

2nd and 3rd Quarterly Monitoring Report

for

Town of Hamilton Well #14
Stone Eden Well
Hamilton, Virginia

Prepared for:

Mayor Ray Whitbey
Town of Hamilton
53 East Colonial Highway
Hamilton, Virginia 20158

Prepared by:

ANALYTICAL SERVICES, INC.
402 N. West Street
Culpeper, Virginia 22701

and

TRIAD ENGINEERING, INC.
21641 Beaumeade Circle
Suite 300
Ashburn, VA 20147

TRIAD Project # 05-07-0092

Date: May 10, 2010

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LOUDOUN COUNTY
BUILDING & DEVELOPMENT

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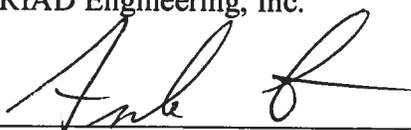
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1.0 INTRODUCTION

This Monitoring Report presents the results of the monitoring activities during the second and third quarters of active pumping operation in Well 14 by the Town of Hamilton. Quarterly reports are required to be submitted to the Loudoun County Department of Building and Development, which approved the Town's Pumping, Monitoring, and Mitigation Plan (PMMP) in November 2008. The PMMP addresses the groundwater monitoring requirements of Section 6.240, G., I., J., and K. of the Loudoun County Facility Standards Manual (FSM).

This report includes the water level data and water quality field-testing from ASI's previously submitted report "Background and Initial Pump Start-up (30-day) Monitoring Report", dated October 13, 2009 ("30-Day Report"), and the First Quarterly Monitoring Report (QMR1), dated November 15, 2009. Please refer to the 30-Day Report for details regarding monitoring well information, installation of the probes, and the water quality sampling methods.

Relevant information on the monitored wells is summarized in Table 1 below.

Table 1
Domestic Well Monitoring Locations

Well #	Residence Address	PIN	Well Yield (gpm)	Total Depth (feet)	Depth to Bedrock (feet)	Static Water Level (feet)	Water-Bearing Depths (feet)**
4	Gaston and Kapsang Gutierrez 38286 Alfalfa Ct	419157282	50	380	20	30	180 (2), 365 (48)
5	Robert and Lori Gammache 38280 Alfalfa Ct	419155183	30	400	10	12	190 (4), 360 (26)
6	Hemadri and Aparna Dasari 38274 Alfalfa Ct	419153482	30	275	10	30	253
7	Edward and Courtney Cooke 38268 Alfalfa Ct	419150980	50	250	8	0	225
9	Bernardo and Jacklyn Dedekind 17936 Manassas Gap Ct	454105978	60	383	50	30	381
12	James and Amy Walton 17979 Sands Road	454297930	15	380	25	2	365
13	Brian and Sherri Omara 17969 Sands Road	454302227	15	260	51	40	235
32	Omara, Maureen A. & E. B. Omara J/T 17899 Sands Road	454204465	50	260	20	2	235

3.0 WATER QUALITY MONITORING

Section 4.5 of the PMMP recommended that the monitoring program should include an evaluation of water quality. Laboratory results from the sampling of all monitored domestic wells were reported in the 30-Day Report. The laboratory results from Well 32 were reported in the QMR1. The water samples were tested by calibrated field instrumentation for the following parameters: pH, specific conductivity, turbidity and temperature.

3.1 Field Parameters

Field parameters (Temperature, pH, Specific Conductance, and Turbidity) were measured in domestic water samples by field meters, during the installation of the probes. Parameters were measured at the beginning of pumping of Well 14, then one week after start up, and then monthly thereafter. Water samples were collected from the residences from outside spigots where practicable, or from indoor faucets where necessary, after purging water from the piping. The results of sampling events have been tabulated in Appendix I. The new results do not appear to change the findings from the 30-Day report that some variations have been recorded in the field measurements; however, no long term trends are readily discernable. Additional data will be useful in evaluating any potential trends in the recorded data.

3.2 Laboratory Analysis

Sampling for laboratory analyses was not conducted during the 2nd and 3rd quarters of active pumping.

4.0 GROUNDWATER LEVEL MONITORING

ASI personnel mobilized to the site on the following dates to check the operation of the probes and to download data from the probes:

- November 17, 2009
- December 28, 2009
- January 29, 2010
- February 24, 2010
- March 24, 2010, and
- April 30, 2010.

Water level monitoring began at Well #32 on November 17, 2009. Water level measurements were automatically recorded by the probes on an hourly basis. Water level data collected during the monitoring program have been plotted for each monitor well resulting in graphs that depict changes in water levels over time during the monitoring period. The plots include data from both background phase and pumping phase of the monitoring program. Graphs for each individual monitor well have been included in

Appendix C. An electronic copy of the monitoring data has been included in Appendix E.

4.1 Water Level Analysis

Water levels fluctuations in the monitored wells continued in the general pattern described in the First Quarterly Report. The times of operation of Well #14 can be inferred from the coincidental drawdowns of several of the wells. According to Town of Hamilton staff, Well #14 is brought online on a discretionary, as-needed basis, so that the pumping events (and the associated drawdowns in the monitored wells) continue to be sporadically timed, with extended periods of time in between pumping events.

As previously reported, significant water level fluctuations in Wells #4, #5, and #6 appeared to coincide very closely, supporting the view that the greater drawdowns are caused by withdrawals from Well #14. Water level fluctuations within Well #13 and Well #32 were also found to display significant responses to the pumping of Well #14. The recovery in all of the monitored wells was relatively rapid, with water levels usually re-stabilizing at pre-drawdown levels in most wells. This rapid recovery suggests that the wells are strongly recharged by the local aquifer.

In contrast, Wells #9 and #12 exhibited minimal decreases in their water levels during the apparent operation of Well #14, which suggests that withdrawals from Well 14 may have a lesser impact on these two wells than on the other five monitored wells.

4.2 Discharge Data from Well #14

Well #14 discharge data were obtained from the Hamilton Water Treatment Plant (WTP) for the period of October, 2009 through April, 2010. The data include the dates, duration, and total water volume of pumping, which are obtained from the Town's monthly reports to the Virginia Health Department.

Town staff has indicated that discharge data for Well #14 is currently obtained from a totalizer meter that is fitted to a transfer tank supplied by Well #14. Water withdrawal from Well #14 occurred in each month of the pumping period. Pumping durations varied from 20 minutes to 5.9 hours, with most durations lasting between one and two hours. Average pumping rates in gallons per minute (gpm) varied between 107 and 333, for an average rate for the seven-month period of 265 gpm. Well 14 was pumped the least in February, with 9 pumping hours over 7 days, while the maximum monthly pumping occurred in March, with 23 hours of pumping over 14 days. Totals and averages for each month during the pumping period are summarized below in Table 2. The pumping data, including daily pumping durations and volumes, are provided in Appendix D.

**Table 2. Well 14
 Pumping Data Summary**

	Pumping Days	Total Hours	Pumpage (gal)	Average Rate (gpm)
October '09	12	17.7	287,800	272
November '09	14	20	294,300	267
December '09	9	14	231,500	270
January '10	14	14.4	209,900	265
February '10	7	9	156,300	277
March '10	14	23	373,900	266
April '10	10	15	243,300	276
Total	80	114	1,797,500	
Average				265

5.0 CONCLUSIONS AND RECOMMENDATIONS

The data from the additional five months of monitoring since the 30-day report supports the conclusions of the 30-day report and the First Quarterly Report. That is, the nearly simultaneous drops in well water levels during numerous occasions are believed to be associated with the withdrawal of groundwater from Well #14. Recoveries in the wells continue to be strong and no reports of groundwater quantity or quality problems have been received by the Town of Hamilton from these well owners. Water levels in the monitored wells have continued to recover to approximately background levels. However additional monitoring data will be needed to evaluate more long term effects following the continued active operation of Well #14.

Water quality parameters suggested some variation in water quality during the monitoring period; however, the collection of additional quality data will enable a better assessment of water quality trends over time including potential seasonal fluctuations. While data collected and included in this report are considered useful in evaluating potential effects of the pumping of Well #14, future monitoring data may be more representative of conditions during the active operation of Well #14.

Correspondence from the Loudoun County Department of Building and Development to TRIAD Engineering, dated March 31, included comments on the previously submitted 1st Quarterly Monitoring Report. On April 27, 2010, a meeting was held with the Town of Hamilton Mayor to discuss a means towards addressing the comments, including an effort to identify potentially useful additional monitoring locations and to obtain more detailed monitoring information from Well #14.

6.0 LIMITATIONS

The work performed in conjunction with this project, and the data developed, are intended as a description of available information at the sample locations indicated and the dates specified. Generally accepted industry standards were used in the preparation of this report.

Laboratory data are intended to approximate actual conditions at the time of sampling. Results from future sampling and testing may vary significantly as a result of natural conditions, a changing environment, or the limits of analytical capabilities. This report does not warrant against future operations or conditions, nor does it warrant against operations or conditions present of a type or at a specific location not investigated. The limited sampling conducted was intended to approximate subsurface conditions by extrapolation between data points. Actual conditions may vary.

FIGURES



Figure 1. Area of Well Monitoring

Legend

-  Town of Hamilton Well
-  Monitored Domestic Supply Wells

Imagery Source: ESRI/ArcGIS Map Service



Figure 2
Wells 4, 5, 6, and 32

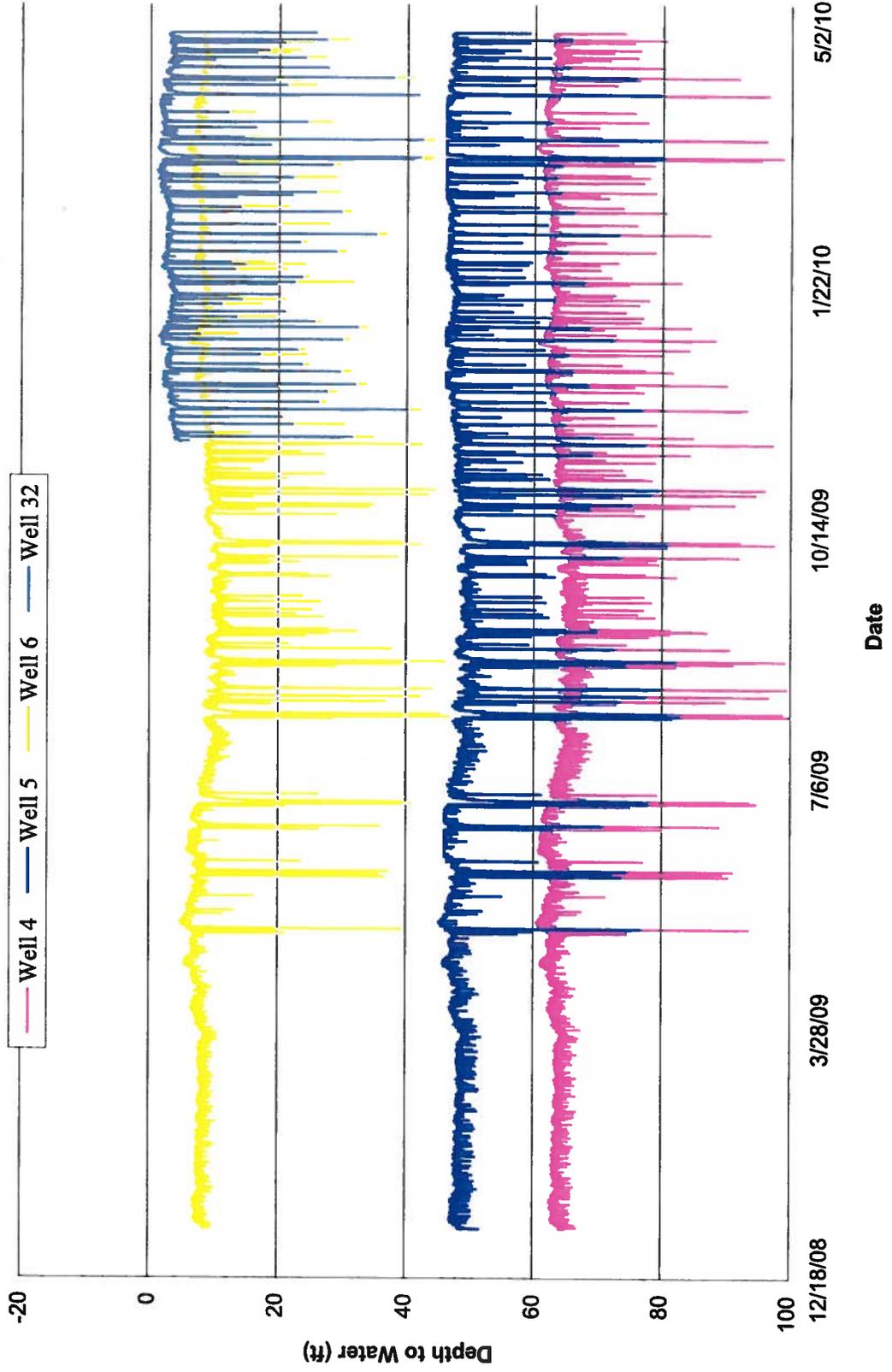


Figure 3
Wells 9, 12, and 13

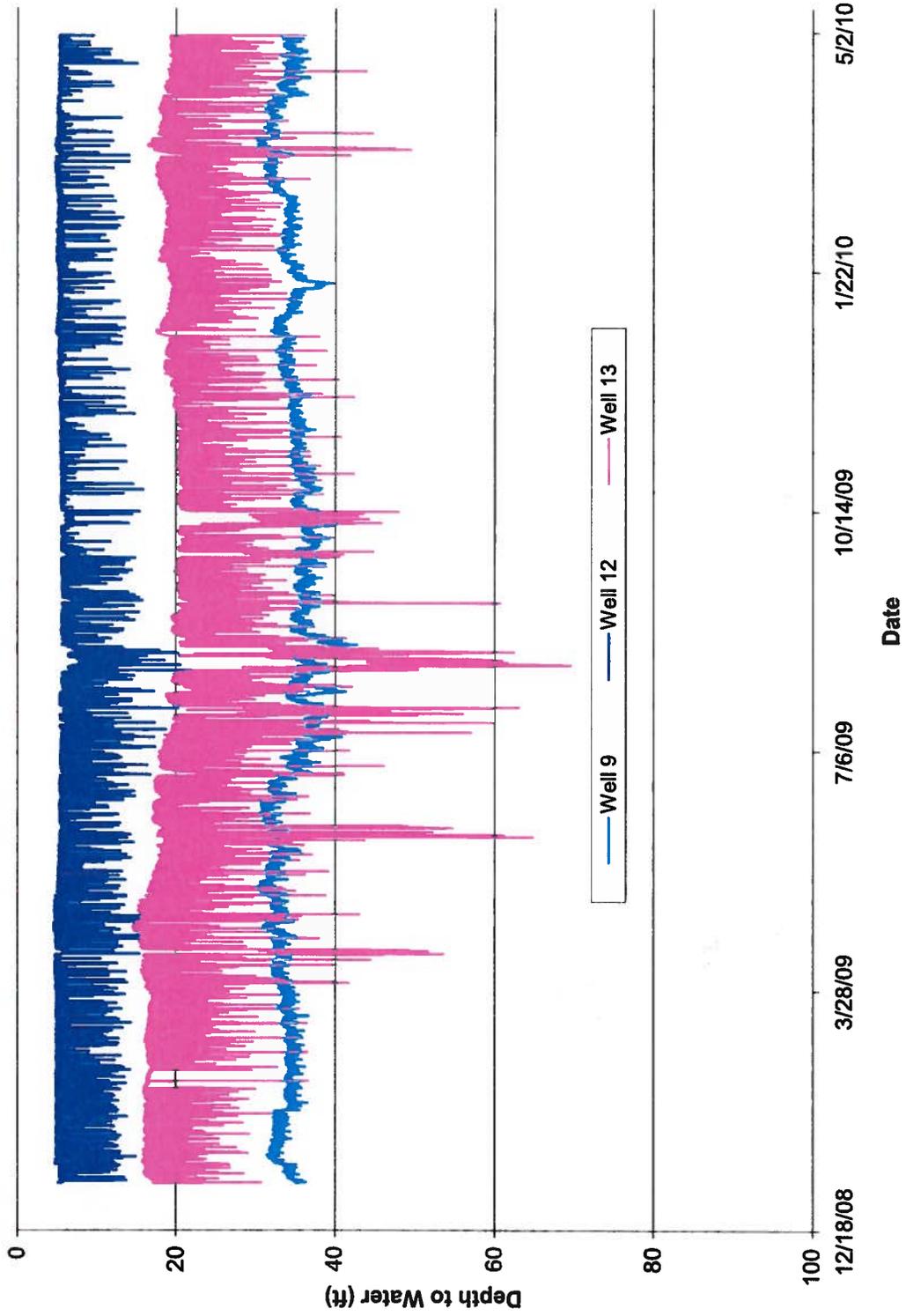
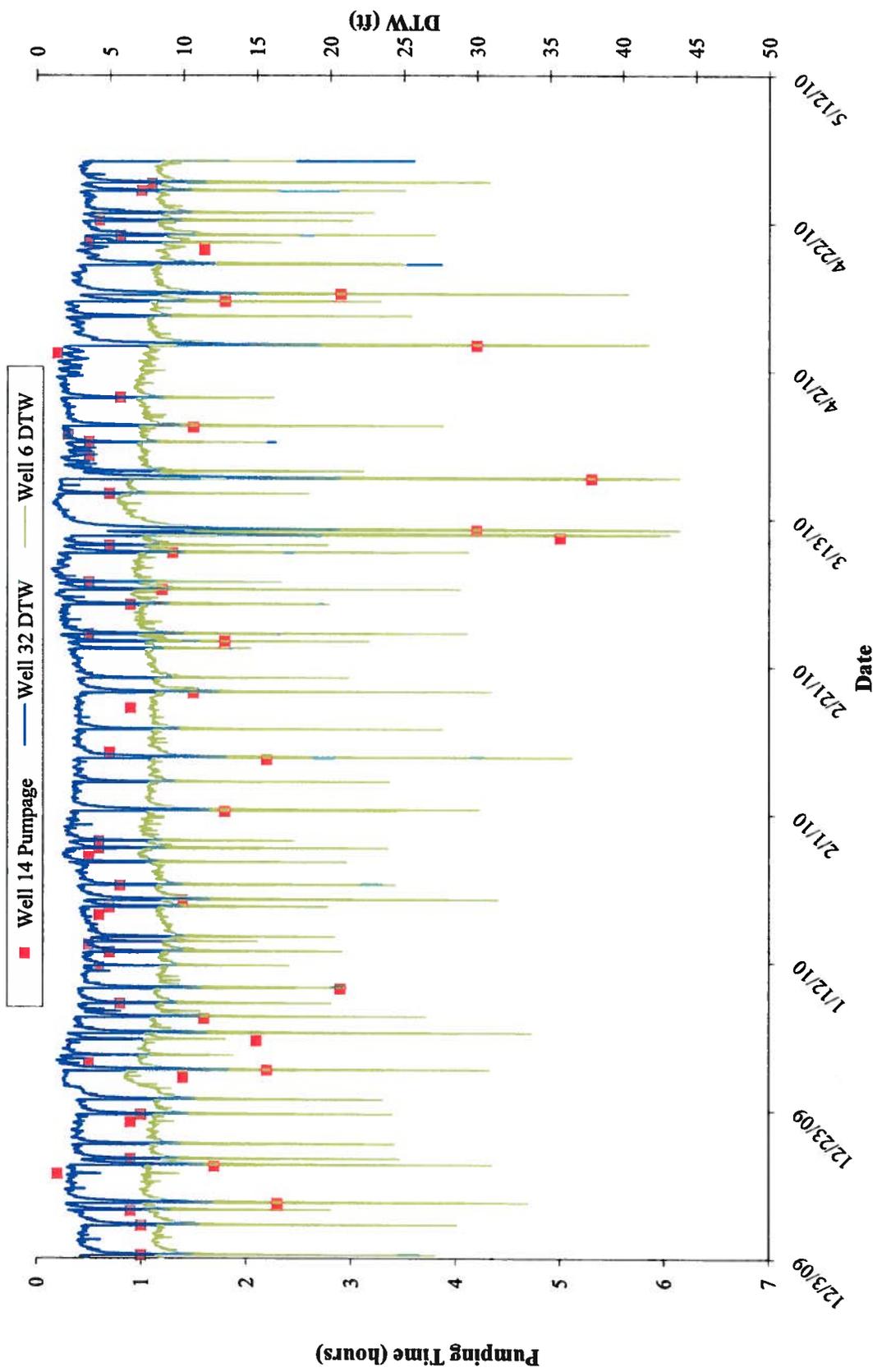


Figure 4. Well 14 Pumping and Drawdowns of Wells 6 and 32



APPENDIX A

SUMMARY TABLE OF FIELD PARAMETERS

Appendix A. Summary Table of Field Parameters

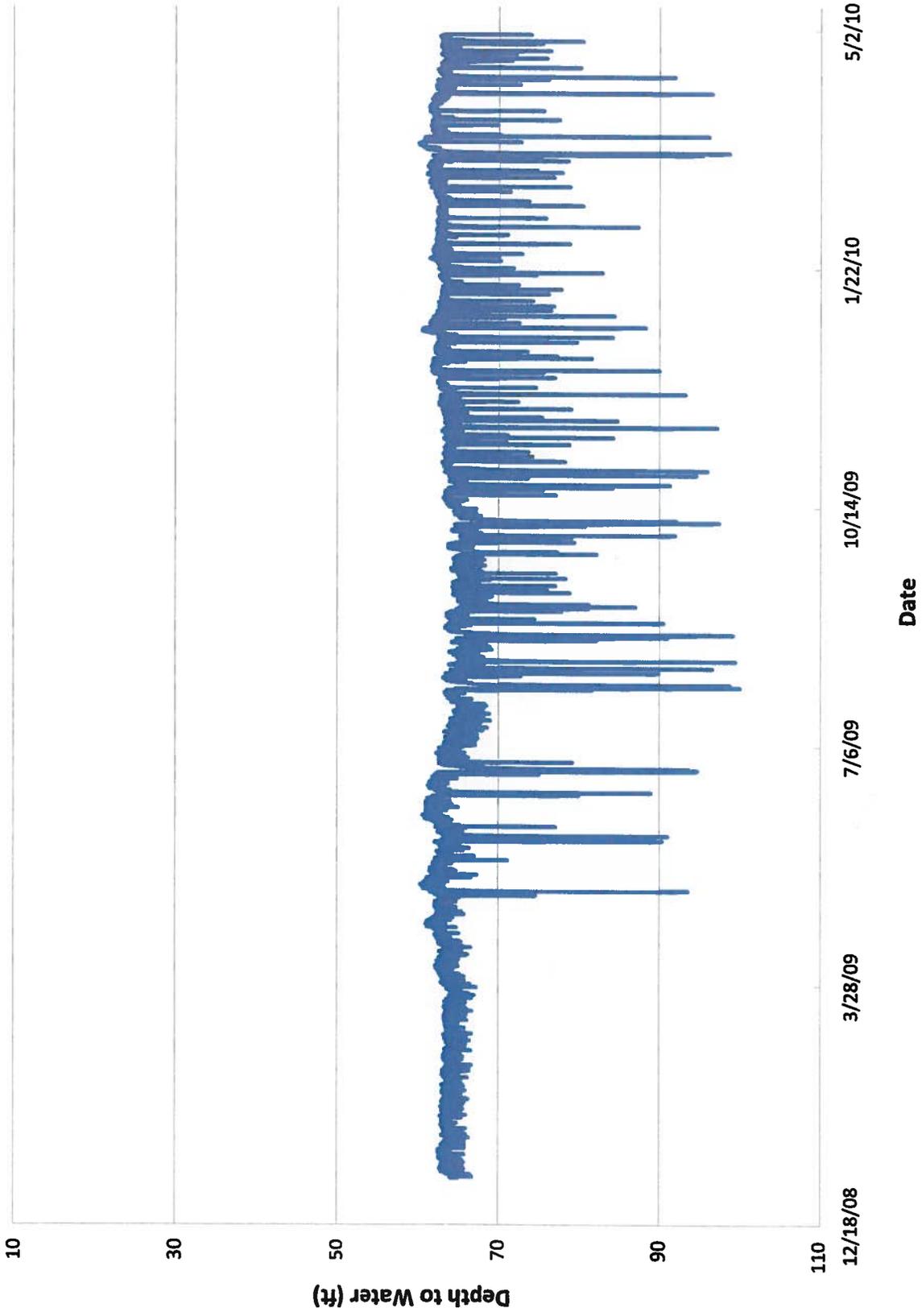
Date	1/9/09	8/9/09	8/26/09	10/6/09	10/29/09	11/17/09	12/28/09	1/29/10	2/24/10	3/24/10	4/30/10
Well ID											
pH (Standard Units)											
Well 4	6.79	7.8	7.93	8.17	7.84	7.6	7.66	*	*	*	7.24
Well 5	7.27	7.15	7.42	7.1	7.46	7.26	7.44	7.18	*	*	7
Well 6	6	7.7	7.77	7.61	7.96	7.68	7.86	*	*	*	7.33
Well 9	6.1	7.9	8.16	7.77	8.22	7.89	7.95	*	*	8.11	7.52
Well 12	7.71	7.54	7.37	7.53	7.54	7.23	7.47	*	*	7.27	7.08
Well 13	7.41	7.4	7.5	7.34	7.42	7.45	7.39	6.96	*	6.94	6.77
Well 32						7.6	7.61	*	*	7.18	7.09
Specific Conductance (µS)											
Well 4	420	288	524	365	424	321	335	*	*	*	466
Well 5	342	355	415	390	416	372	381	381	*	*	387
Well 6	315	271	322	295	290	281	279	*	*	*	282
Well 9	270	229	250	263	244	230	254	*	*	281	248
Well 12	311	286	260	290	277	247	269	*	*	322	278
Well 13	269	284	255	270	333	275	242	243	*	276	255
Well 32						234	236	*	*	259	270
Temperature (°C)											
Well 4	16	17.5	21.9	16.3	15.8	15.3	18.9	*	*	*	17.6
Well 5	13.3	19	21	17.8	15.8	16.1	17	14.2	*	*	18.8
Well 6	11	21	25.7	18.3	15.9	15.6	21.4	*	*	*	18.3
Well 9	11.4	24.5	23.1	19.6	16.9	16.9	17.4	*	*	18.2	18.3
Well 12	12.4	19.5	23.3	18.8	15.7	14.4	12.1	*	*	12.8	17.1
Well 13	13.3	21	23.2	19	16.3	14.7	10.8	10	*	13.7	17.3
Well 32						16.5	13.8	*	*	17.6	19
Turbidity (NTUs)											
Well 4	0.08	0.2	1.38	0.005	0.51	10.96	3.59	*	*	*	0.46
Well 5	0.01	0.55	0.77	2.84	0.46	8.47	0	0.03	*	*	2.73
Well 6	0	0.89	0.6	0.61	0.16	10.33	0	*	*	*	0.24
Well 9	1.23	1.82	0.45	0.64	1.09	15.23	0.18	*	*	1.64	1.28
Well 12	0.01	0.21	4.5	0.59	0.21	14.22	0.01	*	*	0.71	3.78
Well 13	0.06	0.83	0.75	0.86	0.17	15.62	0	0	*	2.49	0.7
Well 32						15.92	0	*	*	5.29	0.83

Note: *: Outdoor spigots were shut off because of freezing weather. No sample was collected.

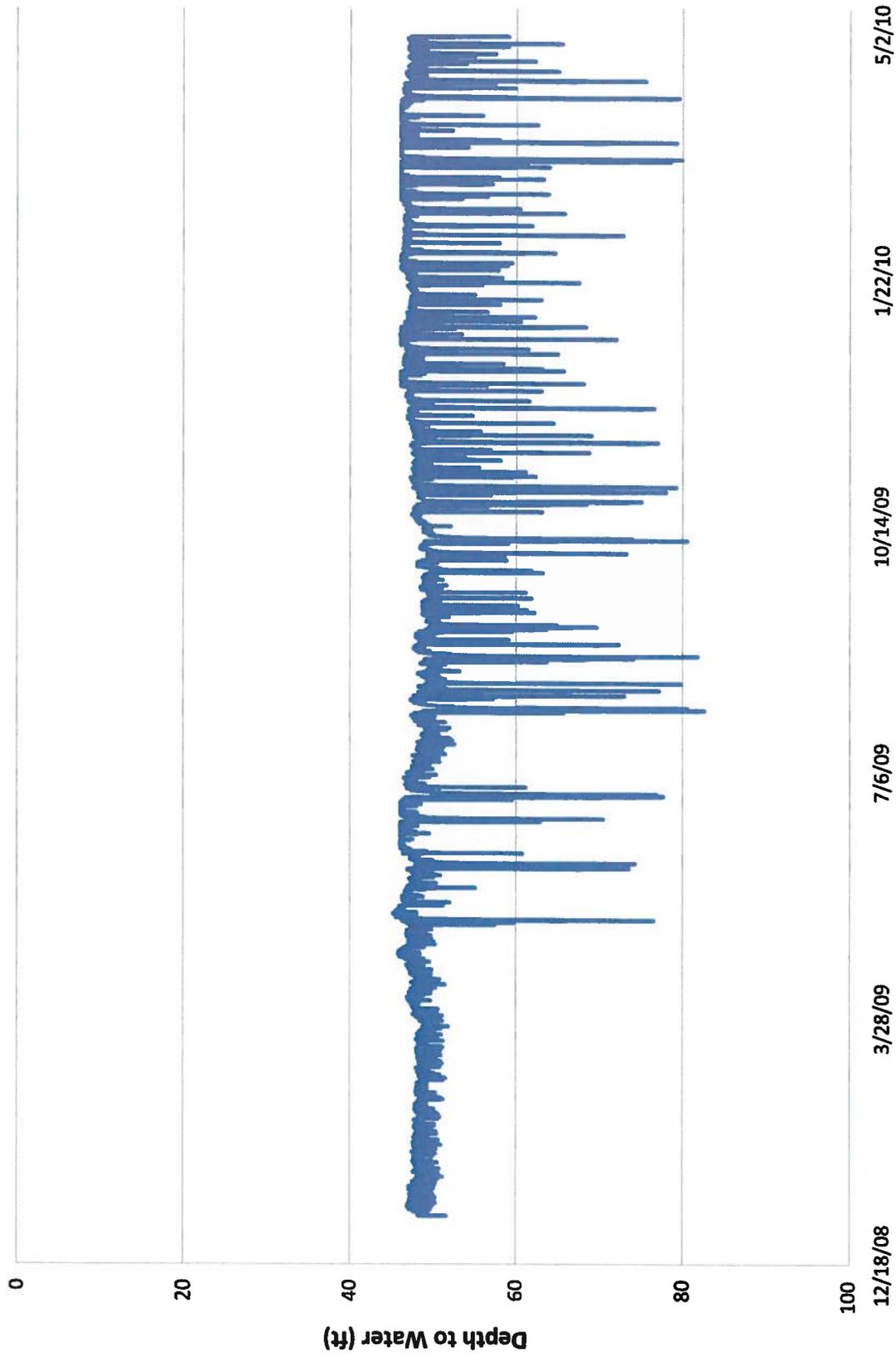
APPENDIX B

WATER LEVEL GRAPHS FOR INDIVIDUAL WELLS

Well 4. Depth to Water



Well 5. Depth to Water

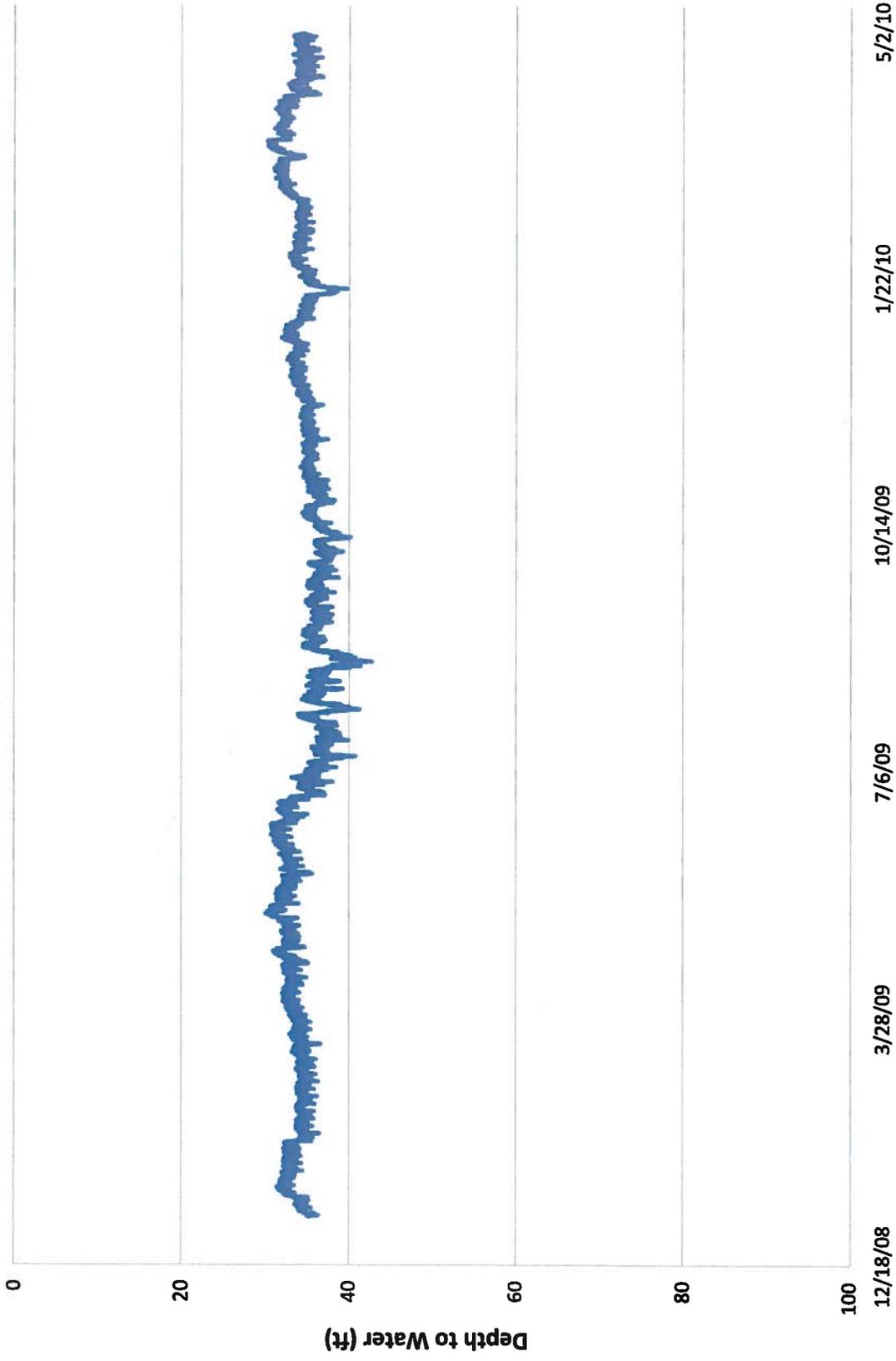


Well 6. Depth to Water



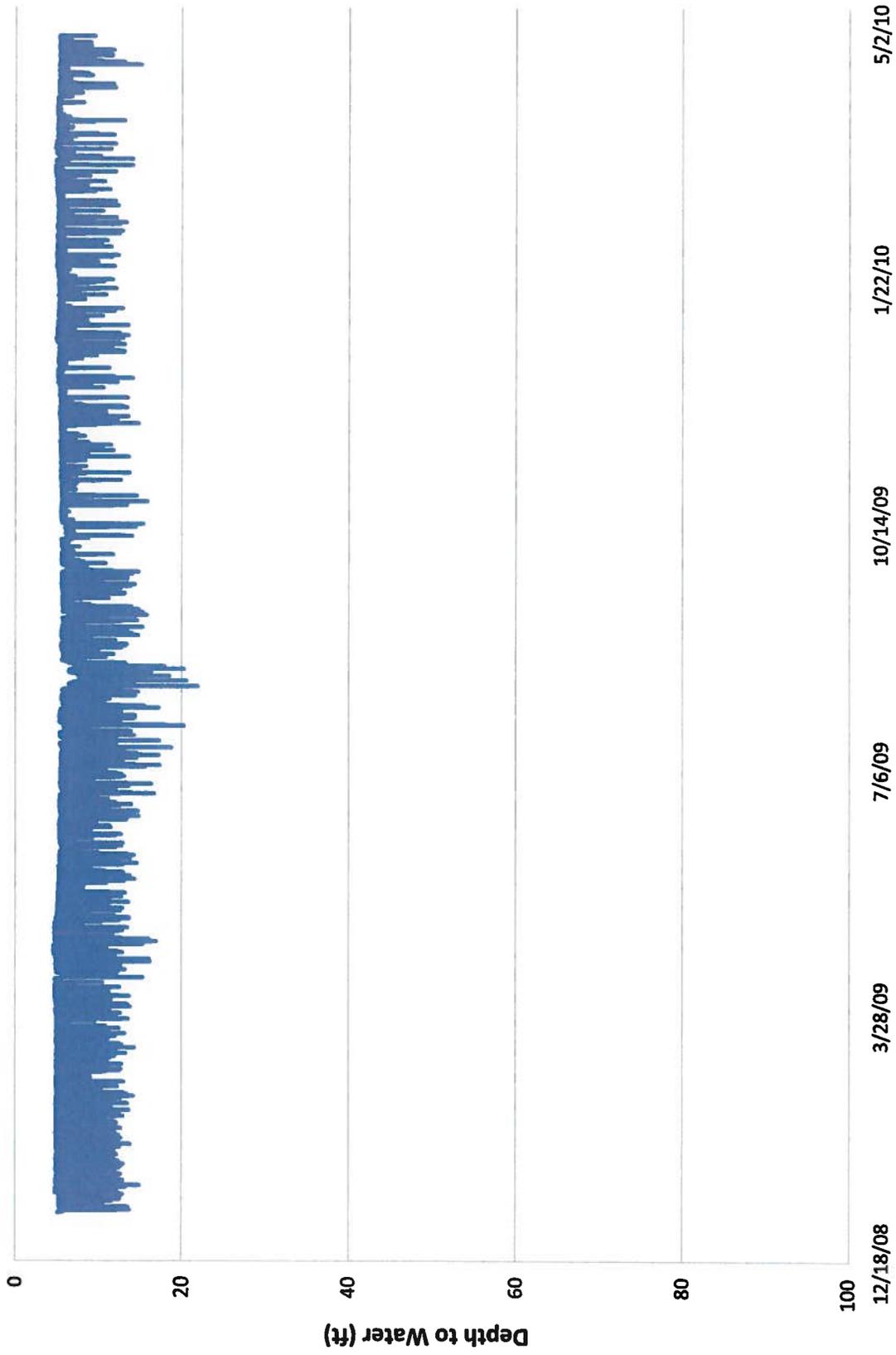
Date

Well 9. Depth to Water



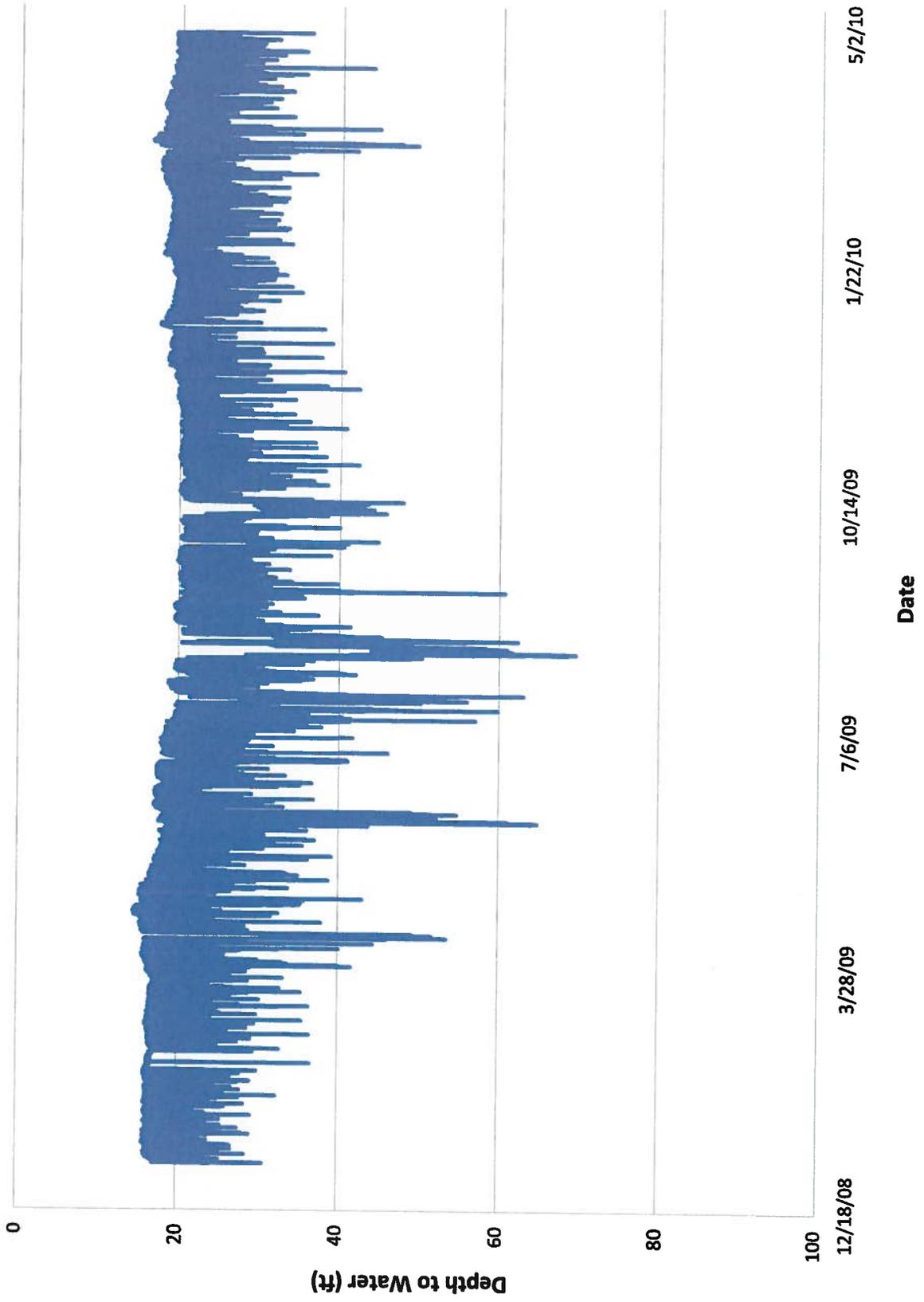
Date

Well 12. Depth to Water

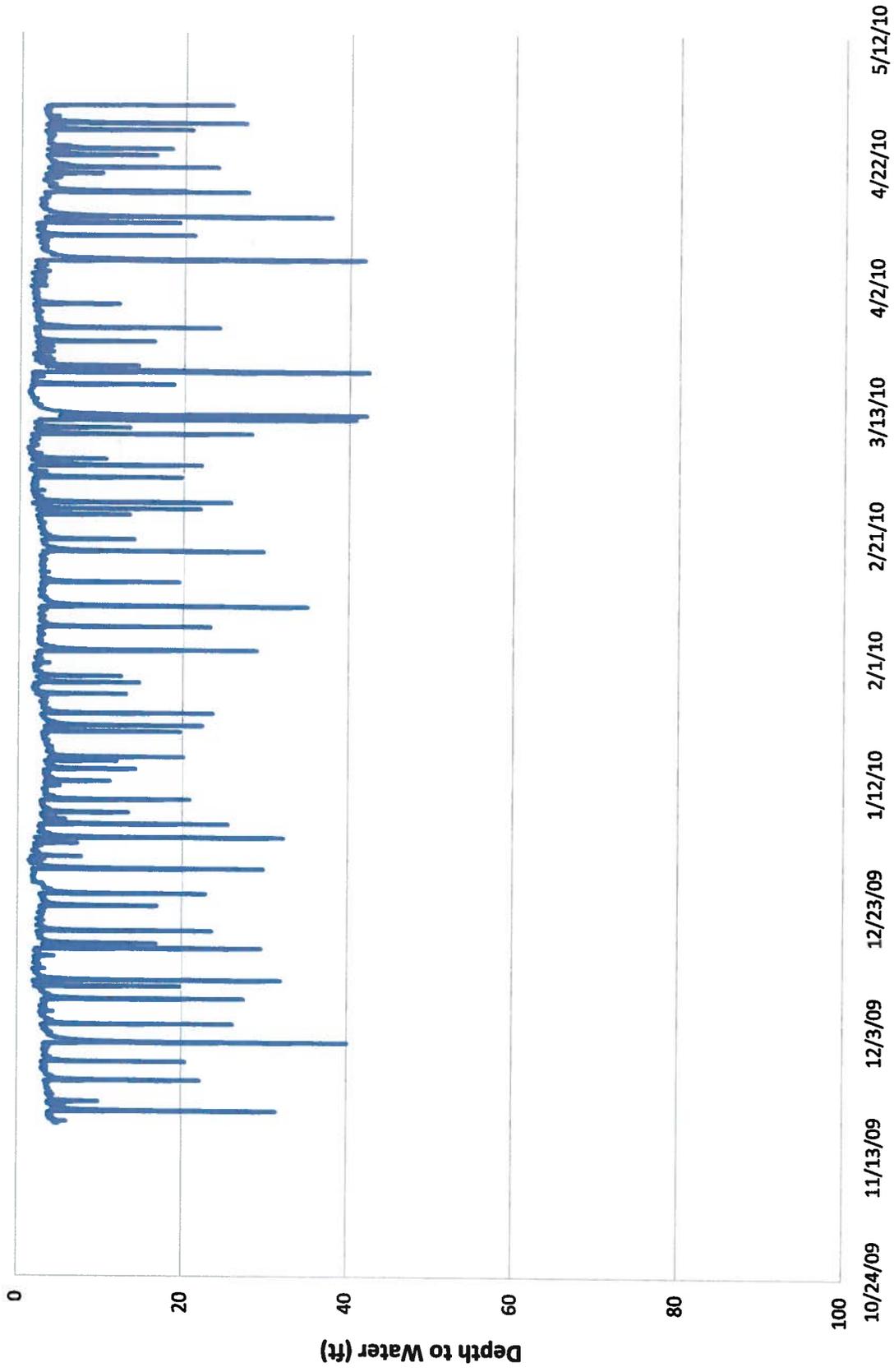


Date

Well 13. Depth to Water



Well 32. Depth to Water



Date

APPENDIX C

WELL #14 PUMPING DATA

APPENDIX C. Well 14 Pumping Data

Well 14			
Date & Time¹	Hours	Gallons	gpm²
10/7/2009 9:00	2.5	38,000	253
10/8/2009 9:00	1.8	31,700	294
10/19/2009 9:00	0.9	15,000	278
10/21/2009 9:00	0.6	9,500	264
10/23/2009 9:00	3.1	51,900	279
10/27/2009 9:00	0.5	8,400	280
10/28/2009 9:00	3.5	56,200	268
10/29/2009 9:00	3.3	53,900	272
10/30/2009 9:00	1.5	23,200	258
11/2/2009 9:00	1.2	20,300	282
11/3/2009 9:00	0.4	7,600	317
11/4/2009 9:00	0.8	13,600	283
11/8/2009 9:00	0.6	9,300	258
11/10/2009 9:00	0.5	8,100	270
11/12/2009 9:00	0.9	14,400	267
11/13/2009 9:00	0.5	8,700	290
11/16/2009 9:00	0.6	10,300	286
11/17/2009 9:00	4	63,900	266
11/19/2009 9:00	1.4	18,700	223
11/20/2009 9:00	1.7	28,100	275
11/21/2009 9:00	0.5	7,700	257
11/24/2009 9:00	1	17,900	298
11/30/2009 9:00	5.9	65,700	186
12/3/2009 9:00	1	16,600	277
12/7/2009 9:00	1	18,000	300
12/9/2009 9:00	0.9	14,200	263
12/10/2009 9:00	2.3	38,400	278
12/14/2009 9:00	0.2	2,600	217
12/15/2009 9:00	1.7	28,500	279
12/16/2009 9:00	0.9	14,600	270
12/21/2009 9:00	0.9	14,600	270
12/22/2009 9:00	1	17,000	283
12/27/2009 9:00	1.4	23,100	275
12/28/2009 9:00	2.2	36,500	277
12/29/2009 9:00	0.5	7,400	247
1/1/2010 9:00	2.1	36,200	287
1/4/2010 9:00	1.6	26,100	272
1/6/2010 9:00	0.8	12,300	256
1/8/2010 9:00	2.9	18,700	107
1/11/2010 9:00	0.6	9,800	272
1/13/2010 9:00	0.7	12,800	305

Notes

1: Time is estimated.

2: gpm = gallons per minute

APPENDIX C. Well 14 Pumping Data

Date & Time¹	Hours	Gallons	gpm²
1/14/2010 9:00	0.5	7,700	257
1/18/2010 9:00	0.6	10,100	281
1/19/2010 9:00	0.7	12,000	286
1/20/2010 9:00	1.4	23,200	276
1/22/2010 9:00	0.8	12,500	260
1/26/2010 9:00	0.5	9,500	317
1/27/2010 9:00	0.6	10,000	278
1/28/2010 9:00	0.6	9,000	250
2/1/2010 9:00	1.8	30,100	279
2/8/2010 9:00	2.2	36,300	275
2/9/2010 9:00	0.7	11,800	281
2/15/2010 9:00	0.9	14,800	274
2/17/2010 9:00	1.5	24,200	269
2/24/2010 9:00	1.8	30,300	281
2/25/2010 9:00	0.5	8,800	293
3/1/2010 9:00	0.9	14,700	272
3/3/2010 9:00	1.2	18,800	261
3/4/2010 9:00	0.5	10,000	333
3/8/2010 9:00	1.3	20,900	268
3/9/2010 9:00	0.7	11,600	276
3/10/2010 9:00	5	81,200	271
3/11/2010 9:00	4.2	66,800	265
3/16/2010 9:00	0.7	13,000	310
3/18/2010 9:00	5.3	84,700	266
3/21/2010 9:00	0.5	9,400	313
3/23/2010 9:00	0.5	8,800	293
3/24/2010 9:00	0.3	3,800	211
3/25/2010 9:00	1.5	17,700	197
3/29/2010 9:00	0.8	12,500	260
4/4/2010 9:00	0.2	3,600	300
4/5/2010 9:00	4.2	67,800	269
4/11/2010 9:00	1.8	30,000	278
4/12/2010 9:00	2.9	47,700	274
4/18/2010 9:00	1.6	25,900	270
4/19/2010 9:00	0.5	8,900	297
4/20/2010 9:00	0.8	12,800	267
4/22/2010 9:00	0.6	10,900	303
4/26/2010 9:00	1	16,000	267
4/27/2010 9:00	1.1	19,700	298

APPENDIX D
ELECTRONIC MONITORING DATA

