

SFCTA Contract Number 06/07-29

SOUTH ACCESS TO THE GOLDEN GATE BRIDGE
DOYLE DRIVE

DOYLE DRIVE REPLACEMENT PROJECT

**Annual Report on Pre-Construction
Groundwater Elevation Monitoring**

West Crissy Bluffs

June 2008 through August 2009

December 2009

Prepared By:

BASELINE Environmental Consulting

for

Caltrans and Arup PB Joint Venture

Our ref 131558/FRG
File ref 4-01
Date January 20, 2010



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Mr. Jared Goldfine
District Branch Chief
Office of Environmental Analysis
Caltrans
Design South - District 4
111 Grand Avenue
Oakland, CA 94612

**Re: Annual Report on Pre-Construction Groundwater Elevation Monitoring\
West Crissy Bluffs – June 2008 through August 2009
Doyle Drive Replacement Project
San Francisco, California**

Dear Mr. Goldfine:

The Arup PB Joint Venture (JV) is pleased to present four (4) copies of the Annual Report on Pre-Construction Groundwater Monitoring for the West Crissy Bluffs on the subject project. The report was prepared by BASELINE Environmental Consulting, who is engaged under an agreement with the JV to provide groundwater elevation monitoring services.

The report describes and summarizes the monitoring program objectives, background information on the piezometer installation, field activities and methods, data evaluation, monitoring results (groundwater levels, and rainfall and tidal influence), and limitations.

The report contains necessary figures showing the project area and piezometer locations, and tables presenting piezometer installation information and level measurement records for the piezometers read manually. Also, the report contains the following appendices:

- Appendix A – Groundwater Elevation and Rainfall Hydrographs
- Appendix B – Groundwater Elevation and Tide Hydrographs
- Appendix C – Groundwater Level Monitoring Forms for Transducer Installations
- Appendix D – Manual and Transducer Data

Appendix D is presented on the attached CD-ROM.

Should you have any questions regarding this report, please contact Cheri Page of BASELINE at (707) 762-5233 or the undersigned.

Yours sincerely



Francis R. Greguras, P.E., G.E.
Arup PB JV

Distribution: Jared Goldfine, Caltrans – 4 copies
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Cheri Page, BASELINE – 3 copies
John Karn, Arup PB JV Project Manager – 1 copy
Sabine van der Sluis, Parsons Brinckerhoff – 1 copy
Project Files

ANNUAL REPORT ON PRE-CONSTRUCTION GROUNDWATER ELEVATION MONITORING

WEST CRISSY BLUFFS
JUNE 2008 THROUGH AUGUST 2009

DECEMBER 2009

DOYLE DRIVE REPLACEMENT
PROJECT
SAN FRANCISCO, CALIFORNIA

For:

ARUP/PB Joint Venture
San Francisco, California

Y0239-03.B1.01395

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ANNUAL REPORT ON PRE-CONSTRUCTION GROUNDWATER ELEVATION MONITORING

WEST CRISSY BLUFFS
JUNE 2008 THROUGH AUGUST 2009

DECEMBER 2009

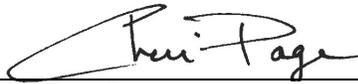
DOYLE DRIVE REPLACEMENT PROJECT
SAN FRANCISCO, CALIFORNIA

For:

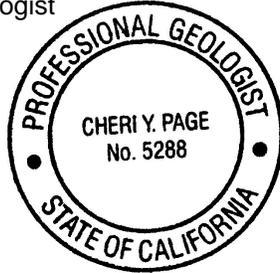
ARUP/PB Joint Venture
San Francisco, California

Y0239-03.B1.01395

This *Annual Report on Pre-Construction Groundwater Elevation Monitoring*, dated 23 December 2009, has been prepared by BASELINE Environmental Consulting as part of Caltrans contract EA 04-1637XX.



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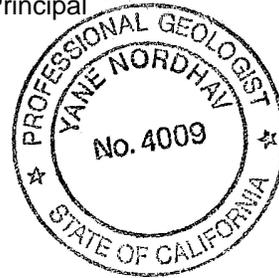


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ANNUAL REPORT ON PRE-CONSTRUCTION GROUNDWATER ELEVATION MONITORING

WEST CRISSY BLUFFS: JUNE 2008 THROUGH AUGUST 2009

Doyle Drive Replacement Project San Francisco, California

1.0 INTRODUCTION

BASELINE Environmental Consulting (“BASELINE”), under subcontract to ARUP/PB Joint Venture, has prepared this groundwater elevation monitoring report in support of the Doyle Drive Replacement Project (“DDRP”) in San Francisco, California (Figure 1). The DDRP, currently in progress, is an upgrade of Doyle Drive within the Presidio to meet current design and safety standards. The San Francisco County Transportation Authority and the State of California Department of Transportation (“Caltrans”) are directing the DDRP.

A portion of the DDRP will upgrade Doyle Drive near a biologically sensitive area within the West Crissy Bluffs (Figure 2). Doyle Drive will be placed within a new tunnel south of the West Crissy Bluffs and north of the San Francisco National Cemetery. Tunneling may alter or disrupt groundwater flows to the bluffs, and as a result, potentially impact existing wetland plants that rely on the groundwater. Therefore, the California Environmental Quality Act (CEQA) process for the DDRP required development and implementation of a hydrogeologic and biological monitoring program to evaluate potential indirect impacts to the hydrogeology and dependent biological resources. This program is described in the final *Environmental Impact Statement/Report (EIS/R)* and the *Natural Environmental Study* appended to the EIS/R,¹ and requires monitoring for one year prior to construction to establish baseline conditions, and continued monitoring for at least five years after completion of the project. A *Long-Term Vegetation and Groundwater Monitoring Plan* has been prepared in response to the long-term monitoring requirement, and proposes quarterly monitoring for five years.² This plan has not yet been approved by the San Francisco Bay Regional Water Quality Control Board (Water Board).

Results of monthly pre-construction groundwater elevation monitoring are presented in this report. Pre-construction groundwater elevation monitoring was conducted by BASELINE from June 2008 through May 2009 to establish baseline groundwater conditions. Monthly groundwater elevations were measured manually in eighteen piezometers upgradient of the West Crissy Bluffs (Figure 2). Eight of these piezometers were also equipped with automated water level measuring devices, referred to as “pressure transducers” or “transducers,” to measure hourly groundwater elevation changes. Beginning in August 2009 monitoring frequency was

¹ Federal Highway Administration, San Francisco Transportation Authority, Caltrans, et al., 2008, *South Access to the Golden Gate Bridge-Doyle Drive Final Environmental Impact Statement/Report*, September.

² ESA, 2009, Doyle Drive West Crissy Bluffs, *Long-Term Vegetation and Groundwater Monitoring Plan*, July.

changed to quarterly, and results for the period between June 2008 and August 2009 are included in this report.

Groundwater level data were collected and uploaded to an Access database, and hydrographs were prepared for each piezometer. Local rainfall and tidal information were researched and provided on the graphs for potential future use by others (Appendices A and B). This study did not include identification of aquifers or evaluation of aquifer properties such as aquifer type or groundwater flow direction.

2.0 PIEZOMETER INSTALLATION

Eighteen piezometers were installed in the West Crissy Bluff area between January and June 2008, at surface elevations ranging from approximately 22 to 108 feet above mean sea level (relative to the North American Vertical Datum of 1988 [NAVD88]). Seventeen of the piezometers were installed by the ARUP/PB Joint Venture, and one piezometer was installed by Caltrans. Piezometer screened intervals typically ranged from 10 to 20 feet and were completed at various depths as deep as 98 feet below ground surface (bgs).

Piezometer construction information is presented on Table 1, and the piezometer locations are shown on Figure 2. Piezometer installation was previously documented by the ARUP/PB Joint Venture in July 2009.³

3.0 FIELD ACTIVITIES AND METHODS

This section describes field activities related to pressure transducer installation and water level data collection.

3.1 Pressure Transducer Installation Procedures

On 7 August 2008, pressure transducers (Solinst Leveloggers Gold Model 3001) were installed in five piezometers (BTSB-R3-PZ-D, BTNB-R5A-PZ-S, BTNB-R7A-PZ-S, BTNB-R7-PZ-D, and RW6-R2-PZ-D). Each piezometer's wellhead was accessed by removing the Christy box lid and locked expansion well plug. The transducer was installed by crimping a small diameter stainless steel suspension cable to the transducer cap, and lowering the transducer into the PVC well casing to a depth of about two feet above the bottom of the piezometer. The suspension cable was secured to the outside of the piezometer casing using two sets of zip-ties. The well plug and lid were replaced, and a small hole (1/8 inch in diameter) was drilled through the well plug and the lid to allow groundwater in the piezometer to equilibrate to atmospheric pressure.

On 7 August 2008, a barometric pressure transducer (Solinst Barologger Gold Model 3001) was installed in piezometer RW6-R2-PZ-D to measure background barometric pressure. This pressure transducer was installed on a suspension cable to a depth of approximately three feet bgs. On 6 May 2009, additional pressure transducers were installed in three piezometers (BTSB-R3A-PZ-S, BTNB-R5-PZ-D, and RW8-R1A-PZ). These transducers were installed in the same way as the transducers installed in August 2008, except that direct-read cables, which allow for data downloads without physically pulling the pressure transducer to the surface, were used instead of suspension cables. On 6 and 21 May 2009, the suspension cables for piezometers

³ ARUP/PB Joint Venture, 2009, *Foundation Report, Southbound Battery Tunnel*, July.

BTSB-R3-PZ-D, BTNB-R7A-PZ-S, BTNB-R7-PZ-D, and RW6-R2-PZ-D were replaced with direct-read cables.

The initial transducer reading, barometric pressure, and manual depth to water measurement were recorded on a water level monitoring form for each transducer installation and re-installation (Appendix C). Manual readings were measured from the north side of the Christy box rim using an electronic water level meter with an accuracy of ± 0.01 foot. Initially, all transducers were set to record one water-level reading per hour. In August 2009, all transducers were reset to record one water-level reading every six hours.

3.2 Groundwater Data Collection

On a monthly basis during the period from June 2008 through May 2009, BASELINE collected both manual water-level measurements from the eighteen piezometers and downloaded data from the pressure transducers. Fieldwork for the first quarterly event in August 2009 was completed jointly by ARUP and BASELINE.

Water levels were measured manually in each piezometer by removing the Christy box lid and well plug, and allowing the water level to equilibrate with atmospheric pressure. During this time, the condition of the well box and cable was documented. After water levels had stabilized, the water level was measured using an electronic water level meter (with an accuracy of ± 0.01 foot) relative to the north side of the Christy box rim and immediately recorded on a water-level monitoring form. All water level readings were collected within a period of eight hours for each event.

If the piezometer was equipped with a transducer, the data were then downloaded to a laptop computer. Transducers with direct-read cables were accessed by connecting a PC interface cable to the direct read cable. Transducers without direct-read cables were retrieved using the suspension cables and the transducers were connected to an optical reader. The PC interface cable or optical reader was then connected to the computer and the water level data stored in the transducer were retrieved. Once the download was complete, the transducers with suspension cables were lowered back into their respective piezometers and all the well plugs and lids were placed back in their original location.

4.0 DATA EVALUATION METHODOLOGY

Water level pressure transducers measure total pressure above the device. This total pressure is the sum of the pressure of the overlying groundwater column and atmospheric pressure. The transducers convert the total pressure readings into corresponding depth to water level equivalents. However, this total pressure reading, uncorrected for atmospheric pressure changes, does not represent actual depth to water. Using *Solinst Levellogger Software 3.1*, the atmospheric pressure readings measured by the barometric transducer installed in piezometer RW6-R2-PZ-D were subtracted from the total pressure readings measured in each transducer to calculate actual depth to water. Groundwater elevations were calculated by subtracting the actual water levels from the surveyed piezometer casing elevations.

Hydrographs illustrating fluctuation in groundwater elevations during the monitoring period in all eighteen piezometers are presented in Appendix A. Due to the relatively large amount of data

collected from each transducer, these data were filtered for plotting.⁴ Cumulative rainfall data collected at downtown San Francisco,⁵ supplemented with data from San Francisco International Airport,⁶ are also included on the hydrographs to allow for comparisons between groundwater level changes and precipitation. All data used for preparing the hydrographs are presented in Appendix D.

Additional hydrographs were prepared to illustrate the relationship between local tides and groundwater elevations for the eight wells with transducers. June is typically a dry month in the San Francisco Bay Area with little to no rainfall. Therefore, June 2009 was selected to best illustrate potential tidal effects on the groundwater elevations without influence from rainfall. Tidal data from Crissy Field⁷ for June 2009 were used to create hydrographs. Tidal hydrographs are presented in Appendix B.

5.0 MONITORING RESULTS

5.1 Groundwater Levels

Manual water level measurements and calculated groundwater elevations are presented on Table 2. Groundwater elevations ranged from about 26 to 89 feet above NAVD88 in the eighteen piezometers from June 2008 through August 2009. Groundwater elevations in piezometers identified as “shallow” (e.g., BTNB-R7A-PZ-S) ranged from about 45 to 86 feet above NAVD88. Groundwater elevations in piezometers identified as “deep” (e.g., BTNB-R7-PZ-D) ranged from about 26 to 86 feet above NAVD88. Three very shallow piezometers near the base of the bluffs (HA-1-PZ, HA-2-PZ, and HA-3-PZ) were dry over the monitoring period.

5.2 Rainfall and Tidal Influence

Hydrographs that included rainfall and tidal information (Appendices A and B) were analyzed to identify potential groundwater level responses to precipitation events and tidal fluctuations. Groundwater level response to rainfall ranged from a clear, rapid response (e.g., BTSB-R3-PZ-D) to no apparent response (e.g., BTNB-R5A-PZ-S). The water level in piezometer BTSB-R3-PZ-D increased about seven feet between 9 February 2009 and 9 March 2009, a period when at least seven inches of rainfall were reported.

Water levels in all of the piezometers equipped with transducers appeared to exhibit a slight response to tidal fluctuations. However, in general, the groundwater level responses to the tides were less than 0.1 foot. Groundwater levels in six of the eight piezometers with transducers (BTNB-R5-PZ-D, BTNB-R7A-PZ-S, BTNB-R7-PZ-D, BTSB-R3-PZ-D, RW6-R2-PZ-D, and RW8-R1A-PZ) appeared to exhibit a slight response to an increase in tidal fluctuations between approximately June 16 and 23, 2009. Piezometer RW8-R1A-PZ exhibited the maximum response of about 0.25 foot per day.

⁴ The maximum daily groundwater elevations were extracted from the Access database and imported into Excel to create hydrographs. All groundwater elevations calculated from manual depth-to-water readings are included in the hydrographs.

⁵ National Oceanic and Atmospheric Administration (NOAA) Station 047772.

⁶ National Weather Service Station CF6SFO.

⁷ NOAA Station 9414290.

6.0 LIMITATIONS

BASELINE's objective is to perform our work with care, exercising the customary thoroughness and competence of earth science, environmental, and engineering consulting professionals, in accordance with the standard for professional services for a consulting firm at the time these services were provided.

The passage of time, manifestation of latent conditions, or occurrence of future events may require further exploration at the project site, analysis of the data, and re-evaluation of the findings, observations, conclusions, and recommendations expressed in the report.

The findings, observations, conclusions, and recommendations expressed by BASELINE in this report are limited by the scope of services. No warranty or guarantee, whether expressed or implied is made with respect to the data reported or findings, observations, conclusions, and recommendations expressed in this report.

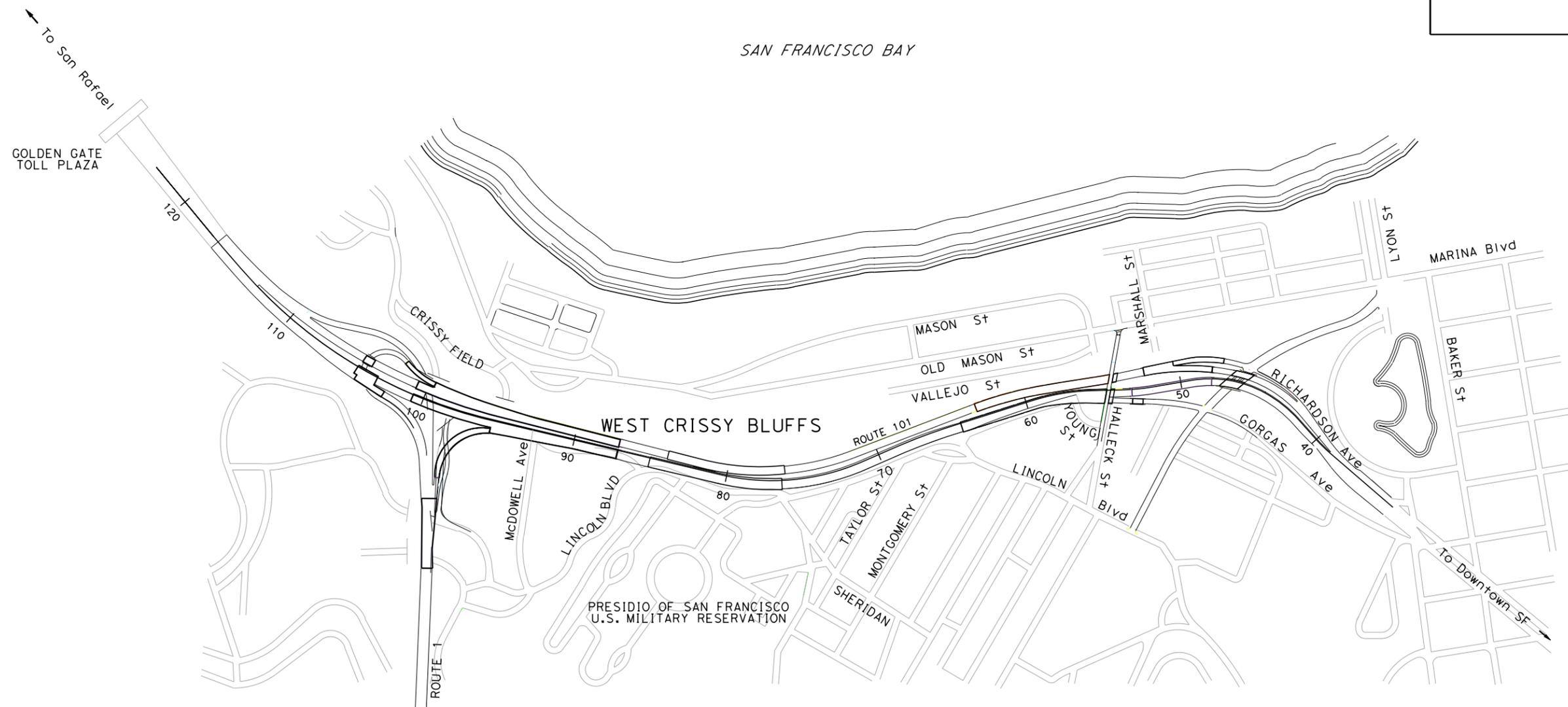
FIGURES

STATE OF CALIFORNIA
 DEPARTMENT OF TRANSPORTATION
 PROJECT PLANS FOR CONSTRUCTION ON
 STATE HIGHWAY

IN THE CITY AND COUNTY OF SAN FRANCISCO
 AT THE ROUTE 101/1 SEPARATION
 TO GOLDEN GATE TOLL PLAZA

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

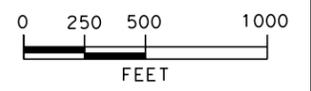
| Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET NO. | TOTAL SHEETS |
|------|--------|-------|-----------------------------|--------------|-----------------|
| 04 | SF | 101,1 | 9.2/9.8, 6.8/7.1 | | |



DOYLE DRIVE REPLACEMENT PROJECT
 PROJECT AREA
 WEST CRISSY BLUFFS GROUNDWATER LEVEL MONITORING
 FIGURE 1 - December 3, 2009



ARUP PB
 joint venture



RELATIVE BORDER SCALE
 IS IN INCHES

LAST REVISION: 00-00-00
 DATE PLOTTED => 12/31/2009
 TIME PLOTTED => 3:56:23 PM

TABLES

**TABLE 1: Installation Data: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer ID | Installed By | Piezometer Install Date | Transducer Installed | Northing (feet)⁶ | Easting (feet)⁶ | Elevation (feet, NAVD88)⁷ | Well Screen Interval (feet btoc) | Sand Pack Interval (feet btoc) |
|----------------------------|---------------------|--------------------------------|-----------------------------|------------------------------------|-----------------------------------|---|---|---------------------------------------|
| 34-0157NB-A1-PZ | Caltrans | 2/28/2008 | No | 2120509.438 | 5993931.703 | 80.911 | 15 to 25 | 14 to 25 |
| BTNB-R4-PZ | ARUP | 2/18/2008 | No | 2120366.979 | 5994998.299 | 70.422 | 49.5 to 69.5 | 47 to 69.5 |
| BTNB-R5A-PZ-S ¹ | ARUP | 4/11/2008 | Yes | 2120582.620 | 5994169.980 | 79.370 | 15 to 35 | 14 to 36 |
| BTNB-R5-PZ-D | ARUP | 4/10/2008 | Yes | 2120581.324 | 5994178.193 | 79.635 | 78 to 98 | 77 to 99 |
| BTNB-R6A-PZ-S ² | ARUP | 3/27/2008 | No | 2120558.479 | 5994527.552 | 83.531 | 17 to 32 | 15 to 32 |
| BTNB-R6-PZ-D | ARUP | 3/28/2008 | No | 2120559.949 | 5994521.542 | 83.591 | 60 to 80 | 58.5 to 80 |
| BTNB-R7A-PZ-S ³ | ARUP | 4/1/2008 | Yes | 2120461.975 | 5994829.468 | 78.961 | 28.5 to 43.5 | 26.5 to 43.5 |
| BTNB-R7-PZ-D | ARUP | 4/3/2008 | Yes | 2120459.851 | 5994825.735 | 79.353 | 50 to 70 | 47 to 70 |
| BTSB-R1-PZ | ARUP | 1/23/2008 | No | 2120323.729 | 5994396.263 | 101.030 | 23.5 to 33.5 | 21.5 to 33.5 |
| BTSB-R3A-PZ-S ⁴ | ARUP | 4/23/2008 | Yes | 2120227.544 | 5994550.875 | 98.049 | 9 to 18 | 7 to 19.3 |
| BTSB-R3-PZ-D | ARUP | 4/23/2008 | Yes | 2120225.975 | 5994556.115 | 97.900 | 50 to 70 | 48.5 to 71 |
| HA-1-PZ | ARUP | 4/29/2008 | No | 2120752.489 | 5994220.945 | 27.802 | 6.5 to 11.5 | 5 to 11.5 |
| HA-2-PZ | ARUP | 4/29/2008 | No | 2120690.897 | 5994579.932 | 25.348 | 6.5 to 11.5 | 5.5 to 11.5 |
| HA-3-PZ | ARUP | 4/29/2008 | No | 2120613.038 | 5994884.724 | 22.315 | 3 to 6.5 | 2.5 to 6.5 |
| RW6-R1-PZ | ARUP | 2/28/2008 | No | 2120380.700 | 5994104.938 | 108.507 | 12 to 22 | 10 to 22 |
| RW6-R2A-PZ-S ⁵ | ARUP | 4/17/2008 | No | 2120266.257 | 5993963.449 | 108.315 | 13 to 28 | 12 to 29 |
| RW6-R2-PZ-D | ARUP | 4/17/2008 | Yes ⁸ | 2120270.083 | 5993967.843 | 108.659 | 77 to 97 | 76 to 98 |
| RW8-R1A-PZ | ARUP | 6/5/2008 | Yes | 2120200.018 | 5995013.992 | 90.063 | 25 to 45 | 23 to 45 |

Notes:

All piezometer data provided by ARUP PB Joint Venture.

btoc = below top of casing.

¹ This piezometer has been renamed, and was originally identified as BTNB-R5I.

² This piezometer has been renamed, and was originally identified as BTNB-R6I.

³ This piezometer has been renamed, and was originally identified as BTNB-R7I.

⁴ This piezometer has been renamed, and was originally identified as BTSB-R3I.

⁵ This piezometer has been renamed, and was originally identified as RW6-R2I.

⁶ Northings and eastings are in NAD83, State Plane, California, Zone 3 coordinate system.

⁷ Elevation of north side of Christy box rim surveyed by Chaudary and Associates relative to NAVD88.

⁸ Piezometer RW6-R2-PZ-D has a barometric pressure transducer and a water pressure transducer.

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|-------------|--------------------------|--|---|
| 34-0157NB-A1-PZ | 6/11/2008 | ARUP | Dry ¹ | -- |
| | 7/18/2008 | BASELINE | 24.03 ⁴ | 56.88 |
| | 8/29/2008 | BASELINE | 24.46 | 56.45 |
| | 9/25/2008 | BASELINE | 24.72 | 56.19 |
| | 10/24/2008 | BASELINE | 24.94 | 55.97 |
| | 11/25/2008 | BASELINE | 25.09 ² | 55.82 |
| | 12/22/2008 | BASELINE | 25.12 ² | 55.79 |
| | 1/30/2009 | BASELINE | 25.15 ² | 55.76 |
| | 2/25/2009 | BASELINE | 25.17 ² | 55.74 |
| | 3/25/2009 | BASELINE | 25.17 ² | 55.74 |
| | 4/24/2009 | BASELINE | 25.18 ² | 55.73 |
| | 5/22/2009 | BASELINE | 25.20 ² | 55.71 |
| | 8/17/2009 | BASELINE | 25.20 ² | 55.71 |
| | BTNB-R4-PZ | 6/9/2008 | ARUP | 25.15 ¹ |
| 7/18/2008 | | BASELINE | 29.96 ⁴ | 40.46 |
| 8/29/2008 | | BASELINE | 30.02 | 40.40 |
| 9/25/2008 | | BASELINE | 30.32 | 40.10 |
| 10/24/2008 | | BASELINE | 30.40 | 40.02 |
| 11/25/2008 | | BASELINE | 30.88 | 39.54 |
| 12/22/2008 | | BASELINE | 31.05 | 39.37 |
| 1/30/2009 | | BASELINE | 31.76 | 38.66 |
| 2/25/2009 | | BASELINE | 29.92 | 40.50 |
| 3/25/2009 | | BASELINE | 30.14 | 40.28 |
| 4/24/2009 | | BASELINE | 29.17 | 41.25 |
| 5/22/2009 | | BASELINE | 29.67 | 40.75 |
| 8/17/2009 | BASELINE | 31.72 | 38.70 | |
| BTNB-R5A-PZ-S | 6/13/2008 | ARUP | 3.07 ¹ | 76.30 |
| | 7/18/2008 | BASELINE | 3.66 ⁴ | 75.71 |
| | 8/29/2008 | BASELINE | 4.01 | 75.36 |
| | 9/25/2008 | BASELINE | 4.17 | 75.20 |
| | 10/24/2008 | BASELINE | 4.32 | 75.05 |
| | 11/25/2008 | BASELINE | 4.28 | 75.09 |
| | 12/22/2008 | BASELINE | 4.33 | 75.04 |
| | 1/30/2009 | BASELINE | 4.50 | 74.87 |
| | 2/25/2009 | BASELINE | 4.42 | 74.95 |
| | 3/25/2009 | BASELINE | 4.35 | 75.02 |
| | 4/24/2009 | BASELINE | 4.80 | 74.57 |
| | 5/22/2009 | BASELINE | 4.85 | 74.52 |
| 8/17/2009 | BASELINE | 5.03 | 74.34 | |

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|---------------|--------------------------|--|---|
| BTNB-R5-PZ-D | 6/13/2008 | ARUP | 53.84 ¹ | 25.80 |
| | 7/18/2008 | BASELINE | 51.97 ⁴ | 27.67 |
| | 8/29/2008 | BASELINE | 51.44 | 28.20 |
| | 9/25/2008 | BASELINE | 51.20 | 28.44 |
| | 10/24/2008 | BASELINE | 51.04 | 28.60 |
| | 11/25/2008 | BASELINE | 50.75 | 28.89 |
| | 12/22/2008 | BASELINE | 50.20 | 29.44 |
| | 1/30/2009 | BASELINE | 49.78 | 29.86 |
| | 2/25/2009 | BASELINE | 49.45 | 30.19 |
| | 3/25/2009 | BASELINE | 49.27 | 30.37 |
| | 4/24/2009 | BASELINE | 43.23 | 36.41 |
| | 5/22/2009 | BASELINE | 43.00 | 36.64 |
| | 8/17/2009 | BASELINE | 43.93 | 35.71 |
| | BTNB-R6A-PZ-S | 6/13/2008 | ARUP | 27.46 ¹ |
| 7/18/2008 | | BASELINE | 29.54 ⁴ | 53.99 |
| 8/29/2008 | | BASELINE | 29.58 | 53.95 |
| 9/25/2008 | | BASELINE | 30.14 | 53.39 |
| 10/24/2008 | | BASELINE | 31.88 ² | 51.65 |
| 11/25/2008 | | BASELINE | 31.84 ² | 51.69 |
| 12/22/2008 | | BASELINE | 31.85 ² | 51.68 |
| 1/30/2009 | | BASELINE | 31.83 ² | 51.70 |
| 2/25/2009 | | BASELINE | 31.85 ² | 51.68 |
| 3/25/2009 | | BASELINE | 31.85 ² | 51.68 |
| 4/24/2009 | | BASELINE | 31.86 ² | 51.67 |
| 5/22/2009 | | BASELINE | 31.83 ² | 51.70 |
| 8/17/2009 | | BASELINE | 31.40 | 52.13 |
| BTNB-R6-PZ-D | | 6/13/2008 | ARUP | 26.78 ¹ |
| | 7/18/2008 | BASELINE | 27.92 ⁴ | 55.67 |
| | 8/29/2008 | BASELINE | 27.68 | 55.91 |
| | 9/25/2008 | BASELINE | 28.48 | 55.11 |
| | 10/24/2008 | BASELINE | 30.68 | 52.91 |
| | 11/25/2008 | BASELINE | 33.58 | 50.01 |
| | 12/22/2008 | BASELINE | 35.28 | 48.31 |
| | 1/30/2009 | BASELINE | 36.93 | 46.66 |
| | 2/25/2009 | BASELINE | 37.53 | 46.06 |
| | 3/25/2009 | BASELINE | 36.74 | 46.85 |
| | 4/24/2009 | BASELINE | 36.03 | 47.56 |
| | 5/22/2009 | BASELINE | 36.43 | 47.16 |
| | 8/17/2009 | BASELINE | 38.32 | 45.27 |

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|-------------|--------------------------|--|---|
| BTNB-R7A-PZ-S | 6/10/2008 | ARUP | 28.45 ¹ | 50.51 |
| | 7/18/2008 | BASELINE | 30.17 ⁴ | 48.79 |
| | 8/29/2008 | BASELINE | 30.04 | 48.92 |
| | 9/25/2008 | BASELINE | 30.11 | 48.85 |
| | 10/24/2008 | BASELINE | 30.65 | 48.31 |
| | 11/25/2008 | BASELINE | 31.88 | 47.08 |
| | 12/22/2008 | BASELINE | 32.64 | 46.32 |
| | 1/30/2009 | BASELINE | 33.57 | 45.39 |
| | 2/25/2009 | BASELINE | 34.00 | 44.96 |
| | 3/25/2009 | BASELINE | 32.42 | 46.54 |
| | 4/24/2009 | BASELINE | 31.33 | 47.63 |
| | 5/22/2009 | BASELINE | 31.99 | 46.97 |
| | 8/17/2009 | BASELINE | 34.23 | 44.73 |
| BTNB-R7-PZ-D | 6/10/2008 | ARUP | 11.84 ¹ | 67.51 |
| | 7/18/2008 | BASELINE | 30.92 ⁴ | 48.43 |
| | 8/29/2008 | BASELINE | 30.43 | 48.92 |
| | 9/25/2008 | BASELINE | 30.47 | 48.88 |
| | 10/24/2008 | BASELINE | 31.10 | 48.25 |
| | 11/25/2008 | BASELINE | 32.60 | 46.75 |
| | 12/22/2008 | BASELINE | 33.49 | 45.86 |
| | 1/30/2009 | BASELINE | 34.64 | 44.71 |
| | 2/25/2009 | BASELINE | 35.04 | 44.31 |
| | 3/25/2009 | BASELINE | 33.18 | 46.17 |
| | 4/24/2009 | BASELINE | 32.40 | 46.95 |
| | 5/22/2009 | BASELINE | 33.04 | 46.31 |
| | 8/17/2009 | BASELINE | 35.41 | 43.94 |
| BTSB-R1-PZ | 3/28/2008 | ARUP | 17.15 ¹ | 83.88 |
| | 6/12/2008 | ARUP | 18.48 ¹ | 82.55 |
| | 7/18/2008 | BASELINE | 20.50 ⁴ | 80.53 |
| | 8/29/2008 | BASELINE | 21.48 | 79.55 |
| | 9/25/2008 | BASELINE | 20.53 ⁴ | 80.50 |
| | 10/24/2008 | BASELINE | 21.93 | 79.10 |
| | 11/25/2008 | BASELINE | 21.45 | 79.58 |
| | 12/22/2008 | BASELINE | 22.57 | 78.46 |
| | 1/30/2009 | BASELINE | 22.55 | 78.48 |
| | 2/25/2009 | BASELINE | 21.14 | 79.89 |
| | 3/25/2009 | BASELINE | 18.06 | 82.97 |
| | 4/24/2009 | BASELINE | 20.72 | 80.31 |
| | 5/22/2009 | BASELINE | 22.10 | 78.93 |
| 8/17/2009 | BASELINE | 21.07 | 79.96 | |

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|-------------|--------------------------|--|---|
| BTSB-R3A-PZ-S | 6/12/2008 | ARUP | 15.00 ¹ | 83.05 |
| | 7/18/2008 | BASELINE | 15.22 ⁴ | 82.83 |
| | 8/29/2008 | BASELINE | 14.80 | 83.25 |
| | 9/25/2008 | BASELINE | 14.93 | 83.12 |
| | 10/24/2008 | BASELINE | 15.54 | 82.51 |
| | 11/25/2008 | BASELINE | 14.79 | 83.26 |
| | 12/22/2008 | BASELINE | 16.12 | 81.93 |
| | 1/30/2009 | BASELINE | 15.96 | 82.09 |
| | 2/25/2009 | BASELINE | 11.91 | 86.14 |
| | 3/25/2009 | BASELINE | 12.08 | 85.97 |
| | 4/24/2009 | BASELINE | 14.62 | 83.43 |
| | 5/22/2009 | BASELINE | 15.80 | 82.25 |
| | 8/17/2009 | BASELINE | 14.01 | 84.04 |
| BTSB-R3-PZ-D | 6/12/2008 | ARUP | 11.85 ¹ | 86.05 |
| | 7/18/2008 | BASELINE | 17.69 ⁴ | 80.21 |
| | 8/29/2008 | BASELINE | 17.42 | 80.48 |
| | 9/25/2008 | BASELINE | 17.65 | 80.25 |
| | 10/24/2008 | BASELINE | 18.27 | 79.63 |
| | 11/25/2008 | BASELINE | 17.95 | 79.95 |
| | 12/22/2008 | BASELINE | 18.98 | 78.92 |
| | 1/30/2009 | BASELINE | 19.24 | 78.66 |
| | 2/25/2009 | BASELINE | 14.83 | 83.07 |
| | 3/25/2009 | BASELINE | 14.11 | 83.79 |
| | 4/24/2009 | BASELINE | 17.03 | 80.87 |
| | 5/22/2009 | BASELINE | 18.31 | 79.59 |
| | 8/17/2009 | BASELINE | 17.81 | 80.09 |
| HA-1-PZ | 6/11/2008 | ARUP | Dry ¹ | -- |
| | 7/18/2008 | BASELINE | Dry | -- |
| | 8/29/2008 | BASELINE | Dry | -- |
| | 9/25/2008 | BASELINE | Dry | -- |
| | 10/24/2008 | BASELINE | Dry | -- |
| | 11/25/2008 | BASELINE | Dry | -- |
| | 12/22/2008 | BASELINE | Dry | -- |
| | 1/30/2009 | BASELINE | Dry | -- |
| | 2/25/2009 | BASELINE | Dry | -- |
| | 3/25/2009 | BASELINE | Dry | -- |
| 4/24/2009 | BASELINE | Dry | -- | |
| 5/22/2009 | BASELINE | Dry | -- | |
| 8/17/2009 | BASELINE | Dry | -- | |

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|-------------|--------------------------|--|---|
| HA-2-PZ | 6/11/2008 | ARUP | Dry ¹ | -- |
| | 7/18/2008 | BASELINE | Dry | -- |
| | 8/29/2008 | BASELINE | Dry | -- |
| | 9/25/2008 | BASELINE | Dry | -- |
| | 10/24/2008 | BASELINE | Dry | -- |
| | 11/25/2008 | BASELINE | Dry | -- |
| | 12/22/2008 | BASELINE | Dry | -- |
| | 1/30/2009 | BASELINE | Dry | -- |
| | 2/25/2009 | BASELINE | Dry | -- |
| | 3/25/2009 | BASELINE | Dry | -- |
| | 4/24/2009 | BASELINE | Dry | -- |
| | 5/22/2009 | BASELINE | Dry | -- |
| | 8/17/2009 | BASELINE | Dry | -- |
| HA-3-PZ | 6/10/2008 | ARUP | Dry ¹ | -- |
| | 7/18/2008 | BASELINE | Dry | -- |
| | 8/29/2008 | BASELINE | Dry | -- |
| | 9/25/2008 | BASELINE | Dry | -- |
| | 10/24/2008 | BASELINE | Dry | -- |
| | 11/25/2008 | BASELINE | Dry | -- |
| | 12/22/2008 | BASELINE | Dry | -- |
| | 1/30/2009 | BASELINE | Dry | -- |
| | 2/25/2009 | BASELINE | Dry | -- |
| | 3/25/2009 | BASELINE | Dry | -- |
| | 4/24/2009 | BASELINE | Dry | -- |
| | 5/22/2009 | BASELINE | Dry | -- |
| | 8/17/2009 | BASELINE | Dry | -- |
| RW6-R1-PZ | 6/9/2008 | ARUP | 19.87 ¹ | 88.64 |
| | 7/18/2008 | BASELINE | 20.53 ^{2,4} | 87.98 |
| | 8/29/2008 | BASELINE | 20.60 ² | 87.91 |
| | 9/25/2008 | BASELINE | Dry | -- |
| | 10/24/2008 | BASELINE | Dry | -- |
| | 11/25/2008 | BASELINE | Dry | -- |
| | 12/22/2008 | BASELINE | 20.38 ² | 88.13 |
| | 1/30/2009 | BASELINE | 20.37 ² | 88.14 |
| | 2/25/2009 | BASELINE | 20.37 ² | 88.14 |
| | 3/25/2009 | BASELINE | 20.36 ² | 88.15 |
| | 4/24/2009 | BASELINE | 20.38 ² | 88.13 |
| | 5/22/2009 | BASELINE | 20.40 ² | 88.11 |
| | 8/17/2009 | BASELINE | Dry | -- |

**TABLE 2: Groundwater Level Manual Measurements: Bluff Piezometers
Doyle Drive Replacement Project**

| Piezometer | Date | Data Collected by | Depth to Water from Top of Rim (feet) | Groundwater Elevation (feet, NAVD88) |
|-------------------|-------------|--------------------------|--|---|
| RW6-R2A-PZ-S | 6/9/2008 | ARUP | Dry ¹ | -- |
| | 7/18/2008 | BASELINE | 28.52 ^{2,4} | 79.80 |
| | 8/29/2008 | BASELINE | 28.55 ² | 79.77 |
| | 9/25/2008 | BASELINE | 28.82 ² | 79.50 |
| | 10/24/2008 | BASELINE | Dry | -- |
| | 11/25/2008 | BASELINE | 28.47 ² | 79.85 |
| | 12/22/2008 | BASELINE | 28.53 ² | 79.79 |
| | 1/30/2009 | BASELINE | 28.47 ^{2,3,4} | 79.85 |
| | 2/25/2009 | BASELINE | 28.48 ^{2,3,4} | 79.84 |
| | 3/25/2009 | BASELINE | 28.50 ^{2,3,4} | 79.82 |
| | 4/24/2009 | BASELINE | Dry ³ | -- |
| | 5/22/2009 | BASELINE | 28.51 ^{2,3,4} | 79.81 |
| | 8/17/2009 | BASELINE | Dry ³ | -- |
| | RW6-R2-PZ-D | 6/9/2008 | ARUP | 41.70 ¹ |
| 7/18/2008 | | BASELINE | 49.74 ⁴ | 58.92 |
| 8/29/2008 | | BASELINE | 52.20 | 56.46 |
| 9/25/2008 | | BASELINE | 52.95 | 55.71 |
| 10/24/2008 | | BASELINE | 53.41 | 55.25 |
| 11/25/2008 | | BASELINE | 53.69 | 54.97 |
| 12/22/2008 | | BASELINE | 53.71 | 54.95 |
| 1/30/2009 | | BASELINE | 53.83 ^{3,4} | 54.83 |
| 2/25/2009 | | BASELINE | 53.61 ^{3,4} | 55.05 |
| 3/25/2009 | | BASELINE | 53.26 ^{3,4} | 55.40 |
| 4/24/2009 | | BASELINE | 53.08 ^{3,4} | 55.58 |
| 5/21/2009 | | BASELINE | 51.96 ^{3,4} | 56.70 |
| 8/17/2009 | | BASELINE | 51.54 ^{3,4} | 57.12 |
| RW8-R1A-PZ | | 6/11/2008 | ARUP | 39.45 ¹ |
| | 7/18/2008 | BASELINE | 39.10 ⁴ | 50.96 |
| | 8/29/2008 | BASELINE | 38.80 | 51.26 |
| | 9/25/2008 | BASELINE | 38.67 | 51.39 |
| | 10/24/2008 | BASELINE | 38.79 | 51.27 |
| | 11/25/2008 | BASELINE | 39.22 | 50.84 |
| | 12/22/2008 | BASELINE | 39.00 | 51.06 |
| | 1/30/2009 | BASELINE | 40.21 | 49.85 |
| | 2/25/2009 | BASELINE | 40.58 | 49.48 |
| | 3/25/2009 | BASELINE | 38.51 | 51.55 |
| | 4/24/2009 | BASELINE | 38.27 | 51.79 |
| | 5/22/2009 | BASELINE | 38.61 | 51.45 |
| | 8/17/2009 | BASELINE | 39.68 | 50.38 |

**TABLE 2: Groundwater Elevations in the Bluff Piezometers
Doyle Drive Replacement Project**

Notes:

"Dry" indicates that groundwater was not encountered above the bottom of the piezometer.

"--" indicates that a groundwater elevation could not be calculated.

¹ Depth to water measured before the piezometer was developed.

² The water level measured may be from water trapped in the end cap of the piezometer and not the actual groundwater level, based on consistent water level measurements near bottom of piezometer. Approximate elevation of bottom of piezometer is shown graphically on the hydrographs (Appendix A) for these piezometers.

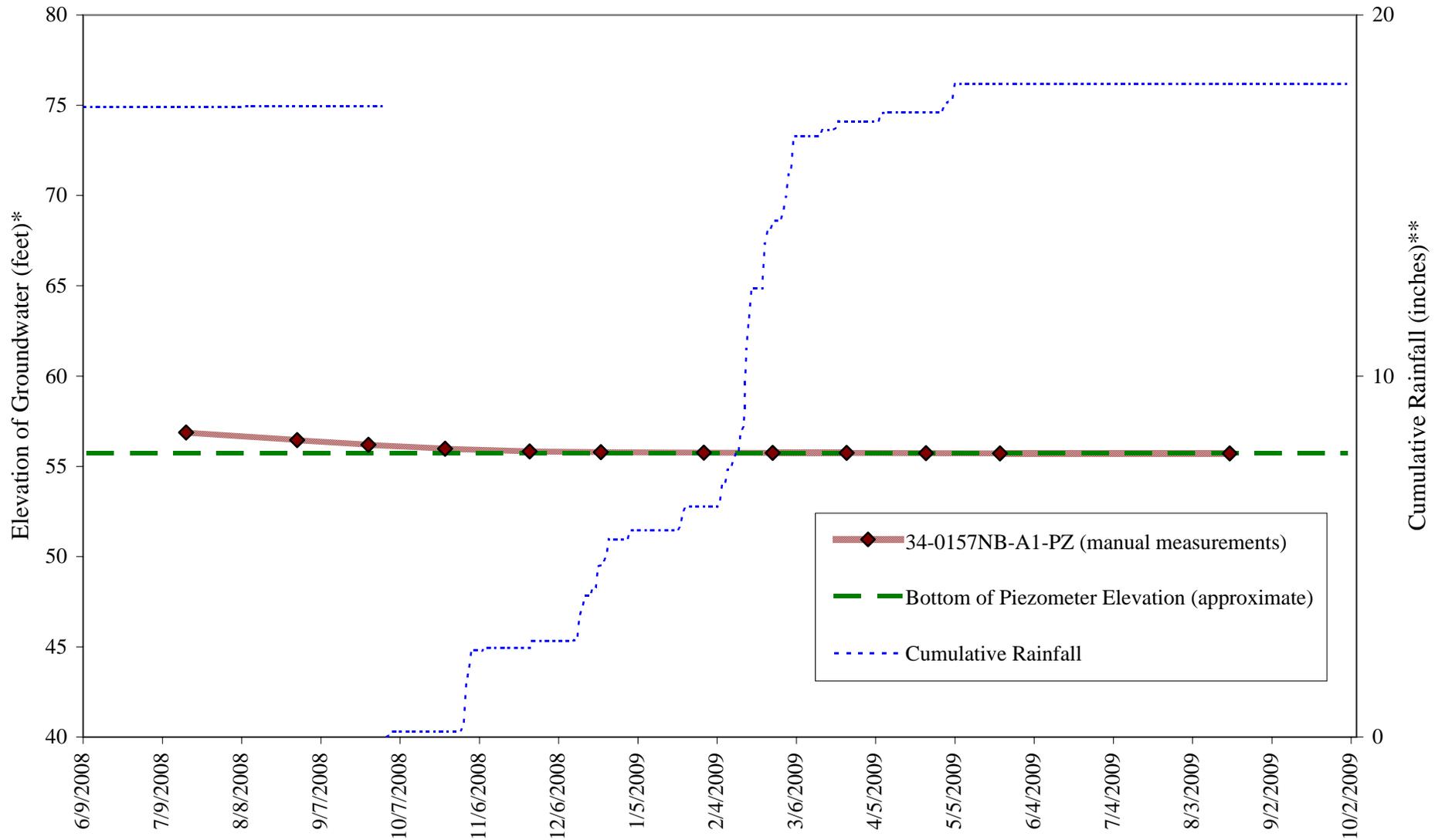
³ Rim elevation may have changed due to construction around well head beginning circa January 2009.

⁴ Depth to water (DTW) measured from the top of casing (TOC) in the field. The DTW water from the top of rim (TOR) was calculated by adding the difference between TOR and TOC measured on 8/29/2008.

APPENDIX A:
GROUNDWATER ELEVATION AND RAINFALL HYDROGRAPHS

Figure A-1

Groundwater Elevations - Wells 34-0157NB-A1-PZ

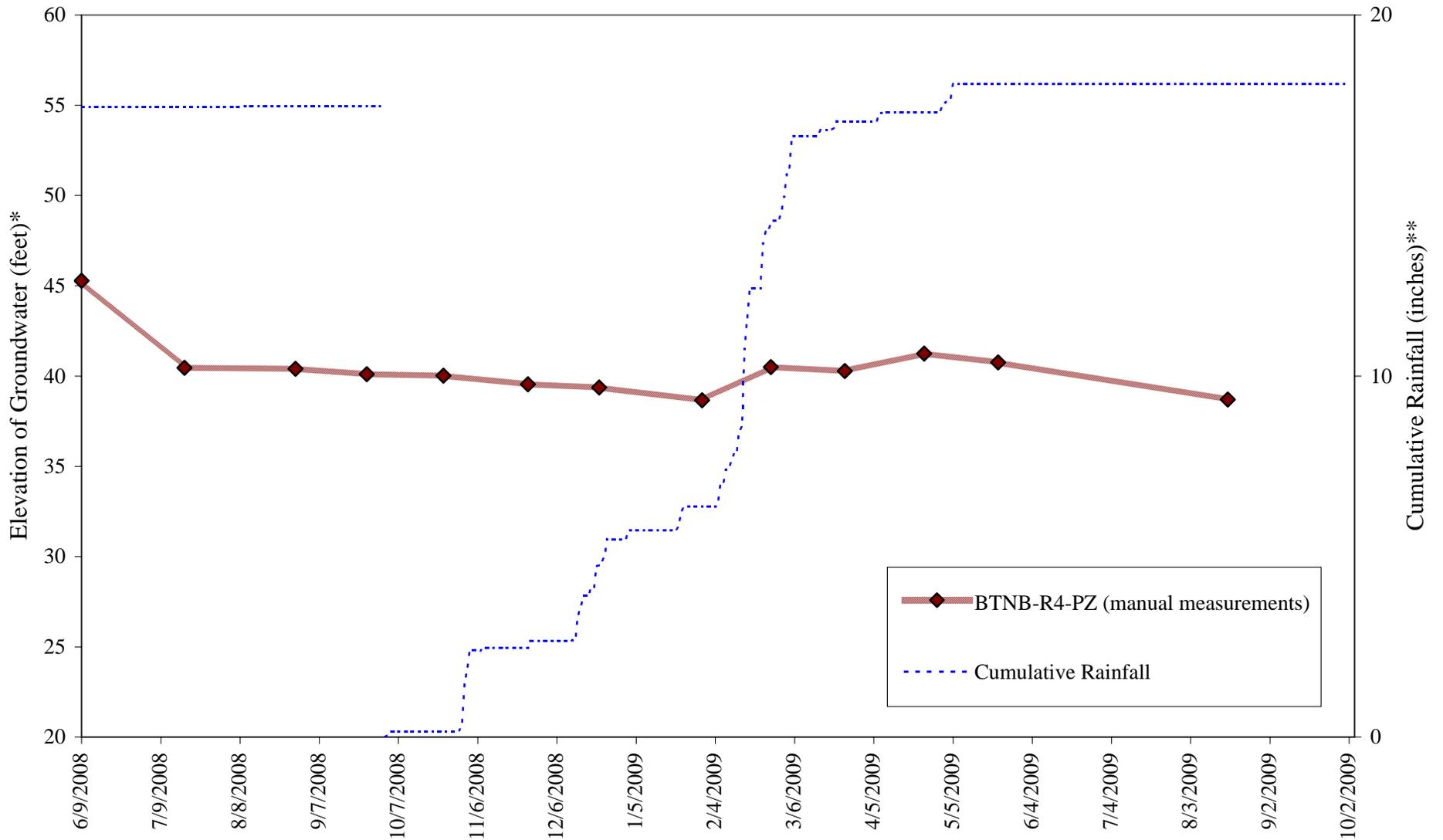


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-2

Groundwater Elevations - Well BTNB-R4-PZ

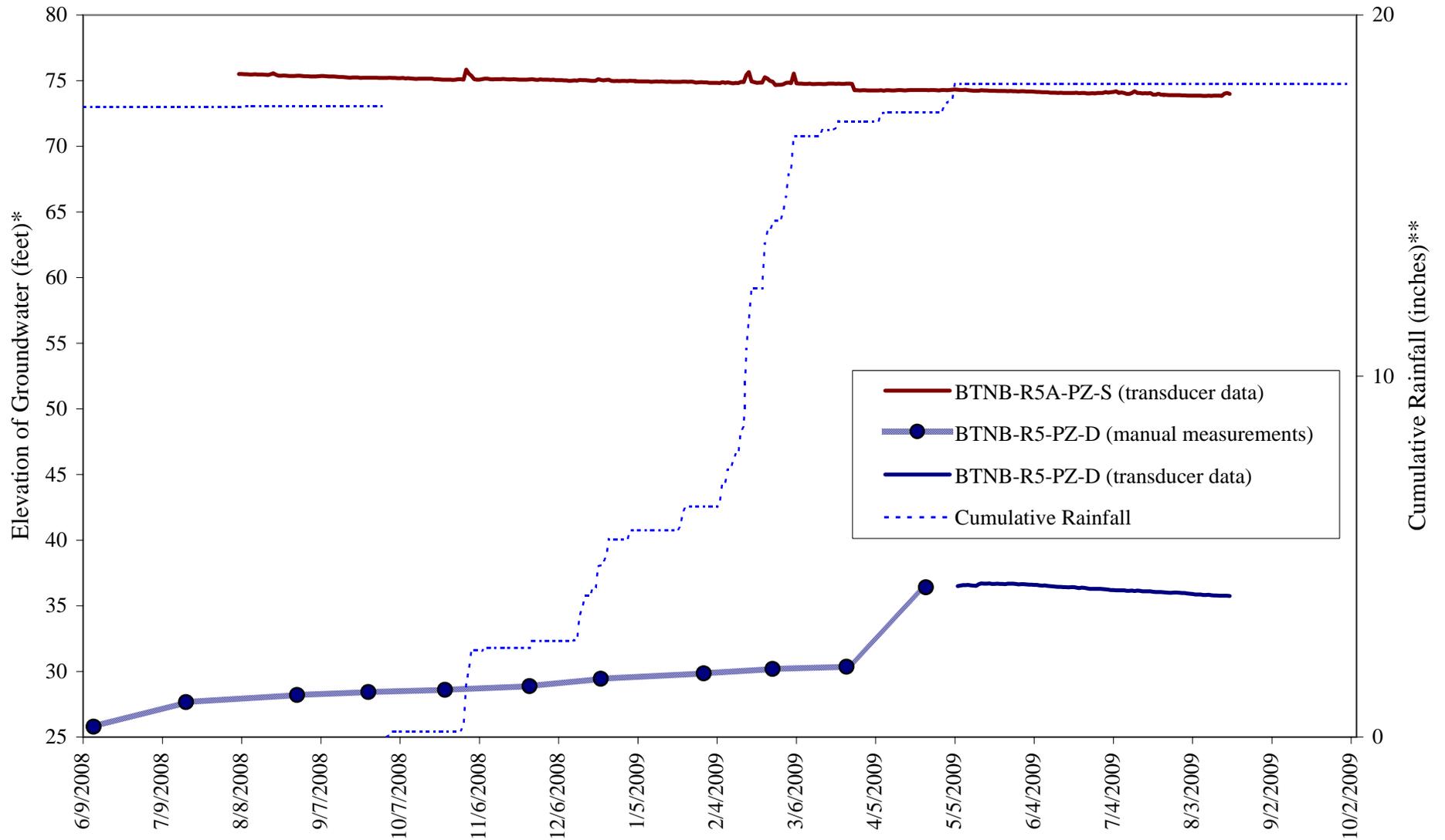


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-3

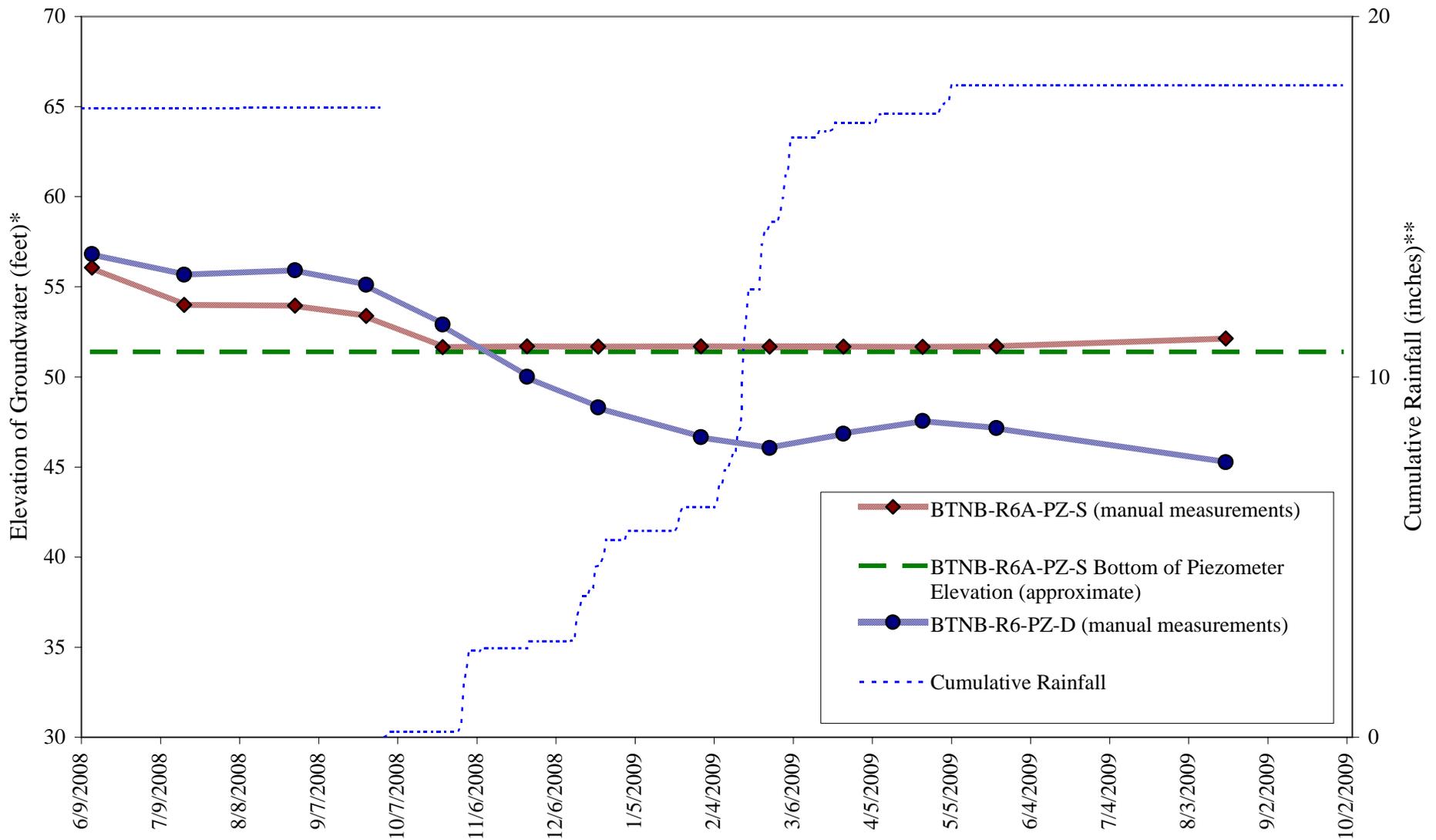
Groundwater Elevations - Wells BTNB-R5A-PZ-S and BTNB-R5-PZ-D



* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-4 Groundwater Elevations - Wells BTNB-R6A-PZ-S and BTNB-R6-PZ-D

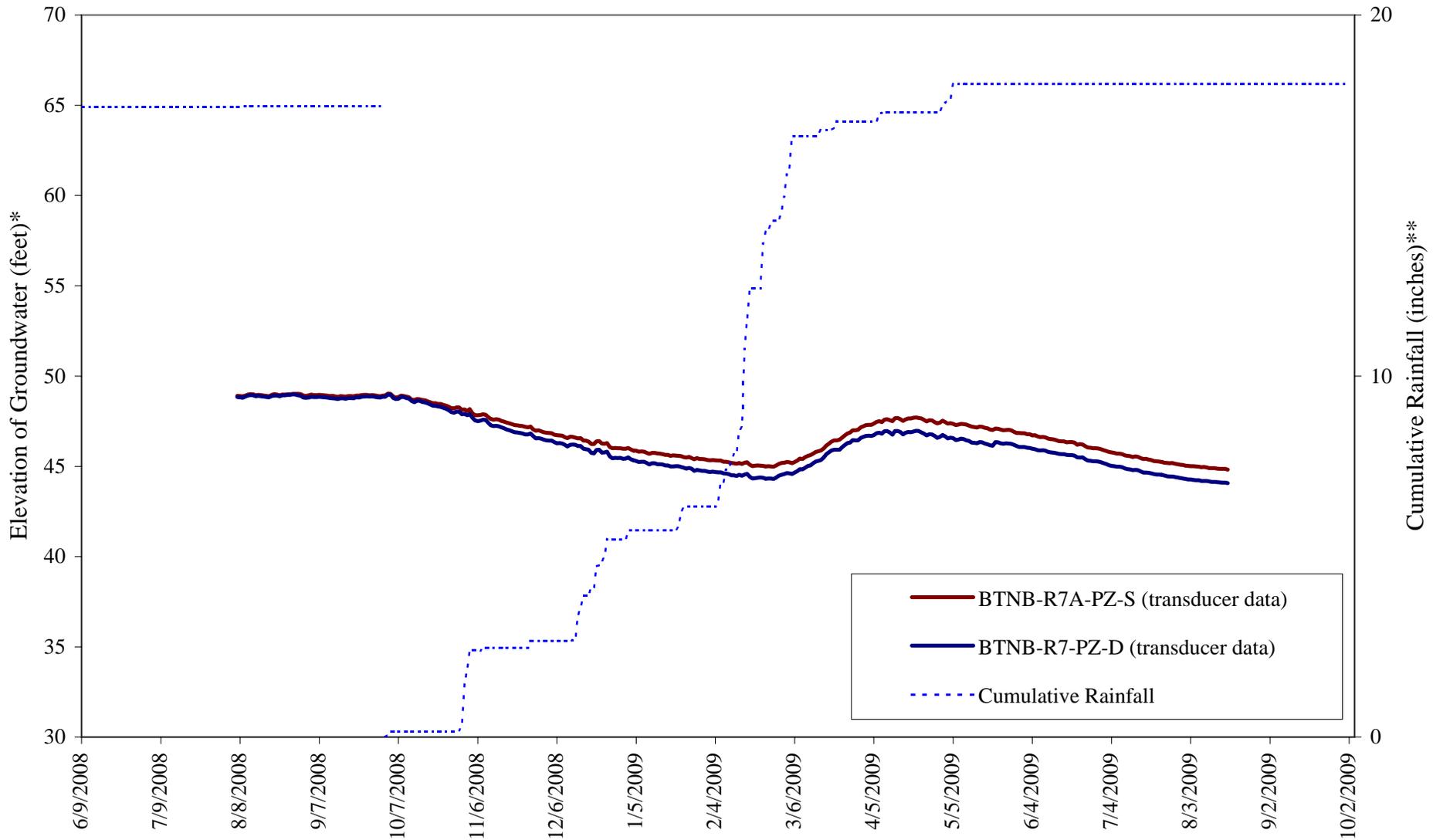


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-5

Groundwater Elevations - Wells BTNB-R7A-PZ-S and BTNB-R7-PZ-D

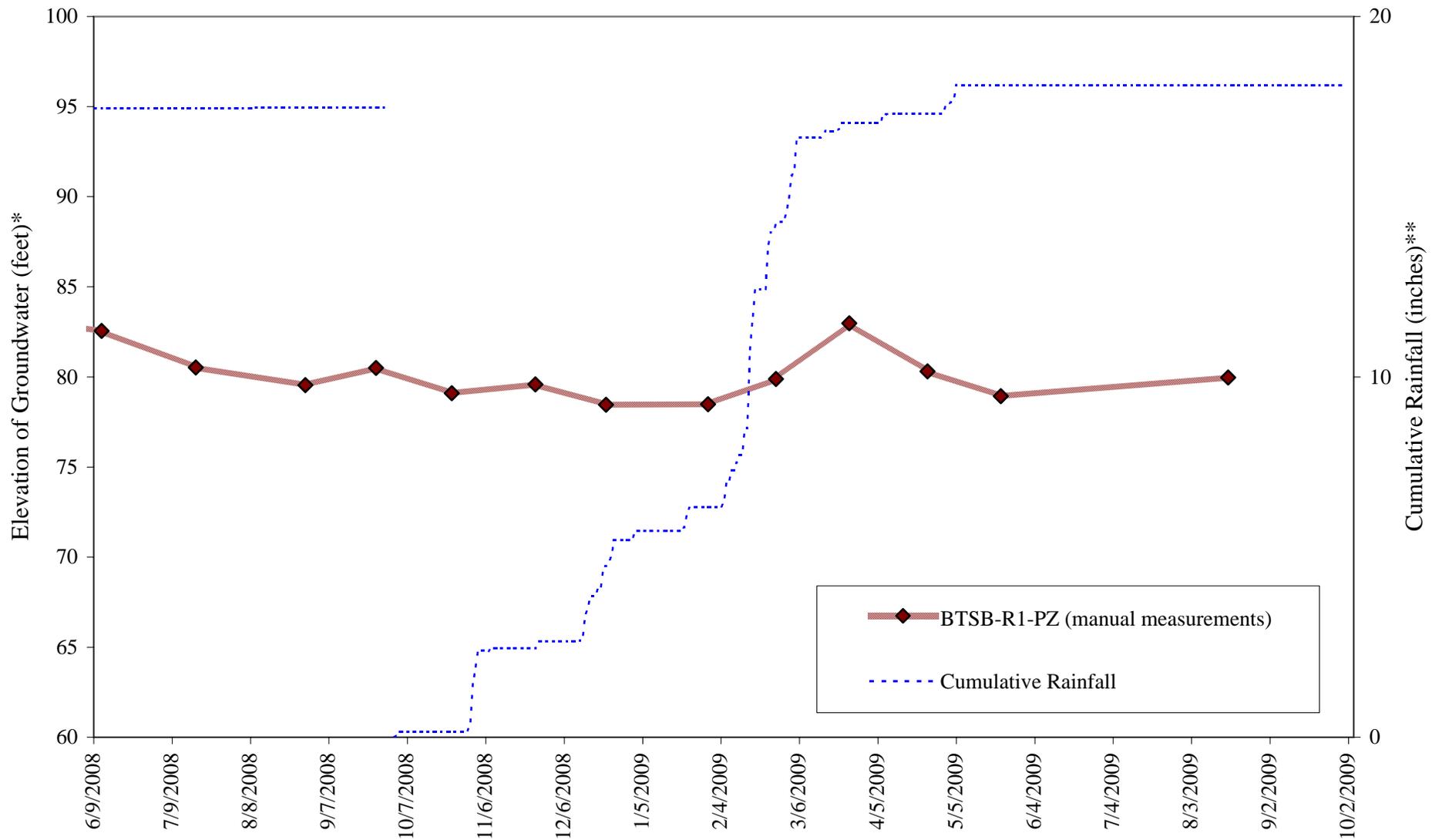


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-6

Groundwater Elevations - Well BTSB-R1-PZ

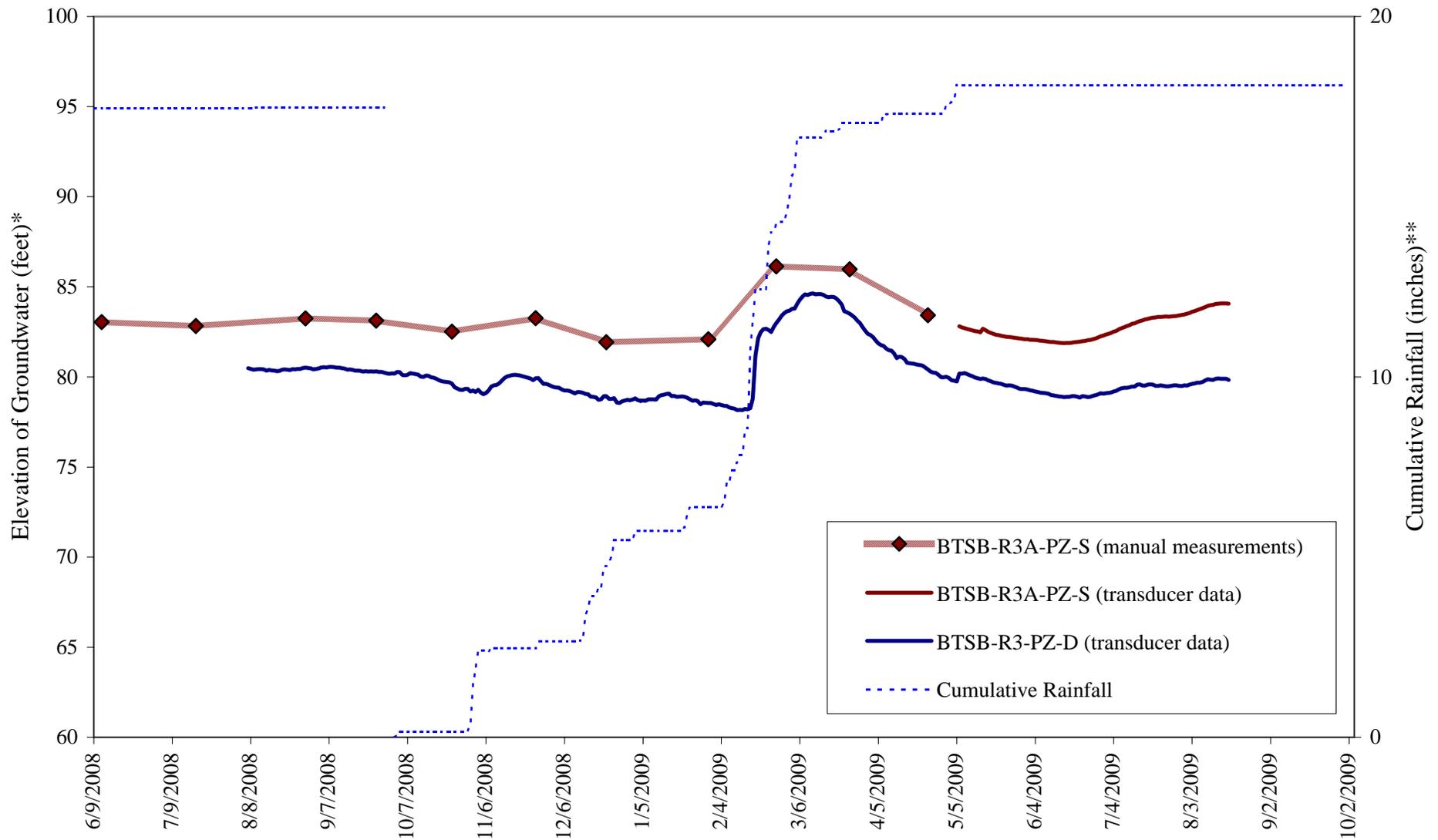


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-7

Groundwater Elevations - Wells BTSB-R3A-PZ-S and BTSB-R3-PZ-D

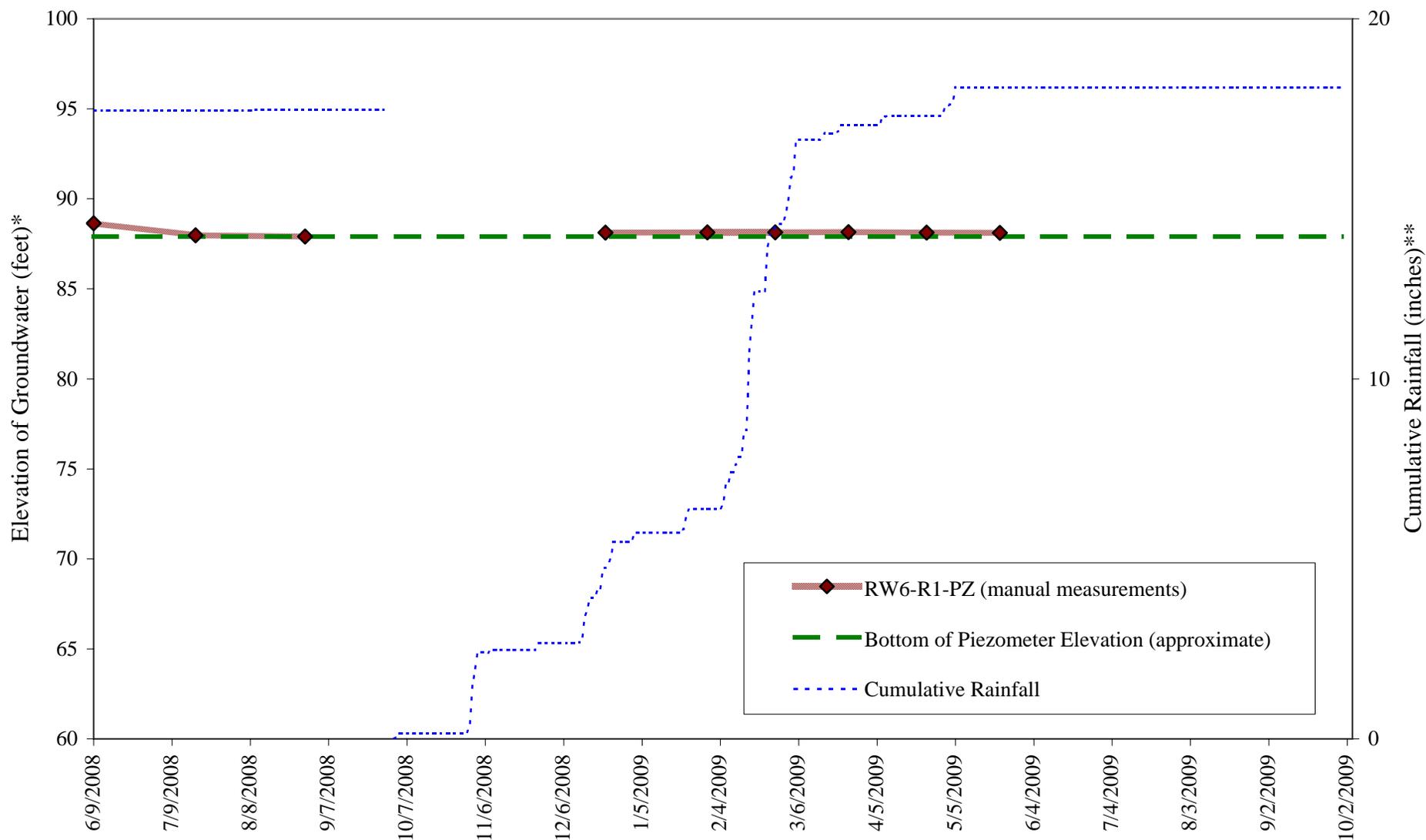


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-8

Groundwater Elevations - Well RW6-R1-PZ

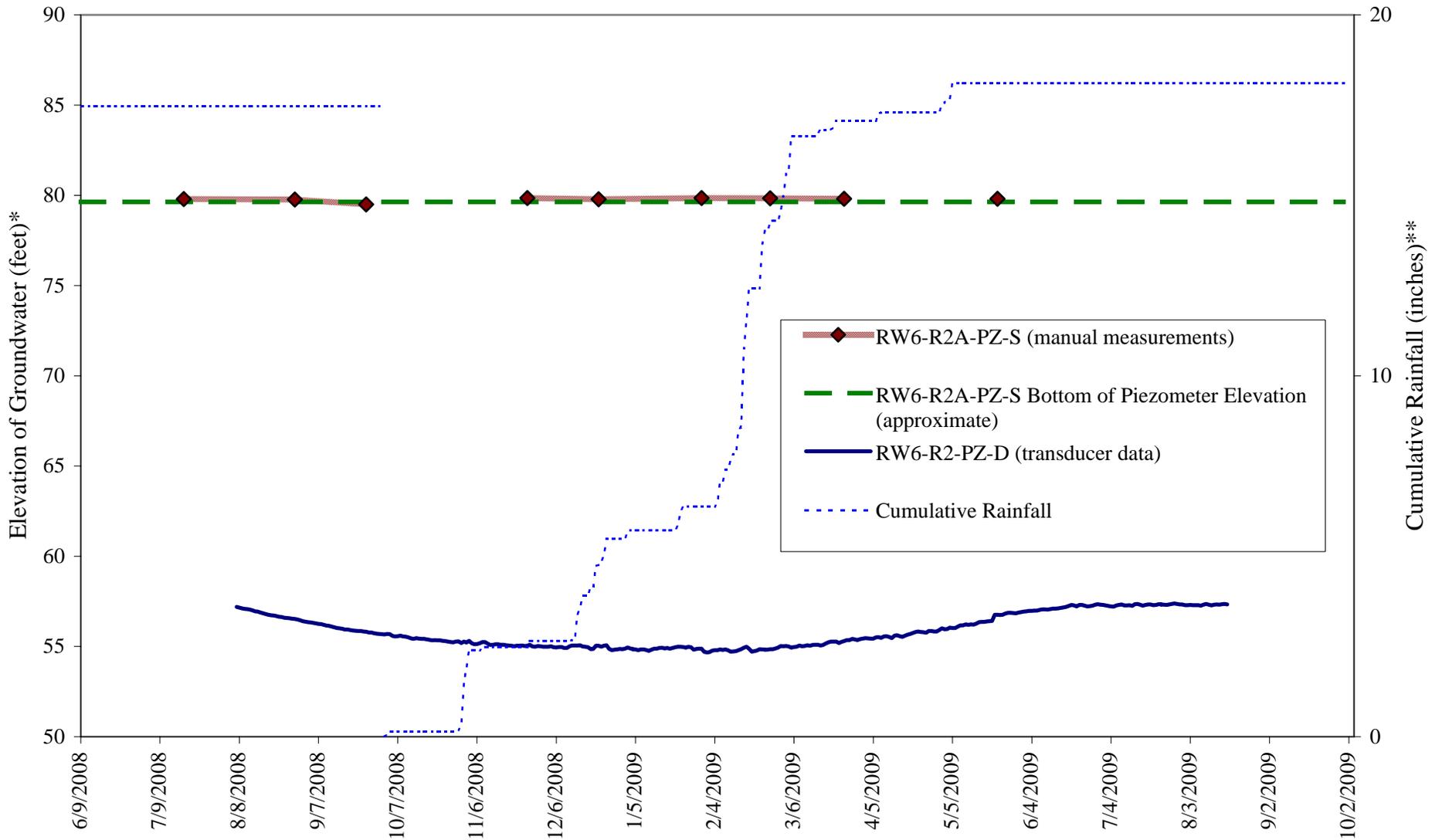


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-9

Groundwater Elevations - Wells RW6-R2A-PZ-S and RW6-R2-PZ-D

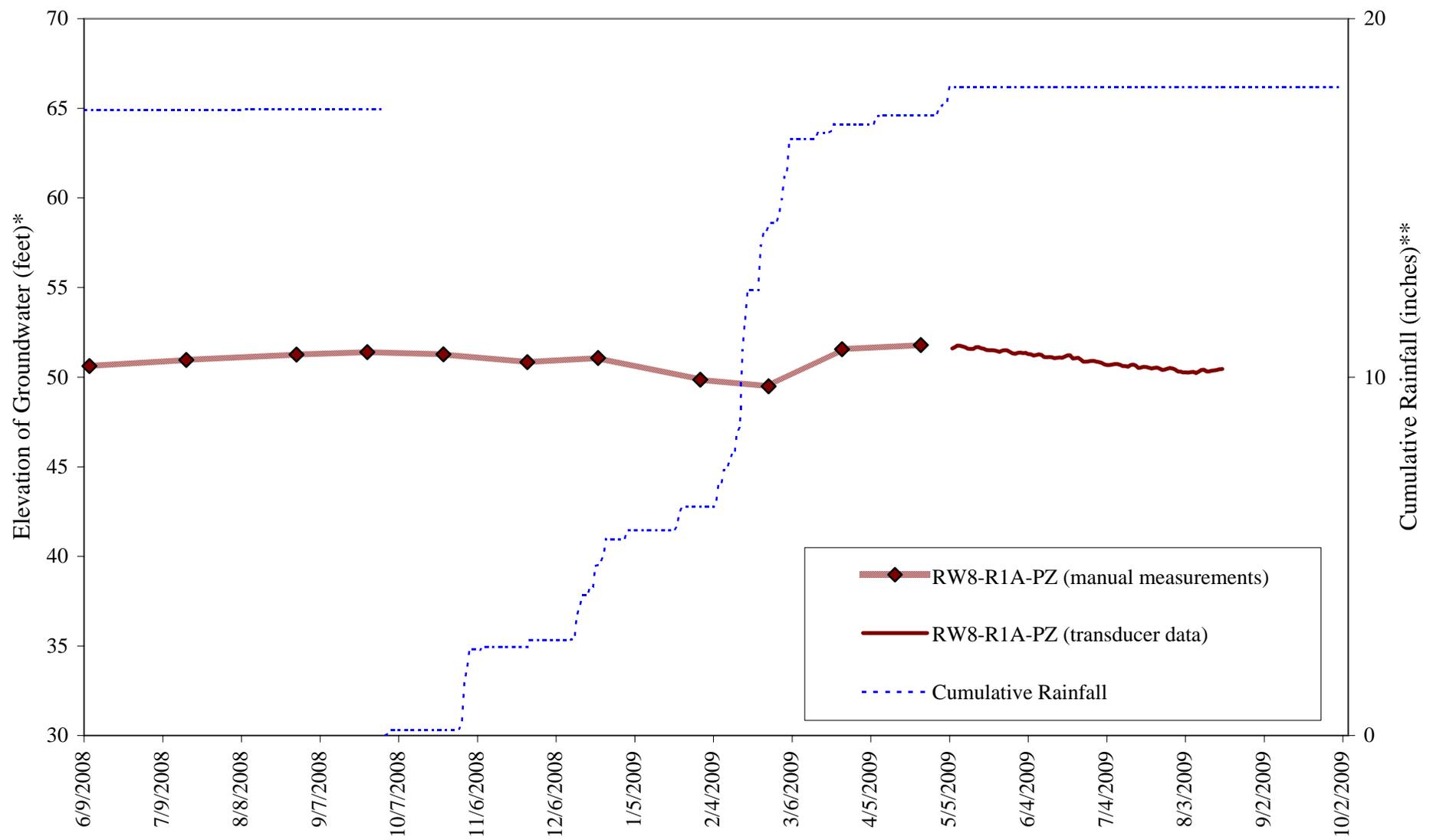


* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

Figure A-10

Groundwater Elevations - Well RW8-R1A-PZ



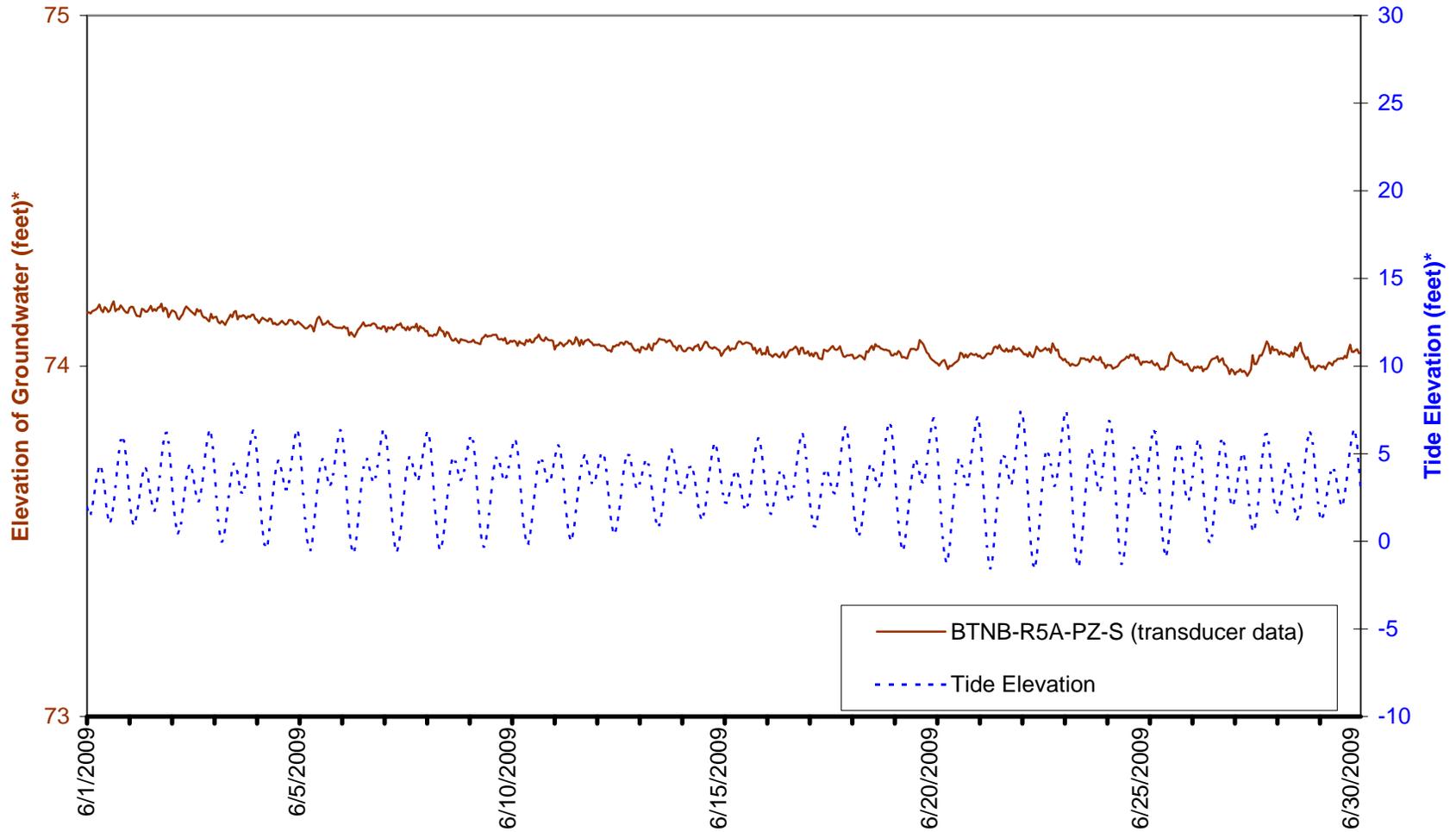
* Datum = NAVD88

** NOAA rain year starts October 1st. Cumulative precipitation data from 10-1-2007 to 12-31-2007 measured at Station CF6FSFO (San Francisco International Airport) and cumulative precipitation data starting 1-1-08 measured at Station 47774 (Downtown San Francisco) accessed at: www.ncdc.noaa.gov.

APPENDIX B:
GROUNDWATER ELEVATION AND TIDE HYDROGRAPHS

Figure B-1

Groundwater Elevations and Tide - Well BTNB-R5A-PZ-S

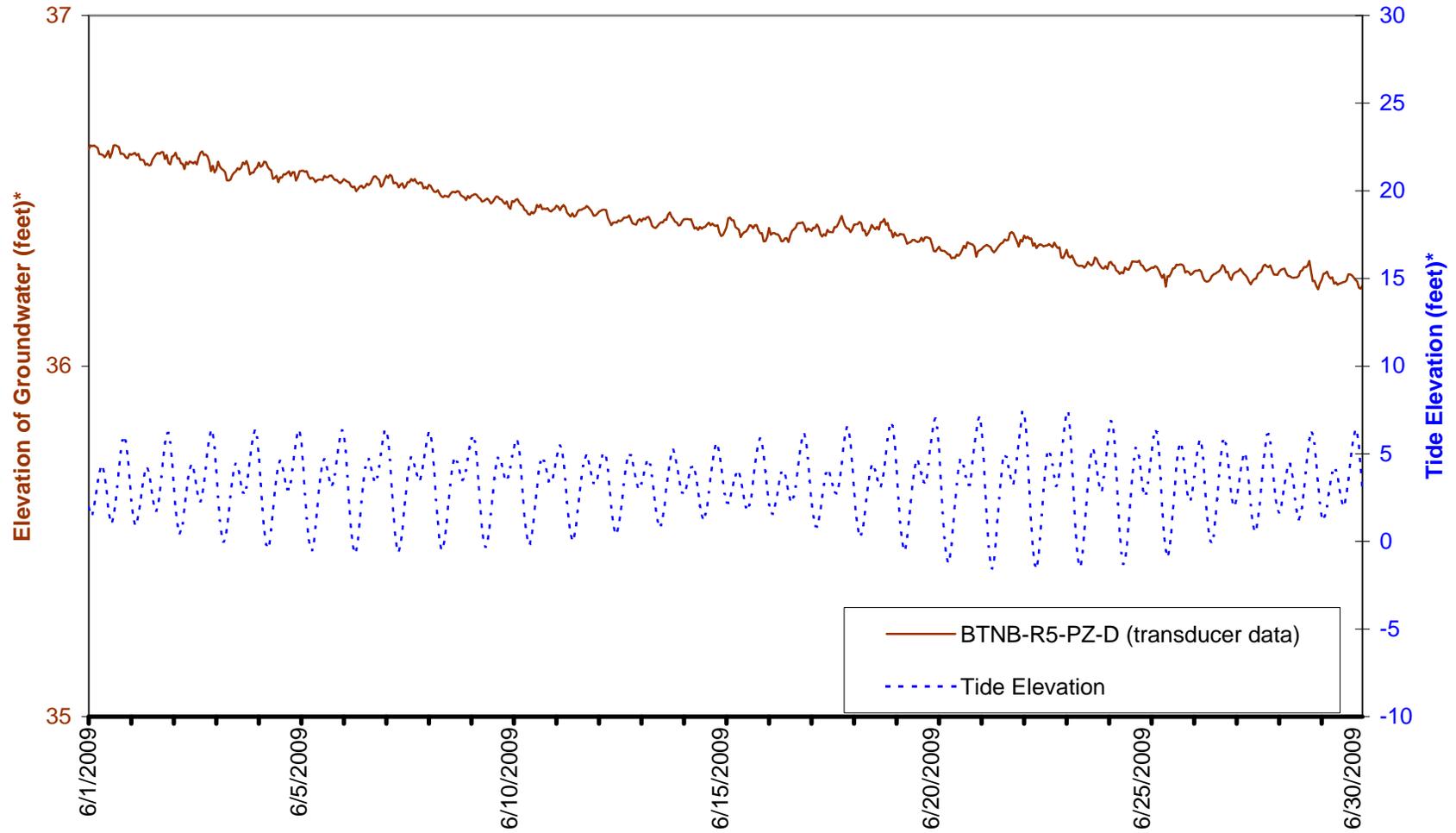


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-2

Groundwater Elevations and Tide - Well BTNB-R5-PZ-D

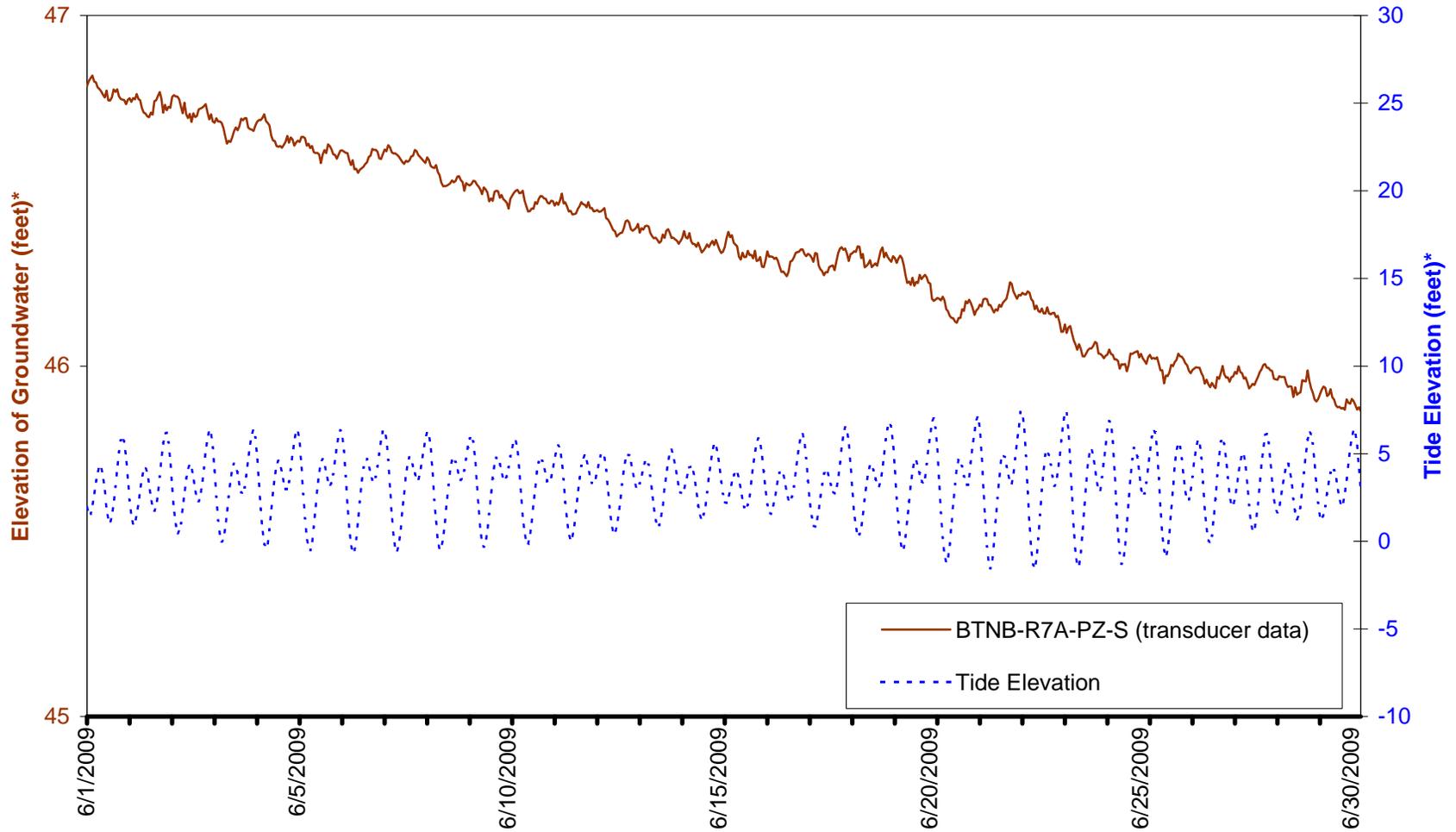


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-3

Groundwater Elevations and Tide - Well BTNB-R7A-PZ-S

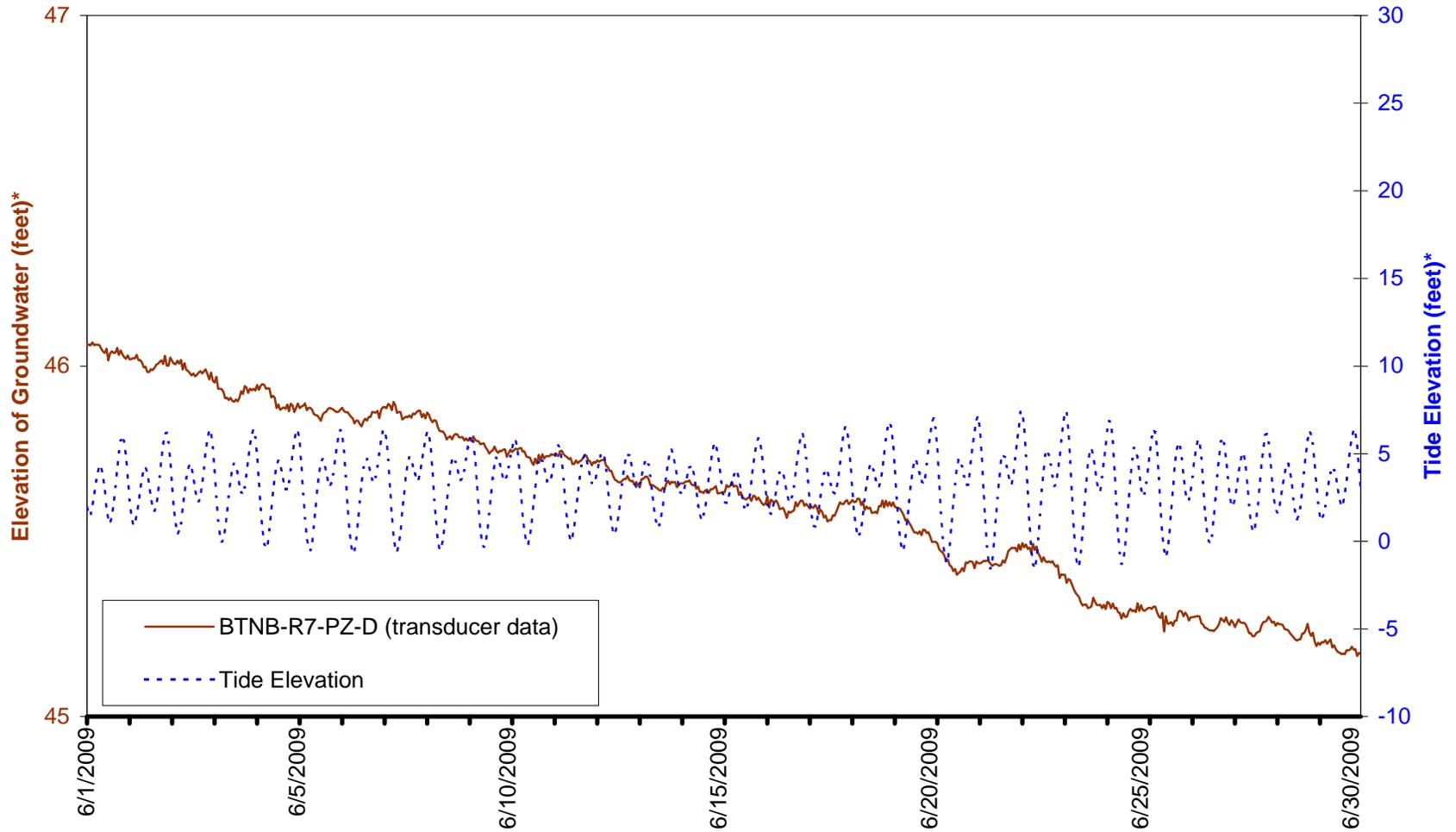


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-4

Groundwater Elevations and Tide - Well BTNB-R7-PZ-D

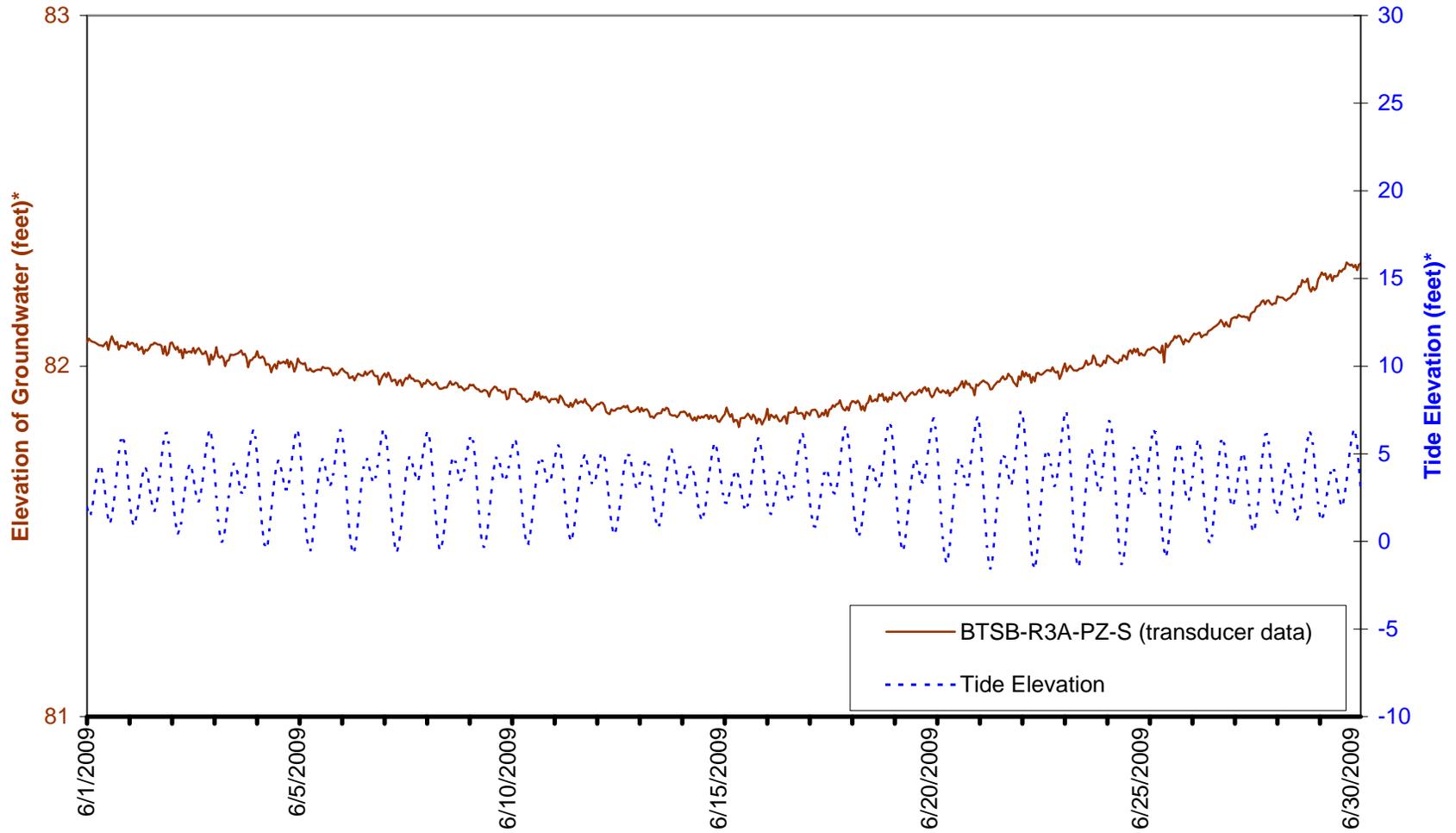


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-5

Groundwater Elevations and Tide - Well BTSB-R3A-PZ-S

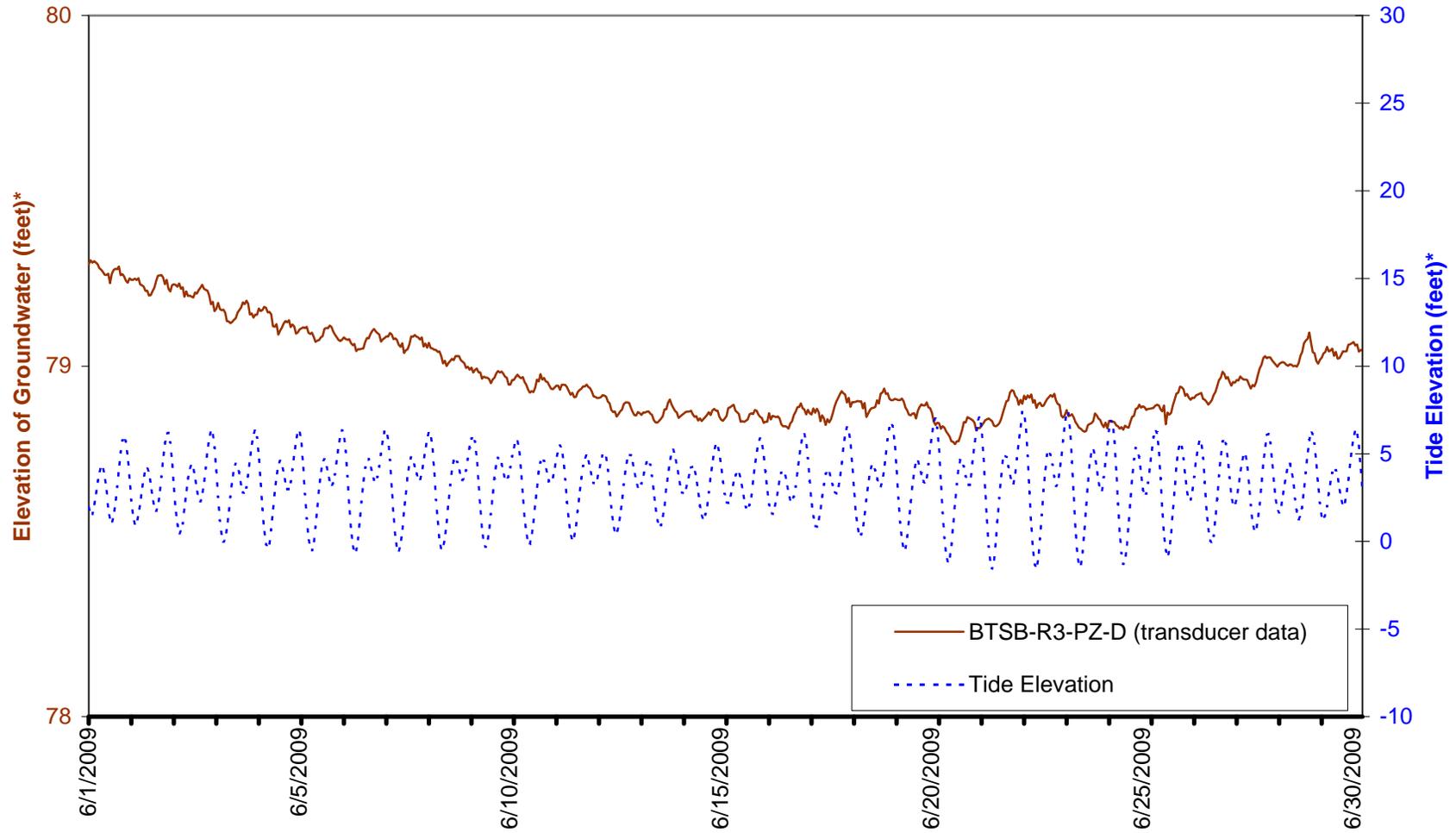


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-6

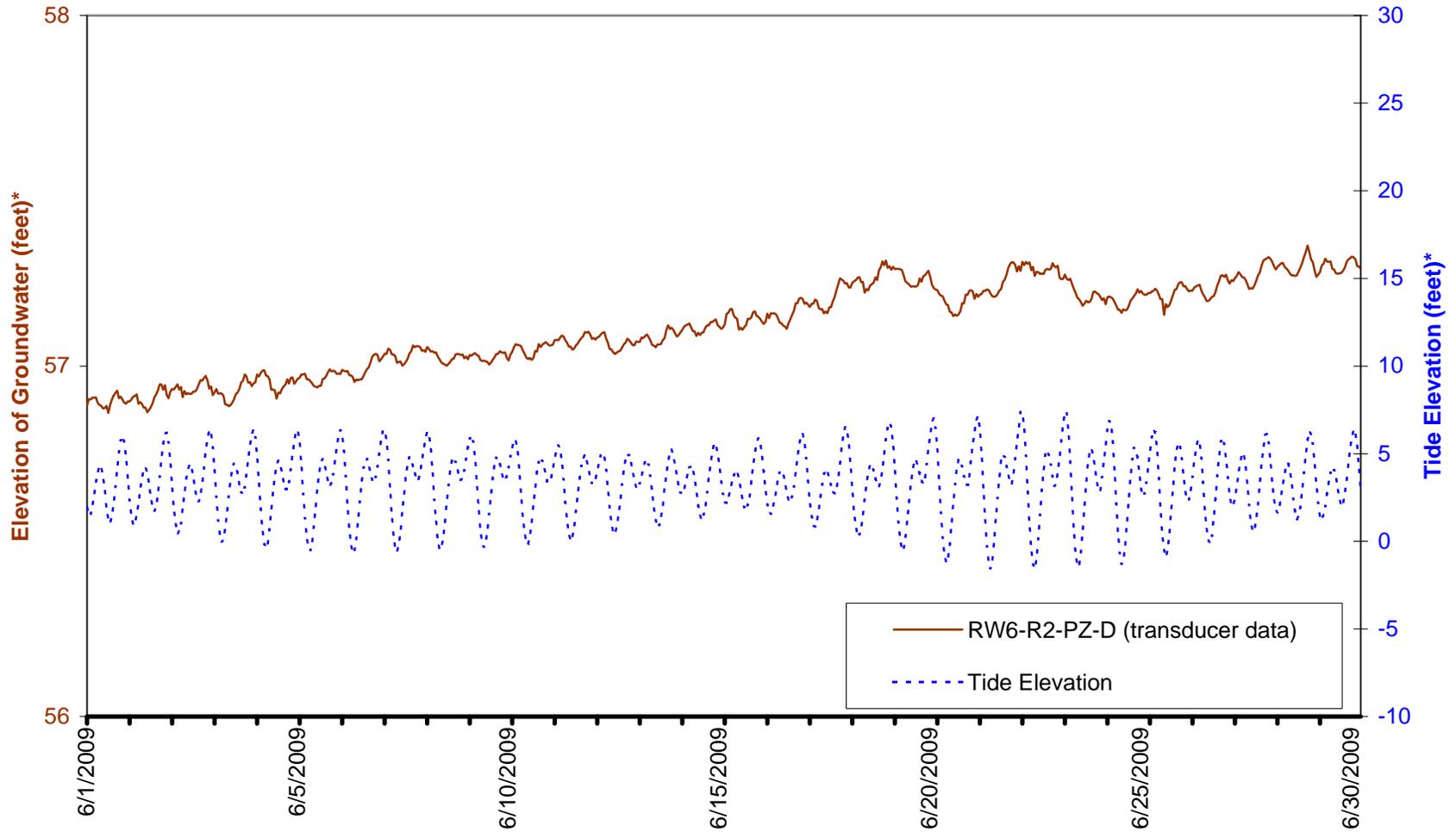
Groundwater Elevations and Tide - Well BTSB-R3-PZ-D



Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.
*Datum: NAVD88

Figure B-7

Groundwater Elevations and Tide - Well RW6-R2-PZ-D

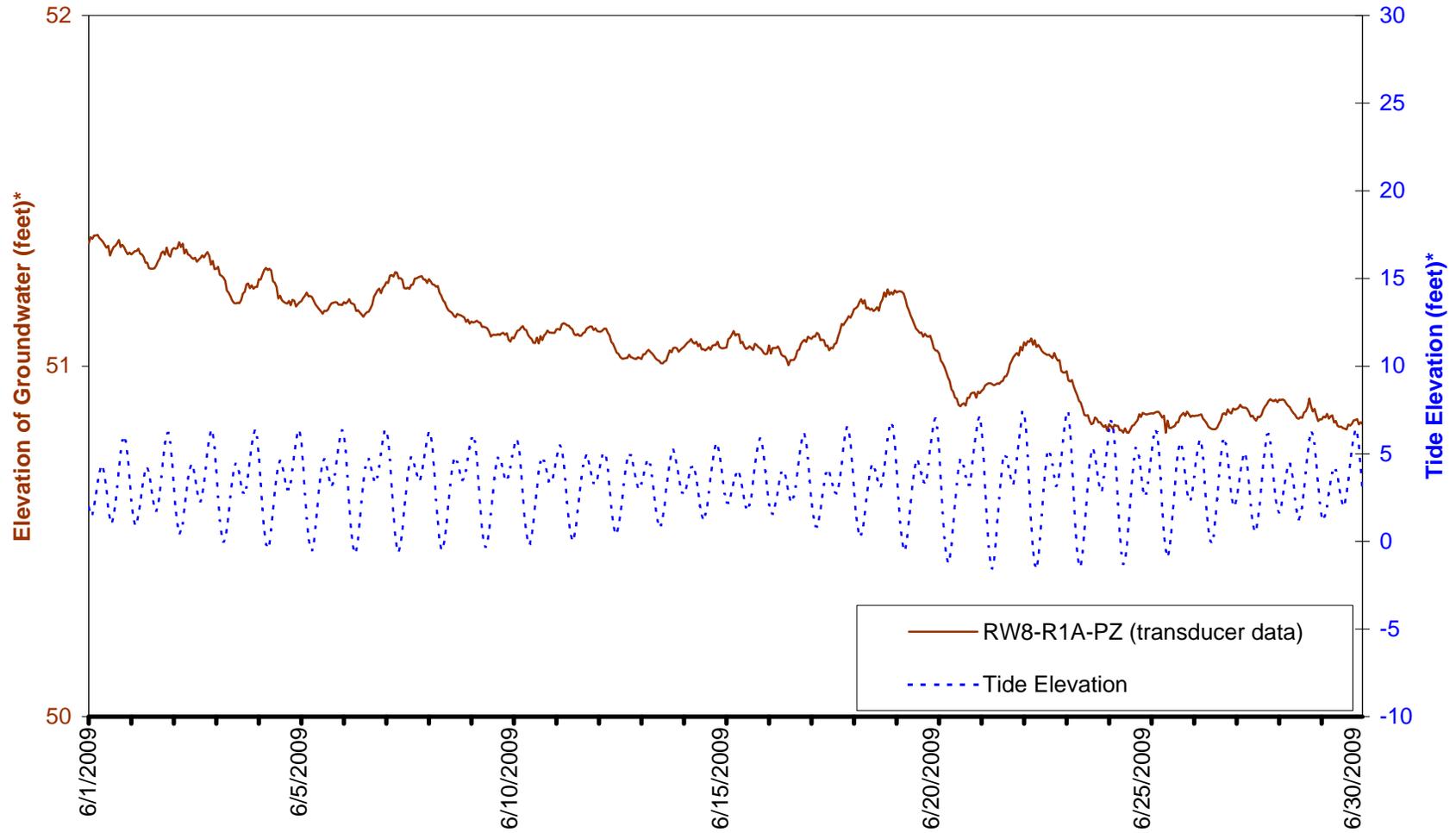


Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

Figure B-8

Groundwater Elevations and Tide - Well RW8-R1A-PZ



Notes: Tide Data from NOAA, Crissy Field Station ID# 9414290, accessed at: tidesandcurrents.noaa.gov.

*Datum: NAVD88

APPENDIX C:
GROUNDWATER LEVEL MONITORING FORMS FOR
TRANSDUCER INSTALLATIONS

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTSB-R3A-PZ-S **Transducer ID:** BTSB-R3A-PZ-S **Date:** 5/6/2009
Screen Interval: 8.0 to 18.0 (ft) **Transducer SN:** 1034718 **Logger:** WKS/TC
Rim Elevation: 98.049 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer SN:11034262

Total Depth From TOC: NA (measured)(ft)
Depth To Groundwater Below TOC 14.85 (ft) **Time:** 9:40 (PDT)
Depth To Groundwater Below Rim: 15.24 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.39 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 15.24 (ft) **Date:** 5/6/2009
Initial Water Level Reading (NAVD88): 82.81 (ft) **Time:** 9:40 (PDT)
Initial Transducer Reading: 5.26498
Initial Barologger Reading: 2.89717
Initial Transducer Reading Barometrically Compensated: 2.36781
Transducer Depth Below TOC: 17.22 (ft)
Download Datalogger File: NO
Reset Datalogger Memory: YES **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: YES **Start Time:** 12:00 (PDT) **Start Date:** 5/6/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTSB-R3-PZ-D **Transducer ID:** BTSB-R3D **Date:** 5/6/2009
Screen Interval: 50.0-70.0 (ft) **Transducer SN:** 1034108 **Logger:** WKS/TC
Rim Elevation: 97.9 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 70.01 (measured)(ft)
Depth To Groundwater Below TOC 17.27 (ft) **Time:** 10:04 (PDT)
Depth To Groundwater Below Rim: 17.73 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.46 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 17.73 (ft) **Date:** 5/6/2009
Initial Water Level Reading (NAVD88): 80.17 (ft) **Time:** 10:04 (PDT)
Initial Transducer Reading: 34.01690
Initial Barologger Reading: 2.89717
Initial Transducer Reading Barometrically Compensated: 31.11973
Transducer Depth Below TOC: 48.39 (ft)
Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 12:00 (PDT) **Start Date:** 5/6/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R5A-PZ-S **Transducer ID:** BTNB-R5I **Date:** 8/7/2008
Screen Interval: 15.0-35.0 (ft) **Transducer SN:** 31034058 **Logger:** WKS
Rim Elevation: 79.37 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 35.12 (measured)
Depth To Groundwater Below TOC 3.59 (ft) **Time:** 8:35 (PST)
Depth To Groundwater Below Rim: 3.87 (ft) **Water Level Meter Used:** Solinst
TOC and Rim Reference Point Description: Black mark on TOC, north side & pink mark on top of rim, north side.
Weather: Heavy fog

Initial Water Level Reading Below (TOC): 3.60 (ft) **Date:** 8/7/2008
Initial Water Level Reading Below (Rim): 3.89 (ft) **Time:** 9:00 (PST)
Initial Water Level Reading (NAVD88): 75.48 (ft)
Initial Transducer Reading: 29.9739
Initial Barologger Reading: 2.70255
Transducer Depth Below TOC: 30.87 (ft)

Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 10:00 (PST) **Start Date:** 8/7/2008

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | * _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | ** _____ |

Comments: * Used two zip-ties to secure transducer suspending cable to piezometer casing.
** Drilled 5/64th- inch diameter hole through well cap to allow venting.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R5-PZ-D **Transducer ID:** BTNB-R5-PZ-D **Date:** 5/6/2009
Screen Interval: 78.0 to 98.0 (ft) **Transducer SN:** 1037351 **Logger:** WKS/TC
Rim Elevation: 79.635 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer SN:11034262

Total Depth From TOC: NA (measured)(ft)
Depth To Groundwater Below TOC 42.91 (ft) **Time:** 10:26 (PDT)
Depth To Groundwater Below Rim: 43.17 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.26 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 43.17 (ft) **Date:** 5/6/2009
Initial Water Level Reading (NAVD88): 36.47 (ft) **Time:** 10:26 (PDT)
Initial Transducer Reading: 55.42770
Initial Barologger Reading: 2.92424
Initial Transducer Reading Barometrically Compensated: 52.50346
Transducer Depth Below TOC: 95.41 (ft)

Download Datalogger File: NO
Reset Datalogger Memory: YES **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: YES **Start Time:** 12:00 (PDT) **Start Date:** 5/6/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R7A-PZ-S **Transducer ID:** BTNB-R7I **Date:** 8/7/2008
Screen Interval: 28.5-43.5 (ft) **Transducer SN:** 31034034 **Logger:** WKS
Rim Elevation: 78.961 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 43.26 (measured)
Depth To Groundwater Below TOC 29.77 (ft) **Time:** 7:38 (PST)
Depth To Groundwater Below Rim: 30.13 (ft) **Water Level Meter Used:** Solinst
TOC and Rim Reference Point Description: Black mark on TOC, north side & pink mark on top of rim, north side.
Weather: Heavy fog

Initial Water Level Reading Below (TOC): 29.76 (ft) **Date:** 8/7/2008
Initial Water Level Reading Below (Rim): 30.12 (ft) **Time:** 8:11 (PST)
Initial Water Level Reading (NAVD88): 48.84 (ft)
Initial Transducer Reading: 14.1058
Initial Barologger Reading: 2.69776
Transducer Depth Below TOC: 41.17 (ft)

Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 9:00 (PST) **Start Date:** 8/7/2008

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | * _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | ** _____ |

Comments: * Used two zip-ties to secure transducer suspending cable to piezometer casing.
** Drilled 5/64th- inch diameter hole through well cap to allow venting.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R7A-PZ-S **Transducer ID:** BTNB-R7I **Date:** 5/21/2009
Screen Interval: 28.5-43.5 (ft) **Transducer SN:** 1034034 **Logger:** WKS
Rim Elevation: 78.961 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 43.26 (measured)(ft)
Depth To Groundwater Below TOC 31.60 (ft) **Time:** 11:20 (PDT)
Depth To Groundwater Below Rim: 31.96 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.36 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 31.96 (ft) **Date:** 5/21/2009
Initial Water Level Reading (NAVD88): 47.00 (ft) **Time:** 11:20 (PDT)
Initial Transducer Reading: 11.99260
Initial Barologger Reading: 2.69776
Initial Transducer Reading Barometrically Compensated: 9.29484
Transducer Depth Below TOC: 40.89 (ft)
Download Datalogger File: YES
Reset Datalogger Memory: YES **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: YES **Start Time:** 15:00 (PDT) **Start Date:** 5/21/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R7-PZ-D **Transducer ID:** BTNB-R7D **Date:** 8/7/2008
Screen Interval: 50.0-70.0 (ft) **Transducer SN:** 41034088 **Logger:** WKS
Rim Elevation: 79.353 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer SN:11034262

Total Depth From TOC: 70.15 (measured), soft bottom
Depth To Groundwater Below TOC 29.98 (ft) **Time:** 6:27 (PST)
Depth To Groundwater Below Rim: 30.57 (ft) **Water Level Meter Used:** Solinst

TOC and Rim Reference Point Description: Black mark on TOC, north side & pink mark on top of rim, north side.
Weather: Heavy fog

Initial Water Level Reading Below (TOC): 29.95 (ft) **Date:** 8/7/2008
Initial Water Level Reading Below (Rim): 30.54 (ft) **Time:** 7:10 (PST)
Initial Water Level Reading (NAVD88): 48.81 (ft)
Initial Transducer Reading: 39.8406
Initial Barologger Reading: 2.69312
Transducer Depth Below TOC: 67.10 (ft)

Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 8:00 (PST) **Start Date:** 8/7/2008

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | * _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | ** _____ |

Comments: * Used two zip-ties to secure transducer suspending cable to piezometer casing.
** Drilled 5/64th- inch diameter hole through well cap to allow venting.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: BTNB-R7-PZ-D **Transducer ID:** BTNB-R7D **Date:** 5/21/2009
Screen Interval: 50.0-70.0 (ft) **Transducer SN:** 1034088 **Logger:** WKS
Rim Elevation: 79.353 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 43.26 (measured)(ft)
Depth To Groundwater Below TOC 32.46 (ft) **Time:** 11:00 (PDT)
Depth To Groundwater Below Rim: 33.04 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.58 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 33.04 (ft) **Date:** 5/21/2009
Initial Water Level Reading (NAVD88): 46.31 (ft) **Time:** 11:00 (PDT)
Initial Transducer Reading: 19.61970
Initial Barologger Reading: 2.68407
Initial Transducer Reading Barometrically Compensated: 16.93563
Transducer Depth Below TOC: 49.40 (ft)
Download Datalogger File: YES
Reset Datalogger Memory: YES **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: YES **Start Time:** 11:00 (PDT) **Start Date:** 5/21/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: RW6-R2-PZ-D **Transducer ID:** RW6-R2D **Date:** 8/7/2008
Screen Interval: 76.0-98.0 (ft) **Transducer SN:** 41034086 **Logger:** WKS
Rim Elevation: 108.659 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 96.38 (measured)
Depth To Groundwater Below TOC 50.75 (ft) and dropping **Time:** 10:45 (PST)
Depth To Groundwater Below Rim: 51.15 (ft) **Water Level Meter Used:** Solinst
TOC and Rim Reference Point Description: Black mark on TOC, north side & pink mark on top of rim, north side.
Weather: Heavy fog

Initial Water Level Reading Below (TOC): 51.00 (ft) **Date:** 8/7/2008
Initial Water Level Reading Below (Rim): 51.40 (ft) **Time:** 11:03 (PST)
Initial Water Level Reading (NAVD88): 57.26 (ft)
Initial Transducer Reading: 45.82030
Initial Barologger Reading: 2.67017
Transducer Depth Below TOC: 94.15 (ft)

Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 13:00 (PST) **Start Date:** 8/7/2008

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | * _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | ** _____ |

Comments: * Used two zip-ties to secure transducer suspending cable to piezometer casing.
** Drilled 5/64th- inch diameter hole through well cap to allow venting.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: RW6-R2-PZ-D **Transducer ID:** RW6-R2D **Date:** 5/21/2009
Screen Interval: 76.0-98.0 (ft) **Transducer SN:** 1034086 **Logger:** WKS
Rim Elevation: 108.659 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer **SN:** 11034262

Total Depth From TOC: 97.50 (measured)(ft)
Depth To Groundwater Below TOC 51.61 (ft) **Time:** 13:00 (PDT)
Depth To Groundwater Below Rim: 51.94 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.33 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 51.94 (ft) **Date:** 5/21/2009
Initial Water Level Reading (NAVD88): 56.72 (ft) **Time:** 13:00 (PDT)
Initial Transducer Reading: 45.79300
Initial Barologger Reading: 2.66786
Initial Transducer Reading Barometrically Compensated: 43.12514
Transducer Depth Below TOC: 94.74 (ft)
Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 13:00 (PDT) **Start Date:** 5/21/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MOINITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: RW8-R1A-PZ **Transducer ID:** RW8-R1A-PZ **Date:** 5/6/2009
Screen Interval: 25.0 to 45.0 (ft) **Transducer SN:** 1037331 **Logger:** WKS/TC
Rim Elevation: 90.616 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer SN:11034262

Total Depth From TOC: NA (measured)(ft)
Depth To Groundwater Below TOC 38.11 (ft) **Time:** 9:15 (PDT)
Depth To Groundwater Below Rim: 38.46 (ft) **Water Level Meter Used:** Solinst
Distance From TOC to Rim: 0.35 (ft)
TOC and Rim Reference Point Description: Top of well casing and top of Christy box rim

Initial Water Level Reading Below (Rim): 38.46 (ft) **Date:** 5/6/2009
Initial Water Level Reading (NAVD88): 52.16 (ft) **Time:** 9:15 (PDT)
Initial Transducer Reading: 8.52781
Initial Barologger Reading: 2.89649
Initial Transducer Reading Barometrically Compensated: 5.63132
Transducer Depth Below TOC: 43.74 (ft)
Download Datalogger File: NO
Reset Datalogger Memory: YES **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: YES **Start Time:** 12:00 (PDT) **Start Date:** 5/6/2009

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | _____ |
| Well Head Protection: | YES | NO | NO | _____ |
| Well Cap: | YES | NO | NO | _____ |

Comments: Transducer suspended using direct read cable.

DOYLE DRIVE PIEZOMETER GROUNDWATER LEVEL MONITORING, SAN FRANCISCO, CA

PIEZOMETER AND TRANSDUCER DATALOGGER INFORMATION

Piezometer ID: RW6-R2-PZ-D **Transducer ID:** Barologger **Date:** 8/7/2008
Screen Interval: NA (ft) **Transducer SN:** NA **Logger:** WKS
TOC Elevation: 108.659 NAVD88 (ft) **Barologger ID:** Doyle Dr. Bluff Piezometer SN:11034262

Total Depth From TOC: NA (measured)
Depth To Groundwater Below TOC: NA (ft) **Time:** NA (PST)
Depth To Groundwater Below Rim: NA (ft) **Water Level Meter Used:** Solinst
TOC Reference Point Description: Black mark on TOC, north side & pink mark on top of rim, north side.
Weather: Heavy fog

Initial Water Level Reading: NA (ft) **Date:** 8/7/2008
Initial Transducer Reading: NA **Time:** _____ (PST)
Initial Barologger Reading: NA
Transducer Depth Below TOC: Approx. 3 (ft)

Download Datalogger File: **YES**
Reset Datalogger Memory: **YES** **Time Interval Set To Record Every:** 60 minutes
Changed Data Logging Frequency: **YES** **Start Time:** 13:00 (PST) **Start Date:** 8/7/2008

CONDITION OF PIEZOMETER & TRANSDUCER

| | <u>Good or Unchanged</u> | <u>Needs Attention</u> | <u>Photo Taken</u> | <u>Comments</u> |
|-------------------------------------|------------------------------|----------------------------|------------------------|-----------------|
| Transducer: | YES | NO | NO | _____ |
| Transducer Suspending Cable: | YES | NO | NO | * _____ |
| Well Head Protection: | YES | NO | NO | ** _____ |
| Well Cap: | YES | NO | NO | *** _____ |

Comments: * Used two zip-ties to secure transducer suspending cable to piezometer casing.
 ** Drilled 1/8th-inch diameter hole through christy box lid to allow for venting.
 *** Drilled 1/8th-inch diameter hole through well cap to allow venting.

**APPENDIX D:
MANUAL AND TRANSDUCER DATA (ON CDROM)**