePages/Home.aspx

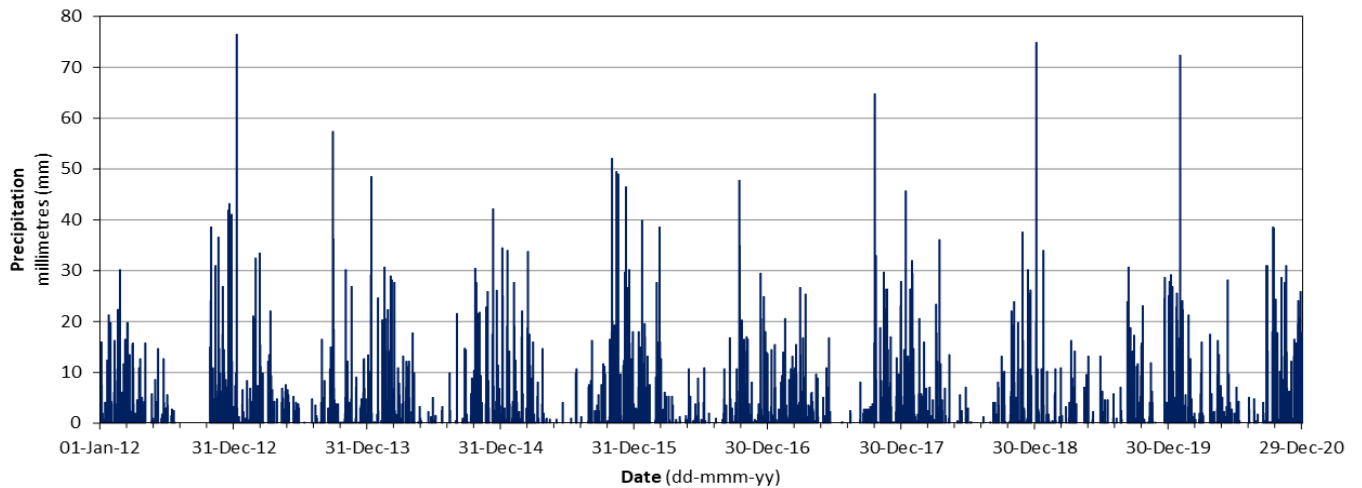
PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MONITORING WELL DOH-04B AND PRECIPITATION IN WESTERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ----		DESIGN CB 06NOV14			SCALE NTS		REV.0
CADD AU 16JUN21			CHECK AU 16JUN21			FIGURE 4				
REVIEW MB JUN21										



District of Highlands Monitoring Well DOH-07B



Cal Reville Nature Sanctuary Weather Station (01-Jan-2012 to 31-Dec-2020)




Notes

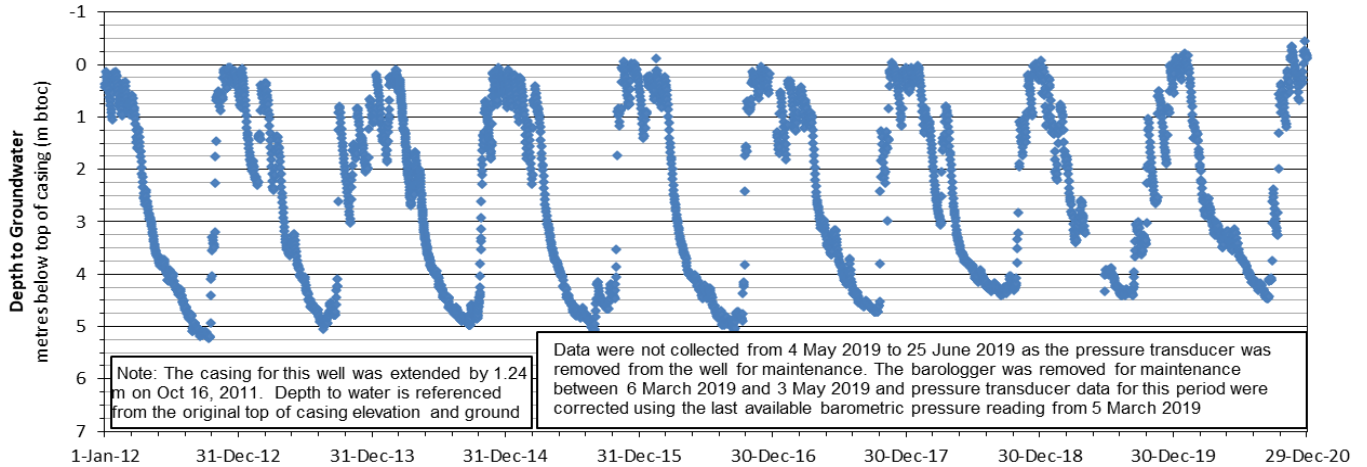
Water level data collected under the District of Highlands Groundwater Monitoring Program.

Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

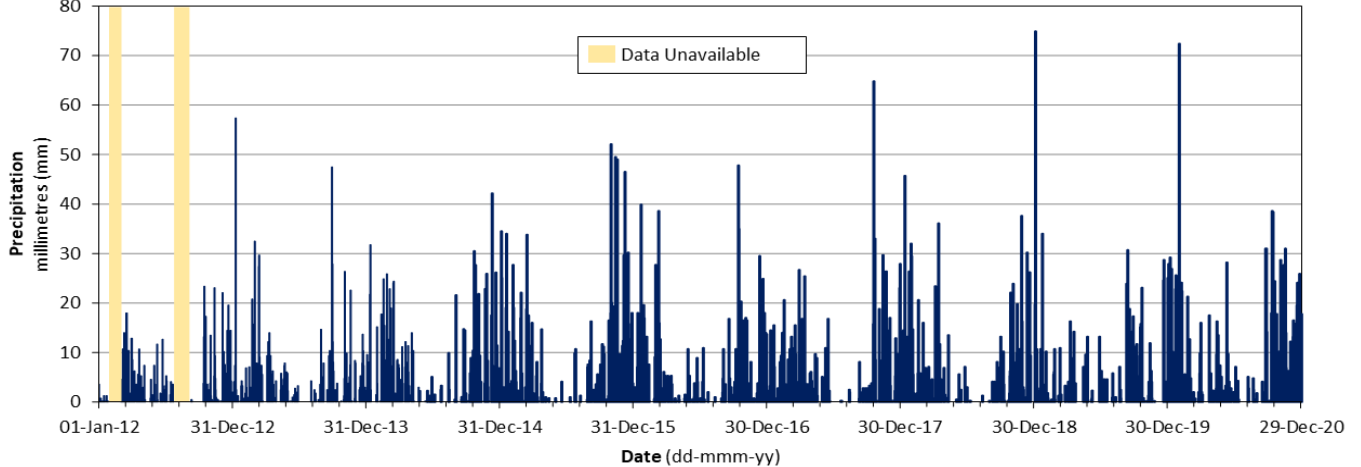
FILE: https://goldeassociates.sharepoint.com/sites/25417g/SitePages/Home.aspx

PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MONITORING WELL DOH-07B AND PRECIPITATION IN NORTHERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ----		DESIGN CB 06NOV14			SCALE NTS		REV.0
CADD AU 16JUN21			CHECK AU 16JUN21			REVIEW MB JUN21			FIGURE 5	
										

District of Highlands Monitoring Well DOH-09A



East Highlands District Firehall Weather Station (01-Jan-2012 to 31-May -2014); Cal Reville Nature Sanctuary Weather Station (01-Jun-2014 to 31-Dec-2020)



Notes

Water level data collected under the District of Highlands Groundwater Monitoring Program.

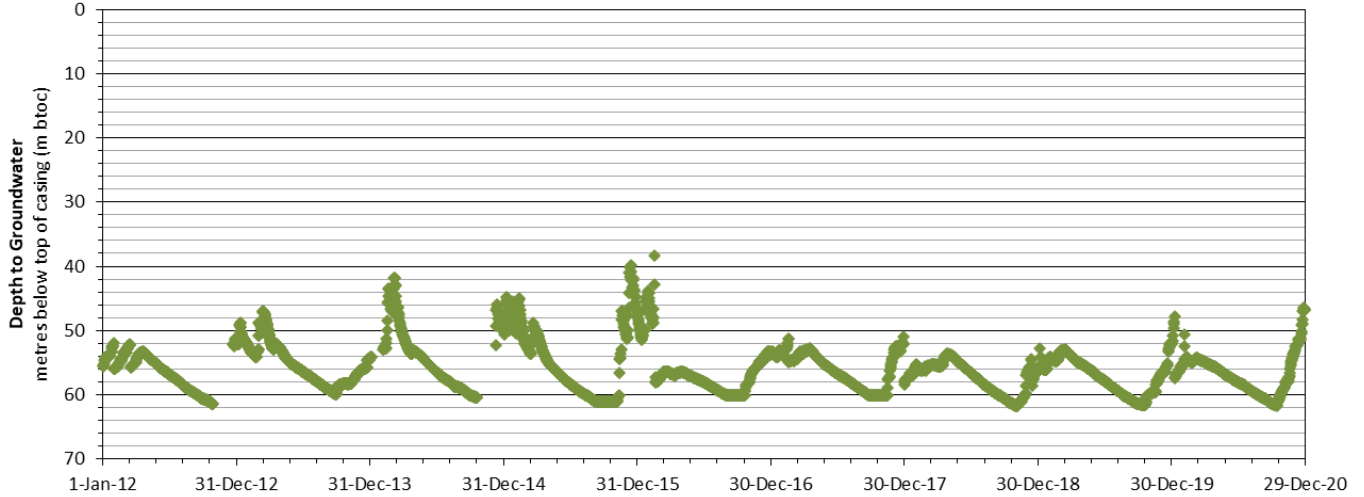
Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

FILE: https://goldeassociates.sharepoint.com/sites/25417g/SitePages/Home.aspx

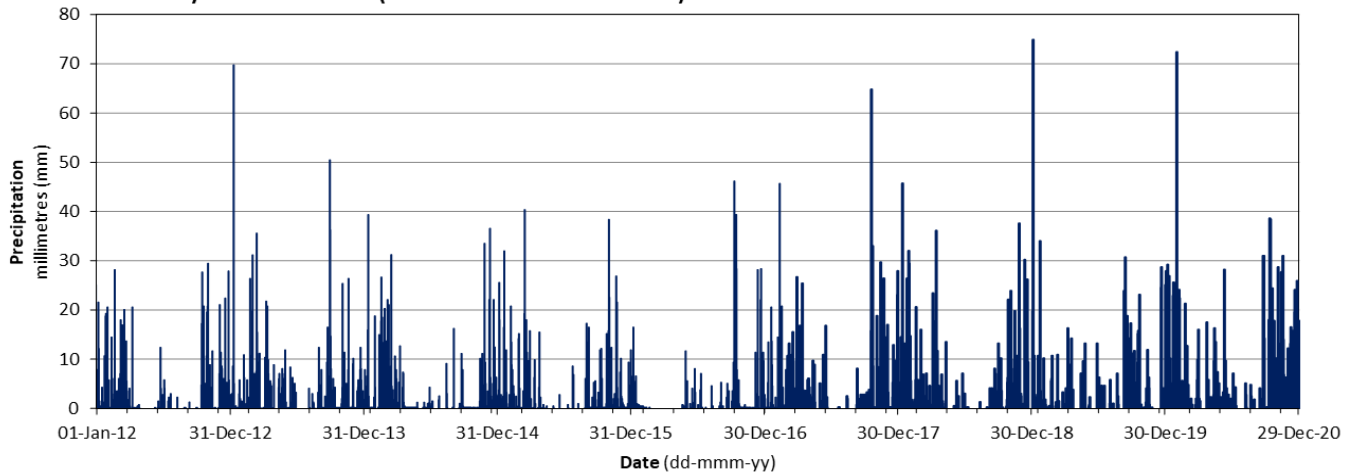
PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MONITORING WELL DOH-09A AND PRECIPITATION IN EASTERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ----		DESIGN CB 06NOV14			SCALE NTS		REV.0
CADD AU 16JUN21					CHECK AU 16JUN21			FIGURE 6		
REVIEW MB JUN21					REVIEW MB JUN21					



BC Ministry of Environment Observation Well No. 372



West Highlands District Firehall Weather Station (01-Jan-2012 to 28-Feb-2017); Cal Reville Nature Sanctuary Weather Station (01-Mar-2017 to 31-Dec-2020)



Notes

Water level data obtained online from the Ministry of Environment British Columbia Groundwater Observation Network.
http://www.env.gov.bc.ca/wsd/data_searches/obsWell/map/obsWells.html

Precipitation data obtained online from the University of Victoria School-Based Weather Station Network.
<http://www.victoriaweather.ca/>

PROJECT					DISTRICT OF HIGHLANDS 2020 GROUNDWATER MONITORING PROGRAM HIGHLANDS, BC					
TITLE					DEPTH TO GROUNDWATER MOE OBSERVATION WELL 372 AND PRECIPITATION IN WESTERN HIGHLANDS					
PROJECT No. 20137086			FILE No. ----		DESIGN CB 06NOV14			SCALE NTS		REV.0
CADD AU 16JUN21					CHECK AU 16JUN21			FIGURE 7		
REVIEW MB JUN21					REVIEW MB JUN21					

