State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
Division of Planning and Local Assistance
Central District

Reclamation District 544
Seepage Monitoring Study
2001-2002

Memorandum Report

November 2002

*Please take note: This report has been altered from its original file type to a Portable Document Format.

State of California

The Resources Agency

Memorandum

Date : NOV 13 2002

To : Mike Ford, Chief
South Delta Branch, Bay-Delta Office

11/12/02
Karl P. Winkler, Chief
Central District

From : **Department of Water Resources**

Subject: Reclamation District 544 Seepage Monitoring Study

Central District is pleased to present the attached report, *Reclamation District 544 Seepage Monitoring Study, 2001*-2002. This report presents seepage monitoring results for Upper Roberts Island from April 20, 2001 to May 1, 2002.

Surface and groundwater level monitoring was initiated in April 2000 to evaluate the effects of the operation of the temporary fish barrier at the head of Old River on shallow groundwater levels on Upper Roberts Island. This work was completed at the request of the Temporary Barriers Project and Lower San Joaquin Section of the Bay-Delta Office with the cooperation of Reclamation District 544 and several landowners.

Data was collected from seven groundwater monitoring stations, two tide gages along the San Joaquin River and a tide gage along Old River at Upper Roberts Island. During the study period, river stage and groundwater levels did not rise above the Island's land surface and seepage was not observed.

If you have any questions regarding this report, please contact Mark Souverville at (916) 227-7601 or Bob Niblack at (916) 227-7590.

Attachment

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DWR 155 (Rev. 2/86)

Reclamation District 544 Seepage Monitoring Study

2001-2002

This annual summary report presents seepage monitoring results for Upper Roberts Island from April 20, 2001 to May 1, 2002. Surface and groundwater level monitoring was initiated in April 2000 to evaluate the effects of the operation of the temporary fish barrier at the head of Old River on shallow groundwater levels on Upper Roberts Island. The initial report on this study, "Reclamation District 544 Seepage Monitoring Study 2000-2001," contains more detail. This work was completed at the request of the Temporary Barriers Project and Lower San Joaquin Section of the Bay-Delta Office with the cooperation of Reclamation District 544 and several landowners.

Introduction

Upper Roberts Island is an agricultural area in the south Delta bounded on the west by Middle River, on the south by Old River and on the east by the San Joaquin River. The north end of the head of Old River barrier (the barrier) rests on the Island's Old River levee just downstream of the San Joaquin River. It is reconstructed in the spring and fall of each year, except during high flows. The barrier is operated to benefit fisheries by preventing migrating salmon from swimming into Old River towards the Central Valley and State Water Project pumps.

The fish barrier at the head of Old River is bounded on both ends by private land, and Temporary Entry Permits are required to install the barrier. Streamflow and stream stage on the east and west sides of Upper Roberts Island are affected by the barrier. During periods of barrier operation, flow and water levels in Old River are reduced, while flow and water levels in the San Joaquin River are increased. Landowners on Upper Roberts Island have been concerned that the rise in San Joaquin River stage due to the fish barrier has caused a rise in the groundwater levels on the Island and created a negative impact on crop production. As a condition of the TEPs, the landowners on Upper Roberts Island have requested that we monitor Island groundwater levels to evaluate seepage.

Monitoring Activities

The period of record for data in this report is April 20, 2001 to May 1, 2002. Groundwater levels are measured from seven monitoring wells at three sites (Sites 1, 2 and 3) on Upper Roberts Island (Figure 1). Surface water levels are measured at two tide gages (SJL and at Brandt Bridge) along the San Joaquin River and a tide gage (OH1) along Old River just below the San Joaquin River. Data loggers record hourly measurements that are collected once a month from these ten monitoring stations.

Data gaps occurred over the period of record at Site 1 (Well UR1A and river stage). Two data sets were lost during routine calibration of the data logger at Well UR1A when the system overwrote previous data files. Data download hardware and software have been upgraded and the problem should not occur in the future.

A data set was lost due to battery failure at the Site 1 (SJL) temporary gage. The temporary gage at this location has been replaced with a permanent stage gage. Continuous data was collected from all other monitoring stations. Continuous data observed at Site 1 from Wells UR1B and UR1C indicate that the periods of lost data were not significant.

Monitoring Results

The collected data are evaluated by creating hydrographs showing the groundwater elevation, ground surface elevation and San Joaquin River stage at each site, as well as a hydrograph showing only the river stages. These hydrographs can be seen on Figures 2 through 5. On the hydrographs, vertical lines bracket the periods of construction and removal of the fish barrier at the head of Old River. A solid horizontal line represents the ground surface at the monitoring site. Water levels in the Upper Roberts Island monitoring wells and the San Joaquin River gage stations increased during periods of scheduled reservoir releases for the Vernalis Adaptive Management Plan. Water levels at Vernalis are recorded hourly by the Department of Water Resources. Vernalis is located 13 miles southeast, and upstream, of the barrier installation.

The following observations can be made from the Site 1 hydrograph (Figure 3). Changes in the site's groundwater elevation mimic changes in adjacent river stage but are less pronounced and lag slightly behind. The groundwater elevations in Well UR1A were the most responsive to river stage changes. Well UR1A data is missing from July 11, 2001 to August 15, 2001 and from September 26, 2001 to November 20, 2001. San Joaquin River stage data at Site 1 is missing from September 11, 2001 to October 24, 2001. During the period of record, the highest recorded San Joaquin River stage at the Site 1 gage was 5.3 feet on May 13, 2001, coincident with a groundwater elevation of 4.3 feet (a depth of 8.8 feet below ground surface) in Well UR1A. The San Joaquin River maintained stage above groundwater levels in Well UR1A for the majority of the period. During two notable events, mid December 2001 and mid to late January 2002, rapid decreases in river stage resulted in periods when groundwater levels were above the river surface. The predominant groundwater elevation gradient has been away from the San Joaquin River.

The following observations can be made from the Site 2 hydrograph (Figure 4). Changes in the site's groundwater elevation are compared to changes in San Joaquin River stage at Brandt Bridge, approximately 1.4 river miles downstream from Site 2. Groundwater level trends typically follow changes in river stage but are less pronounced. Groundwater levels in Wells UR2A and UR2B were very similar in response to river stage fluctuations. During the period of record, the highest recorded San Joaquin River stage at Brandt Bridge was 5.4 feet on December 2, 2001, coincident with a groundwater elevation of 2.6 feet (a depth of 6.8 feet bgs) in Well UR2A. The highest recorded groundwater elevation was 5.4 feet (a depth of 3.5 feet bgs) in Well UR2B on June 16, 2001. A maximum groundwater elevation of 4.2 feet (a depth of 5.2 feet bgs) in Well UR2A was also recorded on June 16, 2001, but river stage at Brandt Bridge rose to 3.1 feet that day. That stage was 2.3 feet below groundwater level in Well UR2B. This high groundwater level

occurred at Site 2 during a three-day event from June 15 to June 18, 2001. During this event, groundwater rose nearly 4 feet in Well UR2B and almost 3 feet in Well UR2A. It can be noted further that groundwater in Well UR2B rose more rapidly and peaked at a higher level than in Well UR2A. Also, the typical response of groundwater level to river stage was not seen for nearly 2½ days, during which time no abnormal rise in river stage was recorded. This event may have occurred during seasonal or scheduled crop irrigation, but no observation of field conditions was made at that time. Other than this event, San Joaquin River stage at Brandt Bridge remained above groundwater levels in the Site 2 wells. The predominant groundwater elevation gradient has been away from the San Joaquin River.

The following observations can be made from the Site 3 hydrograph (Figure 5). Changes in the site's groundwater elevation are compared to changes in San Joaquin River stage at Brandt Bridge, which is approximately 1,000 feet downstream from Site 3. Groundwater levels typically mimic changes in river stage but are less pronounced and lag slightly behind. Well UR3A's groundwater levels responded more quickly to changes in river stage than groundwater levels in Well UR3B. During the period of record, the highest recorded San Joaquin River stage at Brandt Bridge was 5.4 feet, coincident with a groundwater elevation of 1.5 feet (a depth of 5.2 feet bgs) in Well UR3A. The highest groundwater level occurred at Site 3 during a five-day event from April 3 to April 8, 2002. During this event, groundwater rose 2.6 feet (a depth of 3.1 feet bgs) in Well UR3B and 1.6 feet (a depth of 3.5 feet bgs) in Well UR3A on April 4, 2002. River stage at Brandt Bridge rose to 3.5 feet that day. That stage was 0.6 feet below groundwater level in Well UR3B. It can be noted further that the groundwater in Well UR3B rose more rapidly and peaked at a higher level than Well UR3A. Also, the typical response of groundwater levels to river stage was not seen for four days, during which time no abnormal rise in river stage was recorded. Groundwater levels in Well UR3B rose above those in Well UR3A during two other events, one in mid June 2001 and the other during the month of January 2002. These three events represent periods when the groundwater gradient was toward the San Joaquin River. The events may have occurred during seasonal or scheduled crop irrigation, but no observation of field conditions was made at that time. From April 22 to April 24, 2002, groundwater levels in Well UR3A rose above river stage for 1½ days, reaching a peak elevation of 3.3 feet (a depth of 3.3 feet bgs) on April 24. For the majority of the period of record, San Joaquin River stage at Brandt Bridge remained above groundwater levels in the Site 3 wells. The predominant groundwater elevation gradient has been away from the San Joaquin River.

The following observations can be made from the river stage hydrograph (Figure 2). Changes in San Joaquin River stage are compared to one another and to changes in Old River stage. Periods of increasing San Joaquin River stage at Brandt Bridge and Site 1 (SJL), from the end of April to the end of May 2001, from the beginning to mid January 2002, and from mid April 2002 to the end of the period of record, concur with increasing San Joaquin River stage at Vernalis (VNS). During the April-May period when the barrier was installed, stage at SJL was approximately 1.5 and 2.0 feet higher than stage at Brandt Bridge and OH1, respectively. During the October-November period when the barrier was installed, the three stages near the study area were generally about the same level as one another. During the

one week prior to barrier removal, OH1's water level was approximately 1 foot below the water levels at SJL and Brandt Bridge. During all other periods, stages in the San Joaquin and Old River channels at stations used for this study were within about 0.5 foot of one another.

Conclusions

- Over the monitoring period, groundwater levels and river stage did not rise to the elevation of the land surface.
- Over the monitoring period, seepage was not observed or reported by others.
- Rapid rises in groundwater levels at Sites 2 and 3 were due to influences other than river stage.

Recommendations

- Continue monitoring to capture spring high-flow event data, which has not occurred over monitoring periods to date.
- Obtain irrigation schedules from landowners at Sites 2 and 3, as irrigating may be affecting groundwater levels.

Study Area and Site Locations

RD 544 Seepage Monitoring Study

Department of Water Resources
Central District
Geology and Groundwater Section

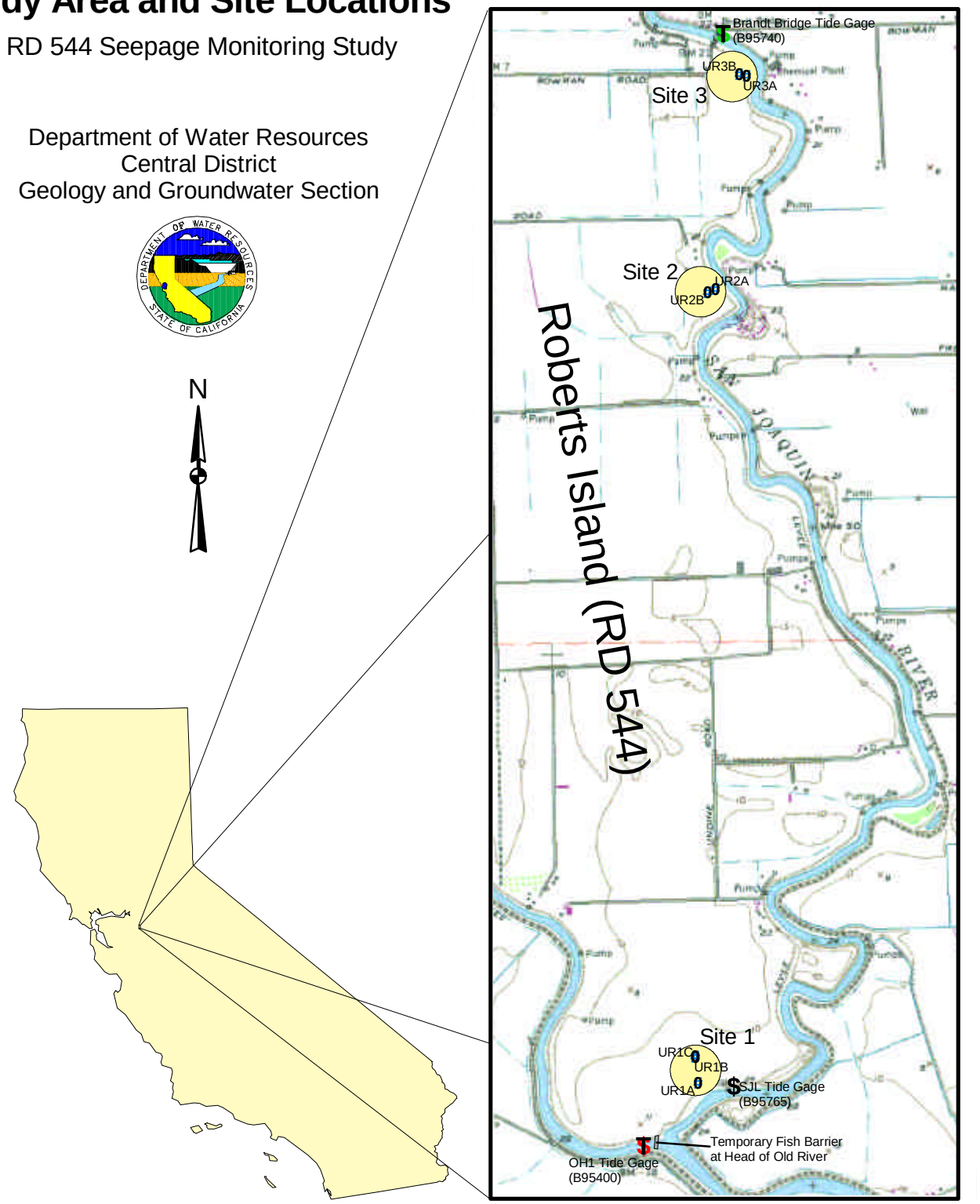
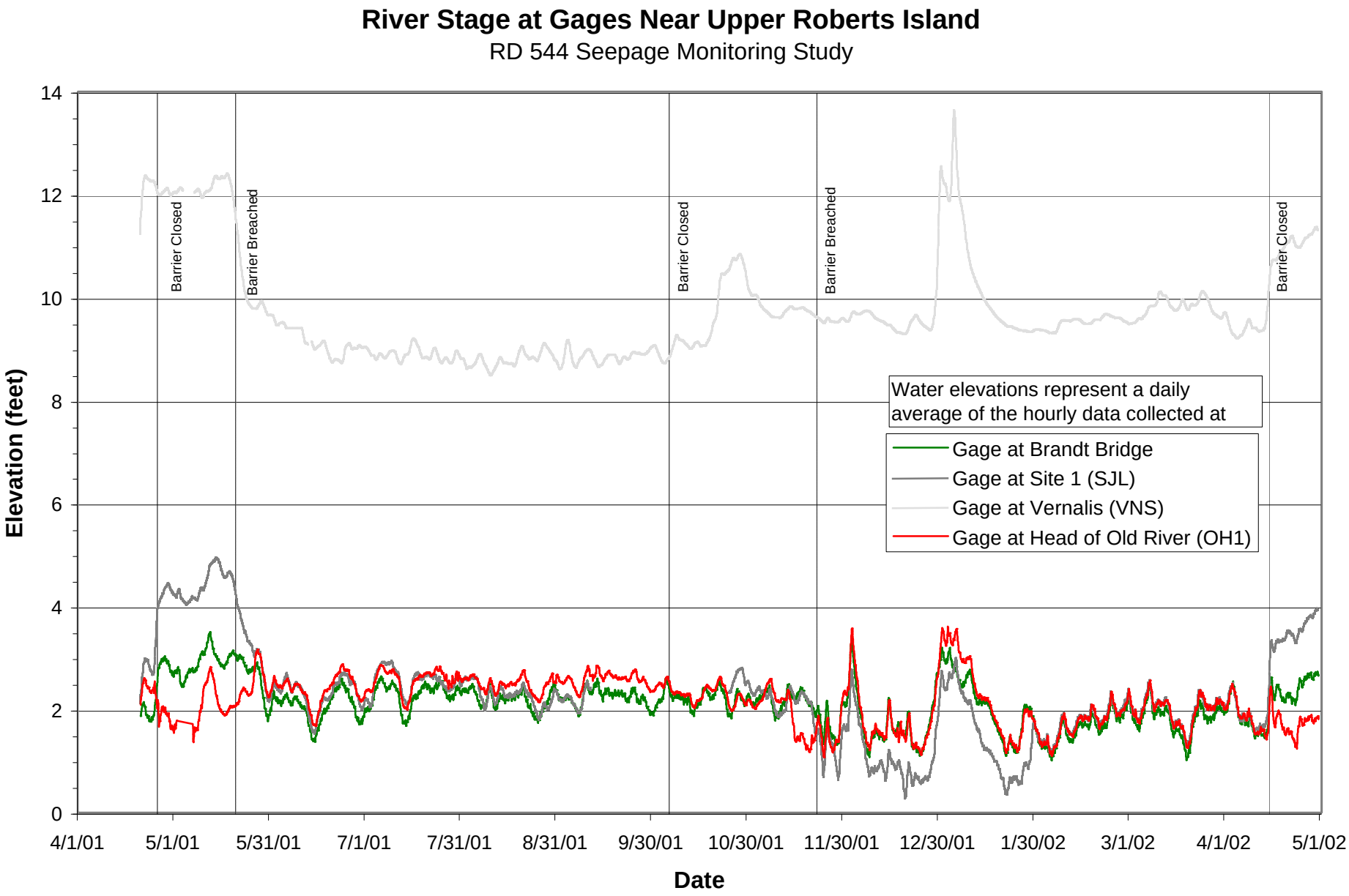


Figure 1

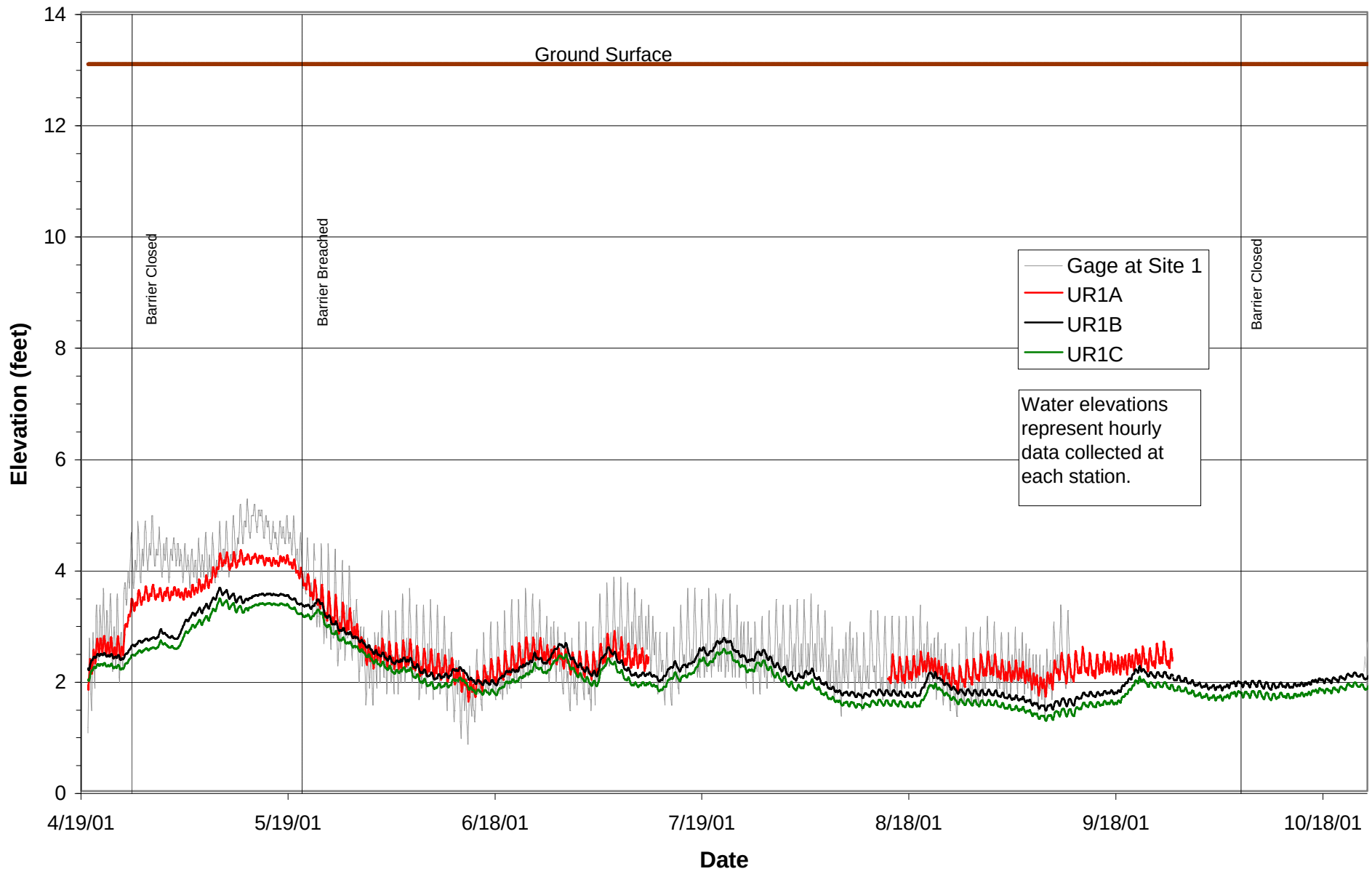


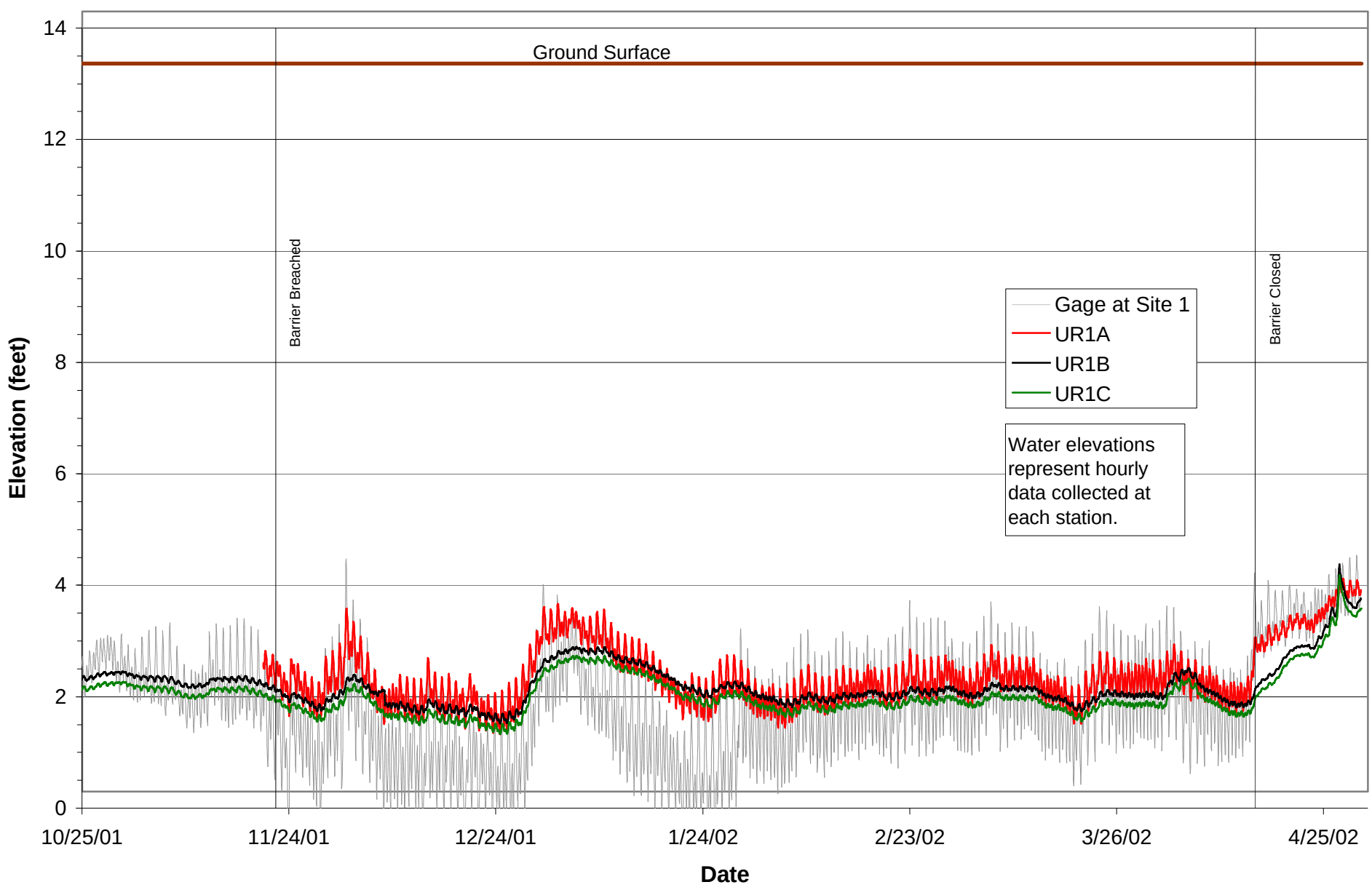
Central District Geology and Groundwater

Figure 2

San Joaquin River Stage and Groundwater Levels at Site 1

RD 544 Seepage Monitoring Study





San Joaquin River Stage and Groundwater Levels at Site 2

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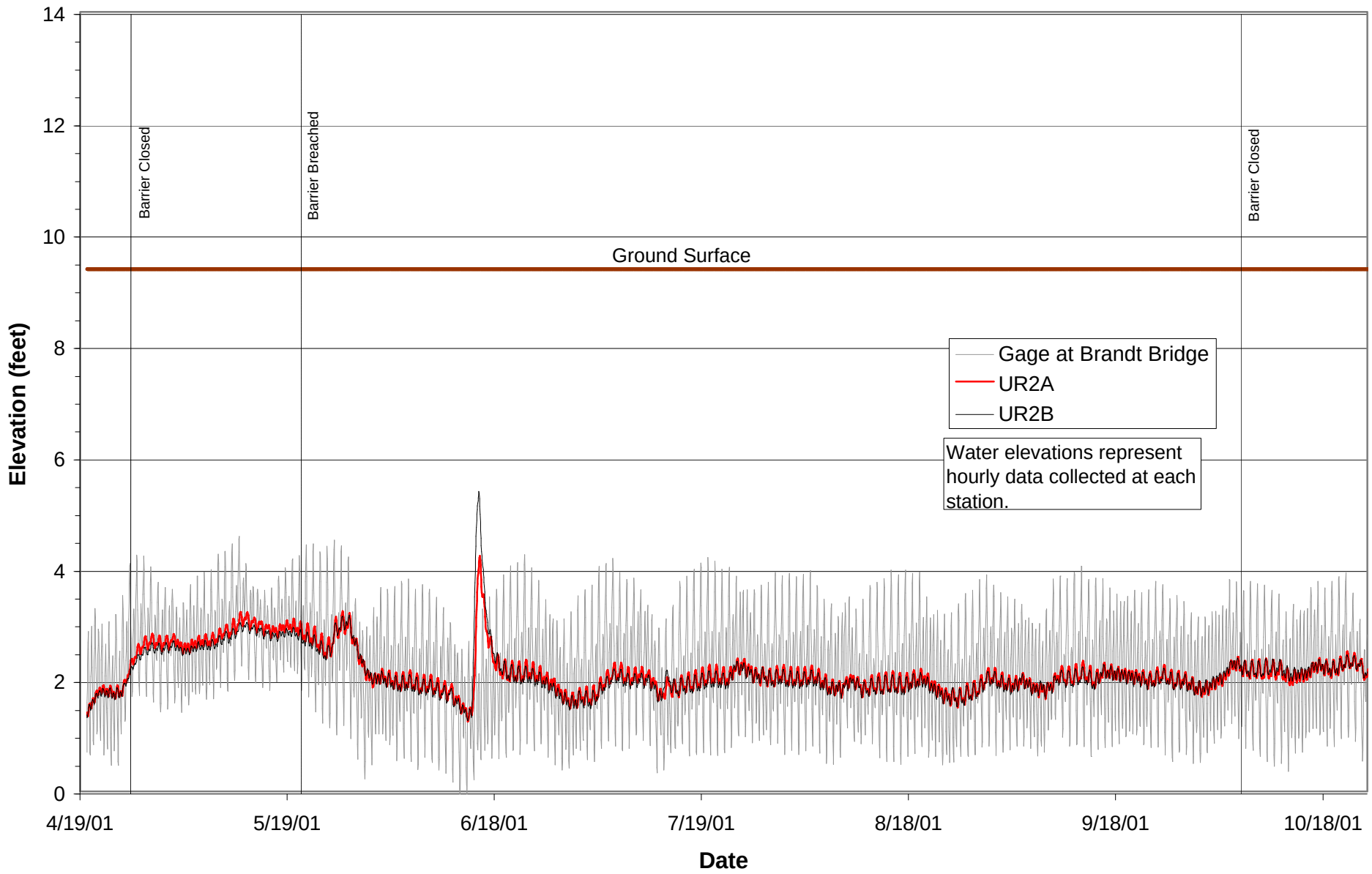
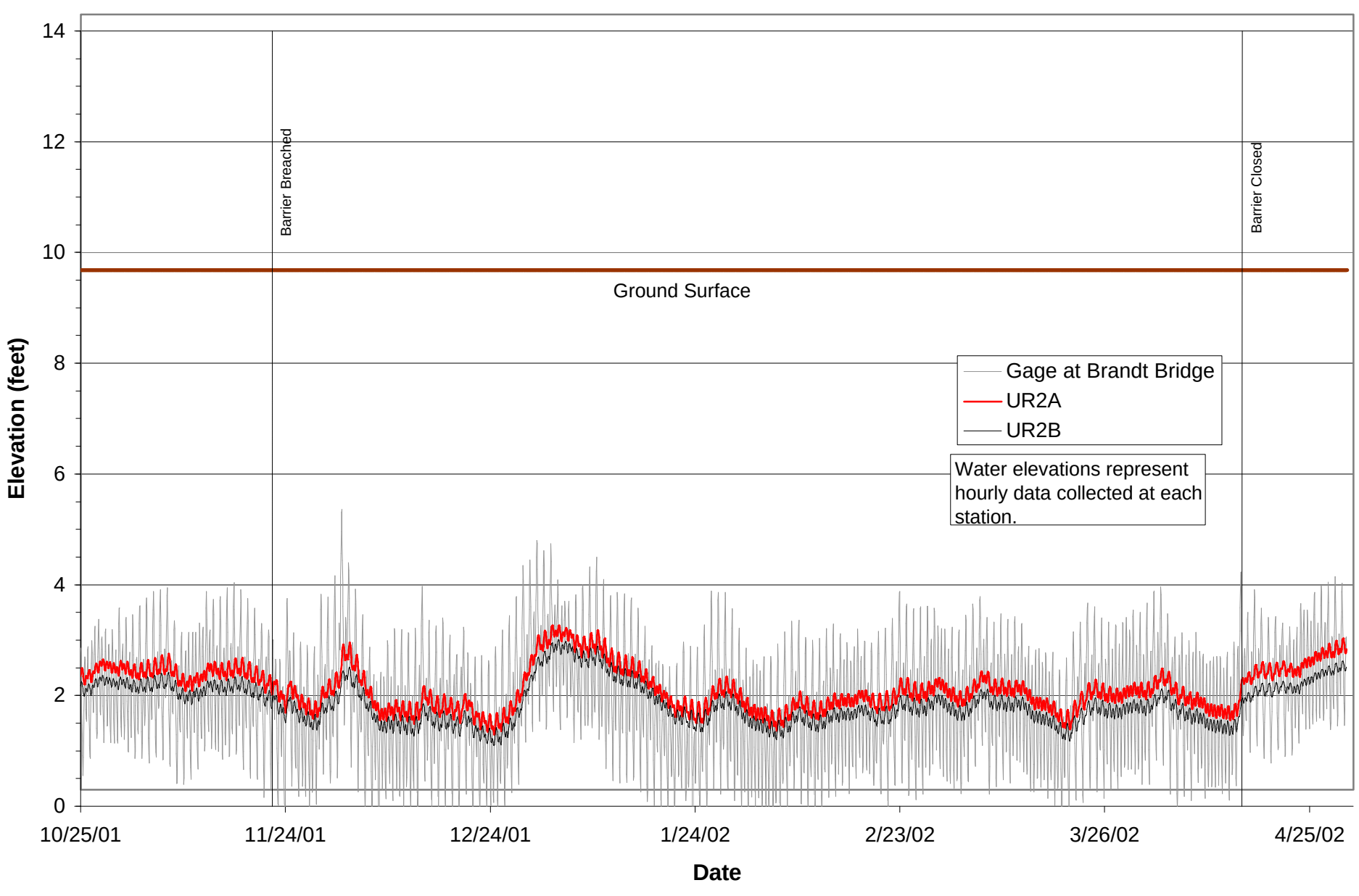
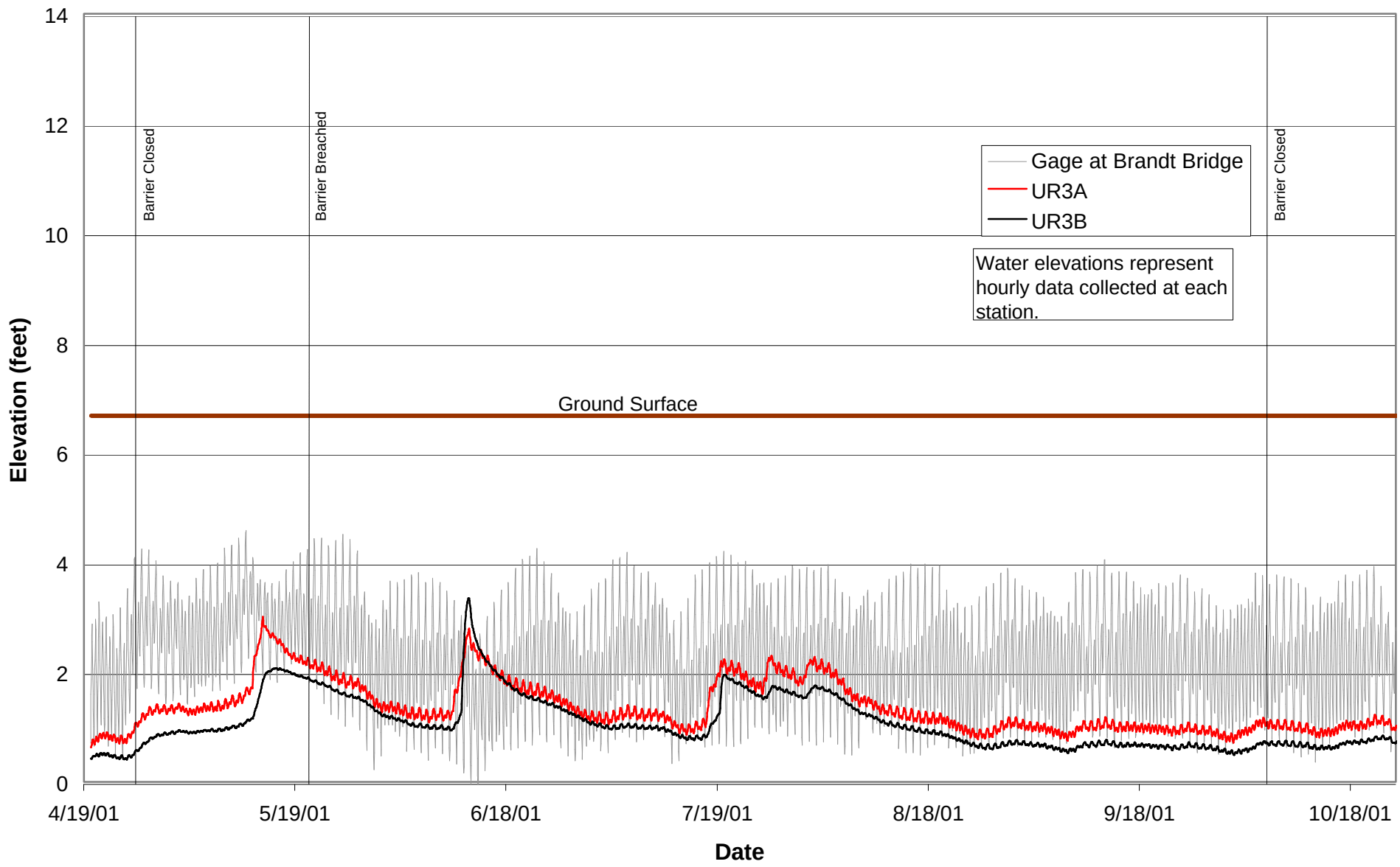
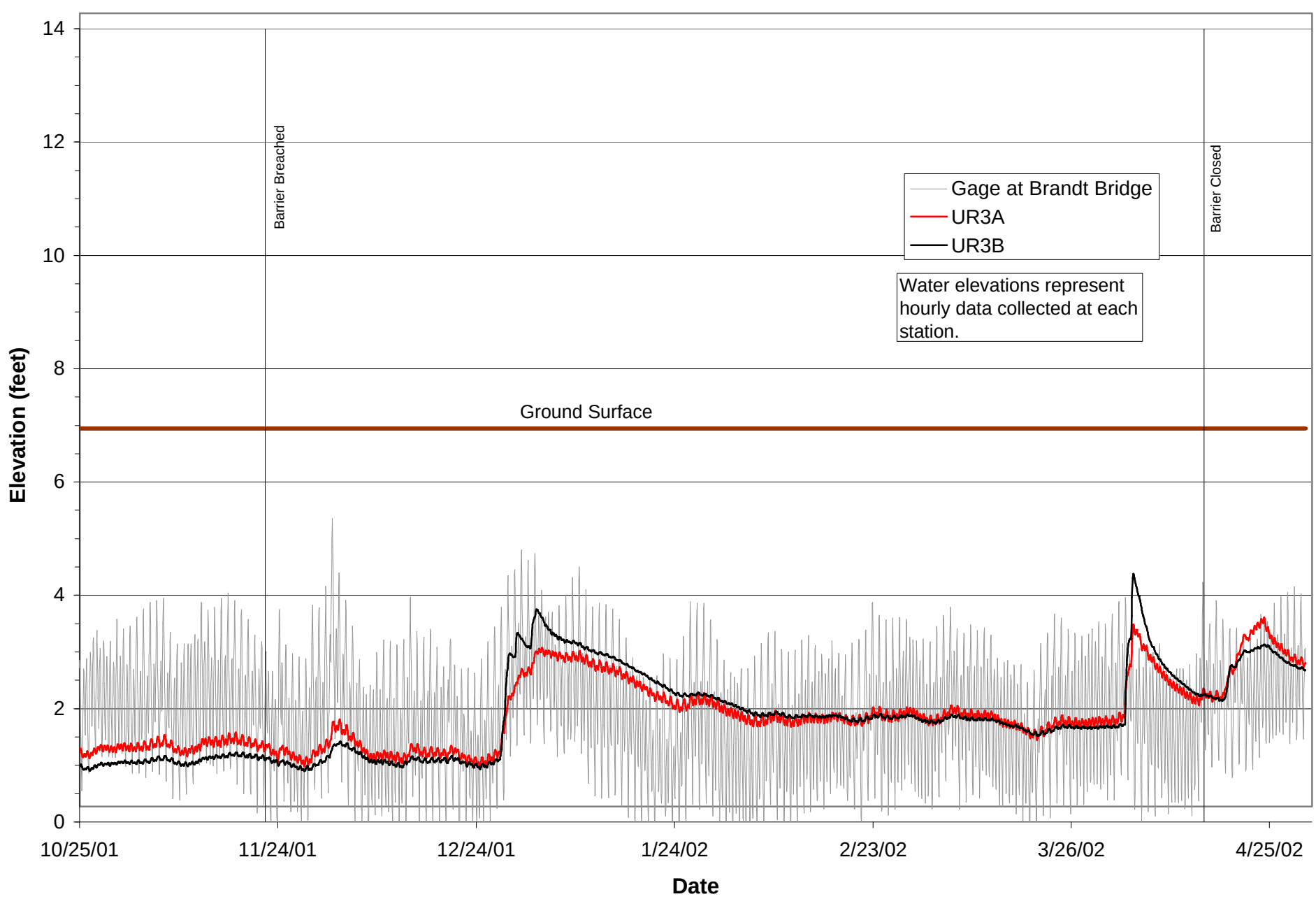




San Joaquin River Stage and Groundwater Levels at Site 3

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