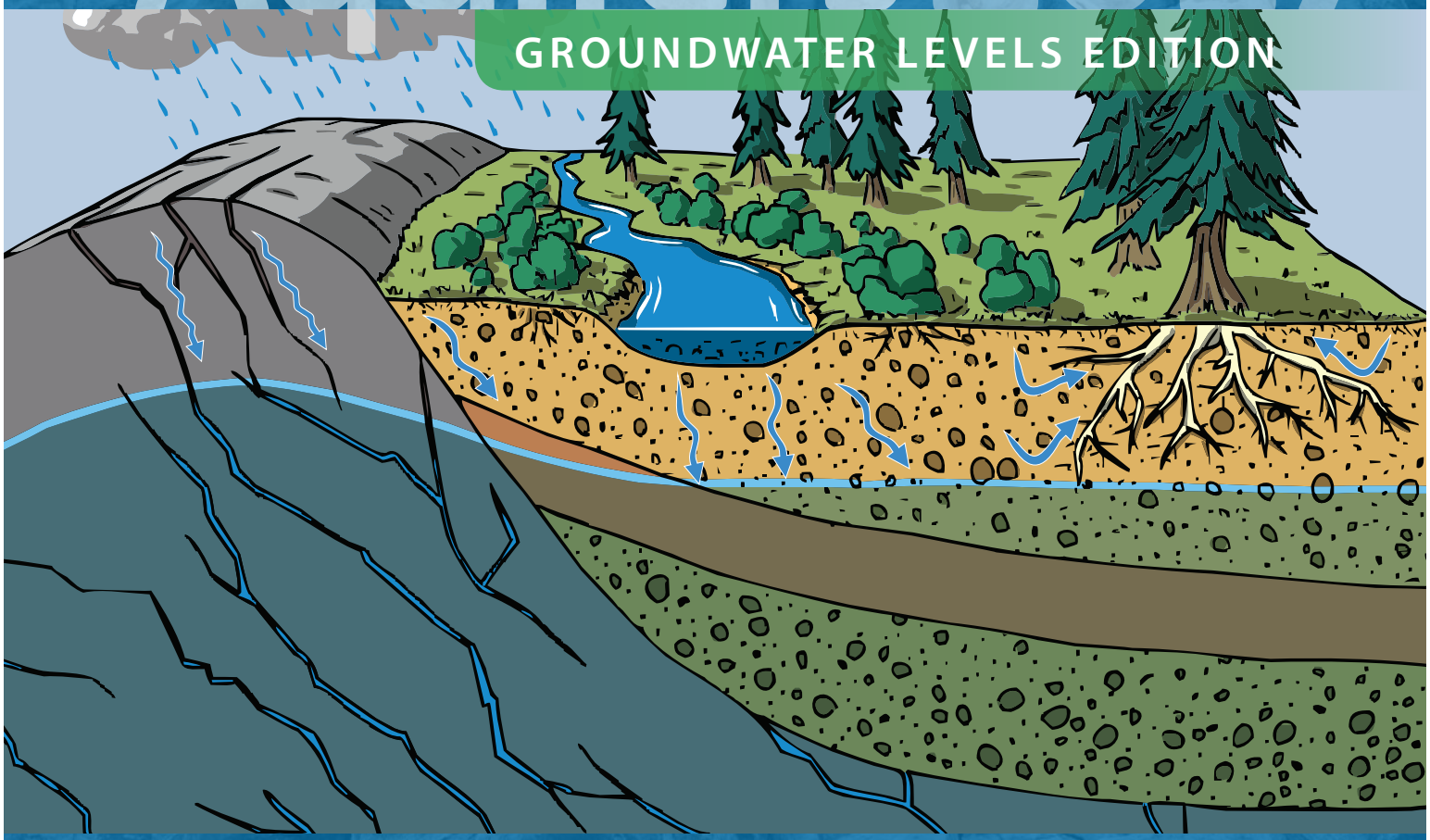
State of our Aquifers 2017

GROUNDWATER LEVELS EDITION



Aquifers are underground areas where spaces between gravel, sand, clay or rock fill with water. This underground water is called '**groundwater**' and is an important drinking water source across our region.

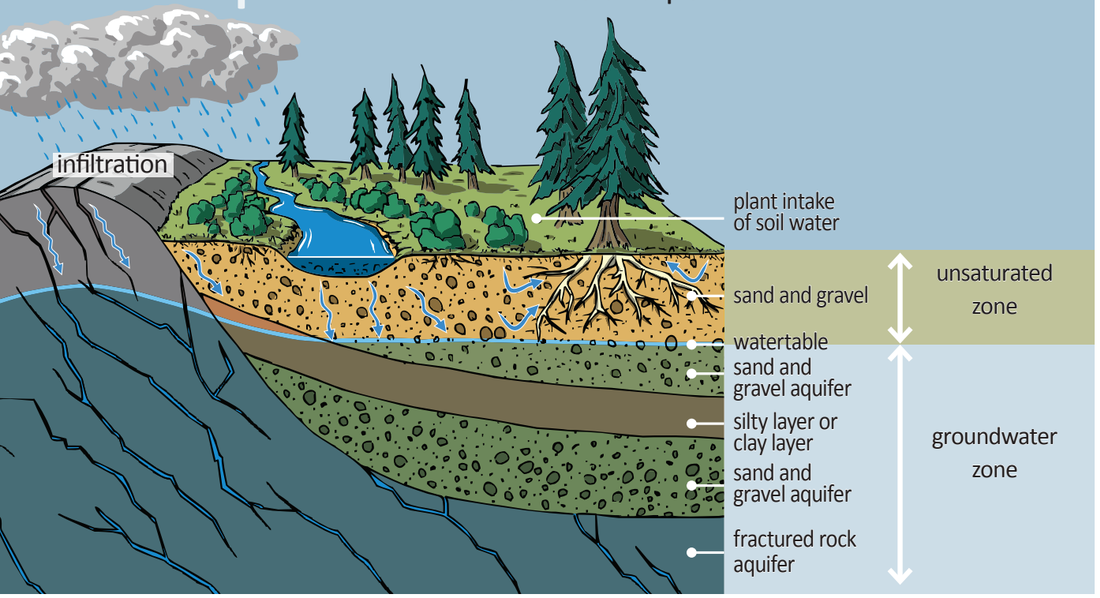
For more information please visit: **www.dwwp.ca**

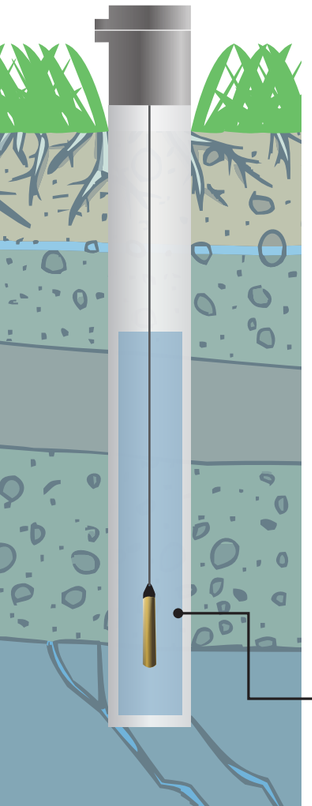
DRINKING WATER WATERSHED PROTECTION

REGIONAL DISTRICT OF NANAIMO

What is a Groundwater Aquifer?

Water stored underground in cracks and pores





Why & how we monitor groundwater in the region

Roughly 64,000 residents in our region rely on groundwater for their water supply, including the residents of **all electoral areas and municipalities,** except for the City of Nanaimo where the drinking water supply is surface water from the Nanaimo River. **Many of the streams in our region rely on groundwater for base flow in the summer.** Groundwater is underground and not readily visible. Therefore, **monitoring is crucial to track the health of the resource.** Observation wells provide a window into the aquifer and a means of monitoring groundwater levels. Using data loggers installed in observation wells, we can track seasonal fluctuations and yearly changes in the water table. This provides **oversight to help guide water management.** Within the RDN, 35 observation wells are operated by the Province and 28 are coordinated by the RDN Drinking Water and Watershed Protection (DWWP) program, through partnerships with volunteer well owners who agree to have a data logger in their well to help track groundwater levels.

Groundwater data is best observed over the long term, for a minimum of 10 years, to meaningfully understand trends. We care because groundwater is an important **drinking water source** in our communities and plays a key role in contributing to streamflow to support **aquatic habitat** in many watercourses over the summer period.

The following table lists aquifers in our region where there are observation wells monitoring groundwater levels. Bedrock aquifers and overburden (sand and gravel) aquifers behave differently so it is important to monitor both. Bedrock aquifers in our region are generally lower yielding and more vulnerable to drought. In sand and gravel aquifers it is variable – some are high yielding, with lots of storage; others are more moderate yielding and more susceptible to overpumping and drought.

Aquifer Location	Aquifer #	RDN Water Region	# of Observation Wells	Water Level Trend (last 5 years)	Water Level Trend (>5 years)
Deep Bay, Bowser	416	1	1	INCREASING +0.089m observed per year	STABLE
Qualicum Bay, Dashwood	662	1	3	NOT ENOUGH DATA	NOT ENOUGH DATA
Little Qualicum River Valley	664	2	1	STABLE	STABLE
Errington, Coombs	220	3	1	DECLINING -0.32m observed per year	DECLINING -0.11m observed per year
Qualicum Beach, Coombs	217	3	4	DECLINING -0.095 to-0.68 observed per year	VARIABLE +0.34 and-0.091 to-0.31 observed per year
Parksville, French Creek	216	3 & 4	5	DECLINING -0.18 to-0.32m observed per year	DECLINING -0.03 to-0.29m observed per year
East Wellington, Westwood Lake	167	5	1	NOT ENOUGH DATA	NOT ENOUGH DATA
Benson Meadows, Jingle Pot	211	5	1	DECLINING -0.94m observed per year	DECLINING -0.66m observed per year
Lantzville	213	5	3	NOT ENOUGH DATA	NOT ENOUGH DATA
Lantzville	215	5	2	VARIABLE +0.17 to-0.17m observed per year	VARIABLE +0.17 to-0.17m observed per year
Central Nanoose (upper)	219	5	4	VARIABLE ±0.02 to-0.04m observed per year	NOT ENOUGH DATA
Central Nanoose (mid)	1098	5	1	STABLE	NOT ENOUGH DATA
Cassidy (lower)	160	6	3	STABLE	STABLE
Cassidy (upper)	161	6	2	DECLINING -0.05m observed per year	STABLE
Cedar, Yellowpoint	162	6	4	INCREASING +0.08 to 1.32m observed per year	DECLINING -0.43m observed per year
South Wellington	165	6	2	NOT ENOUGH DATA	NOT ENOUGH DATA
Gabriola Island	709	7	6	DECLINING -0.04 to -0.32m observed per year	VARIABLE ±0.02 to-0.05m observed per year

Sand & Gravel Bedrock

What factors can influence groundwater levels

Climate and Precipitation

The amount and distribution of rainfall is an important factor that can influence groundwater levels in aquifers over time. It makes sense that if it doesn't rain, water doesn't infiltrate into the ground. Some aquifers react more quickly to precipitation, others have a delayed reaction. Some aquifers are more susceptible to winter drought; others more vulnerable to summer drought. In the State of Our Aquifers trend analysis done for the RDN by GW Solutions (2017), trends in local climate were compared with trends in aquifer levels to see if there was a correlation. The graphs on pages 6 and 7 of this newsletter illustrate the influence of precipitation on some aquifers in our region. *The full technical reports from this study are all available at* **www.rdn.bc.ca/dwwpreports**.

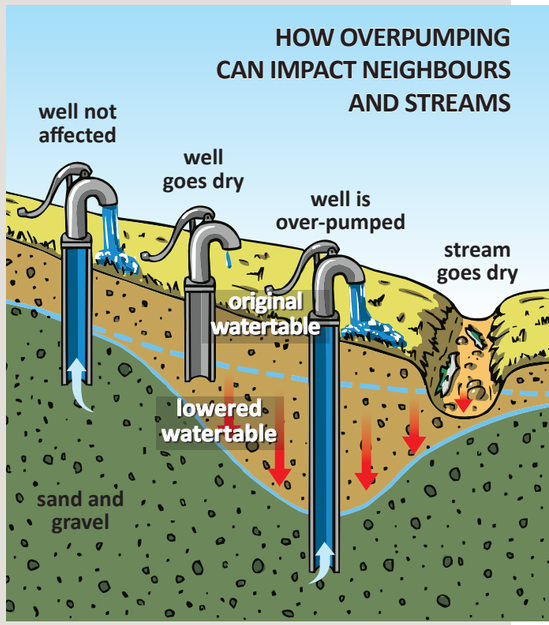
Groundwater Extraction

Pumping groundwater for human uses can have an effect on aquifer levels over time. Some aquifers are more resilient to extraction and continue to maintain stable levels even with more extraction. Overall, managing our water extraction to not outstrip an aquifer's capacity is a key objective that is informed by this groundwater monitoring. Some aquifers see a declining trend as more extraction takes place, but then reach a new equilibrium.

Land Use Changes

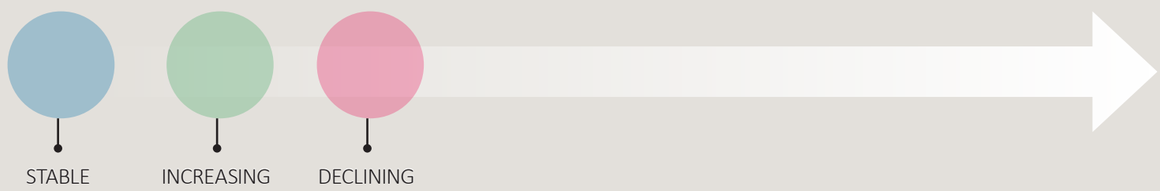
Activities such as vegetation removal, paving surfaces, and erecting buildings are land use changes that can impact how much water enters the groundwater table via infiltration. This is a factor that requires more analysis to determine its effect in each aquifer.

HOW OVERPUMPING CAN IMPACT NEIGHBOURS AND STREAMS



RDN Water Regions

1 BIG QUALICUM
2 LITTLE QUALICUM
3 FRENCH CREEK
4 ENGLISHMAN RIVER
5 NANOOSE TO SOUTH WELLINGTON
6 NANAIMO RIVER
7 GABRIOLA ISLAND



Examples of groundwater level trends across the region, on the next page

Trends

Across our region, the trends in water levels vary from aquifer to aquifer. Looking at the last 5 years of data in comparison to the whole historical dataset can give an indication if aquifer levels are reacting differently in recent years.

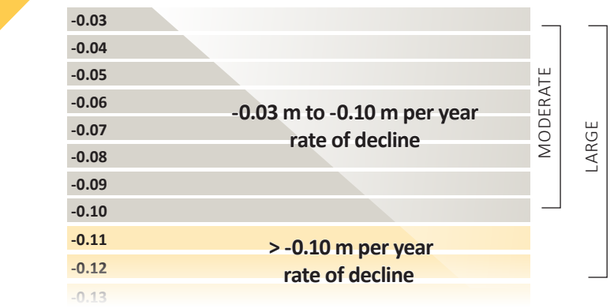
An interesting finding is that some groundwater levels are increasing in recent years even if historically their trend was stable or declining.

In other aquifers, the rate of decline has accelerated over the past 5 years, potentially due to more extraction or site specific climate variation where those areas received less precipitation than average.

TREND	# of Aquifers Last 5 years	# of Aquifers Historically
Stable	3	3
Increasing	2	-
Declining	5	5
Variable	2	2
Not enough data	5	7

What do we need to keep an eye on?

Where we are observing declining aquifer levels, it is in terms of a few centimeters per year. We are not at a point of alarm, just observing trends to inform water management to be proactive and help to stop or reverse trends where possible. This information helps convey that water is not infinite, even on our wet coast. Some things are beyond our control, such as the timing of amount of rainfall we receive to recharge groundwater levels. Other things are within our control such as water use habits and land-use decisions.



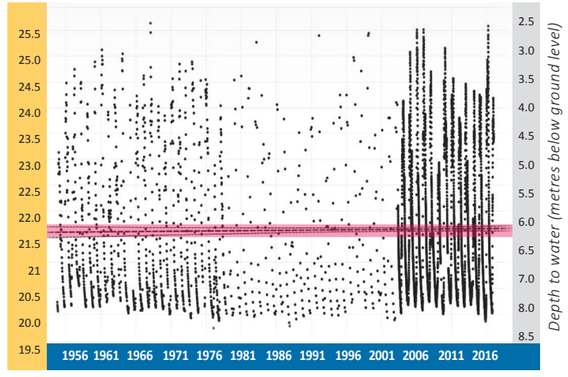
Stable

160

WR 6 Aquifer 160 – Cassidy (lower)

This aquifer has displayed stable groundwater levels over decades. Cycles of drier and wetter years have not influenced the water level. For instance, during drier years (1984 to 1994) water level has not followed the precipitation trend. Minimum and maximum water levels have remained stable as well.

Well ID: OW228 (Provincial overburden obs. well)



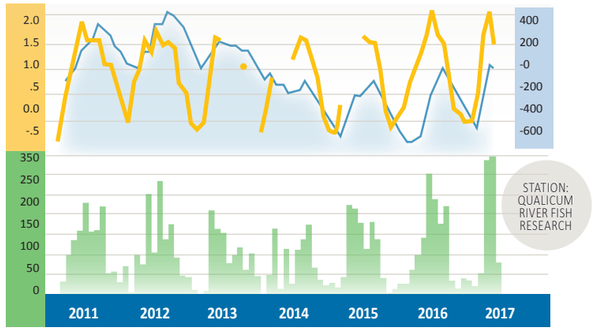
Daily water level and trend line estimation (1954-2016)

664

WR 2 Aquifer 664 – Little Qualicum River Valley

This aquifer has displayed **very stable groundwater levels** even through years with below average precipitation.

Well ID: OW389 (Provincial overburden obs. well)



Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (2010-2016)

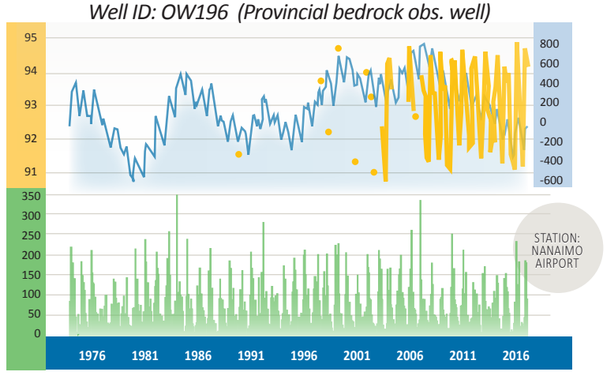
Declining

709

WR 7 Aquifer 709 – Gabriola

The long-term trend is stable and the water level has risen to ground surface most years suggesting the aquifer is seasonally filling up. However the trend has been decreasing in the last few years, corresponding to declining average precipitation.

Well ID: OW196 (Provincial bedrock obs. well)



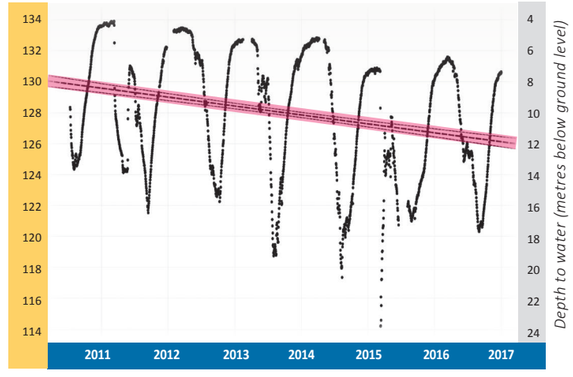
Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (1973-2016)

211

WR 5 Aquifer 211 – Benson Meadows

Fractured rock aquifers like this one have limited space in the fractures for water to be stored, making it more vulnerable to over pumping. There is a delay of two to three months before water levels react to precipitation. In addition, during this time (2010-2016), a decreasing precipitation trend is happening.

Well ID: OW388 (Provincial bedrock obs. well)



Daily water level and trend line estimation (2010-2016)

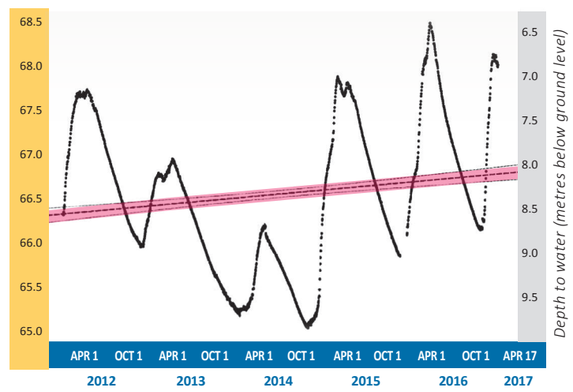
Increasing

416

WR1 Aquifer 416 – Bowser Deep Bay

Groundwater levels have been stable since 1990 and increasing over the past 5 years. The increase might be due to stable extraction levels and wetter conditions. There is a delay of five months for the water level to fully react to precipitation.

Well ID: OW310 (Provincial overburden obs. well)



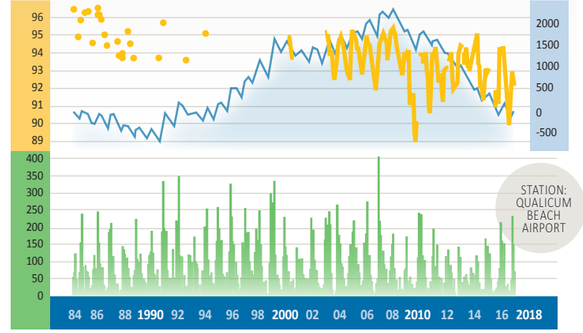
Daily water level and trend line estimation (2010-2016)

220

GRAPH WR 3 Aquifer 220 – Errington

The declining trend in precipitation coincides with the large decreasing trend in water level. There is a delay of two to three months before the water level fully reacts to precipitation.

Well ID: OW287 (Provincial bedrock obs. well)



Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (1984-2016)

GROUNDWATER ELEVATION - METRES ABOVE SEA LEVEL

MONTHLY TOTAL PRECIPITATION [mm]

CUMULATIVE PRECIPITATION DEPARTURE – CPD [mm]

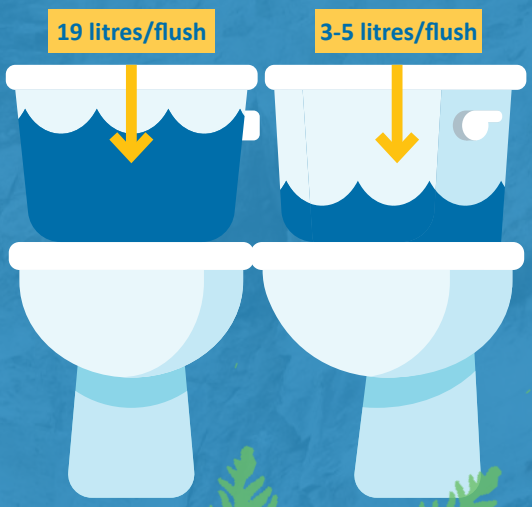
CPD is utilized to describe if precipitation was above or below average in a certain period. This is then used to evaluate the correlation with groundwater levels.

WORKING TOGETHER

What can we do?

✓ Be efficient with water!

LOW FLOW APPLIANCES



WATER SMART LANDSCAPE DESIGN

✓ Promote infiltration

MINIMIZE PAVED AND IMPERVIOUS SURFACES

✓ Continue to monitor

TO IMPROVE WATER MANAGEMENT

✓ Collect rainwater

FOR OUTDOOR WATERING OR TOILET FLUSHING, TO TAKE PRESSURE OFF GROUNDWATER SUPPLIES

REGIONAL LINKS

RDN DWWP – Groundwater Monitoring:
www.rdn.bc.ca/groundwater-monitoring

RDN Watersheds Interactive Map:
www.rdn.bc.ca/watersheds

State of our Aquifers – Technical Reports per Aquifer:
www.rdn.bc.ca/dwwpreports

Questions? Call RDN Drinking Water and Watershed Protection program staff at 250-390-6560 or email **waterprotection@rdn.bc.ca**

PROVINCIAL LINKS

Provincial Groundwater Observation Well Network:
www2.gov.bc.ca/gov/content/environment/air-land-water/water/groundwater-wells/aquifers/groundwater-observation-well-network

Groundwater Level Data Interactive Map:
www.env.gov.bc.ca/wsd/data_searches/obswell/map/

DRINKING WATER WATERSHED PROTECTION

REGIONAL DISTRICT OF NANAIMO