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Date:
June 3, 2014

ARCADIS Project No.:
B0064479,80,81

Subject:
Passive Flux Meter and Transducer Study Summary
Racer Trust Plants 2, 3, and 6, Lansing, Michigan

Prior to the submittal of the updated Corrective Measures Study for the RACER Trust Lansing Site (Site), additional work was completed to further characterize and evaluate the lower 1,4-dioxane plume located beneath Plants 2 and 3. As described in the *Resource Conservation and Recovery Act Facility Investigation (RFI) Phase 2 Supplemental Activities Summary Report* (ARCADIS 2014), the lower 1,4-dioxane plume extends from the Plant 3 “coliseum” area to the south-central portion of Plant 2. The lower 1,4-dioxane plume is present within the saturated deep overburden and weathered bedrock units at depths generally greater than 65 feet below grade. The orientation of the plume is included on Figure 1.

The additional work consisted of the following:

1. Deployment of Passive Flux Meters (PFMs, http://enviroflux.com/technology/passive-flux-meter) to directly measure groundwater velocity within the lower 1,4-dioxane plume and confirm groundwater flow direction. Additionally, an evaluation of mass flux is presented, as is a pore flushing model based on the PFM results.

2. Completion of a groundwater transducer study to evaluate the potential effect of municipal pumping on groundwater elevation observed at the Site within the weathered bedrock / bedrock aquifer.

The deployment of transducers and PFMs and the Site is summarized on Figure 1.

Passive Flux Meter Deployment and Results

As proposed in the work plan dated February 7, 2014, groundwater velocity was measured at Plants 2, 3 and 6 by deploying PFMs in six weathered bedrock monitoring wells and two deep overburden monitoring wells. The PFMs consist of a nylon mesh tube filled with a sorbent resin / alcohol tracer mixture. The PFMs are inserted into groundwater monitoring wells where they passively intercept groundwater flow. After a period of time the PFM is removed from the well and the residual tracer mass is evaluated to calculate groundwater velocity. Additional information on PFM technology can be found at the Enviroflux website (http://enviroflux.com/technology/passive-flux-meter). The locations of the wells included in the study are included on Figure 1.

Based on conditions encountered in the field, there were several changes to the PFM deployment from what was proposed in the February 2014 work plan. These changes included the following:

- MW-13-42 – There was insufficient water for PFM deployment. This PFM was moved to MW-13-29.
- MW-13-34 – A blockage within the screen would not allow placement of PFM. The resulting damage to PFM did not allow for reuse.
- MW-13-53 – There was only 7 feet of water in the 10 foot well screen at the time of deployment. The 5 foot directional PFM was installed at this location and the remaining 5 foot non-directional PFM was installed at MW-12-21.

The PFMs were constructed in lengths of five feet that included a number of vertical segments that provided measurement of the average groundwater velocity through each segment. In all of the monitoring wells except MW-12-21, a middle segment of the PFMs was designed to also measure the direction of the groundwater flow. In this segment, the PFM is divided into three sections; each covering 120 degrees around the circumference of the PFM segment (i.e. three pie pieces). In theory, the section that faces up-gradient will measure the highest groundwater flow of the three sections within the segment. The orientation of the PFM segments was controlled during deployment.

The PFMs were deployed March 4 and 5, 2014, by placing the PFM at the bottom of each monitoring well. The PFMs were deployed for approximately two weeks. On March 20, 2014, each PFM was removed and sampled at designed intervals into glass sample jars provided by Enviroflux. The samples from the PFMs were shipped to Enviroflux for laboratory analysis and interpretation. Survey data was used to estimate the midpoint elevations of the segments in each PFM and evaluate the vertical variability of the measured groundwater flow in each well.

Groundwater Flux Results

Groundwater flux, or velocity, was estimated through the specified intervals within the PFMs. The mean value of groundwater flux along the lower 1,4-dioxane plume is 4.0 centimeters per day (cm/d) or approximately 50 feet per year (ft/yr). The distribution of the groundwater flux measurements around the mean appears to be normal with a slight positive skewness (Figure 2). Overall, the variation in measured groundwater flux was moderate (coefficient of variation of 0.47) as shown in the graphs of groundwater flux variability with depth at each monitoring well (Figures 3, 4, and 5). The measured groundwater flux in the deep overburden wells ranged from 3.1 to 7.9 cm/d (Figure 3). In the weathered bedrock wells the groundwater flux ranged from 0.4 to 8.4 cm/d (Figures 4 and 5). The average groundwater flux at each well is summarized on Table 1. Based on the maximum measured groundwater flux (80 ft/yr) and the approximate length of the lower 1,4-dioxane plume (2,600 feet), the plume has been migrating for a minimum of 30 years.

Table 1. Average groundwater flux through each monitoring well

Well	Hydrostratigraphic Unit	Average Groundwater Flux (cm/d)	Average Groundwater Flux (ft/yr)
MW-12-21	Deep Overburden	3.2	38
MW-13-22	Weathered Bedrock	6.7	80
MW-13-29	Deep Overburden	5.8	69
MW-13-43	Weathered Bedrock	3.5	42
MW-13-45	Weathered Bedrock	5.2	62
MW-13-51	Weathered Bedrock	3.0	36
MW-13-52	Weathered Bedrock	2.1	25
MW-13-53	Weathered Bedrock	4.1	49
	Average:	**4.0**	**50**

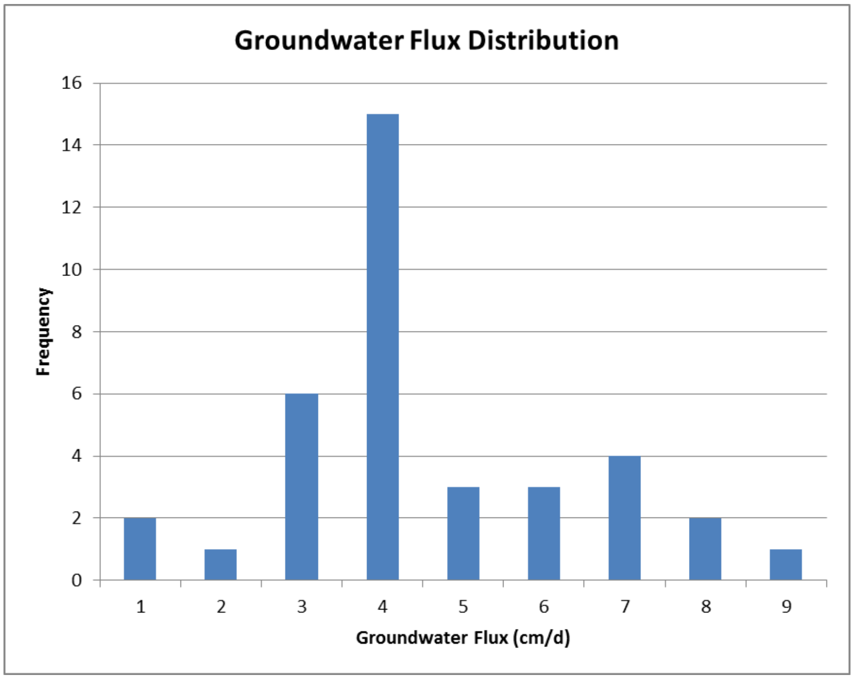

Figure 2. Groundwater flux distribution from PFM results.

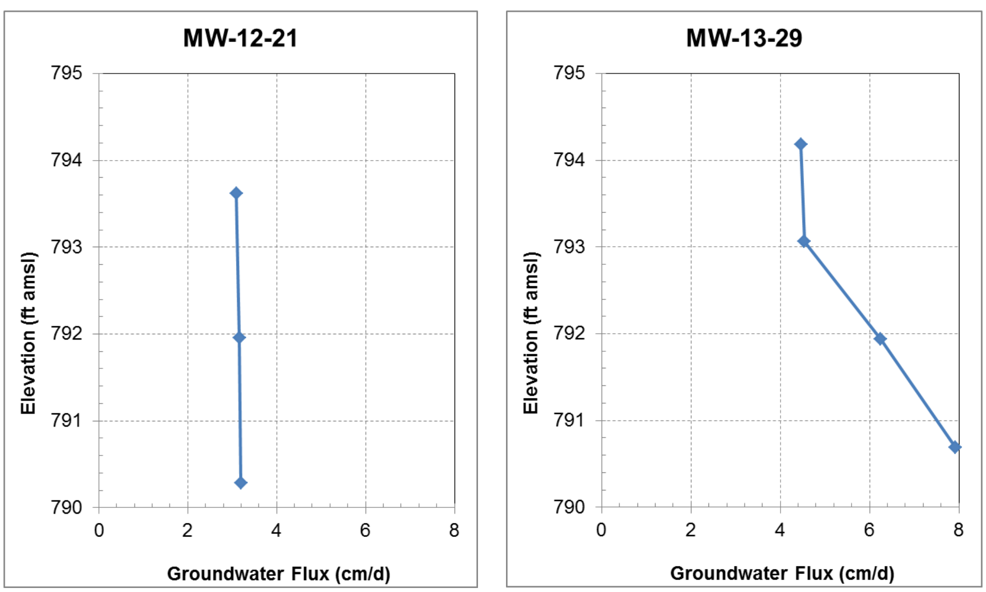

Figure 3. Groundwater flux in deep overburden wells.

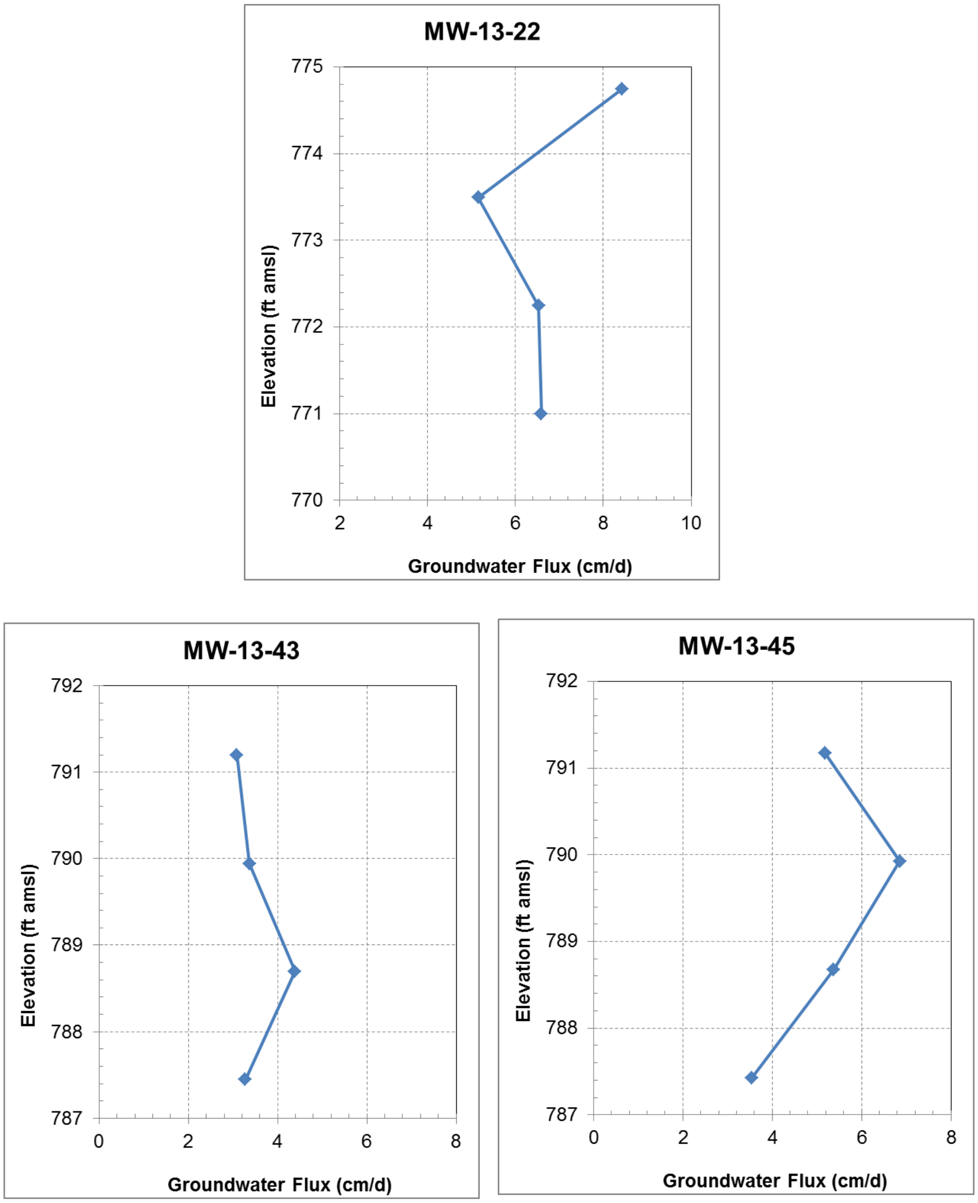

Figure 4. Groundwater flux in weathered bedrock wells located within the 1,4-dioxane plume.

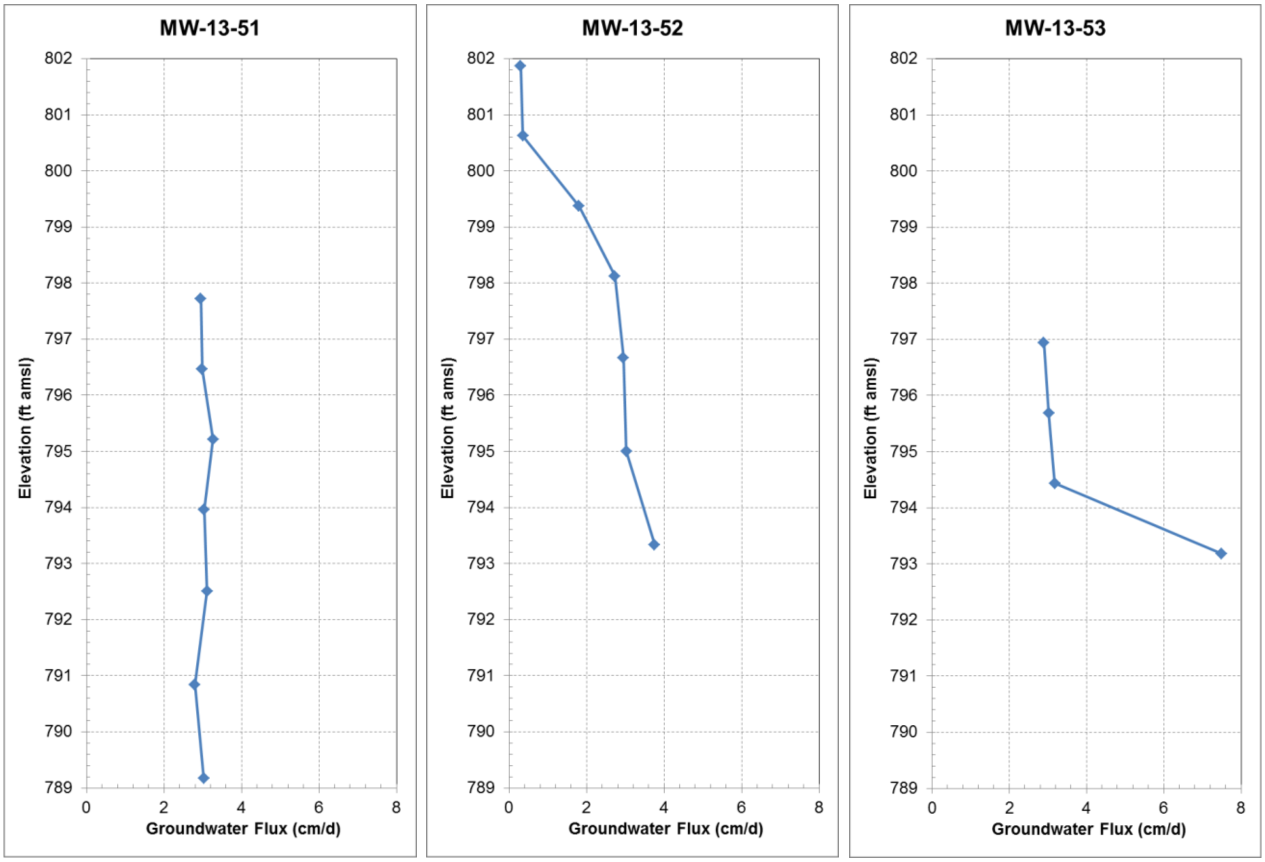

Figure 5. Groundwater flux in weathered bedrock wells located down gradient of the plume's leading edge.

Groundwater Flow Direction Results

For monitoring wells that contained the PFM segment for estimating the direction of groundwater flow, the direction and magnitude of measured groundwater flow are summarized in a rosette diagram (Figure 6). The direction of groundwater flow varied between well locations and along the plume length, but is generally to the south as expected based on the plume orientation. In the well near the source area (MW-13-22) where groundwater recharge occurs, the direction of measured groundwater flow was to the northwest. Down gradient of the source, the estimated direction of groundwater flow ranged from east-southeast in MW-13-43 to west in MW-13-45. Down gradient of the plume, the direction of measured groundwater flow ranged from southwest at MW-13-53 to southeast at MW-13-52. The variability of measured groundwater flow can be attributed, in part, to the variability of groundwater flow at any given point in an aquifer (i.e. not a straight line), as well as the limited size of the data set. The results are consistent with recharge at the coliseum source area and then southerly flow from the coliseum to Plant 2.

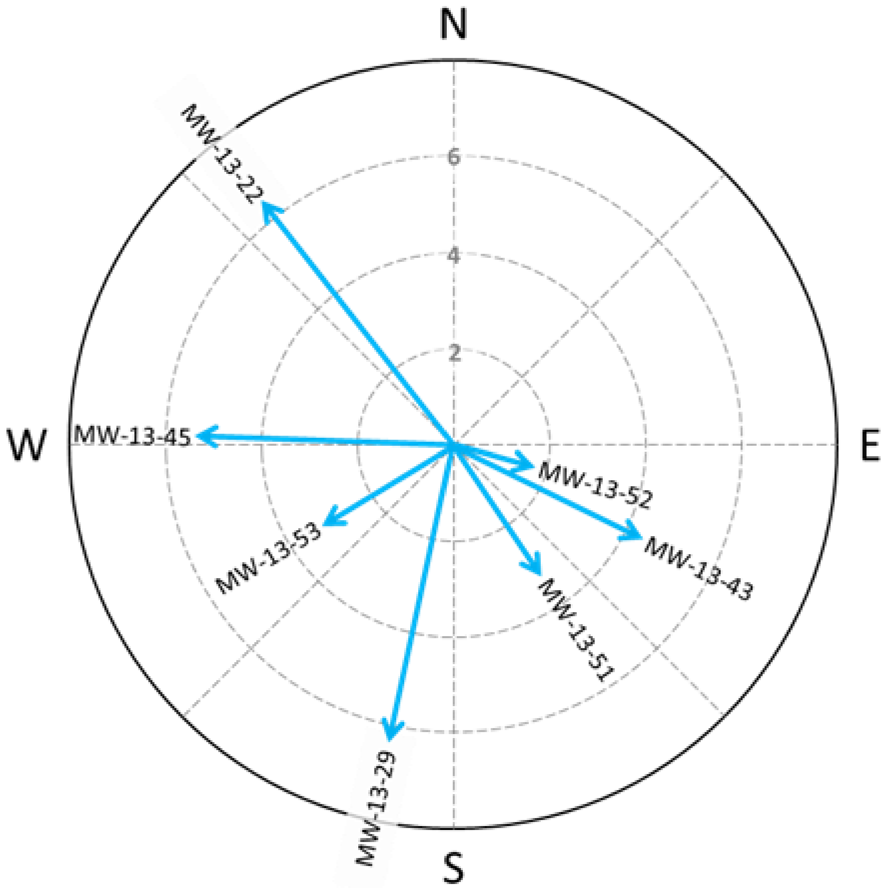

Figure 6. Estimated groundwater flow direction at each well.

Mass Flux Calculations

Based on the average concentration of 1,4-dioxane detected at monitoring wells during the groundwater sampling events, the 1,4-dioxane mass flux was calculated as follows:

$$J = q \times C$$

Where:	J	=	advective contaminant mass flux, $M/L^2/t$
	q	=	groundwater flux (velocity), L/t
	C	=	concentration of 1,4-dioxane in groundwater M/L^3

The average 1,4-dioxane mass flux ranged from 0-13 mg/m^2/day in the eight wells tested. In general, the mass flux was higher at the source area and decreased downgradient. The results are presented in Table 2 and summarized on Figure 7.

Table 2. Average 1,4-dioxane mass flux at each monitoring well

Well	Hydrostratigraphic Unit	Average Groundwater Concentration (µg/L)	Average Mass Flux (mg/m^2/day)
MW-12-21	Deep Overburden	410	13
MW-13-22	Weathered Bedrock	164	11
MW-13-29	Deep Overburden	29	1.7
MW-13-43	Weathered Bedrock	245	8.6
MW-13-45	Weathered Bedrock	27	1.4
MW-13-51	Weathered Bedrock	<5	0
MW-13-52	Weathered Bedrock	<5	0
MW-13-53	Weathered Bedrock	<5	0

Recirculation Duration Estimate

The forthcoming RCRA Corrective Measures Study outlines groundwater recirculation (GR) as the proposed remedy for the lower 1,4-dioxane plume. The preliminary recirculation system design includes three recirculation cells. The preliminary conceptual layout of the GR system is included as Figure 8. Groundwater would be extracted from the lower 1,4-dioxane plume, treated above ground, and then recirculated into injection wells. The amount of time the recirculation system would operate to meet criteria can be estimated using the groundwater flux measurements.

Assuming that the source mass is reduced through treatment (i.e. recirculation, ISCO, etc.), the duration of pump and treat can be roughly estimated using pore flushes, after Zheng & Bennet (1995):

$$NPF = R*Ln(C_o/C_f)$$

Where:
- NPF = the number of pore flushes
- R = the retardation factor for 1,4-dioxane in groundwater (Assumed = 1 due to minimal sorption)
- C_o = the initial groundwater concentration
- C_f = the final clean-up goal

The amount of time the recirculation system would have to be operated was estimated as follows.

1. The number of pore flushes required to reduce the 1,4-dioxane concentration from C_o to C_f was calculated using the above equation,
2. The amount of time that would be required to achieve a single pore flush under ambient flow conditions was estimated using the groundwater flux,
3. The two values were multiplied to provide an estimate of the time it would take to achieve the required number of pore flushes under ambient conditions, and
4. The time required to achieve pore flushes with recirculation was calculated assuming that flushing increases the groundwater flow by a factor of 3X.

The results of the pore flush model are summarized on Table 3. The pore flush model was developed with the following assumptions:

- Source mass is reduced through treatment
- Groundwater flux ranging from 25 to 80 ft/yr with an average of 50 ft/yr
- Scenario 1 Clean-up goal of 8.5 µg/L (proposed standard)
- Scenario 2: Clean-up goal of 85 µg/L (current residential drinking water standard)

Table 3. Summary of Pore Flush Calculations*

Criteria Scenario	Ambient Flow Travel Time		Recirculation Travel Time	
	Range (yrs)	Average (yrs)	Range (yrs)	Average (yrs)
Cf = 8.5 µg/L	24-74	38	8-26	13
Cf = 85 µg/L	8-24	12	2-8	4

* - calculated based on the minimum, maximum and average groundwater flux

Groundwater Elevation Transducer Study

Absolute pressure transducers were deployed in twelve Site wells from March 21 through April 8, 2014. Pressure measurements were collected on a one-minute frequency, and atmospheric pressures were recorded by an on-site logger during this period. Initial processing of water levels included compensation of absolute pressures, and subsequent conversion of gage pressures to groundwater elevations through comparison to manual water-level data collected periodically during the period of transducer deployment. Attachment 1 presents plots of groundwater elevations (hydrographs) for each monitoring well.

Water levels measured in wells often exhibit significant fluctuations due to variations in atmospheric pressure. Water-level data for each well were examined to identify the effects of barometric influence on water levels, and water-level corrections (barometric efficiency) were mathematically applied to remove noise resulting from variations in atmospheric pressure. Barometric efficiencies ranging from 0.90 to 1.0 were applied to well water levels; these relatively high barometric efficiencies (approaching 1.0) are typical for confined, fractured-bedrock aquifers. Plots of corrected water levels are presented in Attachment 1.

Evaluation of Water Levels and Municipal Pumping

Barometrically-corrected water levels for each monitored well were plotted with municipal well pump on/off times to facilitate identification of hydraulic influence of pumping on well water levels (Attachment 1). The Lansing Township wells TWP #2, #3, #4, #5, and the Lansing Board of Water and Light (BWL) well BWL-15-08, are typically run continually; during the monitoring period, wells were pumped continuously, except for staggered individual shut-down periods of approximately 24 to 38 hours, as shown in the table below. Pumping well on/off times were recorded by data loggers attached to the municipal pump control switches.

Table 4. Municipal well shutdown summary

TWP WELL	PUMP OFF	PUMP ON
TWP #2	3/26/2014 7:54	3/27/2014 8:26
TWP #4	3/28/2014 6:03	3/31/2014 8:01
BWL-15-08	4/1/2014 6:33	4/2/2014 8:07
TWP #3	4/3/2014 8:10	4/4/2014 8:46
TWP #5	4/5/2014 18:23	4/7/2014 8:04

Water-level plots were visually examined to identify water-level drawdown and recovery responses to changes in system pumping. Observed responses were qualified as “response”, “potential” response or no response (“NR”) depending on the magnitude, shape, and timing of the responses, as well as uncertainty related to background trends. As shown in the table below and the water-level plots presented in Attachment 1, none of the monitored wells showed an apparent response to changes in pumping at well TWP #2 or TWP #3. Several of the monitoring wells exhibited water-level responses to changes in the pumping of well TWP #4, and several wells exhibited responses to pumping changes at well TWP #5. Municipal well BWL 10-10 showed a moderate recovery and drawdown related to changes in pumping at BWL 15-08.

Table 5. Summary of monitored well response to municipal pumping

Well ID	Hydrostratigraphic Unit	Barometric Efficiency (BE)	Response to TWP #4	Response to BWL-15-08	Response to TWP #5
BWL 10-10	Bedrock	0.90	response	response	response
MW 04-04R	Bedrock	1.0	NR	NR	NR
MW 12-04	Bedrock	1.0	response	NR	response
MW 13-22	Weathered Bedrock	1.0	potential	NR	NR
MW-13-28	Bedrock	1.0	potential	NR	NR
MW-13-34	Weathered Bedrock	1.0	potential	NR	NR
MW-13-39B	Bedrock	1.0	NR	NR	NR
MW-13-44	Bedrock	1.0	potential	NR	NR
MW-13-47	Bedrock	1.0	response	NR	response
MW-13-50	Bedrock	1.0	NR	NR	NR
MW-13-52	Weathered Bedrock	0.97	NR	NR	NR
MW-91-5	Bedrock	1.0	response	NR	response

Based on the sharp changes in slope corresponding directly to the timing of the shut-down and restart of TWP #4, the changes in groundwater elevation observed at wells MW-91-5, MW-13-47, MW-12-04, and BWL-10-10 are attributed to changes in pumping. The "potential" responses noted at several wells are associated with a confounding factor that occurred during the TWP #4 shut down. The weekend that TWP #4 shut down (beginning March 27, 2014) corresponded to a rise in temperatures and significant snow melt. It is possible that the rise in water levels observed at wells MW-13-44, MW-13-34, MW-13-28, and MW-13-22 at this time are due to infiltration of snowmelt (primarily through the floor of the coliseum).

When assessing water-level records with respect to nearby pumping, it is important to note that an observed response to pumping does not necessarily indicate hydraulic capture. Although the bedrock wells beneath the lower 1,4-dioxane plume indicate a hydraulic response to municipal pumping, they are not impacted. In addition, the distribution of the overlying 1,4-dioxane plume within the deep overburden and weathered bedrock does not appear to be affected by pumping wells. Based on the age of the plume (>30 years) and the lack of influence on pumping on the lower 1,4-dioxane plume, municipal wells are unlikely to be impacted by the lower 1,4-dioxane plume in the future.

Conclusions

Additional work was completed to further characterize and evaluate the lower 1,4-dioxane plume, prior to the submittal of the updated Corrective Measures Study. The additional work consisted of 1) deployment of PFMs to directly measure groundwater velocity and confirm groundwater flow direction; and 2) a groundwater transducer study to evaluate the potential effect of municipal pumping on groundwater. The primary conclusions are as follows:

- Groundwater Flux Results – The measured groundwater flux along the plume ranges from 25 to 80 ft/yr with an average flux of approximately 50 ft/yr. Based on the maximum observed groundwater flux, the lower 1,4-dioxane plume has been migrating for a minimum of 30 years.

- Groundwater Flux Direction Results – The direction of groundwater flow varies at each point measurement, but is generally consistent with recharge at the coliseum source area and then flow to the south to Plant 2.

- 1,4-Dioxane Mass Flux – Based on measured concentrations of 1,4-dioxane at each well, the average 1,4-dioxane mass flux ranged from 0-13 $mg/m^2/day$.

- Recirculation Duration Estimate – GR is the proposed remedy for the lower 1,4-dioxane plume. The average time to achieve the proposed 1,4-dioxane drinking water standard of 8.5 µg/L was estimated to be 13 years. The average time to achieve the current standard of 85 µg/L was estimated to be 4 years.

- Municipal Pumping Wells – Several bedrock wells near the lower 1,4-dioxane plume indicate a hydraulic response to municipal pumping. Based on the age of the plume (>30 years) and the lack of influence of pumping on the lower 1,4-dioxane plume, municipal wells are unlikely to be impacted by the lower 1,4-dioxane plume in the future.

References

ARCADIS. 2014. RFI Supplemental Phase 2 Activities Summary Report. RACER Trust, Lansing, Michigan Plants 2, 3 & 6 Industrial Land. February 26.

Zheng, C., and G. D. Bennett, 1995, Applied Contaminant Transport Modeling: Theory and Practice. Van Nostrand Reinhold (now Wiley), New York, 440 pp.

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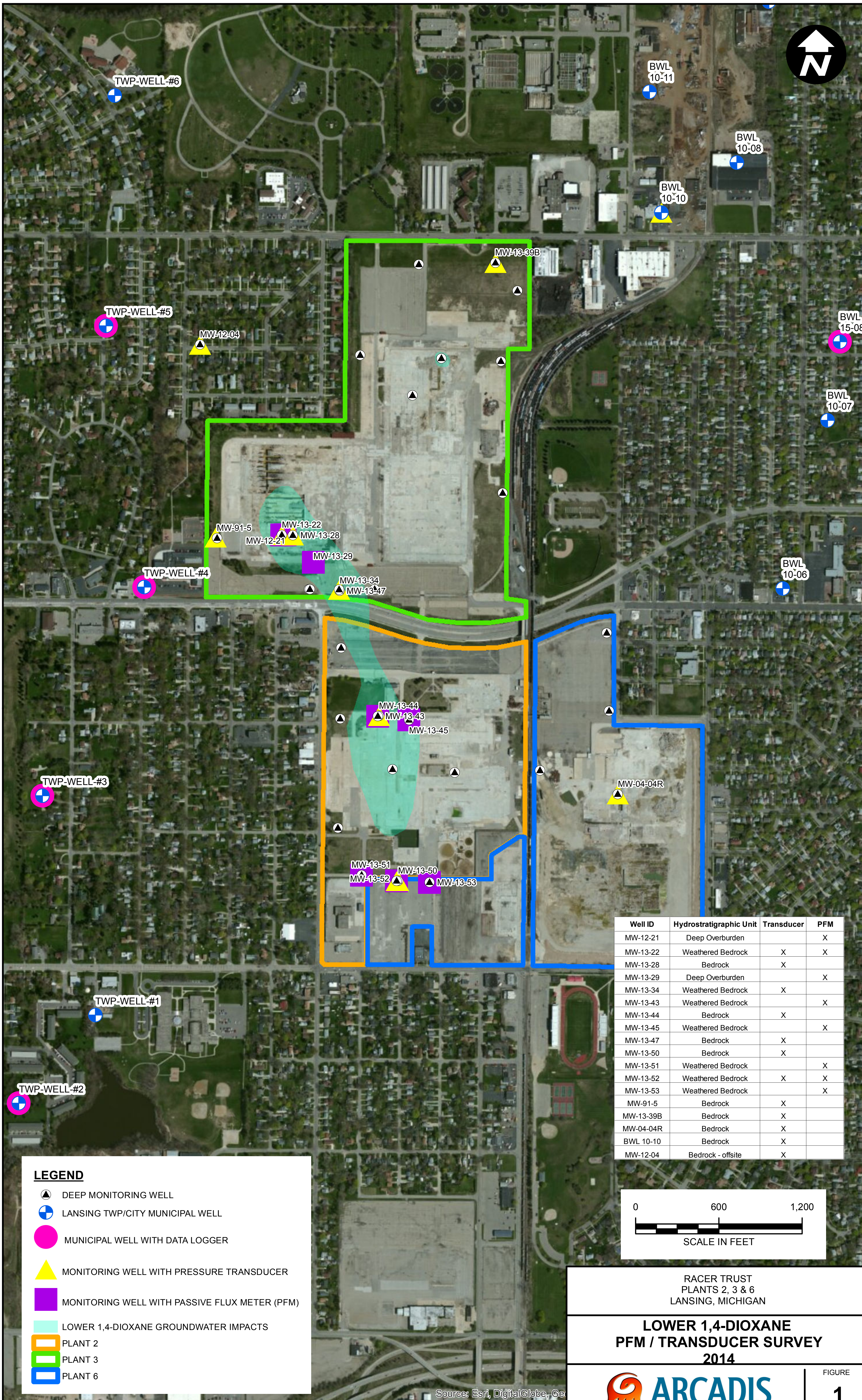
Figures



Well ID	Hydrostratigraphic Unit	Transducer	PFM
MW-12-21	Deep Overburden		X
MW-13-22	Weathered Bedrock	X	X
MW-13-28	Bedrock	X	
MW-13-29	Deep Overburden		X
MW-13-34	Weathered Bedrock	X	
MW-13-43	Weathered Bedrock		X
MW-13-44	Bedrock	X	
MW-13-45	Weathered Bedrock		X
MW-13-47	Bedrock	X	
MW-13-50	Bedrock	X	
MW-13-51	Weathered Bedrock		X
MW-13-52	Weathered Bedrock	X	X
MW-13-53	Weathered Bedrock		X
MW-91-5	Bedrock	X	
MW-13-39B	Bedrock	X	
MW-04-04R	Bedrock	X	
BWL 10-10	Bedrock	X	
MW-12-04	Bedrock - offsite	X	

RACER TRUST
PLANTS 2, 3 & 6
LANSING, MICHIGAN

LOWER 1,4-DIOXANE PFM / TRANSDUCER SURVEY 2014

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FIGURE 1

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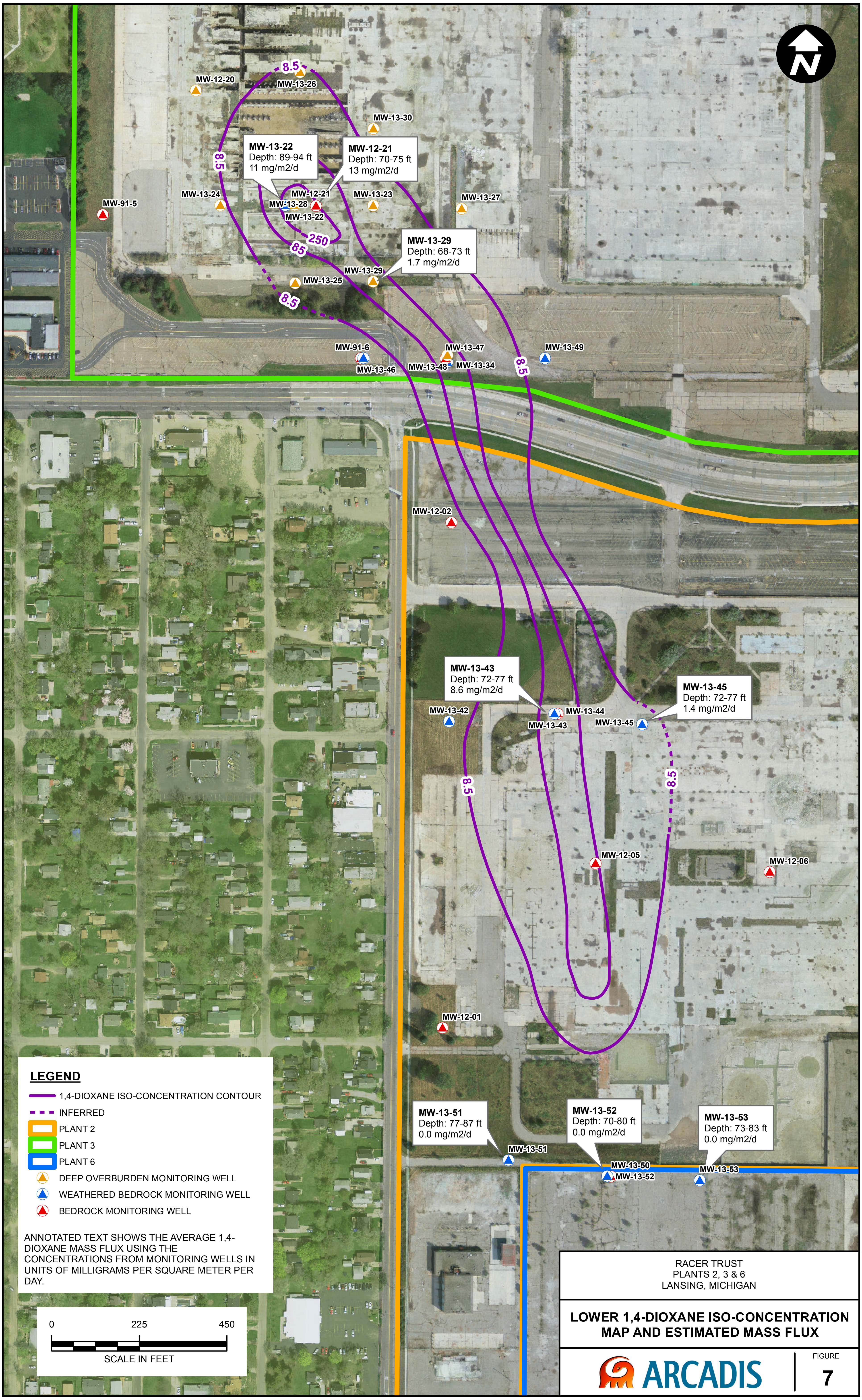

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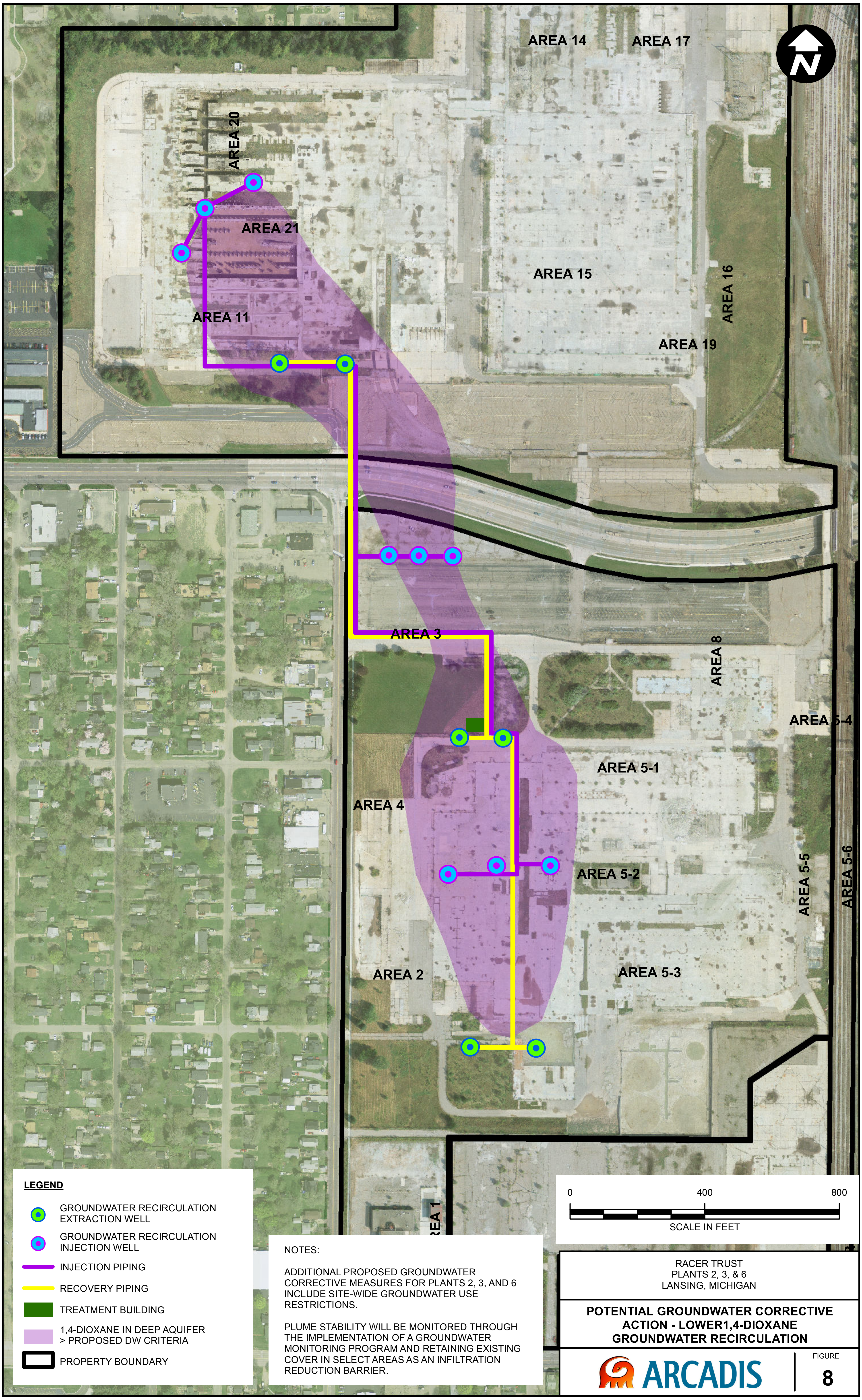

LEGEND

- GROUNDWATER RECIRCULATION EXTRACTION WELL
- GROUNDWATER RECIRCULATION INJECTION WELL
- INJECTION PIPING
- RECOVERY PIPING
- TREATMENT BUILDING
- 1,4-DIOXANE IN DEEP AQUIFER > PROPOSED DW CRITERIA
- PROPERTY BOUNDARY

NOTES:

ADDITIONAL PROPOSED GROUNDWATER CORRECTIVE MEASURES FOR PLANTS 2, 3, AND 6 INCLUDE SITE-WIDE GROUNDWATER USE RESTRICTIONS.

PLUME STABILITY WILL BE MONITORED THROUGH THE IMPLEMENTATION OF A GROUNDWATER MONITORING PROGRAM AND RETAINING EXISTING COVER IN SELECT AREAS AS AN INFILTRATION REDUCTION BARRIER.

RACER TRUST
PLANTS 2, 3, & 6
LANSING, MICHIGAN

POTENTIAL GROUNDWATER CORRECTIVE ACTION - LOWER1,4-DIOXANE GROUNDWATER RECIRCULATION

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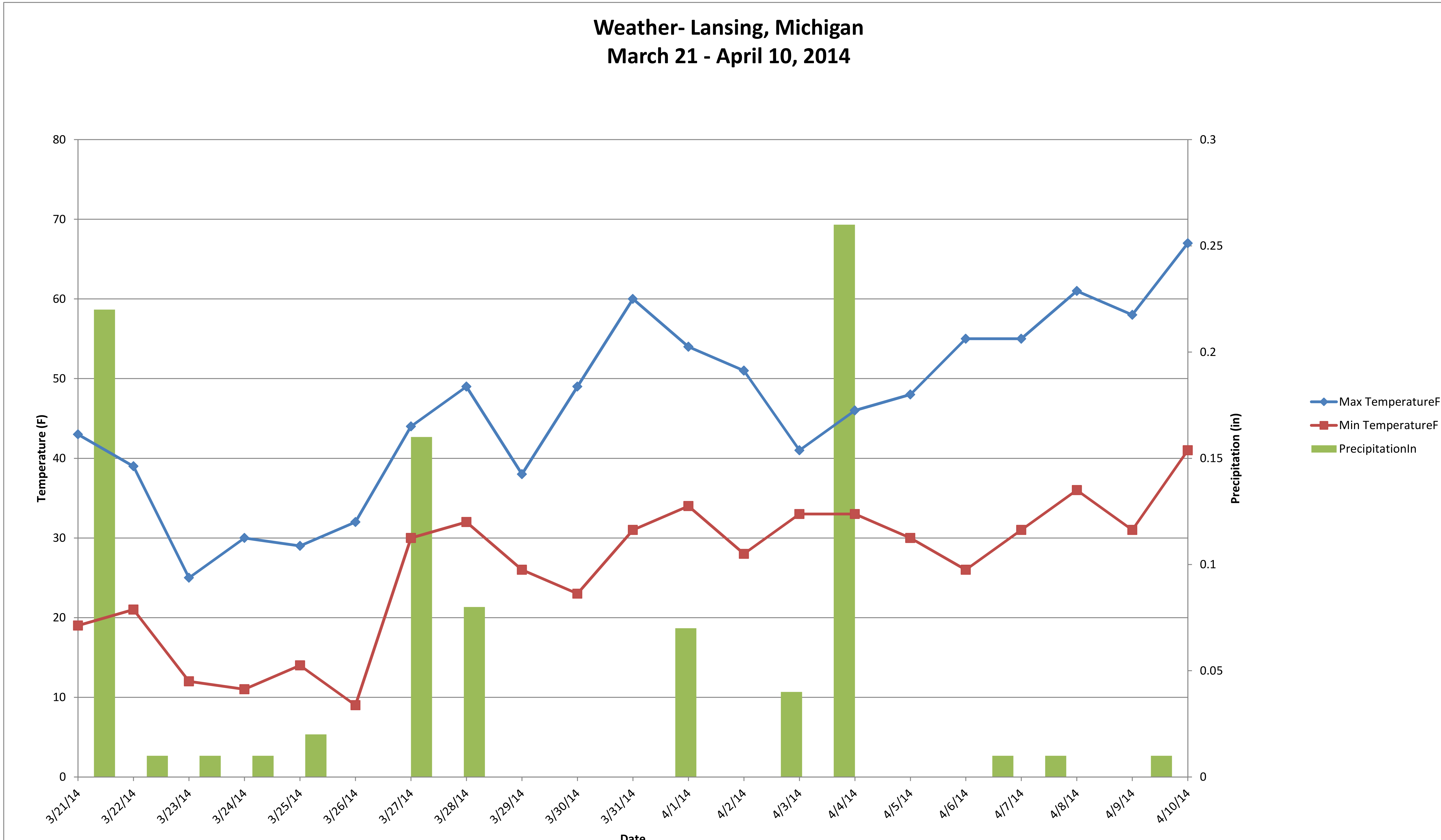
FIGURE
8

CITY: BRIGHTON DIV: ENV DB: D. OLEXA PIC: CHRIS PETERS PM: AMY HOEKSEMA TM: RANDY CHRISTENSEN TR: JACKIE SALING PROJECT NUMBER: B0064479.2013 COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl
G:\GIS\Project Files\MotorsLiquidationCompany\Lansing\Docs\CMS Report Figures\FIG 8 - GW Recirculation.mxd PLOTTED: 5/19/2014 4:15:04 PM BY: PCurry

Attachment 1

Racer Lansing Transducer Plots



Weather- Lansing, Michigan
March 21 - April 10, 2014
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Precipitation (in)
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60
50
40
30
20
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0.3
0.25
0.2
0.15
0.1
0.05
0
3/21/14
3/22/14
3/23/14
3/24/14
3/25/14
3/26/14
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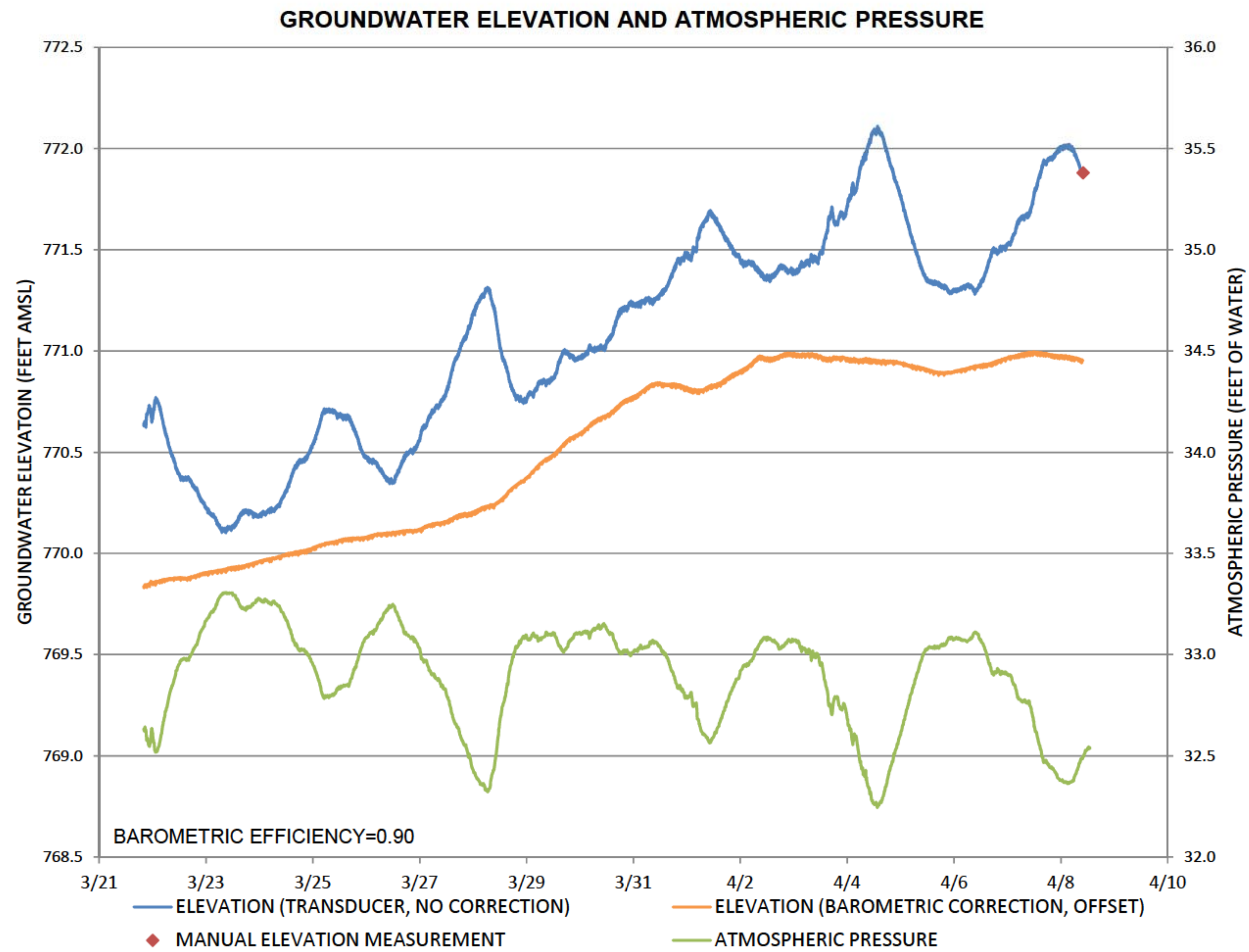
Max TemperatureF
Min TemperatureF
PrecipitationIn

BWL 10-10


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
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771.0
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33.0
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32.0
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3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
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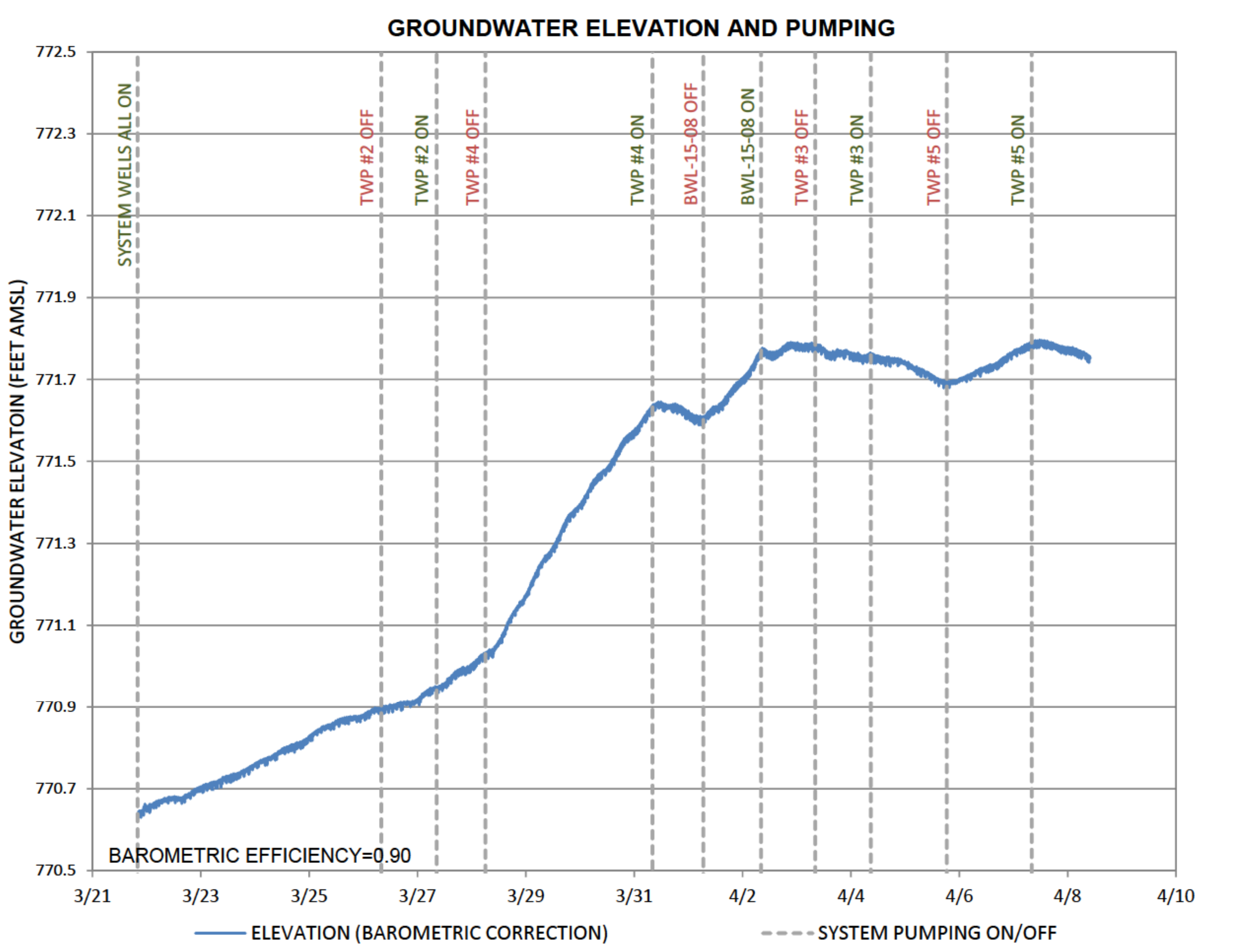
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
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771.5
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770.9
770.7
770.5
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=0.90
3/21
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3/25
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3/29
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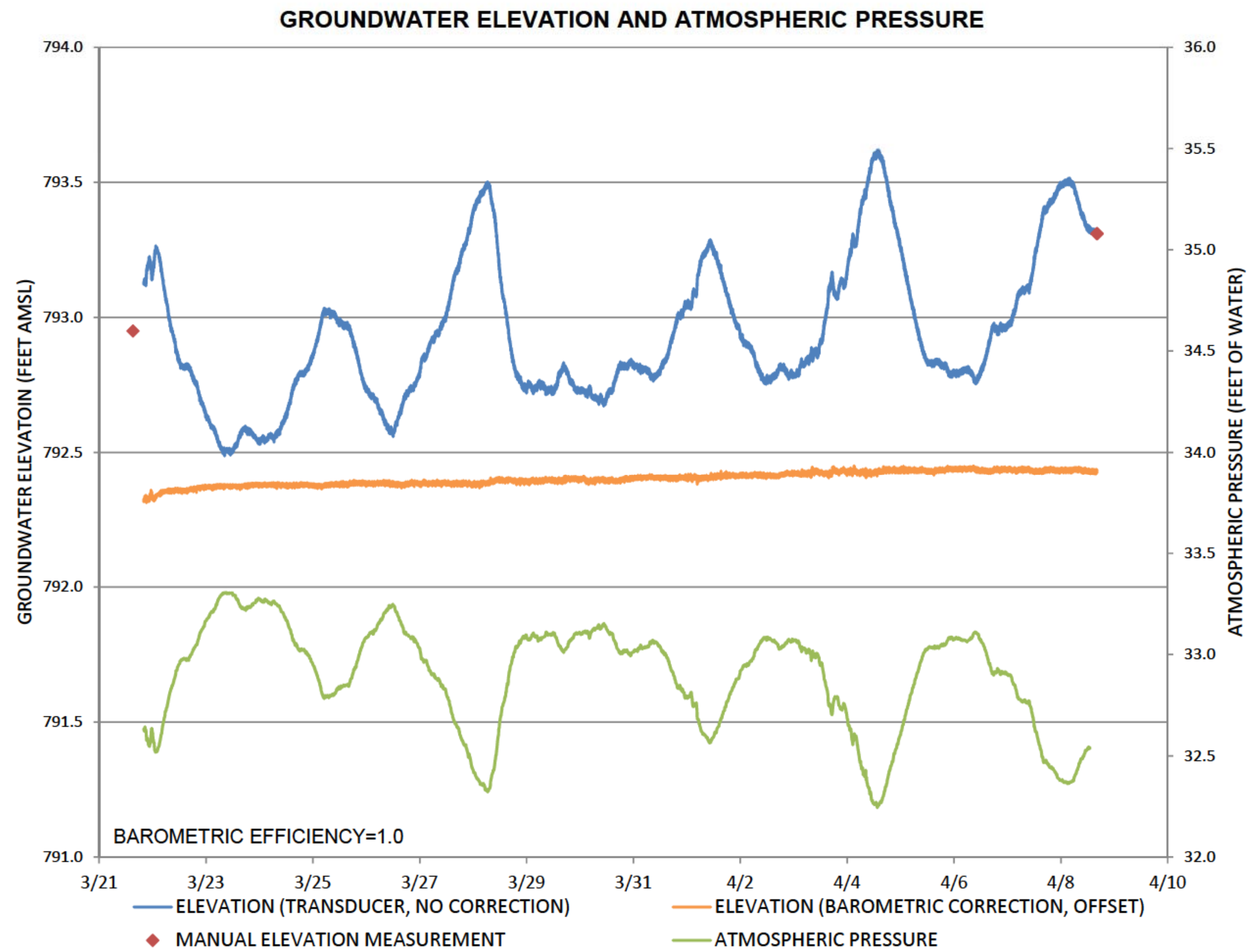
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

MW 04-04R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ATMOSPHERIC PRESSURE (FEET OF WATER)
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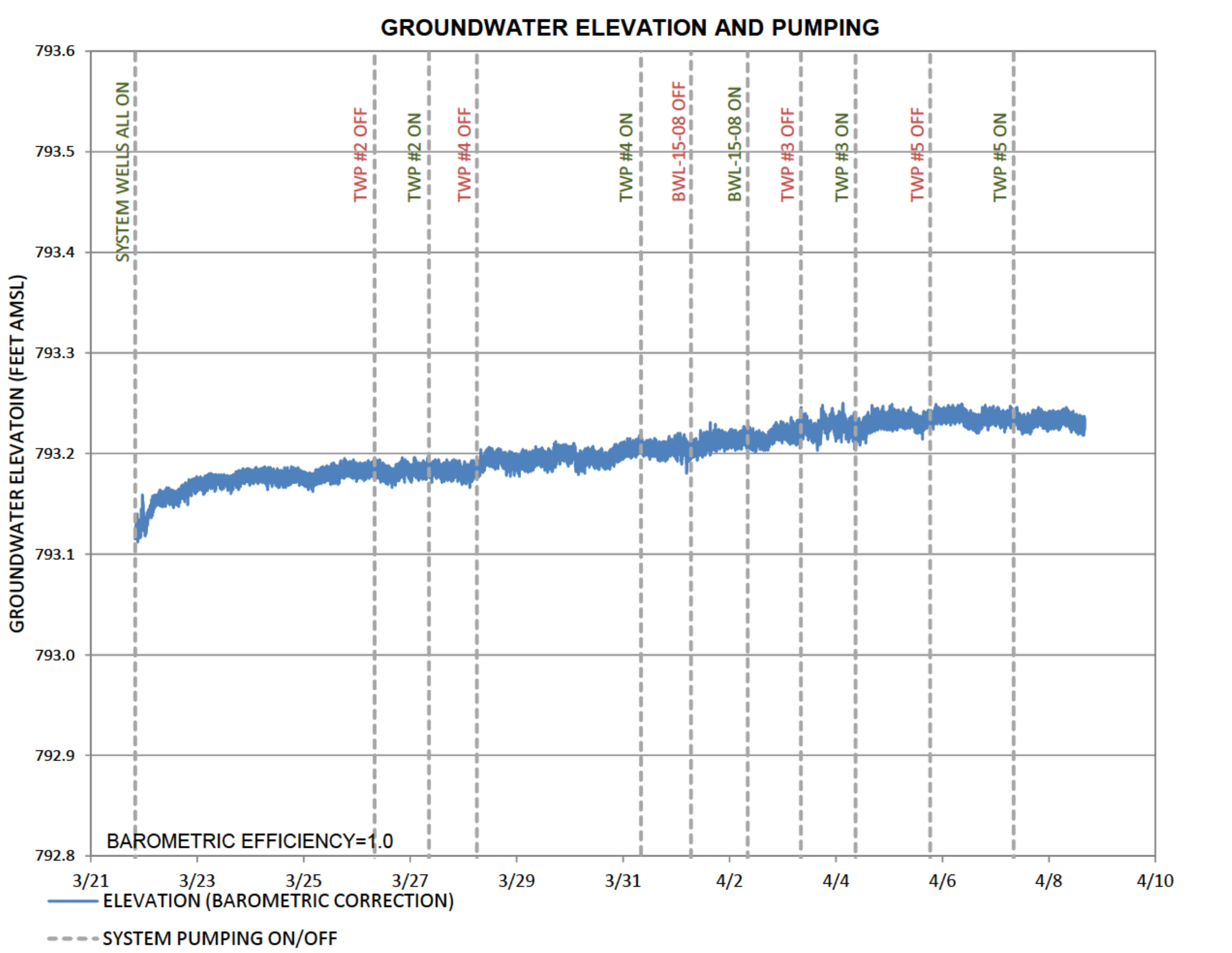
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
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793.4
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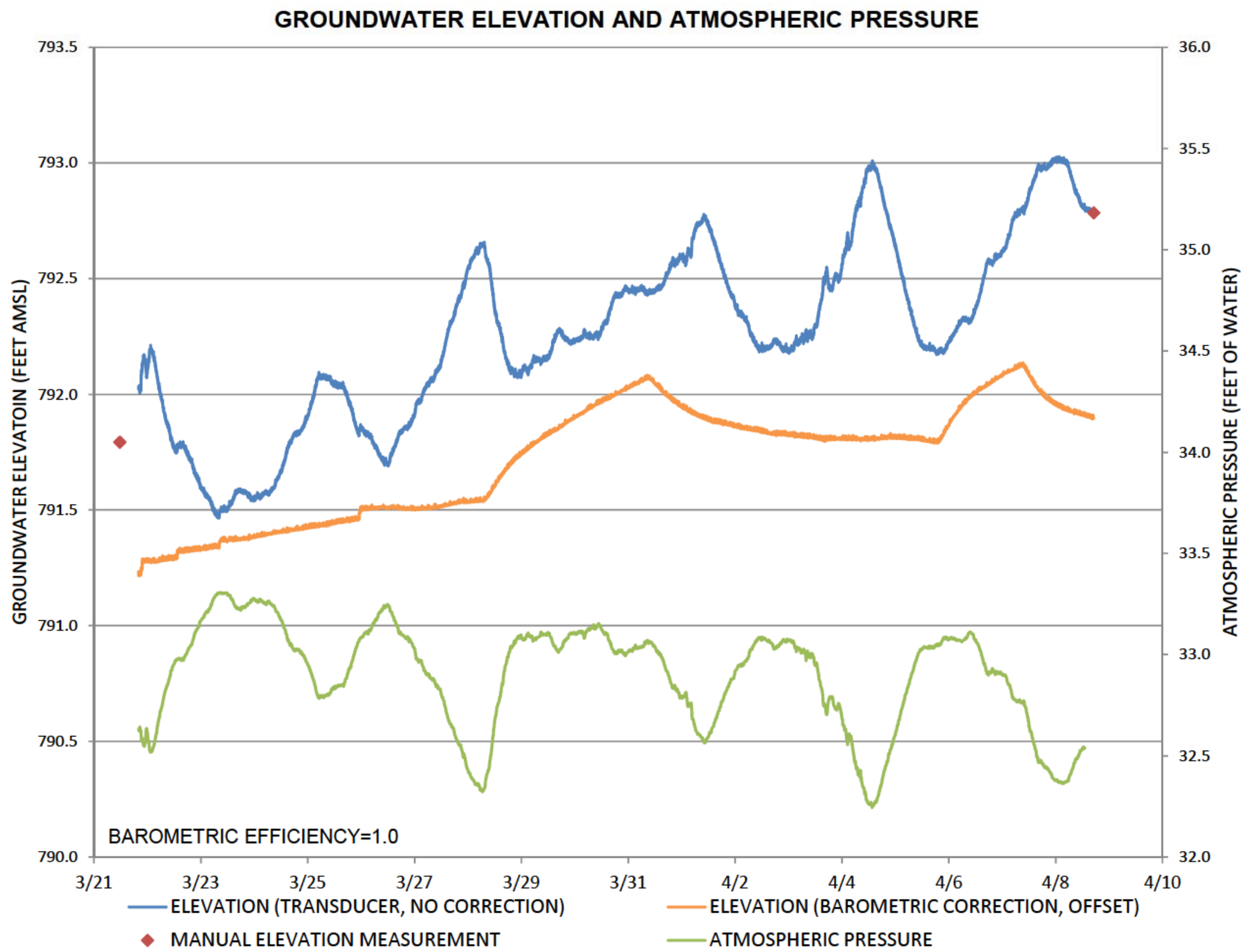
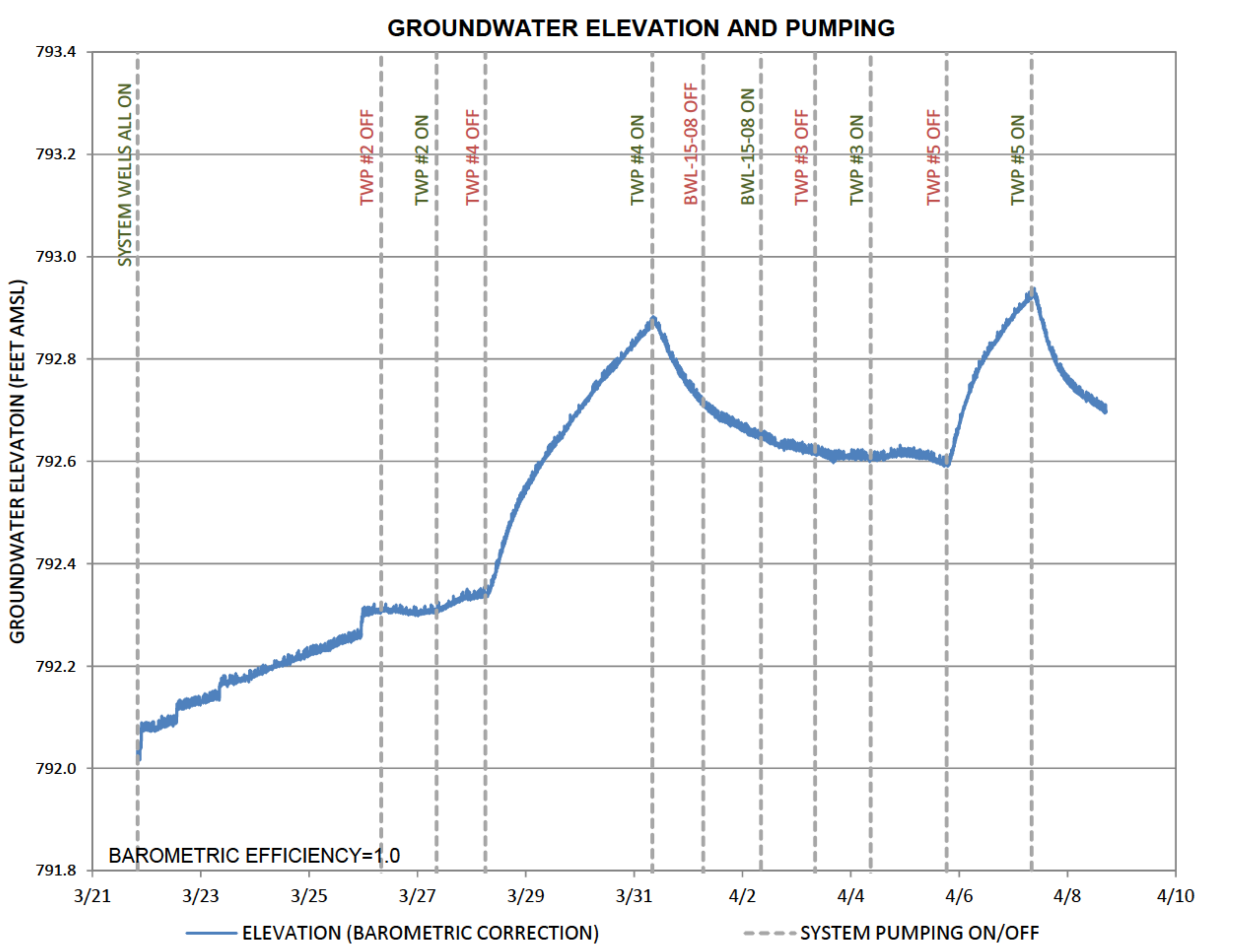
793.2
793.1
793.0
792.9
792.8
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

MW 12-04

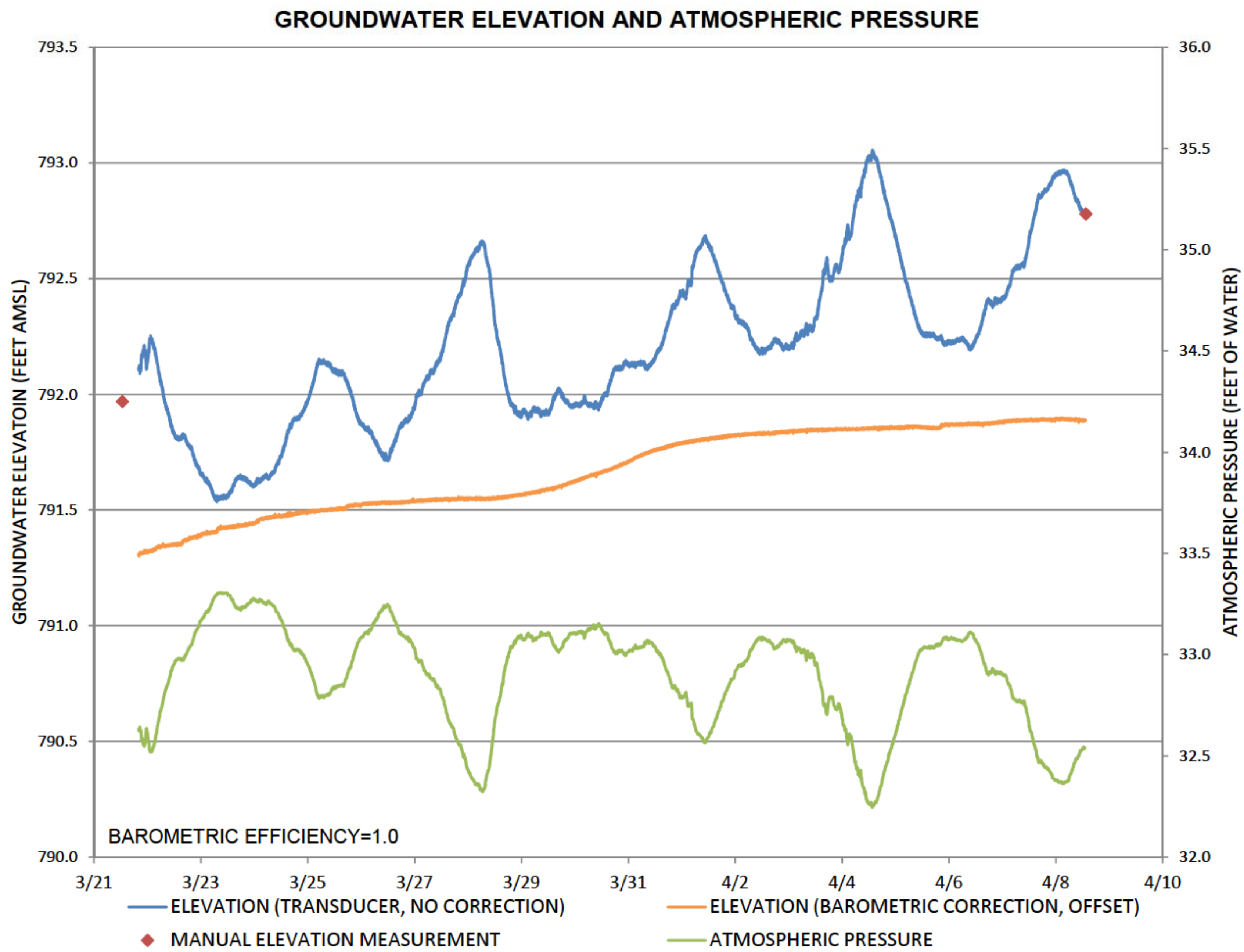


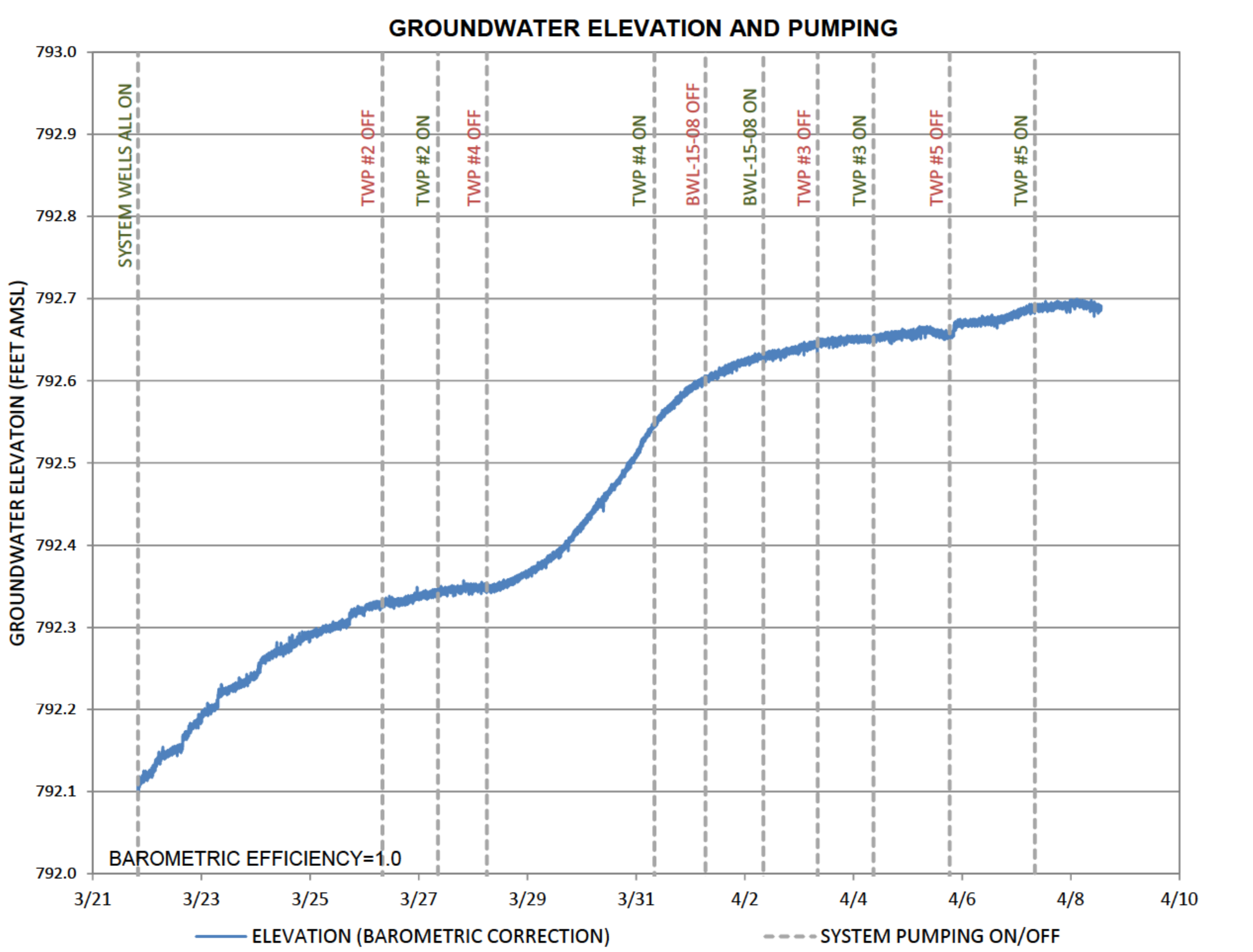
GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
793.5
793.0
792.5
792.0
791.5
791.0
790.5
790.0
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
BAROMETRIC EFFICIENCY=1.0
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE



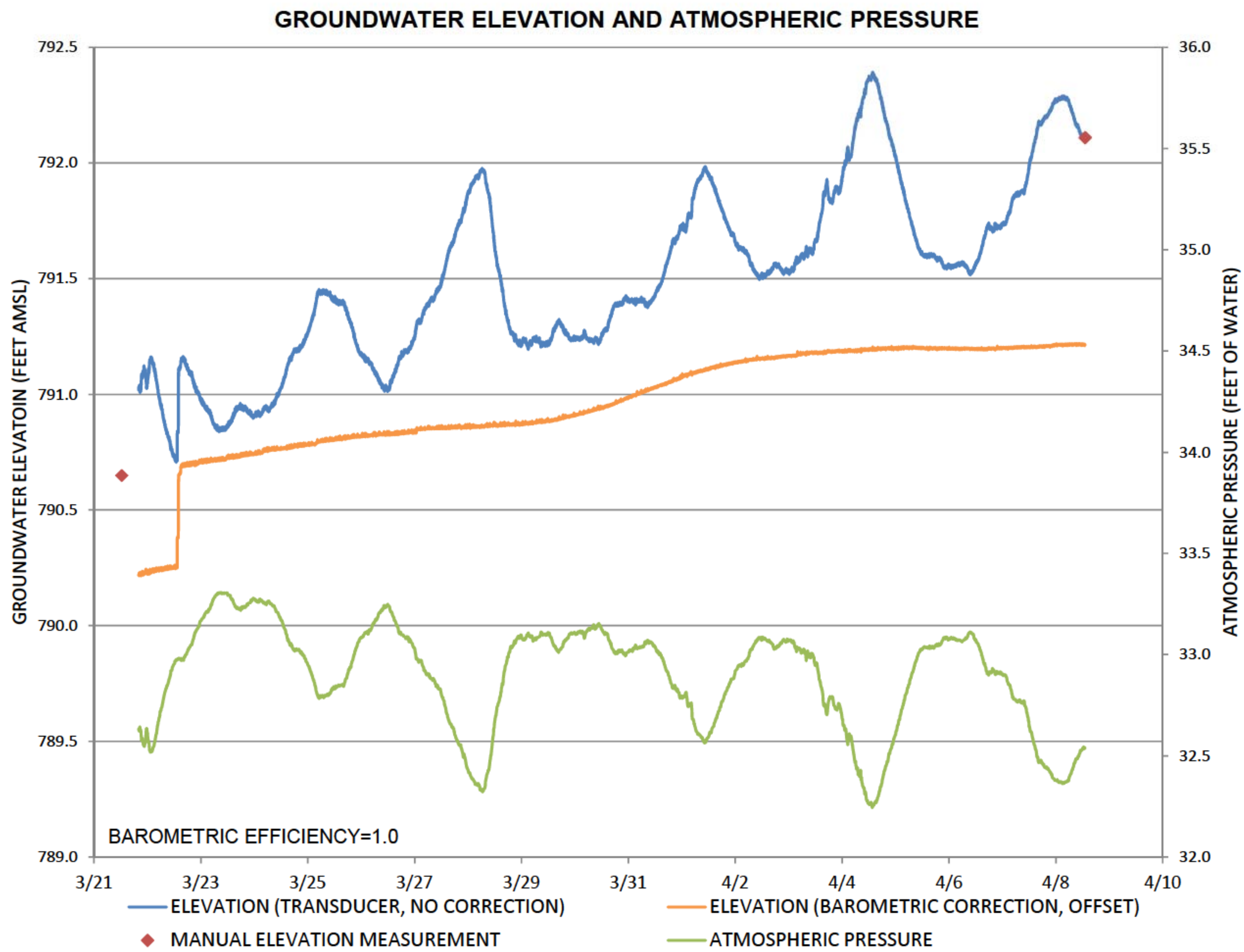
GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
793.4
793.2
793.0
792.8
792.6
792.4
792.2
792.0
791.8
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
BAROMETRIC EFFICIENCY=1.0
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

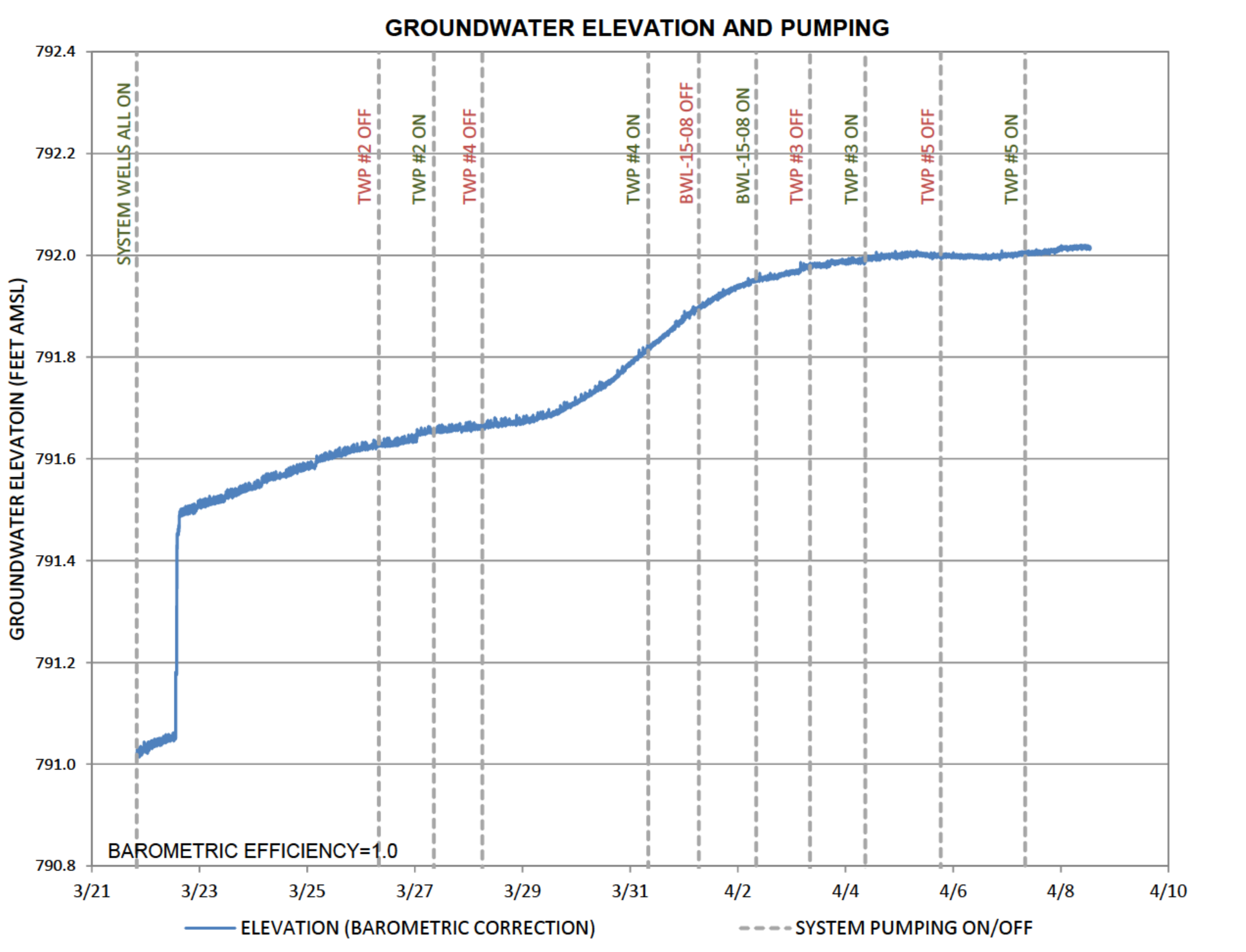
MW 13-22


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
793.5
793.0
792.5
792.0
791.5
791.0
790.5
790.0
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
793.0
792.9
792.8
792.7
792.6
792.5
792.4
792.3
792.2
792.1
792.0
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

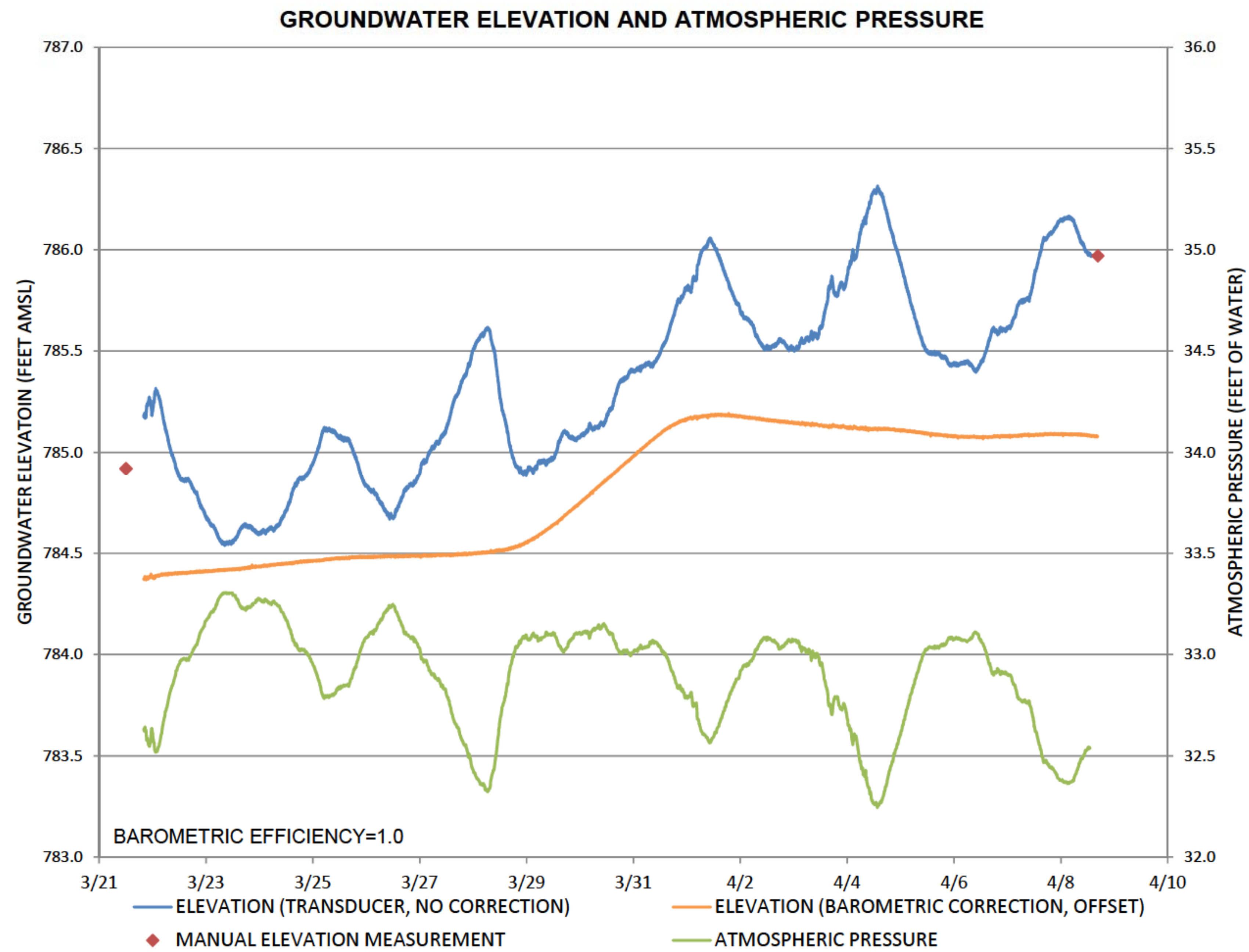
MW 13-28

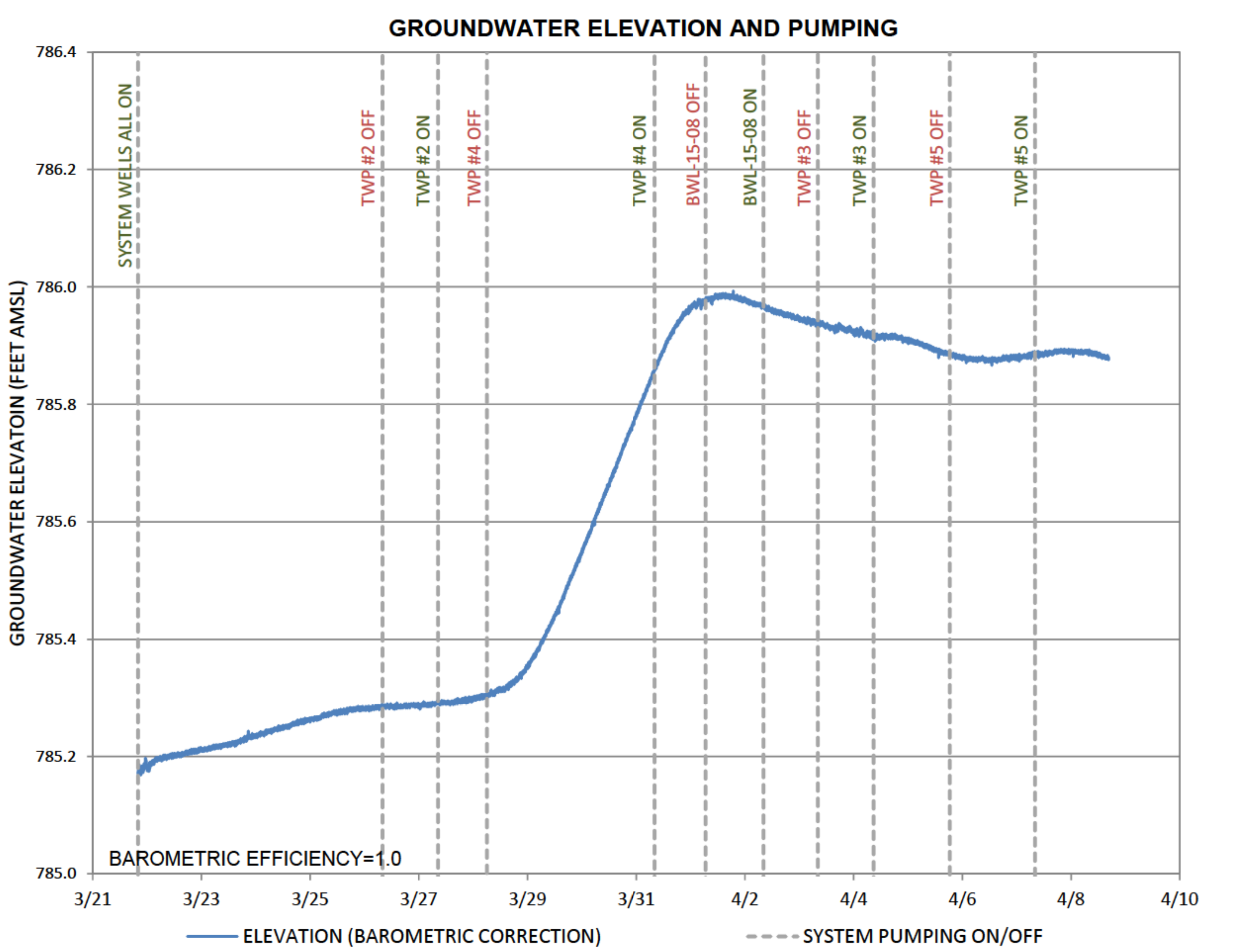




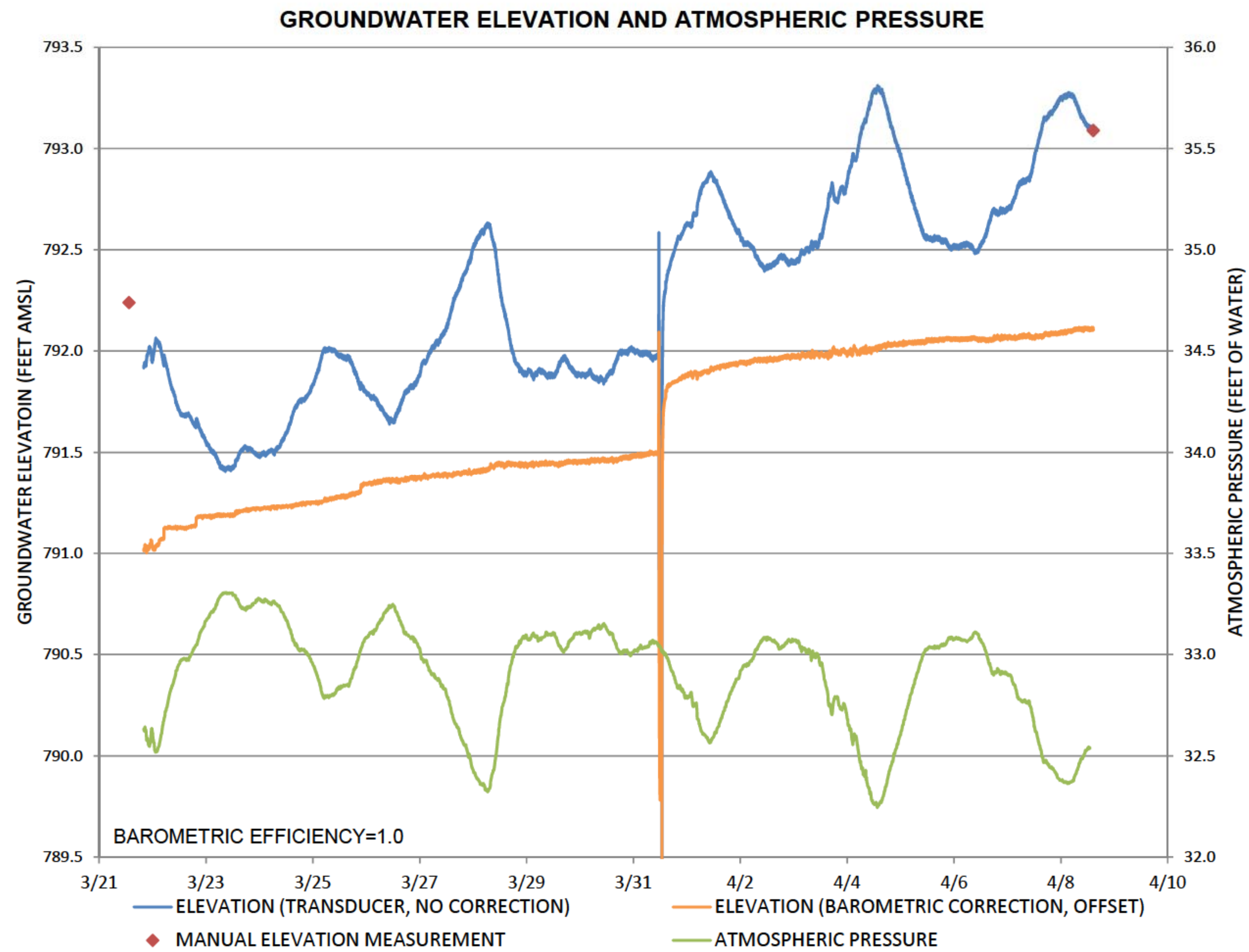
Notes:
Suspected transducer shift of 0.44 feet at approximately 13:00 on 3/21/14.

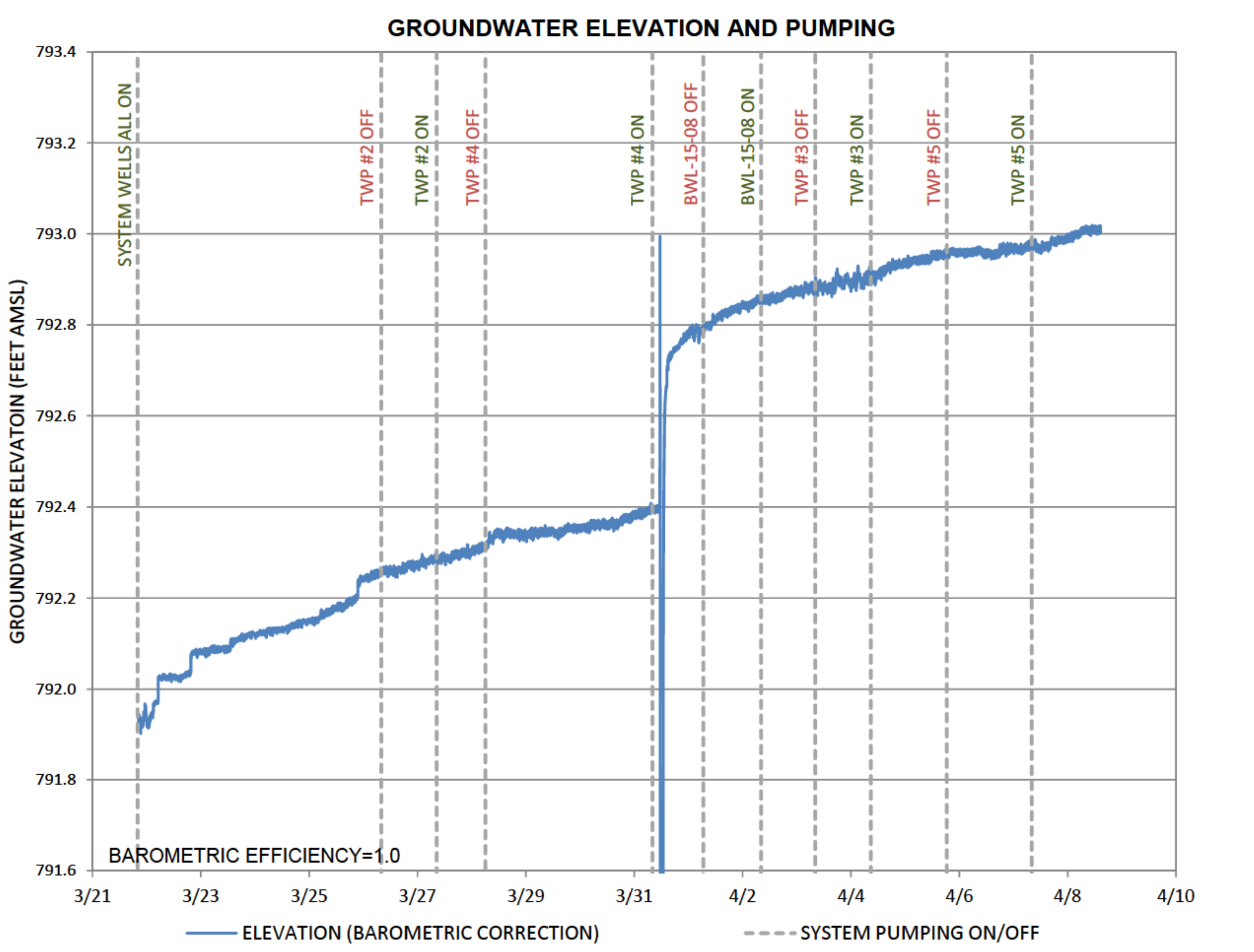
MW 13-34


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
787.0
786.5
786.0
785.5
785.0
784.5
784.0
783.5
783.0
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
786.4
786.2
786.0
785.8
785.6
785.4
785.2
785.0
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

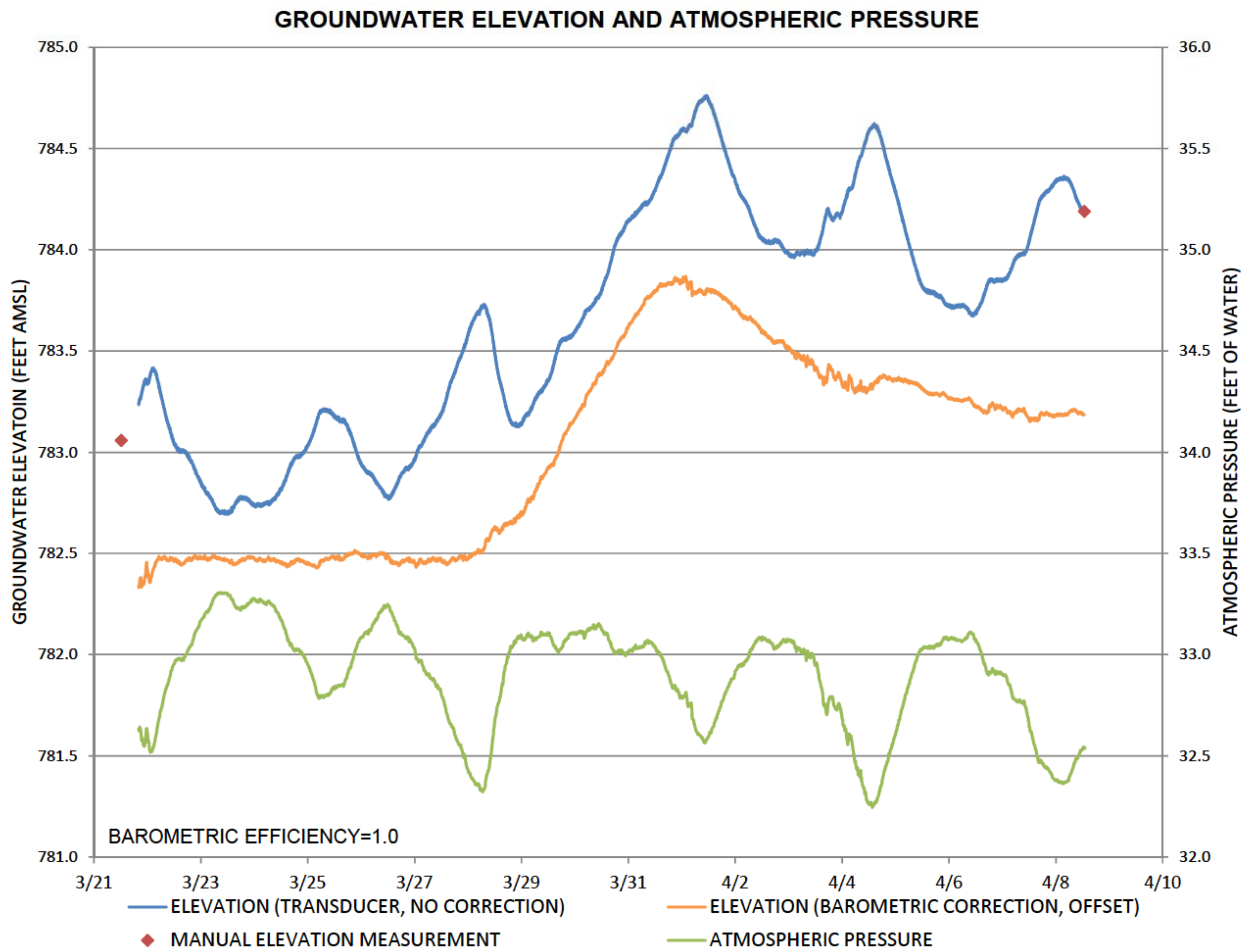
MW 13-39B

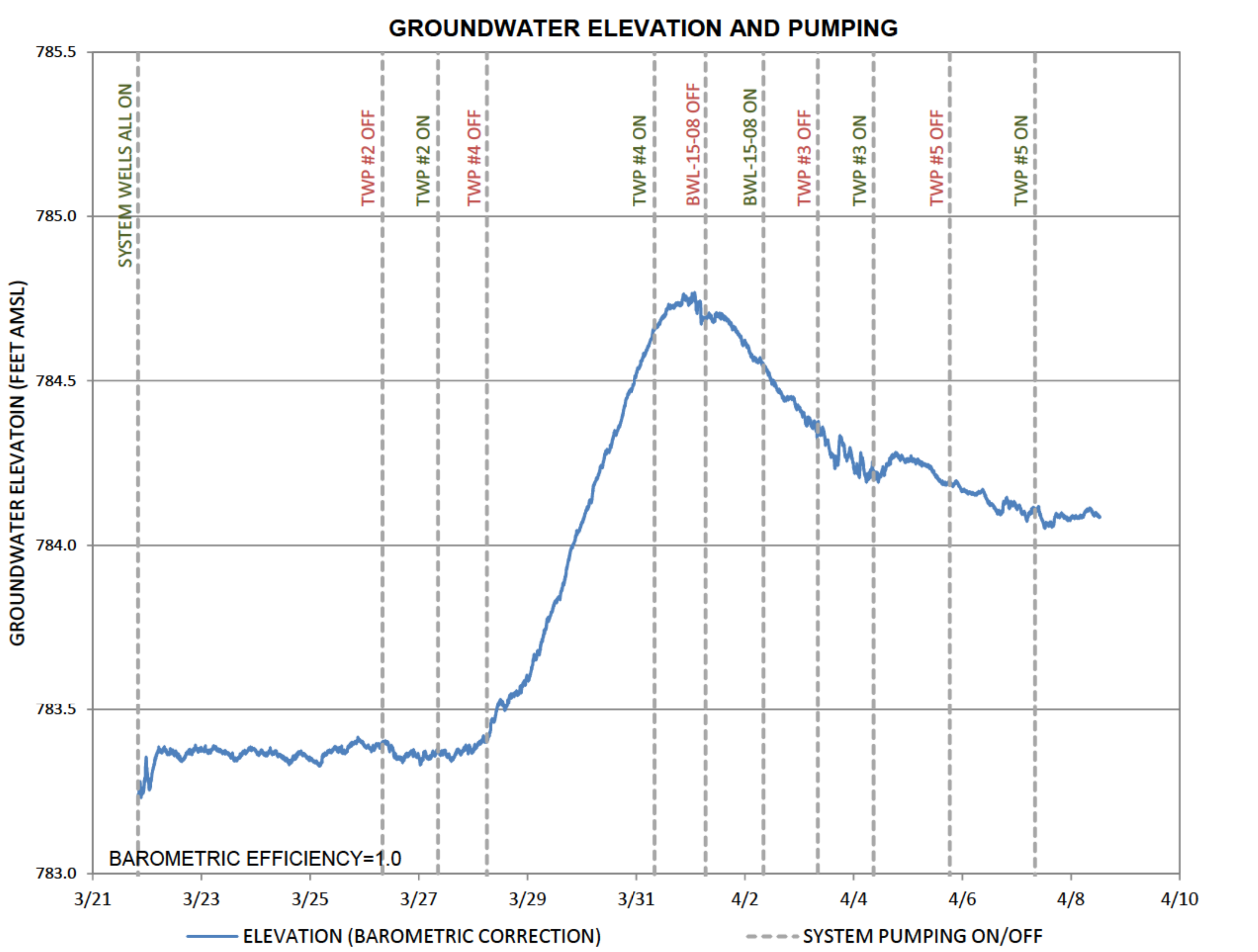




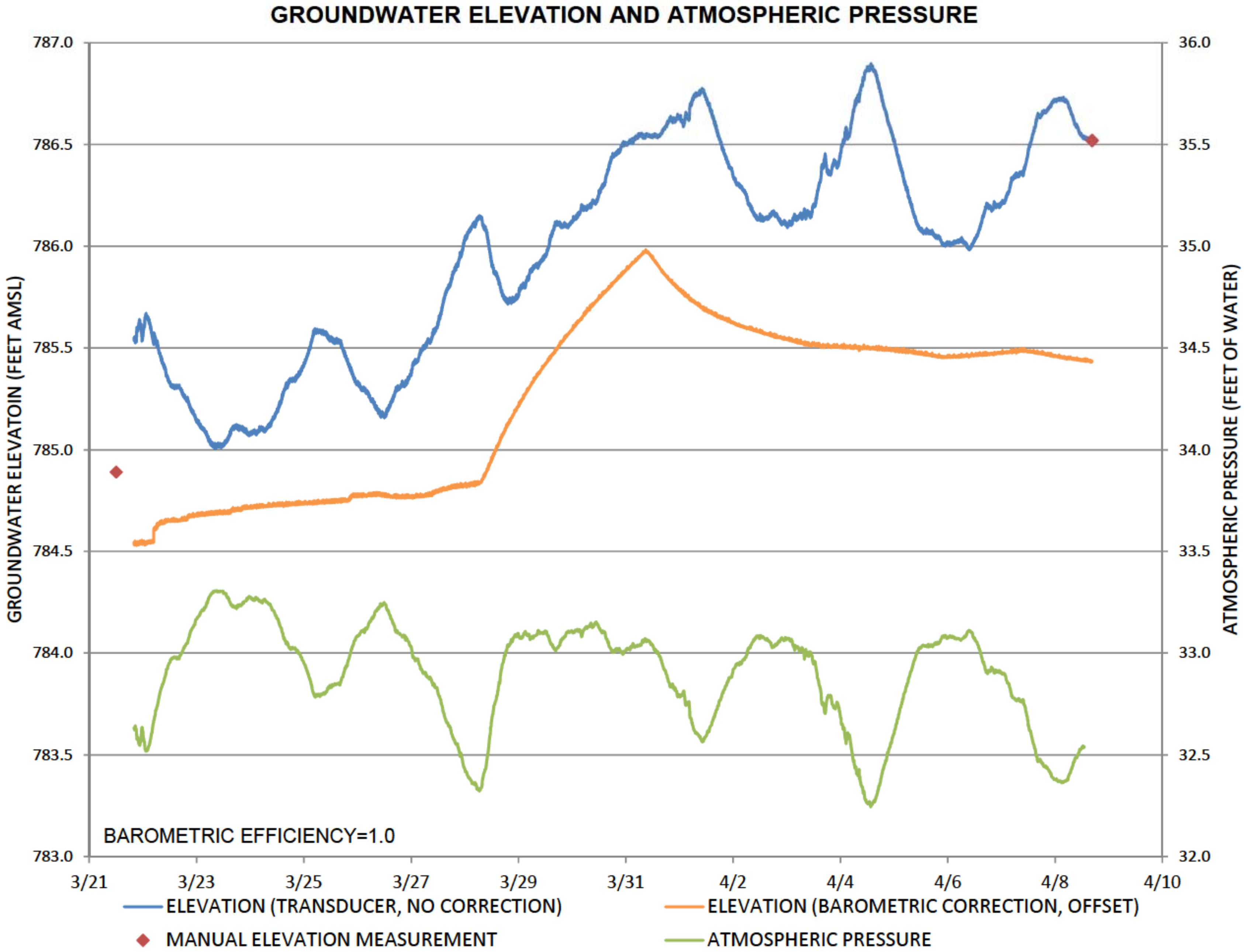
Notes:
Suspected transducer shift of 0.33 feet at approximately 08:00 on 3/31/14.

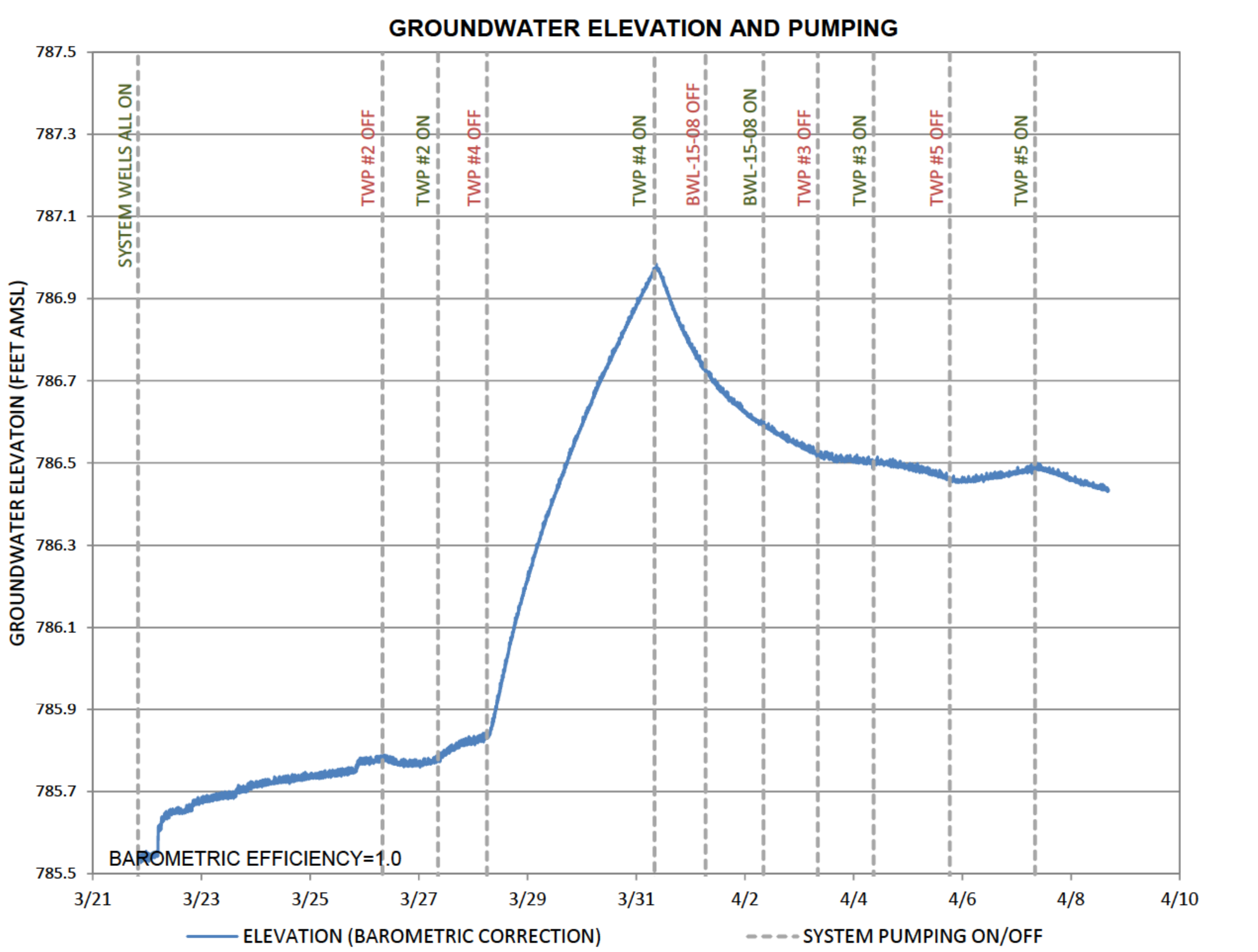
MW 13-44


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
785.0
784.5
784.0
783.5
783.0
782.5
782.0
781.5
781.0
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE

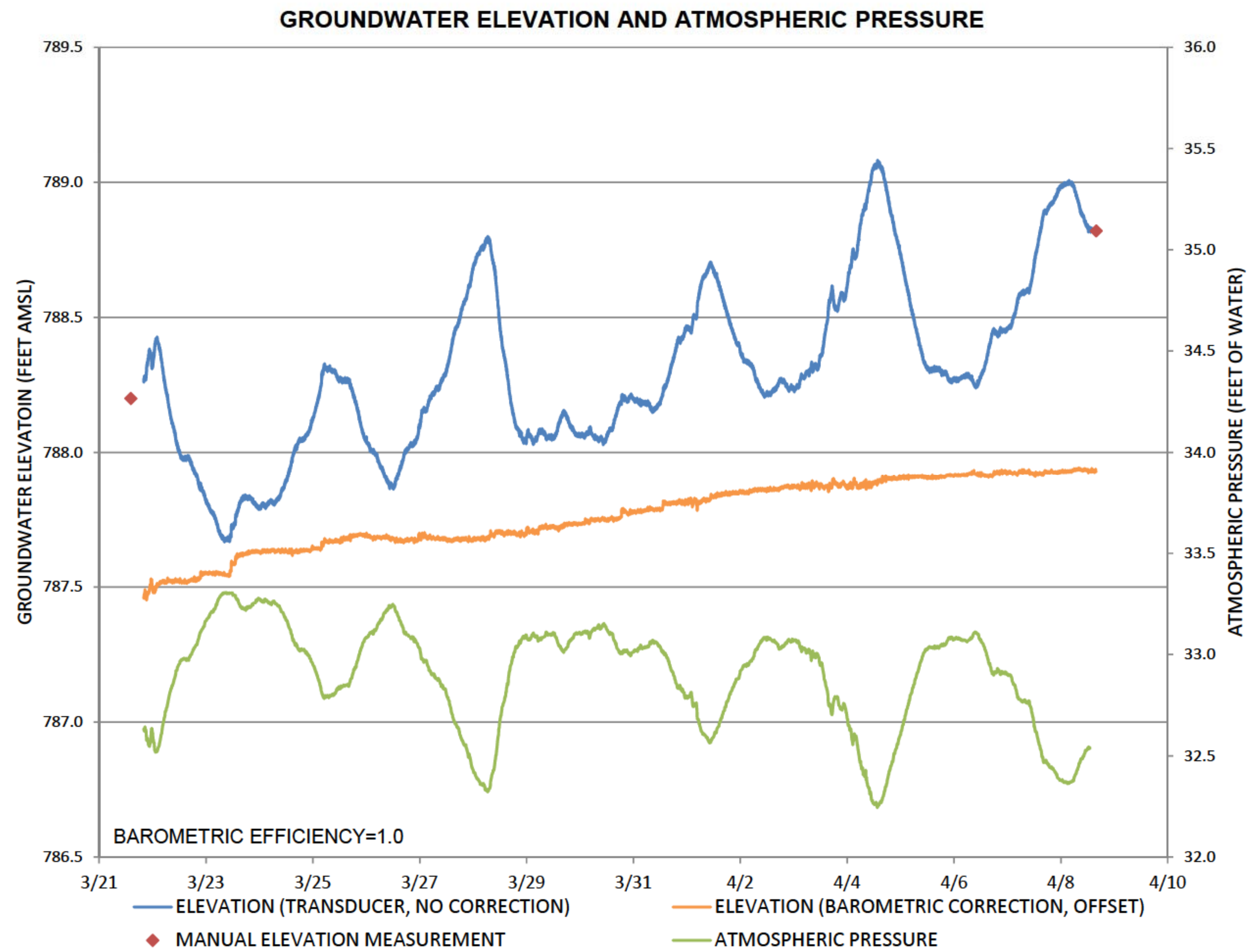

GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
785.5
785.0
784.5
784.0
783.5
783.0
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

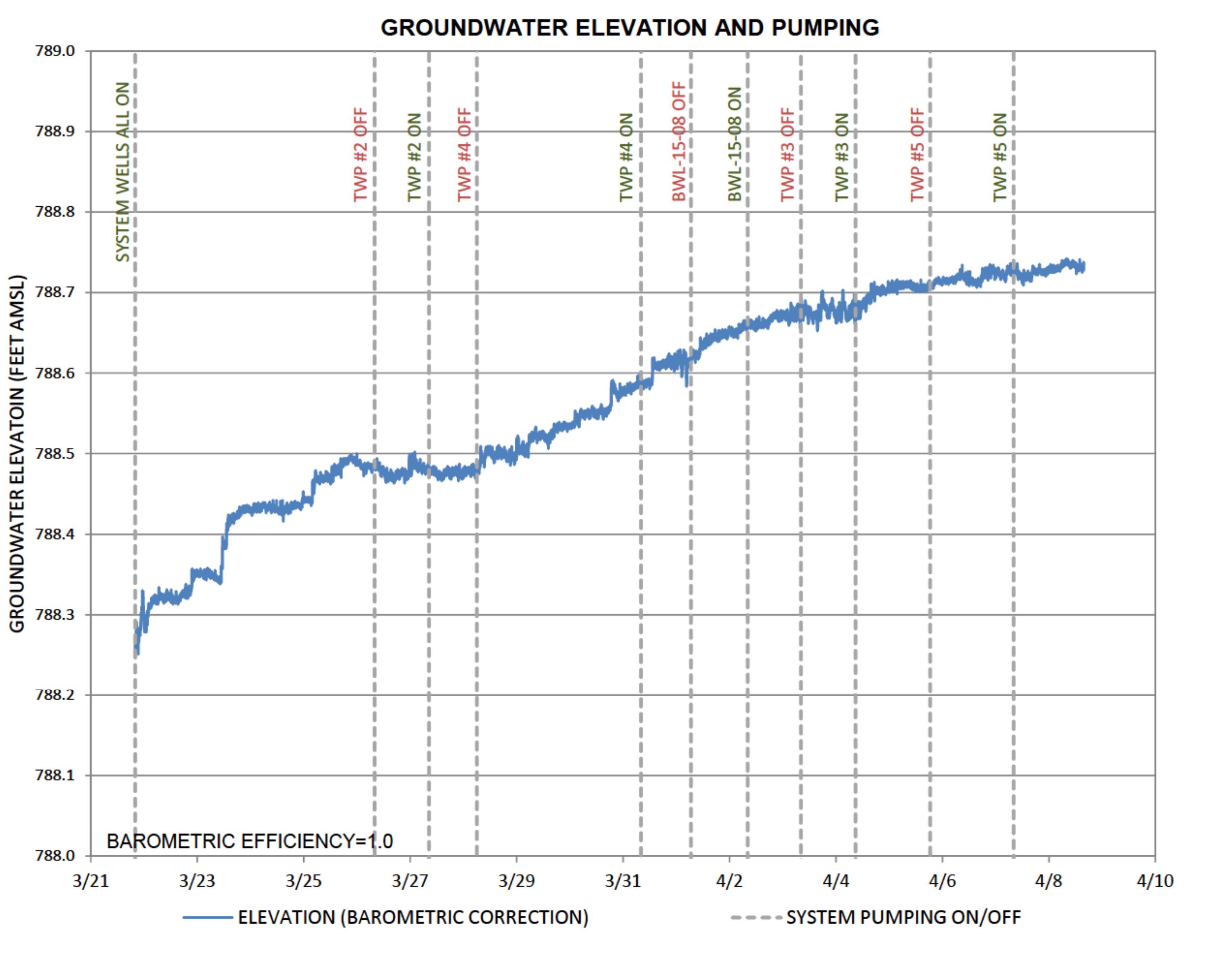
MW 13-47


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
787.0
786.5
786.0
785.5
785.0
784.5
784.0
783.5
783.0
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE

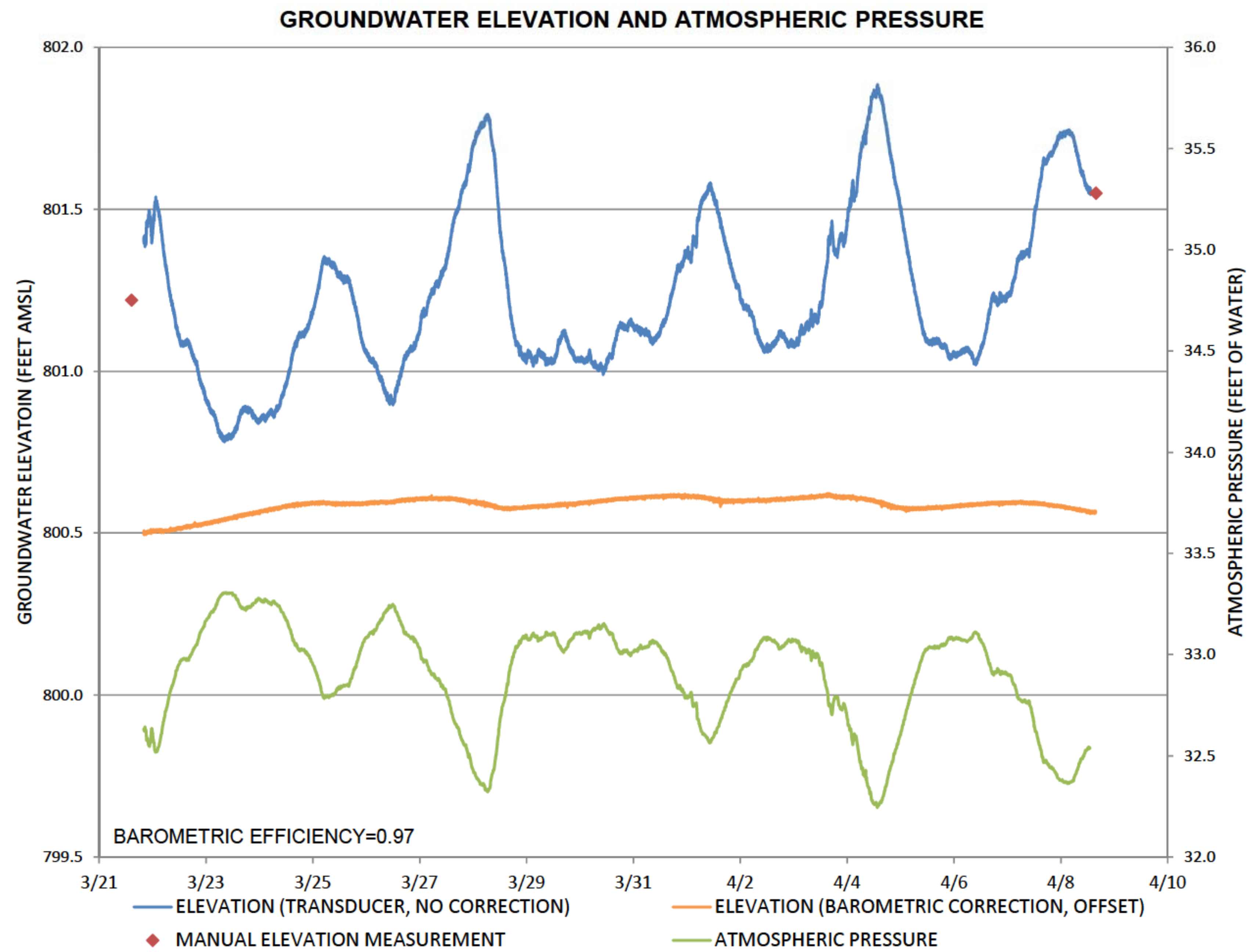

GROUNDWATER ELEVATION AND PUMPING
787.5
787.3
787.1
786.9
786.7
786.5
786.3
786.1
785.9
785.7
785.5
GROUNDWATER ELEVATOIN (FEET AMSL)
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

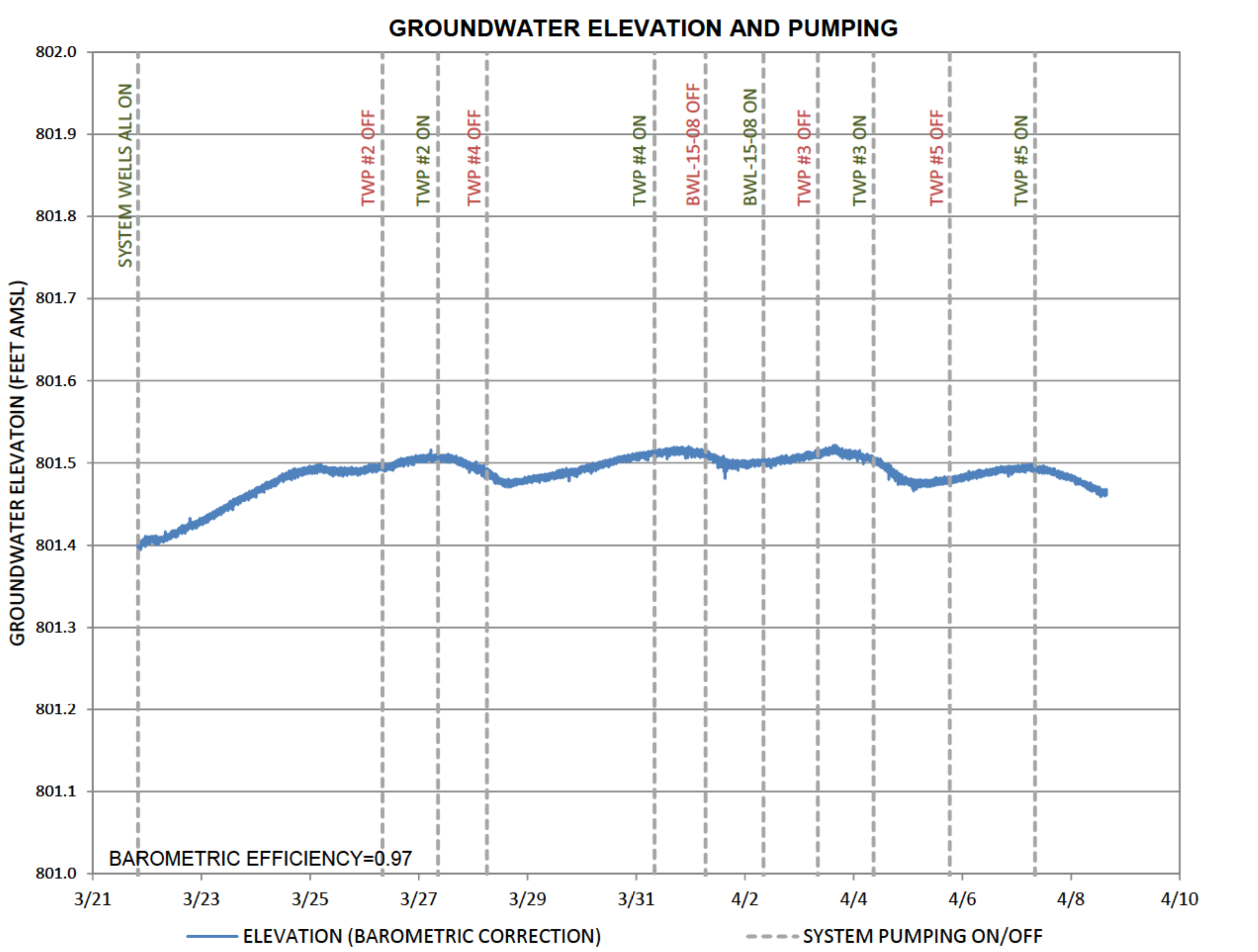
MW 13-50


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
789.5
789.0
788.5
788.0
787.5
787.0
786.5
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
789.0
788.9
788.8
788.7
788.6
788.5
788.4
788.3
788.2
788.1
788.0
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF

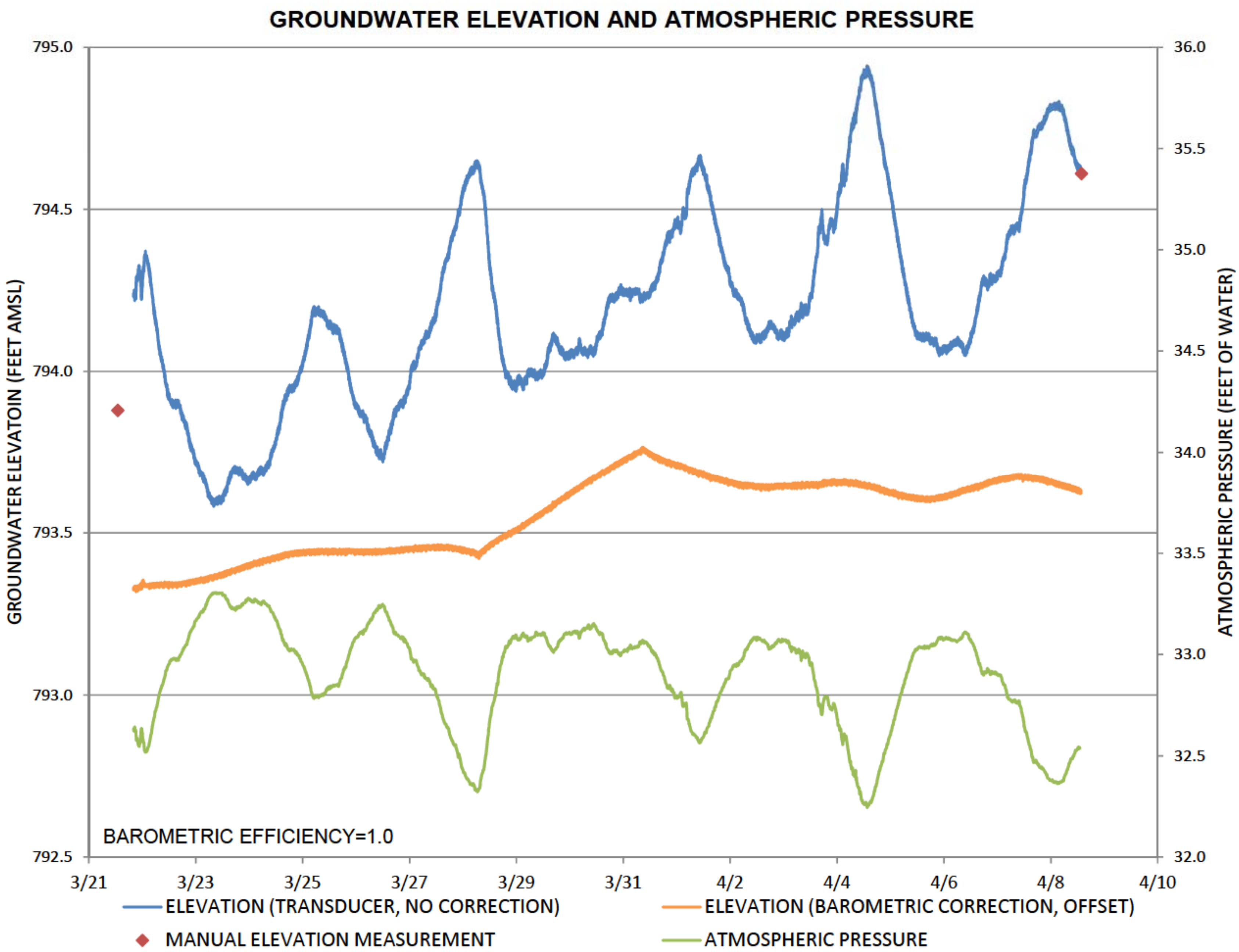
MW 13-52

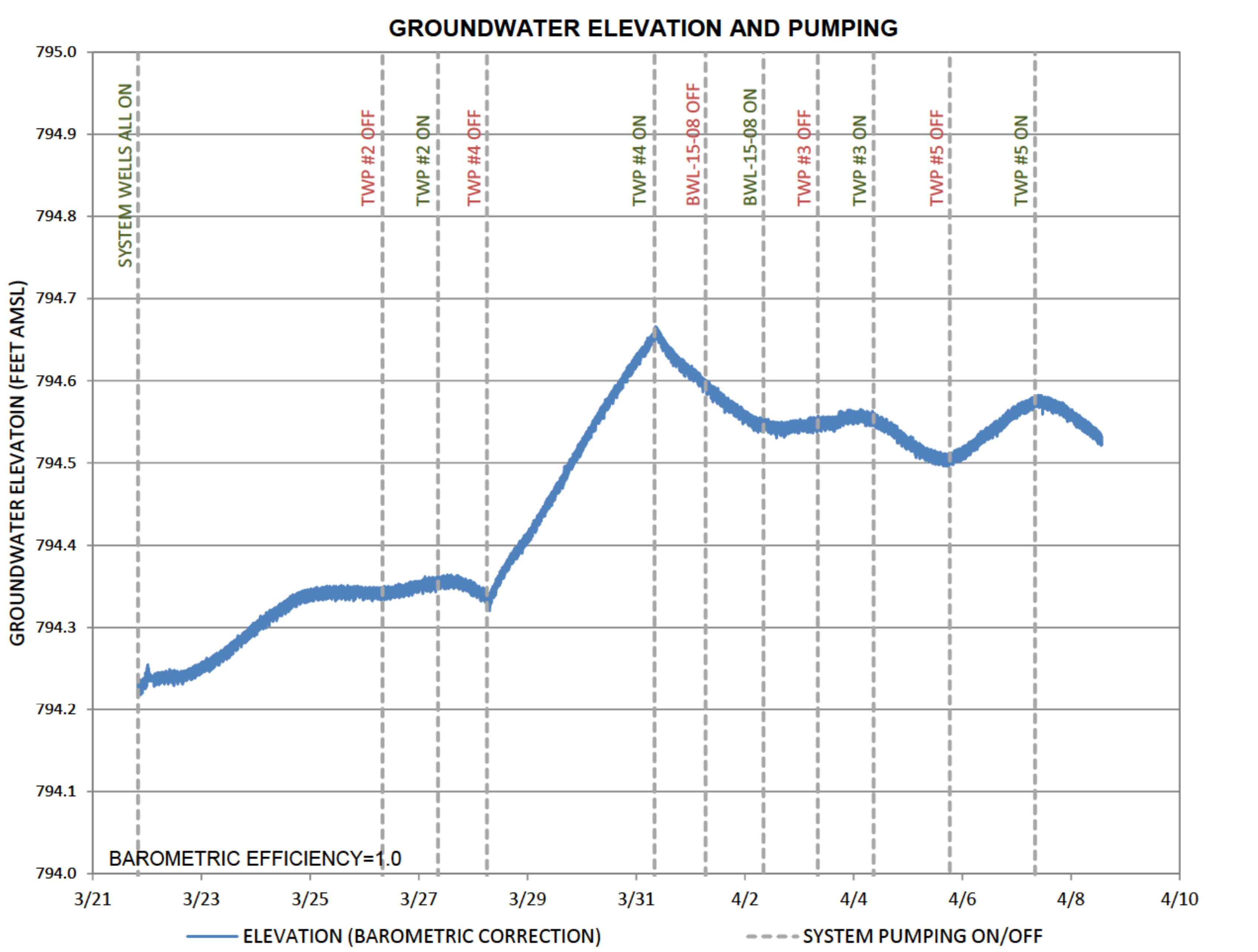




Notes:
Slope inflection points in corrected groundwater elevations are potentially due to incomplete barometric correction.

MW 91-5


GROUNDWATER ELEVATION AND ATMOSPHERIC PRESSURE
GROUNDWATER ELEVATOIN (FEET AMSL)
ATMOSPHERIC PRESSURE (FEET OF WATER)
795.0
794.5
794.0
793.5
793.0
792.5
36.0
35.5
35.0
34.5
34.0
33.5
33.0
32.5
32.0
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (TRANSDUCER, NO CORRECTION)
ELEVATION (BAROMETRIC CORRECTION, OFFSET)
MANUAL ELEVATION MEASUREMENT
ATMOSPHERIC PRESSURE


GROUNDWATER ELEVATION AND PUMPING
GROUNDWATER ELEVATOIN (FEET AMSL)
795.0
794.9
794.8
794.7
794.6
794.5
794.4
794.3
794.2
794.1
794.0
SYSTEM WELLS ALL ON
TWP #2 OFF
TWP #2 ON
TWP #4 OFF
TWP #4 ON
BWL-15-08 OFF
BWL-15-08 ON
TWP #3 OFF
TWP #3 ON
TWP #5 OFF
TWP #5 ON
BAROMETRIC EFFICIENCY=1.0
3/21
3/23
3/25
3/27
3/29
3/31
4/2
4/4
4/6
4/8
4/10
ELEVATION (BAROMETRIC CORRECTION)
SYSTEM PUMPING ON/OFF