2016 Groundwater Monitoring Report

Gull Lake Area
Tp 040 to 042, R 27 to 28, W4M, and Tp 040 to 042, R 01, W5M

Prepared for
Ponoka County

Prepared by
hydrogeological consultants ltd. **(HCL)**
1.800.661.7972

April 2018

HCL Project No.: MR-0323.16

PERMIT TO PRACTICE
HYDROGEOLOGICAL CONSULTANTS LTD.
Signature _____
Date _____
PERMIT NUMBER P 385
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

TABLE OF CONTENTS

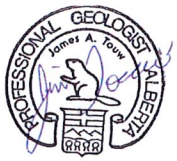
Signatures

Prepared by:

Jennifer Catt

Jennifer Catt, B.Sc.
Project Administrator

Reviewed by:



Jim Touw, P.Geol.
Senior Hydrogeologist

1. Introduction

1.1. Project Overview

Gull Lake is in Tp 040 to 042, R 27 to 28, W4M, and Tp 040 to 042, R 01, W5M, approximately 100 kilometres southwest of Edmonton in the South Saskatchewan River Basin, as shown in Figure 1. There is a population of approximately 20,000 full-time residents within 15 kilometres of Gull Lake; the Lake also sees a significant amount of recreational use. Water wells are used to supply groundwater to most of the people in the area.

In 2011, Ponoka County (the County) initiated a groundwater monitoring program to track changes in water levels and the chemical quality of groundwater in five water wells in the Gull Lake Watershed, within the County (Appendix A).

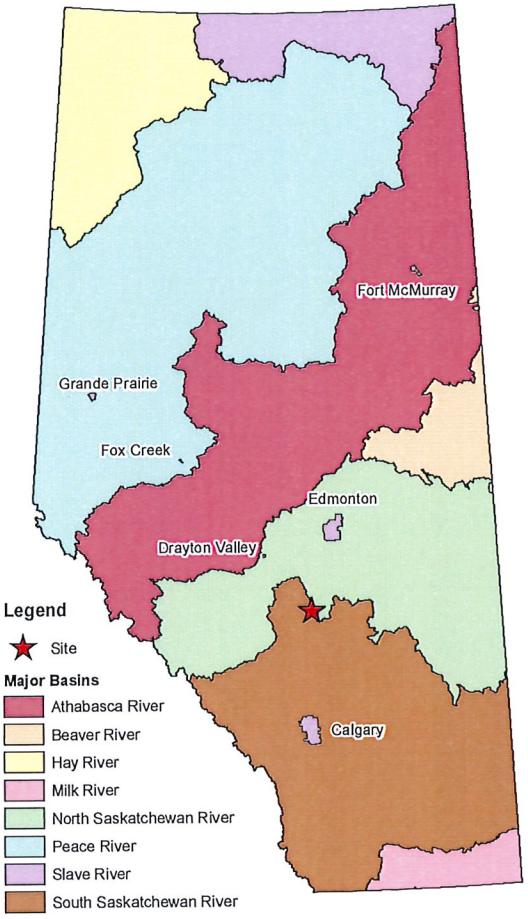


Figure 1. Index Map

1.2. Purpose

Hydrogeological Consultants Ltd. (HCL) was retained by the County to gather groundwater monitoring data from five water wells in the Gull Lake Watershed. The data collected are to be reviewed, validated and provided in a covering report.

1.3. Scope

Water-level data and groundwater samples for chemical-quality analysis were to be collected from the following water wells:

- 1983 Rogers Domestic and Stock Water Well (1983 Rogers WW) [GIC ID: 275201; M35377.069370]
- 1992 Gull Lake Golf Course Water Well (1992 Gull Lake Golf Course WW) [GIC ID: 365500; M35379.066969]
- 2001 Wegmann Domestic Water Well (2001 Wegmann WW) [GIC ID: 499682; M37490.034988]
- Inshore Developments 2004 Water Source Well No. 1 (2004 WSW – Inshore 1) [GIC ID: 1035048; M39227.478953]
- Inshore Developments 2004 Water Source Well No. 2 (2004 WSW – Inshore 2) [GIC ID: 1035047; M39227.478952]

In addition to the collection of water-level data from the five water wells, water-level data were obtained for Gull Lake from the Water Survey of Canada (WSC).

The present report includes the water-level data and the results of the laboratory analysis for groundwater samples collected in 2016 from the five water wells. The groundwater samples were submitted to an accredited laboratory in Alberta.

2. Background

2.1. Previous Work

In 2015, HCL was retained by the Gull Lake Water Quality Management Society to study potential groundwater connectivity to Gull Lake (HCL 2015). HCL concluded that two aquifers, the Sun169 Aquifer and the Sun180 Aquifer, may be hydraulically connected to Gull Lake. The aquifer nomenclature is based on the number of metres that the top of each Aquifer is above the base of the Sunchild Member of the Paskapoo Formation; the tops of the Sun169 and the Sun180 aquifers are 169 metres and 180 metres, respectively, above the base of the Sunchild Member.

Annual groundwater monitoring reports have been prepared by HCL on behalf of the County since 2012.

2.2. Water Well Details

The five water wells as shown in Table 1 are completed in four different aquifers in the Sunchild Member.

Water Well Designation	Water Well Owner	Location	Aquifer	Depth Completed (metres BGL)	Gull Lake Side
1983 Rogers WW	Dennis and Monica Rogers	09-04-042-28 W4M	Sun169	63.7	East
1992 Gull Lake Golf Course WW	Gull Lake Golf Course	04-10-42-01 W5M	Sun199	32.0	West
2001 Wegmann WW	Herman Wegmann	16-04-042-01 W5M	Sun180	54.9	West
2004 WSW – Inshore 1	Norval Horner/ Inshore Developments	08-12-042-01 W5M	Sun155	24.4	East
2004 WSW – Inshore 2	Norval Horner/ Inshore Developments	08-12-042-01 W5M	Sun155	24.4	East

Table 1. Water Well Details

2.3. Site Maps

Figure 2 is a site map showing Gull Lake and the locations of the five water wells being monitored; site maps for the five water wells are also shown in Figures 3 through 6.

Figure 2. Site Map – Gull Lake and Water Wells

04-042-28 W4M

Figure 3. Site Map – 1983 Rogers WW

Figure 4. Site Map – 1992 Gull Lake Golf Course WW

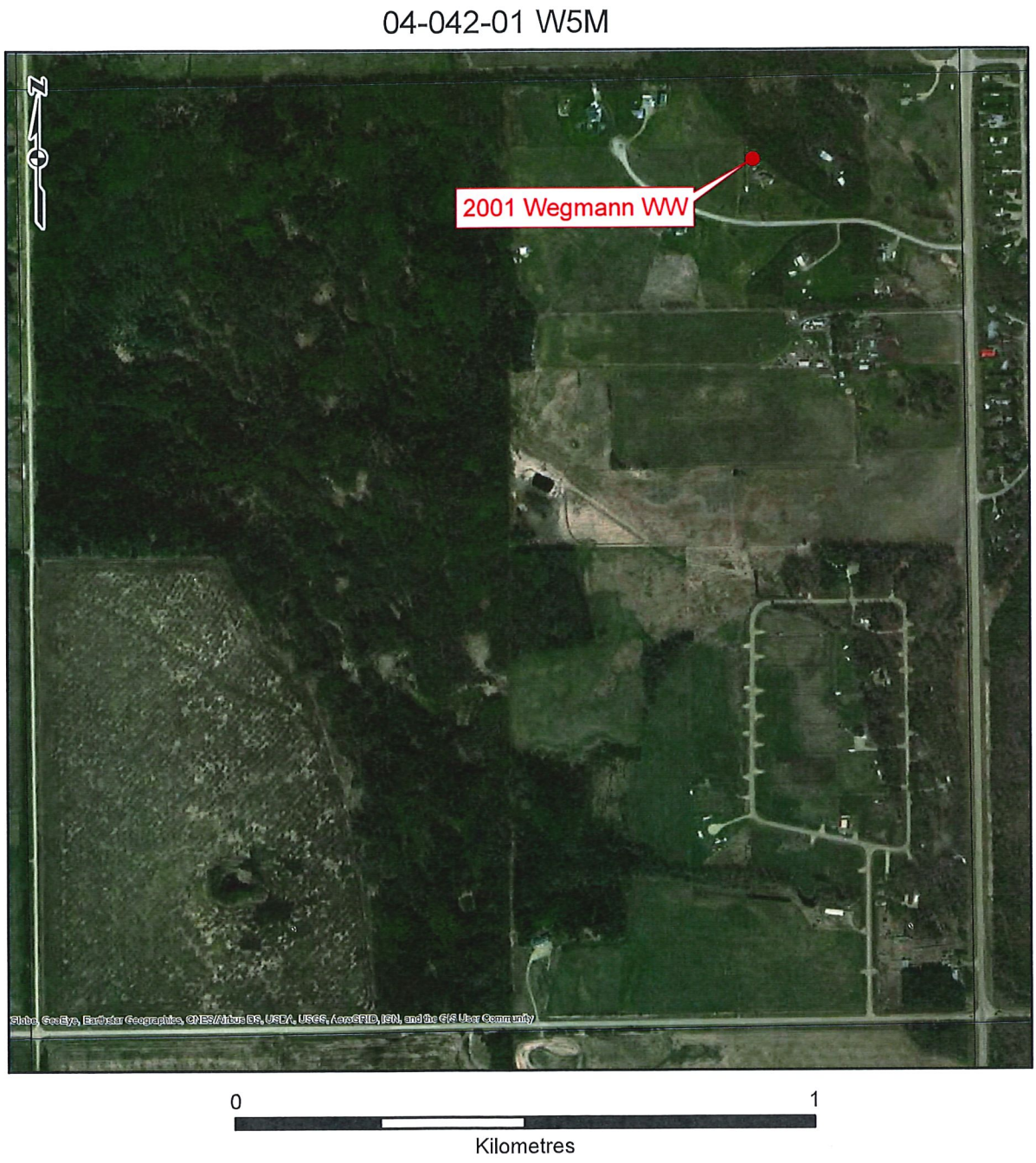


Figure 5. Site Map – 2001 Wegmann WW

Figure 6. Site Map – 2004 WSW – Inshore 1 and 2004 WSW – Inshore 2

3. Groundwater Monitoring Summary

3.1. Water-Level Summary

Level TROLL data loggers were installed in the five water wells by HCL personnel on June 28, 2011, and have been programmed to record 24 water-level measurements per day. The water-level data have been downloaded on an annual basis by HCL personnel. The highest and lowest water-level measurements from 2011 through 2016 are summarized in Table 2. Additional water well details and hydrographs for the five water wells are in Appendix B.

	Water Level (metres below reference point)											
	2011		2012		2013		2014		2015		2016	
	Highest (m)	Lowest (m)	Highest (m)	Lowest (m)	Highest (m)	Lowest (m)	Highest (m)	Lowest (m)	Highest (m)	Lowest (m)	Highest (m)	Lowest (m)
1983 Rogers WW	45.2	50.5	45.0	50.0	45.0	49.2	44.0	48.7	45.2	50.0	31.2	57.0
1992 Gull Lake Golf Course WW	19.8	21.4	19.7	20.5	20.5	21.7	21.0	21.9	21.9	22.6	22.4	22.9
2001 Wegmann WW	34.9	37.3	35.0	37.1	34.5	38.3	35.0	38.0	35.2	38.7	35.7	39.4
2004 WSW – Inshore 1	4.4	9.6	4.2	10.2	4.2	9.2	4.1	7.8	4.4	9.4	4.8	9.2
2004 WSW – Inshore 2	4.6	6.8	4.5	7.4	4.5	6.9	4.3	6.2	4.6	7.3	5.0	7.3

Table 2. Water-Level Summary

3.2. Groundwater Sampling

HCL personnel collected groundwater samples from each of the five water wells being monitored in 2016. The samples were submitted to an accredited laboratory for analysis of routine chemical and physical parameters. Table 3 summarizes the most recent chemical analysis dates.

	Analysis Date
Water Well Designation	Most Recent
1983 Rogers WW	November 2016
1992 Gull Lake Golf Course WW	November 2016
2001 Wegmann WW	November 2016
2004 WSW – Inshore 1	November 2016
2004 WSW – Inshore 2	November 2016

Table 3. Groundwater-Quality Summary

4. Discussion

4.1. Water Levels – General

The comparative hydrograph below (Figure 7) shows the water-level elevations over time for the five water wells and Gull Lake. Over five and a half years of record, the water-level elevations vary between 899 and 914 metres above mean sea level. There has been a general water-level fluctuation, which includes a water-level rise in late spring/early summer, followed by a general water-level decline until the next late-spring/early-summer rise. The one exception to this pattern is the water level in the 1992 Gull Lake Golf Course WW, where a water-level rise has only been recorded in three of the last six years.

In 2014, there was a noticeable rise in the water levels in all five water wells; in the 1983 Rogers WW, the rise was more than two metres. There was a less noticeable rise in water levels in the water wells in 2013, except in the 1992 Gull Lake Golf Course WW, where there was no evidence of a water-level rise.

Since 2015, there has a been a general decline in water levels. The decline is most noticeable in the 1983 Rogers WW and the 1992 Gull Lake Golf Course WW. The water-level decline in the 1992 Gull Lake Golf Course WW began before 2015 and has being occurring since 2012. Over the last four years, the water level in the 1992 Gull Lake Golf Course WW has declined three metres.

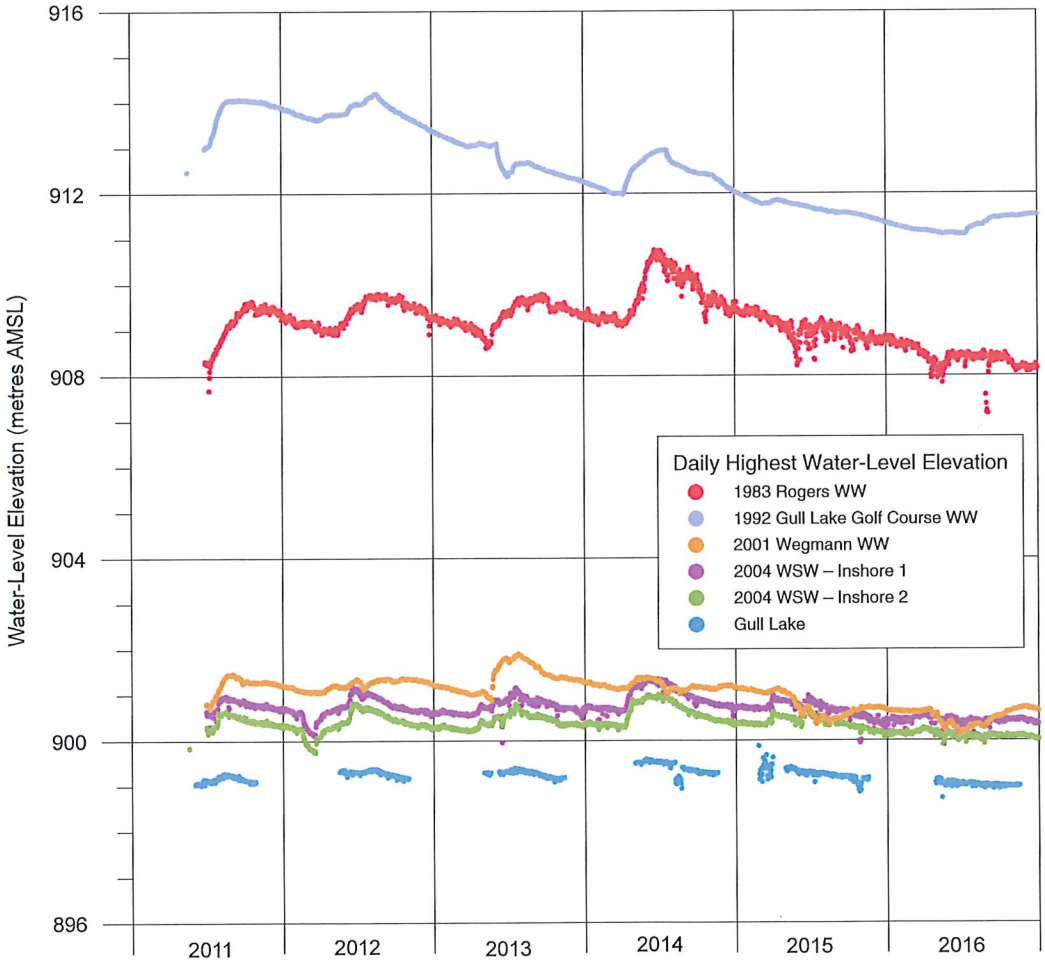


Figure 7. Hydrograph of Water-Level Elevations in the Five Water Wells and Gull Lake

4.2. Water Levels by Aquifer

The elevations of the highest daily water levels in the 1983 Rogers WW (Sun169 Aquifer) and the 1992 Gull Lake Golf Course WW (Sun199 Aquifer) are more than 10 metres above the elevation of Gull Lake. The elevations of the highest daily water levels in the 2001 Wegmann WW (Sun180 Aquifer), the 2004 WSW – Inshore 1 and the 2004 WSW – Inshore 2 (Sun155 Aquifer) are within 3 metres of the elevation of Gull Lake, as shown in Figure 7 on the previous page.

4.2.1. Sun199 Aquifer

The 1992 Gull Lake Golf Course WW is completed in the Sun199 Aquifer, which is above the water level in Gull Lake. The Sun199 Aquifer does not have a direct hydraulic connection to Gull Lake and is expected to discharge onto the land surface (HCL, 2015). An overall lowering of more than 2 metres has been observed in the 1992 Gull Lake Golf Course WW since 2012, except for a brief water-level rise of approximately 1 metre in the spring of 2014. In 2016, water levels in the latter half of the year have recovered nearly 1 metre.

4.2.2. Sun180 Aquifer

The 2001 Wegmann WW is completed in the Sun180 Aquifer, which may be hydraulically connected to Gull Lake (HCL, 2015). In 2015 and 2016, small-scale recharge was observed, but the timing was offset to begin in late summer (2015) and early fall (2016). Recharge from 2011 through 2014 consistently began in the spring.

4.2.3. Sun169 Aquifer

The 1983 Rogers WW is completed in the Sun169 Aquifer, which may be hydraulically connected to Gull Lake (HCL, 2015). Spring recharge was evident from May 2016 to June 2016, but was less pronounced than in 2011 through 2014.

4.2.4. Sun155 Aquifer

The top of the Sun155 Aquifer is below the base of Gull Lake; no hydraulic connection is expected between the Aquifer and the Lake (HCL, 2015). The 2004 WSW – Inshore 1 and the 2004 WSW – Inshore 2 are completed in the Sun155 Aquifer and have similar water-level trends. From 2011 through 2014, a water-level rise of approximately 0.7 metres was measured each spring. The spring recharge in 2015 was less than 0.4 metres, and there was no significant measured water-level rise in either monitoring water well in 2016.

4.3. Water Levels in Gull Lake

Water-level data for Gull Lake are collected by the WSC. Per the WSC, water-level measurements from October 25, 1999, through December 31, 2016, are considered to be provisional and preliminary[1]. The data do show that the water level in Gull Lake generally rose a total of 0.3 metres between 2011 and 2014. Between 2014 and 2016, there has been a general water-level decline of 0.6 metres.

[1] https://rivers.alberta.ca

Figure 8 shows water-level data for Gull Lake at a higher resolution than in Figure 7. The Gull Lake water-level data, starting in 2014, show more scattering of the readings. In 2014, there is only one occurrence when the readings show a short-term fluctuation of several tens of centimetres. In 2015, there are several occasions when the lake level fluctuates several tens of centimetres over a short time interval. In 2016, the lake-level change is more of a ten-centimetre "band" of water-level change. These results suggest that over the last three years, the equipment used to measure the water level in Gull Lake has been changed or needs maintenance.

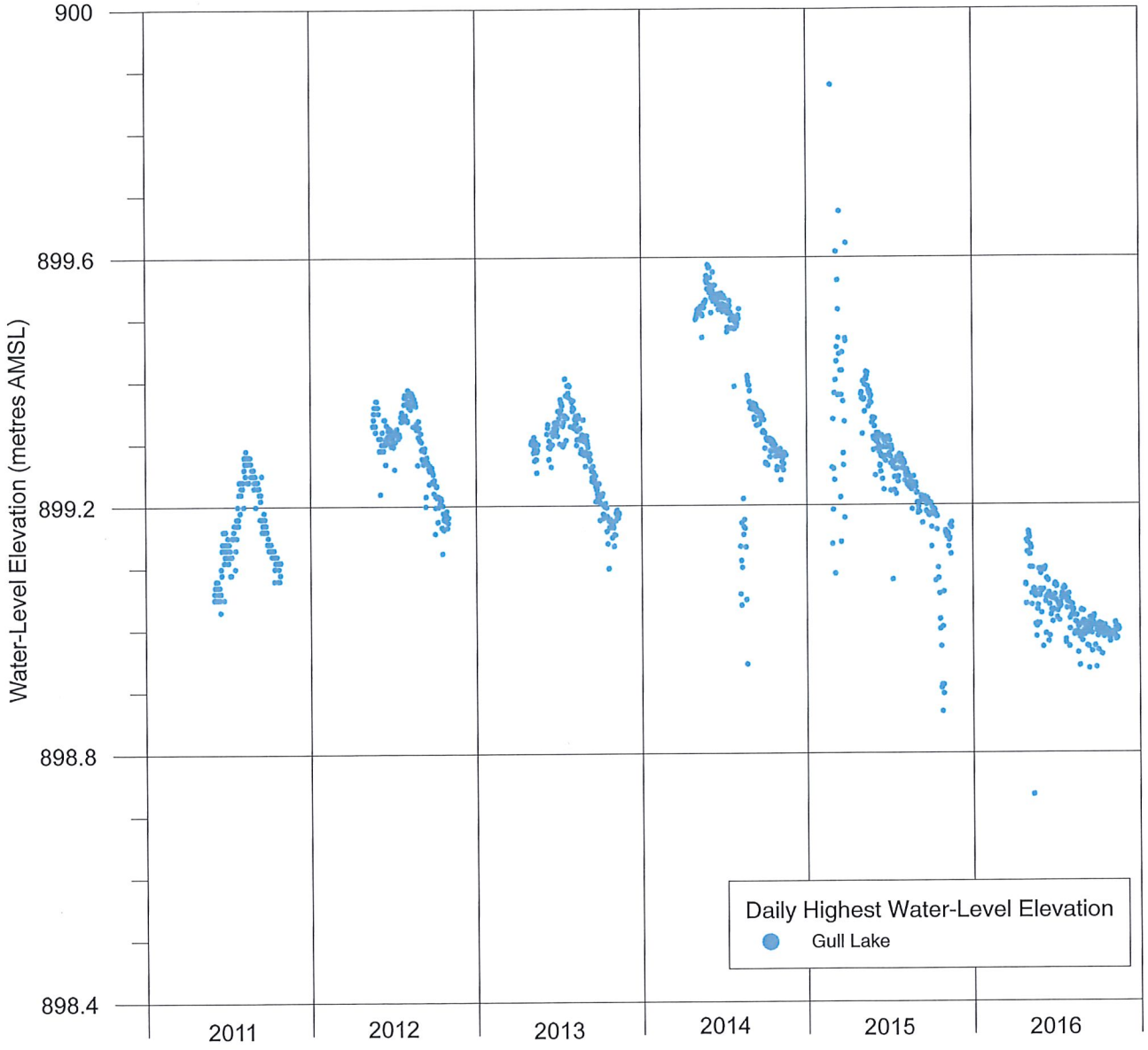


Figure 8. Hydrograph of Gull Lake Water-Level Elevations

4.4. Groundwater Quality

Groundwater samples were collected by HCL personnel on October 5, 2016, from the five water wells being monitored. The groundwater samples were submitted to Exova Canada Inc. (Exova) for routine chemical analysis. The analysis results were reported by Exova on November 24, 2016; copies of the results are in Appendix B.

The 2016 groundwater-quality results from the 1983 Rogers WW, the 1992 Gull Lake Golf Course WW, the 2001 Wegmann WW and the 2004 WSW – Inshore 1 were similar to previous years. As shown in Figure 9, the groundwater quality for the 2004 WSW – Inshore 2 has varied significantly. The 2012 and 2016 chemical analysis results for the 2004 WSW – Inshore 2 show a higher calcium-to-sodium ratio, indicative of chemically harder water, than the results from 2013 and 2014.

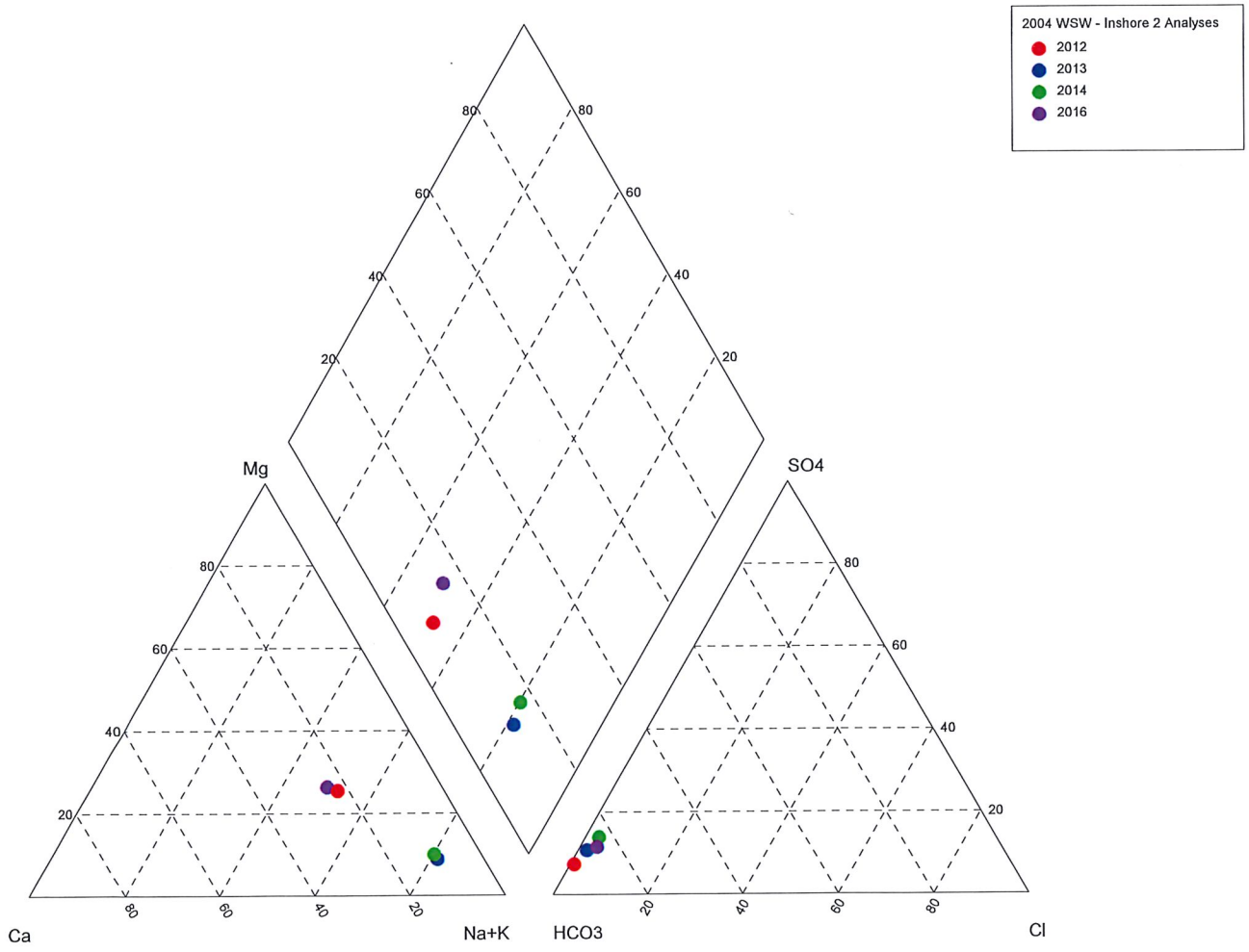


Figure 9. Piper Tri-Linear Diagram – 2004 WSW – Inshore 2

5. Conclusions and Recommendations

In 2015 and 2016, water levels declined in each of the five water wells, most likely because of reduced late-spring/early-summer recharge. The greatest water-level decline was measured in the 1992 Gull Lake Golf Course WW, with an overall lowering of more than three metres since 2012.

It is recommended that groundwater samples for routine chemical analysis continue to be collected from each of the five water wells being monitored. The data will provide an ongoing record of any changes in the chemical quality of the groundwater. Also, measuring and recording water levels over time is a necessary part of managing the groundwater resource, and it is recommended that the County continue to collect and validate the water-level data.

6. Bibliography

Alberta Lake Management Society. 2016. Lakewatch – Gull Lake 2016. Available at: https://alms.ca/reports

Hydrogeological Consultants Ltd. June 2012. Groundwater Monitoring. Gull Lake Area. Tp 041 to 043, W4M and Tp 041 to 043, R 01 and 02, W5M. Prepared for Ponoka County. [MR-0323.12].

Hydrogeological Consultants Ltd. July 2014. 2013 Groundwater Monitoring Report. Gull Lake Area. Tp 041 to 043, W4M and Tp 041 to 043, R 01 and 02, W5M. Prepared for Ponoka County. [MR-0323.13].

Hydrogeological Consultants Ltd. November 2015. Groundwater Impact on Gull Lake Water Level. Part of the Red Deer River Watershed. Tp 040 to 043 from R 27, W4M to R 02, W5M. Prepared for the Gull Lake Water Quality Management Society. [14-0219.01].

Hydrogeological Consultants Ltd. December 2015. 2014 Groundwater Monitoring. Gull Lake Area. Tp 041 to 043 from R 28, W4M to R 02, W5M. Prepared for Ponoka County. [MR-0323.14].

Hydrogeological Consultants Ltd. December 2016. 2015 Groundwater Monitoring Report. Tp 041 to 043 from R 28, W4M to R 02, W5M. Prepared for Ponoka County. [MR-0323.15].

Appendix A – Project Approval

TABLE OF CONTENTS

Project Approval

Ponoka County

VIA EMAIL ONLY TO: Gill@HCL.ca

January 20, 2011

HYDROGEOLOGICAL CONSULTANTS LTD.
10704 – 181 Street
EDMONTON, AB
T5S 1K8

ATTENTION: Gill Poulter, P. Geol.
Project Hydrogeologist

Dear Ms. Poulter:

RE: Gull Lake Monitoring Program

In follow-up to the HCL groundwater report, the Ponoka County would like to proceed with a monitoring program in 2011.

Five locations have been confirmed with property owners and are listed as follows complete with contact numbers;

1. N.E. 4-42-28-W4 - Dennis & Monica Rogers PH: 403-782-9962
2. S.W. 10-42-1-W5 - Gull Lake Golf Course
   Carla McCann PH: 403-843-2188
3. N.E. 4-42-1-W5 - Herman Wegmann PH: 403-748-2893
4. S.E. 12-42-1-W5 - Meridian Beach
   (2 Wells @ different Aquifers)
   Norval Horner PH: 403-803-6914

I've had discussions with Mike Semple and he indicated that he would like to install the data loggers in each well prior to the May long weekend.

.....2

4205 Highway #2A
Ponoka, Alberta T4J 1V9
Phone: (403) 783-3333
Fax: (403) 783-6965

Ponoka County

Hydrogeological Consultants Ltd.
January 20, 2011
Page 2

I assume the cost estimates provided in your proposal are still relevant, however, if you anticipate significant increases, please advise.

Should more locations or details be required, please call.

Sincerely yours,

Thomas G. Webber
A.C.A.O.

TGW/lc

cc. Charlie Cutforth

4205 Highway #2A
Ponoka, Alberta T4J 1V9
Phone: (403) 783-3333
Fax: (403) 783-6965

Appendix B – Water Well Details

TABLE OF CONTENTS

1983 Rogers Domestic and Stock Water Well

(1983 Rogers WW)

09-04-042-28 W4M

(M35377.069370)

Well Spatial Location:

Easting: ***70,162***
Northing: ***5,824,898***
(spatial accuracy HCL GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***955***
(elevation accuracy MT DEM)

Date Completed: ***June 14, 1983***

Depth Drilled (m): ***63.7***

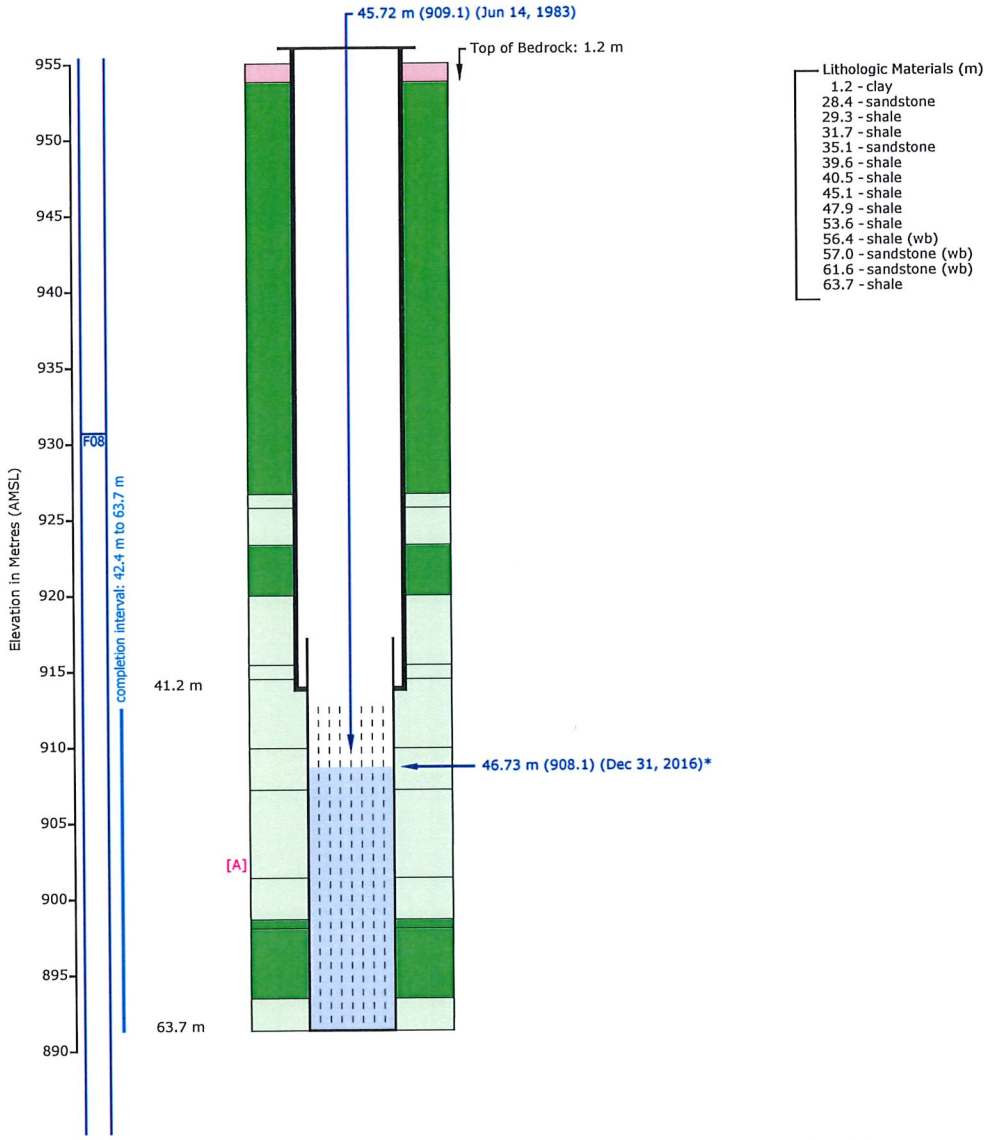
Completion Interval (m): ***42.4 – 63.7 ****
(TGWC determined value)*

Earliest Water Level (m): ***45.72 – June 14, 1983***

Most Recent Water Level (m): ***46.73 – December 31, 2016 @ 23:00***

GIC ID: ***275201***

1983 Rogers Domestic and Stock Water Well
Water Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained

Bedrock: Fine Grained; Coarse Grained

Other

Geologic Unit Legend (Top) - Regional Analysis

F08 - Dalehurst Member

Summary

TGWC ID: M35377.069370
Well Name: 1983 Rogers Domestic and Stock Water Well
Legal Location: 09-04-042-28 W4M
Casing (OD): 177.8 mm; Steel (7.0")
Liner (OD): 141.2 mm; Steel (5.6")
Casing Stick-Up: 0.4 m (not drawn to scale)
Completion [A]: 42.4 to 63.7 m; Slotted
*Water Level (recent): 46.73 m (908.1m AMSL) on December 31, 2016 @ 23:00 - Reference Point: Top of Casing
Water Level (oldest): 45.72 m (909.1m AMSL) on June 14, 1983

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by Hydrogeological Consultants Ltd. (HCL) (http://www.hcl.ca) on behalf of Ponoka County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: April 06, 2018 11:41 --- http://www.tgwc.com

Owner: **Rogers, Dennis & Monica**

Contractor: **Forrester Water Well Drilling (1981) Ltd.**
Name: **1983 Rogers Domestic and Stock Water Well (1983 Rogers WW)**

Field Survey: **May 18, 2011 - Confirmed - Physically**
Work Type: **New Well**
Drilling Method: **Cable Tool**
Proposed Use: **Domestic & Stock**
Completion Type: **Casing/Perforated Liner**
Date Started: **June 8, 1983**
Date Completed: **June 14, 1983**
Well Status: **Producing**
Feature Class: **Water Well**

METRIC REPORT

Easting (m):	70,162.00 **	75/80
Northing (m):	5,824,898.00 **	
Elevation (m):	955 ***	
Lot:		
Block:		
Plan:		

Presence of Gas: **No**

09-04-042-28 W4M

M35377.069370

210800 — 1 Google

Elog Taken: **No**
Gamma Taken: **No**
Flowing: **No**
Stick Up (m): **0.4**

General Details

Depth Completed (m)*: **63.7**
Depth Drilled (m): **63.7**
Completion Aquifer: **Dalehurst Member ***
Top of Bedrock (m): **1.2 ***
Completion Interval (m): **42.4 – 63.7 ***

Completion Details

Surface Casing: **Steel – 177.8 mm (O.D.) x 6.90 mm (thick) x 41.2 m (bottom)**
Liner: **Steel – 141.2 mm (O.D.) x 8.00 mm (thick)**; Top: **38.1 (m)**; Bottom: **63.7 (m)**

Intervals

Slotted: **42.4** to **63.7 m - 0.25 x 6** - Method: **Torch**

Driven: **0.0** to **41.2 m**

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (rate Lpm)
953.6	1.2	Brown Clay
926.4	28.3	Hard Brown Sandstone
925.5	29.3	Dark Grey Shale
923.1	31.7	Grey Shale
919.7	35.0	Grey Sandstone
915.2	39.6	Dark Grey Shale
914.2	40.5	Light Grey Shale
909.7	45.1	Sandy Blue & Grey Shale
906.9	47.9	Blue & Grey Shale
901.1	53.6	Grey Shale
898.4	56.4	Water-Bearing Grey Shale
897.8	57.0	Water-Bearing Grey Sandstone
893.2	61.6	Water-Bearing Grey Sandstone
891.1	63.7	Sandy Grey Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: **October 5, 2016 @ 13:00**
Analysis Details: **November 24, 2016 - Exova Canada Inc. (1164885-4)**

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	916	Nitrate as N:	< 0.01	Colour (TCU):	< 5
Total Dissolved Solids:	558	Nitrite as N:	< 0.005	Turbidity (NTU):	0.7
Hardness (as CaCO3):	4.5	pH (pH Unit):	8.93	Fluoride:	1.39
T-Alkalinity (as CaCO3):	424	Ion Balance (%):	96	Carbonate:	28
P-Alkalinity (as CaCO3):	23	Total Coliforms:		Bicarbonate:	460
Nitrate + Nitrite as N:	< 0.01	Fecal Coliforms:		Hydroxide:	< 5
Total Suspended Solids:		Escherichia coli:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C):	19.6

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	1.4		Mercury:		
Chloride:		0.7	Molybdenum		
Iron:	0.01		Magnesium:	0.2	
Manganese:	< 0.005		Sodium:	221	
Aluminum:			Potassium:	0.4	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		
Sulfate:	79.9		Uranium:		

(1 / 5)

Extractable - unfiltered
Dissolved - filtered

*** MAC Exceedence

210221

Comments: **Sample collected by Hydrogeological Consultants Ltd. (HCL)**

Note: Constituents have been compared to the maximum acceptable concentration, Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Health Canada. Ottawa. Ontario.

General Comments / Observations

Initial Comments, Jun 14, 1983: Stock water well in green casing.

Most Recent Water Level (m): **46.73 m – December 31, 2016**
Pump Intake BTOC (m): **57.9 on June 14, 1983**

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (Lpm)	NPWL (metres)	Drawdown (metres)	Pump (metres)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effecti
1	1983-06-14	Bailer	[unknown]			45.5	45.7	11.9	57.9			6.2		

Alias IDs

GIC ID: **275201**
GIC (WellReportId): **275201**

** The Groundwater Centre (TGWC) calculated or determined value.*
*** 75 - HCL GPS — 10TM NAD83*
**** 80 - MT DEM — {Ground; AMSL}*

1983 Rogers Domestic and Stock Water Well
AEP – Water Well Drilling Report

Alberta

Water Well Drilling Report

View in Imperial **Export to Excel**

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 275201
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1983/10/05

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
STREET, MARTY	P.O. BOX 2167 LACOMBE				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	4	42	28	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.591814 Longitude -113.969188
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Cable Tool

Type of Work
New Well

Proposed Well Use
Domestic & Stock

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
1.22		Brown Clay
28.35		Brown Hard Sandstone
29.26		Dark Gray Shale
31.70		Gray Shale
35.05		Gray Sandstone
39.62		Dark Gray Shale
40.54		Light Gray Shale
45.11		Blue Gray Sandy Shale
47.85		Blue Gray Shale
53.64		Gray Shale
56.39	Yes	Gray Water Bearing Shale
57.00	Yes	Gray Water Bearing Sandstone
61.57	Yes	Gray Water Bearing Sandstone
63.70		Gray Sandy Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 0.00 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
1983/06/14	45.46	45.72

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
63.70 m		1983/06/08	1983/06/14

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	63.70

Surface Casing (if applicable)
Steel
Size OD : 17.78 cm
Wall Thickness : 0.691 cm
Bottom at : 41.15 m

Well Casing/Liner
Steel
Size OD : 14.12 cm
Wall Thickness : 0.795 cm
Top at : 38.10 m
Bottom at : 63.70 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
42.37	63.70	0.635		15.24

Perforated by Torch

Annular Seal Driven
Placed from 0.00 m to 41.15 m
Amount

Other Seals

Type	At (m)

Screen Type
Size OD : 0.00 cm

From (m)	To (m)	Slot Size (cm)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Company Name
FORRESTER WATER WELL DRILLING (1981) LTD.

Certification No
1

Copy of Well report provided to owner *Date approval holder signed*

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 275201
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1983/10/05

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
STREET, MARTY	P.O. BOX 2167 LACOMBE				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	4	42	28	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.591814 Longitude -113.969188
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level cm
Is Artesian Flow
Rate L/min
Is Flow Control Installed
Describe

Recommended Pump Rate 0.00 L/min
Recommended Pump Intake Depth (From TOC) 0.00 m
Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability
Submitted to ESRD Yes

Additional Comments on Well
DRILLER REPORTS SOFT WATER.

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Metric

Test Date	Start Time	Static Water Level
1983/06/14	12:00 AM	45.72 m

Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)

Method of Water Removal
Type Bailer
Removal Rate 45.46 L/min
Depth Withdrawn From 57.91 m

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
FORRESTER WATER WELL DRILLING (1981) LTD.

Copy of Well report provided to owner
Date approval holder signed

1983 Rogers Domestic and Stock Water Well
Chemical Analysis Results (November 24, 2016)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To: Hydrogeological Consultants
Report To: Hydrogeological Consultants
17740 - 118 Avenue
Edmonton, AB, Canada
T5S 2W3
Attn: Tara Parker
Sampled By: S. Thomson
Company: HCL

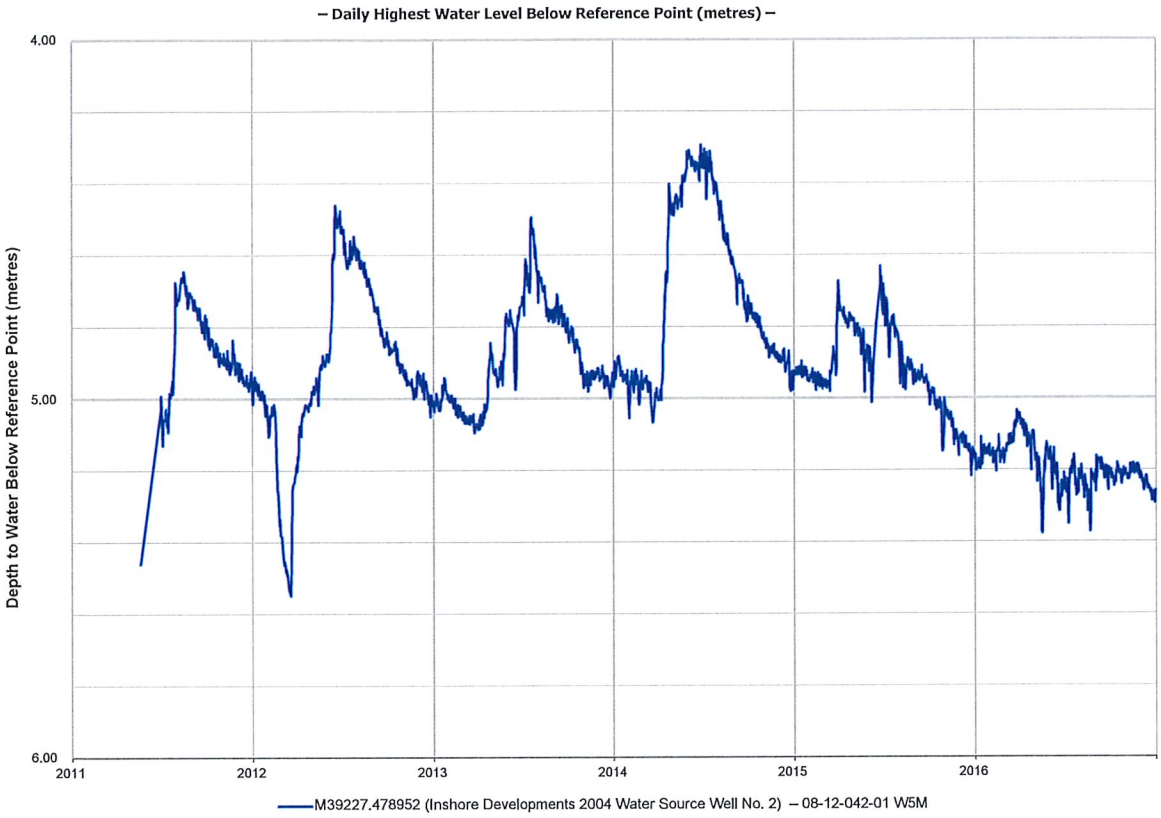
Project:
ID: MR-0323.16
Name: County of Ponoka GW Monitoring
Location: Gull Lake area
LSD:
P.O.: 18223
Acct code:

Lot ID: **1164885**
Control Number: Z-270791
Date Received: Oct 6, 2016
Date Reported: Nov 24, 2016
Report Number: 2150804

Reference Number	1164885-4
Sample Date	October 05, 2016
Sample Time	13:00
Sample Location	
Sample Description	Rogers / M35377.069370 / -1.4°c
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	<5	5	15	Below AO
Turbidity		NTU	0.7	0.1	0.1	Above OG
Routine Water						
pH			8.93		6.5 - 8.5	Above AO
Temperature of observed pH		°C	19.6			
Electrical Conductivity	at 25 °C	uS/cm	916	1		
Calcium	Extractable	mg/L	1.4	0.2		
Magnesium	Extractable	mg/L	0.2	0.2		
Sodium	Extractable	mg/L	221	0.4	200	Above AO
Potassium	Extractable	mg/L	0.4	0.4		
Iron	Extractable	mg/L	0.01	0.01	0.3	Below AO
Manganese	Extractable	mg/L	<0.005	0.005	0.05	Below AO
Chloride	Dissolved	mg/L	0.7	0.4	250	Below AO
Fluoride		mg/L	1.39	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)	Extractable	mg/L	79.9	0.9	500	Below AO
Hydroxide		mg/L	<5			
Carbonate		mg/L	28			
Bicarbonate		mg/L	460			
P-Alkalinity	as CaCO3	mg/L	23	5		
T-Alkalinity	as CaCO3	mg/L	424	5		
Total Dissolved Solids		mg/L	558	1	500	Above AO
Hardness	as CaCO3	mg/L	4.5			
Ionic Balance		%	96			

1983 Rogers Domestic and Stock Water Well
2011 – 2016 Hydrograph



1992 Gull Lake Golf Course Water Well

04-10-042-01 W5M

(M35379.066969)

Photograph taken on May 17, 2012

Well Spatial Location:

Easting: ***62,813***
Northing: ***5,825,524***
(spatial accuracy HCL GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***934***
(elevation accuracy MT DEM)

Date Completed: ***July 15, 1992***

Depth Drilled (m): ***32.0***

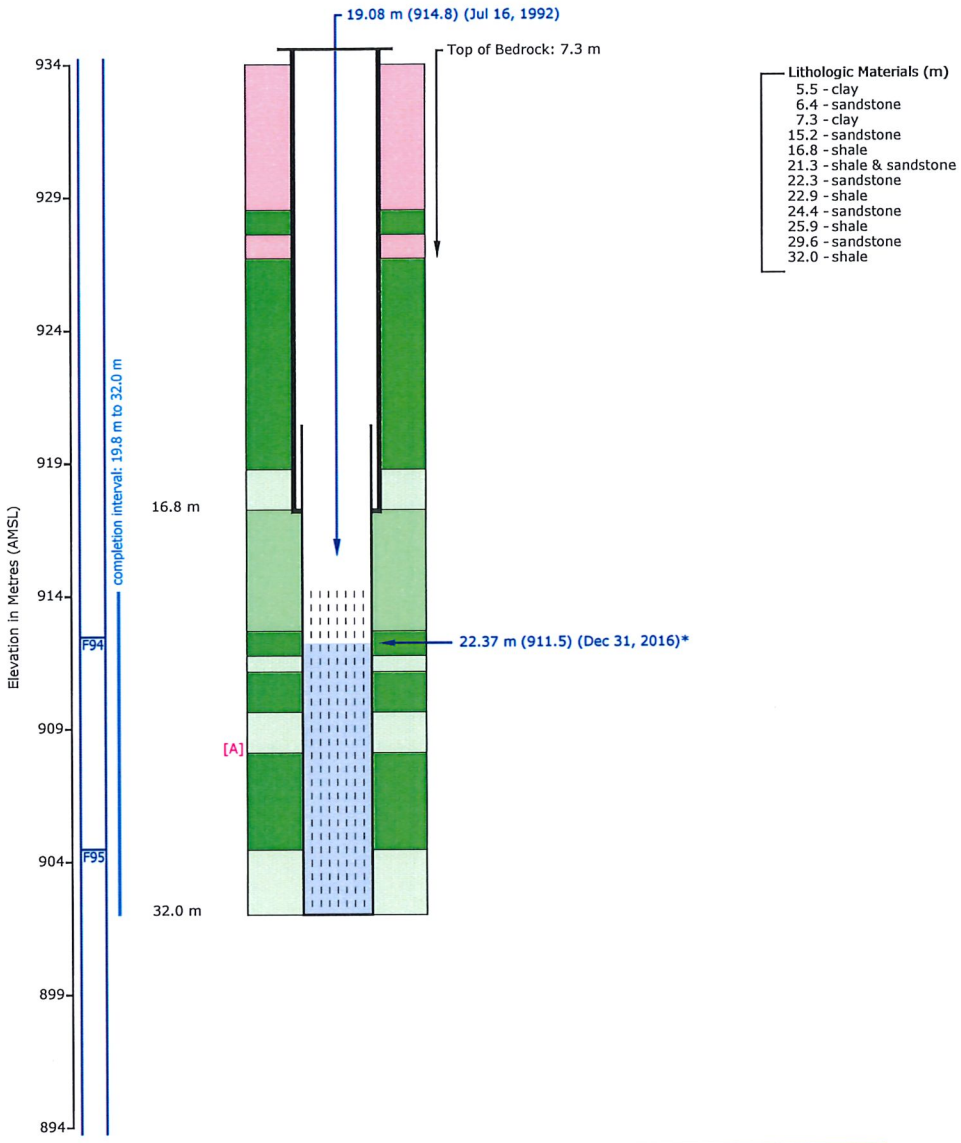
Completion Interval (m): ***19.8 – 32.0 ****
(TGWC determined value)*

Earliest Water Level (m): ***19.08 – July 16, 1992***

Most Recent Water Level (m): ***22.37 – December 31, 2016 @ 23:00***

GIC ID: ***365500***

1992 Gull Lake Golf Course Water Well
Water Well Diagram



Summary

TGWC ID: M35379.066969
Well Name: 1992 Gull Lake Golf Course Water Well
Legal Location: 04-10-042-01 W5M
Casing (OD): 141.2 mm; Steel (5.6")
Liner (OD): 114.3 mm; Plastic (4.5")
Casing Stick-Up: 0.6 m (not drawn to scale)
Completion [A]: 19.8 to 32.0 m; Slotted
*Water Level (recent): 22.37 m (911.5m AMSL) on December 31, 2016 @ 23:00 - Reference Point: Top of Casing
Water Level (oldest): 19.08 m (914.8m AMSL) on July 16, 1992

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by Hydrogeological Consultants Ltd. (HCL) (http://www.hcl.ca) on behalf of Ponoka County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: April 06, 2018 11:42 --- http://www.tgwc.com

Owner: **Gull Lake Golf Course**
RR 2 Site 10 (Box 6), Red Deer, AB T4N 5E2
Contractor: **G & S Water Well Servicing**
Name: **1992 Gull Lake Golf Course Water Well**

Field Survey: **May 18, 2011 - Confirmed - Physically**
Work Type: **New Well** | Date Started: **July 12, 1992**
Drilling Method: **Rotary** | Date Completed: **July 15, 1992**
Proposed Use: **Industrial** | Well Status: **Producing**
Completion Type: **Casing/Perforated Liner** | Feature Class: **Water Well**

METRIC REPORT

Easting (m):	62,813.00 **	75/80
Northing (m):	5,825,524.00 **	
Elevation (m):	934 ***	
Lot:		
Block:		
Plan:		

Presence of Gas: **No**

04-10-042-01 W5M

M35379.066969

210802 – 1 Google

Elog Taken: **No**
Gamma Taken: **No**
Flowing: **No**
Stick Up (m): **0.6**

General Details

Depth Completed (m)*: **32.0**
Depth Drilled (m): **32.0**
Completion Aquifer: **Dalehurst Member ***
Top of Bedrock (m): **7.3 ***
Completion Interval (m): **19.8 – 32.0 ***

Completion Details

Surface Casing: **Steel – 141.2 mm (O.D.) x 4.80 mm (thick) x 16.8 m (bottom)**
Liner: **Plastic – 114.3 mm (O.D.) x 6.20 mm (thick)**; Top: **13.7 (m)**; Bottom: **32.0 (m)**

Intervals

Slotted: **19.8** to **32.0 m - 0.125 x 12** - Method: **Machine**

Driven: **0.0** to **16.8 m**

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (rate Lpm)
928.4	5.5	Clay
927.5	6.4	Grey Sandstone
926.6	7.3	Clay
918.6	15.2	Loss Circulation Brown Sandstone
917.1	16.8	Brown Shale
912.6	21.3	Brown Shale & Sandstone
911.6	22.3	Grey Sandstone
911.0	22.9	Grey Shale
909.5	24.4	Brown Sandstone
908.0	25.9	Grey Shale
904.3	29.6	Grey Sandstone
901.9	32.0	Grey Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: **October 5, 2016 @ 14:35**
Analysis Details: **November 24, 2016 - Exova Canada Inc. (1164885-6)**

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	1,010	Nitrate as N:	0.72	Colour (TCU):	< 5
Total Dissolved Solids:	609	Nitrite as N:	< 0.005	Turbidity (NTU):	0.5
Hardness (as CaCO3):	291	pH (pH Unit):	8.03	Fluoride:	0.08
T-Alkalinity (as CaCO3):	511	Ion Balance (%):	96	Carbonate:	< 6
P-Alkalinity (as CaCO3):	< 5	Total Coliforms:		Bicarbonate:	623
Nitrate + Nitrite as N:	0.72	Fecal Coliforms:		Hydroxide:	< 5
Total Suspended Solids:		Escherichia coli:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C):	19.6

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	52.3		Mercury:		
Chloride:		3.6	Molybdenum		
Iron:	< 0.01		Magnesium:	38.9	
Manganese:	< 0.005		Sodium:	128	
Aluminum:			Potassium:	2.2	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		
Sulfate:	77		Uranium:		

(1 / 4)
Extractable - unfiltered
Dissolved - filtered
*** MAC Exceedence
210223

Comments: **Sample collected by Hydrogeological Consultants Ltd. (HCL)**

Note: Constituents have been compared to the maximum acceptable concentration, Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Health Canada. Ottawa. Ontario.

General Comments / Observations

Most Recent Water Level (m): **22.37 m – December 31, 2016**
Pump Intake BTOC (m): **27.4 on July 16, 1992**

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval	Duration (minutes) Pumping	Recovery	Avg. Rate (Lpm)	NPWL (metres)	Drawdown (metres)	Pump (metres)	Q20 (m³/day)* Apparent	Effective	Transmissivity (m²/day)* Apparent	Aquifer	Effecti
1	1992-07-16	Pump	[unknown]	720	120	54.6	19.1	0.1	27.4	477.1		1.725		

Alias IDs

GIC ID: **365500**
GIC (WellReportId): **365500**

* The Groundwater Centre (TGWC) calculated or determined value.
** 75 - HCL GPS — 10TM NAD83
*** 80 - MT DEM — {Ground; AMSL}

1992 Gull Lake Golf Course Water Well
AEP – Water Well Drilling Report

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 365500
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1992/08/04

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
GULL LAKE GOLF COURSE	P.O. BOX 6 RR2 SITE 10,	RED DEER			

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	4	10	42	1	5	1	3	9023426	

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.596994 Longitude -114.071579
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Industrial

Type of Work
New Well

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
5.49		Clay
6.40		Gray Sandstone
7.32		Clay
15.24		Brown Lost Circulation Sandstone
16.76		Brown Shale
21.34		Brown Shale & Sandstone
22.25		Gray Sandstone
22.86		Gray Shale
24.38		Brown Sandstone
25.91		Gray Shale
29.57		Gray Sandstone
32.00		Gray Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 0.00 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
1992/07/16	54.55	19.08

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
32.00 m		1992/07/12	1992/07/15

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	32.00

Surface Casing (if applicable)
Steel
Size OD : 14.12 cm
Wall Thickness : 0.478 cm
Bottom at : 16.76 m

Well Casing/Liner
Plastic
Size OD : 11.43 cm
Wall Thickness : 0.620 cm
Top at : 13.72 m
Bottom at : 32.00 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
19.81	32.00	0.318		30.48

Perforated by Machine

Annular Seal Driven
Placed from 0.00 m to 16.76 m
Amount

Other Seals

Type	At (m)

Screen Type
Size OD : 0.00 cm

From (m)	To (m)	Slot Size (cm)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
G&S WATER WELL SERVICING

Copy of Well report provided to owner Date approval holder signed

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 365500
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1992/08/04

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
GULL LAKE GOLF COURSE	P.O. BOX 6 RR2 SITE 10,	RED DEER			

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	4	10	42	1	5	1	3	9023426	

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.596994 Longitude -114.071579
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level cm
Is Artesian Flow
Rate L/min
Is Flow Control Installed
Describe

Recommended Pump Rate 0.00 L/min
Recommended Pump Intake Depth (From TOC) 0.00 m
Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability Submitted to ESRD

Additional Comments on Well

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER
Certification No
1
Company Name
G&S WATER WELL SERVICING
Copy of Well report provided to owner Date approval holder signed

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 365500
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1992/08/04

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
GULL LAKE GOLF COURSE	P.O. BOX 6 RR2 SITE 10,	RED DEER			

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	4	10	42	1	5	1	3	9023426	

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.596994 Longitude -114.071579
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Metric

Test Date 1992/07/16
Start Time 12:00 AM
Static Water Level 19.08 m

Method of Water Removal
Type Pump
Removal Rate 54.55 L/min
Depth Withdrawn From 27.43 m

If water removal period was < 2 hours, explain why

Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
19.08	0:00	19.17
19.15	0:30	19.11
19.15	1:00	19.10
19.15	1:30	19.10
19.15	2:00	19.10
19.15	3:00	19.10
19.15	4:00	19.10
19.16	5:00	19.10
19.16	6:00	19.10
19.16	7:00	19.10
19.16	8:00	19.10
19.16	9:00	19.10
19.16	10:00	19.10
19.16	12:00	19.10
19.16	14:00	19.10
19.16	16:00	19.10
19.16	18:00	19.10
19.16	20:00	19.10
19.16	25:00	19.10
19.16	30:00	19.10
19.16	35:00	19.10
19.16	40:00	19.10
19.16	50:00	19.10
19.16	60:00	19.10
19.16	75:00	18.91
19.16	90:00	19.08
19.16	105:00	19.08
19.16	120:00	19.08
19.16	150:00	
19.16	180:00	
19.16	210:00	
19.16	240:00	
19.17	300:00	
19.17	360:00	
19.17	420:00	
19.17	480:00	
19.17	600:00	
19.17	720:00	

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
G&S WATER WELL SERVICING

Copy of Well report provided to owner | Date approval holder signed

1992 Gull Lake Golf Course Water Well
Chemical Analysis Results (November 24, 2016)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: Edmonton@exova.com
W: www.exova.com

Analytical Report

Bill To: Hydrogeological Consultants
Report To: Hydrogeological Consultants
17740 - 118 Avenue
Edmonton, AB, Canada
T5S 2W3
Attn: Tara Parker
Sampled By: S. Thomson
Company: HCL

Project:
ID: MR-0323.16
Name: County of Ponoka GW Monitoring
Location: Gull Lake area
LSD:
P.O.: 18223
Acct code:

Lot ID: **1164885**
Control Number: Z-270791
Date Received: Oct 6, 2016
Date Reported: Nov 24, 2016
Report Number: 2150804

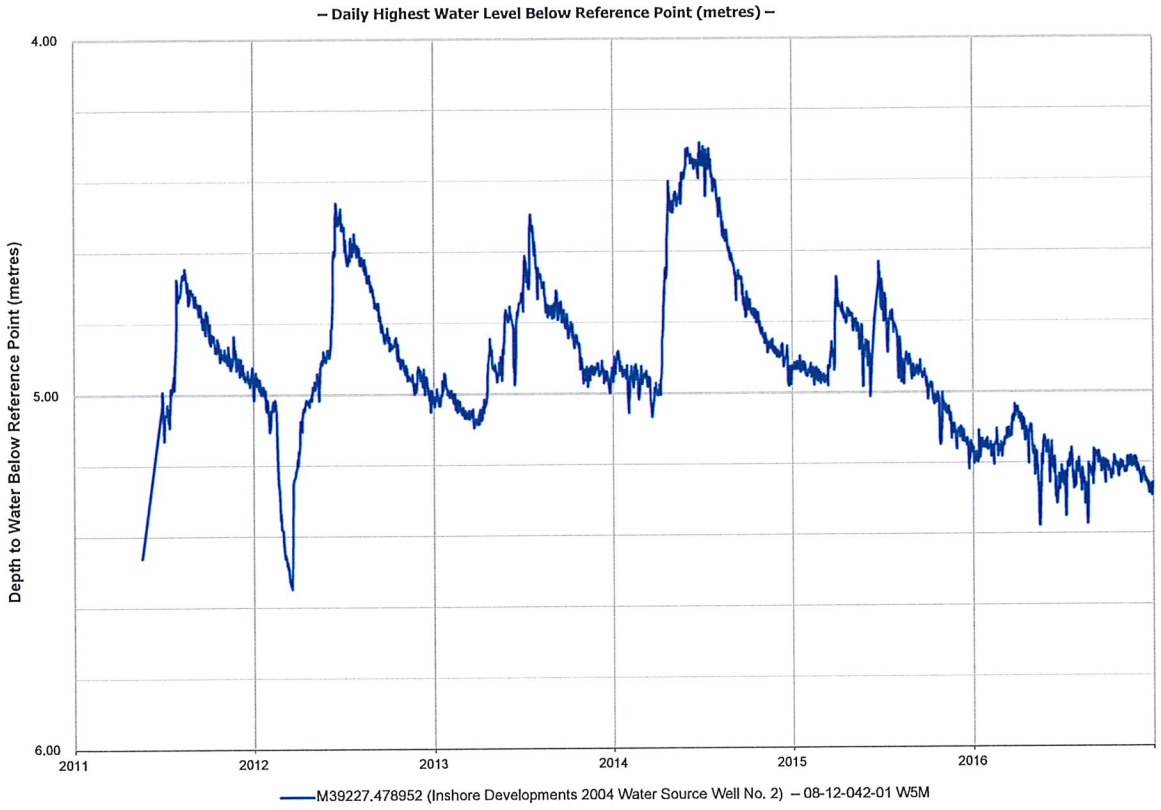
Reference Number	1164885-6
Sample Date	October 05, 2016
Sample Time	14:35
Sample Location	
Sample Description	Gull Lake GCC / M35379.006969 / -1.4°c
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	<5	5	15	Below AO
Turbidity		NTU	0.5	0.1	0.1	Above OG
Routine Water						
pH			8.03		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.6			
Electrical Conductivity	at 25 °C	uS/cm	1010	1		
Calcium	Extractable	mg/L	52.3	0.2		
Magnesium	Extractable	mg/L	38.9	0.2		
Sodium	Extractable	mg/L	128	0.4	200	Below AO
Potassium	Extractable	mg/L	2.2	0.4		
Iron	Extractable	mg/L	<0.01	0.01	0.3	Below AO
Manganese	Extractable	mg/L	<0.005	0.005	0.05	Below AO
Chloride	Dissolved	mg/L	3.6	0.4	250	Below AO
Fluoride		mg/L	0.08	0.05	1.5	Below MAC
Nitrate - N		mg/L	0.72	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	0.72	0.01	10	Below MAC
Sulfate (SO4)	Extractable	mg/L	77.0	0.9	500	Below AO
Hydroxide		mg/L	<5			
Carbonate		mg/L	<6			
Bicarbonate		mg/L	623			
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	511	5		
Total Dissolved Solids		mg/L	609	1	500	Above AO
Hardness	as CaCO3	mg/L	291			
Ionic Balance		%	96			

Approved by:
Randy Neumann, BSc
Vice President

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.
Terms and Conditions: www.exova.com/about/terms-and-conditions

1992 Gull Lake Golf Course Water Well
2011 – 2016 Hydrograph



2001 Wegmann Domestic Water Well

(2001 Wegmann WW)

16-04-042-01 W5M

(M37490.034988)

Well Spatial Location:

Easting: ***62,345***
Northing: ***5,825,262***
(spatial accuracy HCL GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***936***
(elevation accuracy MT DEM)

Date Completed: ***September 2, 2001***

Depth Drilled (m): ***54.9***

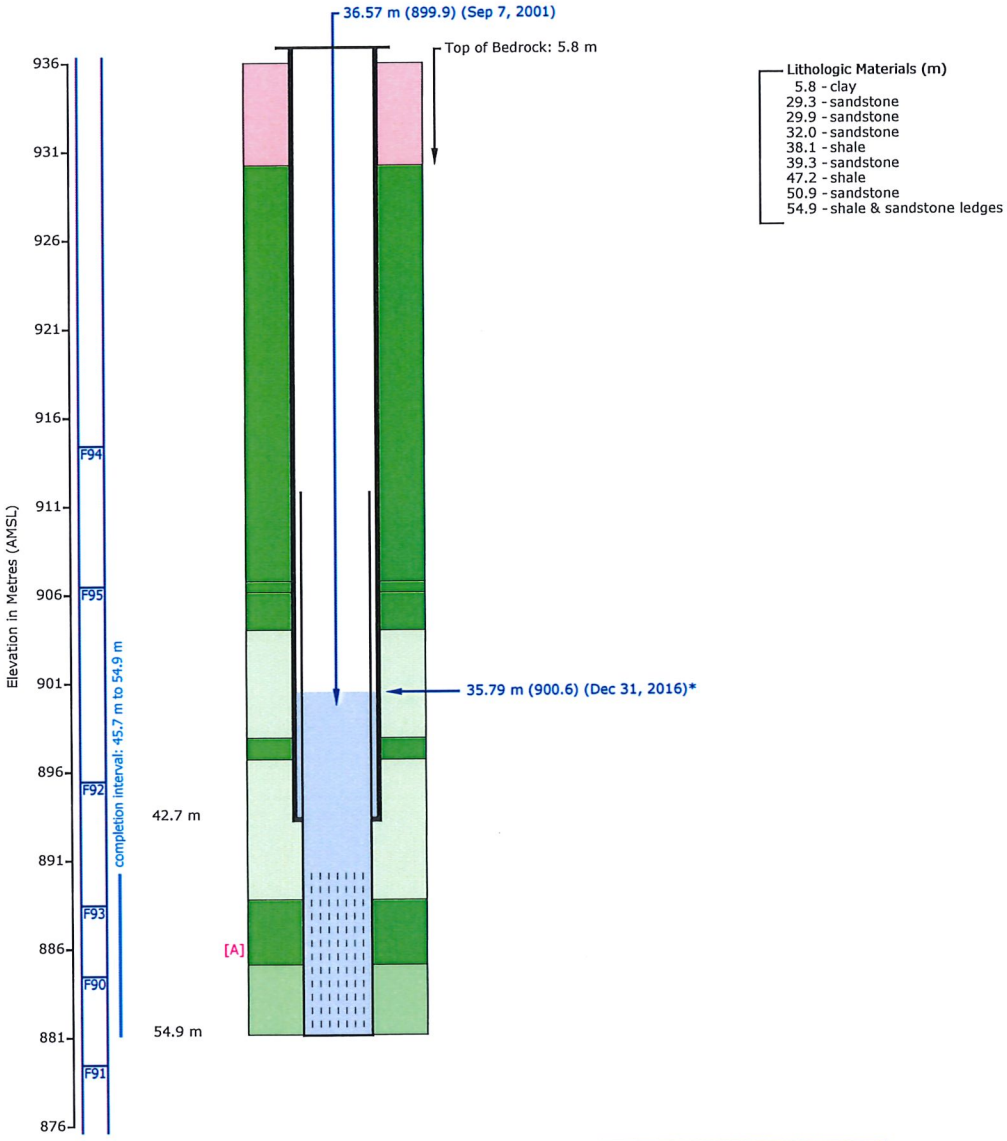
Completion Interval (m): ***45.7 – 54.9 ****
(TGWC determined value)*

Earliest Water Level (m): ***36.57 – September 7, 2001***

Most Recent Water Level (m): ***35.79 – December 31, 2016 @ 23:00***

GIC ID: ***499682***

2001 Wegmann Domestic Water Well
Water Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

F94 - Sun199 Aquifer
F95 - Sun199 Aquifer Base
F92 - Sun180 Aquifer
F93 - Sun180 Aquifer Base
F90 - Sun169 Aquifer
F91 - Sun169 Aquifer Base

Summary

TGWC ID: M37490.034988
Well Name: 2001 Wegmann Domestic Water Well
Legal Location: 16-04-042-01 W5M
Casing (OD): 139.7 mm; Steel (5.5")
Liner (OD): 114.3 mm; Plastic (4.5")
Casing Stick-Up: 0.3 m (not drawn to scale)
Completion [A]: 45.7 to 54.9 m; Slotted
*Water Level (recent): 35.79 m (900.6m AMSL) on December 31, 2016 @ 23:00 - Reference Point: Top of Casing
Water Level (oldest): 36.57 m (899.9m AMSL) on September 7, 2001

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by Hydrogeological Consultants Ltd. (HCL) (http://www.hcl.ca) on behalf of Ponoka County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: April 06, 2018 11:42 --- http://www.tgwc.com

Owner: **Wegmann, Herman**
538 Madeira Drive N.E., Calgary, AB T2A 4M8
Contractor: **Aiken Basin Drilling Ltd.**
Name: **2001 Wegmann Domestic Water Well (2001 Wegmann WW)**

Field Survey: **June 28, 2011 - Confirmed - Physically**
Work Type: **New Well** | Date Started: **September 2, 2001**
Drilling Method: **Rotary** | Date Completed: **September 2, 2001**
Proposed Use: **Domestic** | Well Status: **Producing**
Completion Type: **Casing/Perforated Liner** | Feature Class: **Water Well**

METRIC REPORT

Easting (m): **62,345.00** ** 75/80
Northing (m): **5,825,262.00** **
Elevation (m): **936** ***
Lot: **11**
Block:
Plan:
Presence of Gas: **No**

16-04-042-01 W5M
M37490.034988
210801 – 1 Google

Elog Taken: **No**
Gamma Taken: **No**
Flowing: **No**
Stick Up (m): **0.3**

General Details

Depth Completed (m)*: **54.9**
Depth Drilled (m): **54.9**
Completion Aquifer: **Dalehurst Member ***
Top of Bedrock (m): **5.8 ***
Completion Interval (m): **45.7 – 54.9 ***

Completion Details

Surface Casing: **Steel – 139.7 mm (O.D.) x 6.20 mm (thick) x 42.7 m (bottom)**
Liner: **Plastic – 114.3 mm (O.D.) x 6.00 mm (thick); Top: 24.4 (m); Bottom: 54.9 (m)**

Intervals

Slotted: **45.7** *to* **54.9 m** *-* **0.375 x 0.375** *- Method:* **Hand Drill**

Driven & Bentonite: **0.0** *to* **42.7 m**

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (rate Lpm)
930.6	5.8	Brown Clay
907.2	29.3	Brown Sandstone
906.6	29.9	Grey Sandstone
904.4	32.0	Brown Sandstone
898.3	38.1	Grey Shale
897.1	39.3	Grey Sandstone
889.2	47.2	Grey Shale
885.5	50.9	Grey Sandstone
881.6	54.9	Grey Shale & Sandstone Ledges

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: **October 5, 2016 @ 13:55**
Analysis Details: **November 24, 2016 - Exova Canada Inc. (1164885-5)**

Constituent	Result
Conductivity (µS/cm)	1,080
Total Dissolved Solids	655
Hardness (as CaCO3)	14
T-Alkalinity (as CaCO3)	522
P-Alkalinity (as CaCO3)	8.3
Nitrate + Nitrite as N	0.03
Total Suspended Solids	
Sulfate Reducing Bacteria*	
Iron Related Bacteria**	

Constituent	Result
Nitrate as N	0.02
Nitrite as N	0.012
pH (pH Unit)	8.47
Ion Balance (%)	93
Total Coliforms	
Fecal Coliforms	
Escherichia coli	

Constituent	Result
Colour (TCU)	< 5
Turbidity (NTU)	0.4
Fluoride	0.41
Carbonate	10
Bicarbonate	616
Hydroxide	< 5
Total Iron	
Total Mn	
Temperature (°C)	19.5

Constituent	Extractable	Dissolved
Calcium	4.1	
Chloride		0.5
Iron	< 0.01	
Manganese	< 0.005	
Aluminum		
Arsenic		
Barium		
Beryllium		
Cadmium		
Chromium		
Cobalt		
Sulfate	82.6	

Constituent	Extractable	Dissolved
Mercury		
Molybdenum		
Magnesium	0.9	
Sodium	253	
Potassium	0.7	
Vanadium		
Strontium		
Nickel		
Zinc		
Copper		
Lead		
Uranium		

(1 / 4)
Extractable - unfiltered
Dissolved - filtered
*** MAC Exceedence
210222

Comments: **Sample collected by Hydrogeological Consultants Ltd. (HCL)**

Note: Constituents have been compared to the maximum acceptable concentration, Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Health Canada. Ottawa. Ontario.

General Comments / Observations

Initial Comments, Sep 2, 2001: 5 - 120 minutes recovery stayed at 120'.

Most Recent Water Level (m): **35.79 m – December 31, 2016**
Pump Intake BTOC (m): **54.9 on September 7, 2001**

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval	Duration (minutes) Pumping	Recovery	Avg. Rate (Lpm)	NPWL (metres)	Drawdown (metres)	Pump (metres)	Q20 (m³/day)* Apparent	Effective	Transmissivity (m²/day)* Apparent	Aquifer	Effecti
1	2001-09-07	Air	[unknown]	120	120	113.7	36.6	18.3	54.9	37.6		10.9		

Alias IDs

GIC ID: **499682**
GIC (WellReportId): **499682**

* The Groundwater Centre (TGWC) calculated or determined value.
** 75 - HCL GPS — 10TM NAD83
*** 80 - MT DEM — {Ground; AMSL}

2001 Wegmann Domestic Water Well
AEP – Water Well Drilling Report

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 499682
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2001/09/27

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
WEGMAN, HERMAN	538 MADEIRA DR NE, CALGARY				T2A 4M8

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	4	42	1	5	11			

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.592444 Longitude -114.079858
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Domestic

Type of Work
New Well

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
5.79		Brown Clay
29.26		Brown Sandstone
29.87		Gray Sandstone
32.00		Brown Sandstone
38.10		Gray Shale
39.32		Gray Sandstone
47.24		Gray Shale
50.90		Gray Sandstone
54.86		Gray Shale & Sandstone Ledges

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 45.46 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
2001/09/07	113.65	36.58

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
54.86 m		2001/09/02	2001/09/02

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	54.86

Surface Casing (if applicable)
Steel
Size OD : 13.97 cm
Wall Thickness : 0.620 cm
Bottom at : 42.67 m

Well Casing/Liner
Plastic
Size OD : 11.43 cm
Wall Thickness : 0.602 cm
Top at : 24.38 m
Bottom at : 54.86 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
45.72	54.86	0.953		0.95

Perforated by Hand Drill

Annular Seal Driven & Bentonite
Placed from 0.00 m to 42.67 m
Amount

Other Seals

Type	At (m)

Screen Type
Size OD : 0.00 cm

From (m)	To (m)	Slot Size (cm)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
ALKEN BASIN DRILLING LTD.

Copy of Well report provided to owner Date approval holder signed

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 499682
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2001/09/27

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
WEGMAN, HERMAN	538 MADEIRA DR NE, CALGARY				T2A 4M8

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	4	42	1	5	11			

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.592444 Longitude -114.079858
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level cm
Is Artesian Flow
Rate L/min

Is Flow Control Installed
Describe

Recommended Pump Rate 45.46 L/min
Recommended Pump Intake Depth (From TOC) 47.24 m

Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m

Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD

Sample Collected for Potability Submitted to ESRD

Additional Comments on Well
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 3'. 5-120 MIN RECOVERY STAYED AT 120'.

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Metric

Test Date	Start Time	Static Water Level
2001/09/07	12:00 AM	36.58 m

Method of Water Removal
Type Air
Removal Rate 113.65 L/min
Depth Withdrawn From 54.86 m

If water removal period was < 2 hours, explain why

Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
	0:00	54.86
	1:00	49.07
	2:00	42.67
	3:00	36.88
	4:00	36.58
	120:00	36.58

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
ALKEN BASIN DRILLING LTD.

Copy of Well report provided to owner Date approval holder signed

2001 Wegmann Domestic Water Well
Chemical Analysis Results (November 24, 2016)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To: Hydrogeological Consultants
Report To: Hydrogeological Consultants
17740 - 118 Avenue
Edmonton, AB, Canada
T5S 2W3
Attn: Tara Parker
Sampled By: S. Thomson
Company: HCL

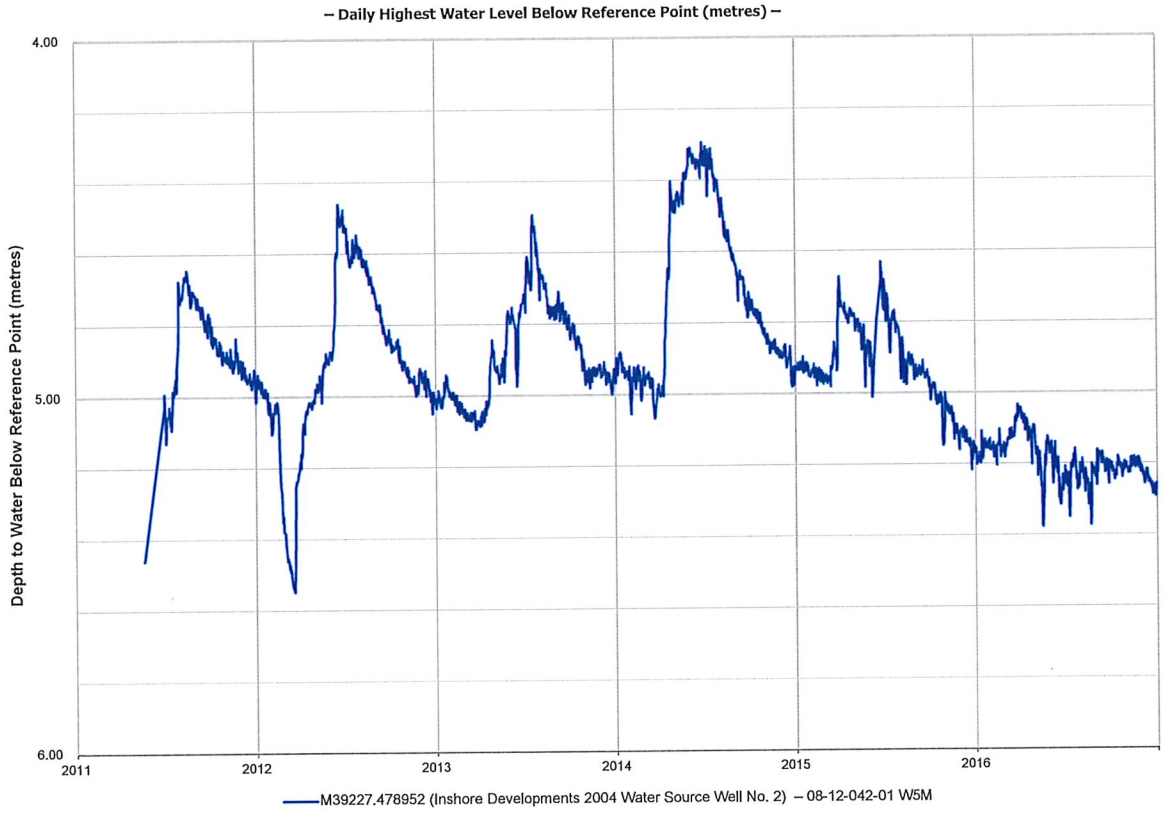
Project:
ID: MR-0323.16
Name: County of Ponoka GW Monitoring
Location: Gull Lake area
LSD:
P.O.: 18223
Acct code:

Lot ID: **1164885**
Control Number: Z-270791
Date Received: Oct 6, 2016
Date Reported: Nov 24, 2016
Report Number: 2150804

Reference Number	1164885-5
Sample Date	October 05, 2016
Sample Time	13:55
Sample Location	
Sample Description	Wegmaan / M37490.034988 / -1.4°c
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	<5	5	15	Below AO
Turbidity		NTU	0.4	0.1	0.1	Above OG
Routine Water						
pH			8.47		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.5			
Electrical Conductivity	at 25 °C	uS/cm	1080	1		
Calcium	Extractable	mg/L	4.1	0.2		
Magnesium	Extractable	mg/L	0.9	0.2		
Sodium	Extractable	mg/L	253	0.4	200	Above AO
Potassium	Extractable	mg/L	0.7	0.4		
Iron	Extractable	mg/L	<0.01	0.01	0.3	Below AO
Manganese	Extractable	mg/L	<0.005	0.005	0.05	Below AO
Chloride	Dissolved	mg/L	0.5	0.4	250	Below AO
Fluoride		mg/L	0.41	0.05	1.5	Below MAC
Nitrate - N		mg/L	0.02	0.01	10	Below MAC
Nitrite - N		mg/L	0.012	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	0.03	0.01	10	Below MAC
Sulfate (SO4)	Extractable	mg/L	82.6	0.9	500	Below AO
Hydroxide		mg/L	<5			
Carbonate		mg/L	10			
Bicarbonate		mg/L	616			
P-Alkalinity	as CaCO3	mg/L	8.3	5		
T-Alkalinity	as CaCO3	mg/L	522	5		
Total Dissolved Solids		mg/L	655	1	500	Above AO
Hardness	as CaCO3	mg/L	14			
Ionic Balance		%	93			

2001 Wegmann Domestic Water Well
2011 – 2016 Hydrograph



Inshore Developments 2004 Water Source Well No. 1

(2004 Meridian Beach Water Well No. 1)

08-12-042-01 W5M

(M39227.478953)

Well Spatial Location:

Easting: ***67,275***
Northing: ***5,825,894***
(spatial accuracy HCL GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***905.4***
(elevation accuracy Surveyed (other))

Date Completed: ***April 22, 2004***

Depth Drilled (m): ***30.5***

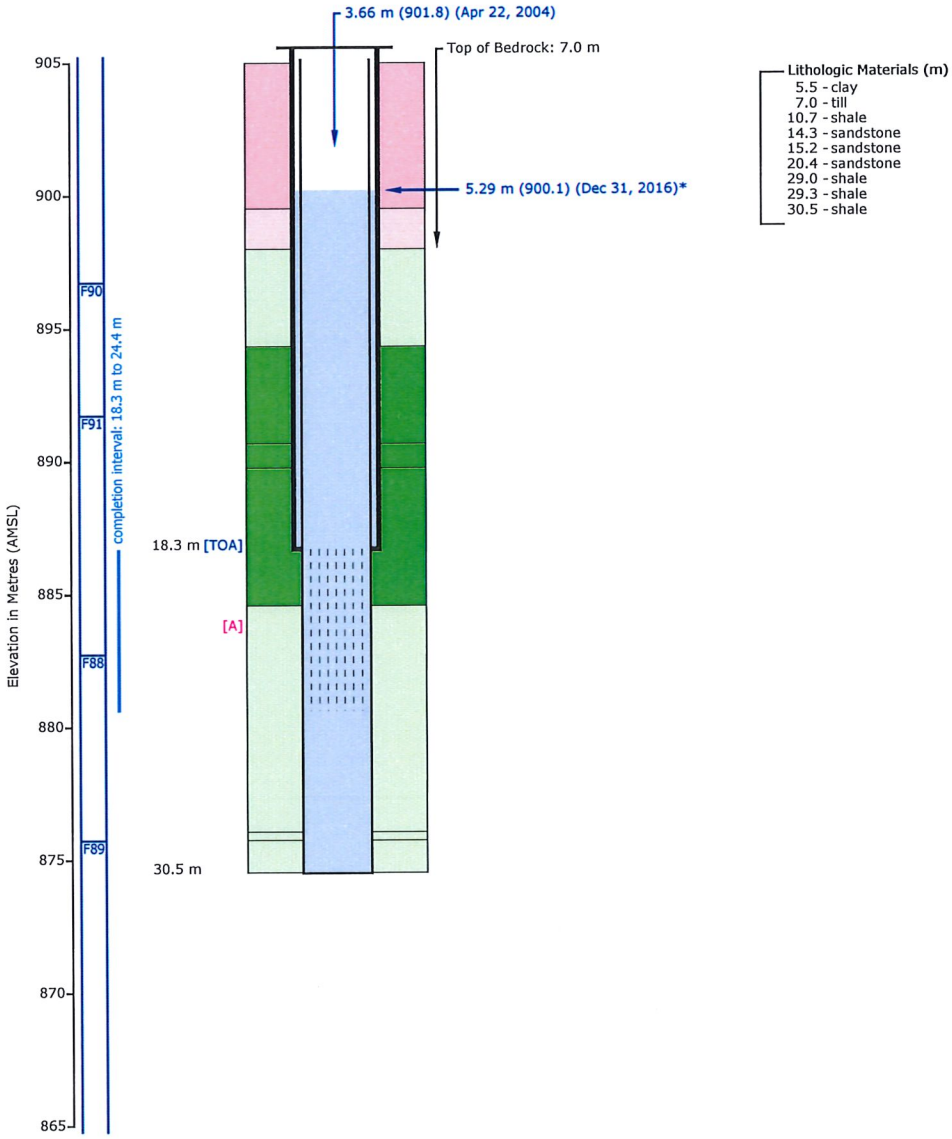
Completion Interval (m): ***18.3 – 24.4 ****
(TGWC determined value)*

Earliest Water Level (m): ***3.66 – April 22, 2004***

Most Recent Water Level (m): ***5.29 – December 31, 2016 @ 23:00***

GIC ID: ***1035048***

Inshore Developments 2004 Water Source Well No. 1
Water Well Diagram



Summary

TGWC ID: M39227.478953
Well Name: Inshore Developments 2004 Water Source Well No. 1
Legal Location: 08-12-042-01 W5M
Casing (OD): 141.3 mm; Steel (5.6")
Liner (OD): 114.3 mm; Plastic (4.5")
Casing Stick-Up: 0.5 m (not drawn to scale)
Completion [A]: 18.3 to 24.4 m; Slotted
Top of Aquifer [TOA]: 18.3 m on April 22, 2004
***Water Level (recent): 5.29 m (900.1m AMSL) on December 31, 2016 @ 23:00 - Reference Point: Top of Casing**
Water Level (oldest): 3.66 m (901.8m AMSL) on April 22, 2004

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by Hydrogeological Consultants Ltd. (HCL) (http://www.hcl.ca) on behalf of Ponoka County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: April 06, 2018 11:42 --- http://www.tgwc.com

Owner: **Horner, Norval/Inshore Developments**
209 Scarboro Avenue SW, Calgary, AB T3C 2H4
Contractor: **Aero Drilling & Consulting Ltd.**
Name: **Inshore Developments 2004 Water Source Well No. 1 (2004 Meridian Beach Water Well No. 1)**

Field Survey: **May 18, 2011 - Confirmed - Physically**
Work Type: **New Well** | Date Started: **April 22, 2004**
Drilling Method: **Rotary** | Date Completed: **April 22, 2004**
Proposed Use: **Municipal** | Well Status: **Producing**
Completion Type: **Casing/Perforated Liner** | Feature Class: **Water Well**

METRIC REPORT

Easting (m): **67,275.00** ** 75/83
Northing (m): **5,825,894.00** **
Elevation (m): **905.4** ***
Lot:
Block:
Plan:
Presence of Gas: **No**

08-12-042-01 W5M
M39227.478953
210798 – 3 Google

Elog Taken: **No**
Gamma Taken: **No**
Flowing: **No**
Stick Up (m): **0.5**

General Details

Depth Completed (m)*: **24.4**
Depth Drilled (m): **30.5**
Completion Aquifer: **Dalehurst Member ***
Top of Bedrock (m): **7.0 ***
Completion Interval (m): **18.3 – 24.4 ***

Completion Details

Surface Casing: **Steel – 141.3 mm (O.D.) x 6.60 mm (thick) x 18.3 m (bottom)**
Liner: **Plastic – 114.3 mm (O.D.) x 6.00 mm (thick)**; Top: **0.0 (m)**; Bottom: **30.5 (m)**

Intervals

Slotted: **18.3** to **24.4 m - 0.200 Inches** - *Method*: **Machine**
Shale Trap: **0.0** to **18.3 m**
Driven & Bentonite: **0.0** to **18.3 m**
Driven & Grouted: **0.0** to **18.3 m**

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (rate Lpm)
899.9	5.5	Sandy Brown Clay
898.4	7.0	Grey Till
894.8	10.7	Fractured Grey Shale
891.1	14.3	Grey Sandstone
890.2	15.2	Grey Sandstone
885.0	20.4	Grey Sandstone
876.5	29.0	Grey Shale
876.2	29.3	Green Shale
874.9	30.5	Grey Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: **October 5, 2016 @ 11:55**
Analysis Details: **November 24, 2016 - Exova Canada Inc. (1164885-3)**

Constituent	Result
Conductivity (µS/cm)	889
Total Dissolved Solids	542
Hardness (as CaCO3)	126
T-Alkalinity (as CaCO3)	428
P-Alkalinity (as CaCO3)	< 5
Nitrate + Nitrite as N	< 0.01
Total Suspended Solids	
Sulfate Reducing Bacteria*	
Iron Related Bacteria**	

Constituent	Result
Nitrate as N	< 0.01
Nitrite as N	< 0.005
pH (pH Unit)	8.18
Ion Balance (%)	97
Total Coliforms	
Fecal Coliforms	
Escherichia coli	

Constituent	Result
Colour (TCU)	20
Turbidity (NTU)	3.4
Fluoride	0.19
Carbonate	< 6
Bicarbonate	522
Hydroxide	< 5
Total Iron	
Total Mn	
Temperature (°C)	19.6

Constituent	Extractable	Dissolved
Calcium	26.7	
Chloride		5.0
Iron	0.24	
Manganese	0.025	
Aluminum		
Arsenic		
Barium		
Beryllium		
Cadmium		
Chromium		
Cobalt		
Sulfate	69.8	

Constituent	Extractable	Dissolved
Mercury		
Molybdenum		
Magnesium	14.5	
Sodium	167	
Potassium	2	
Vanadium		
Strontium		
Nickel		
Zinc		
Copper		
Lead		
Uranium		

(1 / 5)
Extractable - unfiltered
Dissolved - filtered
*** MAC Exceedence
210220

Comments: **Sample collected by Hydrogeological Consultants Ltd. (HCL)**

Note: Constituents have been compared to the maximum acceptable concentration, Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Health Canada. Ottawa. Ontario.

General Comments / Observations

Initial Comments, Apr 22, 2004: Shale trap 4 x 5 at 60 feet. PERFS are MILLED SLOTS.

Most Recent Water Level (m): **5.29 m – December 31, 2016**
Pump Intake BTOC (m): **30.5 on April 22. 2004**

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval	Duration (minutes) Pumping	Recovery	Avg. Rate (Lpm)	NPWL (metres)	Drawdown (metres)	Pump (metres)	Q20 (m³/day)* Apparent	Effective	Transmissivity (m²/day)* Apparent	Aquifer	Effecti
3	2015-06-15 11:20	AT with One Pumped and Two Observation Water Wells (10540)											174	174
2	2004-04-26 12:00	2004 WSW – Inshore 2 Used as Observation WW during AT II with 2004 WSW – Inshore 1								261.9		45.3		
1	2004-04-22	Air	18.3 to 24.4	120	120	272.8	3.7	26.8	30.5	101.8		18.3		

Alias IDs

GIC ID: *1035048*
GIC (WellReportId): *10820026*

** The Groundwater Centre (TGWC) calculated or determined value.*
*** 75 - HCL GPS — 10TM NAD83*
**** 83 - Surveyed (other) — {Ground; AMSL}*

Inshore Developments 2004 Water Source Well No. 1
AEP – Water Well Drilling Report

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1035048
GOWN ID
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
HORNER, NORVAL/INSHORE DEV	209 SCARBORO AVE SW	CALGARY	ALBERTA	CA	T3C 2H4

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	12	42	1	5				#2 MAIN

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.599615 Longitude -114.007878
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Industrial

Type of Work
New Well

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
5.49		Brown Sandy Clay
7.01		Gray Till
10.67		Gray Fractured Shale
14.33		Gray Sandstone
15.24		Gray Sandstone
20.42		Gray Sandstone
28.96		Gray Shale
29.26		Green Shale
30.48		Gray Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 272.77 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
2004/04/22	272.77	3.66

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
30.48 m		2004/04/22	2004/04/22

Borehole

Diameter (cm)	From (m)	To (m)
12.70	0.00	30.48

Surface Casing (if applicable)
Steel
Size OD : 14.13 cm
Wall Thickness : 0.655 cm
Bottom at : 18.29 m

Well Casing/Liner
Plastic
Size OD : 11.43 cm
Wall Thickness : 0.602 cm
Top at : 0.00 m
Bottom at : 30.48 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
18.29	24.38	0.508		

Perforated by Machine

Annular Seal Driven & Bentonite
Placed from 0.00 m to 18.29 m
Amount

Other Seals

Type	At (m)

Screen Type Slotted PVC
Size OD : 11.43 cm

From (m)	To (m)	Slot Size (cm)
18.29	24.38	0.508

Attachment Unknown
Top Fittings Unknown
Bottom Fittings Unknown

Pack
Type Unknown
Grain Size
Amount Unknown

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
SHAWN CROWELL

Certification No
18687A

Company Name
AERO DRILLING & CONSULTING LTD.

Copy of Well report provided to owner
Date approval holder signed

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1035048
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
HORNER, NORVAL/INSHORE DEV	209 SCARBORO AVE SW	CALGARY	ALBERTA	CA	T3C 2H4

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	12	42	1	5				#2 MAIN

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.599615 Longitude -114.007878
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level 91.44 cm
Is Artesian Flow
Rate L/min
Is Flow Control Installed
Describe

Recommended Pump Rate 272.77 L/min
Recommended Pump Intake Depth (From TOC) 21.34 m
Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability Submitted to ESRD

Additional Comments on Well
TOP OF LINER +2 NOT 2FT. ALSO SHALE TRAP 4X5 AT 60 FT. PERFS ARE MILLED SLOTS.

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Metric

Test Date	Start Time	Static Water Level
2004/04/22	12:00 AM	3.66 m

Method of Water Removal
Type Air
Removal Rate 272.77 L/min
Depth Withdrawn From 30.48 m

If water removal period was < 2 hours, explain why

Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
	0:00	30.48
	1:00	12.50
	2:00	5.79
	3:00	4.57
	4:00	3.96
	5:00	3.66
	6:00	3.66
	7:00	3.66
	10:00	3.66
30.48	120:00	3.66

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
SHAWN CROWELL

Certification No
18687A

Company Name
AERO DRILLING & CONSULTING LTD.

Copy of Well report provided to owner Date approval holder signed

Printed on 4/6/2018 11:41:51 AM

Inshore Developments 2004 Water Source Well No. 1
Chemical Analysis Results (November 24, 2016)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To: Hydrogeological Consultants
Report To: Hydrogeological Consultants
17740 - 118 Avenue
Edmonton, AB, Canada
T5S 2W3
Attn: Tara Parker
Sampled By: S. Thomson
Company: HCL

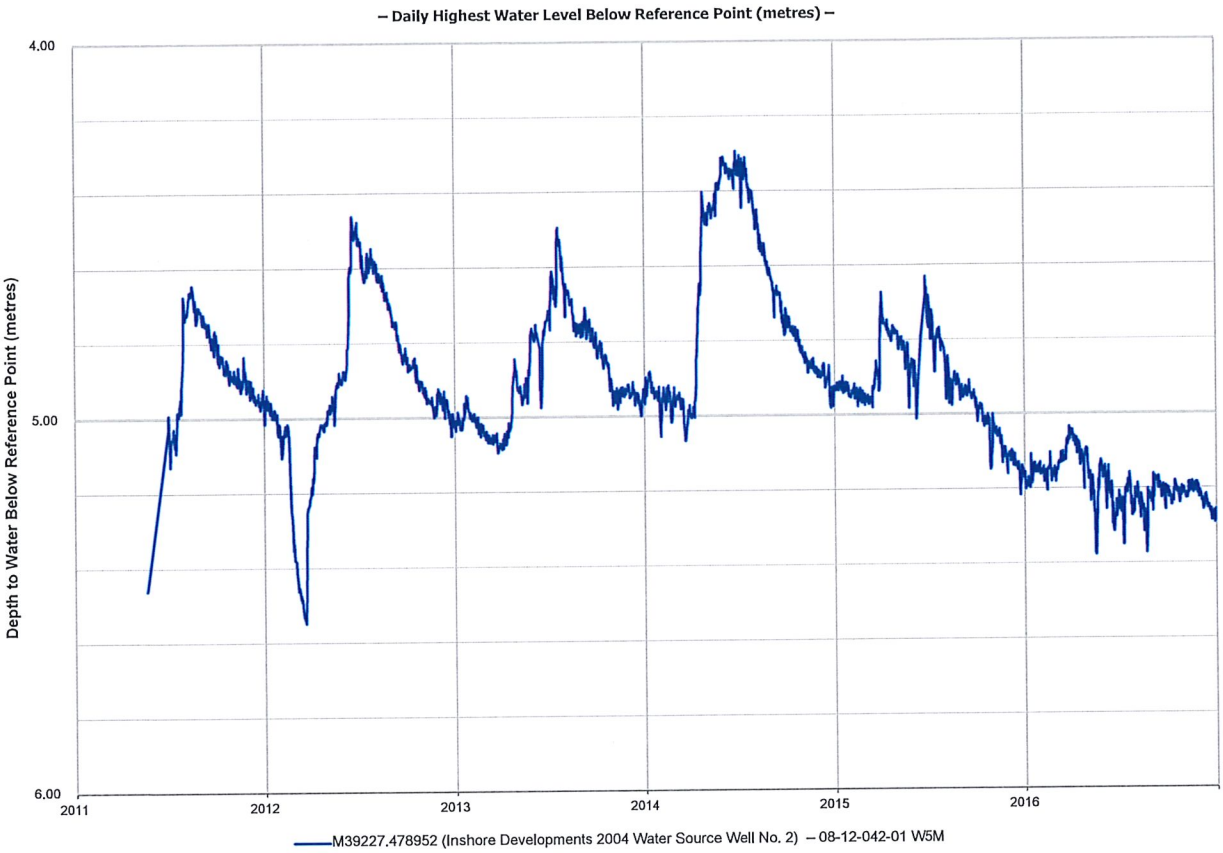
Project:
ID: MR-0323.16
Name: County of Ponoka GW Monitoring
Location: Gull Lake area
LSD:
P.O.: 18223
Acct code:

Lot ID: **1164885**
Control Number: Z-270791
Date Received: Oct 6, 2016
Date Reported: Nov 24, 2016
Report Number: 2150804

Reference Number	1164885-3
Sample Date	October 05, 2016
Sample Time	11:55
Sample Location	
Sample Description	MB#1 / M39227.478953 / -1.4°c
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	20	5	15	Above AO
Turbidity		NTU	3.4	0.1	0.1	Above OG
Routine Water						
pH			8.18		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.6			
Electrical Conductivity	at 25 °C	uS/cm	889	1		
Calcium	Extractable	mg/L	26.7	0.2		
Magnesium	Extractable	mg/L	14.5	0.2		
Sodium	Extractable	mg/L	167	0.4	200	Below AO
Potassium	Extractable	mg/L	2.0	0.4		
Iron	Extractable	mg/L	0.24	0.01	0.3	Below AO
Manganese	Extractable	mg/L	0.025	0.005	0.05	Below AO
Chloride	Dissolved	mg/L	5.0	0.4	250	Below AO
Fluoride		mg/L	0.19	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)	Extractable	mg/L	69.8	0.9	500	Below AO
Hydroxide		mg/L	<5			
Carbonate		mg/L	<6			
Bicarbonate		mg/L	522			
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	428	5		
Total Dissolved Solids		mg/L	542	1	500	Above AO
Hardness	as CaCO3	mg/L	126			
Ionic Balance		%	97			

Inshore Developments 2004 Water Source Well No. 1
2011 – 2016 Hydrograph



Inshore Developments 2004 Water Source Well No. 2

(2004 Meridian Beach Water Well No. 2)

08-12-042-01 W5M

(M39227.478952)

Well Spatial Location:

Easting: ***67,302***
Northing: ***5,825,900***
(spatial accuracy HCL GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***905.3***
(elevation accuracy Surveyed (other))

Date Completed: ***April 21, 2004***

Depth Drilled (m): ***30.5***

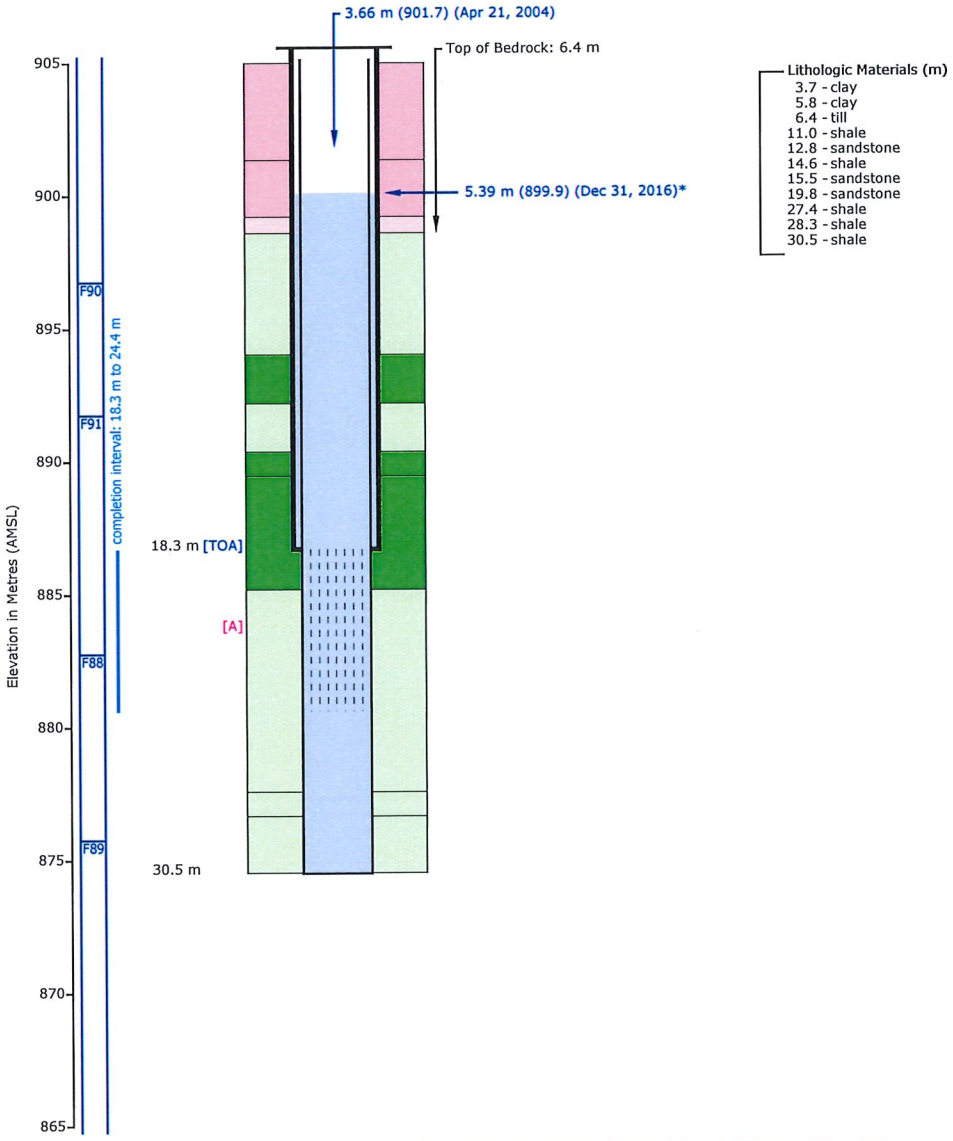
Completion Interval (m): ***18.3 – 24.4 ****
(TGWC determined value)*

Earliest Water Level (m): ***3.66 – April 21, 2004***

Most Recent Water Level (m): ***5.39 – December 31, 2016 @ 23:00***

GIC ID: ***1035047***

Inshore Developments 2004 Water Source Well No. 2
Water Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained

Bedrock: Fine Grained; Coarse Grained

Other

Geologic Unit Legend (Top) - Regional Analysis

F90 - Sun169 Aquifer
F91 - Sun169 Aquifer Base
F88 - Sun155 Aquifer
F89 - Sun155 Aquifer Base

Summary

TGWC ID: M39227.478952
Well Name: Inshore Developments 2004 Water Source Well No. 2
Legal Location: 08-12-042-01 W5M
Casing (OD): 141.3 mm; Steel (5.6")
Liner (OD): 114.3 mm; Plastic (4.5")
Casing Stick-Up: 0.5 m (not drawn to scale)
Completion [A]: 18.3 to 24.4 m; Slotted
Top of Aquifer [TOA]: 18.3 m on April 21, 2004
*Water Level (recent): 5.39 m (899.9m AMSL) on December 31, 2016 @ 23:00 - Reference Point: Top of Casing
Water Level (oldest): 3.66 m (901.7m AMSL) on April 21, 2004

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by Hydrogeological Consultants Ltd. (HCL) (http://www.hcl.ca) on behalf of Ponoka County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: April 06, 2018 11:42 --- http://www.tgwc.com

Owner: **Horner, Norval/Inshore Developments**
209 Scarboro Avenue SW, Calgary, AB T3C 2H4
Contractor: **Aero Drilling & Consulting Ltd.**
Name: **Inshore Developments 2004 Water Source Well No. 2 (2004 Meridian Beach Water Well No. 2)**

Field Survey: **May 18, 2011 - Confirmed - Physically**
Work Type: **New Well** | Date Started: **April 21, 2004**
Drilling Method: **Rotary** | Date Completed: **April 21, 2004**
Proposed Use: **Municipal** | Well Status: **Producing**
Completion Type: **Casing/Perforated Liner** | Feature Class: **Water Well**

METRIC REPORT

Easting (m): **67,302.00** ** 75/83
Northing (m): **5,825,900.00** **
Elevation (m): **905.3** ***
Lot:
Block:
Plan:
Presence of Gas: **No**

08-12-042-01 W5M
M39227.478952
210799 – 3 Google

Elog Taken: **No**
Gamma Taken: **No**
Flowing: **No**
Stick Up (m): **0.5**

General Details

Depth Completed (m)*: **24.4**
Depth Drilled (m): **30.5**
Completion Aquifer: **Dalehurst Member ***
Top of Bedrock (m): **6.4 ***
Completion Interval (m): **18.3 – 24.4 ***

Completion Details

Surface Casing: **Steel – 141.3 mm (O.D.) x 6.60 mm (thick) x 18.3 m (bottom)**
Liner: **Plastic – 114.3 mm (O.D.) x 6.00 mm (thick)**; Top: **0.0 (m)**; Bottom: **30.5 (m)**

Intervals

Slotted: **18.3** to **24.4 m - 0.375 x 0.375 Inches** - Method: **Drill**

Shale Trap: **0.0** to **18.3 m**
Driven & Bentonite: **0.0** to **18.3 m**
Driven & Grouted: **0.0** to **18.3 m**

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (rate Lpm)
901.7	3.7	Sandy Brown Clay
899.5	5.8	Brown Clay
898.9	6.4	Grey Till
894.3	11.0	Grey Shale
892.5	12.8	Grey Sandstone
890.7	14.6	Grey Shale
889.8	15.5	Brown Sandstone
885.5	19.8	Grey Sandstone
877.9	27.4	Grey Shale
877.0	28.3	Green Shale
874.8	30.5	Grey Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: **October 5, 2016 @ 11:40**
Analysis Details: **November 24, 2016 - Exova Canada Inc. (1164885-1)**

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm)	**864**	Nitrate as N	**< 0.01**	Colour (TCU)	**13**
Total Dissolved Solids	**512**	Nitrite as N	**< 0.005**	Turbidity (NTU)	**0.8**
Hardness (as CaCO3)	**198**	pH (pH Unit)	**8.01**	Fluoride	**0.18**
T-Alkalinity (as CaCO3)	**427**	Ion Balance (%)	**96**	Carbonate	**< 6**
P-Alkalinity (as CaCO3)	**< 5**	Total Coliforms:		Bicarbonate	**520**
Nitrate + Nitrite as N	**< 0.01**	Fecal Coliforms:		Hydroxide	**< 5**
Total Suspended Solids:		Escherichia coli:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C)	**19.4**

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium	**29.2**		Mercury:		
Chloride:		**11.1**	Molybdenum		
Iron:	**0.42**		Magnesium	**30.4**	
Manganese:	**0.043**		Sodium:	**111**	
Aluminum:			Potassium	**2.3**	
Arsenic:			Vanadium:		
Barium:			Strontium:		
Beryllium:			Nickel:		
Cadmium:			Zinc:		
Chromium:			Copper:		
Cobalt:			Lead:		
Sulfate:	**56.6**		Uranium:		

(1 / 4)
Extractable - unfiltered
Dissolved - filtered
*** MAC Exceedence
210218

Comments: **Sample collected by Hydrogeological Consultants Ltd. (HCL)**

Note: Constituents have been compared to the maximum acceptable concentration, Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Health Canada. Ottawa. Ontario.

General Comments / Observations

Initial Comments, Apr 21, 2004: Grouted Shale trap 4 x 5 at 60 feet.

Most Recent Water Level (m): **5.39 m – December 31, 2016**
Pump Intake BTOC (m): **30.5 on April 21, 2004**

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (Lpm)	NPWL (metres)	Drawdown (metres)	Pump (metres)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effecti
3	2015-06-15 11:20	AT with One Pumped and Two Observation Water Wells (10540)											157	157
2	2004-04-26 12:00	2004 WSW – Inshore 2 Used as Observation WW during AT II with 2004 WSW – Inshore 1												
1	2004-04-21	Air	18.3 to 24.4	120	10	272.8	3.7	26.8	30.5	101.8		18.3		

Alias IDs

GIC ID: **1035047**
GIC (WellReportId): **10819987**

** The Groundwater Centre (TGWC) calculated or determined value.*
*** 75 - HCL GPS — 10TM NAD83*
**** 83 - Surveyed (other) — {Ground; AMSL}*

Inshore Developments 2004 Water Source Well No. 2
AEP – Water Well Drilling Report

Alberta

Water Well Drilling Report

View in Imperial **Export to Excel**

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1035047
GOWN ID
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
HORNER, NORVAL/INSHORE DEV	209 SCARBORO AVE SW	CALGARY	ALBERTA	CA	T3C 2H4

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	12	42	1	5				#1 OBSERVATION

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.599615 Longitude -114.007878
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Industrial

Type of Work
New Well

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
3.66		Brown Sandy Clay
5.79		Brown Clay
6.40		Gray Till
10.97		Gray Shale
12.80		Gray Sandstone
14.63		Gray Shale
15.54		Brown Sandstone
19.81		Gray Sandstone
27.43		Gray Shale
28.35		Green Shale
30.48		Gray Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 272.77 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
2004/04/21	272.77	3.66

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
30.48 m		2004/04/21	2004/04/21

Borehole

Diameter (cm)	From (m)	To (m)
12.70	0.00	30.48

Surface Casing (if applicable)
Steel
Size OD : 14.13 cm
Wall Thickness : 0.655 cm
Bottom at : 18.29 m

Well Casing/Liner
Plastic
Size OD : 11.43 cm
Wall Thickness : 0.602 cm
Top at : 0.00 m
Bottom at : 30.48 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
18.29	24.38	0.953		0.95

Perforated by Hand Drill

Annular Seal Driven & Bentonite
Placed from 0.00 m to 18.29 m
Amount

Other Seals

Type	At (m)

Screen Type
Size OD : cm

From (m)	To (m)	Slot Size (cm)

Attachment
Top Fittings Bottom Fittings

Pack
Type Unknown Grain Size
Amount Unknown

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
SHAWN CROWELL

Company Name
AERO DRILLING & CONSULTING LTD.

Certification No
18687A

Copy of Well report provided to owner Date approval holder signed

Alberta

Water Well Drilling Report

View in Imperial | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1035047
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
HORNER, NORVAL/INSHORE DEV	209 SCARBORO AVE SW	CALGARY	ALBERTA	CA	T3C 2H4

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	12	42	1	5				#1 OBSERVATION

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 52.599615 Longitude -114.007878
How Location Obtained
Not Verified

Elevation m
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level 91.44 cm
Is Artesian Flow
Rate L/min
Is Flow Control Installed
Describe

Recommended Pump Rate 272.77 L/min
Recommended Pump Intake Depth (From TOC) 21.34 m
Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability Submitted to ESRD

Additional Comments on Well
TOP OF LINER AT +2 NOT 2FT BELOW GROUND LEVEL. GROUTED SHALE TRAP 4X5 AT 60 FT.

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Metric

Test Date	Start Time	Static Water Level
2004/04/21	12:00 AM	3.66 m

Method of Water Removal
Type Air
Removal Rate 272.77 L/min
Depth Withdrawn From 30.48 m

If water removal period was < 2 hours, explain why

Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
	0:00	30.48
	1:00	13.11
	2:00	4.88
	3:00	4.27
	4:00	3.66
	5:00	3.66
	6:00	3.66
	10:00	3.66
30.48	120:00	

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
SHAWN CROWELL

Certification No
18687A

Company Name
AERO DRILLING & CONSULTING LTD.

Copy of Well report provided to owner Date approval holder signed

Inshore Developments 2004 Water Source Well No. 2
Chemical Analysis Results (November 24, 2016)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 434-8586
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To: Hydrogeological Consultants
Report To: Hydrogeological Consultants
17740 - 118 Avenue
Edmonton, AB, Canada
T5S 2W3
Attn: Tara Parker
Sampled By: S. Thomson
Company: HCL

Project:
ID: MR-0323.16
Name: County of Ponoka GW Monitoring
Location: Gull Lake area
LSD:
P.O.: 18223
Acct code:

Lot ID: **1164885**
Control Number: Z-270791
Date Received: Oct 6, 2016
Date Reported: Nov 24, 2016
Report Number: 2150804

Reference Number	1164885-1
Sample Date	October 05, 2016
Sample Time	11:40
Sample Location	
Sample Description	MB#2 / M39227.478952 / -1.4°c
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	13	5	15	Below AO
Turbidity		NTU	0.8	0.1	0.1	Above OG
Routine Water						
pH			8.01		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.4			
Electrical Conductivity	at 25 °C	uS/cm	864	1		
Calcium	Extractable	mg/L	29.2	0.2		
Magnesium	Extractable	mg/L	30.4	0.2		
Sodium	Extractable	mg/L	111	0.4	200	Below AO
Potassium	Extractable	mg/L	2.3	0.4		
Iron	Extractable	mg/L	0.42	0.01	0.3	Above AO
Manganese	Extractable	mg/L	0.043	0.005	0.05	Below AO
Chloride	Dissolved	mg/L	11.1	0.4	250	Below AO
Fluoride		mg/L	0.18	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)	Extractable	mg/L	56.6	0.9	500	Below AO
Hydroxide		mg/L	<5			
Carbonate		mg/L	<6			
Bicarbonate		mg/L	520			
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	427	5		
Total Dissolved Solids		mg/L	512	1	500	Above AO
Hardness	as CaCO3	mg/L	198			
Ionic Balance		%	96			

Inshore Developments 2004 Water Source Well No. 2
2011 – 2016 Hydrograph