REGIONAL DISTRICT OF NANAIMO

REGIONAL GROUNDWATER LEVELS ANALYSIS – PRE-SUMMER 2022

RECOMMENDATION

That the Board receives this report for information.

BACKGROUND

Most communities within our region rely on groundwater for their water supply. This includes water service areas operated by the Regional District of Nanaimo (RDN) as well as District of Lantzville, City of Parksville and Town of Qualicum Beach. Four improvement districts also source groundwater for their waterworks systems, including Deep Bay Improvement District, Bowser Waterworks, Qualicum Bay Horne Lake Waterworks and North Cedar Improvement District. Additionally, Snaw-naw-as First Nation and Stz'uminus First Nation operate water supply systems that rely on groundwater from regional aquifers. EPCOR is a private water system that provides groundwater for residents in French Creek.

The RDN Drinking Water and Watershed Protection (DWWP) program monitors groundwater levels in aquifers across the region, through the RDN Volunteer Observation Well Network, in order to understand water availability and assess trend changes over time. This supplements the monitoring done by the Province in Provincial Observation Wells within the region.

Since 2020, the RDN DWWP program has completed an annual regional analysis of groundwater levels to support water managers in the region in preparation for the summer period ahead. In 2020 and 2021, technical reports from Waterline Resources Inc. (Waterline) provided an update on longer-term and seasonal trends observed in the aquifers within our region. The Regional Groundwater Level Analysis for Summer 2020 report summarized current conditions and related that back to community water service areas and un-serviced areas alike. Waterline updated the tables and hydrographs for 2021 to provide an abbreviated analysis to the reporting done in 2020.

For 2022, the DWWP program has completed this groundwater level analysis internally, to allow for greater access to the data, flexibility on reporting timelines and methods, and to reduce some financial implications associated with contracting out this service. The DWWP program has established an agreement with GW Solutions Inc. for data housing through a service-oriented application developed to manage groundwater data and supports analysis and visualization using Tableau and PostgreSQL software.

As in prior updates, there are some gaps in available data, so the analysis only represents the data available at time of reporting. The data available for and used in the 2022 analysis includes 30 RDN Volunteer Observation Wells (VOW) and 9 Provincial Groundwater Observation Network Wells (OW). This update covers 18 (of the 22)

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mapped aquifers that are monitored in the region; nine of which are bedrock aquifers and the other nine are surficial (sand and gravel) aquifers. Please refer to annotated Figure 1.

This memo will summarize the seasonal and historic trends of the above-mentioned wells and aquifers and discuss the application of this information. A link is provided to the updated data tables and graphs provided as appendices.

SUMMARY

Seasonal Conditions & Longer-Term Trends

Of the 18 aquifers measured this season, all saw average or an increase in relative groundwater levels when compared to past years reporting. This is likely the result of higher-than usual precipitation during the month of April, which, according to the Fairwinds precipitation monitoring station at Nanoose, saw 273% of the average rainfall during that month since data collection began there in 2008. For the methodology used to determine historical and seasonal trends, please refer to sections 3.2 and 3.3 of the 2020 report, as the methods were consistent across reporting years.

As of May 2022, 8 of the 18 aquifers reported above average levels with a trend of stable to increasing levels over the past 3 of years of reporting. Of these aquifers, 8 are surficial, and 2 are bedrock:

- Aquifer 664 – Little Qualicum – surficial (1 monitoring well)
- Aquifer 216 – Parksville – surficial (4 monitoring wells)
- Aquifer 167 – Millstone Valley – surficial (1 monitoring well)
- Aquifer 219 – Nanoose – surficial (3 monitoring wells)
- Aquifer 1098 – Nanoose – surficial (2 monitoring wells)
- Aquifer 160 – Cassidy – surficial (1 monitoring well)
- Aquifer 212 – French Creek – bedrock (1 monitoring well)
- Aquifer 213 – Upper Lantzville - bedrock (3 monitoring wells)

One aquifer reported an average level this season, with increasing historical trends, but should be noted that in past years of reporting, this aquifer was seeing declining trends.

- Aquifer 217 – Qualicum Beach – surficial (1 monitoring well)

Four aquifers reported declining historical trends but reported average to above average levels this year, likely due to unseasonably heavy rain events prior to data collection:

- Aquifer 211 – Benson Meadows – bedrock (1 monitoring well)
- Aquifer 709 – Gabriola – bedrock (3 monitoring wells)
- Aquifer 215 – Lantzville – surficial (1 monitoring well)
- Aquifer 163 – Cedar – surficial (1 monitoring well)

Five aquifers, all bedrock, were analyzed to have variable historic trends, stemming from the fact that different wells in the same aquifer had observed different trends based on the heterogenic nature of aquifer properties such as water-bearing fractures and recharge, or variable local effects from pumping. This heterogeneity is to be expected in bedrock aquifers where water-bearing fractures are randomly distributed and discontinuous:

- Aquifer 214 – Nanoose – bedrock (5 monitoring wells) – Large Decline to Increasing, with below to average trend for 2022
- Aquifer 218 – Nanoose Peninsula – bedrock (2 monitoring wells) – Moderate Decline to Stable, with average trend for 2022
- Aquifer 165 – South Wellington – bedrock (2 monitoring wells) – Moderate Decline to Increasing, with above average trend for 2022
- Aquifer 162 – Cedar-Yellowpoint – bedrock (6 monitoring wells) – Moderate decline to increasing, with average to above trends for 2022
- Aquifer 220 – Errington/Coombs – bedrock (2 monitoring wells) – Large decline to stable, with variable trends in 2022.

Application

This information provides a snapshot of groundwater conditions in the region heading into the summer months. The seasonal conditions observed in early spring, as reported in this memo, can provide an early indication of where heightened water conservation measures may be needed this summer. Watching weather patterns in June, July, August and how that translates into community water demand and/ or low streamflow, will further inform water service providers and well owners across the region.

Water purveyors have currently implemented the annual watering restrictions framework to promote conservation. The primary measures to respond to potential groundwater shortages include water conservation (efficient irrigation, rainwater harvesting, soil improvements, efficient appliances) and eliminating leaks. Understanding the seasonal conditions of a well or aquifer in relation to longer-term groundwater level trends offers important context and can help prioritize policy solutions for areas that are under more water stress due to aquifer characteristics, climate impacts and localized demand.

Data Tables and Graphs

The updated data tables and hydrographs attached to this report include the following:

Appendix A – Overview of Groundwater Observation Well Data provides a detailed table that reports the historical and seasonal groundwater level trend per mapped aquifer, based on either Provincial or RDN observation wells. It also notes which community water service areas, if any, are associated with which aquifer and lists the total number of registered wells correlated to each mapped aquifer to get a sense of the density of private wells relying on the aquifer outside the serviced areas. [Note that this number of private wells is not exhaustive as, a) there are also many registered wells that are uncorrelated to an aquifer but fall within the spatial extent of the aquifer and, b) there are many unregistered wells that are not accounted for].

Appendix B – Long Term Groundwater Level Trend Results provides a table with the long-term groundwater level trend results calculations and hydrographs for each observation well used for this reporting, showing the full dataset available 2013-2022 for level fluctuations over time, charted against precipitation.

Appendix C – Seasonal Groundwater Level Trend Results hydrographs for each observation well used in this analysis, plotting each year of data against the months of the year to see seasonal averages and inter-annual variation, including the most current 2022 data at time of reporting.

This current information will be shared with municipal, improvement district, and small water system staff to provide an outlook for groundwater conditions this coming summer and support their management considerations and communications to customers. It is also important to share this information with residents

on private wells who have an important role in protecting our shared groundwater resources. Water purveyors and communities can use this information to anticipate the potential need for heightened water conservation measures this summer. Long term trends can help inform land use and water management decisions.

FINANCIAL IMPLICATIONS

This report has no financial implications.

STRATEGIC PLAN ALIGNMENT

Environmental Stewardship - Protect and enhance the natural environment, including land, water, and air quality for future generations.

REVIEWED BY:

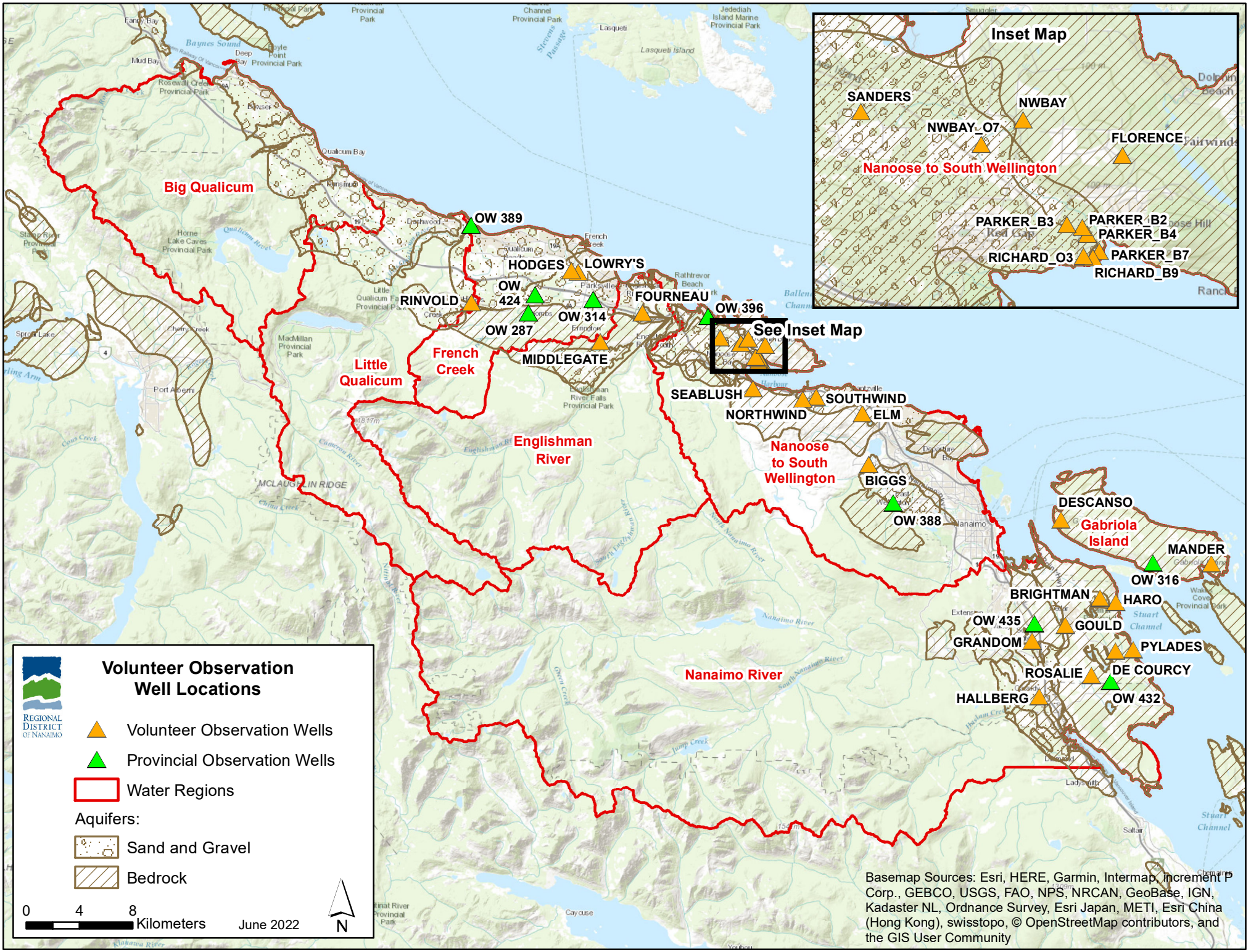
- M. Walters, Manager, Water Services
- E. Tian, General Manager, Regional & Community Utilities

ATTACHMENTS

1. Figure 1 – Volunteer Observation Well Locations
2. Appendix A – Overview Table of Groundwater Observation Well Data
3. Appendix B – Long Term Groundwater Level Trend Results
4. Appendix C – Seasonal Groundwater Level Trend Results

Figure 1 – Volunteer Observation Well Locations

REGIONAL DISTRICT OF NANAIMO


Inset Map
SANDERS
NWBAY
NWBAY_O7
FLORENCE
Nanoose to South Wellington
PARKER_B3
PARKER_B2
PARKER_B4
RICHARD_O3
PARKER_B7
RICHARD_B9
Big Qualicum
OW 389
HODGES
LOWRY'S
OW 424
RINVOLD
FOURNEAU
OW 396
OW 314
OW 287
See Inset Map
MIDDLEGATE
Little Qualicum
French Creek
SEABLUSH
SOUTHWIND
NORTHWIND
ELM
Englishman River
Nanoose to South Wellington
BIGGS
OW 388
DESCANSO
Gabriola Island
MANDER
OW 316
BRIGHTMAN
HARO
OW 435
GOULD
GRANDOM
PYLADES
Nanaimo River
ROSALIE
DE COURCY
HALLBERG
OW 432
Volunteer Observation Well Locations
Volunteer Observation Wells
Provincial Observation Wells
Water Regions
Aquifers:
Sand and Gravel
Bedrock
0 4 8 Kilometers
June 2022
N
Basemap Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community