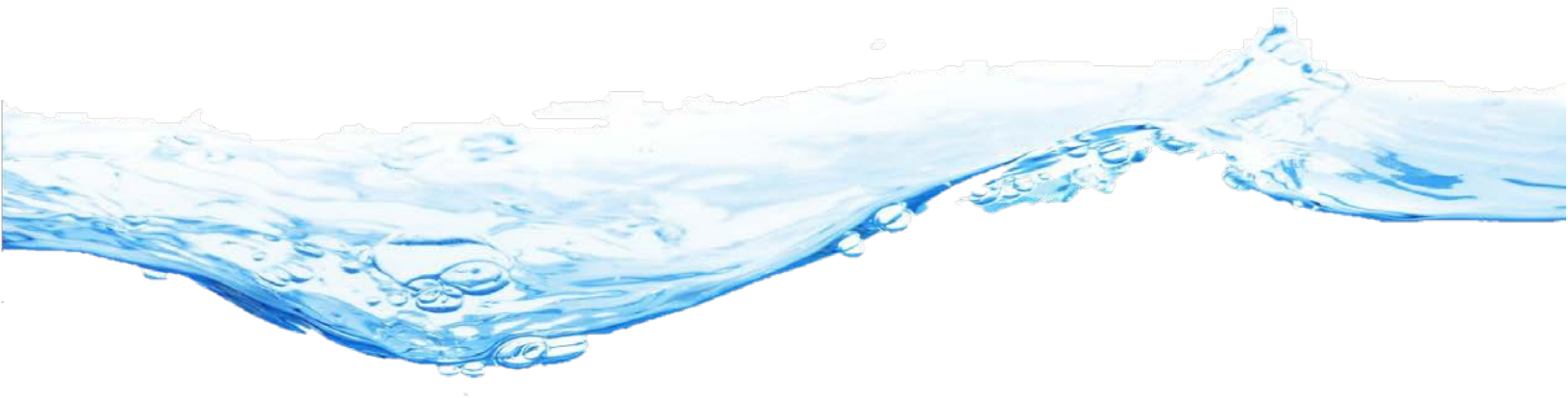


RUTLAND WATERWORKS DISTRICT

Water System Annual Report

2021





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1.0 System Description and Classification

Rutland Waterworks District obtains its water from 14 deep operating wells in the Greater Kelowna Aquifer (Aquifer 464). There are two pressure zones to the system: the Upper Zone and the Lower Zone, which operate at pressures of 475m and 450m (geodetic) respectively. There are wells and pump stations located in both zones but the highest producing wells with the better water quality are located in the Lower Zone. Two booster pump stations lift water from the Lower Zone to the Upper Zone. There is a reservoir, located on Teasdale Road, which regulates the pressure in the Upper Zone. In the Lower Zone, the pumps are set to operate based on system pressure and the wells with the best water quality are higher priority in the pumping order. Several of the wells operate on variable frequency drives that enable a range of flows, depending on system demand.

The District operates four pressure reducing stations. Two of these stations respond to low pressure in the Lower Zone by opening valves to allow water from the Upper Zone storage reservoir to supply high demands in the Lower Zone. The other two pressure reducing stations are interconnects with BMID's system, with one set-up to allow flow in both directions.

The District operates the main office, located at #106 - 200 Dougall Road North, and the warehouse/shop at 1175 Hollywood Road South.

The numerous pump station properties have several types of legal titles. Some station sites are owned by the District while other sites are held by Statutory Right-of-Way on properties owned by FortisBC, the Central Okanagan Regional District and School District No. 23.

The District is classified by the Environmental Operators Certification Program (E.O.C.P.) as a Level III Water Distribution System. The District has six operators with Water Distribution Classifications and are continually upgrading their training and certifications.

Interior Health issues Rutland Waterworks District their Annual Operating Permit. The District works closely with the Health Authority to provide good water quality that meets the Guidelines for Canadian Drinking Water Quality to its customers.

2.0 Annual Operations Summary

2.1. Seasonal Operation

The District has seasonal operating procedures to adapt to water quality and water consumption changes.

During the winter months the daily average demand is 1.4 million US gallons. This demand is supplied primarily from three wells in the Lower Zone (Wells No. 13S, 13N & 15) and boosted to the Upper Zone. These wells are of excellent quality and operate with variable speed drives which provide power efficiencies while stabilizing the demand surges in the system.

The spring and fall months have significant demand ranges depending on the weather. The water consumption can change significantly in any given day during this period. These changes are managed by using variable speed drives, the reservoir and by automatic controls that sequence pumps off and on as demands change.

The summer months are the highest consumption months. The demand is met by introducing the Upper Zone wells and using a sequentially controlled pump program that call for additional pumps as required. The increased water demands can change water quality somewhat as well water with higher mineral content enters the system.

Daily Operations:

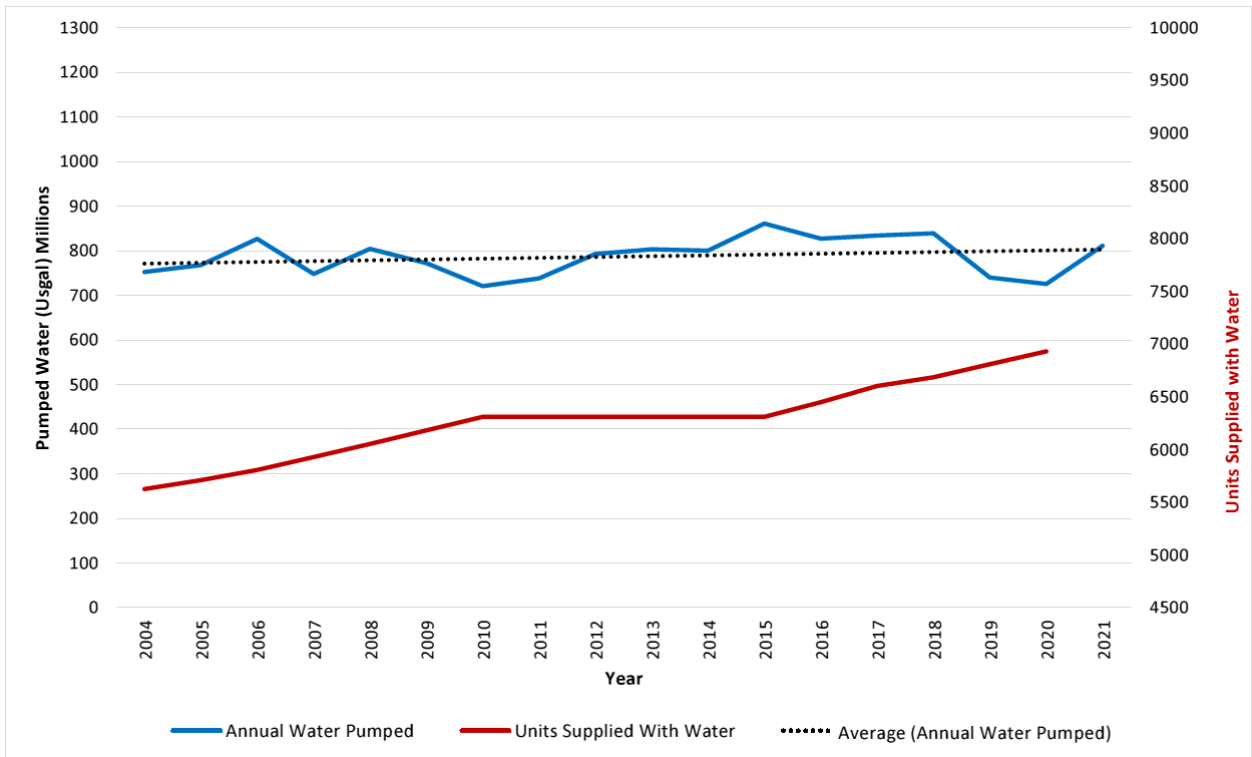
- Daily rounds (Recording gallons pumped, Chlorine used, and visual inspection of equipment & grounds)
- Reservoir grounds inspection
- Cl₂ monitoring

2.2. Pumping Totals

The total annual water consumption for 2021 was just over 811 million US gallons. As can be seen from Figure 1 (next page), this is just slightly above the 23-year average volume pumped (2004 to 2021). Despite the increase in the number of units supplied by RWD and the hot weather records set in 2021, the annual volume pumped was below the recent peak of 861 million US gallons set in 2015.

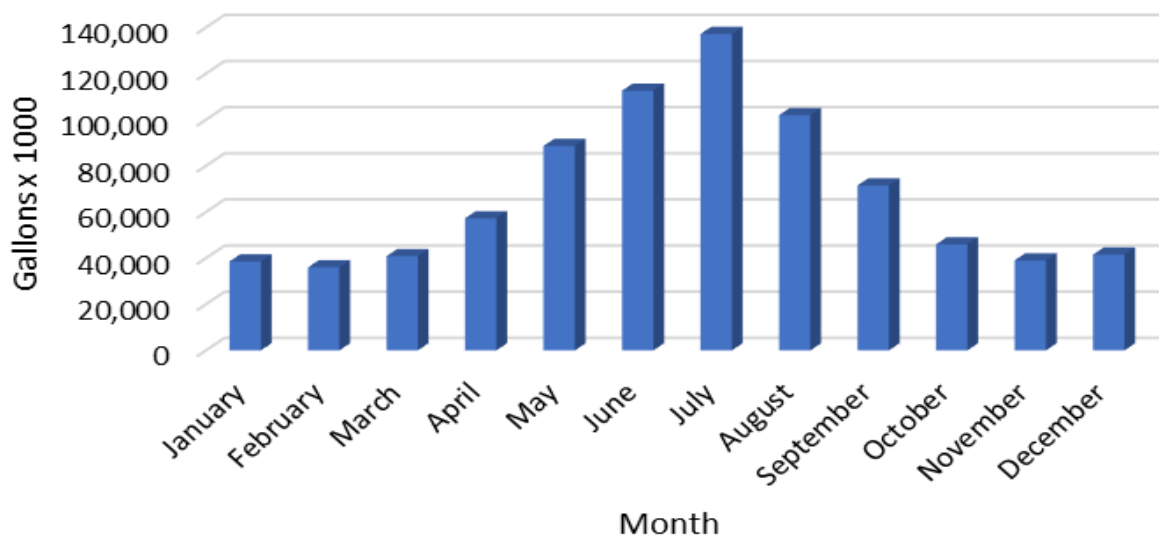
The data used in Figures 1 and 2 can be found in Appendix A.

Figure 1: Annual Gallons Pumped (million US Gallons) – 2004 to 2021



As can be seen from Figure 2 below, the highest consumption month for the year was July at 137 million US gallons and the lowest consumption month was February at 36 million US gallons.

Figure 2: Monthly Volume Pumped (US Gallons) – 2021
(Chart below read in thousands)



2021 Total: 811,118,000 US Gallons

2.3. Heat Dome

In late June 2021, British Columbia experienced an extreme hot weather event or 'heat dome.' Many temperature records were broken over several days. Temperature data* from the UBCO climate station, located approximately 5.1 km north of the District, is shown below.

Date	Max Temp	Min Temp	Mean Temp
June 24	30.1	19.1	24.6
June 25	34.5	16.0	25.3
June 26	38.9	18.9	28.9
June 27	41.5	20.1	30.8
June 28	42.9	21.3	32.1
June 29	45.7	22.6	34.1
June 30	44.4	23.7	34.0
July 1	39.7	24.9	32.3
July 2	34.4	20.5	27.5
July 3	36.5	18.2	27.4
July 4	34.2	18.3	26.2

Despite the extreme temperatures, the District did not experience a peak in demand during this period. The annual peak day occurred approximately three weeks later on July 21. The water volume pumped on the peak day was 4.5 million US gallons, which is about average and less than the peak annual days in 2015 and 2016.

The lower-than-expected annual peak volume occurred in spite of the hot weather and significant increases in the number of residents supplied with water. The decreases are likely the result of changes in the District's metering and billing system (higher charges for high use), an effective water conservation program, and engaging water patrollers during summer months to educate residents (by leaving pamphlets). The District will continue these practices and if necessary, can also respond to future high demand periods by:

1. Rearrange pumping sequence, moving Well Nos. 6 and 10 up the priority order. (Note that would be a temporary measure to respond to an emergency extreme demand scenario. These wells would return to normal priority sequence after the event.)
2. Enact additional watering restrictions if necessary.
3. Reduce system pressure if necessary, resulting in reduced water supply demand.

* Temperature data accessed on November 29, 2022 from https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

2.4. Flushing

A flushing program for both the pipelines and the wells minimizes the effects of varying water quality in the system.

The District's flushing program is primarily designed to remove mineralization build up. These minerals come out of suspension in the water during the disinfection process. The mineral residue tends to adhere to the pipe walls and only move during higher flows from flushing or fire suppression.



Spring & Fall Flushing Program:

- Spring Flushing Upper Zone: April to June 2021
- Fall Flushing Lower Zone: September to November 2021

2.5. Valve, Meter and Hydrant Maintenance

Mainline valves are regularly located and inspected to confirm the open/close position, no leaks and their ease of operation. Water meters are replaced or repaired as required to ensure accuracy and performance. Hydrants are serviced annually.

2.6. Service and Main Repairs

The District repaired approximately 35 water service connections and responded to 29 customer related service breaks. There was one water main break in 2021. As very few city projects were performed within the RWD's distribution system area, such as expansion of city sewer system, road widening, or sidewalks, the amount of service and watermain repairs were kept to a minimum for 2021.



The District has vigorous inspections for work around our infrastructure, especially for the repair and disinfection of watermains should a break occur.

2.7. Teasdale Reservoir Repair

A small leak near the base of the Teasdale Reservoir (believed to be at or near the waterstop) was addressed in 2021. Repairs were carried out at the reservoir over a period of 4.5 days between July 7th and September 21st using a process of pressure injecting polyurethane grout into the gunite wall. Multiple short visits were made, and after each successive visit the leak rate decreased further. When work was complete, leakage was reduced to a slight damp spot.

2.8. New Connections

The District boundaries are relatively fixed. Any change in connection numbers is primarily through densification.

There were 8 new connections added to the system with the removal and decommissioning of 7 old connections.



Lot amalgamations can reduce the number of services, but the number of dwelling and commercial units increases.

2.9. Capital Works (CEC) Projects

The Froelich-McIntosh watermain project was completed in October 2021. This project connected three dead-end watermains and replaced aging AC watermains. The project involved replacing 20 metres of 150 mm AC pipe and 123 metres of 100 mm AC pipe with 195 metres of new 200 mm PVC pipe. The completion of this project improved available fire flow and water quality for residents in the area.

2.10. Developer-Funded Projects

Two major watermain upgrade projects were completed by Developers in 2021.

A watermain upgrade on Hollywood Road S and across private property (191 Hollywood Road) to Petch Road was completed in May 2021. This upgrade was required to provide adequate fire flow to the new apartment building. A total of 211 metres of 150 mm AC pipe was replaced with 200 mm PVC pipe.

Another watermain replacement project was completed in November 2021 along Highway 97N. This project was not required by the District but requested by the Developer to move an existing RWD watermain off of private property. This project replaced 120 metres of 250 mm AC pipe with 250 mm PVC pipe.

3.0 Water Quality Controls

Rutland Waterworks District has a Water Quality Monitoring Program outlining how the District monitors and controls water quality.

Water quality technicians collect chemical and bacterial samples from six sample sites and bacterial samples only from an additional four sites throughout the District. These sample sites have been strategically chosen to ensure a good representative of our water in the system. Numerous chemical parameters tested at the six sites by District staff are included in Appendix B. The 2021 testing results have indicated very little change in the mineral levels and are still within the GCDWQ standards

Rutland Waterworks uses Caro Environmental Services for bacteriological testing (Total Coliform and E. coli) and uranium testing. Caro results can be seen in Appendix C.

Beginning in 2023, the District will schedule chemical analysis testing on each well every 2 years. Chemical testing was last sampled and tested on thirteen wells in 2019. The trends for several chemical parameters have been graphed with previous results (2014 & 2009) to show long term changes, as seen in Appendix D.

As one of our Wells (#12) has been close to the MAC (0.02) for Uranium it is closely monitored in the summer or when in use. If the levels increased above the MAC, it would immediately be removed from the sequence for further testing. Once we receive those results and they comply with the GCDWQ it would then be put back online.



3.1. Backflow Prevention Program

All new developments go through the City of Kelowna Planning & Building departments and the city inspectors determine installation requirements and follow to completion. The District follows up with any delinquent items that need to be enforced.



4.0 Emergency Response Plan

The District has an Emergency Response Plan that is updated regularly. Our plan follows the standards established within the WRF Pocket Guide which provides the necessary procedures, notification lists in order of priority, action items including equipment, manpower, emergency services, etc. to respond to potential emergency situations.

The Emergency Response Plan includes a Water Quality Response Guide, which outlines acceptable levels of WQ parameters and the appropriate response if sampling shows deviation from these levels. Deviations in any tested parameter trigger several responses that vary from retesting, levels of public notification and Interior Health consultations.

The District works in conjunction with health agencies, first responders and other networked groups to foster a cooperative/coordinated response.

5.0 Training and Education

The current EOCP of RWD operators is outlined in the RWD Staffing & Operations Plan. All operators regularly attend seminars and workshops to upgrade and maintain a high skill level.

Safety meetings are a documented regular bi-weekly activity in our operations. The EOCP monitors and certifies the status of all our operators.

The District maintains an active role in the water industry with membership in various associations, including the Water Supply Association of British Columbia, British Columbia Ground Water Association, British Columbia Water and Wastewater Association and the American Water Works Association.

6.0 Water Supply and System Sustainability

The District operates 14 deep water wells and has is currently evaluating several wells for future expansion. The wells are checked regularly by our operators as they conduct standard “daily rounds” throughout the District.

Our water system wells, and infrastructure are maintained by a series of seasonal procedures that include:

- Flushing dormant wells before they are brought online.
- Treating specific wells to control regrowth and screen plugging
- Measuring static well levels, temperature and checking well performance through specific capacity calculations and current demand/water pumped calculations.
- Motor and pump efficiency tests and reports.

Several consultants who specialize in the industry are regularly consulted for current performance and sustainability of all facets of the water system.

The District has a working computer model of the system that models various flow scenarios including fire flows and directional flushing efficiencies. Annual tests are performed to monitor efficiencies of pumps, motors, wells, and power consumption.

6.1. Groundwater Monitoring

The Ministry of Environment monitors observation Well 236 located within the District on Timrick Court. This well is situated between Wells No. 7E & 7W (350 m away) and Well No. 12 (100 m away). The Ministry provides this data on an interactive Groundwater Level Data map with information dating back to 1980 for this well. Appendix E contains two charts showing (1) groundwater levels for 2021 and (2) groundwater levels from 1980 to 2021.

The data for 2021 shows that the groundwater level was at a 10-year high for the first five months of the year (January – May). The level fluctuated approximately 0.5 metres from May to September when Well No. 12 and 7E were operating. These wells pumped 47 million gallons and 30 million gallons, respectively during this time period in 2021. During the last three months of the year (October – December), the level remained high, around the 75th percentile.

Although the 2021 groundwater levels are high compared to the last ten years, the data from 1980 to present shows an overall decline in water level. However, it has not been a constant decrease. The highest groundwater levels from this timeframe average 19 m (below ground) from

1980 – 1985 while the lowest levels average 26 metres around 2016. The average water level for 2021 was approximately 23 m (below ground), which doesn't result in low-capacity issues for any of Rutland's wells.

6.2. Well Head Protection

All of the District's well heads are located within a secured structure (building or chamber), and each of the properties are surrounded by chain-link fencing. Buildings & chambers are regularly checked by employees during daily activities.

6.3. Aquifer Protection

The District relies upon the City of Kelowna's Natural Environment Development permit process to ensure that aquifers are protected during land development activities. Most of the District's operating area is within a City of Kelowna Natural Environment Development Permit Area (DPA). A Natural Environment Development Permit must be approved (unless exempted) before any of the following activities takes place:

- Subdivision of land;
- Alteration of land, including but not limited to clearing, grading, blasting, preparation or construction of services, roads and trails;
- Drilling a well for consumptive or geothermal purposes; and/or
- Construction of, addition to, or alteration of a building or structure.

Two of the objectives of a Natural Environment DPA are to protect and enhance water quality and to protect drinking water sources and subsurface aquifers against possible contamination from land use and development activities. General guidelines for issuing development permits have been prepared, but typically an assessment report must be prepared by a professional qualified in the relevant discipline and licensed to practice in British Columbia (a Qualified Professional (QP)). Guidelines for the protection of aquifers and wells include:

- Land disturbance that could have a negative impact on groundwater recharge and wellhead protection areas is prohibited;
- The use of chemical fertilizers, pesticides and herbicides is to be avoided;
- Proposed underground storage tank sites where the stored material has the potential to contaminate groundwater must be assessed by a hydrogeological QP. If the site is appropriate, the QP shall provide recommendations for the installation and maintenance of the tank(s).
- The frequency with which the landscape and aquifers are disturbed to access groundwater flow must be minimized;

- A hydrogeological assessment must be completed by a hydrogeological QP prior to the design and installation of any geothermal system. The assessment must conclude that the system will result in no significant impacts to existing ground and surface water conditions (e.g. temperature and quality). Design and installation must conform with best management practices, and designers, installers and drillers must be accredited by the Canadian Geoechange Coalition (CGC) and systems must be certified by the CGC.

6.4. Capital Works Plan

The District's Capital Works Plan is updated at a 4 – 6 year interval. The updates are driven by changes in zoning, City of Kelowna plans, rapid development and social needs, rising construction and material costs, etc.

The plans identify specific expansion upgrades to keep pace with development demand and land use changes. The plan is approved by the Ministry of Community, Sport and Cultural Development who control and verify the funds collected and released specifically for Capital Works Projects. The RWD Board of Trustees reviewed and approved the Capital Works Plan 2018 – 2027.

6.5. Water Use Efficiency

Most of the District is metered and has developed a sustainable toll structure to maintain and upgrade the program. Water rates have been developed to encourage responsible water use by keeping water tolls low for basic water requirements and then developing an increasing block rate structure for consumers with higher non-essential water demands. In 2020 we continued our partnership with the Okanagan Waterwise program.

The District enforces water regulations by patrols of residences and by acting on neighbour complaints, etc. Generally, we have found that we have a very responsible customer base with few exceptions. Water consumption is tracked daily in the system and this data aids in the timely actions the District takes to maintain a level of responsible water use.

7.0 Future Plans

Future RWD plans within the next two years include:

- **Upgrading the McIntosh Road watermain** to coincide with the City's construction for the Houghton Road Active Transportation Corridor (Phase III). This involves replacement of approximately 296 metres of 100 mm AC watermain with 200 mm PVC Watermain from Rutland Road to Asher Road
- **Coordination with the City of Kelowna's Central Rutland Sanitary Sewer Connection project.** Planning for this project is ongoing to determine if any efficiencies can be found by improving RWD infrastructure at the same time as City contractors install new sewer mains. This could include replacing aging water services, watermains or installing looping connections to improve water quality.
- **Drilling of a new well.** Many of the wells in the RWD works yard (1175 Hollywood Road S) have decreased in quantity over the last few decades. In addition, the new GCDWQ maximum allowable concentration of manganese (0.12 ppm) means the District is looking to replace existing wells with new sources. The first new well will be a replacement to Well No. 11 (named Well No. 11R) if sufficient quality and quantity are found.
- **Adjustment of pump set points.** The District plans on adjusting both pump set points and reservoir operation set points to prioritize wells with better water quality (including manganese). These wells are mostly in the Lower Zone and this results in more utilization of the booster pumps and the Teasdale Reservoir.
- **Update of numerous planning documents.** The District, in conjunction with engineering consultants, continue to update numerous planning documents to meet Interior Health conditions for their operating permit. These plans include:
 - **Capital Works Plan Update.** The 2018-2027 Capital Works Plan will be reviewed as a 5-year update in 2023. The update will incorporate the City of Kelowna's new planning documents (2040 Official Community Plan and Zoning Bylaw No. 12375), both of which impact the District's CWP. This update will include a review of Capital Expenditure Charges.
 - **Water System Renewal Plan.** This plan will build on the District's previous Tangible Capital Assets evaluation. The plan will outline long term plans for infrastructure renewal for source, treatment and distribution system.

- **Water Quality Monitoring Plan.** This plan will be updated to ensure all Interior Health and Drinking Water Protection Regulation requirements are met.
- **Emergency Response Plan.** This plan continues to be updated on an annual basis.

- **Continue to support new development.** The District continues to work with Developers as the land use trends of infill and densification in Rutland continues. As new infrastructure is needed to supply increased fire flow and water usage, the District reviews development to ensure that growth-related works are constructed.

Appendix A - Historic Water Usage from 1998 to 2021

Monthly Water Demand (x 1,000 US gallons)

**RUTLAND WATERWORKS DISTRICT
HISTORIC WATER USAGE FROM 1998 TO 2021
MONTHLY WATER DEMAND (x 1,000 US gallons)**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL PUMPED*	TOTAL RWD DEMAND**
1998	18,366	37,819	42,973	54,070	110,454	108,372	168,475	168,256	101,385	44,761	34,418	80,746	970,095	970,095
1999	65,241	38,982	44,420	64,905	87,670	114,946	126,176	125,361	78,776	52,702	41,850	43,792	884,821	884,821
2000	43,071	40,191	40,307	56,897	80,241	103,544	127,242	133,047	60,444	51,367	41,192	41,858	819,401	819,401
2001	41,838	38,162	44,345	54,941	92,112	92,375	140,223	131,594	85,970	49,527	39,265	40,358	850,710	850,710
2002	41,227	37,730	44,515	59,045	89,455	136,652	170,868	142,408	88,950	51,380	37,472	38,577	938,279	938,279
2003	39,051	39,062	48,098	62,679	108,166	138,548	188,455	151,151	82,648	53,382	40,836	20,636	972,712	972,712
2004	41,405	39,499	40,801	55,792	73,464	94,245	131,797	100,904	46,968	43,232	40,724	43,531	752,362	752,362
2005	43,126	33,073	35,799	55,591	87,096	74,295	115,205	128,444	70,563	46,899	38,095	39,784	767,970	767,970
2006	40,416	51,568	40,740	49,346	82,291	107,685	129,330	141,154	73,735	45,154	32,377	32,833	826,629	826,629
2007	33,577	31,343	35,766	53,501	99,190	84,283	107,583	109,478	76,886	41,972	35,762	38,360	747,701	747,701
2008	39,566	38,478	40,720	46,528	121,664	94,229	132,467	99,609	78,451	43,108	34,779	34,706	804,305	804,305
2009	35,634	32,174	35,886	42,482	87,762	124,612	124,102	105,837	70,498	42,287	34,780	36,300	772,334	772,334
2010	35,135	34,007	38,442	50,720	66,276	79,145	125,442	115,768	62,683	42,755	34,939	35,364	720,676	720,676
2011	36,640	34,245	91,395	37,654	59,311	78,685	106,505	112,711	75,524	30,553	37,478	37,067	737,768	737,768
2012	41,111	39,262	42,483	47,786	78,813	69,394	110,244	130,426	93,629	57,423	40,830	41,568	792,969	792,969
2013	47,437	47,455	46,296	47,832	82,753	81,102	138,416	118,305	68,785	44,080	39,114	41,692	803,267	803,267
2014	43,565	37,090	41,220	47,448	78,951	100,090	130,797	115,408	72,915	47,492	41,422	43,826	800,224	800,224
2015	50,710	* 91,260	45,336	61,158	98,898	111,990	135,510	112,175	70,274	49,900	41,602	41,701	* 910,514	** 861,000
2016	47,123	* 93,294	* 72,085	63,757	85,663	95,635	100,167	108,064	72,674	49,380	43,584	43,909	* 875,335	** 827,000
2017	44,832	40,392	43,554	44,832	62,152	100,040	142,825	126,849	89,080	51,289	43,799	44,577	834,221	834,221
2018	46,377	44,965	50,336	52,334	97,764	111,653	124,979	111,840	67,594	57,032	37,034	37,119	839,027	839,027
2019	39,549	36,584	40,579	45,573	85,152	100,034	97,773	109,262	66,758	41,937	38,062	39,084	740,347	740,347
2020	39,652	* 75,280	* 66,610	50,407	72,631	71,382	103,201	113,047	83,694	46,213	37,029	37,982	* 797,128	** 725,500
2021	38,546	36,003	40,849	57,259	88,645	112,584	137,193	101,998	71,548	45,973	39,038	41,544	811,180	811,180
Average US Gals	41,383	44,497	46,398	52,605	86,524	99,397	129,791	121,379	75,435	47,075	38,562	40,705	823,749	816,687

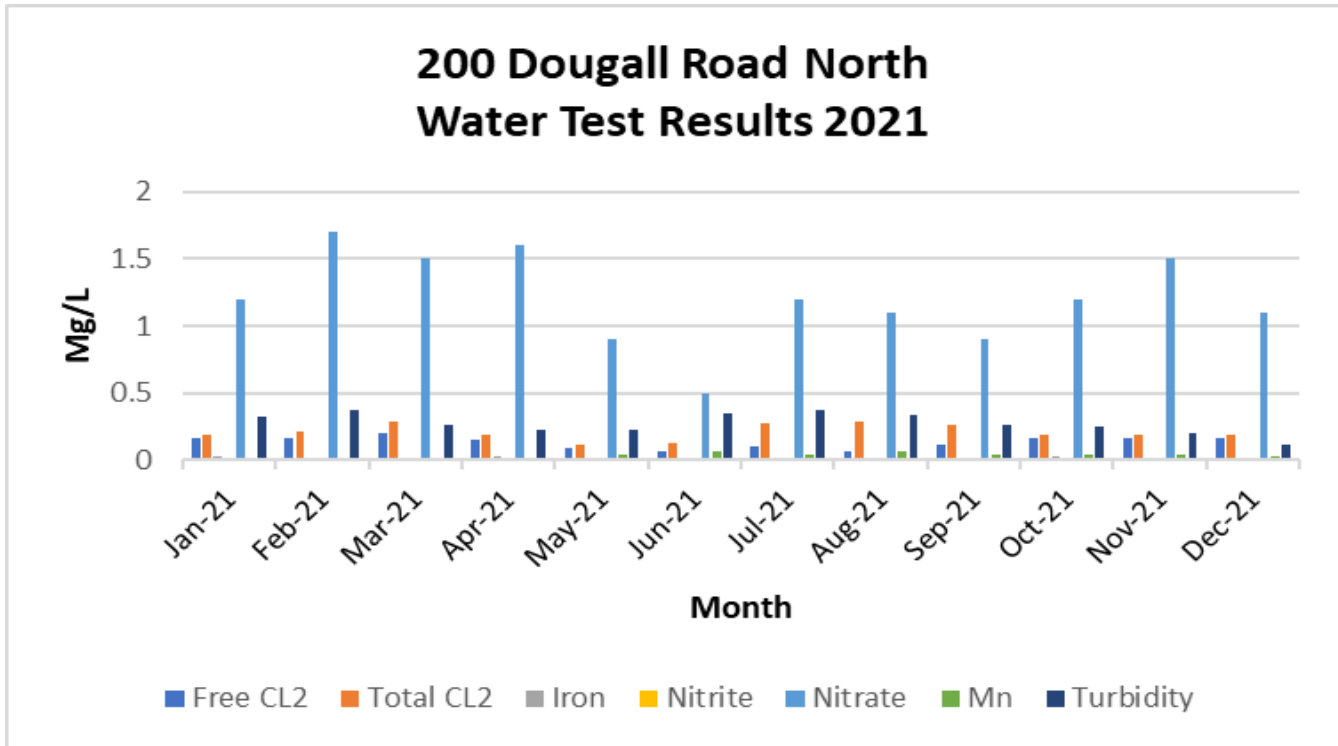
Highest
Lowest

* Includes Water Delivered to BMID
** Excludes Water Delivered to BMID

Appendix B - Water Testing Results 2021

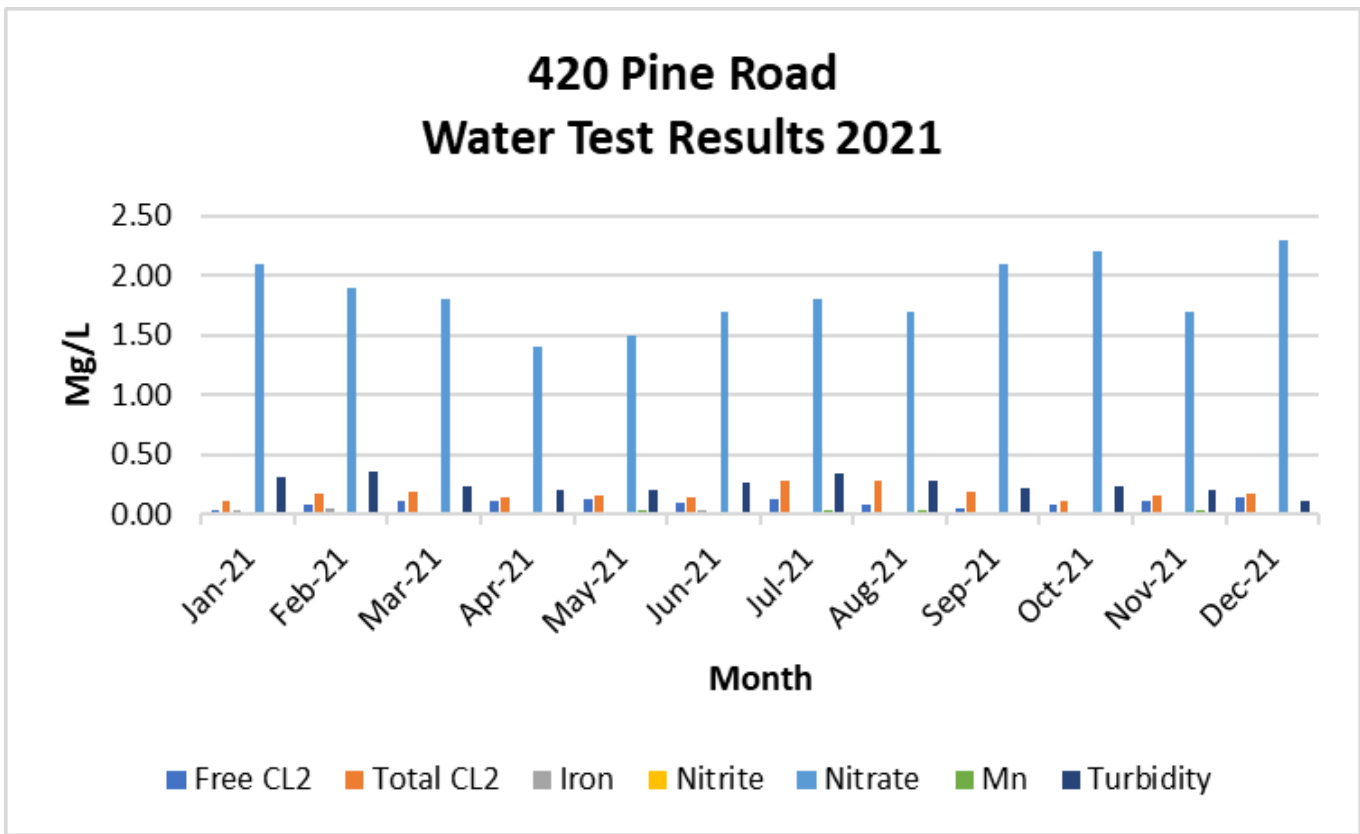
1. 200 Dougall Road North
2. 420 Pine Road
3. 2592 Highway 97 North
4. 920 Saskatoon Road
5. 2080 Hollywood Road South
6. 1040 Villa Vista Road

RWD Water Testing Results 2021
(Monthly Averages)



200 Dougall Road North

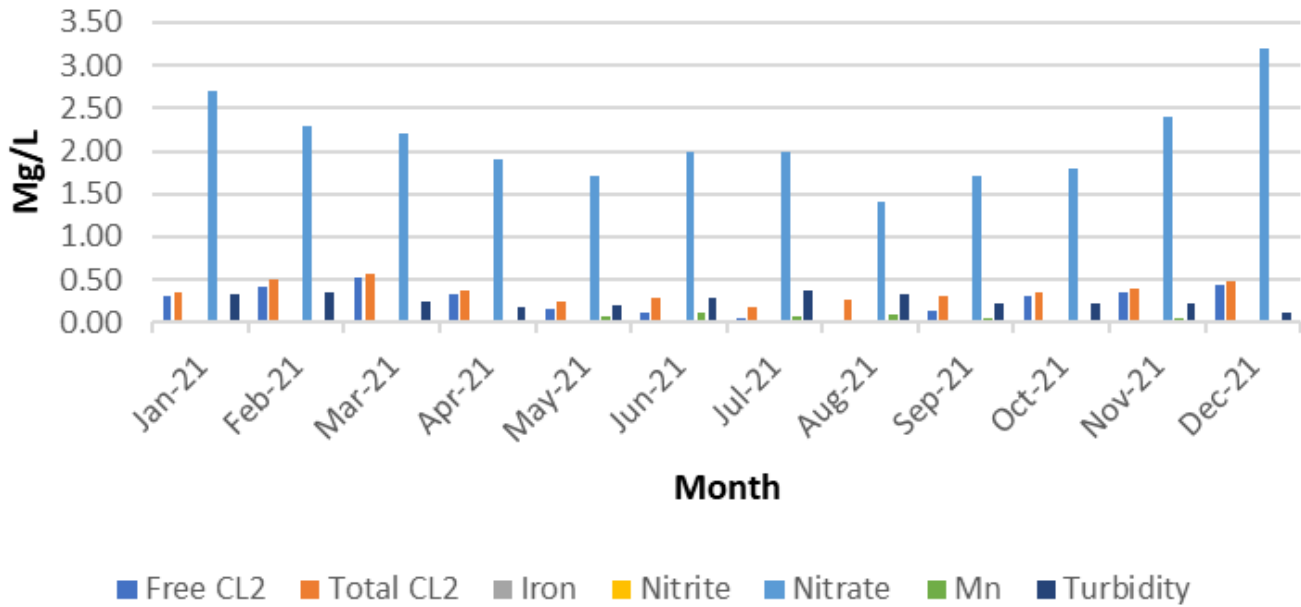
Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.16	0.19	6.9	146	0.03	0.005	1.2	0.015	0.32	11
Feb-21	0.16	0.21	6.9	180	0.02	0.005	1.7	0.019	0.37	12
Mar-21	0.20	0.29	6.9	245	0.02	0.005	1.5	0.016	0.26	11
Apr-21	0.15	0.19	7.0	209	0.03	0.004	1.6	0.022	0.22	12
May-21	0.09	0.12	7.1	216	0.01	0.005	0.9	0.042	0.23	14
Jun-21	0.06	0.13	7.3	288	0.01	0.002	0.5	0.069	0.35	16
Jul-21	0.10	0.27	7.4	271	0.02	0.002	1.2	0.039	0.37	17
Aug-21	0.07	0.29	7.2	274	0.02	0.008	1.1	0.061	0.34	17
Sep-21	0.11	0.26	7.2	294	0.02	0.002	0.9	0.046	0.26	16
Oct-21	0.16	0.19	7.1	249	0.03	0.002	1.2	0.047	0.25	16
Nov-21	0.16	0.19	7.0	226	0.02	0.002	1.5	0.044	0.20	14
Dec-21	0.17	0.19	7.1	232	0.01	0.004	1.1	0.033	0.12	11



420 Pine Road

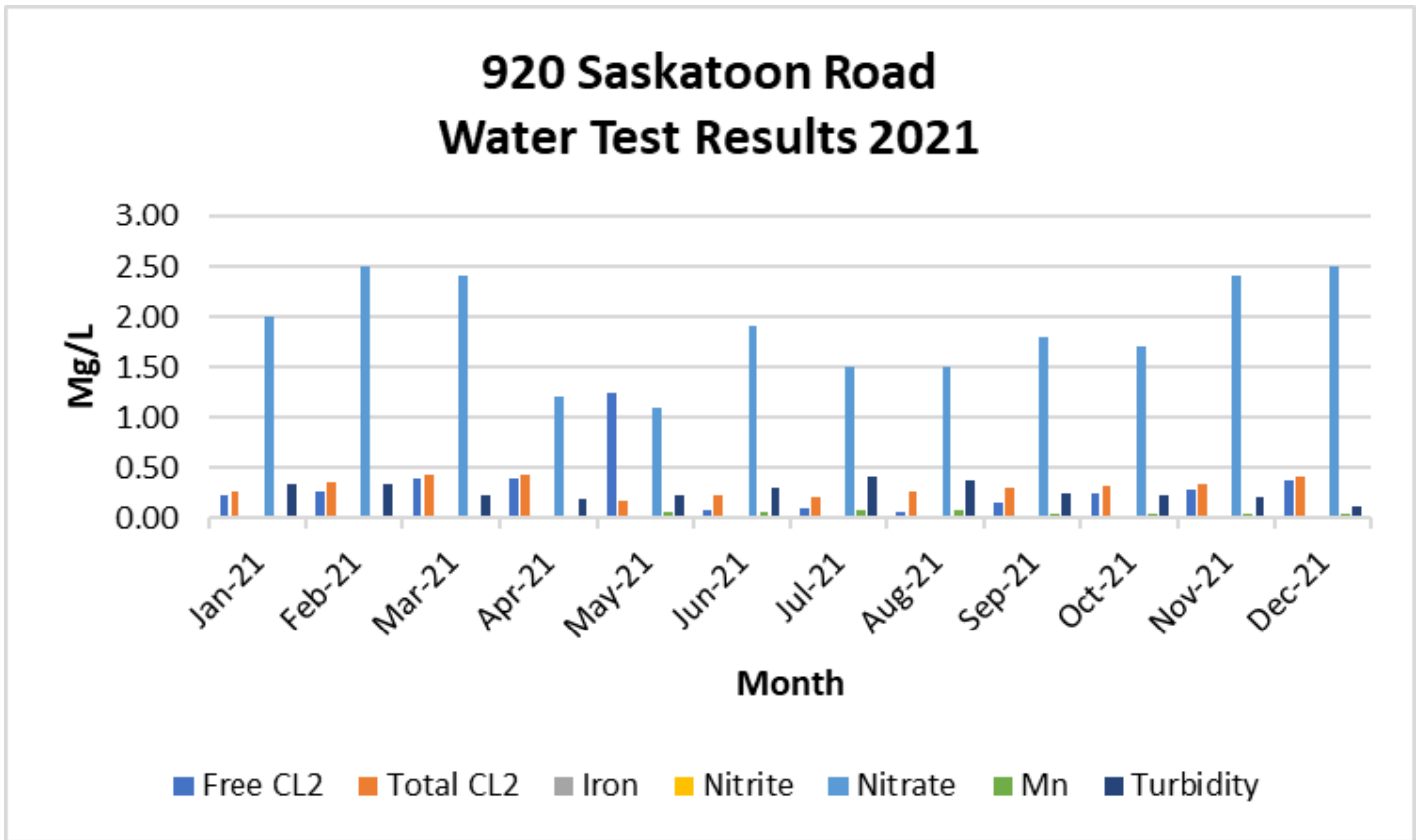
Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.04	0.12	7.1	162	0.04	0.002	2.1	0.019	0.31	10
Feb-21	0.08	0.17	7.1	156	0.05	0.004	1.9	0.016	0.36	9
Mar-21	0.11	0.19	7.1	199	0.02	0.004	1.8	0.023	0.24	6
Apr-21	0.12	0.15	7.1	198	0	0.001	1.4	0.019	0.20	9
May-21	0.13	0.16	7.2	203	0.01	0.004	1.5	0.037	0.20	13
Jun-21	0.1	0.15	7.1	223	0.03	0.004	1.7	0.024	0.27	15
Jul-21	0.13	0.28	7.2	240	0.02	0.003	1.8	0.030	0.34	17
Aug-21	0.08	0.28	7.1	227	0.02	0.004	1.7	0.039	0.28	18
Sep-21	0.05	0.19	7.1	166	0	0.001	2.1	0.021	0.22	17
Oct-21	0.08	0.11	7.0	150	0.01	0.004	2.2	0.026	0.23	15
Nov-21	0.12	0.16	7.0	206	0.02	0.003	1.7	0.030	0.21	12
Dec-21	0.15	0.18	6.9	176	0.02	0.005	2.3	0.006	0.11	9

2592 Highway 97 N. Water Test Results 2021



2592 Highway 97 North

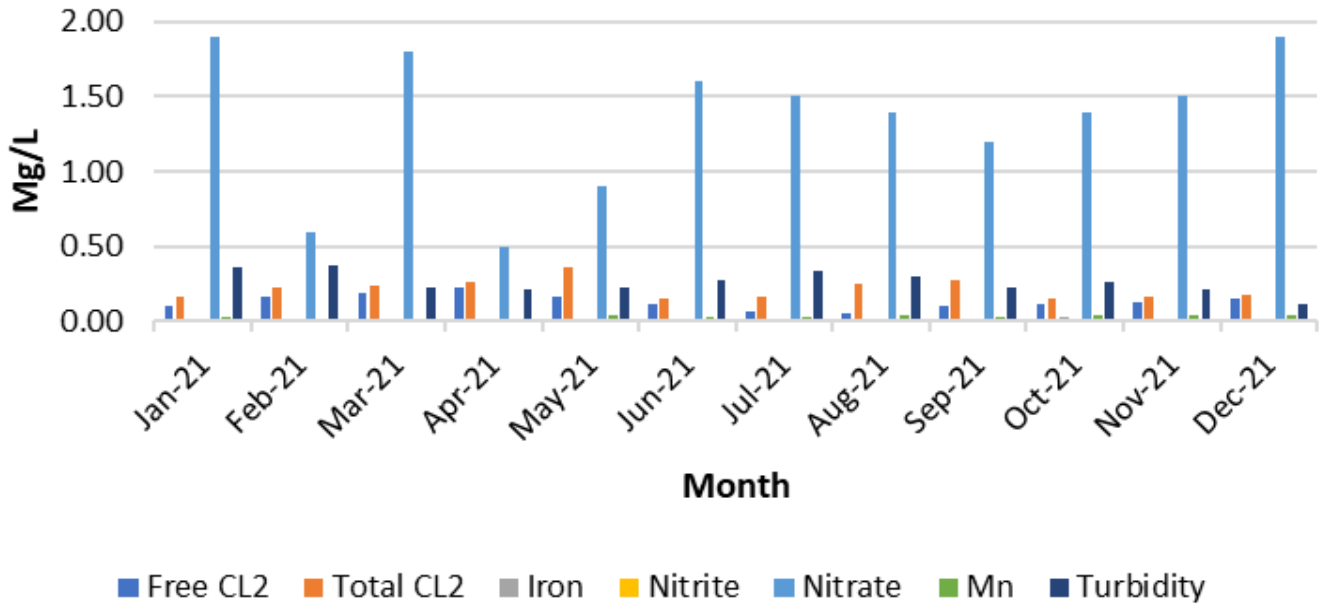
Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.30	0.36	7.00	163.00	0.01	0.004	2.70	0.012	0.33	8.00
Feb-21	0.42	0.51	7.10	180.00	0.01	0.007	2.30	0.014	0.36	7.00
Mar-21	0.52	0.56	7.00	230.00	0.02	0.006	2.20	0.015	0.24	7.00
Apr-21	0.34	0.38	7.10	226.00	0.01	0.006	1.90	0.017	0.18	10.00
May-21	0.16	0.24	7.20	151.00	0.00	0.007	1.70	0.068	0.21	13.00
Jun-21	0.11	0.29	7.40	241.00	0.02	0.001	2.00	0.111	0.29	16.00
Jul-21	0.05	0.19	7.50	280.00	0.02	0.003	2.00	0.062	0.37	17.00
Aug-21	0.04	0.26	7.30	284.00	0.03	0.003	1.40	0.097	0.33	18.00
Sep-21	0.14	0.30	7.10	163.00	0.02	0.006	1.70	0.045	0.23	16.00
Oct-21	0.31	0.36	7.00	225.00	0.03	0.003	1.80	0.035	0.23	15.00
Nov-21	0.36	0.40	7.00	215.00	0.02	0.003	2.40	0.041	0.22	12.00
Dec-21	0.43	0.48	7.00	235.00	0.01	0.011	3.20	0.034	0.11	10.00



920 Saskatoon Road

Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.23	0.27	7.1	157	0.01	0.003	2.0	0.015	0.34	9
Feb-21	0.26	0.35	7.1	155	0.01	0.006	2.5	0.014	0.34	9
Mar-21	0.39	0.44	7.1	204	0.02	0.004	2.4	0.019	0.23	8
Apr-21	0.39	0.44	7.2	244	0.01	0.002	1.2	0.017	0.19	10
May-21	1.24	0.17	7.3	206	0.02	0.002	1.1	0.068	0.22	13
Jun-21	0.08	0.23	7.4	191	0.02	0.002	1.9	0.066	0.3	14
Jul-21	0.10	0.21	7.6	243	0.02	0.002	1.5	0.073	0.42	16
Aug-21	0.06	0.26	7.4	221	0.03	0.005	1.5	0.079	0.38	15
Sep-21	0.15	0.31	7.2	220	0.02	0.006	1.8	0.050	0.25	15
Oct-21	0.24	0.32	7.1	238	0.01	0.023	1.7	0.048	0.23	15
Nov-21	0.29	0.34	7.1	259	0.01	0.006	2.4	0.042	0.21	13
Dec-21	0.38	0.42	7.1	228	0.03	0.003	2.5	0.050	0.12	11

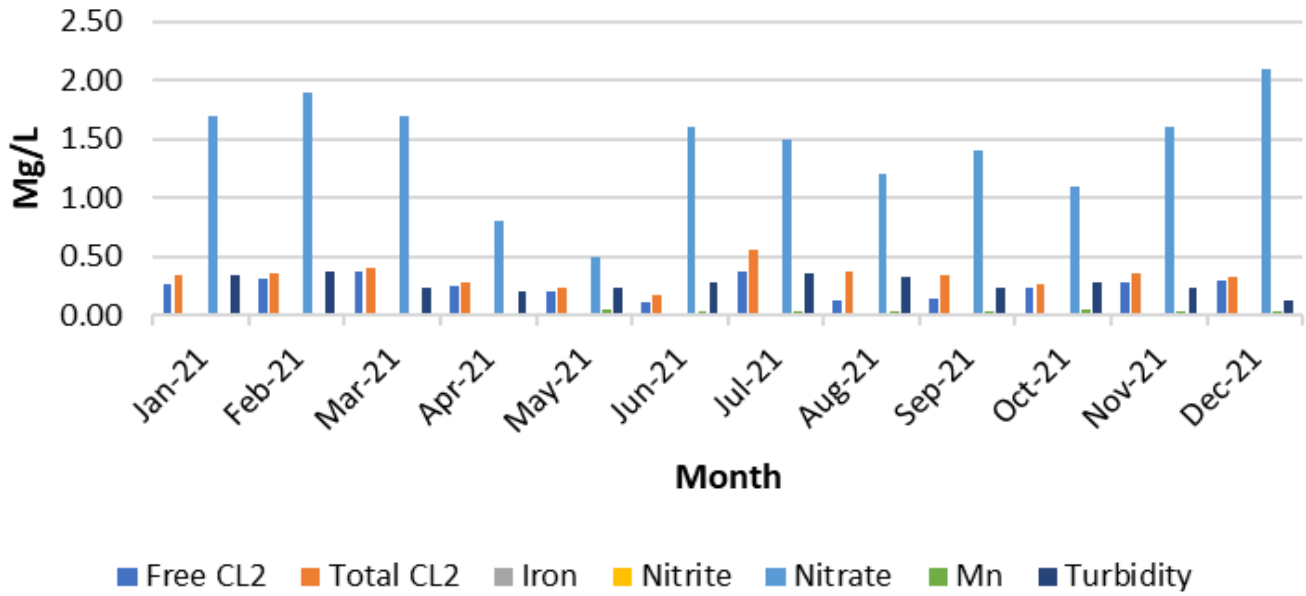
2080 Hollywood Road S. Water Test Results 2021



2080 Hollywood Road South

Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.10	0.17	7.1	165	0.01	0.002	1.9	0.023	0.36	7
Feb-21	0.16	0.23	7.2	166	0.02	0.002	0.6	0.01	0.37	8
Mar-21	0.19	0.24	7.2	213	0.01	0.003	1.8	0.02	0.22	5
Apr-21	0.22	0.26	7.2	215	0.01	0.001	0.5	0.017	0.21	8
May-21	0.17	2.56	7.2	197	0.02	0.004	0.9	0.039	0.23	12
Jun-21	0.11	0.15	7.2	203	0.02	0.005	1.6	0.031	0.28	16
Jul-21	0.06	0.16	7.4	245	0.01	0.003	1.5	0.028	0.34	19
Aug-21	0.05	0.25	7.3	238	0.02	0.005	1.4	0.044	0.30	18
Sep-21	0.10	0.28	7.1	211	0.01	0.003	1.2	0.029	0.23	17
Oct-21	0.12	0.15	7.1	235	0.03	0.015	1.4	0.043	0.26	15
Nov-21	0.13	0.16	7.1	213	0.02	0.004	1.5	0.045	0.21	11
Dec-21	0.15	0.18	7.1	271	0.01	0.002	1.9	0.042	0.12	8

1040 Villa Vista Road Water Test Results 2021



1040 Villa Vista Road

Date	Free CL2	Total CL2	pH	Hardness	Iron	Nitrite	Nitrate	Mn	Turbidity	Temp
Jan-21	0.27	0.34	7.00	148	0.02	0.002	1.7	0.02	0.35	8
Feb-21	0.31	0.36	7.10	161	0.01	0.004	1.9	0.015	0.37	9
Mar-21	0.37	0.41	7.20	181	0.01	0.003	1.7	0.024	0.23	9
Apr-21	0.25	0.29	7.20	182	0.00	0.004	0.8	0.015	0.21	8
May-21	0.21	0.24	7.20	227	0.01	0.002	0.5	0.047	0.24	12
Jun-21	0.12	0.17	7.20	225	0.01	0.002	1.6	0.031	0.28	13
Jul-21	0.38	0.56	7.40	206	0.01	0.002	1.5	0.029	0.36	14
Aug-21	0.13	0.37	7.30	186	0.01	0.002	1.2	0.032	0.33	13
Sep-21	0.15	0.34	7.50	204	0.01	0.002	1.4	0.036	0.24	13
Oct-21	0.23	0.26	7.10	262	0.01	0.012	1.1	0.045	0.28	12
Nov-21	0.29	0.36	7.00	216	0.02	0.004	1.6	0.043	0.23	11
Dec-21	0.30	0.33	7.10	205	0.01	0.003	2.1	0.043	0.13	10

Appendix C - Bacteriological Results 2021

CARO Independent Lab Testing

Total Coliform – E. coli

1. 200 Dougall Road North
2. 420 Pine Road
3. 2592 Highway 97 North
4. 920 Saskatoon Road
5. 2080 Hollywood Road South
6. 1040 Villa Vista Road
7. 200 Mallach Road
8. 125 Adventure Road
9. 705 Kitch Road
10. 470 Ziprick Road

CARO Results

January		Coliform	E-Coli
420 Pine Rd	2021-01-19	<1	<1
200 Dougall Rd N	2021-01-19	<1	<1
2592 Hwy 97 N	2021-01-26	<1	<1
920 Saskatoon Rd	2021-01-26	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-01-05	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-01-05	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-01-12	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-01-12	<1	<1
February		Coliform	E-Coli
2080 Hollywood Rd S	2021-02-09	<1	<1
1040 Villa Vista Rd	2021-02-09	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-02-02	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-02-02	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-02-16	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-02-16	<1	<1
March		Coliform	E-Coli
200 Dougall Rd N	2021-03-16	<1	<1
420 Pine Rd	2021-03-16	<1	<1
2592 Hwy 97 N	2021-03-02	<1	<1
920 Saskatoon Rd	2021-03-02	<1	<1
2080 Hollywood Rd S	2021-03-09	<1	<1
1040 Villa Vista Rd	2021-03-09	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-03-30	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-03-30	<1	<1
April		Coliform	E-Coli
200 Dougall Rd N	2021-04-13	<1	<1
420 Pine Rd	2021-04-13	<1	<1
2592 Hwy 97 N	2021-04-20	<1	<1
2592 Hwy 97 N	2021-04-23	<1	<1
920 Saskatoon Rd	2021-04-20	<1	<1
920 Saskatoon Rd	2021-04-23	<1	<1
2080 Hollywood Rd S	2021-04-27	<1	<1
1040 Villa Vista Rd	2021-04-27	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-04-06	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-04-06	<1	<1

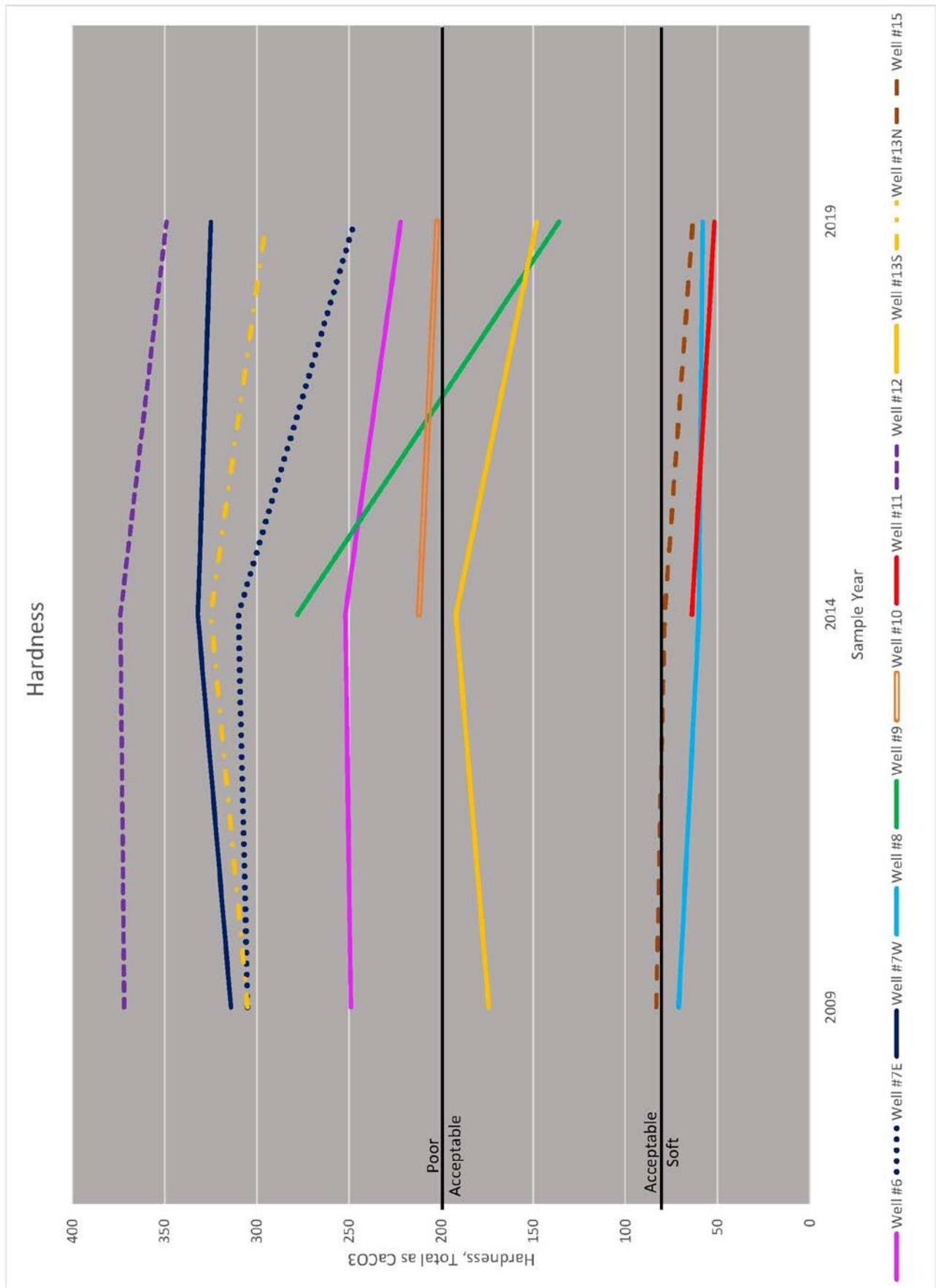
May		Coliform	E-Coli
200 Dougall Rd N	2021-05-18	<1	<1
420 Pine Rd	2021-05-18	<1	<1
2592 Hwy 97 N	2021-05-25	<1	<1
920 Saskatoon Rd	2021-05-25	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-05-11	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-05-11	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-05-04	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-05-04	<1	<1
June		Coliform	E-Coli
200 Dougall Rd N	2021-06-22	<1	<1
420 Pine Rd	2021-06-22	<1	<1
2592 Hwy 97 N	2021-06-29	<1	<1
920 Saskatoon Rd	2021-06-29	<1	<1
2080 Hollywood Rd S	2021-06-01	<1	<1
1040 Villa Vista Rd	2021-06-01	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-06-08	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-06-08	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-06-15	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-06-15	<1	<1
July		Coliform	E-Coli
200 Dougall Rd N	2021-07-13	<1	<1
200 Dougall Rd N	2021-07-27	<1	<1
420 Pine Rd	2021-07-13	<1	<1
420 Pine Rd	2021-07-27	<1	<1
2592 Hwy 97 N	2021-07-20	<1	<1
920 Saskatoon Rd	2021-07-20	<1	<1
2080 Hollywood Rd S	2021-07-06	<1	<1
1040 Villa Vista Rd	2021-07-06	<1	<1
August		Coliform	E-Coli
200 Dougall Rd N	2021-08-10	<1	<1
420 Pine Rd	2021-08-10	<1	<1
2592 Hwy 97 N	2021-08-17	<1	<1
920 Saskatoon Rd	2021-08-17	<1	<1
2080 Hollywood Rd S	2021-08-03	<1	<1
1040 Villa Vista Rd	2021-08-03	<1	<1

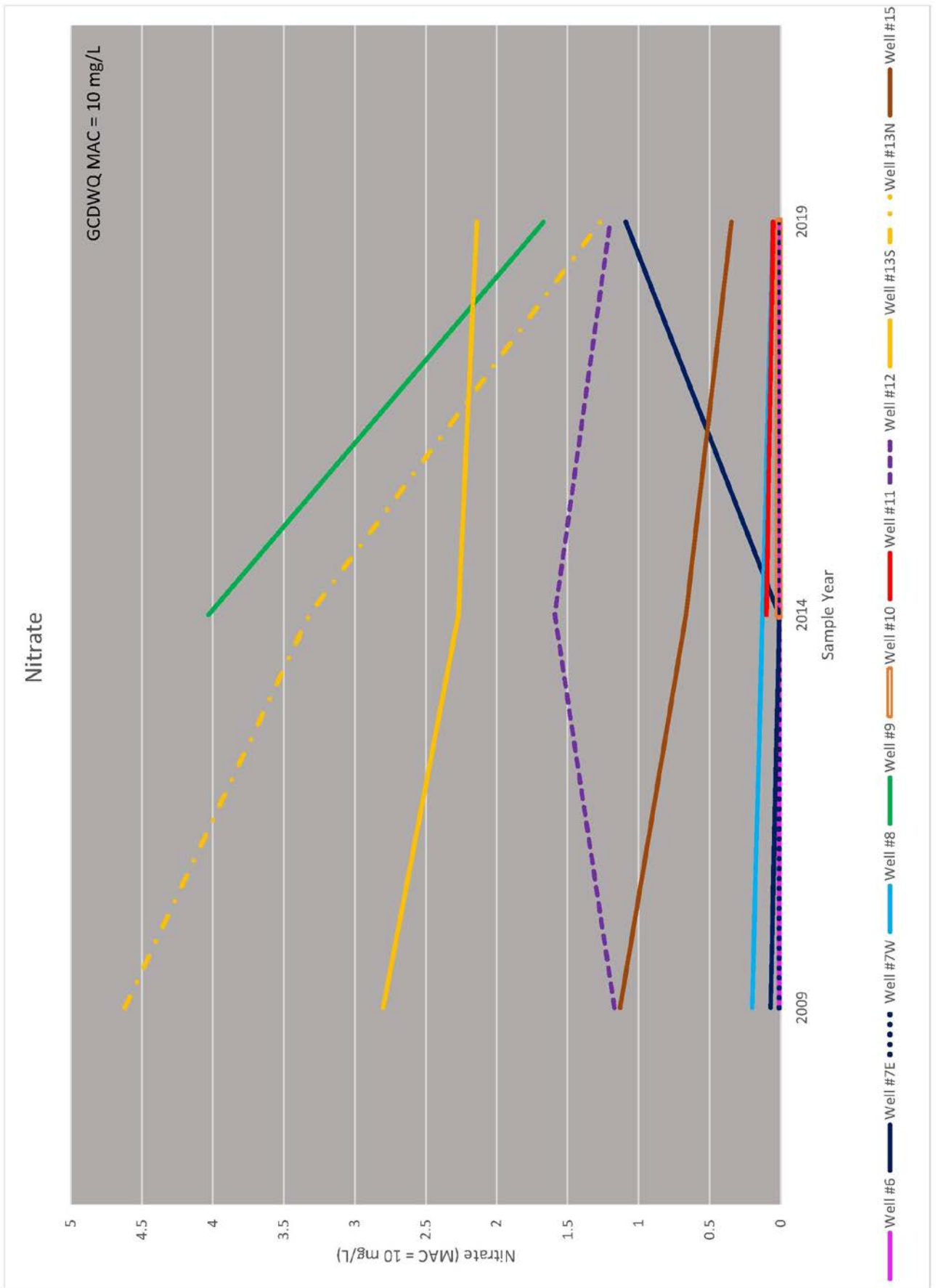
September		Coliform	E-Coli
420 Pine Rd	2021-09-20	<1	<1
200 Dougall Rd N	2021-09-20	<1	<1
2592 Hwy 97 N	2021-09-27	<1	<1
920 Saskatoon Rd	2021-09-27	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-09-06	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-09-06	<1	<1
705 Kitch Rd (Quigley Elem.)	2021-09-13	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-09-13	<1	<1
October		Coliform	E-Coli
200 Dougall Rd N	2021-10-26	<1	<1
420 Pine Rd	2021-10-26	<1	<1
2080 Hollywood Rd S	2021-10-05	<1	<1
1040 Villa Vista Rd	2021-10-05	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-10-12	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-10-12	<1	<1
November		Coliform	E-Coli
200 Dougall Rd N	2021-11-30	<1	<1
420 Pine Rd	2021-11-30	<1	<1
2592 Hwy 97 N	2021-11-02	<1	<1
920 Saskatoon Rd	2021-11-02	<1	<1
2080 Hollywood Rd S	2021-11-09	<1	<1
1040 Villa Vista Rd	2021-11-09	<1	<1
200 Mallach Rd (S. Rutland Elem.)	2021-11-16	<1	<1
125 Adventure Rd (Belgo Elem.)	2021-11-16	<1	<1
470 Ziprick Rd (Springvalley Elem.)	2021-11-24	<1	<1
December		Coliform	E-Coli
200 Dougall Rd N	2021-12-21	<1	<1
200 Dougall Rd N	2021-12-21	<1	<1
420 Pine Rd	2021-12-21	<1	<1
420 Pine Rd	2021-12-21	<1	<1
2592 Hwy 97 N	2021-12-07	<1	<1
920 Saskatoon Rd	2021-12-07	<1	<1
2080 Hollywood Rd S	2021-12-14	<1	<1
2080 Hollywood Rd S	2021-12-14	<1	<1
1040 Villa Vista Rd	2021-12-14	<1	<1
1040 Villa Vista Rd	2021-12-14	<1	<1

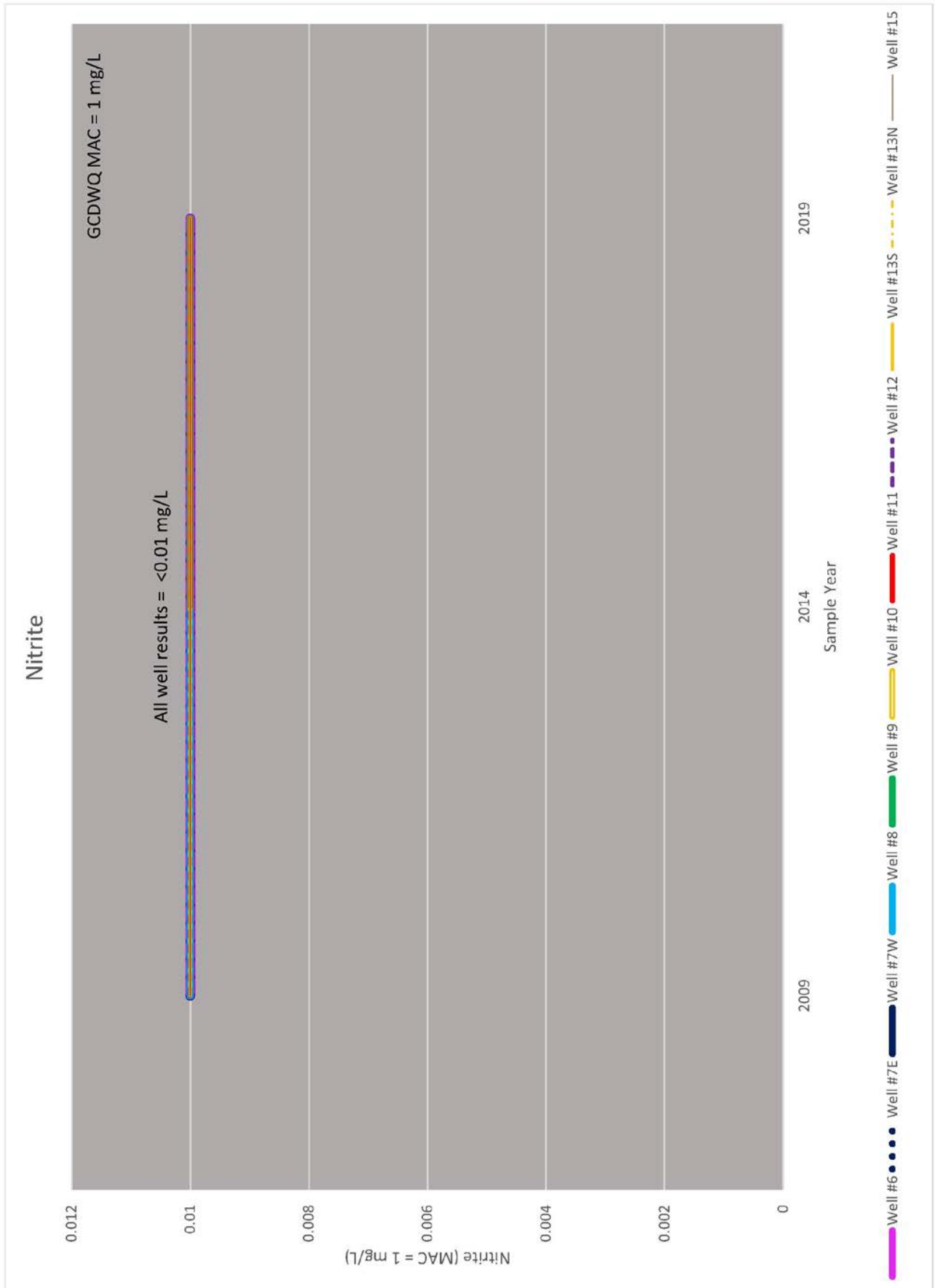
Appendix D – Chemical Parameters of RWD Wells

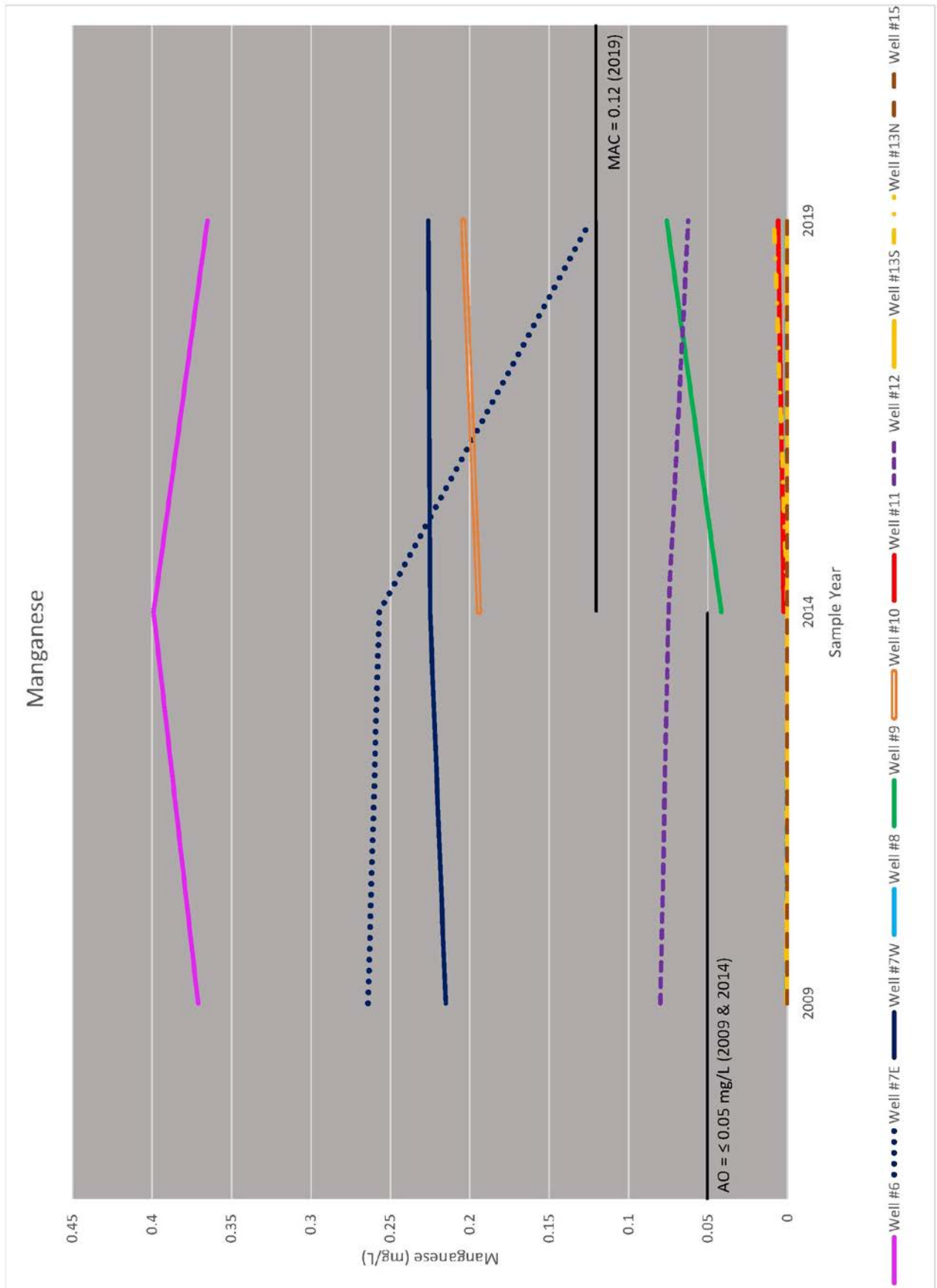
Well (Raw Water) Samples – 2009, 2014 & 2019

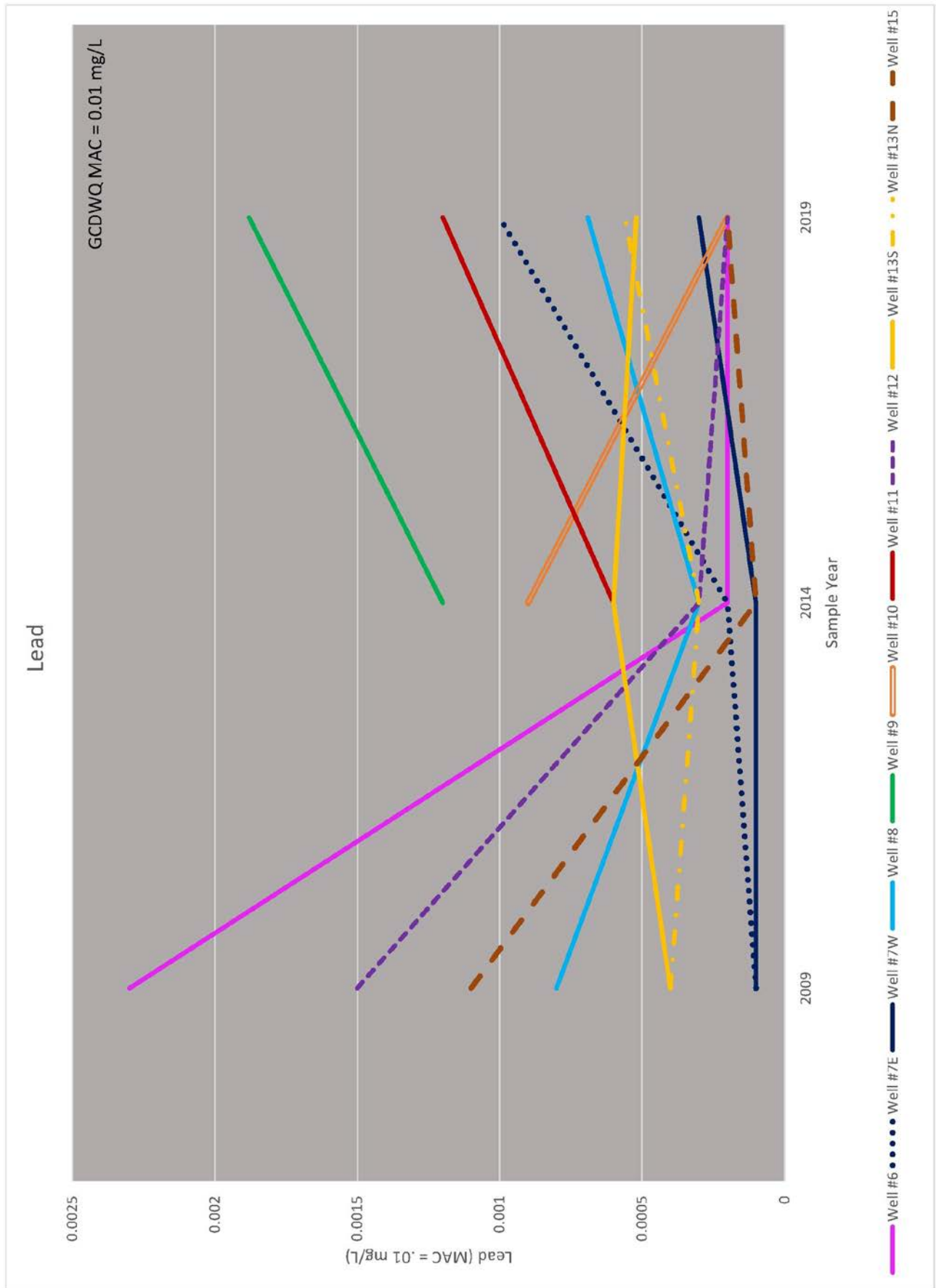
1. Hardness
2. Nitrate
3. Nitrite
4. Lead
5. Manganese



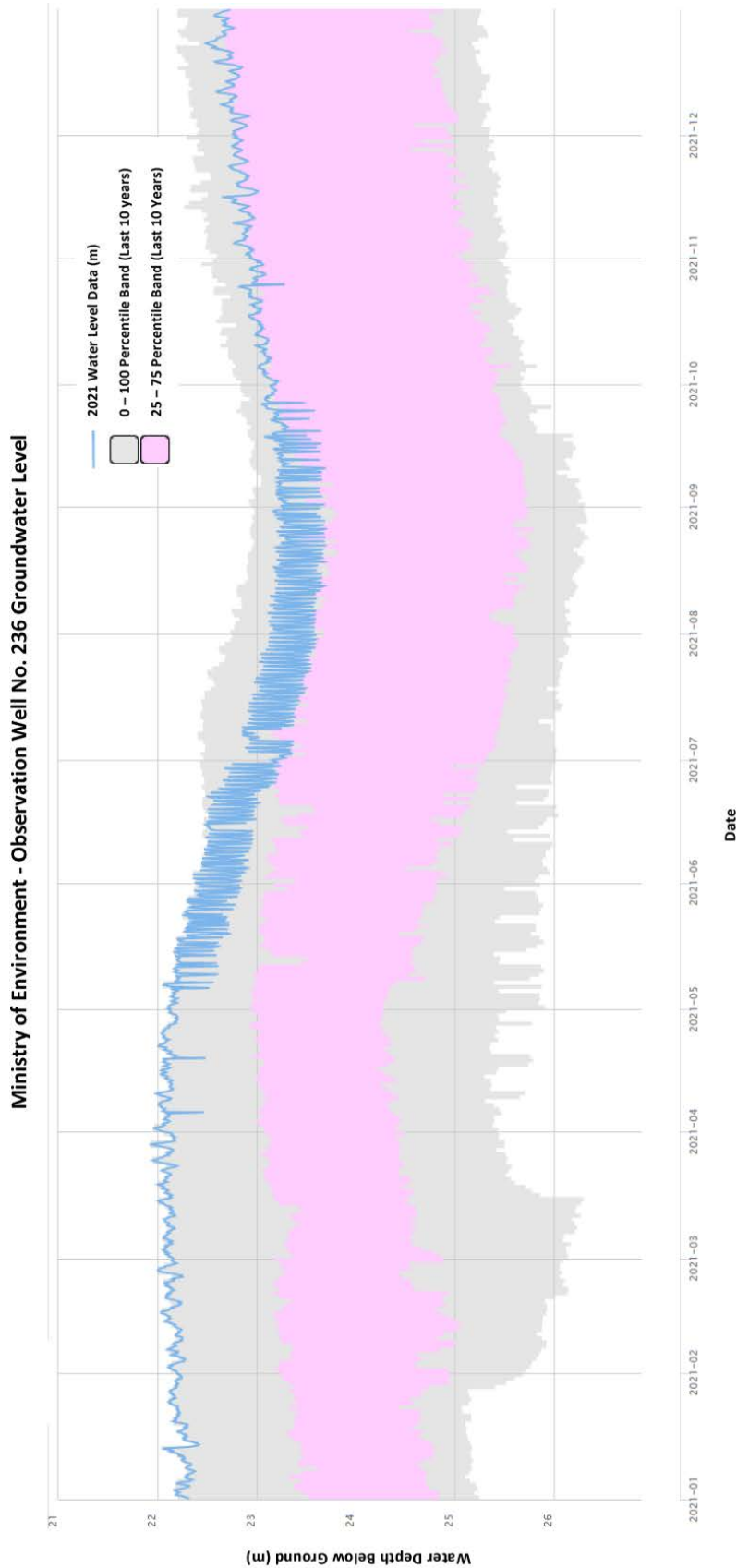


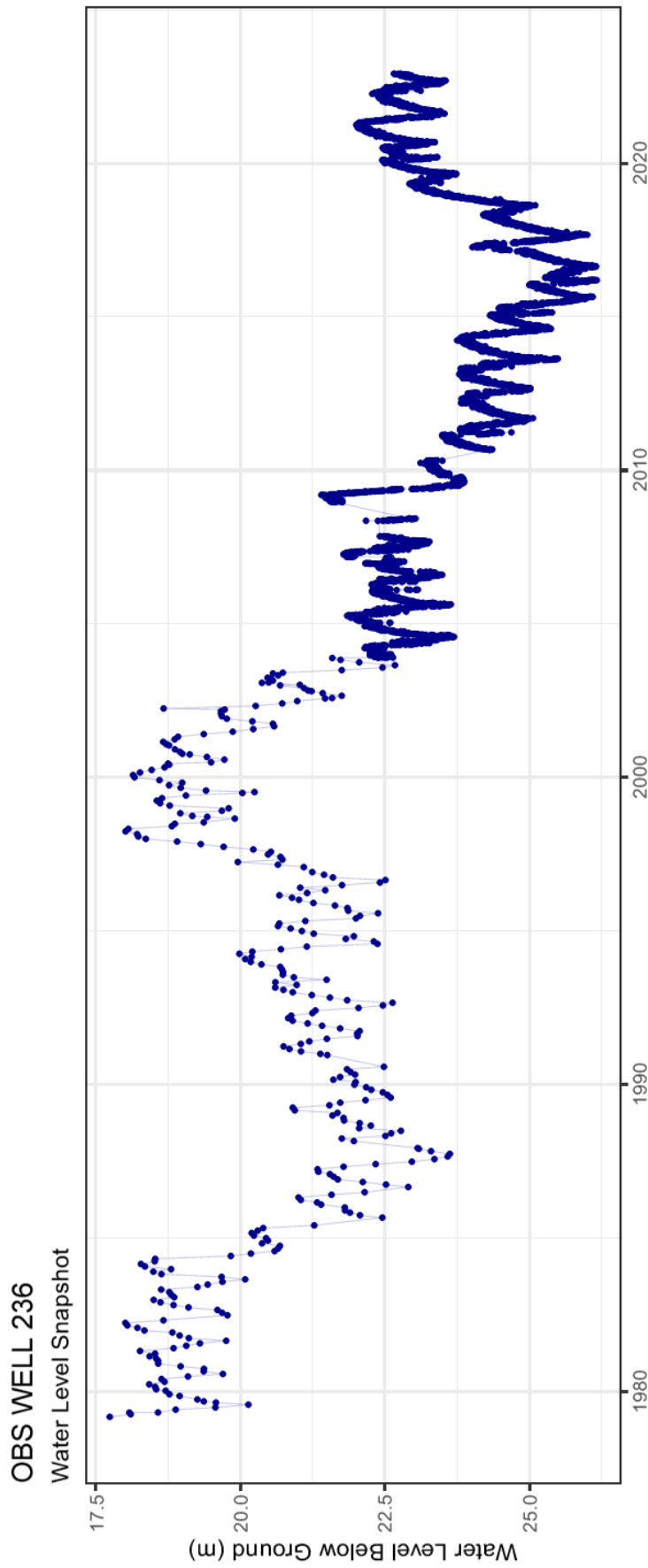






Appendix E – Groundwater Levels at Observation Well No. 236





Note: True data are marked with a dot, the thin line connecting points is a visual aid only and does not represent true observations. The full data set can be downloaded via the BC Data Catalogue or the BC Real-time Water Data tool.

