Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

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Hazardous Waste Bureau

Mr. John E. Kieling, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Bldg. 1
Santa Fe, New Mexico 87505-6303

Subject: Transmittal of the Waste Isolation Pilot Plant May 2015 Semi-Annual Groundwater Surface Elevation Report

Dear Mr. Kieling:

The purpose of this letter is to submit the Waste Isolation Pilot Plant May 2015 Semi-Annual Groundwater Surface Elevation Report. This report is required by Part 5, Section 5.10.2.2. of the Hazardous Waste Facility Permit No. NM4890139088-TSDF.

We certify under penalty of law that this document and all attachments were prepared under our direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations

If you have any questions regarding this data transmittal, please contact Mr. George T. Basabilvazo at (575) 234-7488.

Sincerely,

Jose R. Franco, Manager
Carlsbad Field Office

Robert L. McQuinn, Project Manager
Nuclear Waste Partnership LLC

Enclosures (2)

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UNITED STATES DEPARTMENT OF ENERGY

WASTE ISOLATION PILOT PLANT

CARLSBAD, NEW MEXICO

Semi-Annual Groundwater Surface Elevation Report

WLMP Data Collection, September 2014 – February 2015

SUBMITTED TO THE

NEW MEXICO ENVIRONMENT DEPARTMENT

May 2015

This report has been reviewed and approved by:

___~~Signature on File~~_____ _____

R. A. Salness, Mgr. EM&H Date

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1.0 Introduction

The Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit) of 1996 specified creation of a Detection Monitoring Program (DMP) to demonstrate compliance with the environmental performance standard for the Underground Hazardous Waste Disposal Units (HWDUs).

The DMP is used to establish background ground water quality and quantity through a variety of compliance-monitoring parameters. Compliance-monitoring parameters relevant to this report include: (i) Culebra ground-water composition and (ii) change in Cuelbra ground water flow, as manifested through Cuelbra water levels. The DMP consists of six Detection Monitoring Wells (DMWs) located hydraulically upgradient and at the downgradient point of compliance of the WIPP Underground HWDUs.

In addition to the six DMWs, there are 43 additional wells within the WIPP land withdrawal area used to monitor ground water and pressure density (Table 1). As shown in Figure 1, 49 of the wells are completed in the Culebra Member (Culebra) of the Rustler Formation (Rustler). This is primarily because the Culebra is the most transmissive hydrologic unit within the WIPP boundary and therefore considered the most significant potential hydrologic pathway for a radiologic release to the accessible environment. The transmissivity of the Culebra varies spatially over ten orders of magnitude from east to west in the vicinity of the WIPP site. Transmissivities have been calculated at 1.00E-07 ft^2/d (1.00E-13 m^2/s) at well SNL-15 east of the WIPP site to 1.00E-03 ft^2/d (1.00E-03 m^2/s) at well H-7 in Nash Draw (see Amended Renewal Application Addendum L1, section L1-2a(3)(a)(ii) (DOE, 2009)).

Figure 1 shows the ground water monitoring wells. The three upgradient wells (WQSP-1, WQSP-2, and WQSP-3) are located directly upgradient of the WIPP site and were sited to provide data on ground-water flow downgradient onto the WIPP site. Wells WQSP-4, WQSP-5, and WQSP-6 are located downgradient of the WIPPs to provide data on ground-water flow leaving the region of the site. The regional flow direction of ground water in the Culebra is generally to the south. Measurements of water table elevation are made monthly on 59 wells whereas 73 wells are measured quarterly.

Part 5.10.2.2 and Attachment L, Section L-5c of the Permit requires a Semiannual Groundwater Surface Elevation Report by May 31 and an annual report by November 30 of each year. Of the 132 wells that are routinely monitored, only the Culebra monitoring wells must be reported upon in the semi-annual and annual groundwater reports. This, the first of the two reports, focusses on ground-water surface elevations, fluid densities and the resulting fresh-water heads calculated from field measurements in the Detection Monitoring Well (DMW) network. The reporting period covered by this semiannual report is September 1, 2014 through February 28, 2015. Analytical results and statistical analyses, including changes in DMW water levels greater than two feet for the calendar year and a potentiometric surface map will be presented in the annual ground water report due in November.

2.0 Summary of Groundwater Activities

Permit-required groundwater monitoring activities include groundwater quality sampling, groundwater level monitoring, and the pressure-density survey. Supporting activities during this reporting period included well drilling, maintenance, plugging and abandonment, and reference elevation surveys. Table 1 is a list of the active Culebra wells monitored through February 2015.

Monthly groundwater level data and yearly pressure density data were gathered from the 43 Culebra wells across the WIPP region. Well C-2737 is equipped with a production-injection packer (PIP) to allow groundwater level surveillance of different hydrologic zones within the same well. The six redundant wells on the H-19 pad are measured quarterly for groundwater level and annually for fluid density. Groundwater levels were not taken where access was poor, or in certain wells when testing equipment was present, blocking access to the well.

Table 1 - Culebra Wells Monitored September 2014 - February 2015

AEC-7R*	C-2737[A]	ERDA-9	H-02b2	H-03b2	H-04bR	H-05b
H-06bR	H-07b1	H-09bR	H-10c	H-11b4R	H-12R*	H-15R
H-16	H-17	H-19b0	H-19b2[1]	H-19b3[1]	H-19b4[1]	H-19b5[1]
H-19b6[1]	H-19b7[1]	I-461	SNL-01	SNL-02	SNL-03	SNL-05
SNL-06	SNL-08	SNL-09	SNL-10	SNL-12	SNL-13	SNL-14
SNL-15	SNL-16	SNL-17	SNL-18	SNL-19	WIPP-11	WIPP-13
WIPP-19	WQSP-1[ss]	WQSP-2[ss]	WQSP-3[ss]	WQSP-4[ss]	WQSP-5[ss]	WQSP-6[ss]

* Well survey information and development activities have not been completed
[A] Well C-2737 is equipped with a production-injection packer
1: Redundant wells on H-19 pad, measured quarterly
ss Detection Monitoring Wells

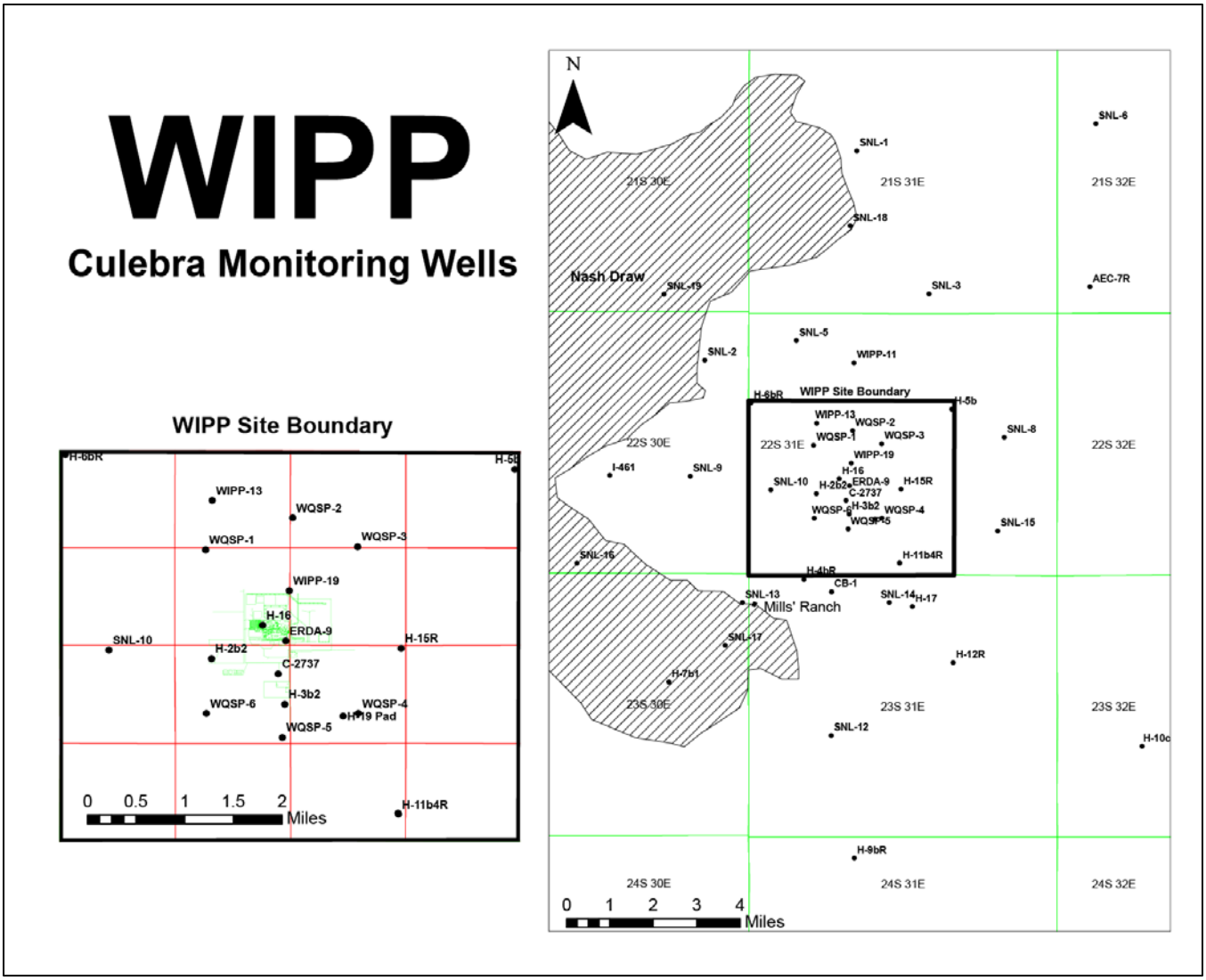


Figure 1 - Culebra Monitoring Wells

2.1 Plugging and Abandonment, Drilling, and Well Maintenance

Well H-12 was plugged and abandoned due to its deteriorating condition and replaced by H-12R in September. The total depth of the drill hole was 865 feet below ground surface with the screened interval in the Culebra at 846 - 821.5 feet below ground surface. Figure 2 shows the completion diagram for the new well.

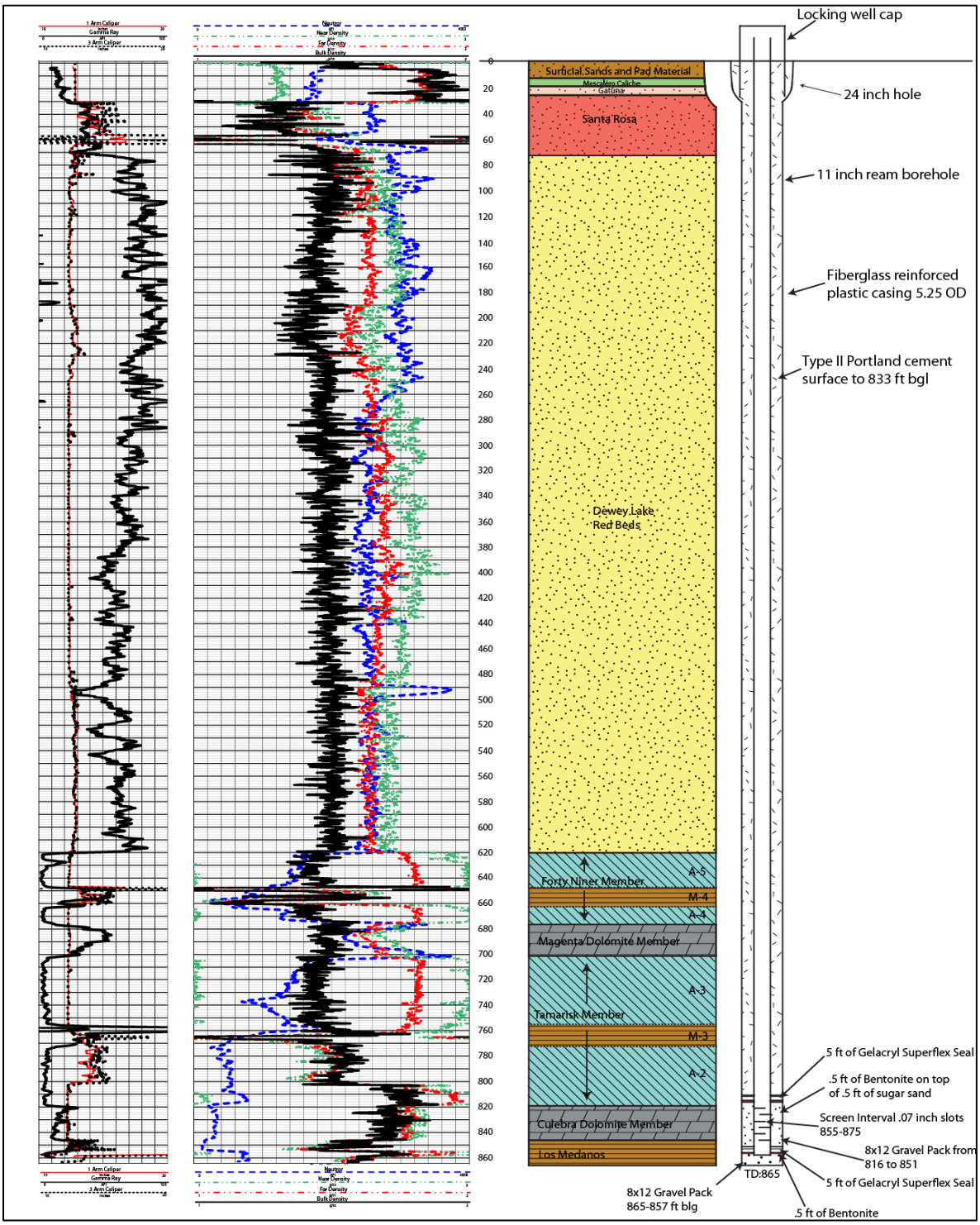


Figure 2: H-12R Completion Diagram. Only depths are to scale.

3.0 Fluid Density Survey

Around the WIPP facility, spatially variable total dissolved solids (TDS) result in spatial variability in groundwater fluid density. The densities of well-bore fluids in Culebra monitoring wells are measured in order to adjust groundwater levels to their equivalent freshwater head values. This allows more accurate determination of relative heads between wells. In 2014, fluid densities were derived from 50 wells, as shown in Table 2. The 2014 densities are used for freshwater head calculations in 2015 therefore are only applicable to January and February. See the 2013 Average Calculated Density column in Table 2 for September through December calculations.

Prior to 2007 fluid density was determined using a mobile trailer-mounted system that obtained data at each well. After 2007 Sandia National Laboratories (SNL) installed a dedicated pressure transducer in each well. This approach employs several calibrated pressure measuring transducers dedicated to given wells at varying times during the year. For the DMP wells (the six WQSP wells in Table 1), field hydrometer measurements are used. Fluid densities have been adjusted to 70°F since 2009, when it was determined that was the average Culebra water temperature.

Data from previous years are also shown in Table 2 for comparison, which shows the largest density change of 0.066 g/cc occurring in H-12. When historical fluid densities are plotted back to the beginning of SNL continuous measurements in 2007, there is no clear evidence of a trend between years. In general, wells to the south and west (i.e. H-09bR and SNL-16) of the WIPP facility tend to have lower fluid densities compared to eastern wells (i.e. H-12R and SNL-15).

Table 2 – Fluid Density Survey Results for 2012-2014

	2012 Fluid Density Survey Result	2012 Conversion to Specific Gravity at 70° F	2013 Fluid Density Survey Result	2013 Conversion to Specific Gravity at 70° F	2014 Fluid Density Survey Result	2014 Conversion to Specific Gravity at 70^0 F	Notes for 2012-2014 Fluid Density Survey
Well	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	
AEC-7	1.065	1.067	1.066	1.068	NA	NA	Plugged August 2013
C-2737	1.021	1.023	1.021	1.023	1.022	1.024	
ERDA-9	1.071	1.073	1.069	1.071	1.070	1.072	
H-02b2	1.010	1.012	1.011	1.013	1.010	1.012	
H-03b2	1.034	1.036	1.030	1.032	1.025	1.027	
H-04bR	1.015	1.017	1.015	1.017	1.025	1.027	
H-05b	1.093	1.095	1.090	1.092	1.087	1.089	
H-06bR	1.036	1.038	1.037	1.039	1.036	1.038	
H-07b1	1.005	1.007	1.005	1.007	1.007	1.009	
H-9bR	1.000*	1.000*	0.999	1.001	1.002	1.004	* Rounded up to 1.000 for 2012
H-10c	1.092	1.094	1.093	1.095	1.094	1.096	
H-11b4R	1.074	1.076	1.074	1.076	1.075	1.077	
H-12	1.111	1.113	1.106	1.108	1.040	1.042	
H-15R	1.116	1.118	1.116	1.118	1.116	1.118	
H-16	1.035	1.037	1.034	1.036	1.033	1.035	
H-17	1.131	1.133	1.131	1.133	1.132	1.134	
H-19b0	1.064	1.066	1.064	1.066	1.065	1.067	
H-19b2	1.060	1.062	1.066	1.068	1.066	1.068	
H-19b3	1.064	1.066	1.064	1.066	1.064	1.066	

	2012 Fluid Density Survey Result	2012 Conversion to Specific Gravity at 70° F	2013 Fluid Density Survey Result	2013 Conversion to Specific Gravity at 70° F	2014 Fluid Density Survey Result	2014 Conversion to Specific Gravity at 70^0 F	Notes for 2012-2014 Fluid Density Survey
Well	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	**Density (g/cc)**	
H-19b4	1.065	1.067	1.064	1.066	1.064	1.066	
H-19b5	1.067	1.069	1.067	1.069	1.067	1.069	
H-19b6	1.068	1.070	1.068	1.070	1.068	1.070	
H-19b7	1.070	1.072	1.068	1.070	1.068	1.070	
I-461	1.000*	1.000*	1.000*	1.000*	1.000*	1.000*	* Rounded up to 1.000 for 2011-2014
SNL-01	1.027	1.029	1.028	1.030	1.028	1.030	
SNL-02	1.007	1.009	1.007	1.009	1.008	1.010	
SNL-03	1.026	1.028	1.026	1.028	1.025	1.027	
SNL-05	1.007	1.009	1.007	1.009	1.006	1.008	
SNL-06	1.241	1.243	1.241	1.243	1.244	1.246	
SNL-08	1.092	1.094	1.093	1.095	1.093	1.095	
SNL-09	1.016	1.018	1.016	1.018	1.016	1.018	
SNL-10	1.007	1.009	1.008	1.010	1.008	1.010	
SNL-12	1.004	1.006	1.004	1.006	1.005	1.007	
SNL-13	1.016	1.018	1.015	1.017	1.020	1.022	
SNL-14	1.044	1.046	1.044	1.046	1.044	1.046	
SNL-15	1.227	1.229	1.227	1.229	1.228	1.230	
SNL-16	1.007	1.009	1.006	1.008	1.010	1.012	
SNL-17	1.003	1.005	1.003	1.005	1.005	1.007	
SNL-18	1.003	1.005	1.007	1.009	1.007	1.009	
SNL-19	1.005	1.007	1.005	1.007	1.004	1.006	
WIPP-11	1.036	1.038	1.036	1.038	1.036	1.038	
WIPP-13	1.039	1.041	1.038	1.040	1.035	1.037	
WIPP-19	1.050	1.052	1.050	1.052	1.051	1.053	
WQSP-1	1.049	1.051	1.047	1.049	1.048	1.050	Average Round 36, field hydrometer
WQSP-2	1.046	1.048	1.045	1.047	1.045	1.047	Average Round 36, field hydrometer
WQSP-3	1.145	1.147	1.146	1.148	1.144	1.146	Average Round 36, field hydrometer
WQSP-4	1.075	1.077	1.074	1.076	1.074	1.076	Average Round 36, field hydrometer
WQSP-5	1.025	1.027	1.025	1.027	1.025	1.027	Average Round 36, field hydrometer
WQSP-6	1.013	1.015	1.013	1.015	1.015	1.017	Average Round 36, field hydrometer

4.0 Groundwater Level Trends

Over the last year (February 2014-February 2015) Culebra groundwater levels with naturally occurring changes have generally been stable across the monitoring region. A major increase in water level can be seen in various wells (H-6bR, IMC-461, SNL-2, SNL-9, SNL-10, SNL-16, SNL-19) during September due to large rain events totaling 11.48 inches. SNL-16 experienced the largest change with an initial rise of 8.02 feet, but then began to stabilize leading to a total rise of 6.37 over the reporting period (Appendix1).

Well H-16 has shown a trend of drawdown and recovery cycles each year since it was reconfigured to a Culebra only well in 2008. This may be attributed to its close proximity to the WIPP Air Intake Shaft (AIS). The water level decrease has started in the winter months and the well recovers by mid spring each year.

4.1 Pumping/Testing and Other Activities that Impacted Culebra Water Levels

The majority of wells within the monitoring network have seen a large decrease in water level due to pumping at Mills Ranch. The resulting changes are considered un-natural and the resulting anthropogenic decreases make natural trends extremely difficult to track. H-4bR was impacted the most with over a 4.66-foot decrease and changes are being seen as far north as SNL-9 (Figure 1). H-7b1 was affected by pumping on a BLM well located on the same pad.

Hydrographs

The annotated hydrographs as required by the Permit are included in Appendix 1. New wells AEC-7R and H-12R do not have a hydrograph since the reference elevation for the top of casing is not complete.

Groundwater Level Data

Groundwater data and equivalent freshwater heads recorded for this reporting period are in Appendix 2.

5.0 References

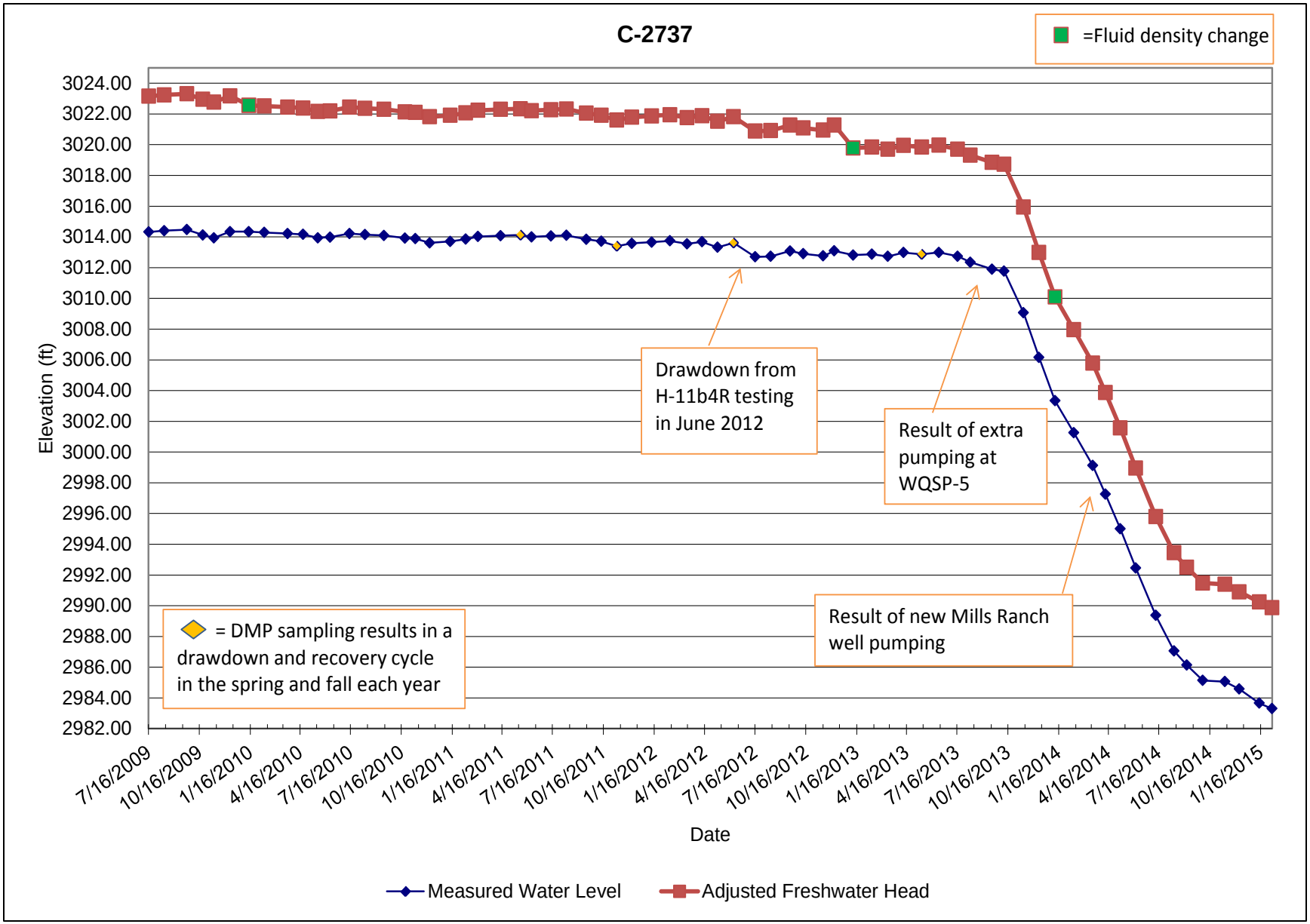
NM4890139088-TSDF. 2012. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*. New Mexico Environment Department, Santa Fe, New Mexico.

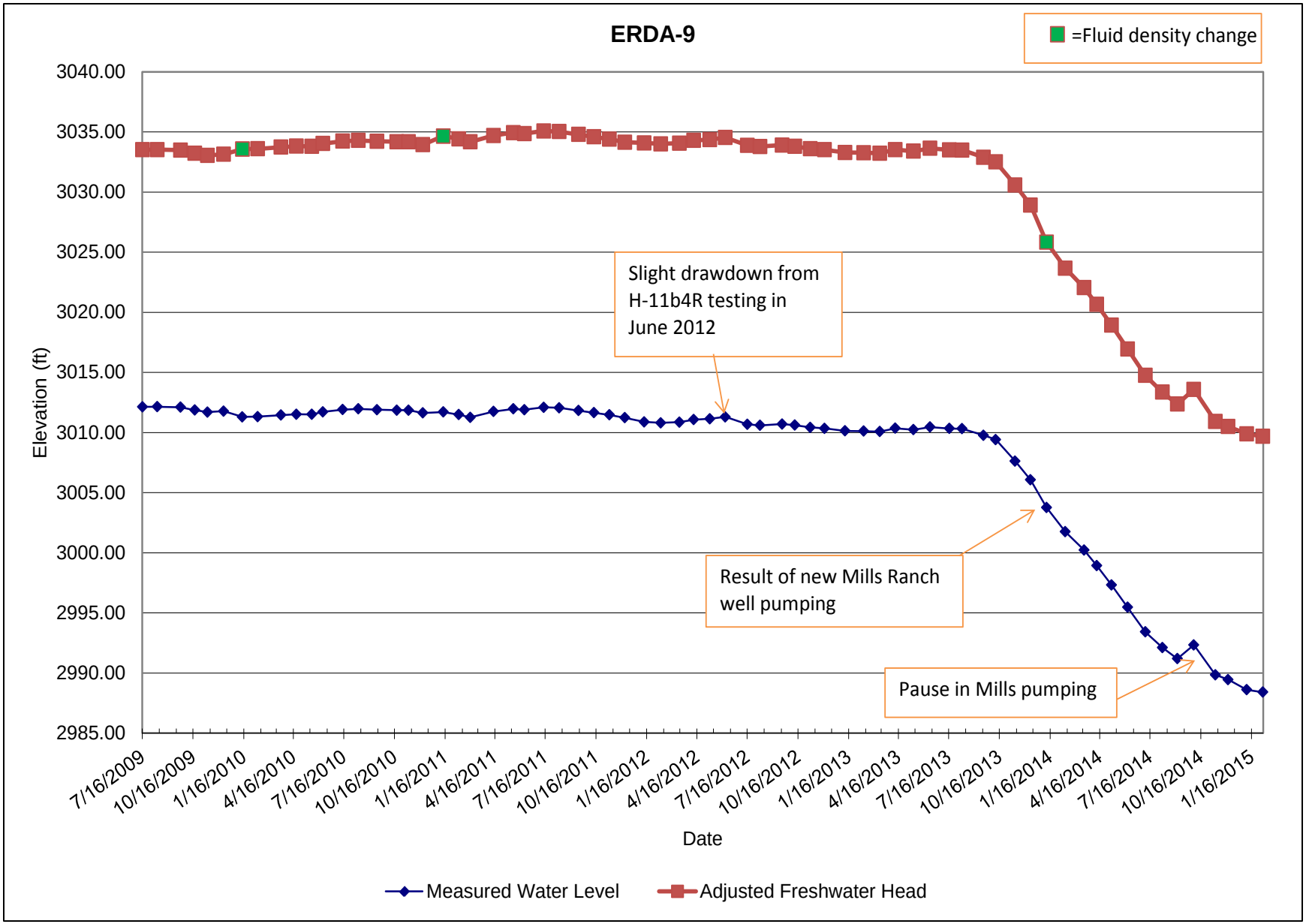
U.S. Department of Energy (DOE). 2009. *WIPP Hazardous Waste Facility Permit Amended Renewal Application*. Carlsbad, New Mexico.

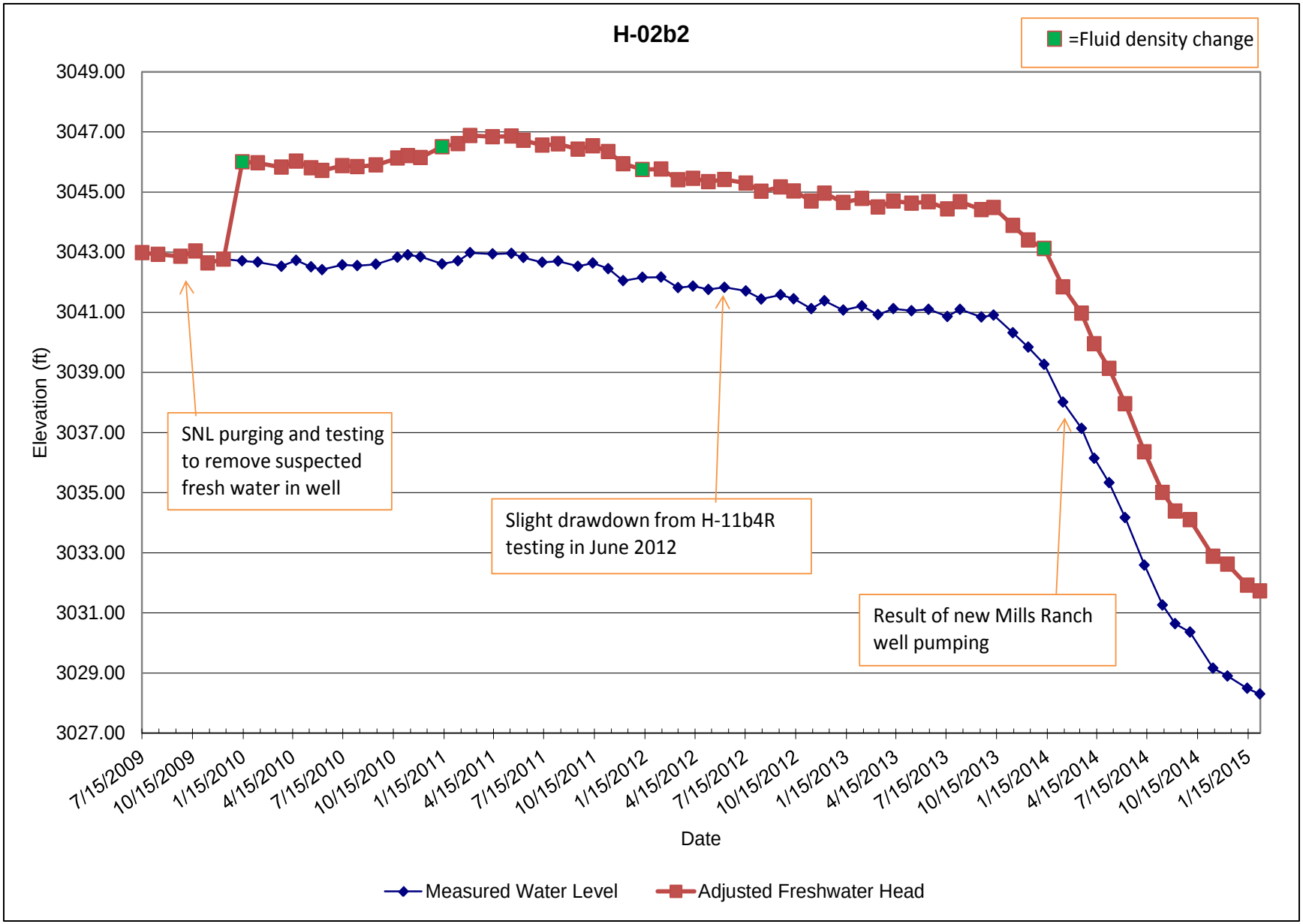
Appendix 1

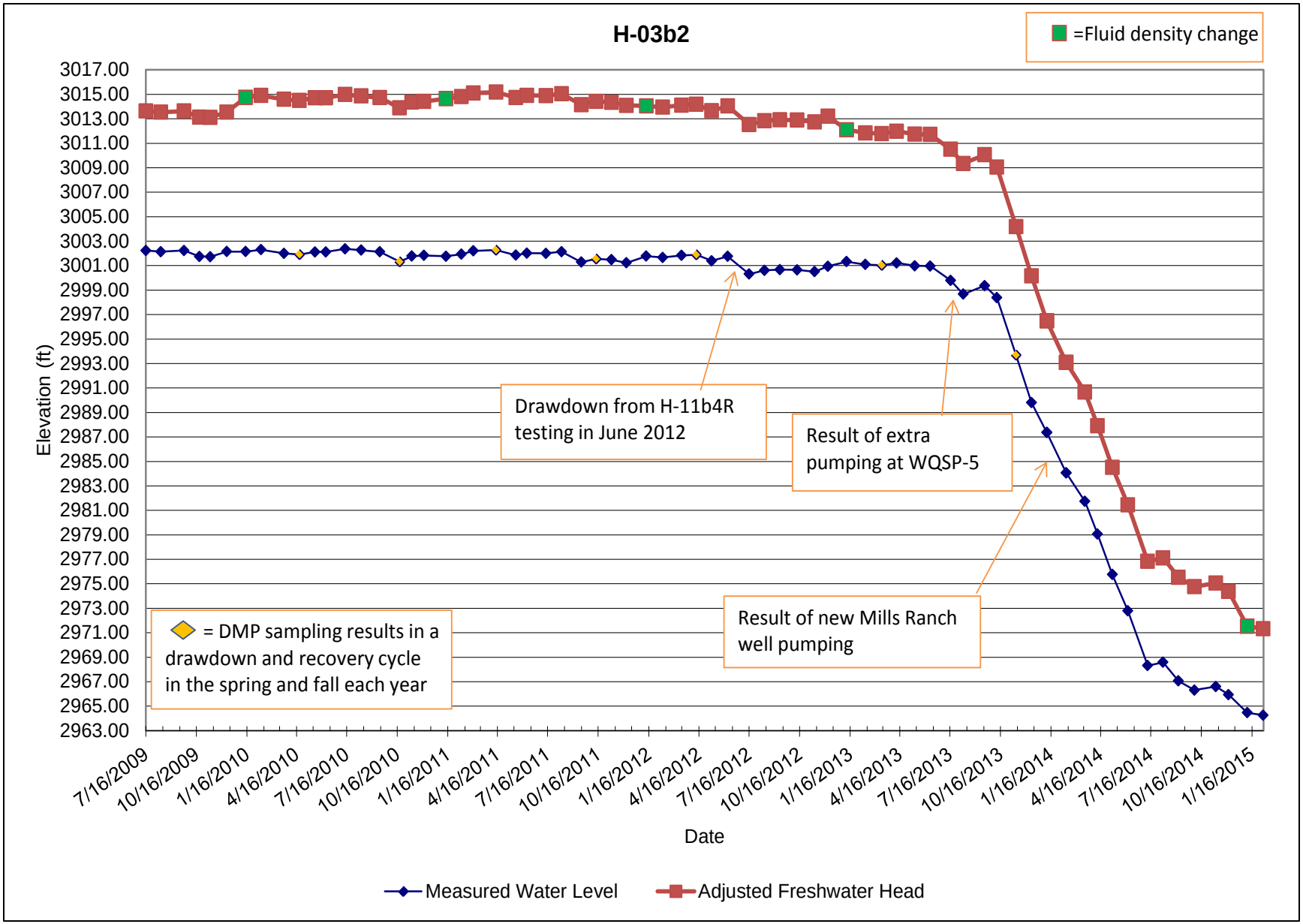
Annotated Hydrographs

Note: There are no graphs for AEC-7R or H-12R due to the lack of survey data and the ongoing development process.


C-2737
=Fluid density change
Elevation (ft)
3024.00
3022.00
3020.00
3018.00
3016.00
3014.00
3012.00
3010.00
3008.00
3006.00
3004.00
3002.00
3000.00
2998.00
2996.00
2994.00
2992.00
2990.00
2988.00
2986.00
2984.00
2982.00
Drawdown from H-11b4R testing in June 2012
Result of extra pumping at WQSP-5
Result of new Mills Ranch well pumping
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
4/16/2013
7/16/2013
10/16/2013
1/16/2014
4/16/2014
7/16/2014
10/16/2014
1/16/2015
Date
Measured Water Level
Adjusted Freshwater Head


ERDA-9
=Fluid density change
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
Elevation (ft)
Slight drawdown from H-11b4R testing in June 2012
Result of new Mills Ranch well pumping
Pause in Mills pumping
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
4/16/2013
7/16/2013
10/16/2013
1/16/2014
4/16/2014
7/16/2014
10/16/2014
1/16/2015
Date
Measured Water Level
Adjusted Freshwater Head


H-02b2
=Fluid density change
3049.00
3047.00
3045.00
3043.00
3041.00
3039.00
3037.00
3035.00
3033.00
3031.00
3029.00
3027.00
Elevation (ft)
SNL purging and testing to remove suspected fresh water in well
Slight drawdown from H-11b4R testing in June 2012
Result of new Mills Ranch well pumping
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
4/15/2013
7/15/2013
10/15/2013
1/15/2014
4/15/2014
7/15/2014
10/15/2014
1/15/2015
Date
Measured Water Level
Adjusted Freshwater Head


H-03b2
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Elevation (ft)
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3015.00
3013.00
3011.00
3009.00
3007.00
3005.00
3003.00
3001.00
2999.00
2997.00
2995.00
2993.00
2991.00
2989.00
2987.00
2985.00
2983.00
2981.00
2979.00
2977.00
2975.00
2973.00
2971.00
2969.00
2967.00
2965.00
2963.00
Drawdown from H-11b4R testing in June 2012
Result of extra pumping at WQSP-5
Result of new Mills Ranch well pumping
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
4/16/2013
7/16/2013
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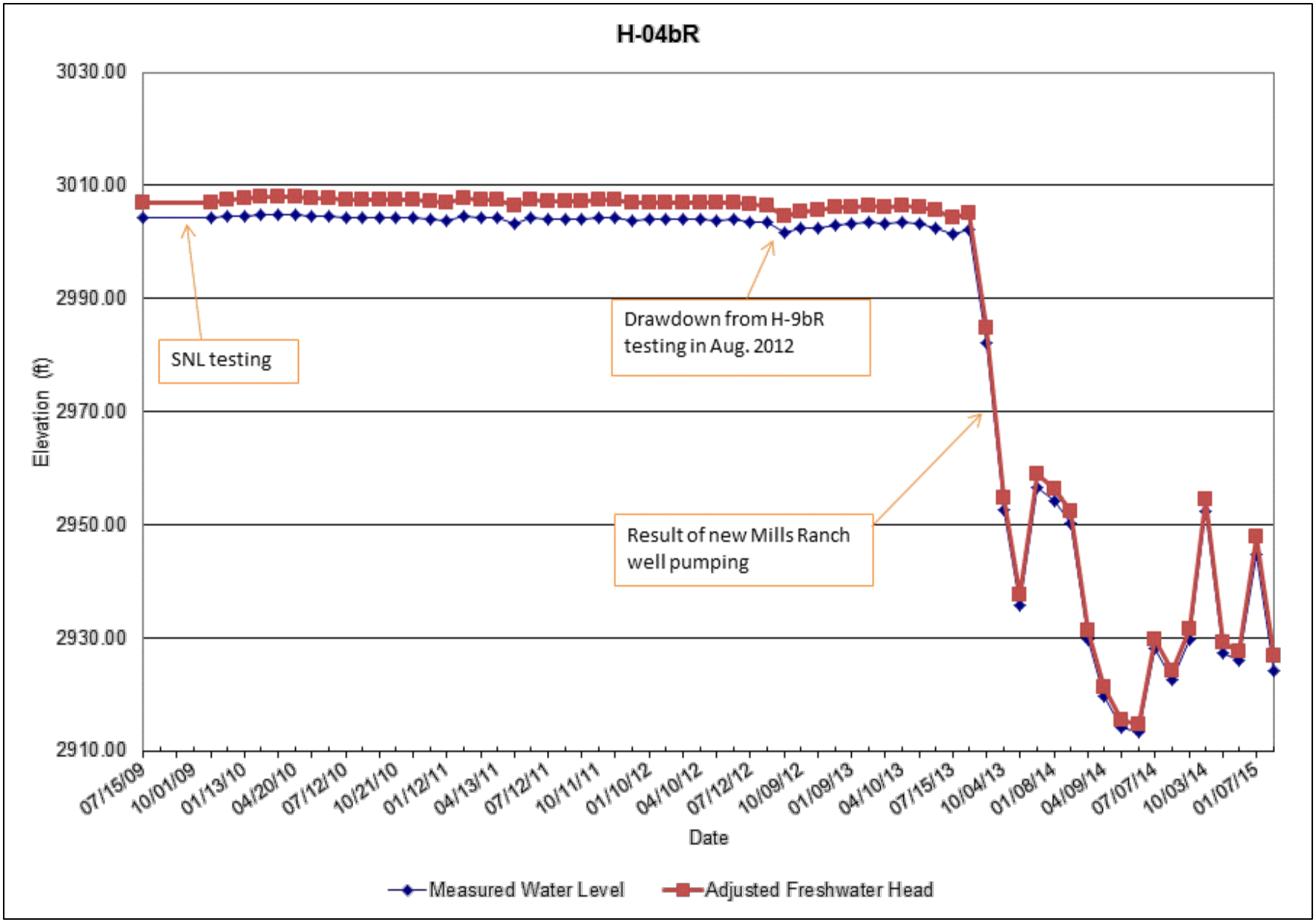
1/16/2015
Date
Measured Water Level
Adjusted Freshwater Head


H-04bR
3030.00
3010.00
2990.00
2970.00
2950.00
2930.00
2910.00
Elevation (ft)
SNL testing
Drawdown from H-9bR testing in Aug. 2012
Result of new Mills Ranch well pumping
07/15/09
10/01/09
01/13/10
04/20/10
07/12/10
10/21/10
01/12/11
04/13/11
07/12/11
10/11/11
01/10/12
04/10/12
07/12/12
10/09/12
01/09/13
04/10/13
07/15/13
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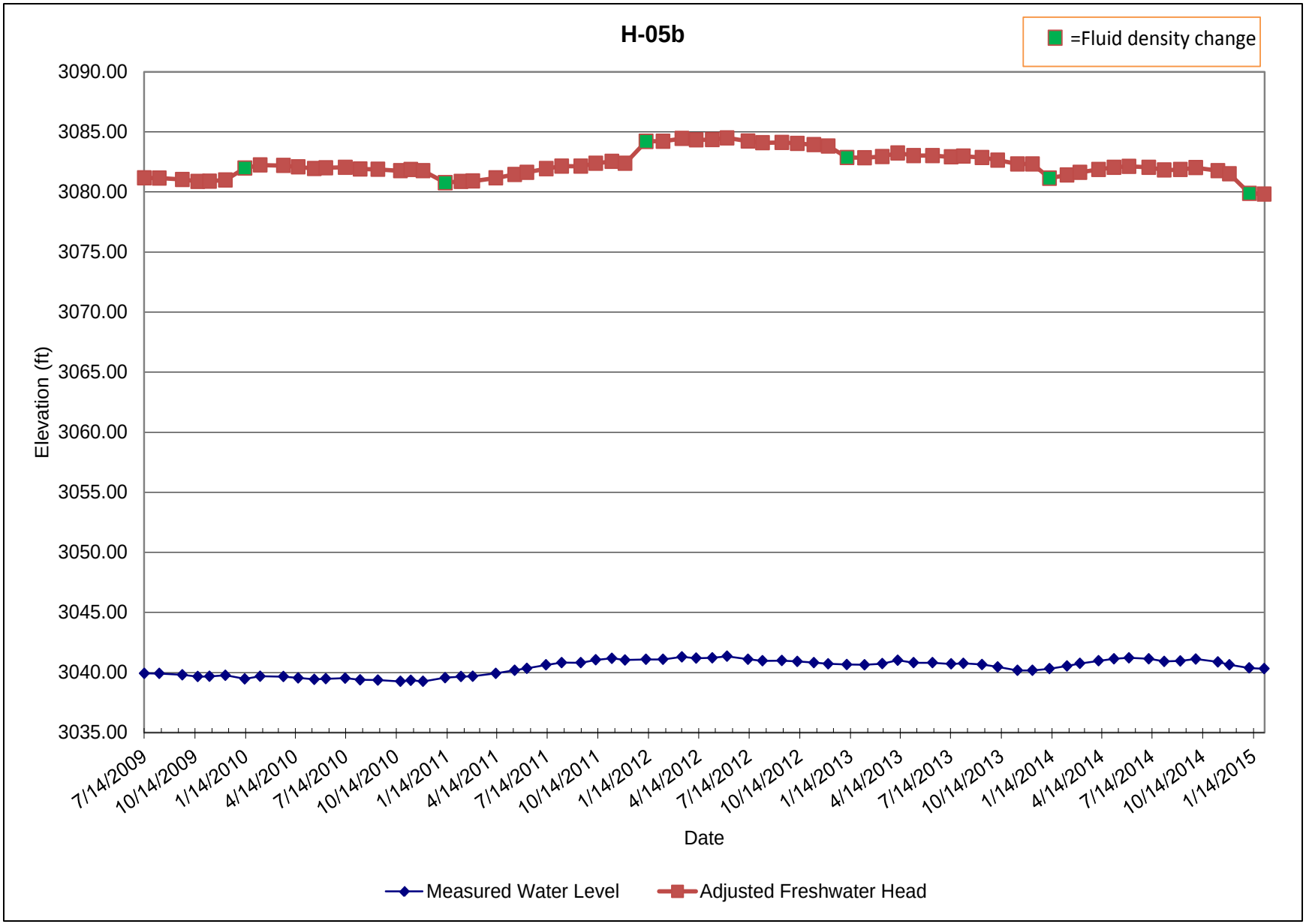
07/07/14
10/03/14
01/07/15
Date
Measured Water Level
Adjusted Freshwater Head


H-05b
=Fluid density change
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
Elevation (ft)
7/14/2009
10/14/2009
1/14/2010
4/14/2010
7/14/2010
10/14/2010
1/14/2011
4/14/2011
7/14/2011
10/14/2011
1/14/2012
4/14/2012
7/14/2012
10/14/2012
1/14/2013
4/14/2013
7/14/2013
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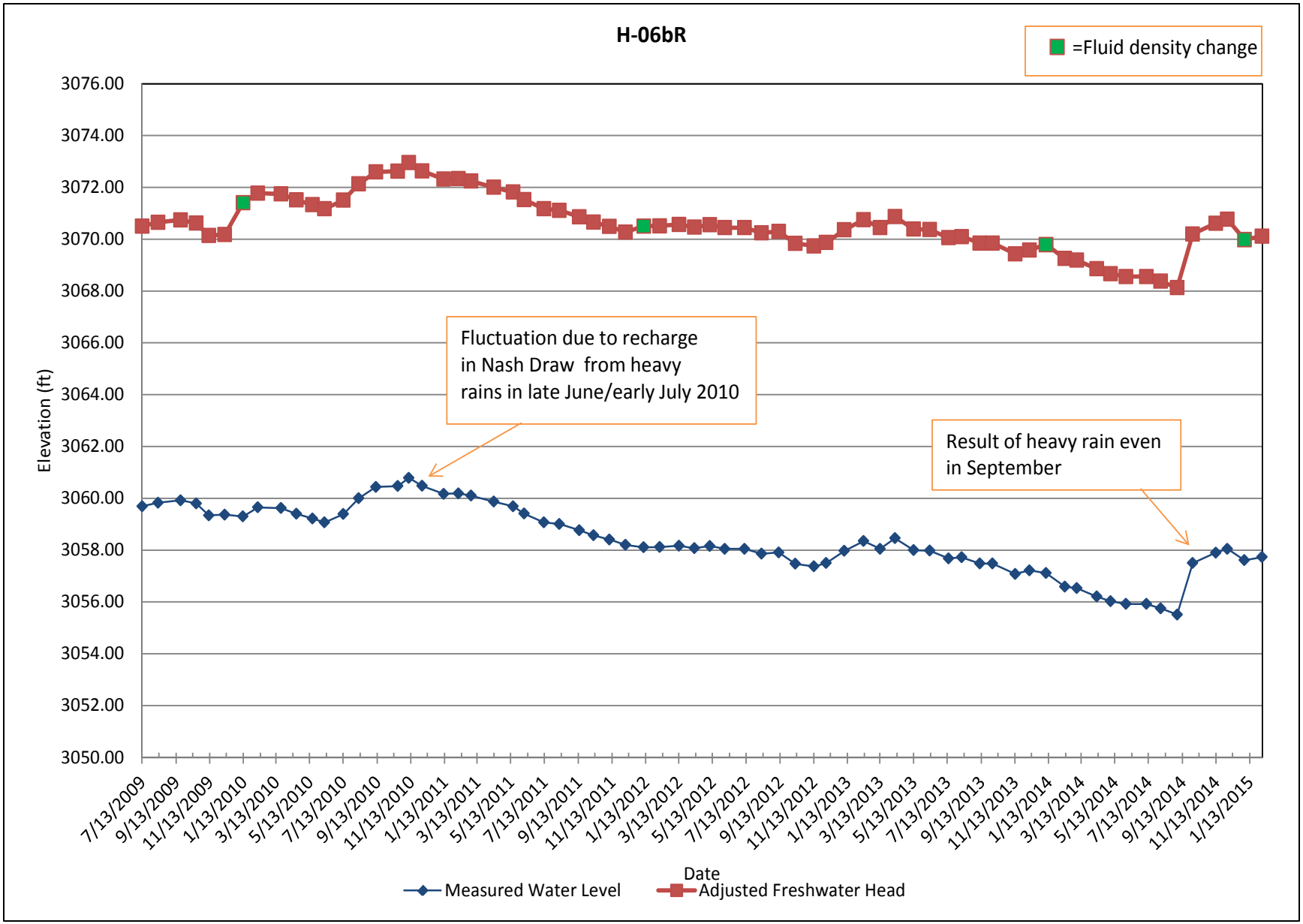
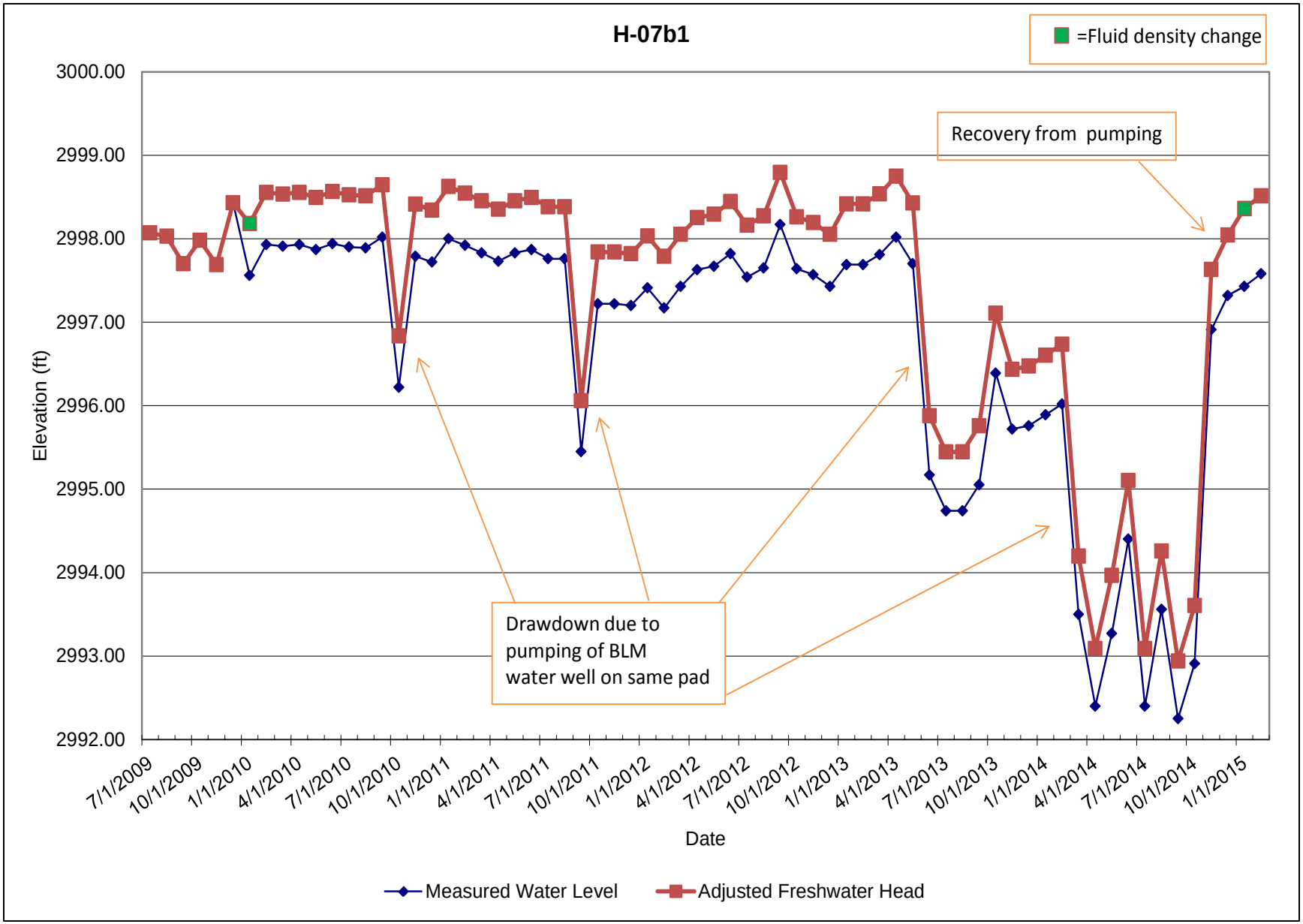
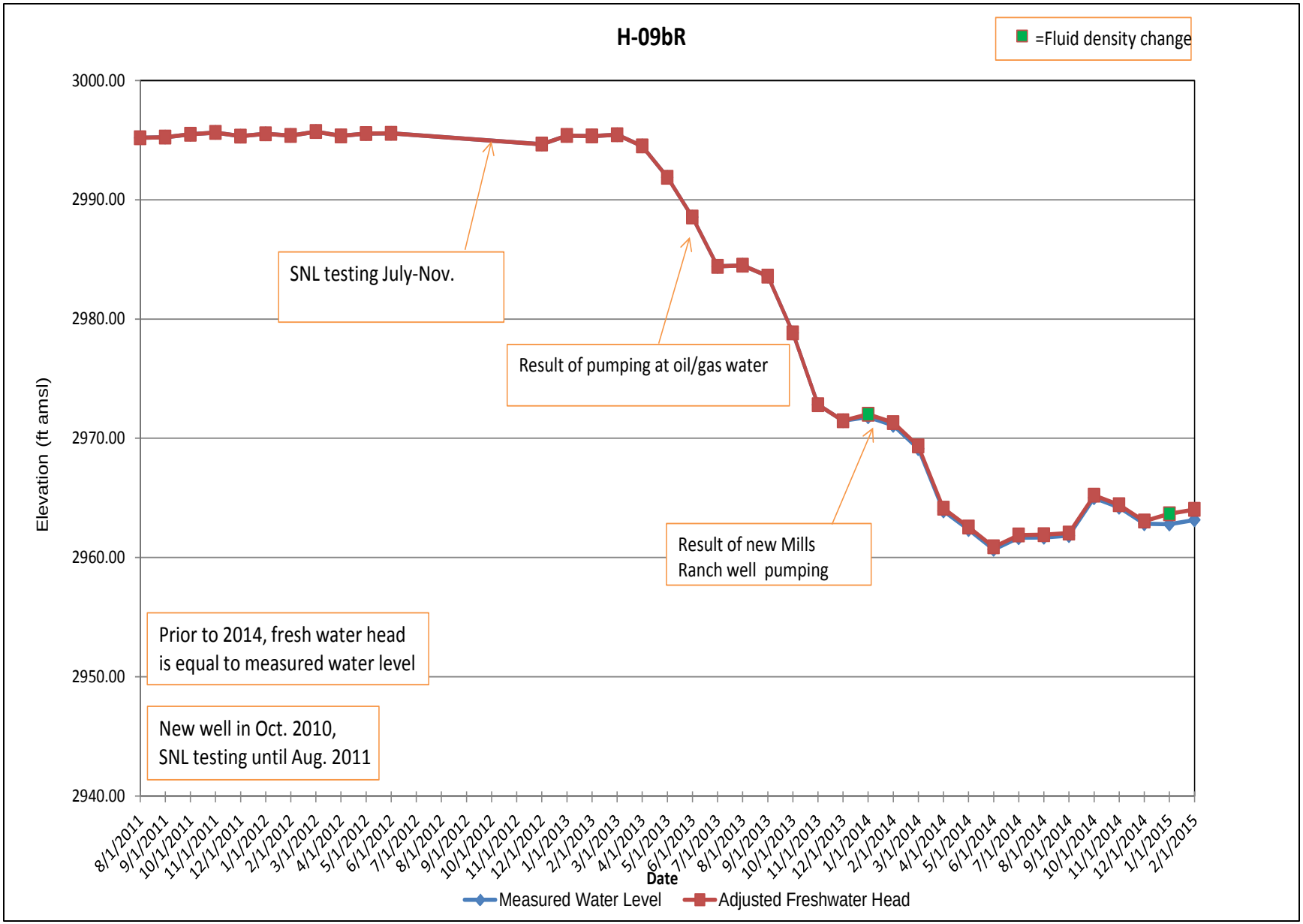
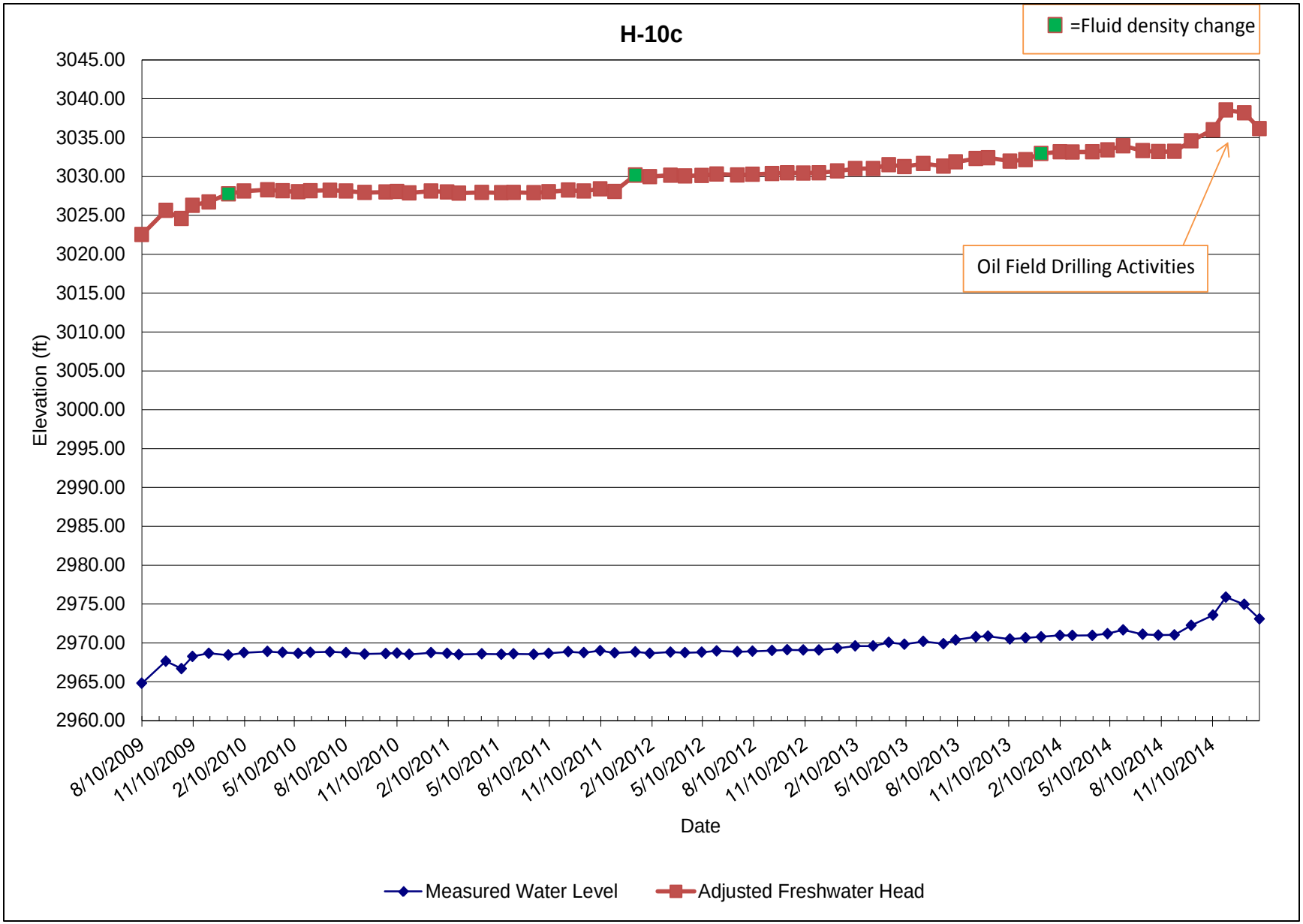
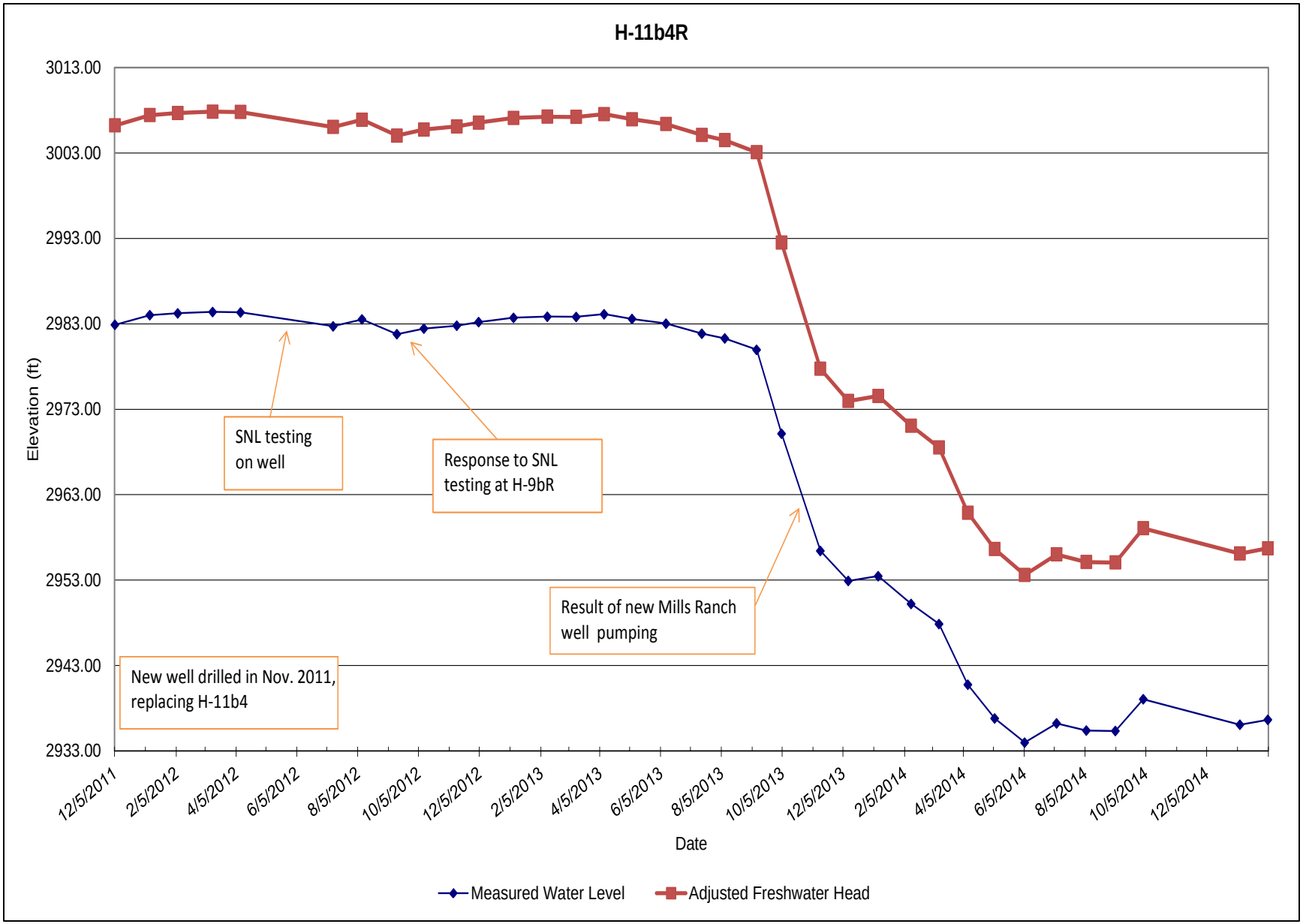
1/14/2015
Date
Measured Water Level
Adjusted Freshwater Head

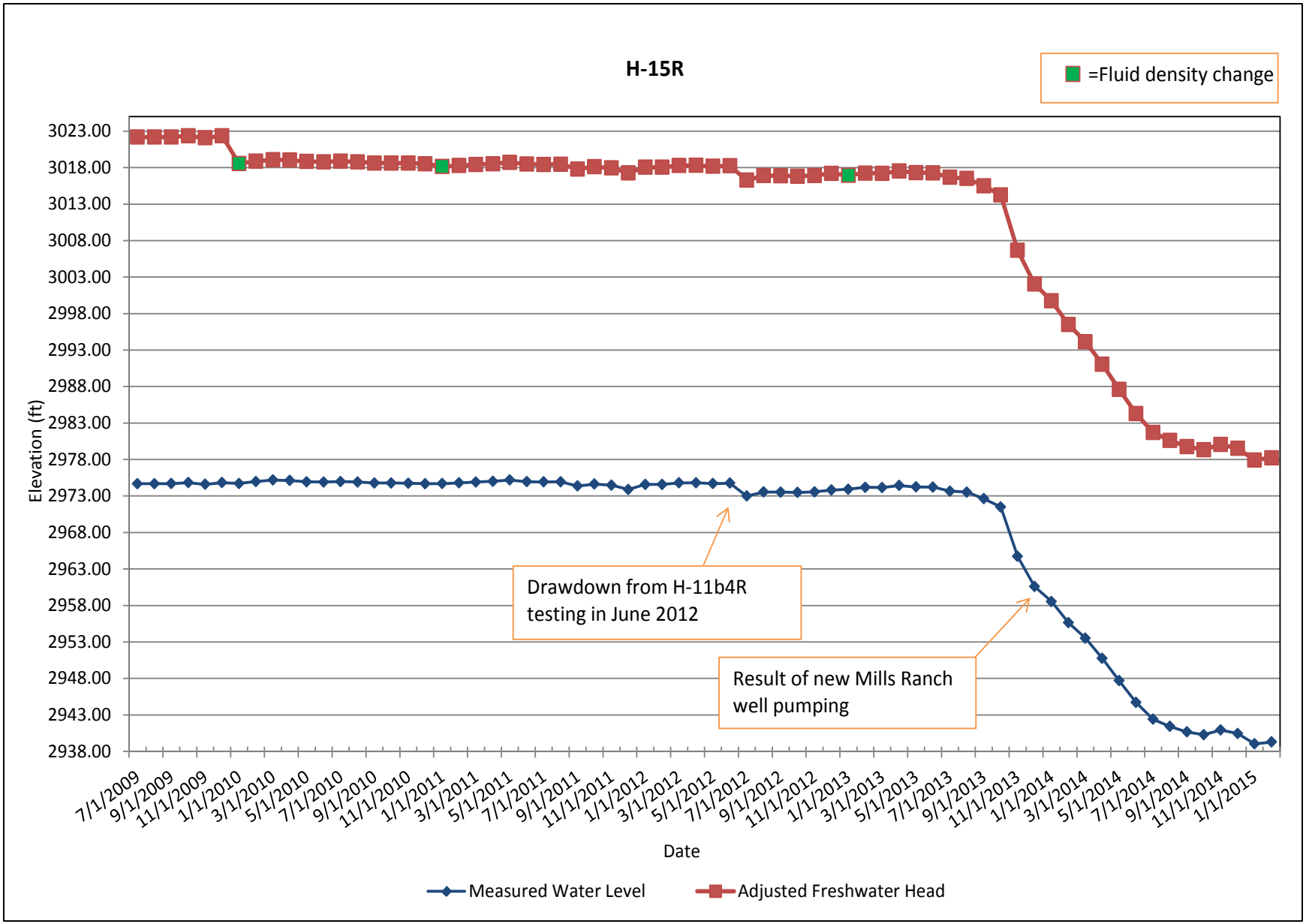

H-06bR
=Fluid density change
Fluctuation due to recharge in Nash Draw from heavy rains in late June/early July 2010
Result of heavy rain even in September
Elevation (ft)
3076.00
3074.00
3072.00
3070.00
3068.00
3066.00
3064.00
3062.00
3060.00
3058.00
3056.00
3054.00
3052.00
3050.00
7/13/2009
9/13/2009
11/13/2009
1/13/2010
3/13/2010
5/13/2010
7/13/2010
9/13/2010
11/13/2010
1/13/2011
3/13/2011
5/13/2011
7/13/2011
9/13/2011
11/13/2011
1/13/2012
3/13/2012
5/13/2012
7/13/2012
9/13/2012
11/13/2012
1/13/2013
3/13/2013
5/13/2013
7/13/2013
9/13/2013
11/13/2013
1/13/2014
3/13/2014
5/13/2014
7/13/2014
9/13/2014
11/13/2014
1/13/2015
Date
Measured Water Level
Adjusted Freshwater Head

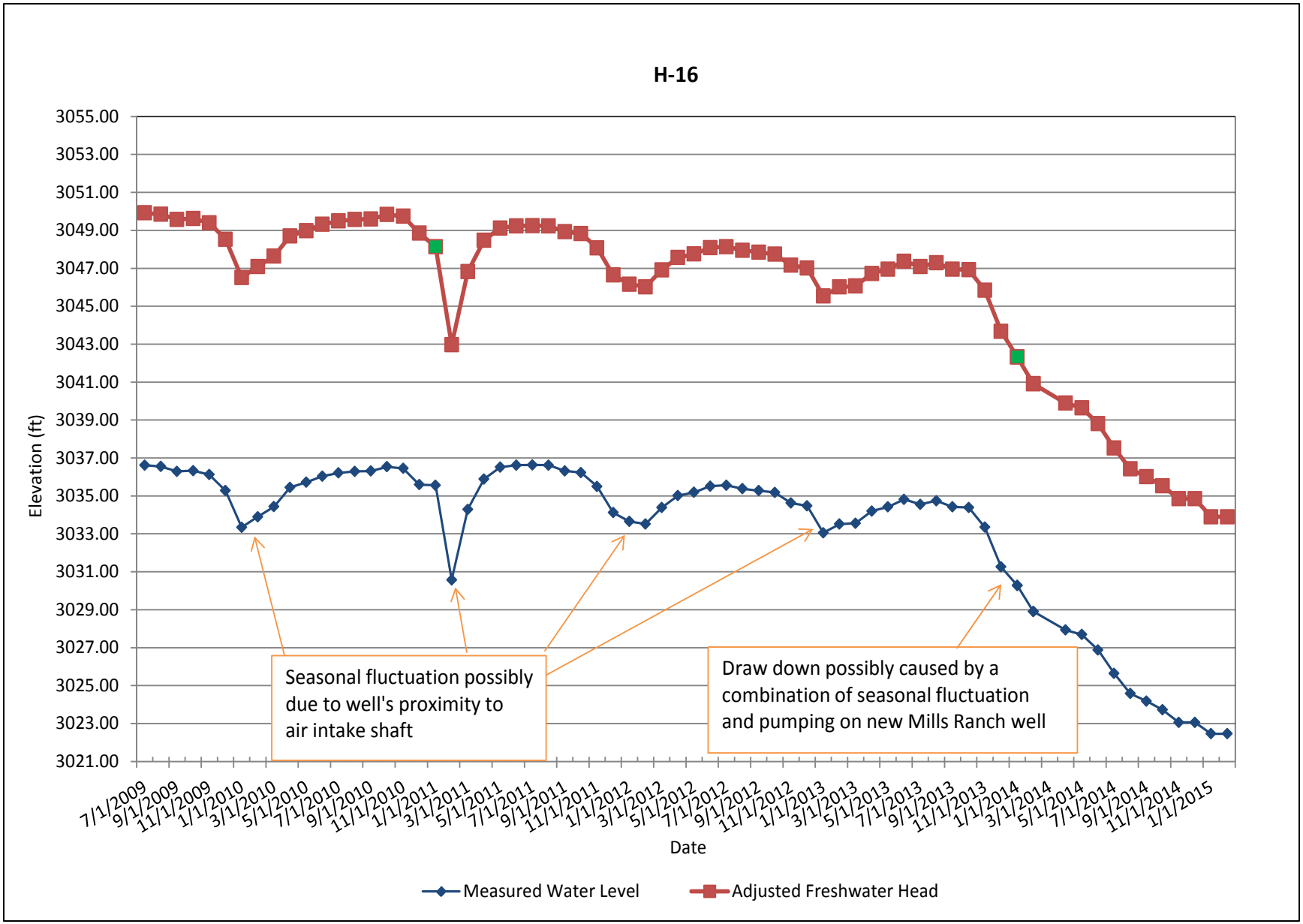

H-07b1
=Fluid density change
Recovery from pumping
Drawdown due to pumping of BLM water well on same pad
Elevation (ft)
3000.00
2999.00
2998.00
2997.00
2996.00
2995.00
2994.00
2993.00
2992.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

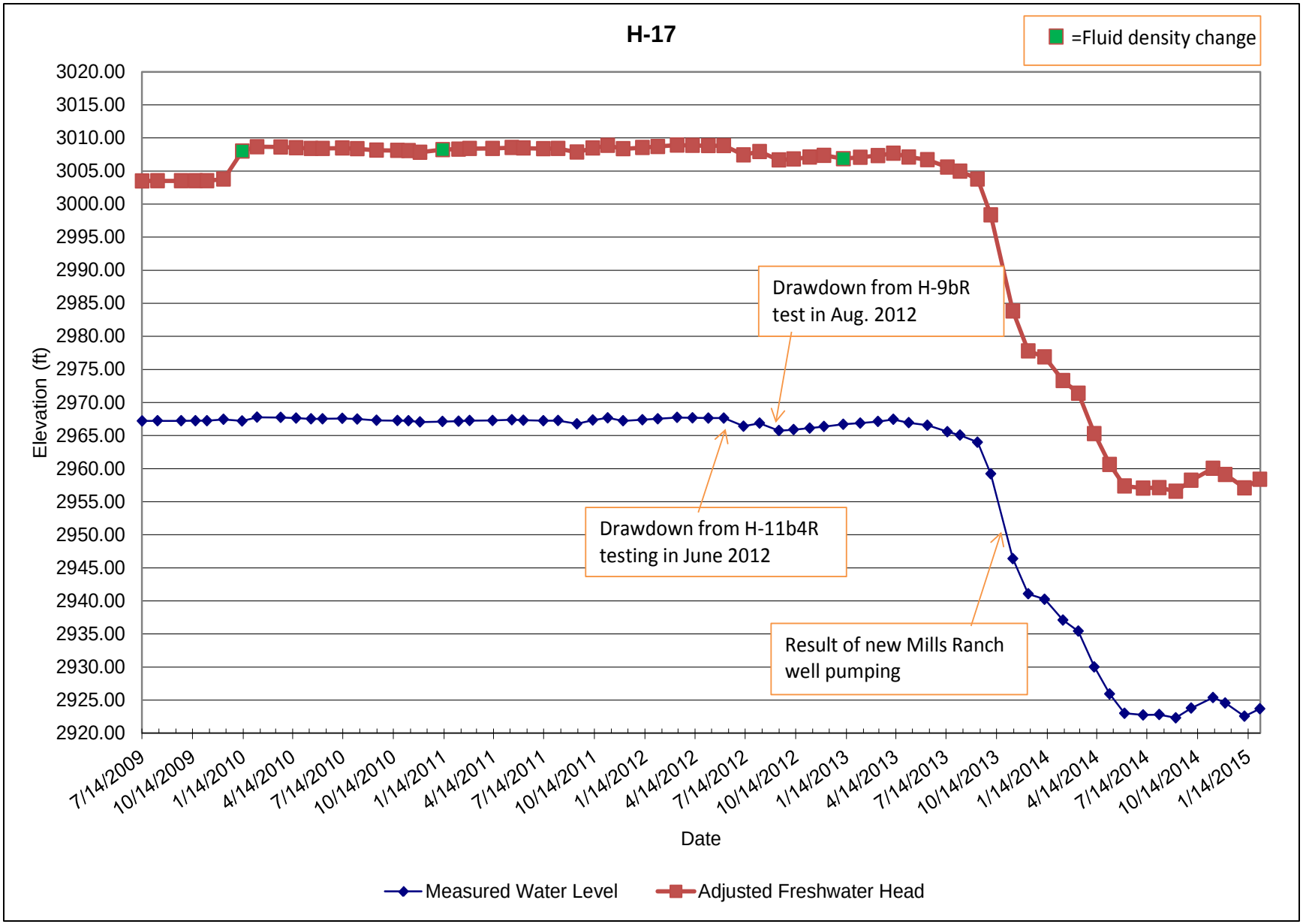

H-09bR
=Fluid density change
3000.00
2990.00
2980.00
2970.00
2960.00
2950.00
2940.00
Elevation (ft amsl)
SNL testing July-Nov.
Result of pumping at oil/gas water
Result of new Mills Ranch well pumping
Prior to 2014, fresh water head is equal to measured water level
New well in Oct. 2010, SNL testing until Aug. 2011
8/1/2011
9/1/2011
10/1/2011
11/1/2011
12/1/2011
1/1/2012
2/1/2012
3/1/2012
4/1/2012
5/1/2012
6/1/2012
7/1/2012
8/1/2012
9/1/2012
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
10/1/2013
11/1/2013
12/1/2013
1/1/2014
2/1/2014
3/1/2014
4/1/2014
5/1/2014
6/1/2014
7/1/2014
8/1/2014
9/1/2014
10/1/2014
11/1/2014
12/1/2014
1/1/2015
2/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

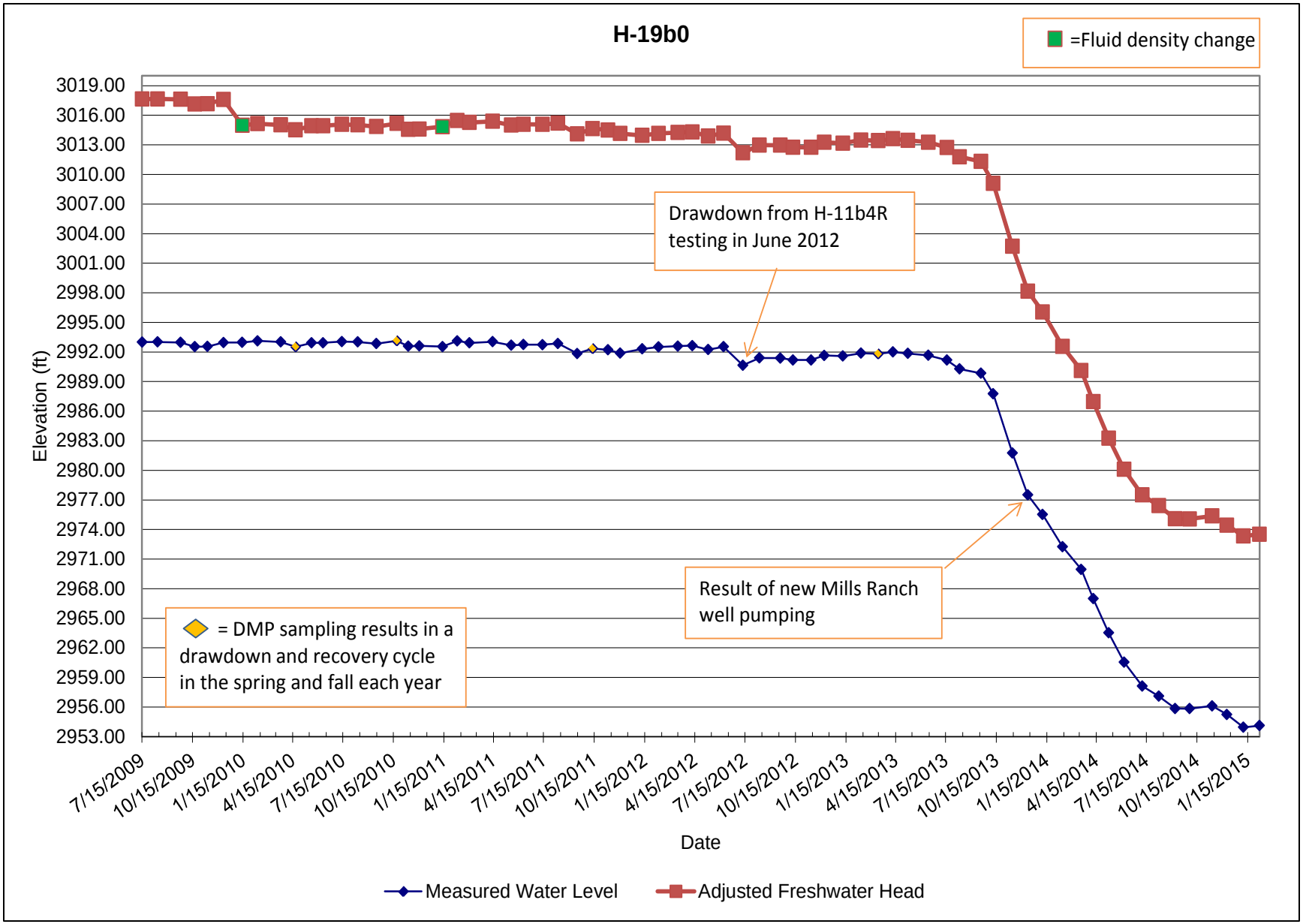

H-10c
=Fluid density change
Oil Field Drilling Activities
Elevation (ft)
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
8/10/2009
11/10/2009
2/10/2010
5/10/2010
8/10/2010
11/10/2010
2/10/2011
5/10/2011
8/10/2011
11/10/2011
2/10/2012
5/10/2012
8/10/2012
11/10/2012
2/10/2013
5/10/2013
8/10/2013
11/10/2013
2/10/2014
5/10/2014
8/10/2014
11/10/2014
Date
Measured Water Level
Adjusted Freshwater Head

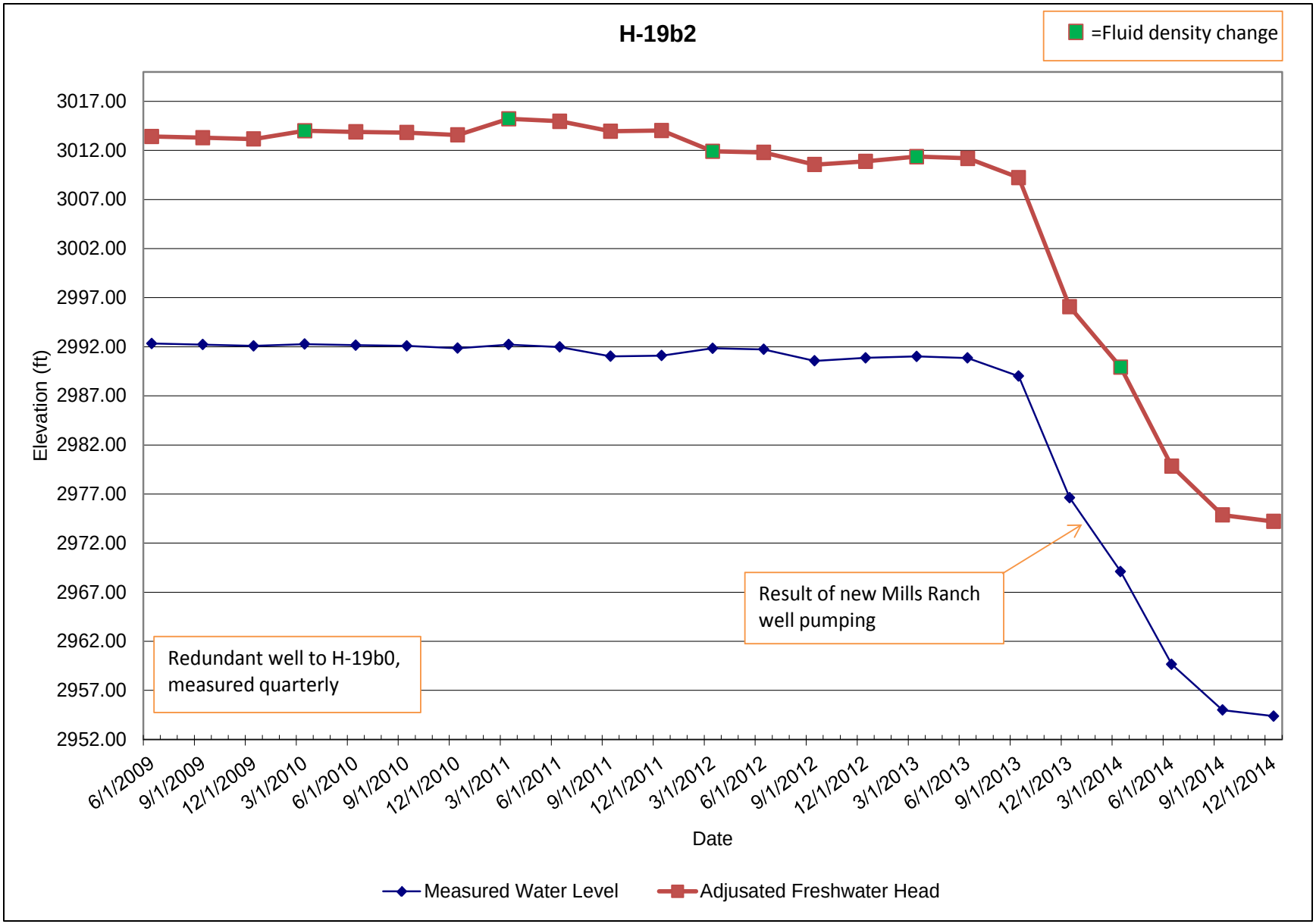

H-11b4R
3013.00
3003.00
2993.00
2983.00
2973.00
2963.00
2953.00
2943.00
2933.00
Elevation (ft)
12/5/2011
2/5/2012
4/5/2012
6/5/2012
8/5/2012
10/5/2012
12/5/2012
2/5/2013
4/5/2013
6/5/2013
8/5/2013
10/5/2013
12/5/2013
2/5/2014
4/5/2014
6/5/2014
8/5/2014
10/5/2014
12/5/2014
Date
SNL testing on well
Response to SNL testing at H-9bR
Result of new Mills Ranch well pumping
New well drilled in Nov. 2011, replacing H-11b4
Measured Water Level
Adjusted Freshwater Head

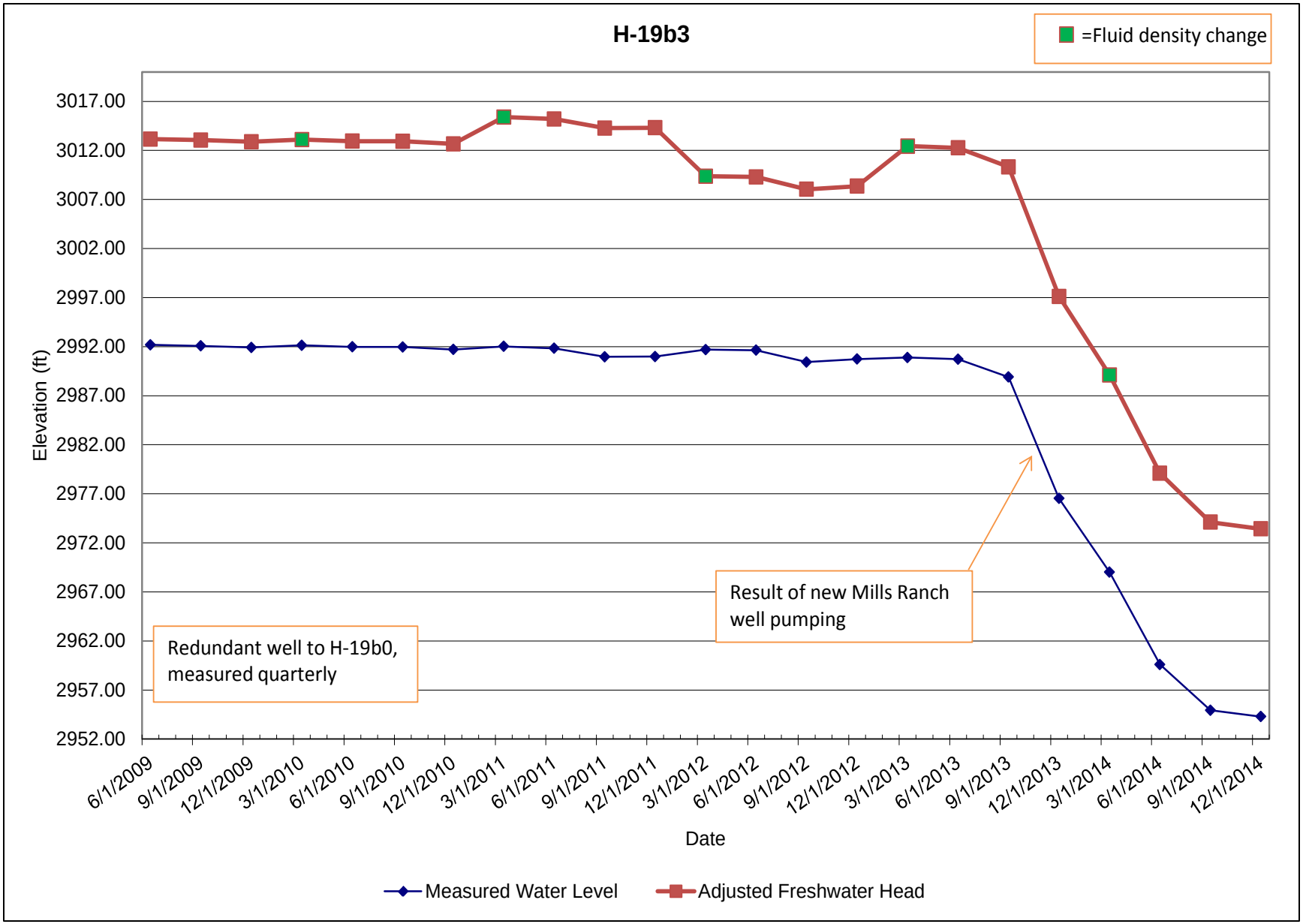

H-15R
=Fluid density change
Elevation (ft)
3023.00
3018.00
3013.00
3008.00
3003.00
2998.00
2993.00
2988.00
2983.00
2978.00
2973.00
2968.00
2963.00
2958.00
2953.00
2948.00
2943.00
2938.00
7/1/2009
9/1/2009
11/1/2009
1/1/2010
3/1/2010
5/1/2010
7/1/2010
9/1/2010
11/1/2010
1/1/2011
3/1/2011
5/1/2011
7/1/2011
9/1/2011
11/1/2011
1/1/2012
3/1/2012
5/1/2012
7/1/2012
9/1/2012
11/1/2012
1/1/2013
3/1/2013
5/1/2013
7/1/2013
9/1/2013
11/1/2013
1/1/2014
3/1/2014
5/1/2014
7/1/2014
9/1/2014
11/1/2014
1/1/2015
Date
Drawdown from H-11b4R testing in June 2012
Result of new Mills Ranch well pumping
Measured Water Level
Adjusted Freshwater Head

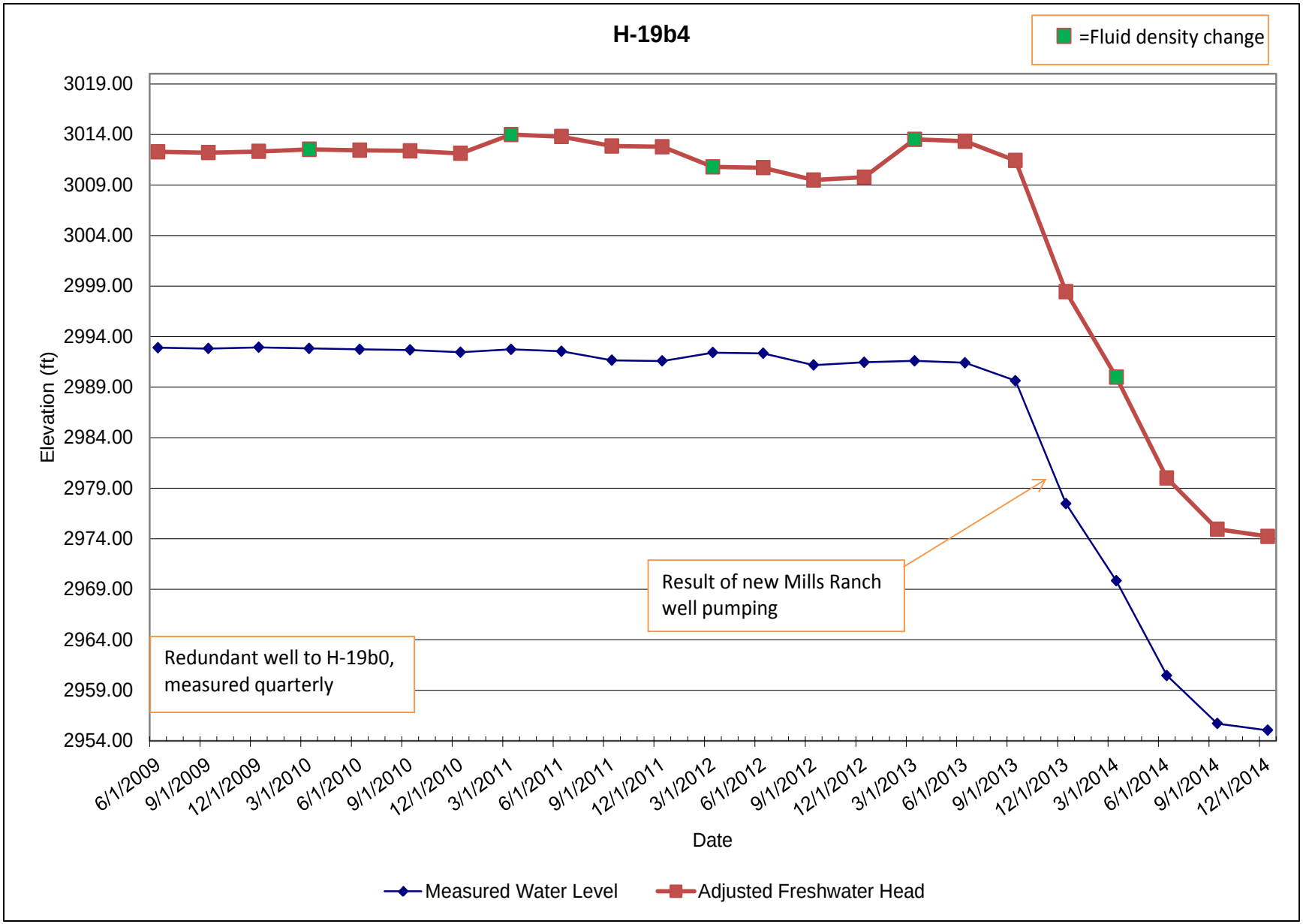

H-16
Elevation (ft)
3055.00
3053.00
3051.00
3049.00
3047.00
3045.00
3043.00
3041.00
3039.00
3037.00
3035.00
3033.00
3031.00
3029.00
3027.00
3025.00
3023.00
3021.00
7/1/2009
9/1/2009
11/1/2009
1/1/2010
3/1/2010
5/1/2010
7/1/2010
9/1/2010
11/1/2010
1/1/2011
3/1/2011
5/1/2011
7/1/2011
9/1/2011
11/1/2011
1/1/2012
3/1/2012
5/1/2012
7/1/2012
9/1/2012
11/1/2012
1/1/2013
3/1/2013
5/1/2013
7/1/2013
9/1/2013
11/1/2013
1/1/2014
3/1/2014
5/1/2014
7/1/2014
9/1/2014
11/1/2014
1/1/2015
Date
Seasonal fluctuation possibly due to well's proximity to air intake shaft
Draw down possibly caused by a combination of seasonal fluctuation and pumping on new Mills Ranch well
Measured Water Level
Adjusted Freshwater Head

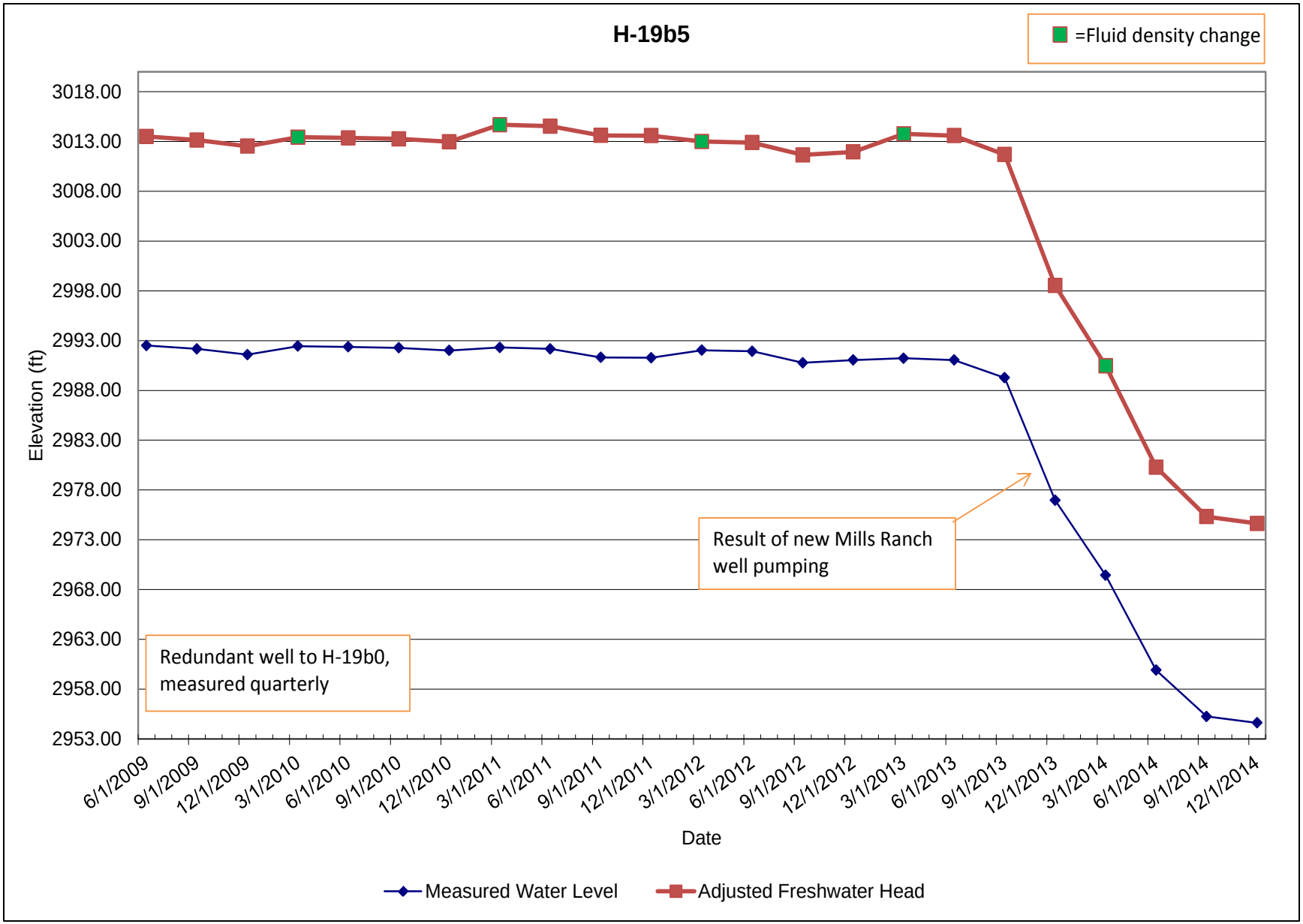

H-17
=Fluid density change
Elevation (ft)
3020.00
3015.00
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
2955.00
2950.00
2945.00
2940.00
2935.00
2930.00
2925.00
2920.00
Drawdown from H-9bR test in Aug. 2012
Drawdown from H-11b4R testing in June 2012
Result of new Mills Ranch well pumping
7/14/2009
10/14/2009
1/14/2010
4/14/2010
7/14/2010
10/14/2010
1/14/2011
4/14/2011
7/14/2011
10/14/2011
1/14/2012
4/14/2012
7/14/2012
10/14/2012
1/14/2013
4/14/2013
7/14/2013
10/14/2013
1/14/2014
4/14/2014
7/14/2014
10/14/2014
1/14/2015
Date
Measured Water Level
Adjusted Freshwater Head

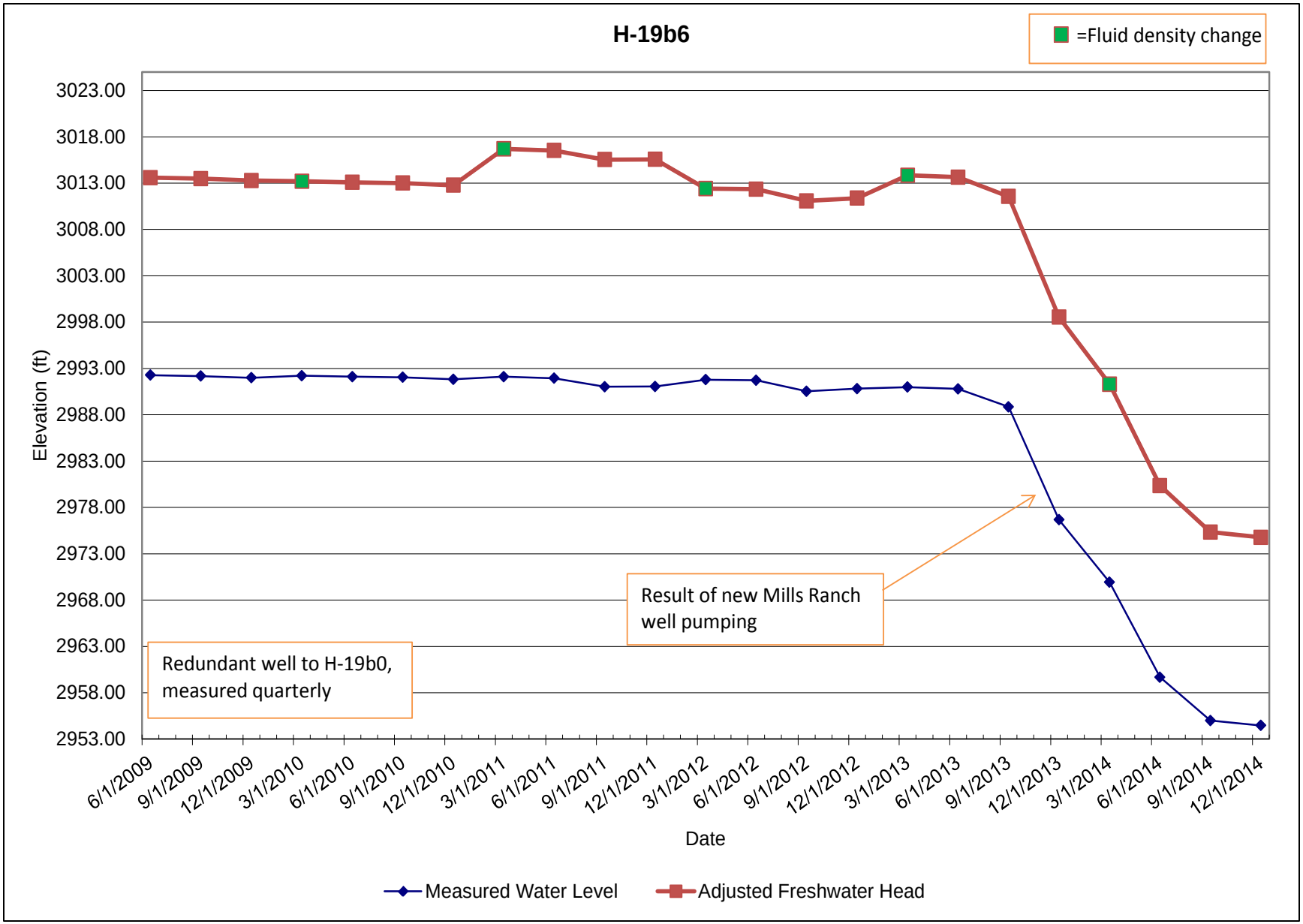

H-19b0
=Fluid density change
Drawdown from H-11b4R testing in June 2012
Result of new Mills Ranch well pumping
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year
Elevation (ft)
3019.00
3016.00
3013.00
3010.00
3007.00
3004.00
3001.00
2998.00
2995.00
2992.00
2989.00
2986.00
2983.00
2980.00
2977.00
2974.00
2971.00
2968.00
2965.00
2962.00
2959.00
2956.00
2953.00
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
4/15/2013
7/15/2013
10/15/2013
1/15/2014
4/15/2014
7/15/2014
10/15/2014
1/15/2015
Date
Measured Water Level
Adjusted Freshwater Head

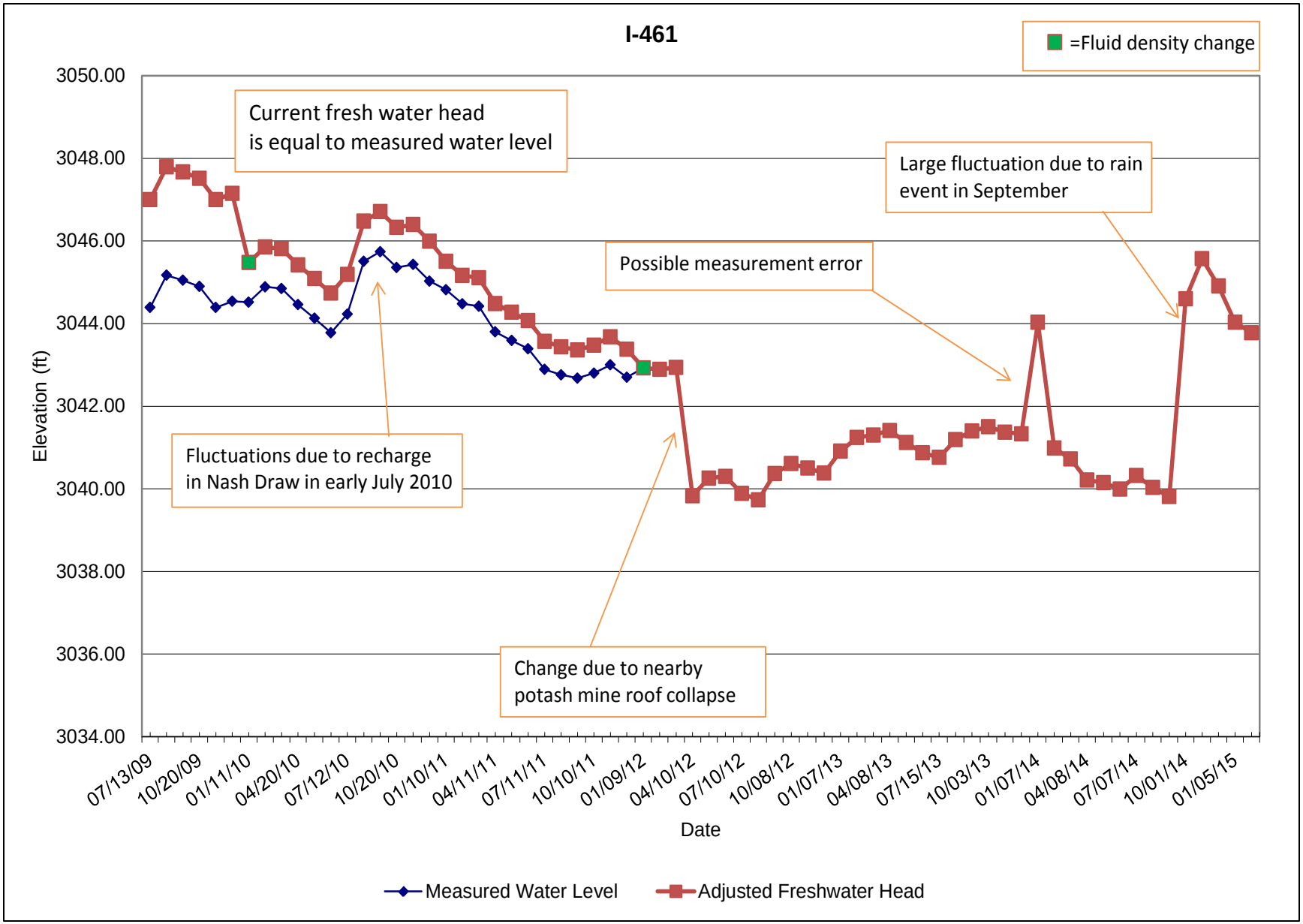

H-19b2
=Fluid density change
3017.00
3012.00
3007.00
3002.00
2997.00
2992.00
2987.00
2982.00
2977.00
2972.00
2967.00
2962.00
2957.00
2952.00
Elevation (ft)
Result of new Mills Ranch well pumping
Redundant well to H-19b0, measured quarterly
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
3/1/2013
6/1/2013
9/1/2013
12/1/2013
3/1/2014
6/1/2014
9/1/2014
12/1/2014
Date
Measured Water Level
Adjusated Freshwater Head

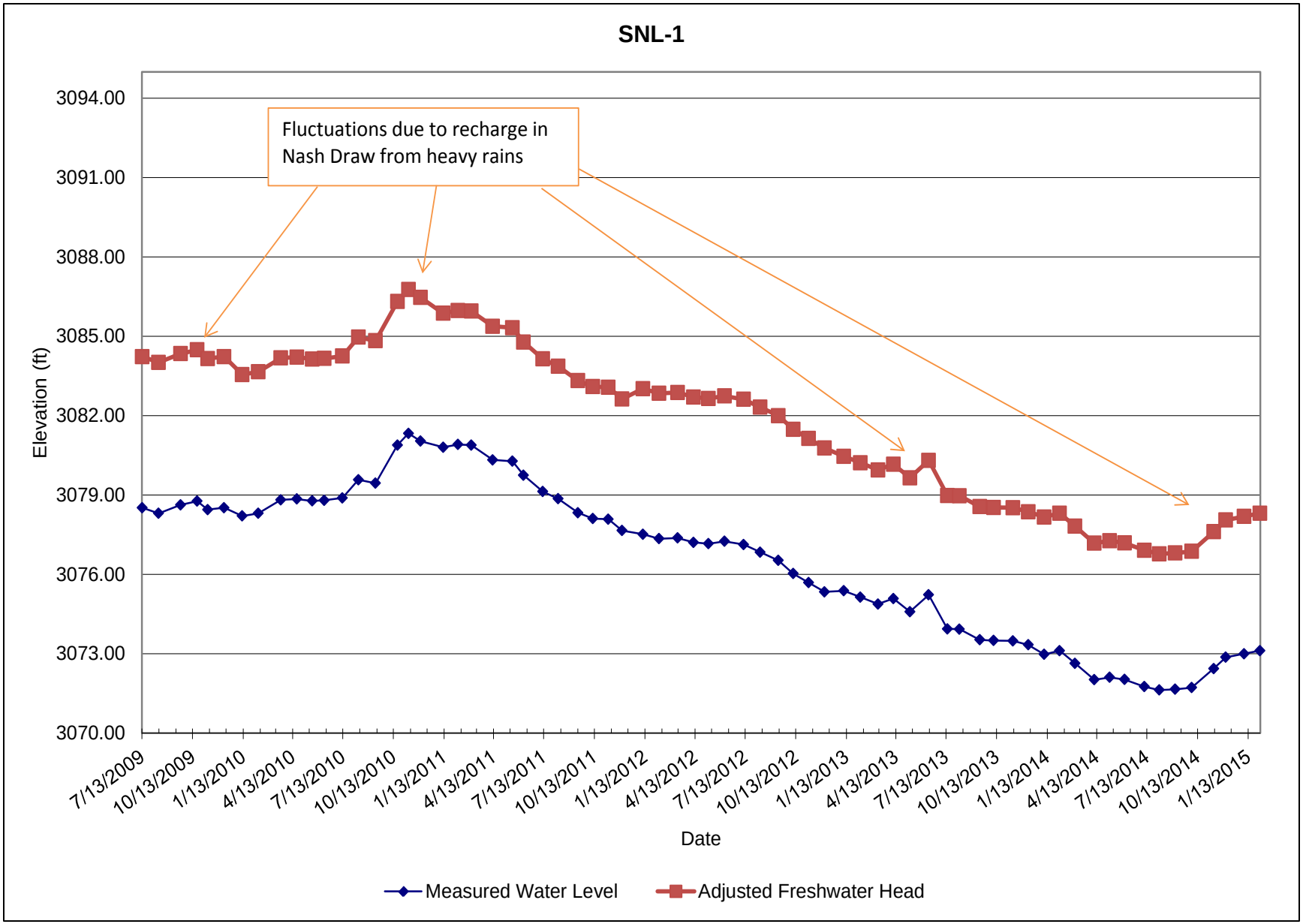

H-19b3
=Fluid density change
3017.00
3012.00
3007.00
3002.00
2997.00
2992.00
2987.00
2982.00
2977.00
2972.00
2967.00
2962.00
2957.00
2952.00
Elevation (ft)
Redundant well to H-19b0, measured quarterly
Result of new Mills Ranch well pumping
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
3/1/2013
6/1/2013
9/1/2013
12/1/2013
3/1/2014
6/1/2014
9/1/2014
12/1/2014
Date
Measured Water Level
Adjusted Freshwater Head

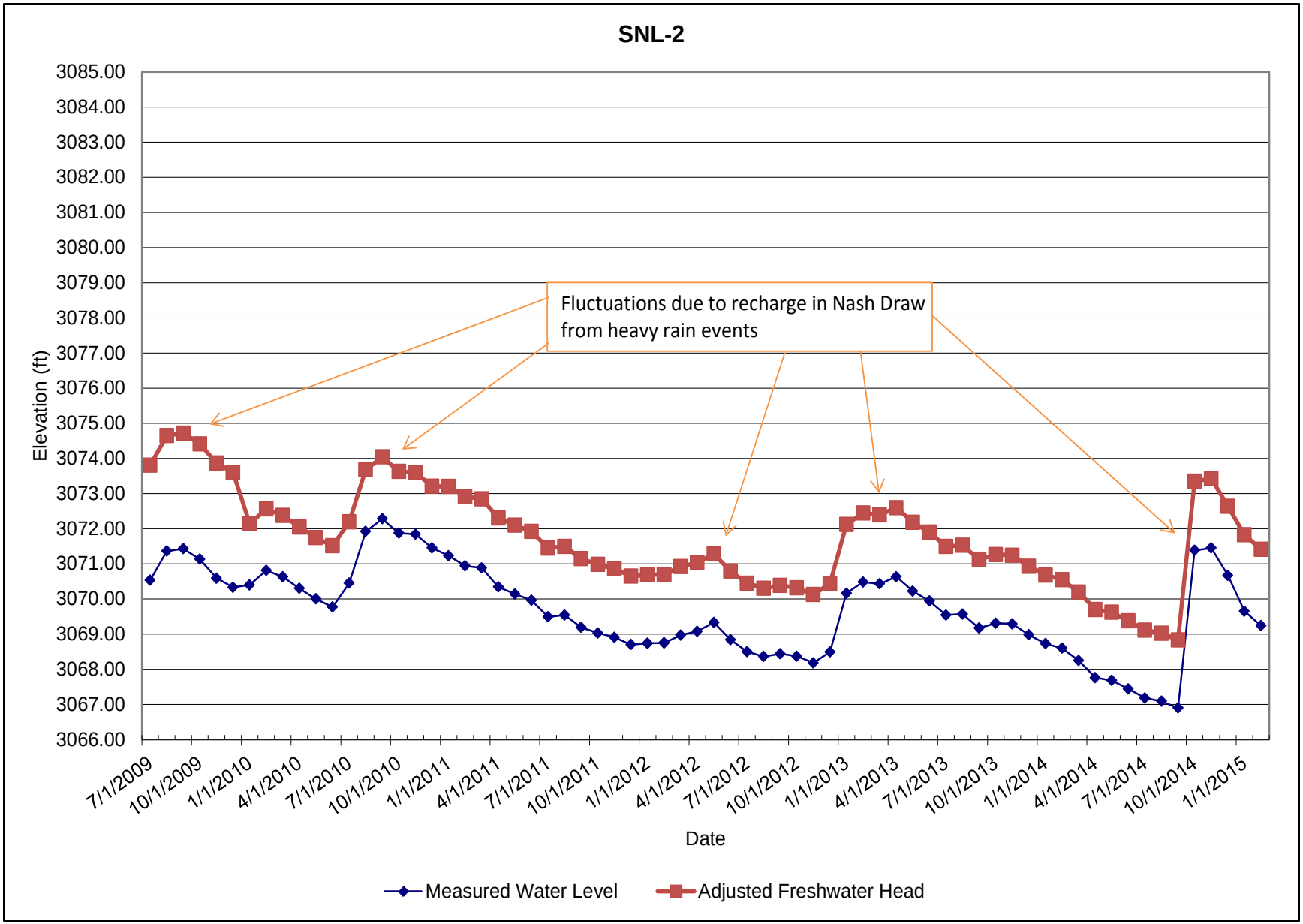

H-19b4
=Fluid density change
3019.00
3014.00
3009.00
3004.00
2999.00
2994.00
2989.00
2984.00
2979.00
2974.00
2969.00
2964.00
2959.00
2954.00
Elevation (ft)
Result of new Mills Ranch well pumping
Redundant well to H-19b0, measured quarterly
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
3/1/2013
6/1/2013
9/1/2013
12/1/2013
3/1/2014
6/1/2014
9/1/2014
12/1/2014
Date
Measured Water Level
Adjusted Freshwater Head

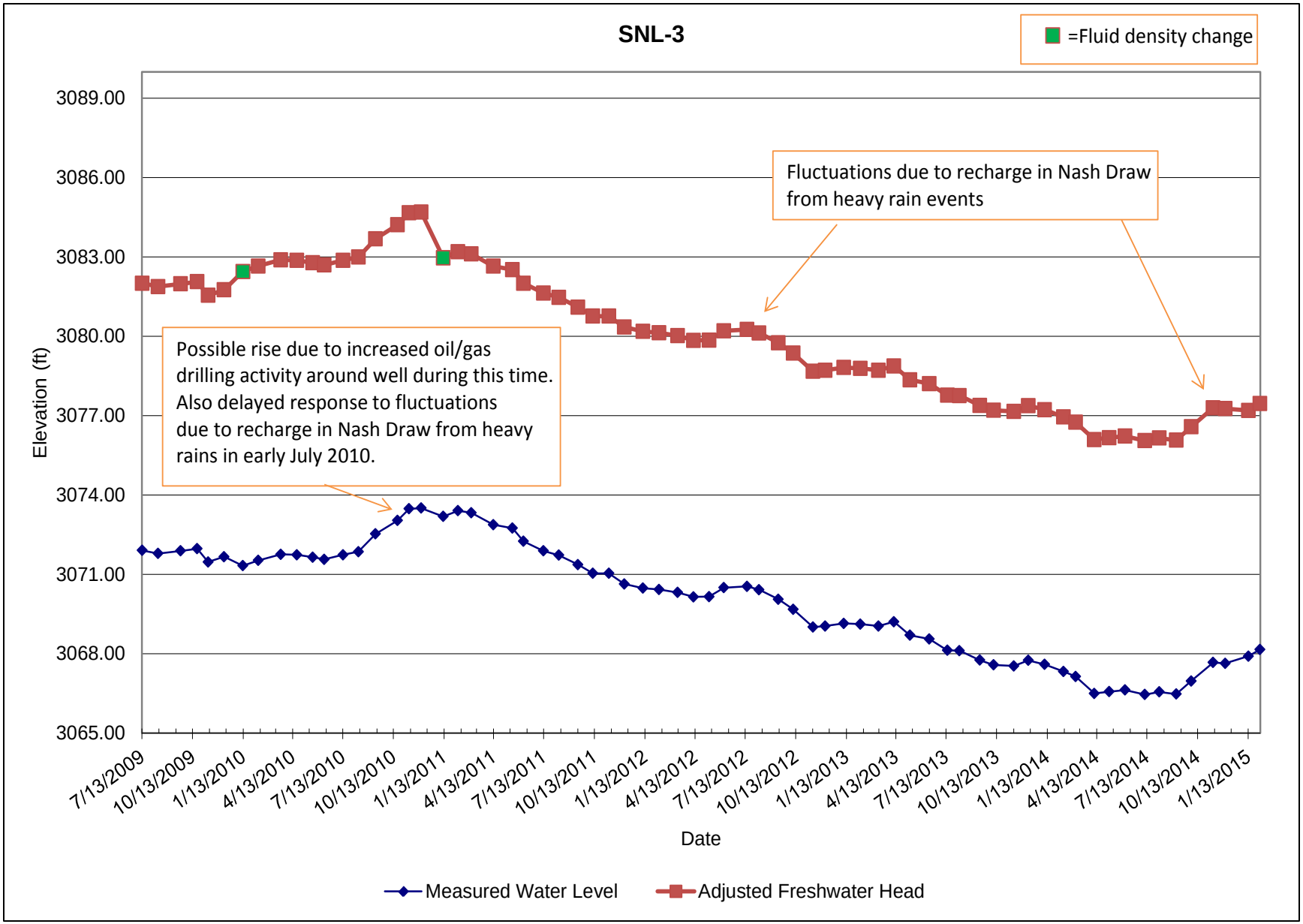

H-19b5
=Fluid density change
3018.00
3013.00
3008.00
3003.00
2998.00
2993.00
2988.00
2983.00
2978.00
2973.00
2968.00
2963.00
2958.00
2953.00
Elevation (ft)
Result of new Mills Ranch well pumping
Redundant well to H-19b0, measured quarterly
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
3/1/2013
6/1/2013
9/1/2013
12/1/2013
3/1/2014
6/1/2014
9/1/2014
12/1/2014
Date
Measured Water Level
Adjusted Freshwater Head

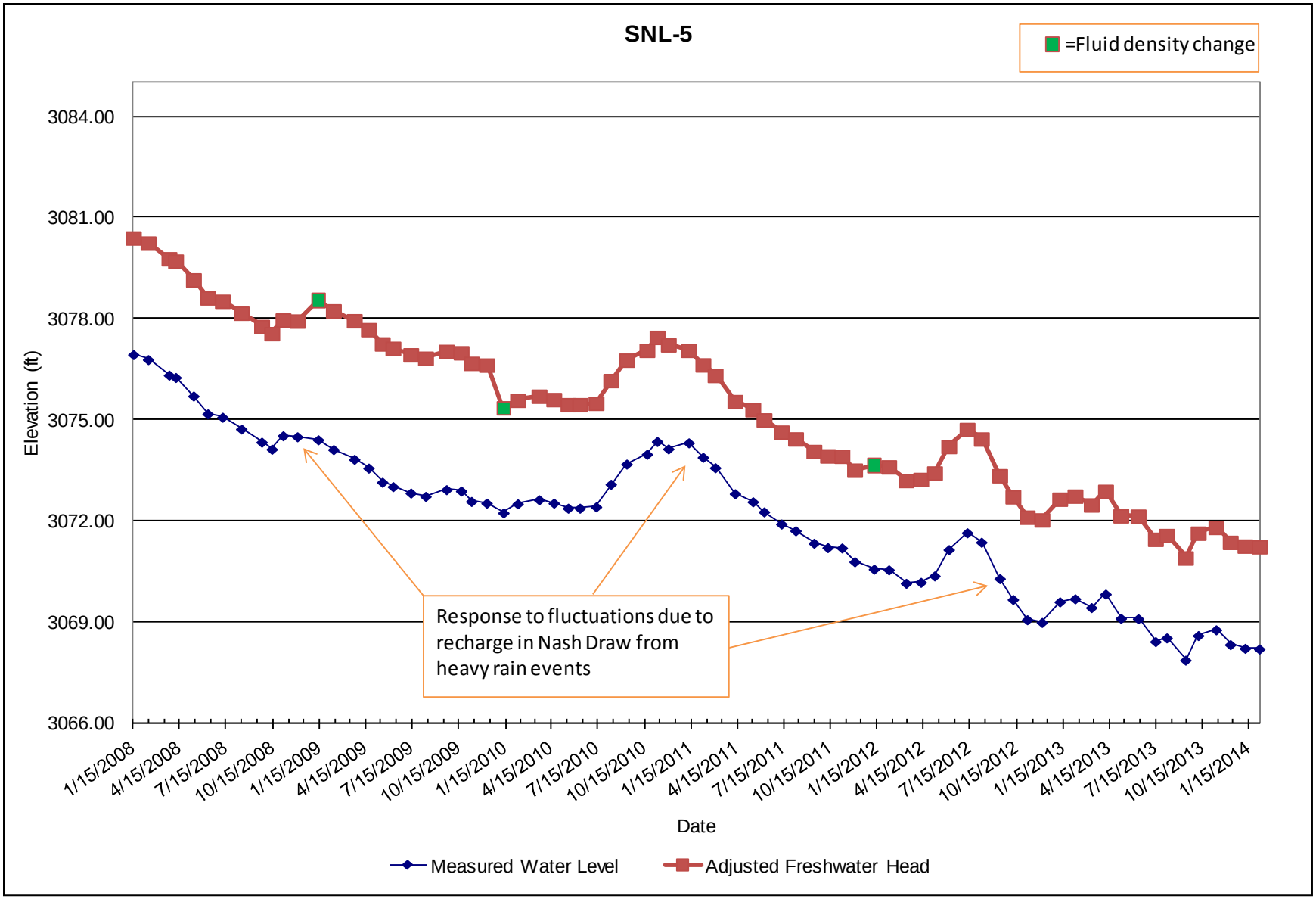

H-19b6
=Fluid density change
3023.00
3018.00
3013.00
3008.00
3003.00
2998.00
2993.00
2988.00
2983.00
2978.00
2973.00
2968.00
2963.00
2958.00
2953.00
Elevation (ft)
Result of new Mills Ranch well pumping
Redundant well to H-19b0, measured quarterly
6/1/2009
9/1/2009
12/1/2009
3/1/2010
6/1/2010
9/1/2010
12/1/2010
3/1/2011
6/1/2011
9/1/2011
12/1/2011
3/1/2012
6/1/2012
9/1/2012
12/1/2012
3/1/2013
6/1/2013
9/1/2013
12/1/2013
3/1/2014
6/1/2014
9/1/2014
12/1/2014
Date
Measured Water Level
Adjusted Freshwater Head

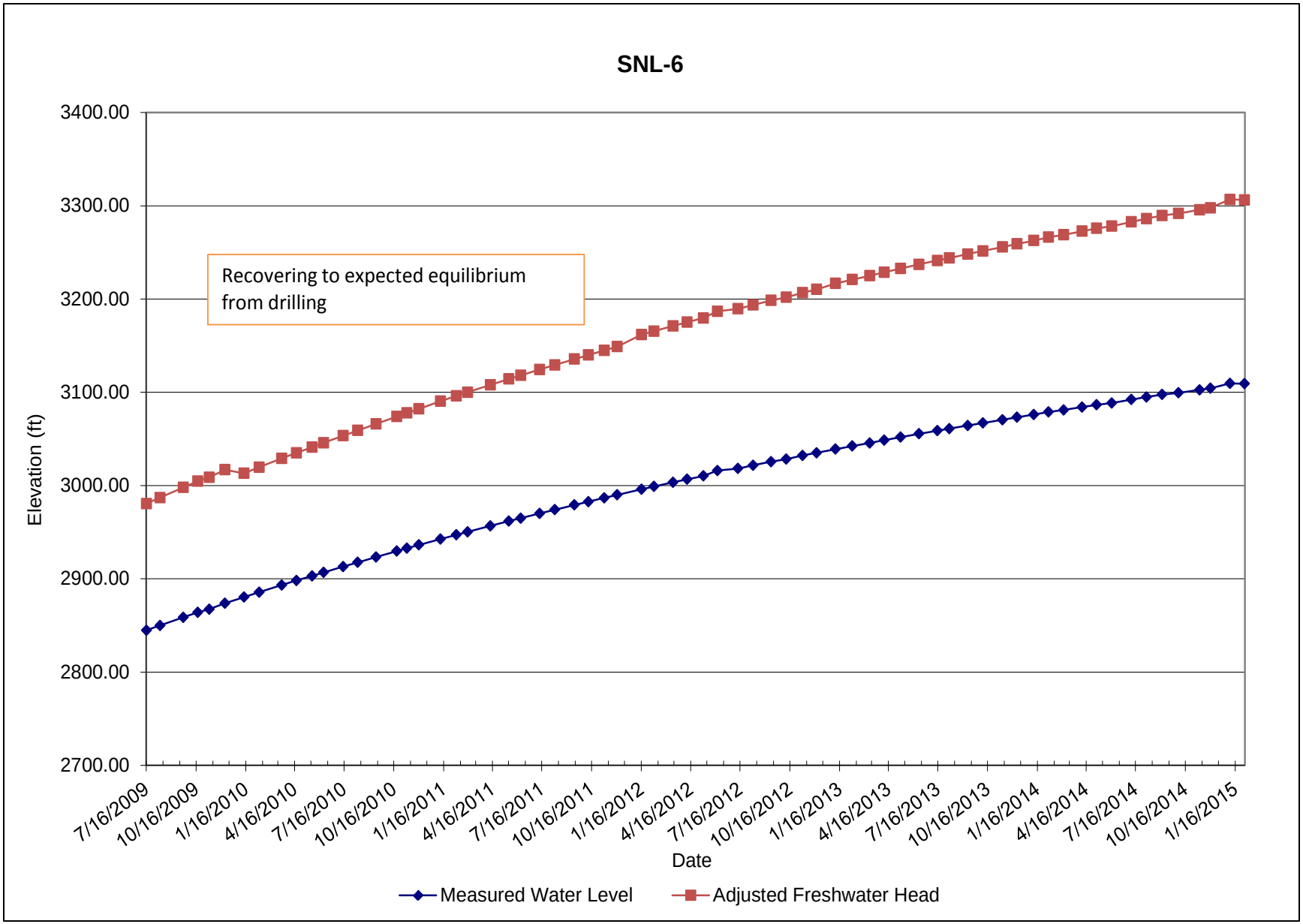

I-461
=Fluid density change
Current fresh water head
is equal to measured water level
Large fluctuation due to rain
event in September
Possible measurement error
Fluctuations due to recharge
in Nash Draw in early July 2010
Change due to nearby
potash mine roof collapse
Elevation (ft)
3050.00
3048.00
3046.00
3044.00
3042.00
3040.00
3038.00
3036.00
3034.00
07/13/09
10/20/09
01/11/10
04/20/10
07/12/10
10/20/10
01/10/11
04/11/11
07/11/11
10/10/11
01/09/12
04/10/12
07/10/12
10/08/12
01/07/13
04/08/13
07/15/13
10/03/13
01/07/14
04/08/14
07/07/14
10/01/14
01/05/15
Date
Measured Water Level
Adjusted Freshwater Head

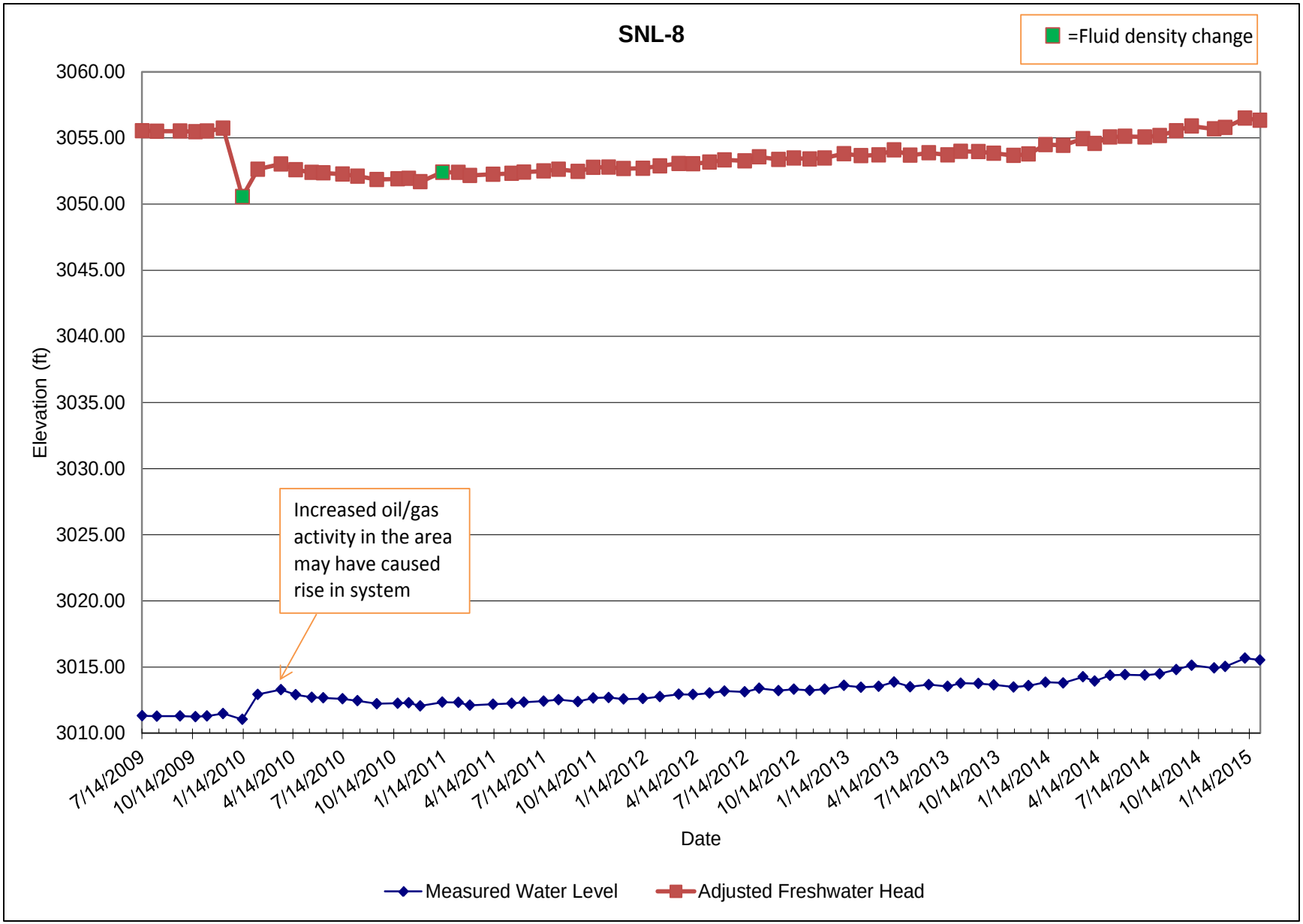

SNL-1
Fluctuations due to recharge in Nash Draw from heavy rains
Elevation (ft)
3094.00
3091.00
3088.00
3085.00
3082.00
3079.00
3076.00
3073.00
3070.00
7/13/2009
10/13/2009
1/13/2010
4/13/2010
7/13/2010
10/13/2010
1/13/2011
4/13/2011
7/13/2011
10/13/2011
1/13/2012
4/13/2012
7/13/2012
10/13/2012
1/13/2013
4/13/2013
7/13/2013
10/13/2013
1/13/2014
4/13/2014
7/13/2014
10/13/2014
1/13/2015
Date
Measured Water Level
Adjusted Freshwater Head

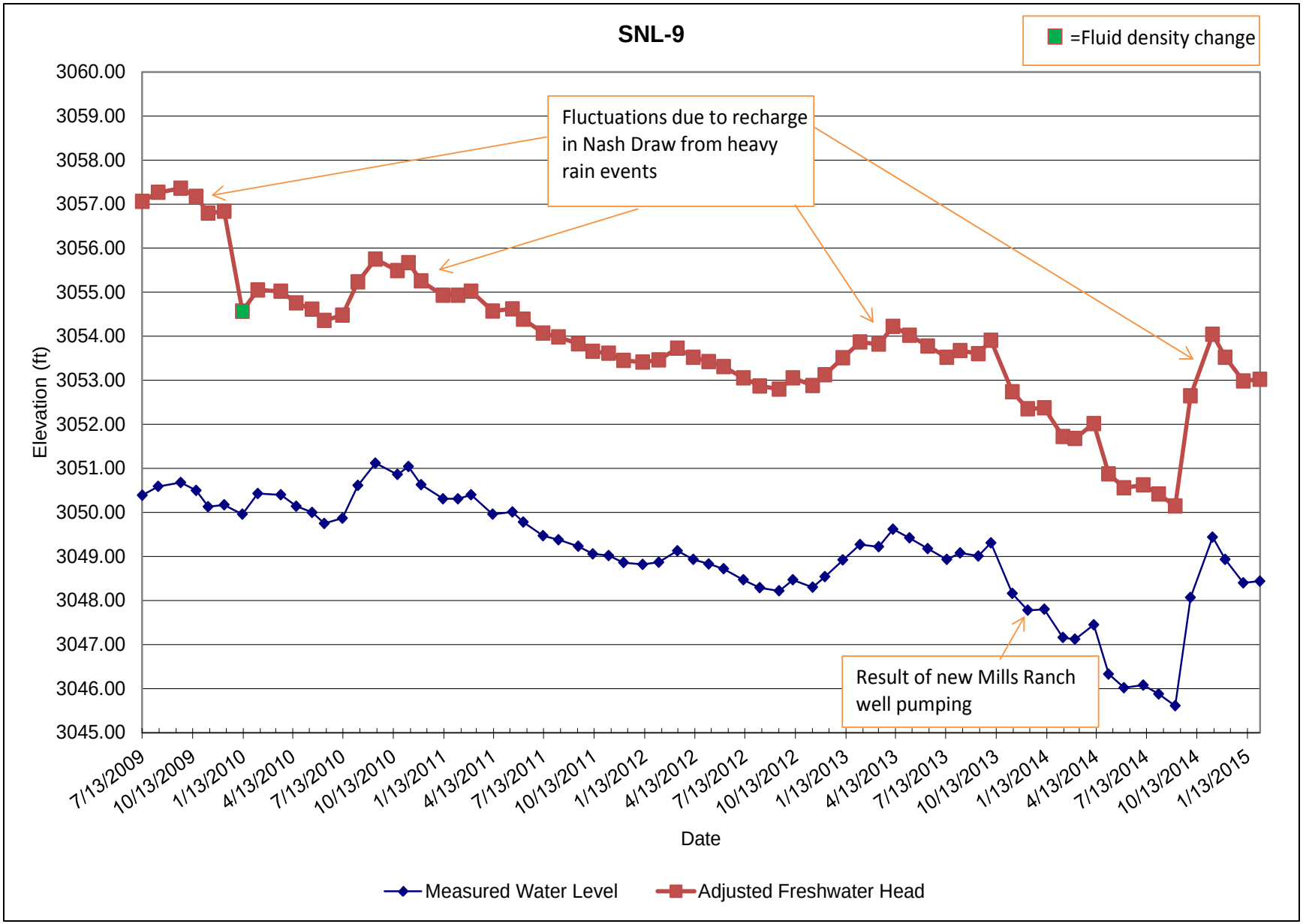

SNL-2
Elevation (ft)
3085.00
3084.00
3083.00
3082.00
3081.00
3080.00
3079.00
3078.00
3077.00
3076.00
3075.00
3074.00
3073.00
3072.00
3071.00
3070.00
3069.00
3068.00
3067.00
3066.00
Fluctuations due to recharge in Nash Draw from heavy rain events
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

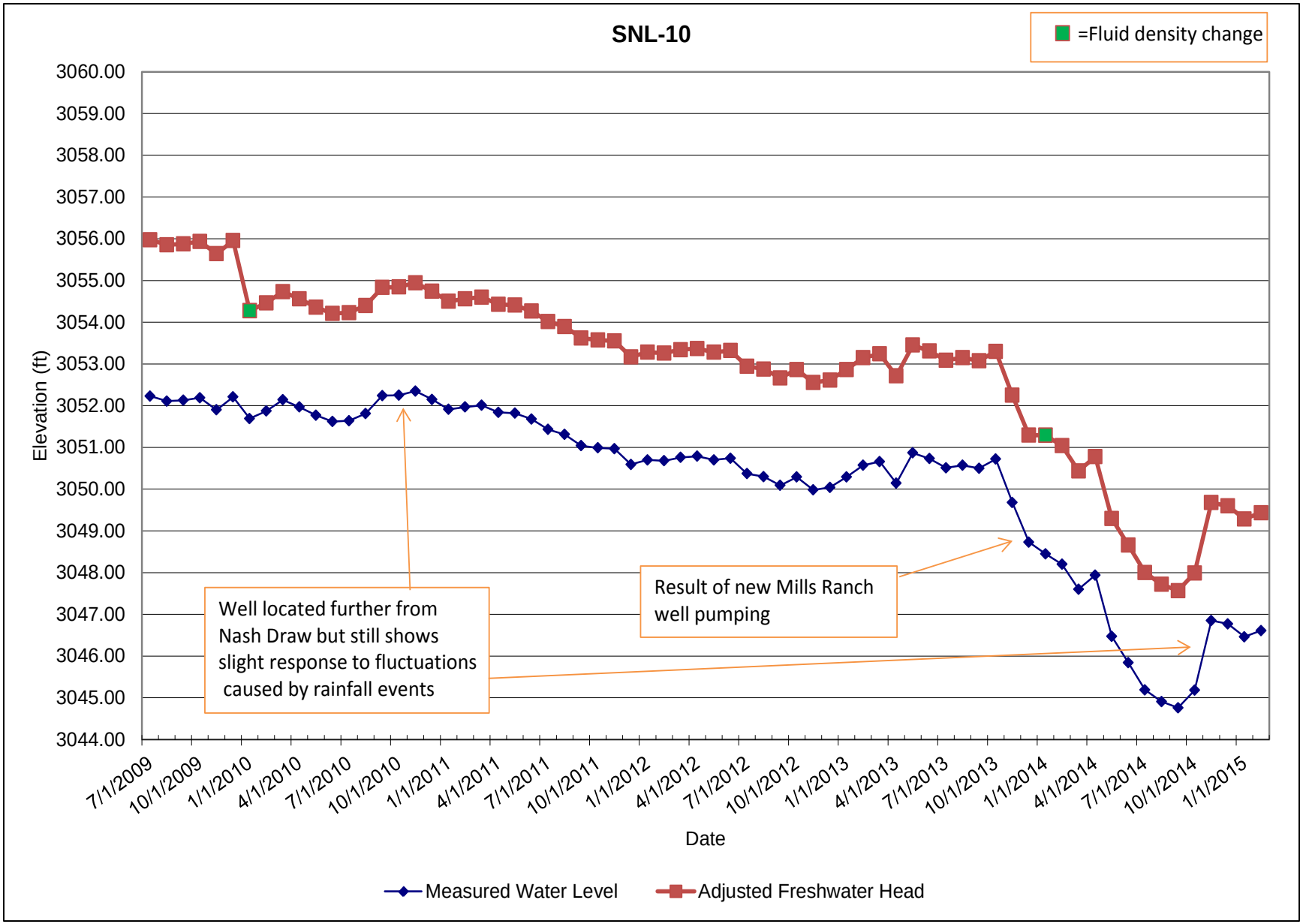

SNL-3
=Fluid density change
Fluctuations due to recharge in Nash Draw from heavy rain events
Possible rise due to increased oil/gas drilling activity around well during this time. Also delayed response to fluctuations due to recharge in Nash Draw from heavy rains in early July 2010.
Elevation (ft)
3089.00
3086.00
3083.00
3080.00
3077.00
3074.00
3071.00
3068.00
3065.00
7/13/2009
10/13/2009
1/13/2010
4/13/2010
7/13/2010
10/13/2010
1/13/2011
4/13/2011
7/13/2011
10/13/2011
1/13/2012
4/13/2012
7/13/2012
10/13/2012
1/13/2013
4/13/2013
7/13/2013
10/13/2013
1/13/2014
4/13/2014
7/13/2014
10/13/2014
1/13/2015
Date
Measured Water Level
Adjusted Freshwater Head

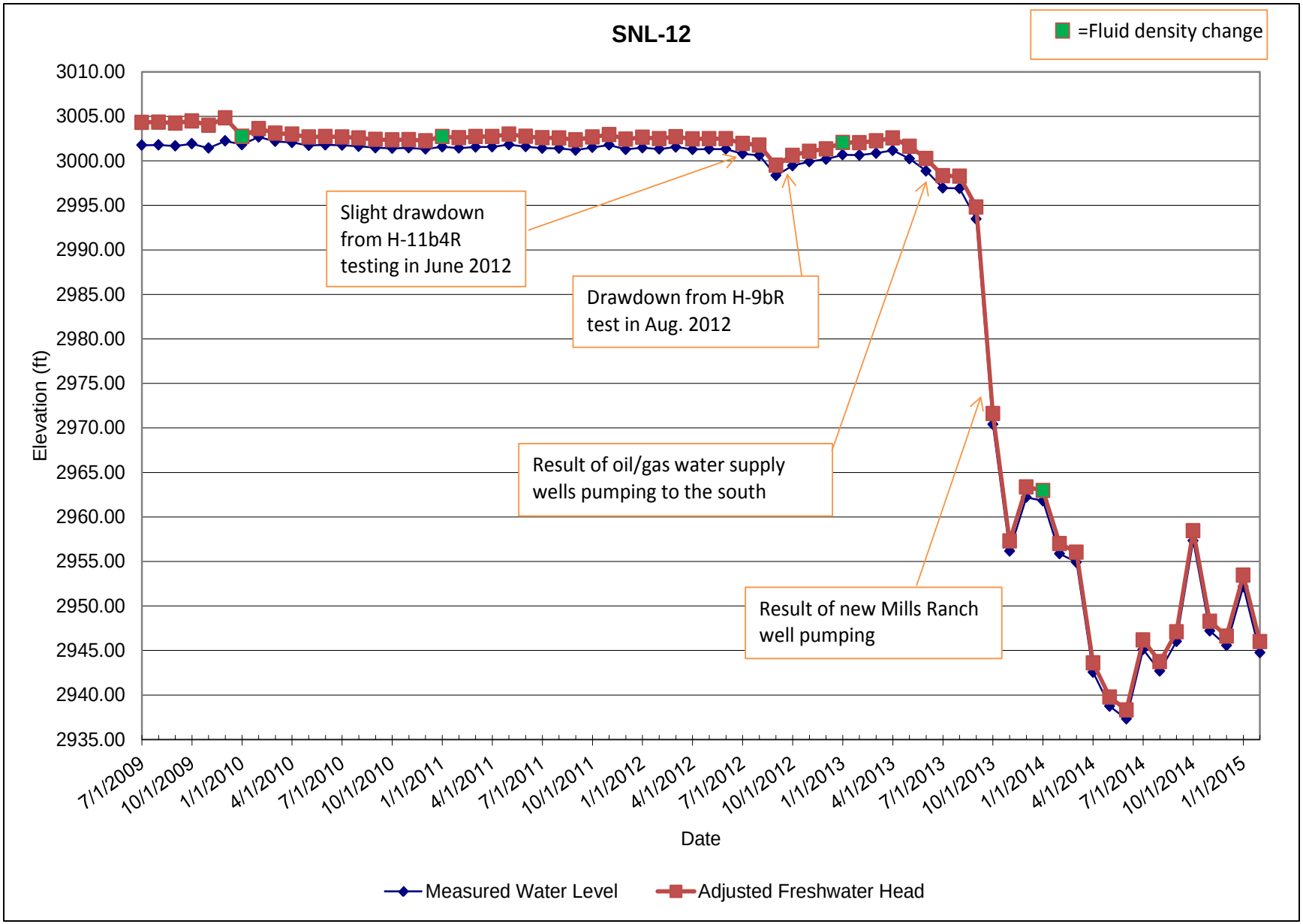

SNL-5
=Fluid density change
3084.00
3081.00
3078.00
3075.00
3072.00
3069.00
3066.00
Elevation (ft)
Response to fluctuations due to recharge in Nash Draw from heavy rain events
1/15/2008
4/15/2008
7/15/2008
10/15/2008
1/15/2009
4/15/2009
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
4/15/2013
7/15/2013
10/15/2013
1/15/2014
Date
Measured Water Level
Adjusted Freshwater Head

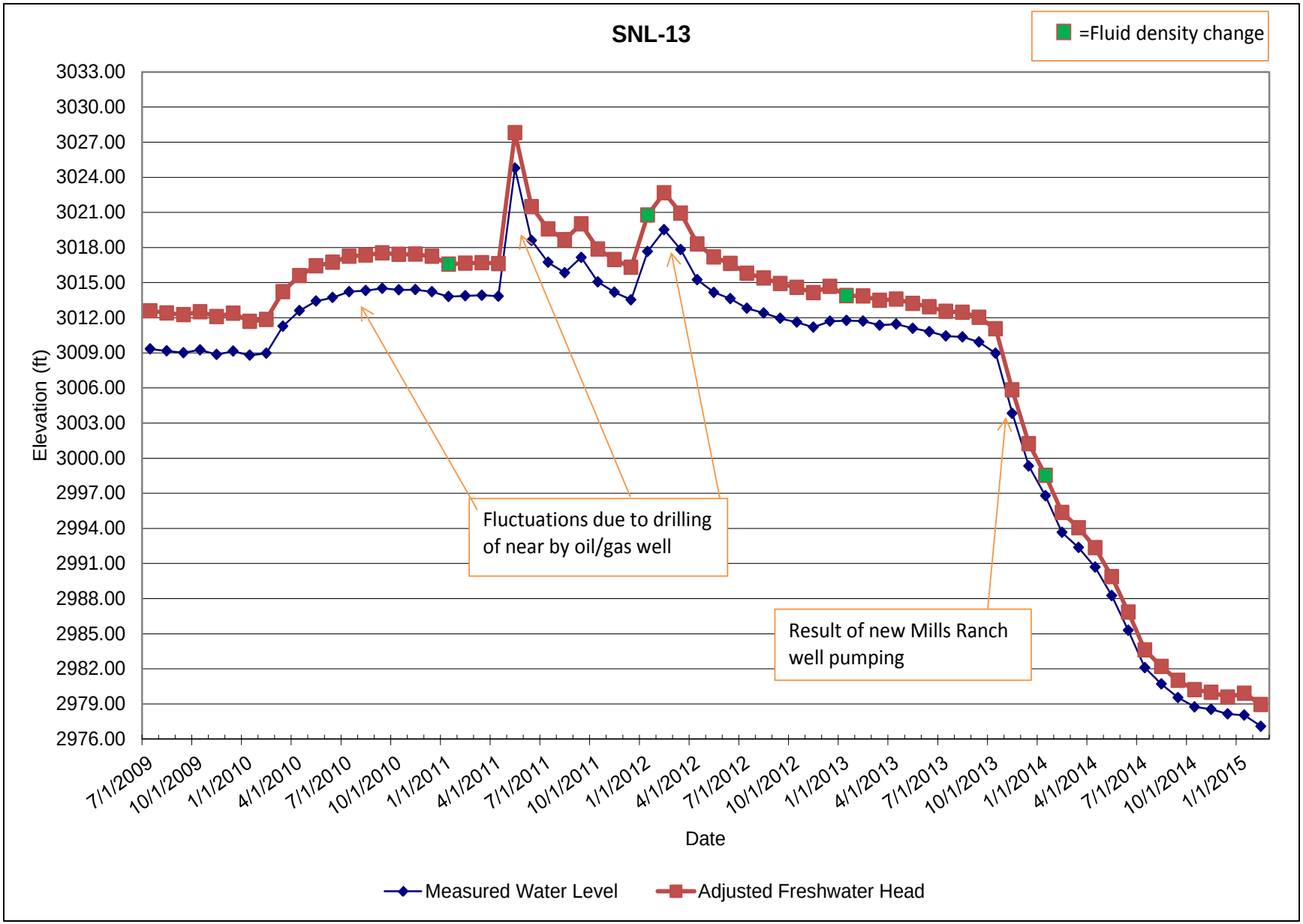

SNL-6
Recovering to expected equilibrium from drilling
Elevation (ft)
3400.00
3300.00
3200.00
3100.00
3000.00
2900.00
2800.00
2700.00
7/16/2009
10/16/2009
1/16/2010
4/16/2010
7/16/2010
10/16/2010
1/16/2011
4/16/2011
7/16/2011
10/16/2011
1/16/2012
4/16/2012
7/16/2012
10/16/2012
1/16/2013
4/16/2013
7/16/2013
10/16/2013
1/16/2014
4/16/2014
7/16/2014
10/16/2014
1/16/2015
Date
Measured Water Level
Adjusted Freshwater Head

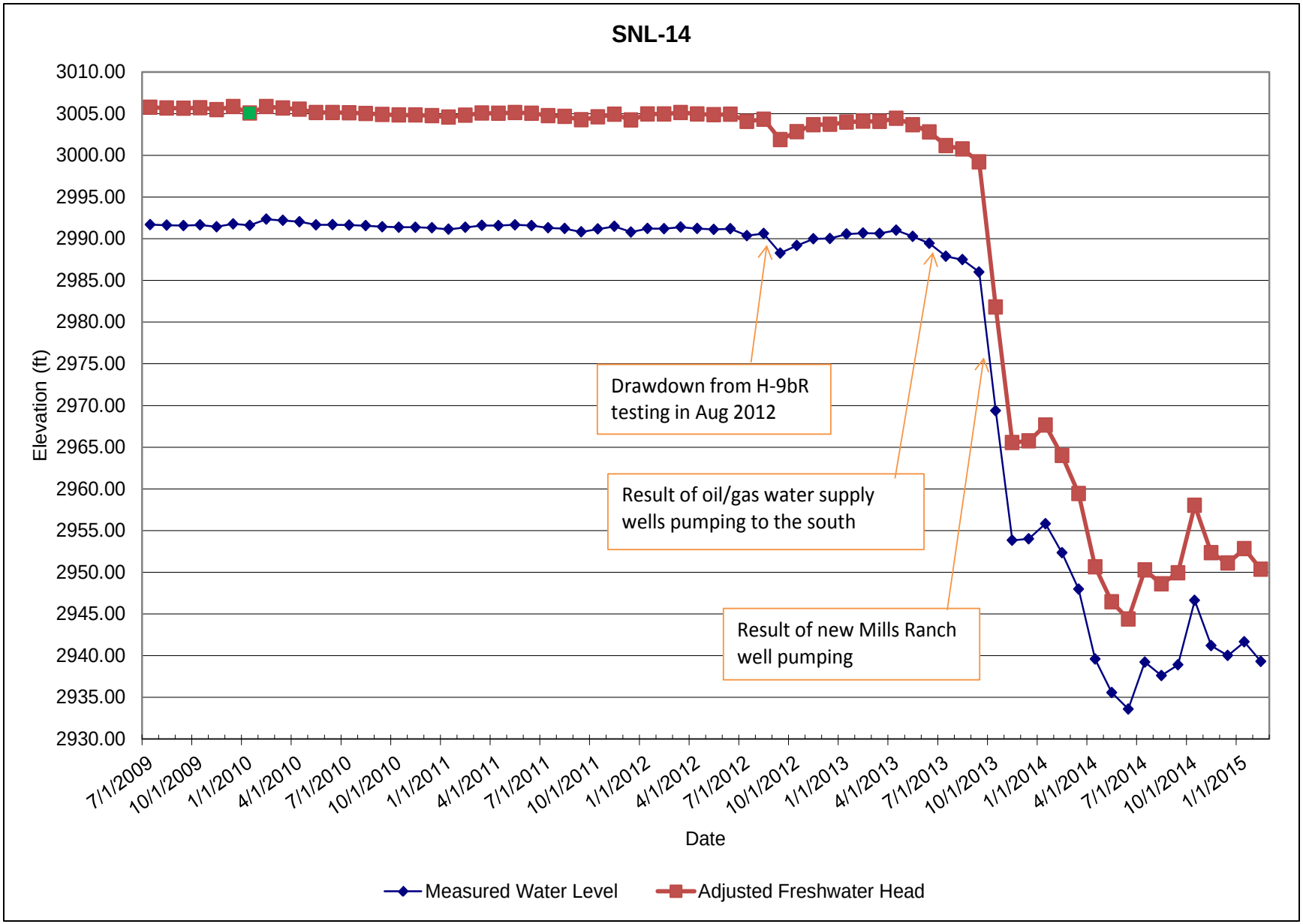

SNL-8
=Fluid density change
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
Elevation (ft)
Increased oil/gas activity in the area may have caused rise in system
7/14/2009
10/14/2009
1/14/2010
4/14/2010
7/14/2010
10/14/2010
1/14/2011
4/14/2011
7/14/2011
10/14/2011
1/14/2012
4/14/2012
7/14/2012
10/14/2012
1/14/2013
4/14/2013
7/14/2013
10/14/2013
1/14/2014
4/14/2014
7/14/2014
10/14/2014
1/14/2015
Date
Measured Water Level
Adjusted Freshwater Head

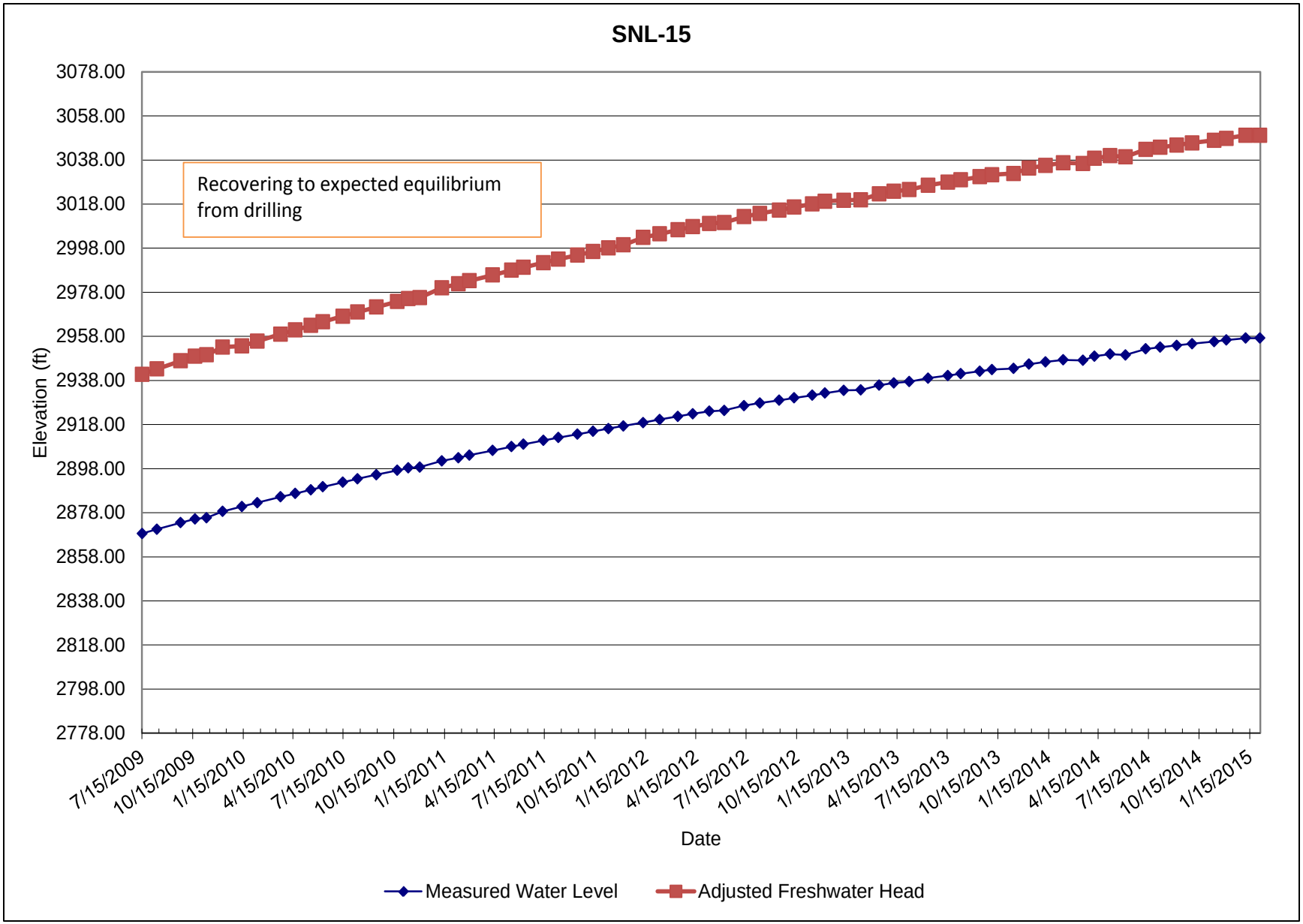

SNL-9
=Fluid density change
Fluctuations due to recharge in Nash Draw from heavy rain events
Result of new Mills Ranch well pumping
Elevation (ft)
3060.00
3059.00
3058.00
3057.00
3056.00
3055.00
3054.00
3053.00
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
7/13/2009
10/13/2009
1/13/2010
4/13/2010
7/13/2010
10/13/2010
1/13/2011
4/13/2011
7/13/2011
10/13/2011
1/13/2012
4/13/2012
7/13/2012
10/13/2012
1/13/2013
4/13/2013
7/13/2013
10/13/2013
1/13/2014
4/13/2014
7/13/2014
10/13/2014
1/13/2015
Date
Measured Water Level
Adjusted Freshwater Head

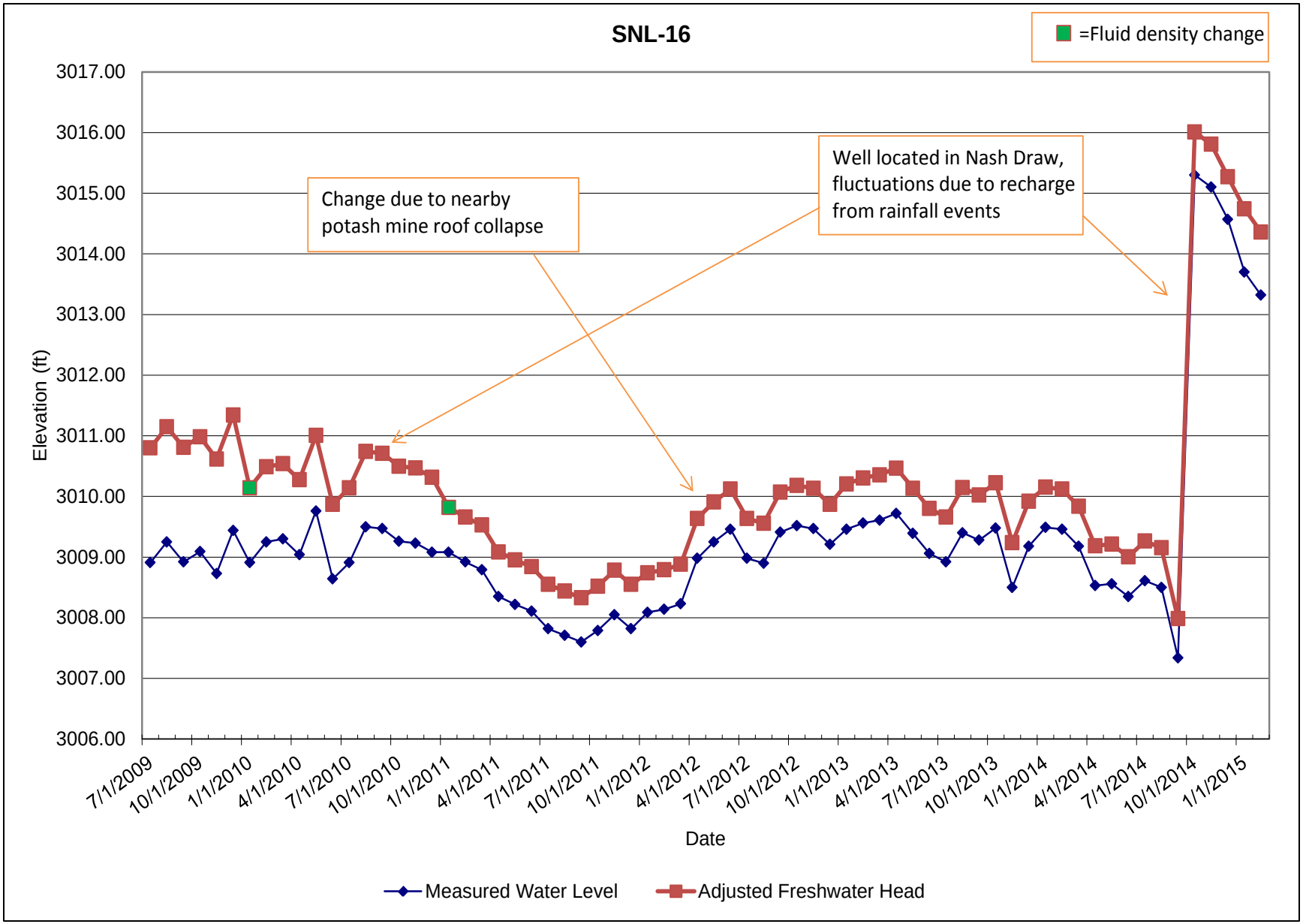

SNL-10
=Fluid density change
Elevation (ft)
3060.00
3059.00
3058.00
3057.00
3056.00
3055.00
3054.00
3053.00
3052.00
3051.00
3050.00
3049.00
3048.00
3047.00
3046.00
3045.00
3044.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Well located further from Nash Draw but still shows slight response to fluctuations caused by rainfall events
Result of new Mills Ranch well pumping
Measured Water Level
Adjusted Freshwater Head

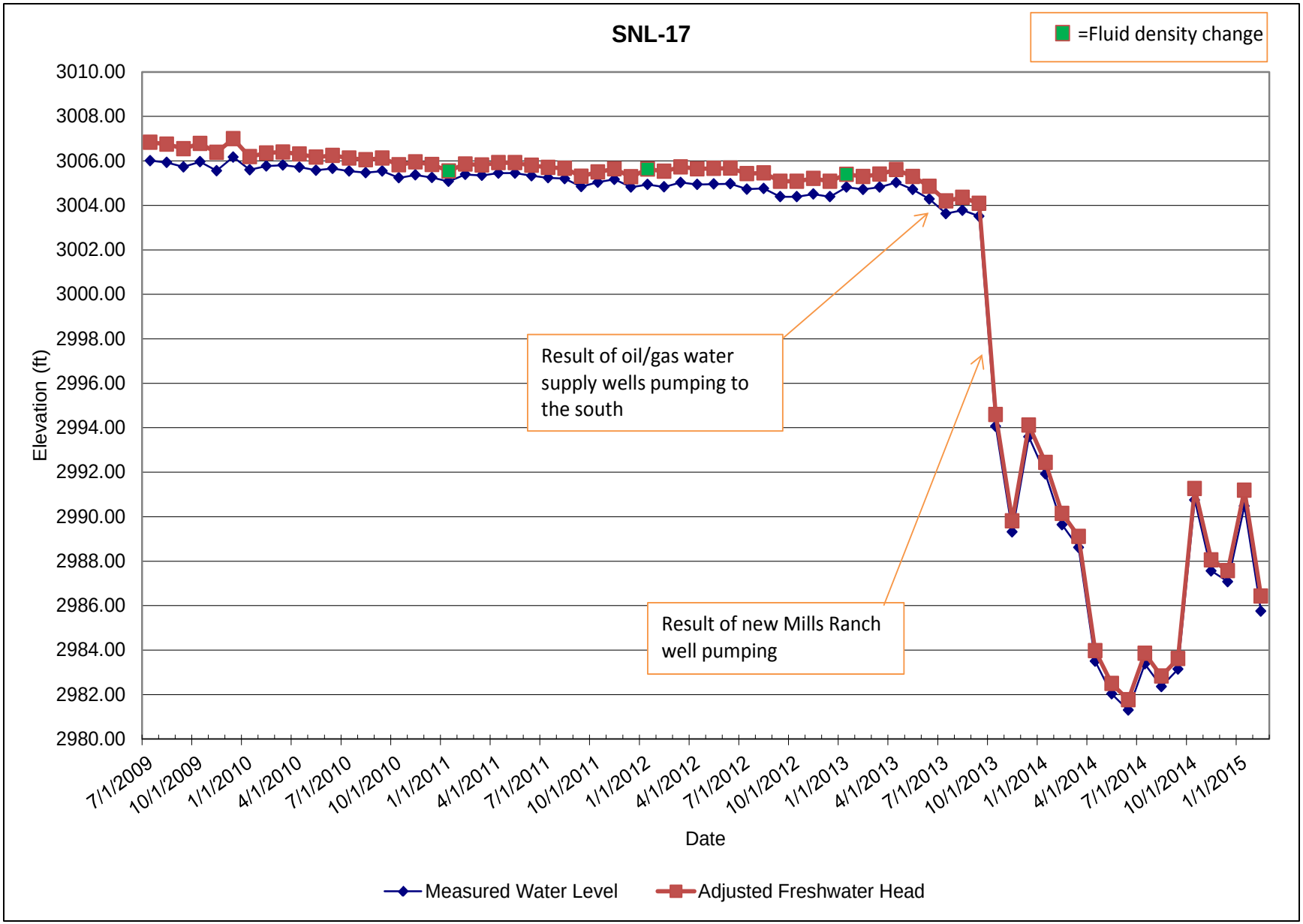

SNL-12
=Fluid density change
Elevation (ft)
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
2955.00
2950.00
2945.00
2940.00
2935.00
Slight drawdown from H-11b4R testing in June 2012
Drawdown from H-9bR test in Aug. 2012
Result of oil/gas water supply wells pumping to the south
Result of new Mills Ranch well pumping
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

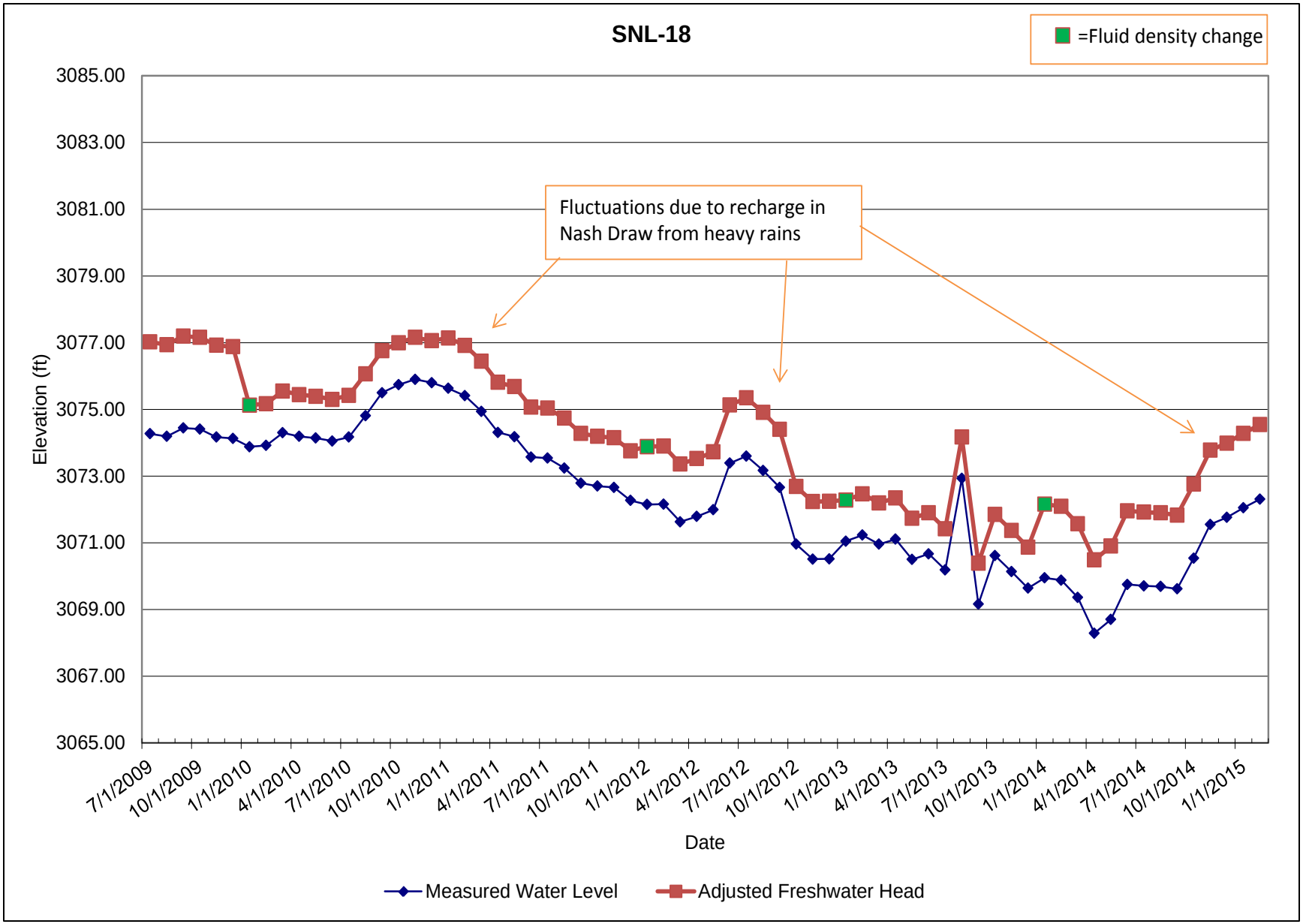

SNL-13
=Fluid density change
Elevation (ft)
3033.00
3030.00
3027.00
3024.00
3021.00
3018.00
3015.00
3012.00
3009.00
3006.00
3003.00
3000.00
2997.00
2994.00
2991.00
2988.00
2985.00
2982.00
2979.00
2976.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Fluctuations due to drilling of near by oil/gas well
Result of new Mills Ranch well pumping
Measured Water Level
Adjusted Freshwater Head

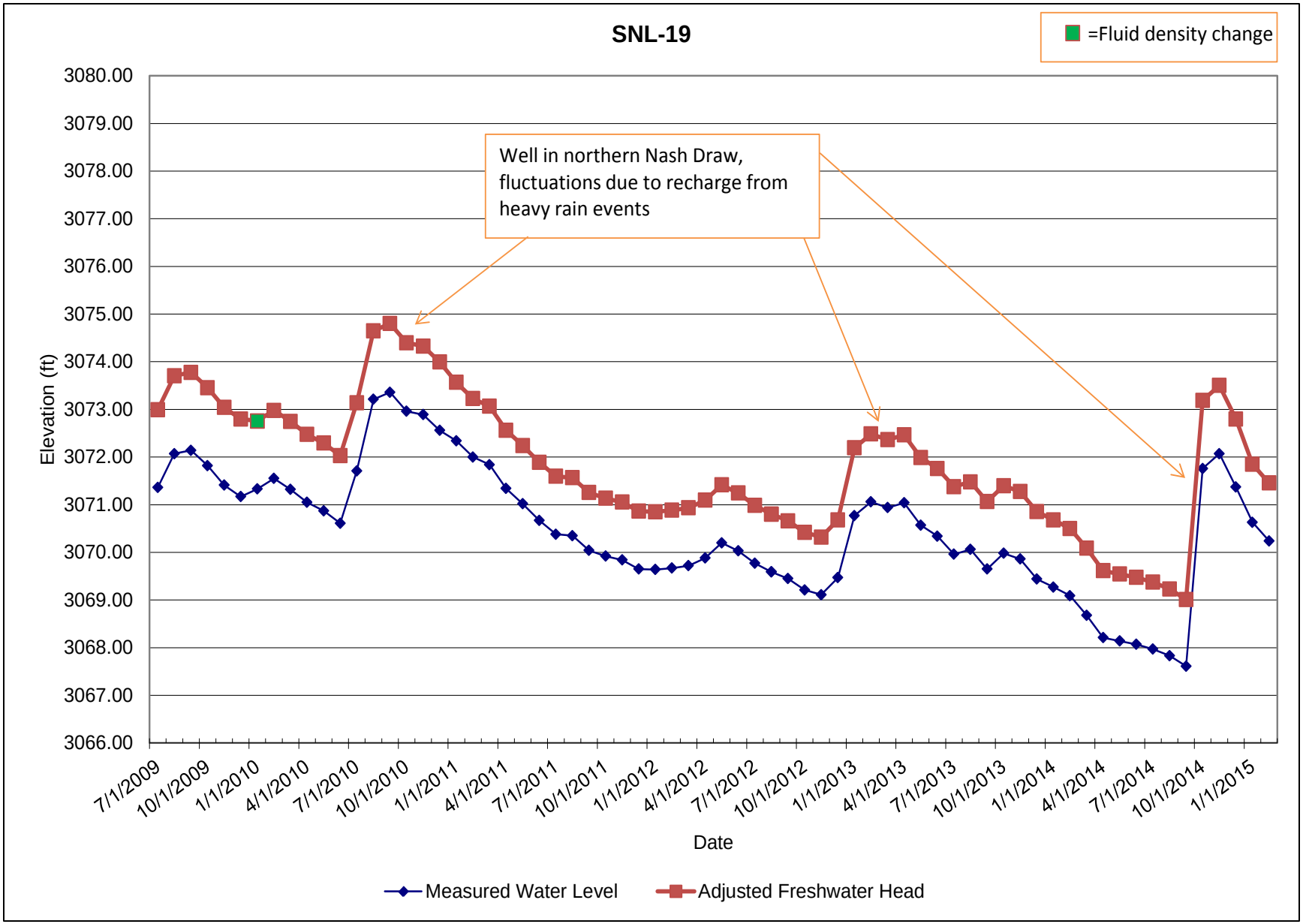

SNL-14
3010.00
3005.00
3000.00
2995.00
2990.00
2985.00
2980.00
2975.00
2970.00
2965.00
2960.00
2955.00
2950.00
2945.00
2940.00
2935.00
2930.00
Elevation (ft)
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Drawdown from H-9bR testing in Aug 2012
Result of oil/gas water supply wells pumping to the south
Result of new Mills Ranch well pumping
Measured Water Level
Adjusted Freshwater Head

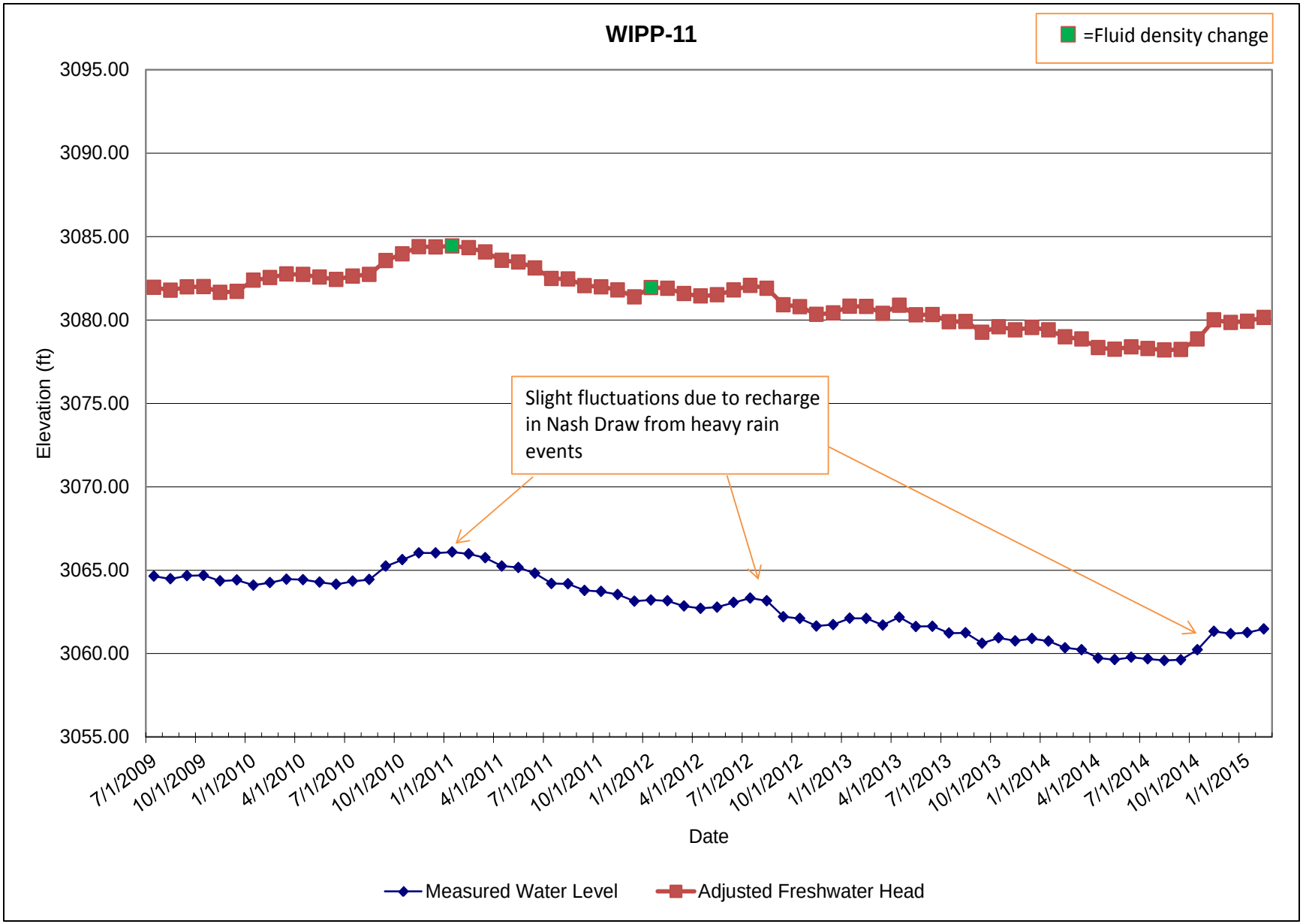

SNL-15
Recovering to expected equilibrium from drilling
Elevation (ft)
3078.00
3058.00
3038.00
3018.00
2998.00
2978.00
2958.00
2938.00
2918.00
2898.00
2878.00
2858.00
2838.00
2818.00
2798.00
2778.00
7/15/2009
10/15/2009
1/15/2010
4/15/2010
7/15/2010
10/15/2010
1/15/2011
4/15/2011
7/15/2011
10/15/2011
1/15/2012
4/15/2012
7/15/2012
10/15/2012
1/15/2013
4/15/2013
7/15/2013
10/15/2013
1/15/2014
4/15/2014
7/15/2014
10/15/2014
1/15/2015
Date
Measured Water Level
Adjusted Freshwater Head

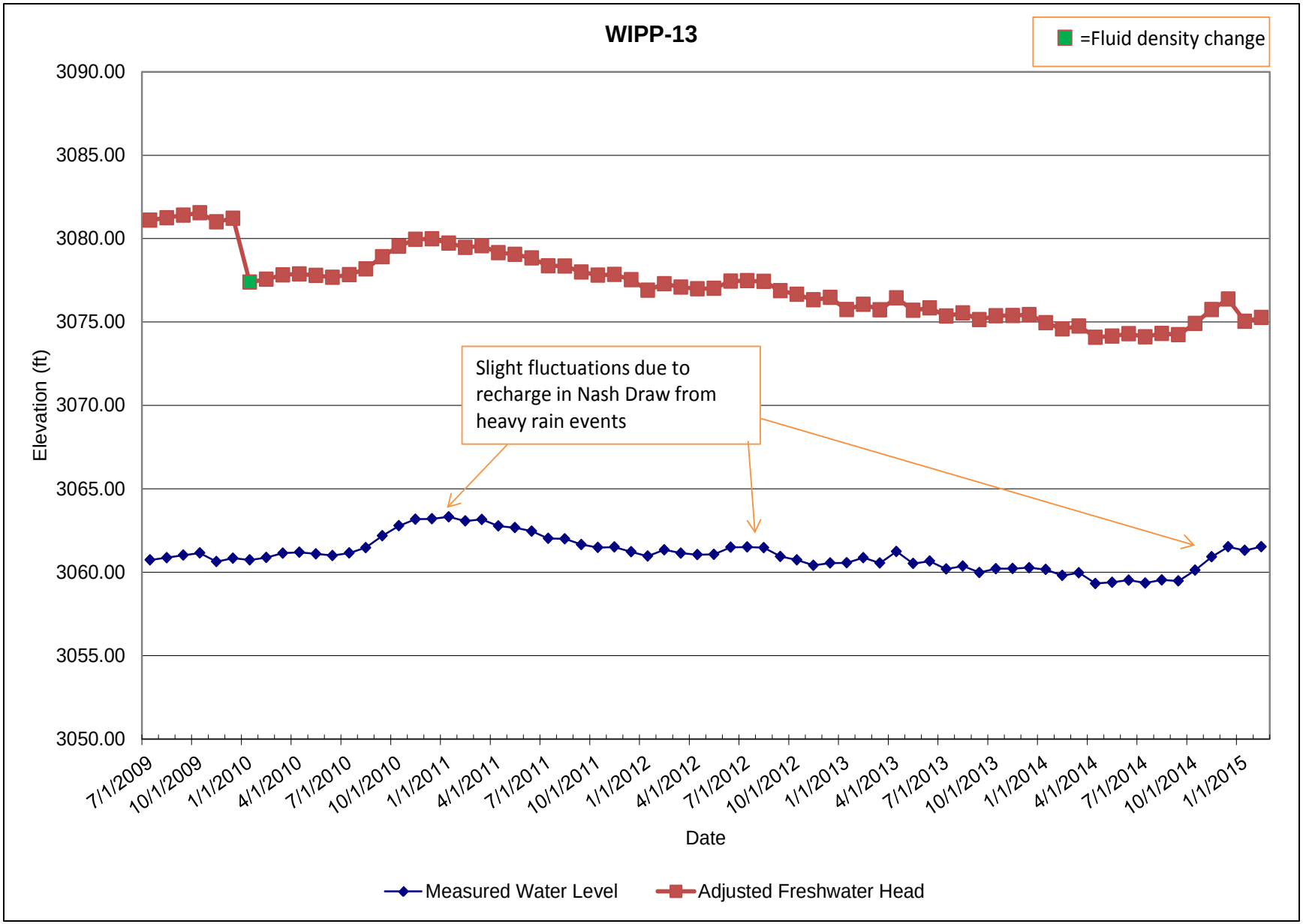

SNL-16
=Fluid density change
Change due to nearby potash mine roof collapse
Well located in Nash Draw, fluctuations due to recharge from rainfall events
Elevation (ft)
3017.00
3016.00
3015.00
3014.00
3013.00
3012.00
3011.00
3010.00
3009.00
3008.00
3007.00
3006.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

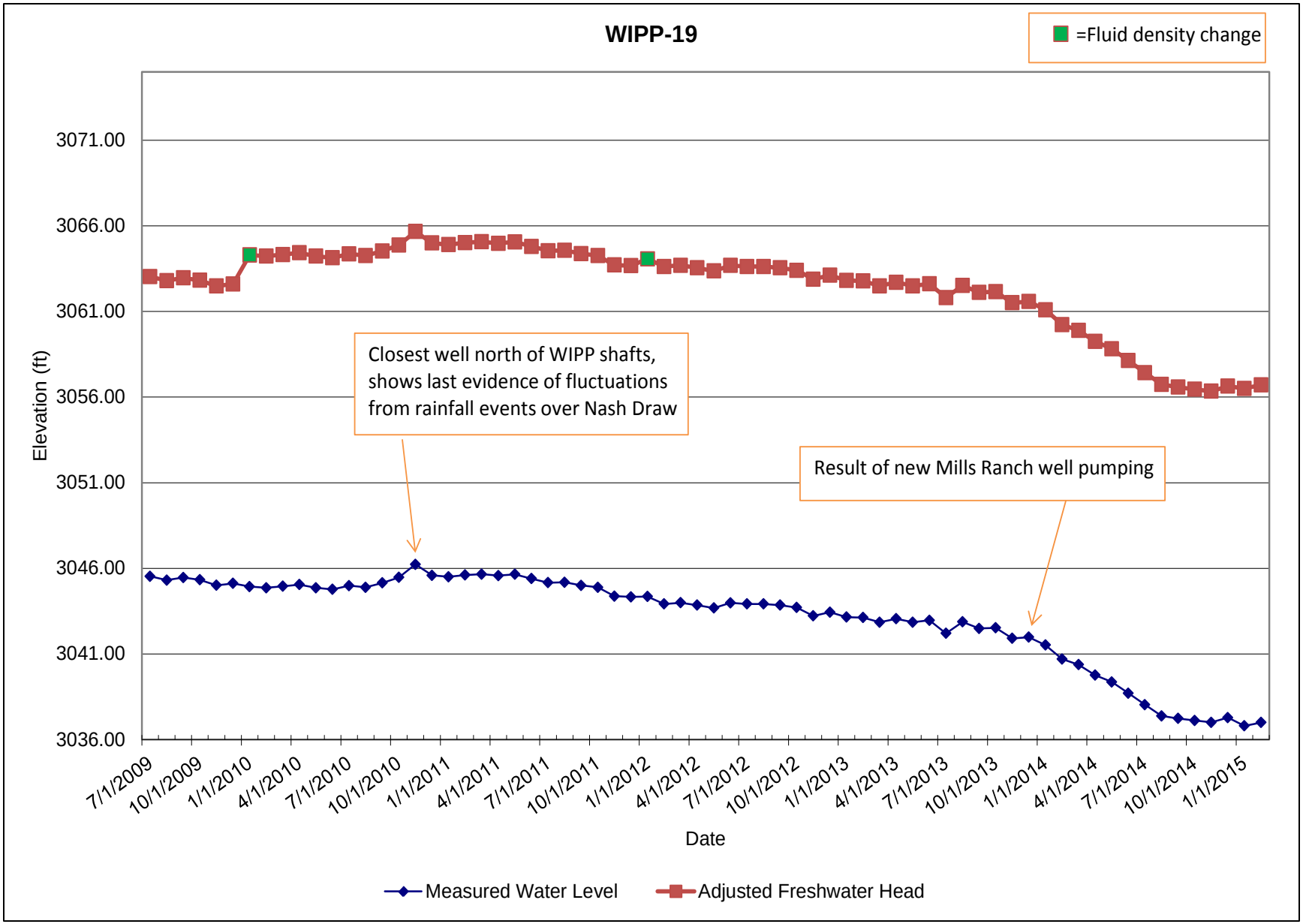

SNL-17
=Fluid density change
3010.00
3008.00
3006.00
3004.00
3002.00
3000.00
2998.00
2996.00
2994.00
2992.00
2990.00
2988.00
2986.00
2984.00
2982.00
2980.00
Elevation (ft)
Result of oil/gas water supply wells pumping to the south
Result of new Mills Ranch well pumping
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

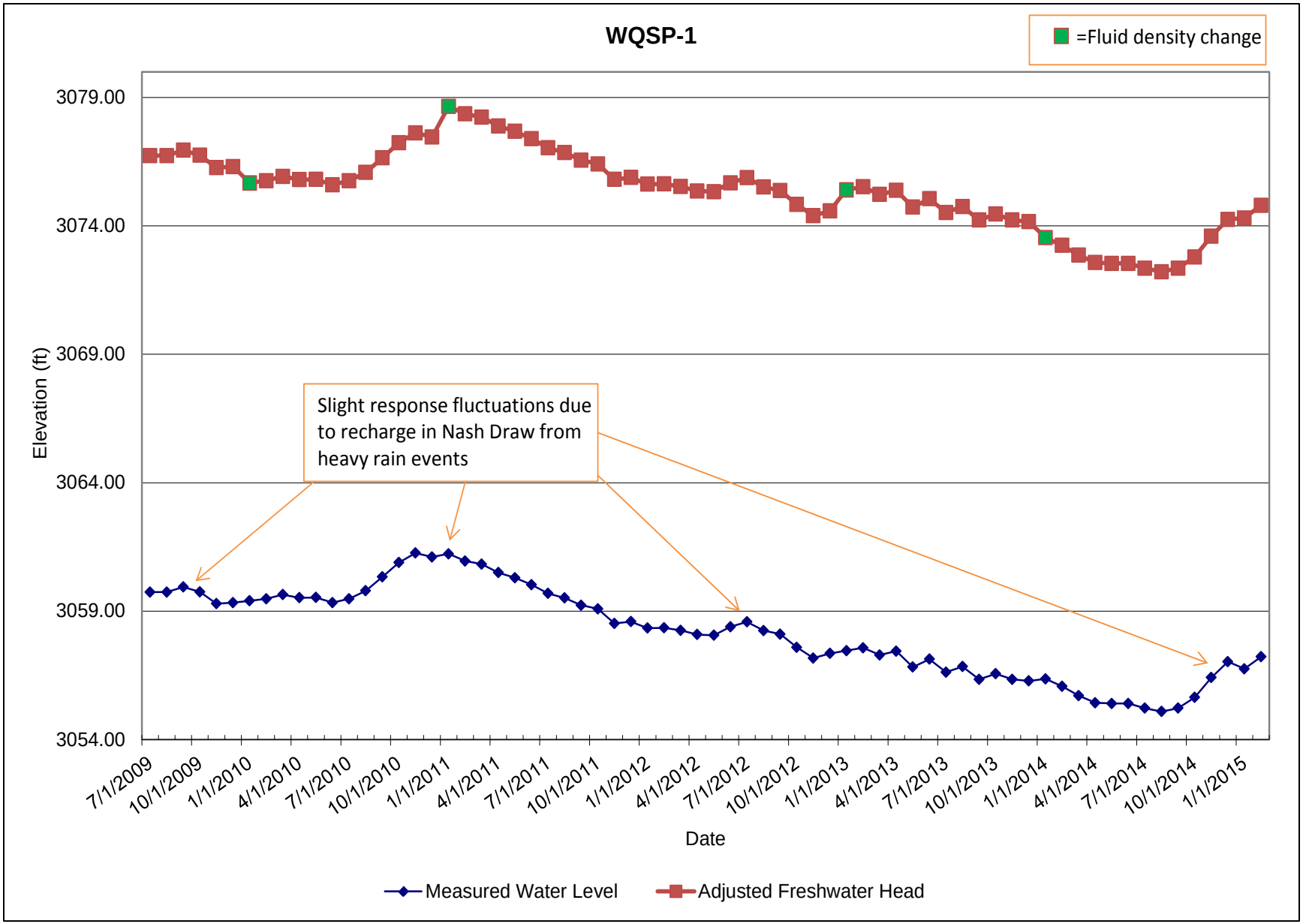

SNL-18
=Fluid density change
Fluctuations due to recharge in Nash Draw from heavy rains
Elevation (ft)
3085.00
3083.00
3081.00
3079.00
3077.00
3075.00
3073.00
3071.00
3069.00
3067.00
3065.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

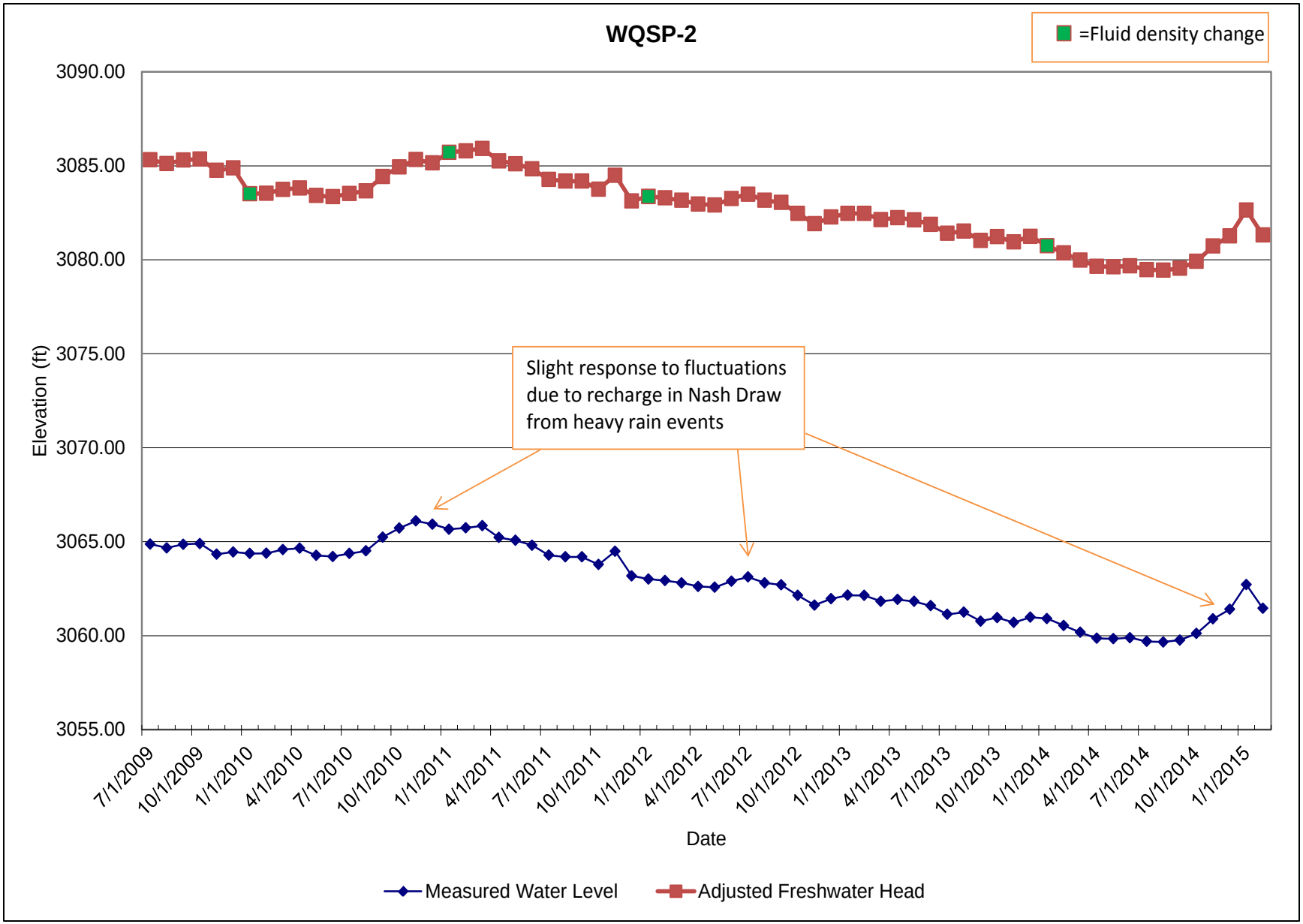

SNL-19
=Fluid density change
Well in northern Nash Draw, fluctuations due to recharge from heavy rain events
Elevation (ft)
3080.00
3079.00
3078.00
3077.00
3076.00
3075.00
3074.00
3073.00
3072.00
3071.00
3070.00
3069.00
3068.00
3067.00
3066.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

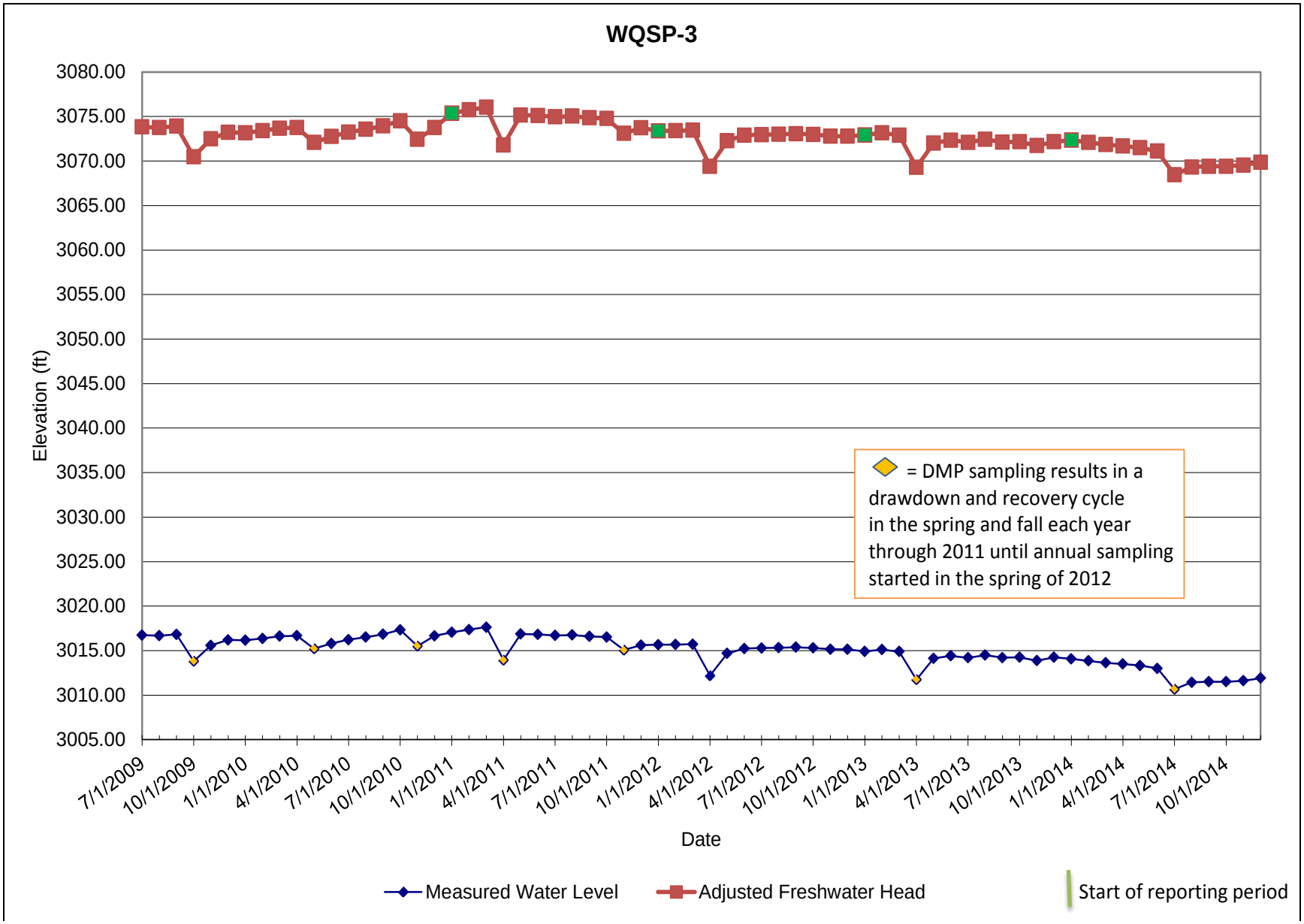

WIPP-11
=Fluid density change
3095.00
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
Elevation (ft)
Slight fluctuations due to recharge in Nash Draw from heavy rain events
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head

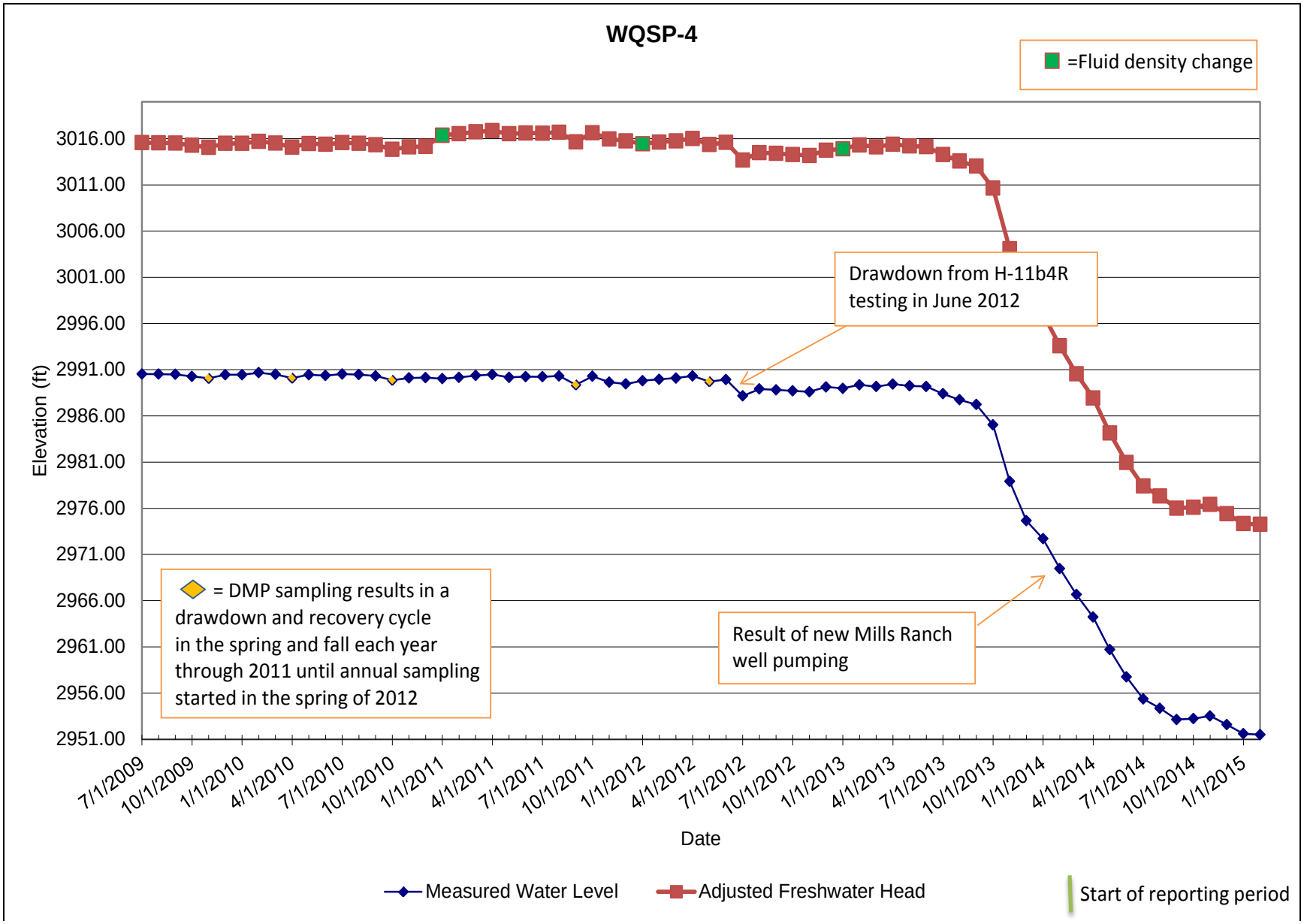

WIPP-13
=Fluid density change
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
Elevation (ft)
Slight fluctuations due to recharge in Nash Draw from heavy rain events
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head


WIPP-19
=Fluid density change
3071.00
3066.00
3061.00
3056.00
3051.00
3046.00
3041.00
3036.00
Elevation (ft)
Closest well north of WIPP shafts, shows last evidence of fluctuations from rainfall events over Nash Draw
Result of new Mills Ranch well pumping
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-1
=Fluid density change
3079.00
3074.00
3069.00
3064.00
3059.00
3054.00
Elevation (ft)
Slight response fluctuations due to recharge in Nash Draw from heavy rain events
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-2
=Fluid density change
3090.00
3085.00
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
Elevation (ft)
Slight response to fluctuations due to recharge in Nash Draw from heavy rain events
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head


WQSP-3
3080.00
3075.00
3070.00
3065.00
3060.00
3055.00
3050.00
3045.00
3040.00
3035.00
3030.00
3025.00
3020.00
3015.00
3010.00
3005.00
Elevation (ft)
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
Date
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year through 2011 until annual sampling started in the spring of 2012
Measured Water Level
Adjusted Freshwater Head
Start of reporting period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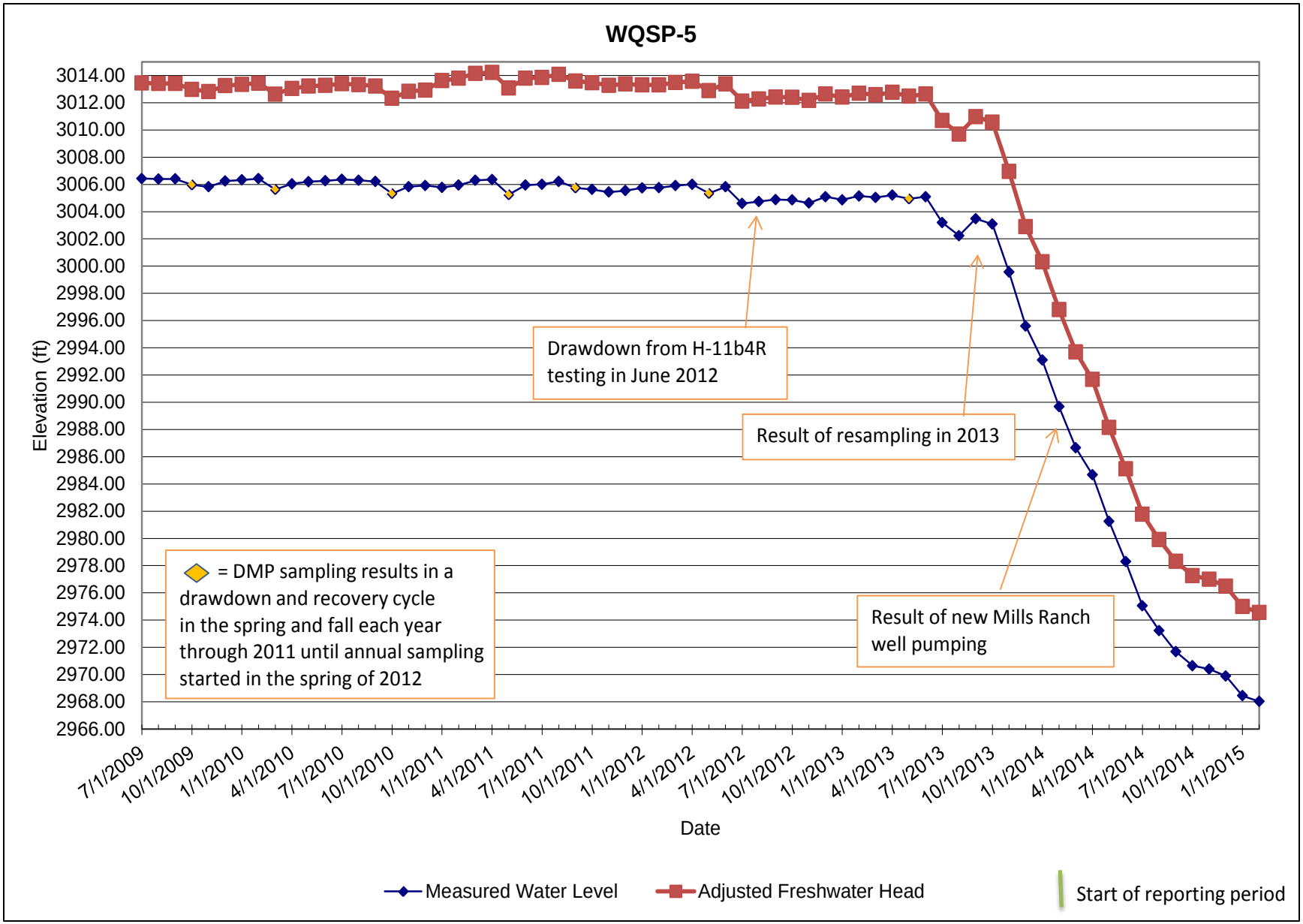
3006.00
3001.00
2996.00
2991.00
2986.00
2981.00
2976.00
2971.00
2966.00
2961.00
2956.00
2951.00
Drawdown from H-11b4R testing in June 2012
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year through 2011 until annual sampling started in the spring of 2012
Result of new Mills Ranch well pumping
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Measured Water Level
Adjusted Freshwater Head
Start of reporting period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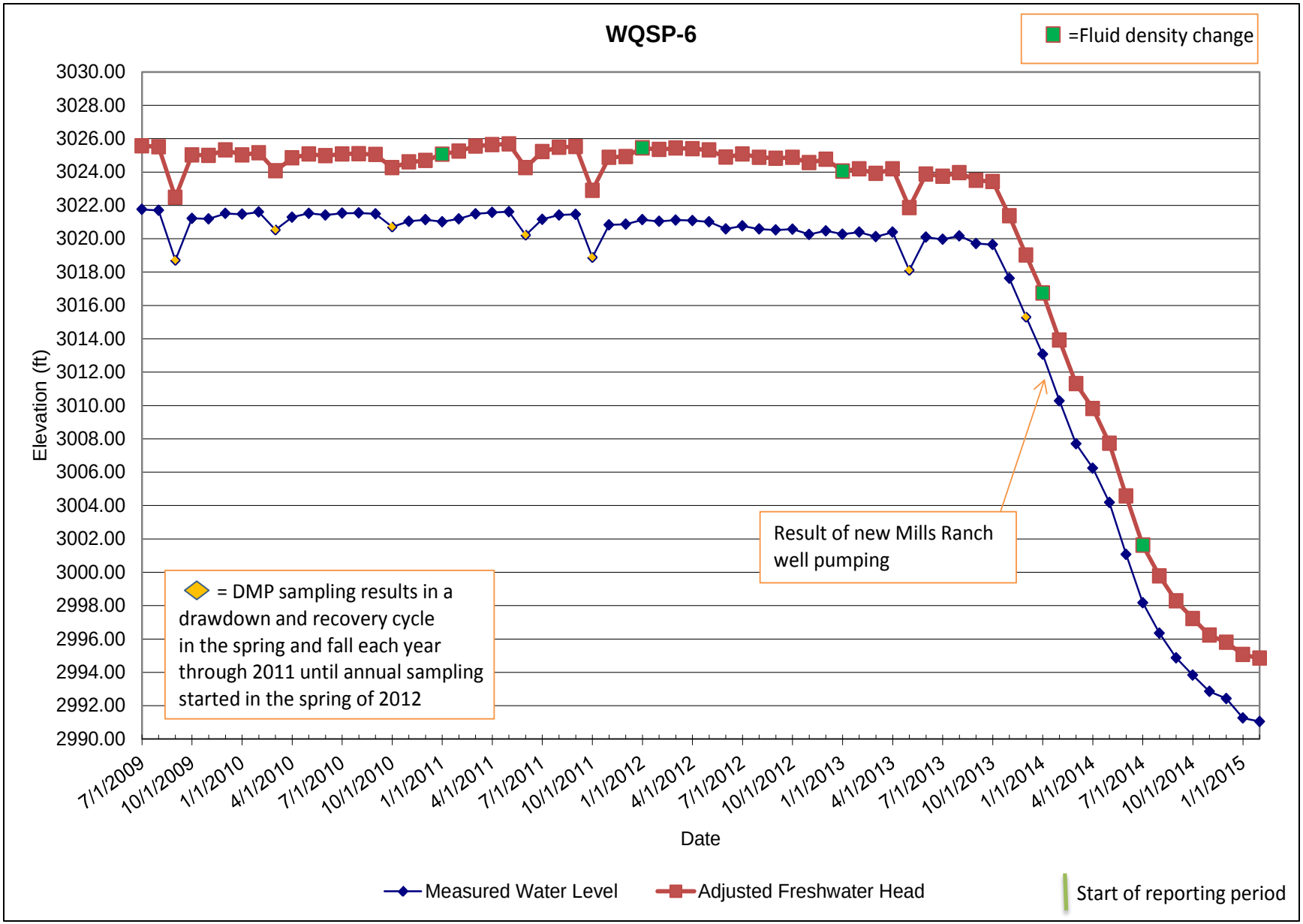
2992.00
2990.00
2988.00
2986.00
2984.00
2982.00
2980.00
2978.00
2976.00
2974.00
2972.00
2970.00
2968.00
2966.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Drawdown from H-11b4R testing in June 2012
Result of resampling in 2013
Result of new Mills Ranch well pumping
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year through 2011 until annual sampling started in the spring of 2012
Measured Water Level
Adjusted Freshwater Head
Start of reporting period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3016.00
3014.00
3012.00
3010.00
3008.00
3006.00
3004.00
3002.00
3000.00
2998.00
2996.00
2994.00
2992.00
2990.00
7/1/2009
10/1/2009
1/1/2010
4/1/2010
7/1/2010
10/1/2010
1/1/2011
4/1/2011
7/1/2011
10/1/2011
1/1/2012
4/1/2012
7/1/2012
10/1/2012
1/1/2013
4/1/2013
7/1/2013
10/1/2013
1/1/2014
4/1/2014
7/1/2014
10/1/2014
1/1/2015
Date
Result of new Mills Ranch well pumping
= DMP sampling results in a drawdown and recovery cycle in the spring and fall each year through 2011 until annual sampling started in the spring of 2012
Measured Water Level
Adjusted Freshwater Head
Start of reporting period

Appendix 2

Culebra Water Levels

Sept. 2013 – Feb. 2014

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
AEC-7R	CUL	Sept. '14	SNL Testing[3]		
AEC-7R	CUL	Oct. '14	SNL Testing[3]		
AEC-7R	CUL	Nov. '14	SNL Testing[3]		
AEC-7R	CUL	Dec. '14	SNL Testing[3]		
AEC-7R	CUL	Jan. '15	SNL Testing[3]		
AEC-7R	CUL	Feb. '15	SNL Testing[3]		
C-2737 (PIP)	CUL	09/04/14	414.62	2986.14	2992.50
C-2737 (PIP)	CUL	10/03/14	415.62	2985.14	2991.48
C-2737 (PIP)	CUL	11/12/14	415.70	2985.06	2991.39
C-2737 (PIP)	CUL	12/08/14	416.18	2984.58	2990.90
C-2737 (PIP)	CUL	01/13/15	417.10	2983.66	2990.24
C-2737 (PIP)	CUL	02/05/15	417.46	2983.30	2989.87
ERDA-9	CUL	09/03/14	418.98	2991.19	3012.36
ERDA-9	CUL	10/03/14	417.83	2992.34	3013.59
ERDA-9	CUL	11/11/14	420.32	2989.85	3010.93
ERDA-9	CUL	12/04/14	420.72	2989.45	3010.50
ERDA-9	CUL	01/07/15	421.56	2988.61	3009.89
ERDA-9	CUL	02/05/15	421.76	2988.41	3009.68
H-02b2	CUL	09/04/14	347.72	3030.64	3034.38
H-02b2	CUL	10/01/14	348.00	3030.36	3034.10
H-02b2	CUL	11/12/14	349.20	3029.16	3032.88
H-02b2	CUL	12/08/14	349.46	3028.90	3032.62
H-02b2	CUL	01/13/15	349.87	3028.49	3031.92

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
H-02b2	CUL	02/05/15	350.06	3028.30	3031.73
H-03b2	CUL	09/04/14	422.85	2967.06	2975.54
H-03b2	CUL	10/03/14	423.60	2966.31	2974.76
H-03b2	CUL	11/11/14	423.31	2966.60	2975.06
H-03b2	CUL	12/04/14	423.97	2965.94	2974.38
H-03b2	CUL	01/07/15	425.45	2964.46	2971.54
H-03b2	CUL	02/05/15	425.65	2964.26	2971.34
H-04bR	CUL	09/04/14	404.91	2929.73	2931.48
H-04bR	CUL	10/03/14	382.19	2952.45	2954.59
H-04bR	CUL	11/11/14	407.20	2927.44	2929.15
H-04bR	CUL	12/04/14	408.64	2926.00	2927.69
H-04bR	CUL	01/07/15	389.88	2944.76	2947.95
H-04bR	CUL	02/04/15	410.45	2924.19	2926.82
H-05b	CUL	09/03/14	465.81	3040.97	3081.86
H-05b	CUL	10/01/14	465.66	3041.12	3082.03
H-05b	CUL	11/10/14	465.89	3040.89	3081.77
H-05b	CUL	12/01/14	466.13	3040.65	3081.51
H-05b	CUL	01/06/15	466.40	3040.38	3079.89
H-05b	CUL	02/02/15	466.46	3040.32	3079.82
H-06bR	CUL	09/03/14	293.71	3055.51	3068.13
H-06bR	CUL	10/01/14	291.72	3057.50	3070.20
H-06bR	CUL	11/12/14	291.32	3057.90	3070.61
H-06bR	CUL	12/03/14	291.17	3058.05	3070.77

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
H-06bR	CUL	01/03/15	291.61	3057.61	3069.99
H-06bR	CUL	02/04/15	291.49	3057.73	3070.11
H-07b1	CUL	09/03/14	171.47	2992.25	2992.94
H-07b1	CUL	10/01/14	170.81	2992.91	2993.60
H-07b1	CUL	11/10/14	166.81	2996.91	2997.63
H-07b1	CUL	12/02/14	166.40	2997.32	2998.04
H-07b1	CUL	01/05/15	166.29	2997.43	2998.36
H-07b1	CUL	02/02/15	166.14	2997.58	2998.51
H-09bR	CUL	09/03/14	446.51	2961.83	2962.05
H-09bR	CUL	10/03/14	443.34	2965.00	2965.22
H-09bR	CUL	11/10/14	444.14	2964.20	2964.42
H-09bR	CUL	12/03/14	445.51	2962.83	2963.05
H-09bR	CUL	01/06/15	445.54	2962.80	2963.68
H-09bR	CUL	02/02/15	445.19	2963.15	2964.03
H-10c	CUL	09/03/14	717.37	2971.03	3033.23
H-10c	CUL	10/03/14	716.13	2972.27	3034.59
H-10c	CUL	11/11/14	714.83	2973.57	3036.01
H-10c	CUL	12/04/14	712.51	2975.89	3038.55
H-10c	CUL	01/06/15	713.45	2974.95	3038.18
H-10c	CUL	02/02/15	715.30	2973.10	3036.15
H-11b4R	CUL	09/04/14	476.52	2935.35	2955.06
H-11b4R	CUL	10/02/14	472.80	2939.07	2959.06
H-11b4R	CUL	11/11/14	473.52	2938.35	2958.29

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
H-11b4R	CUL	12/03/14	474.57	2937.30	2957.16
H-11b4R	CUL	01/07/15	475.79	2936.08	2956.10
H-11b4R	CUL	02/04/15	475.21	2936.66	2956.73
H-12R	CUL	Sept. '14	SNL Testing[3]		
H-12R	CUL	Oct. '14	SNL Testing[3]		
H-12R	CUL	Nov. '14	SNL Testing[3]		
H-12R	CUL	Dec. '14	SNL Testing[3]		
H-12R	CUL	Jan. '15	SNL Testing[3]		
H-12R	CUL	Feb. '15	SNL Testing[3]		
H-15R	CUL	09/04/14	541.35	2940.67	2979.77
H-15R	CUL	10/03/14	541.74	2940.28	2979.34
H-15R	CUL	11/12/14	541.09	2940.93	2980.06
H-15R	CUL	12/04/14	541.57	2940.45	2979.53
H-15R	CUL	01/07/15	543.00	2939.02	2977.93
H-15R	CUL	02/05/15	542.73	2939.29	2978.23
H-16	CUL	09/02/14	385.88	3024.18	3036.01
H-16	CUL	10/06/14	386.34	3023.72	3035.53
H-16	CUL	11/12/14	387.00	3023.06	3034.85
H-16	CUL	12/04/14	387.00	3023.06	3034.85
H-16	CUL	01/13/15	387.60	3022.46	3033.90
H-16	CUL	02/06/15	387.60	3022.46	3033.90
H-17	CUL	09/04/14	462.93	2922.31	2956.56
H-17	CUL	10/02/14	461.46	2923.78	2958.22

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
H-17	CUL	11/11/14	459.85	2925.39	2960.05
H-17	CUL	12/03/14	460.68	2924.56	2959.11
H-17	CUL	01/07/15	462.69	2922.55	2957.09
H-17	CUL	02/04/15	461.55	2923.69	2958.38
H-19b0	CUL	09/05/14	462.48	2955.85	2975.09
H-19b0	CUL	10/01/14	462.50	2955.83	2975.06
H-19b0	CUL	11/11/14	462.21	2956.12	2975.37
H-19b0	CUL	12/08/14	463.09	2955.24	2974.44
H-19b0	CUL	01/07/15	464.39	2953.94	2973.34
H-19b0	CUL	02/05/15	464.22	2954.11	2973.52
H-19b2	CUL	09/05/14	463.93	2955.00	2974.86
H-19b2	CUL	12/08/14	464.55	2954.38	2974.20
H-19b3	CUL	09/05/14	464.09	2954.93	2974.10
H-19b3	CUL	12/08/14	464.73	2954.29	2973.42
H-19b4	CUL	09/05/14	463.27	2955.71	2974.94
H-19b4	CUL	12/08/14	463.93	2955.05	2974.23
H-19b5	CUL	09/05/14	463.33	2955.25	2975.32
H-19b5	CUL	12/08/14	463.97	2954.61	2974.63
H-19b6	CUL	09/05/14	464.02	2955.00	2975.34
H-19b6	CUL	12/01/14	464.56	2954.46	2974.76
H-19b7	CUL	Sept. ‘14	SNL Testing		
H-19b7	CUL	Dec. ‘14	SNL Testing		
I-461	CUL	09/02/14	243.80	3039.81	3039.81

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
I-461	CUL	10/01/14	239.01	3044.60	3044.60
I-461	CUL	11/10/14	238.04	3045.57	3045.57
I-461	CUL	12/02/14	238.70	3044.91	3044.91
I-461	CUL	01/05/15	239.58	3044.03	3044.03
I-461	CUL	02/04/15	239.83	3043.78	3043.78
SNL-01	CUL	09/02/14	441.18	3071.66	3076.81
SNL-01	CUL	10/02/14	441.12	3071.72	3076.87
SNL-01	CUL	11/11/14	440.40	3072.44	3077.61
SNL-01	CUL	12/03/14	439.97	3072.87	3078.06
SNL-01	CUL	01/05/15	439.84	3073.00	3078.19
SNL-01	CUL	02/03/15	439.72	3073.12	3078.31
SNL-02	CUL	09/02/14	256.16	3066.90	3068.83
SNL-02	CUL	10/02/14	251.68	3071.38	3073.35
SNL-02	CUL	11/10/14	251.61	3071.45	3073.42
SNL-02	CUL	12/03/14	252.39	3070.67	3072.64
SNL-02	CUL	01/05/15	253.41	3069.65	3071.82
SNL-02	CUL	02/04/15	253.82	3069.24	3071.41
SNL-03	CUL	09/04/14	423.87	3066.48	3076.08
SNL-03	CUL	10/01/14	423.38	3066.97	3076.58
SNL-03	CUL	11/10/14	422.68	3067.67	3077.30
SNL-03	CUL	12/02/14	422.71	3067.64	3077.27
SNL-03	CUL	01/13/15	422.44	3067.91	3077.20
SNL-03	CUL	02/03/15	422.19	3068.16	3077.46

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
SNL-05	CUL	09/02/14	312.22	3067.76	3070.79
SNL-05	CUL	10/02/14	311.49	3068.49	3071.53
SNL-05	CUL	11/10/14	310.00	3069.98	3073.03
SNL-05	CUL	12/03/14	310.11	3069.87	3072.92
SNL-05	CUL	01/05/15	310.06	3069.92	3072.63
SNL-05	CUL	02/40/15	309.60	3070.38	3073.10
SNL-06	CUL	09/03/14	548.49	3097.62	3289.52
SNL-06	CUL	10/03/14	546.67	3099.44	3291.78
SNL-06	CUL	11/11/14	543.50	3102.61	3295.72
SNL-06	CUL	12/01/14	541.80	3104.31	3297.84
SNL-06	CUL	01/06/15	536.51	3109.60	3306.82
SNL-06	CUL	02/02/15	536.93	3109.18	3306.29
SNL-08	CUL	09/03/14	540.92	3014.81	3055.55
SNL-08	CUL	10/01/14	540.60	3015.13	3055.90
SNL-08	CUL	11/11/14	540.80	3014.93	3055.68
SNL-08	CUL	12/01/14	540.70	3015.03	3055.79
SNL-08	CUL	01/06/15	540.06	3015.67	3056.49
SNL-08	CUL	02/02/15	540.20	3015.53	3056.34
SNL-09	CUL	09/03/14	315.35	3045.61	3050.14
SNL-09	CUL	10/01/14	312.89	3048.07	3052.65
SNL-09	CUL	11/10/14	311.52	3049.44	3054.04
SNL-09	CUL	12/03/14	312.03	3048.93	3053.52
SNL-09	CUL	01/05/15	312.56	3048.40	3052.98

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
SNL-09	CUL	02/04/15	312.52	3048.44	3053.02
SNL-10	CUL	09/03/14	332.83	3044.76	3047.57
SNL-10	CUL	10/01/14	332.41	3045.18	3047.99
SNL-10	CUL	11/10/14	330.74	3046.85	3049.68
SNL-10	CUL	12/03/14	330.82	3046.77	3049.60
SNL-10	CUL	01/06/15	331.13	3046.46	3049.28
SNL-10	CUL	02/04/15	330.98	3046.61	3049.44
SNL-12	CUL	09/03/14	393.44	2946.02	2947.08
SNL-12	CUL	10/03/14	382.13	2957.33	2958.46
SNL-12	CUL	11/10/14	392.25	2947.21	2948.28
SNL-12	CUL	12/03/14	393.90	2945.56	2946.62
SNL-12	CUL	01/06/15	387.29	2952.17	2953.45
SNL-12	CUL	02/02/15	394.71	2944.75	2945.98
SNL-13	CUL	09/03/14	314.57	2979.54	2981.01
SNL-13	CUL	10/01/14	315.36	2978.75	2980.21
SNL-13	CUL	11/11/14	315.57	2978.54	2979.99
SNL-13	CUL	12/03/14	315.97	2978.14	2979.59
SNL-13	CUL	01/06/15	316.07	2978.04	2979.91
SNL-13	CUL	02/04/15	317.02	2977.09	2978.94
SNL-14	CUL	09/04/14	429.52	2938.89	2949.93
SNL-14	CUL	10/02/14	421.79	2946.62	2958.02
SNL-14	CUL	11/11/14	427.22	2941.19	2952.34
SNL-14	CUL	12/03/14	428.40	2940.01	2951.10

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
SNL-14	CUL	01/07/15	426.76	2941.65	2952.82
SNL-14	CUL	02/04/15	429.11	2939.30	2950.36
SNL-15	CUL	09/04/14	526.02	2953.91	3044.78
SNL-15	CUL	10/02/14	525.26	2954.67	3045.71
SNL-15	CUL	11/11/14	524.28	2955.65	3046.92
SNL-15	CUL	12/03/14	523.58	2956.35	3047.78
SNL-15	CUL	01/07/15	522.75	2957.18	3049.20
SNL-15	CUL	02/02/15	522.75	2957.18	3049.20
SNL-16	CUL	09/02/14	125.66	3007.34	3007.99
SNL-16	CUL	10/01/14	117.70	3015.30	3016.01
SNL-16	CUL	11/10/14	117.90	3015.10	3015.81
SNL-16	CUL	12/02/14	118.43	3014.57	3015.27
SNL-16	CUL	01/05/15	119.30	3013.70	3014.74
SNL-16	CUL	02/02/15	119.68	3013.32	3014.36
SNL-17	CUL	09/04/14	254.92	2983.14	2983.61
SNL-17	CUL	10/01/14	247.31	2990.75	2991.26
SNL-17	CUL	11/10/14	250.50	2987.56	2988.06
SNL-17	CUL	12/03/14	250.98	2987.08	2987.57
SNL-17	CUL	01/05/15	247.58	2990.48	2991.19
SNL-17	CUL	02/02/15	252.31	2985.75	2986.43
SNL-18	CUL	09/02/14	305.82	3069.62	3071.83
SNL-18	CUL	10/02/14	304.90	3070.54	3072.76
SNL-18	CUL	11/11/14	303.89	3071.55	3073.78

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
SNL-18	CUL	12/03/14	303.68	3071.76	3073.99
SNL-18	CUL	01/05/15	303.39	3072.05	3074.28
SNL-18	CUL	02/04/15	303.13	3072.31	3074.54
SNL-19	CUL	09/02/14	155.04	3067.61	3069.01
SNL-19	CUL	10/02/14	150.89	3071.76	3073.19
SNL-19	CUL	11/10/14	150.58	3072.07	3073.50
SNL-19	CUL	12/03/14	151.28	3071.37	3072.80
SNL-19	CUL	01/05/15	152.02	3070.63	3071.85
SNL-19	CUL	02/04/15	152.41	3070.24	3071.46
WIPP-11	CUL	09/04/14	368.15	3060.23	3078.86
WIPP-11	CUL	10/01/14	367.55	3061.33	3080.00
WIPP-11	CUL	11/10/14	366.45	3061.19	3079.86
WIPP-11	CUL	12/02/14	366.59	3060.16	3074.95
WIPP-11	CUL	01/09/15	366.52	3061.26	3079.93
WIPP-11	CUL	02/02/15	366.30	3061.48	3080.16
WIPP-13	CUL	09/04/14	346.20	3059.47	3074.24
WIPP-13	CUL	10/01/14	345.55	3060.12	3074.91
WIPP-13	CUL	11/12/14	344.75	3060.92	3075.74
WIPP-13	CUL	12/04/14	344.15	3061.52	3076.37
WIPP-13	CUL	01/09/15	344.36	3061.31	3075.04
WIPP-13	CUL	02/05/15	344.14	3061.53	3075.27
WIPP-19	CUL	09/04/14	397.88	3037.23	3056.59
WIPP-19	CUL	10/03/14	398.00	3037.11	3056.46

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
WIPP-19	CUL	11/12/14	398.11	3037.00	3056.34
WIPP-19	CUL	12/04/14	397.83	3037.28	3056.64
WIPP-19	CUL	01/07/15	398.31	3036.80	3056.51
WIPP-19	CUL	02/05/15	398.12	3036.99	3056.71
WQSP-1	CUL	09/04/14	364.03	3055.22	3072.35
WQSP-1	CUL	10/03/14	363.61	3055.64	3072.79
WQSP-1	CUL	11/12/14	362.84	3056.41	3073.60
WQSP-1	CUL	12/04/14	362.22	3057.03	3074.25
WQSP-1	CUL	01/09/15	362.50	3056.75	3074.31
WQSP-1	CUL	02/04/15	362.03	3057.22	3074.80
WQSP-2	CUL	09/04/14	404.11	3059.76	3079.55
WQSP-2	CUL	10/03/14	403.76	3060.11	3079.91
WQSP-2	CUL	11/12/14	402.98	3060.89	3080.73
WQSP-2	CUL	01/07/15	401.15	3062.72	3082.64
WQSP-2	CUL	02/05/15	402.42	3061.45	3081.31
WQSP-2	CUL	02/12/14	403.33	3060.54	3080.36
WQSP-3	CUL	09/04/14	468.63	3011.51	3069.41
WQSP-3	CUL	10/03/14	468.63	3011.51	3069.41
WQSP-3	CUL	11/12/14	468.52	3011.62	3069.54
WQSP-3	CUL	12/04/14	468.23	3011.91	3069.87
WQSP-3	CUL	01/07/15	468.53	3011.61	3068.74
WQSP-3	CUL	02/05/15	468.19	3011.95	3069.13
WQSP-4	CUL	09/05/14	479.95	2953.14	2976.01

WELL NUMBER	ZONE	DATE	ADJUSTED DEPTH TOC (ft)	WATER LEVEL ELEVATION (ft amsl[1])	ADJUSTED FRESHWATER HEAD (ft amsl)
WQSP-4	CUL	10/01/14	479.86	2953.23	2976.11
WQSP-4	CUL	11/11/14	479.56	2953.53	2976.43
WQSP-4	CUL	12/08/14	480.50	2952.59	2975.42
WQSP-4	CUL	01/15/15	481.50	2951.59	2974.34
WQSP-4	CUL	02/05/15	481.58	2951.51	2974.26
WQSP-5	CUL	09/04/14	412.70	2971.68	2978.32
WQSP-5	CUL	10/03/14	413.73	2970.65	2977.26
WQSP-5	CUL	11/11/14	413.98	2970.40	2977.01
WQSP-5	CUL	12/04/14	414.49	2969.89	2976.48
WQSP-5	CUL	01/07/15	415.94	2968.44	2974.99
WQSP-5	CUL	02/05/15	416.36	2968.02	2974.56
WQSP-6	CUL	09/04/14	369.85	2994.87	2998.28
WQSP-6	CUL	10/03/14	370.89	2993.83	2997.22
WQSP-6	CUL	11/11/14	371.87	2992.85	2996.23
WQSP-6	CUL	12/04/14	372.29	2992.43	2995.80
WQSP-6	CUL	01/07/15	373.46	2991.26	2995.06
WQSP-6	CUL	02/04/15	373.67	2991.05	2994.85

Notes:

1: amsl = Above Mean Sea Level
2: New well in Sept. 2013, fluid density and surface elevation not yet available.
3: SNL Testing = testing equipment in well so not accessible for water level measurements
TOC = Top of Casing
CUL = Culebra