

File: 2007261

February 24, 2022

Mayne Island Housing Society
Mayne Island BC

Attention: Deborah Goldman

Re: Groundwater Level Monitoring, Well WID 43943 (WTN 122538) at Village Bay Road, Mayne Island

Monitoring Installation

As requested, a Diver™ datalogger Serial No. DG948 was installed in the above well on September 30 2021 by Hy-Geo Consulting. Well WID 43943 was constructed on September 29, 2020 to a depth of 140 feet (42.67 m). The well was completed in fractured brown to grey sandstone encountering a major water-bearing fracture zone from 106 to 111 feet (32.32 to 33.83m) below ground yielding 20+ USgpm as reported by the driller. The well was subsequently lined with 4 inch diameter slotted PVC casing from 6 to 106 feet (1.83 to 32.31m) as chunks of rock were reported coming from the major fracture zone. Lithology of the drilling record indicates the well was drilled into the Geoffrey Formation comprised mainly of sandstone (Muller and Jeletzky, 1970). A 72 hour pumping test was carried out on the well in 2020 as reported by (Kohut, 2020b).

The recording interval for the datalogger was set at 10 minutes to detect any potential water level variations from neighbouring pumping wells and tidal effects. The corrected manually measured water level in the well at 8:30 am on September 30, 2021 was 4.7592 m below ground. A second Diver™ datalogger Serial No. DG951 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. DG948.

On February 17, 2022 the datalogger and barologger were removed from the site by Hy-Geo Consulting and data was downloaded offsite. The corrected water level in the well at 9:20 am on February 17, 2022 was manually measured at 1.692 m below ground.

Precipitation Data 2021-22

Although no longer operational, the historic Mayne Island climate station may be considered representative of the general longer-term (monthly) precipitation patterns for Mayne 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. 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.

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).

Monitoring Results

September 30 to February 17, 2022

Given the frequent recording interval of 10 minutes chosen for the monitoring project, a large dataset of over 20,160 water level readings was generated for the above period. A 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 43943 from September 30 to February 17, 2022 compared with precipitation data for the North Pender Island climate station (Climate ID.1015638). Water level data shown has been corrected for barometric effects. The raw water level data for the September 30 to February 17, 2022 monitoring period is provided in Excel[®] spreadsheet titled “Mayne Island Sept to February 2022.csv”.

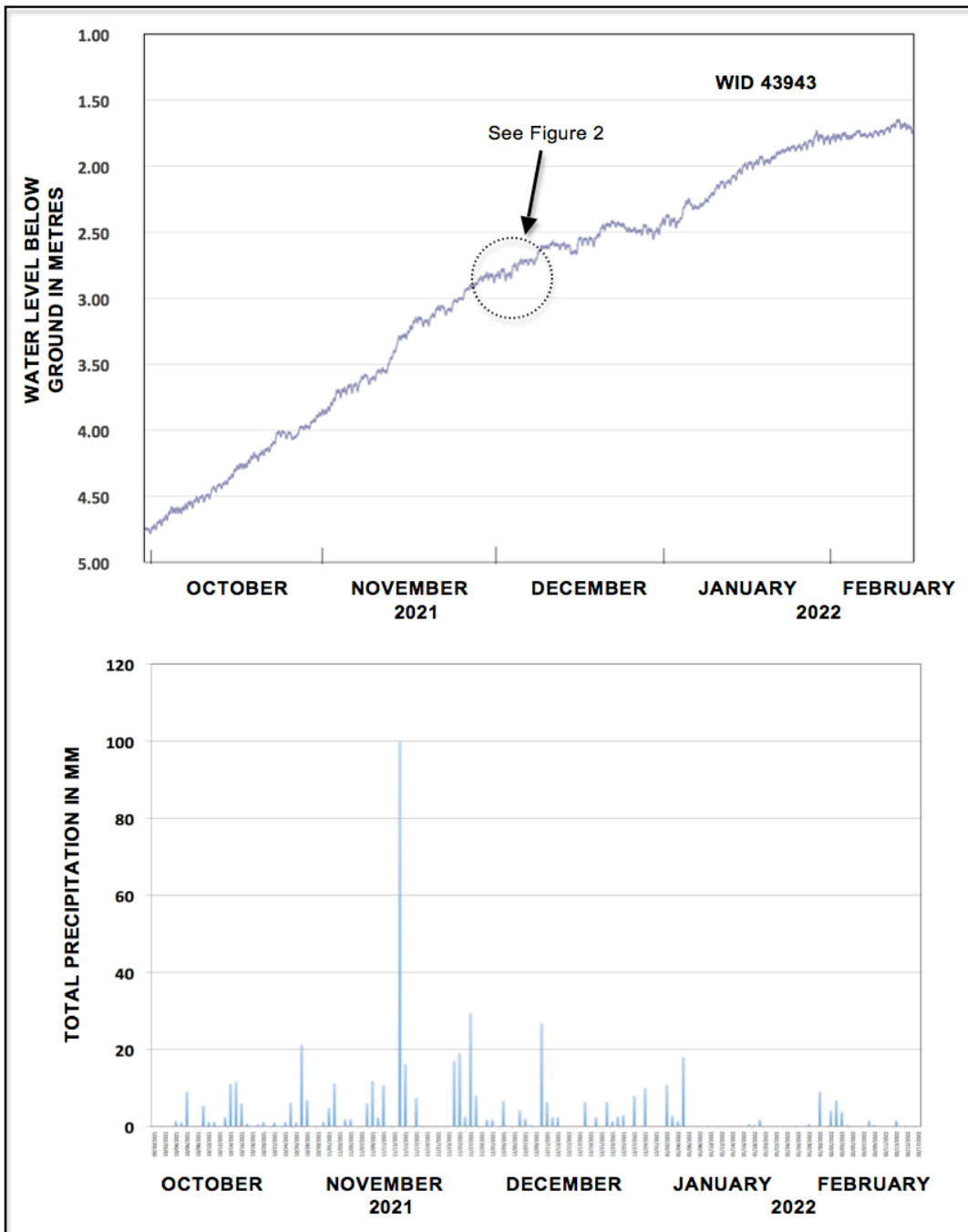


Figure 1. Water level below ground in Well WID 43943 from September 30, 2021 to February 17, 2022 compared with precipitation data from North Pender Island climate station (Climate ID.1015638).

The hydrograph in Figure 1 shows water levels rising just over 3 m during the monitoring period with minor fluctuations of about 0.1 m to 0.2 m. Apart from the overall rising water level trend, major precipitation events beginning in early October do not show any significant effects on water levels. The cumulative effects of fall precipitation, however, are apparent in the overall rising trend in water level. Frequent daily water level fluctuations are evident in Figure 2 and are discussed below.

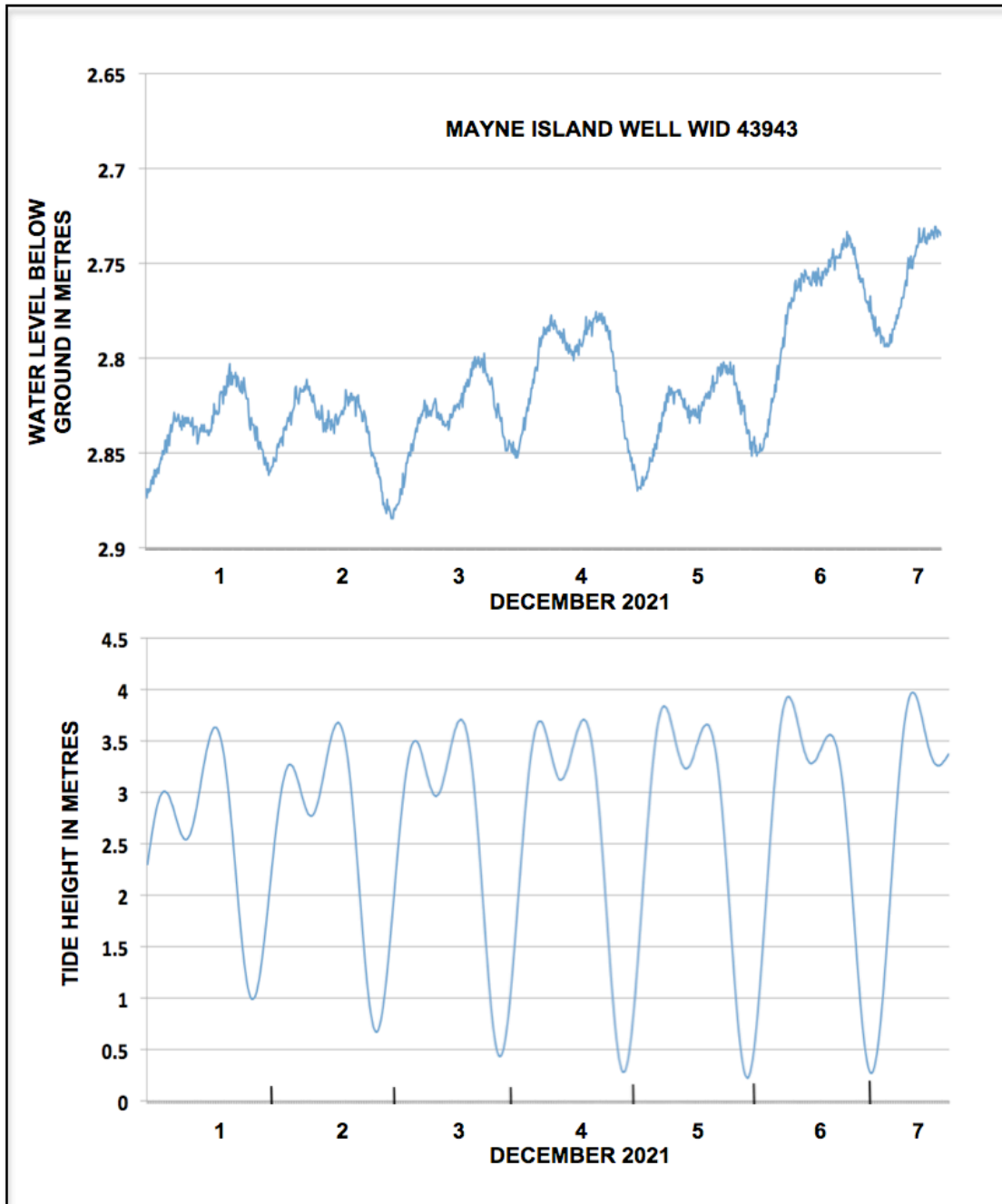


Figure 2. Comparison of water level fluctuations in Well WID 43943 from December 1 to December 8, 2021 with predicted tidal fluctuations at Montague Harbour. Tidal graph adapted from Government of Canada, 2022c.

A detailed representative portion of the hydrograph from December 1 to December 8, 2021 is shown in Figure 2 in comparison to tidal fluctuations at Montague Harbour for the same period. Generally there is a good overall correspondence between the tidal fluctuations and the water levels. The water level peaks, however, lag behind the tidal peaks and only vary by about 5 to 10 cm in amplitude. While the fractured aquifer system at this location

is subject to tidal loading to a minor degree, there is no possibility of sea water intrusion occurring at this site as pumping levels would not be drawn down below sea level.

The overall, non-pumping behaviour of the water level in well WID 43943 rising about 3 m during the fall winter recharge period is consistent with a well completed in a regional groundwater discharge area as discussed previously at this site (Kohut, 2020a). The monitoring results obtained above are also consistent with the observations, assumptions and results reported on the pumping test carried out on well WID 43943 in 2020 (Kohut, 2020b).

Conclusions

Based on the water level monitoring conducted on the project well WID 43943 between September 30, 2021 and February 17, 2022, the following conclusions can be made:

1. During the overall monitoring period the water level in well WID 43943 rose 3 m.
2. For the duration of the monitoring period, minor tidal effects of about 5 to 10 cm are evident in the water level hydrograph data for Well WID 43943.
3. No significant interference effects from neighbouring wells pumping were observable in the hydrograph record.
4. The monitoring results obtained during the monitoring period are consistent with the observations, assumptions and results reported on the pumping test carried out on well WID 43943 in September 2020 (Kohut, 2020b).

Respectfully submitted:

A.P. Kohut
Feb 24/22

A circular professional seal for Alan P. Kohut, a Professional Engineer in the Province of British Columbia. The seal contains the text: "PROFESSIONAL PROVINCE OF BRITISH COLUMBIA ENGINEER" around the perimeter, and "A.P. KOHUT #10194" in the center.

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. *Water levels at Montague Hbr - 07420 relative to chart datum*. Internet website <https://www.tides.gc.ca/en/stations/07420/2021-12-01?tz=PST>
- Kohut, A.P. 2020a. *Preliminary Assessment of Groundwater Supply for Proposed Affordable Housing Project, Mayne Island*. Letter report to Mayne Island Housing Society, Hy-Geo Consulting, Victoria, British Columbia. File 2007261. September 22.
- Kohut, A.P. 2020b. *Assessment of Pumping Test on Well WID 43943 for Proposed Affordable Housing Project, Mayne Island*. Letter report submitted to Mayne Island Housing Society, Hy-Geo Consulting, Victoria, British Columbia. File 2007261. November 22.
- Muller, J. E. and J.A. Jeletzky. 1970. *Geology of the Upper Cretaceous Nanaimo Group, Vancouver Island and Gulf Islands, British Columbia*. Geological Survey of Canada Paper 69-25.