PCWA-L-177

Placer County Water Agency

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April 4, 2005

Mr. Takeshi Yamashita, Regional Engineer
FEDERAL ENERGY REGULATORY COMMISSION
901 Market Street, Suite 350
San Francisco, CA 94103

Re: FERC Project No. 2079-CA

Dear Mr. Yamashita:

In April, 2004, we sent you a total of 16 documents under cover of letters dated April 8 and 21, 2004, to provide you information to assist in understanding and evaluating the Middle Fork Tunnel Surge Shaft situation, particularly, leakage, ground water levels and geology. These documents were sent in response to John Onderdonk's request for information that would assist in evaluating our request made by letter to you dated February 6, 2004 for a one-year extension to the schedule for installation of a steel liner in the surge shaft to mitigate leakage from the existing cracked concrete lining in order to significantly reduce water leakage through the shaft lining. Since then an additional report has been published:

> Weir, Flume, and Well Monitoring Data , Middle Fork Tunnel and Surge Shaft, Monitoring Period November 2003 to November 2004, dated February 8, 2005

If you have any questions, please call me at (530) 885-6917.

Sincerely,

PLACER COUNTY WATER AGENCY

Stephen J. Jones

Stephen J. Jones
Power System Manager

Enclosure

cc: David Breninger
Kevin Goishi, PG&E

WEIR, FLUME, AND WELL MONITORING DATA
MIDDLE FORK TUNNEL AND SURGE SHAFT

Monitoring Period November 2003 to November 2004

Placer County, California

Prepared by:

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Piedmont GeoSciences, Inc.

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Geosciences Department

Pacific Gas and Electric Company

Prepared for

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Pacific Gas and Electric Company

February 8, 2005

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WEIR, FLUME, AND WELL MONITORING DATA
MIDDLE FORK TUNNEL AND SURGE SHAFT
Monitoring Period November 2003 to November 2004
Placer County, California

TABLE OF CONTENTS

INTRODUCTION

This report presents weir, flume and piezometer monitoring data for an engineering geologic and hydrogeologic evaluation of the Middle Fork Surge Shaft. The locations of the various monitoring stations are shown in Figure 1. The monitoring data were collected from November 2003 to November 2004 and complied by Piedmont GeoSciences, Inc. under the technical direction of PG&E Geosciences Department for the PG&E Hydro Generation Department. Hydraulic head measurements taken at the Middle Fork Valvehouse were provided by Mr. John Hollfelder, PG&E Geosciences Department. These data were collected as part of the on-going monitoring study of several weirs, flumes and piezometers in the project area. Figures 2 through 9 show the relationship between measured weir or flume discharge and surge shaft water elevations and precipitation. Figures 10 through 14 show similar relationships, but with piezometer water elevations rather than discharge. Surge shaft water elevations are calculated from the hydraulic head measurements at the Valvehouse. Precipitation data from the Greek Store weather station is presented because the station is at a similar elevation in the American River drainage and it provides a continuous record for the present monitoring period. The processed monitoring data for the period of record are provided on the enclosed CD-ROM (see pocket).

Data for the prior monitoring period, July 2002 to January 2003, is presented in an earlier report entitled "Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft" dated March 12, 2003. A summary of all weir, flume, and well monitoring data for the period of record, May 2000 to August 2003, is presented in the report entitled "Summary of Weir, Flume, and Well Monitoring Data, Middle Fork Surge Shaft" dated April 13, 2004. The methodology and preliminary interpretations of the hydrogeologic study are discussed in the report entitled "Middle Fork Tunnel and Surge Shaft Geologic and Hydrologic Data Report (Period September, 2000 to June, 2001)", dated August 2001.

MONITORING DATA DISCUSSION

Although the monitoring data was automatically collected on 20-minute intervals (10-minutes at Valvehouse), The hydrologic data is presented as daily averages, arithmetic mean values, with no weighting or normalizing. The purpose of presenting daily averages is that this measure filters out diurnal variations, especially in the operation of the powerhouse. Essentially a daily average value is a water level integrated throughout the entire day.

The ranges of hydraulic head conditions or surge shaft water levels during the period of record were well within the range observed during the entire project monitoring period. All of the 2004 trends in the weir, flume or piezometer monitoring data (Figures 2-14) are considered typical and to be consistent with trends observed in the earlier data set. Weir and flume discharge measurements (minimum, maximum, and mean values) are presented in Table 1 for the period of record. Table 2 presents the range and mean piezometer water elevations for the period of record.

Valvehouse

Pressure readings were collected at 10-minute intervals in the Valvehouse during the current monitoring period. During this period data was continuously recorded at the Valvehouse, with no equipment failures. These data were used to calculate a range in surge shaft water elevations from 4421.7 to 4599.7 feet (Figure 2).

Flume 1

Figure 2 presents daily average values of discharge measured at flume 1, surge shaft water elevations, and precipitation. No discharge was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. During the period of record, the daily average discharge ranged from 28.4 gallons per minute (gpm) on October 28, 2004 to 101.1 gpm on April 28, 2004, with a mean of 72.4 gpm (Table 1). Flume 1 was replaced on October 29, 2004 with a smaller flume, because the original

flume was needed to pass higher flows at flume 2. The influence of significant precipitation events on flume 1 discharge is moderately reflected on the graph.

Flume 2

Data for flume 2 is presented in Figure 3, except for the period from August 26 to November 1, 2004, because the monitoring equipment was apparently disturbed by cows. Also, no discharge was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. During the period of record, the daily average discharge ranged from 6.1 gpm on February 17, 2004 to 151.9 gpm on August 3, 2004, with a mean of 77.3 gpm (Table 1). Of note, the reported capacity of the flume is approximately 145 gpm, hence some of large discharge spikes observed throughout the monitoring period may represent less than maximum values (i.e., actual flow appears to have exceeded the capacity of the flume). Flume 2 was replaced with a larger flume on October 28, 2004, having a discharge capacity of 429.5 gpm. Some of the high discharge peaks are unrelated to precipitation events, and may have resulted from breaching of small sediment dams related to active erosion of the 1997 debris flow scar upstream of the flume. The influence of significant precipitation events on flume 2 discharge is well reflected in the higher flows between December 2003 and March 2004.

Flume 3

The current record for flume 3 is nearly continuous and is presented as Figures 4. The record between September 16 and November 1, 2004 is missing apparently because the equipment was disturbed by cows. Also, no discharge was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. During the monitoring period, the daily average discharge ranged from 42.1 gpm on January 4, 2004 to 298.2 gpm on May 27, 2004, with a mean of 226.6 gpm (Table 1). Flume 3 records the highest discharge in the project area.

Weir 4

Data for weir 4 is presented in Figure 5, except for a data gap between June 26 and July 10, 2004, when the memory capacity of the data logger was exceeded. The daily average

discharge ranged from 26.7 gpm on October 13, 2004 to 48.4 gpm on December 25, 2003, with a mean of 37.4 gpm (Table 1). Although relatively minor, the discharge measurements reflect the influence of significant precipitation events between December 2003 and January 2004, between February and March 2004, and between October and November 2004.

Weir 5

The record for weir 5 is nearly continuous and is presented in Figure 6. No discharge was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. During this period the daily average discharge ranged from 36.8 gpm on October 6, 2004 to 147.9 gpm on February 27, 2004, with a mean of 74.9 gpm (Table 1). The record is significantly influenced by precipitation and snowmelt events that have large and long-lasting effects on weir 5 discharges.

Flume 6

Data for flume 6 is presented in Figure 7, except between July 29 and November 1, 2004, because the monitoring equipment was apparently disturbed by cows and between June 26 and July 10, 2004, when the memory capacity of the data logger was exceeded. The daily average discharge ranged from 0 gpm (no flow) on March 7, 2004 to 95.3 gpm on June 25, 2004, with a mean of 27.1 gpm (Table 1). The influence of significant precipitation events on flume 6 discharge is well reflected in the higher flows observed between December 2003 and March 2004.

Flume 7

The record for flume 7 is nearly continuous and is presented in Figure 8. The record between October 7 and November 1, 2004 is missing because equipment was apparently disturbed by cows, and no data was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. During the period of record the daily average discharge ranged from 0 gpm (no flow) on February 13, 2004 to 111.5 gpm on July 11, 2004, with a mean of 33.4 gpm (Table 1). The influence of significant

precipitation events on flume 7 discharge is moderately reflected in the higher flows between December 2003 and March 2004.

Flume 11 (Drains)

Flume 11 passes the combined flow of drains D1, D2, D3, D4, and D5 (Figure 1). The flow data is presented in Figure 9 in relation to surge shaft water elevations and precipitation. No discharge was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. The daily average discharge ranged from 65.8 gpm on October 29, 2004 to 151.8 gpm on May 27, 2004, with a mean of 110.9 gpm (Table 1).

Piezometer B1

Piezometer B1 has a single transducer that provided nearly continuous water elevation data for the period of record, which are presented along with surge shaft water levels and precipitation in Figure 10. No elevation data was recorded between June 26 and July 10, 2004, because the memory capacity of the data logger was exceeded. Water elevations ranged from 4431.4 feet on October 28, 2004 to 4561.4 feet on June 26, 2004, with a mean elevation of 4503.5 feet (Table 2).

Piezometer B2

No data were recorded during the period of record, resulting from repeated malfunctions of the data logger. A back-up data logger was installed on October 29, 2004. The broken data logger was sent to the manufacture in November 2004 and has subsequently been repaired.

Piezometer B3

Piezometer B3 has been and remains a dry well for the entire monitoring period (Table 2).

Piezometer B4

The current record for piezometer B4 is continuous and is shown in Figure 11. Water elevations ranged from 4264.2 feet on October 29, 2004 to 4273.6 feet on June 27, 2004, with a mean elevation of 4270.0 feet (Table 2).

Piezometer B5

The data recorded in piezometer B5 is continuous throughout the monitoring period. Figure 12 presents water elevations measured by three staggered and isolated transducers. Water elevations measured by the upper transducer ranged from 4367.0 feet on October 28, 2004 to 4400.0 feet on May 23, 2004, with a mean elevation of 4384.0 feet. Water elevations measured by the middle transducer ranged from 4352.0 feet on October 28, 2004 to 4388.2 feet on May 23, 2004, with a mean elevation of 4372.0 feet. Water elevations measured by the lower transducer ranged from 4348.3 feet on October 28, 2004 to 4385.7 feet on April 27, 2004, with a mean elevation of 4372.2 feet (Table 2).

Piezometer B6

The record for piezometer B6 is continuous and water elevations measured by all three transducers are shown in Figure 13. Water elevations measured by the upper transducer ranged from 4450.8 feet on October 29, 2004 to 4467.5 feet on April 28, 2004, with a mean elevation of 4461.5 feet. Water elevations measured by the middle transducer ranged from 4436.2 feet on October 28, 2004 to 4471.0 feet on May 22, 2004, with a mean elevation of 4460.8 feet. Water elevations measured by the lower transducer ranged from 4435.0 feet on October 28, 2004 to 4469.6 feet on May 22, 2004, with a mean elevation of 4459.5 feet (Table 2).

Piezometer B7

The data recorded at piezometer B7 is continuous throughout the monitoring period and water elevations measured by both transducers are shown in Figure 14. Water elevations measured by the upper transducer ranged from 4399.1 feet on October 29, 2004 to 4431.7 feet on May 26, 2004, with a mean elevation of 4419.1 feet. Water elevations measured

by the lower transducer ranged from 4403.3 feet on October 29, 2004 to 4439.1 feet on May 26, 2004, with a mean elevation of 4425.1 feet (Table 2).

TABLES

TABLE 1
WEIR/FLUME DISCHARGE FOR PERIOD OF RECORD
(November, 2003 to November, 2004)

Weir / Flume (Spring)	Daily Average Discharge (gpm)	
	Range	Mean Flow[1]
F1 (Sp114)	28.4 – 101.1	72.4
F2 (Sp109;108; 111;401; D1-D5)	6.1 – 151.9	77.3
F3 (Sp112)	42.1 – 298.2	226.6
W4 (Sp106)	26.7 – 48.4	37.4
W5 (Sp103;105; 205)	36.8 – 147.9	74.9
F6 (Sp108)	0.0 – 95.3	27.1
F7 (Sp108;109)	0.0 – 111.5	33.4
F11 (D1-D5)	65.8 – 151.8	110.9

[1] Mean flow represents arithmetic mean of daily average discharge data recorded during the period of record.

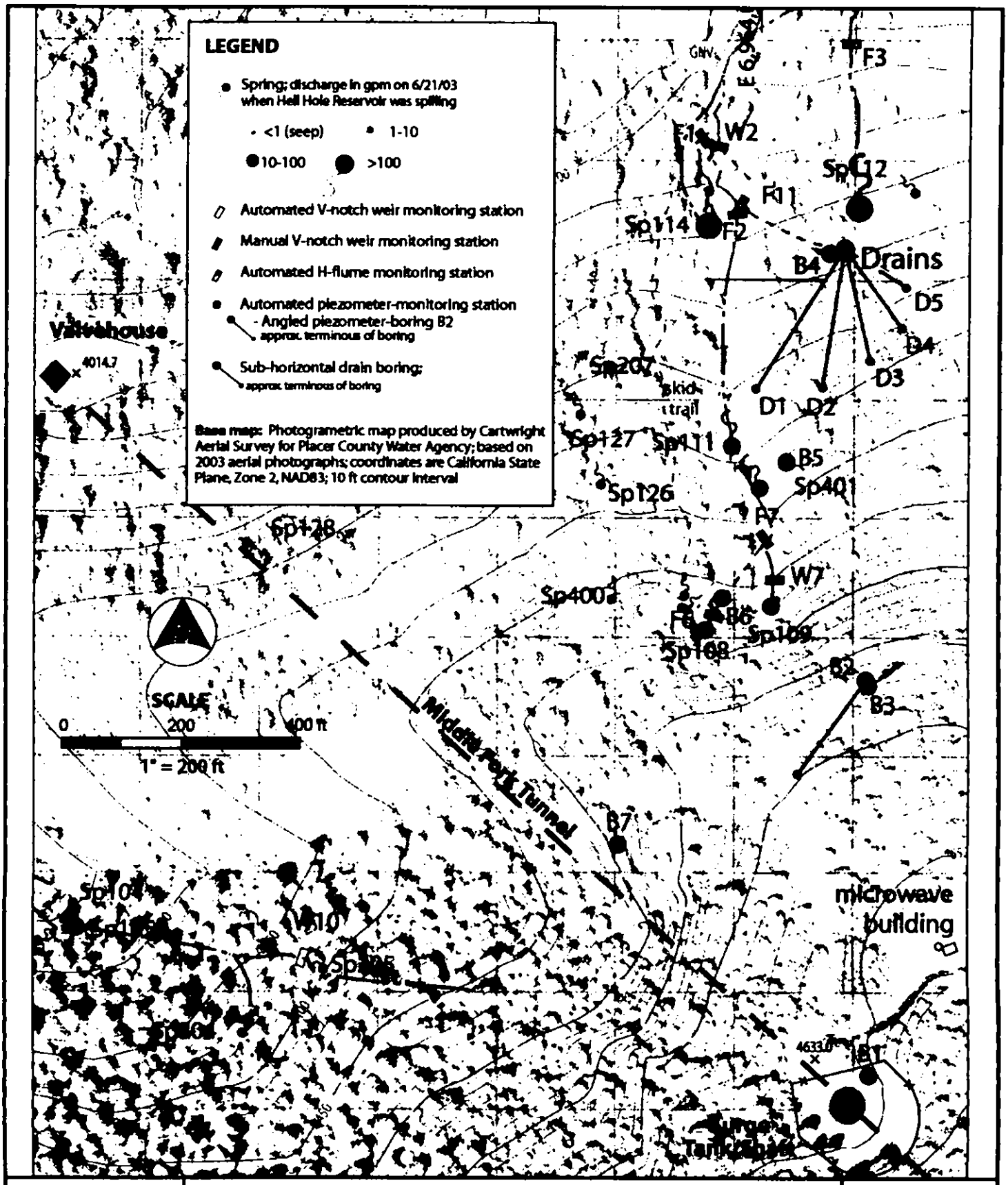
TABLE 2
PIEZOMETER WATER ELEVATIONS
FOR PERIOD OF RECORD
(November, 2003 to November, 2004)

Piezometer No. (Surface Elevation)	Daily Average Elevation (ft)	
	Range	Mean Elevation[1]
B1 (4631 ft)	4431.4 – 4561.4	4503.5
B2-150 (4564 ft) B2-267 B2-399	No data recorded for period of record due to repeated data logger malfunctioning	
B3[2] (4565 ft)	No water	No water
B4 (4267 ft)	4264.2 – 4273.6	4270.0
B5-30 (4373 ft)	4367.0 – 4400.0	4384.0
B5-105	4352.0 – 4388.2	4372.0
B5-158	4348.3 – 4385.7	4372.2
B6-35 (4460 ft)	4348.3 – 4385.7	4372.2
B6-88.5	4436.2 – 4471.0	4460.8
B6-140.5	4435.0 – 4469.6	4459.5
B7-212 (4481 ft)	4399.1 – 4431.7	4419.1
B7-281.5	4403.3 – 4439.1	4425.1

[1] Mean elevation represents arithmetic mean of daily average elevation data recorded during the period of record.

[2] The single transducer in this shallow piezometer has never recorded any water (ie., dry piezometer.

FIGURES

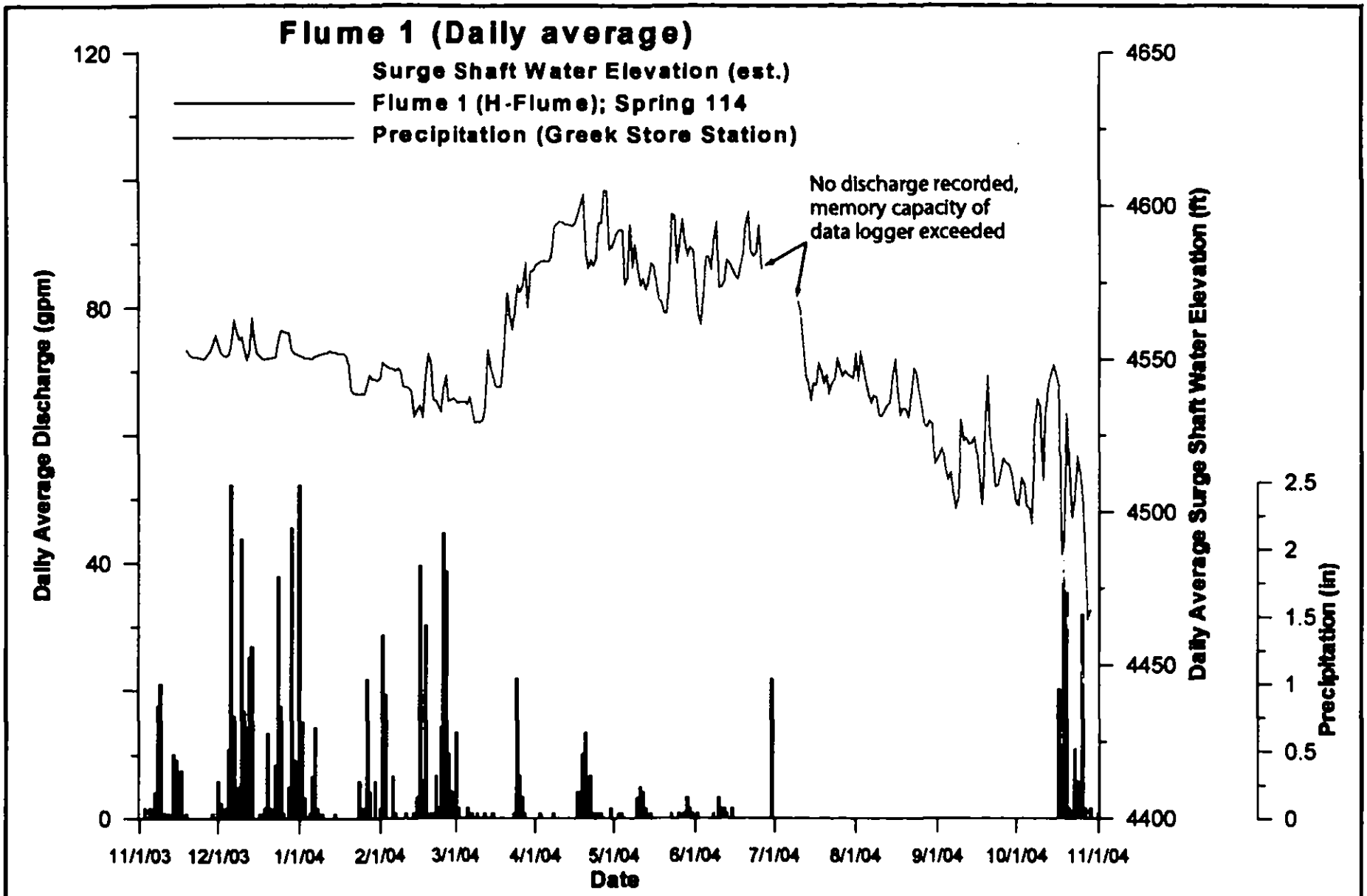


MAP SHOWING LOCATIONS OF PROJECT WEIRS, FLUMES AND PIEZOMETERS

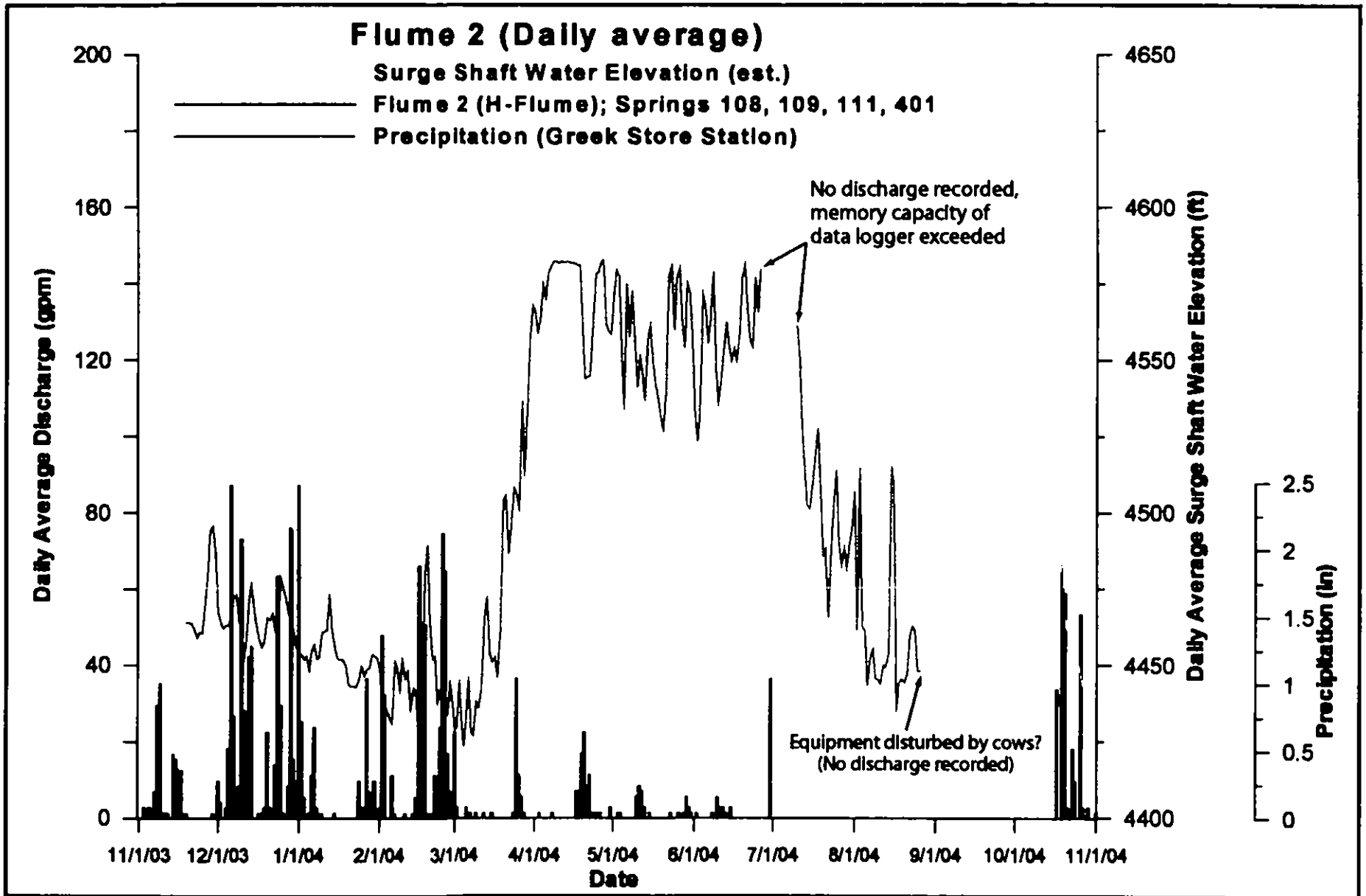
Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft

Figure 1

1082-106



PGS PG&E	**FLUME 1 DISCHARGE FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 2
BY TM, SB	APPROVED BY WP	PROJECT NO. 1062-106	SCALE As reported	Date 12/8/04



FLUME 2 DISCHARGE FOR PERIOD OF RECORD Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 3
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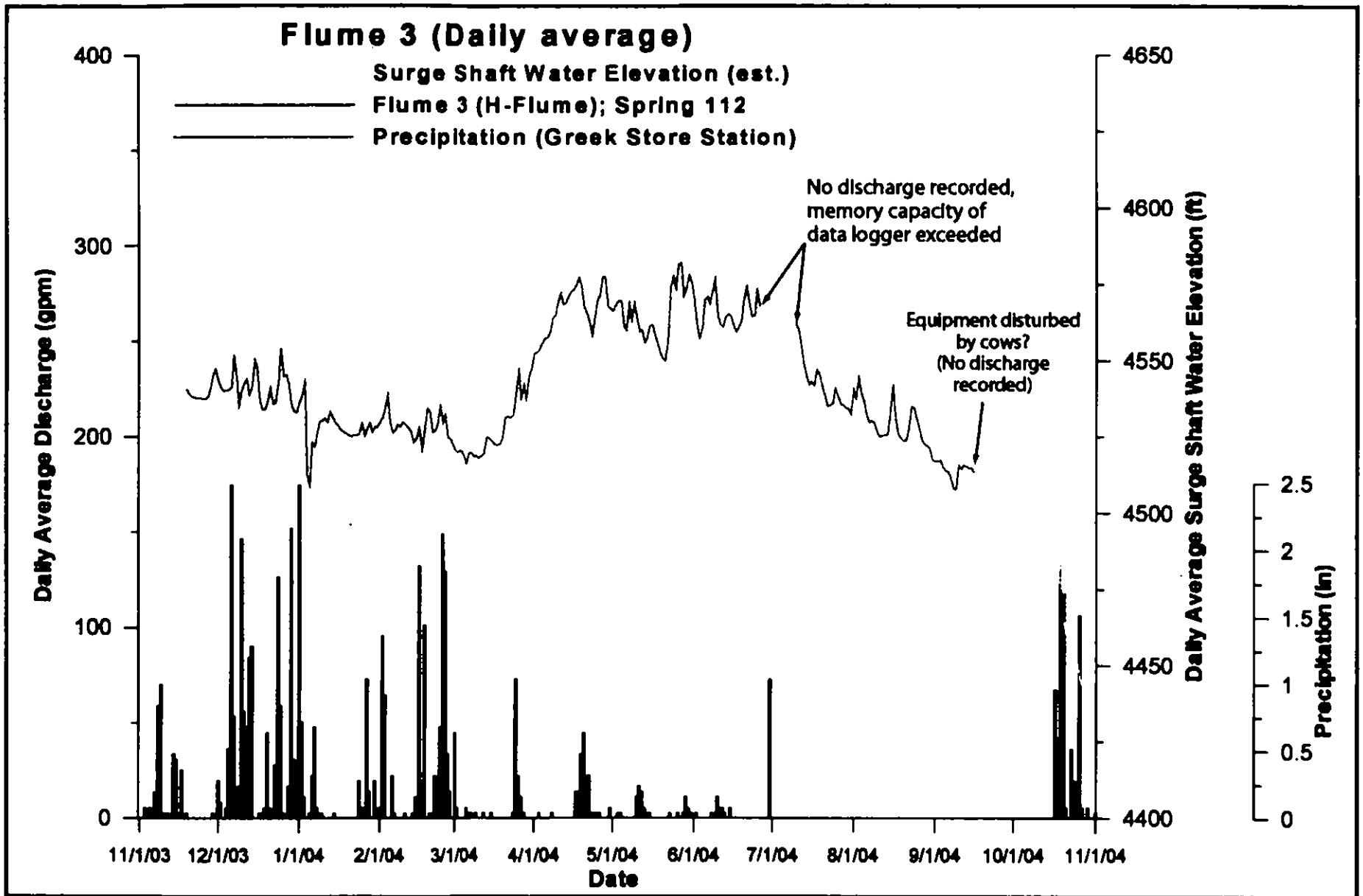

FLUME 3 DISCHARGE FOR PERIOD OF RECORD Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 4
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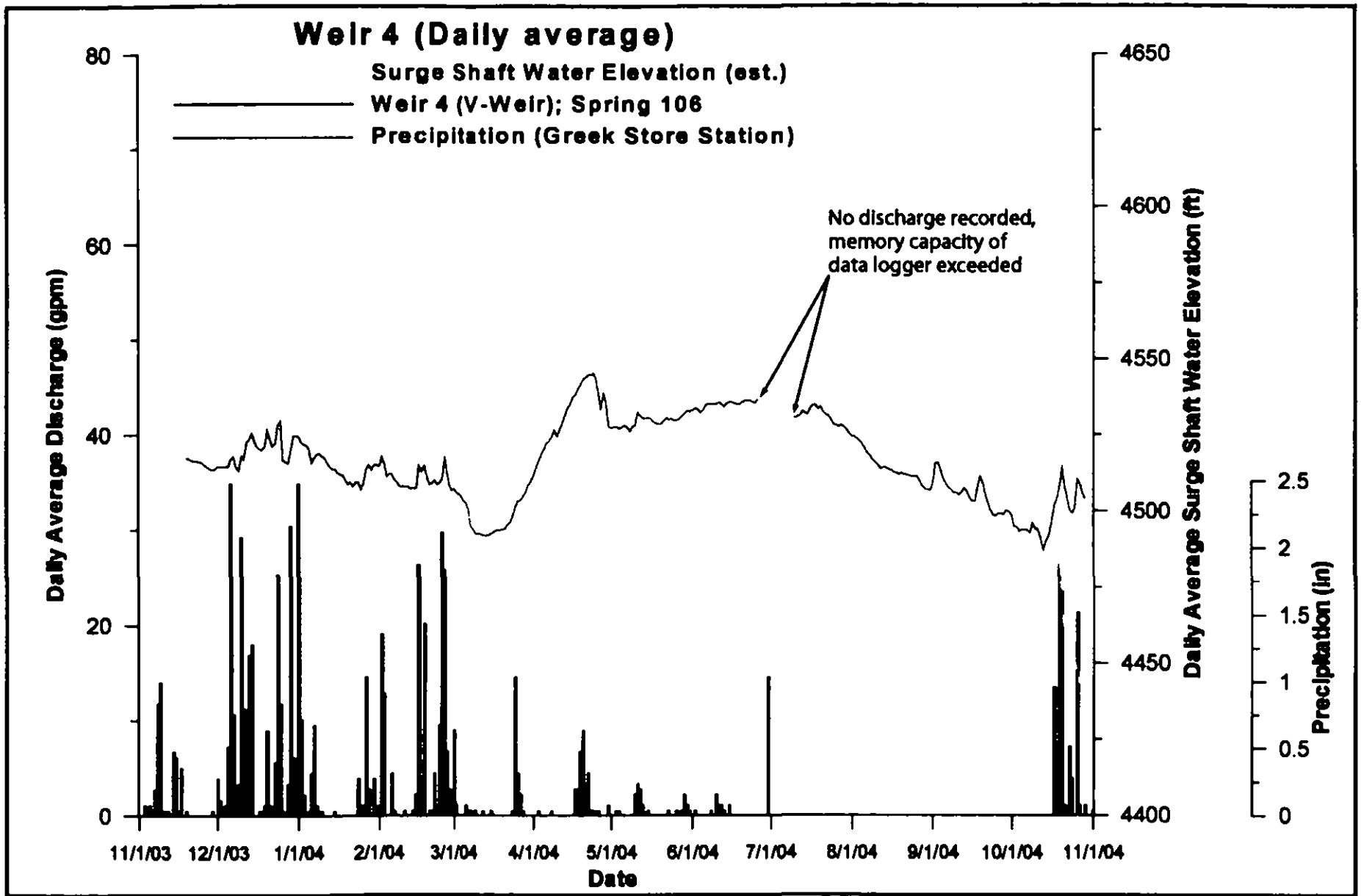

WEIR 4 DISCHARGE FOR PERIOD OF RECORD Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft				FIGURE 5
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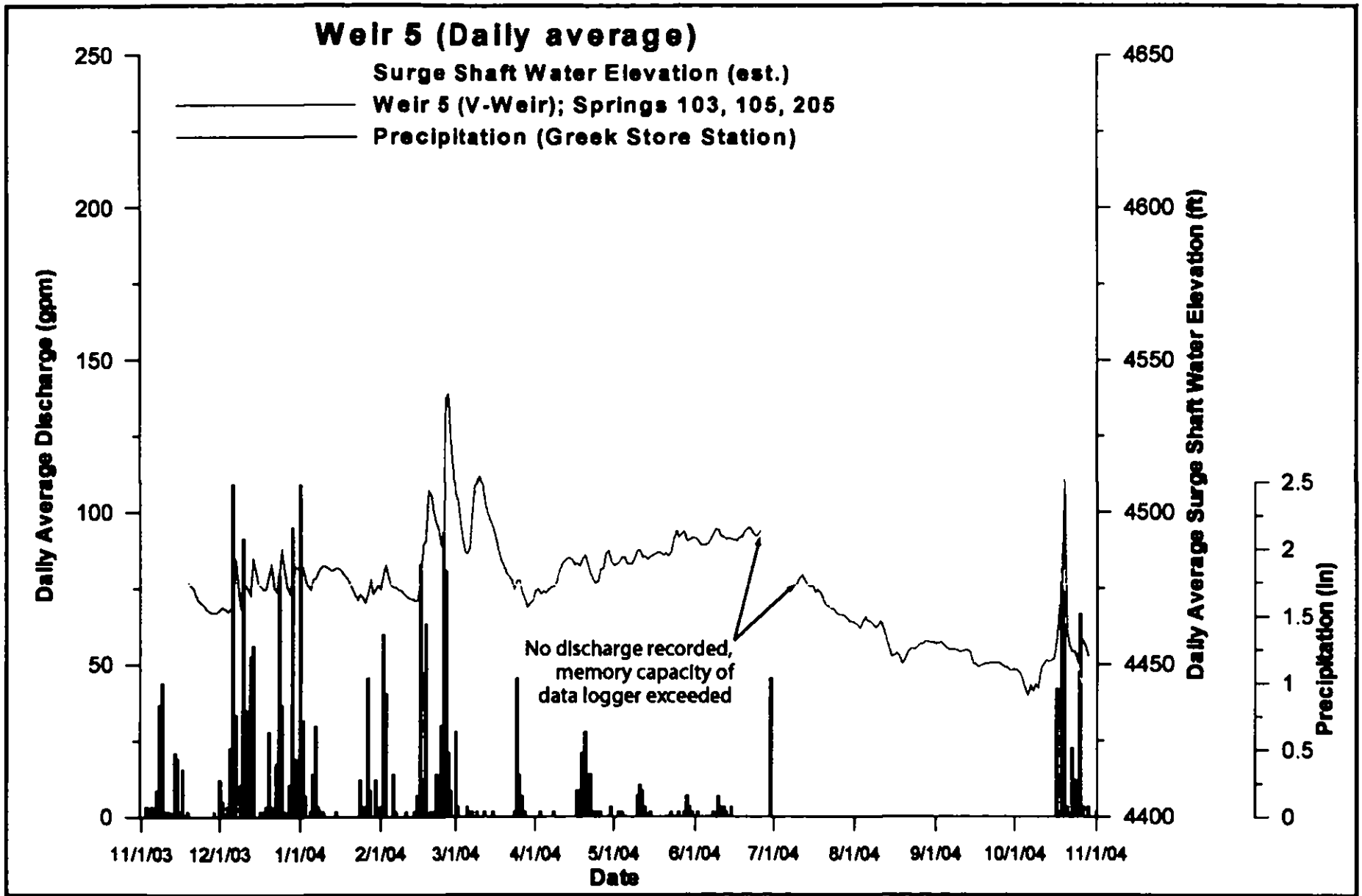

PGS PG&E	**WEIR 5 DISCHARGE FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 6
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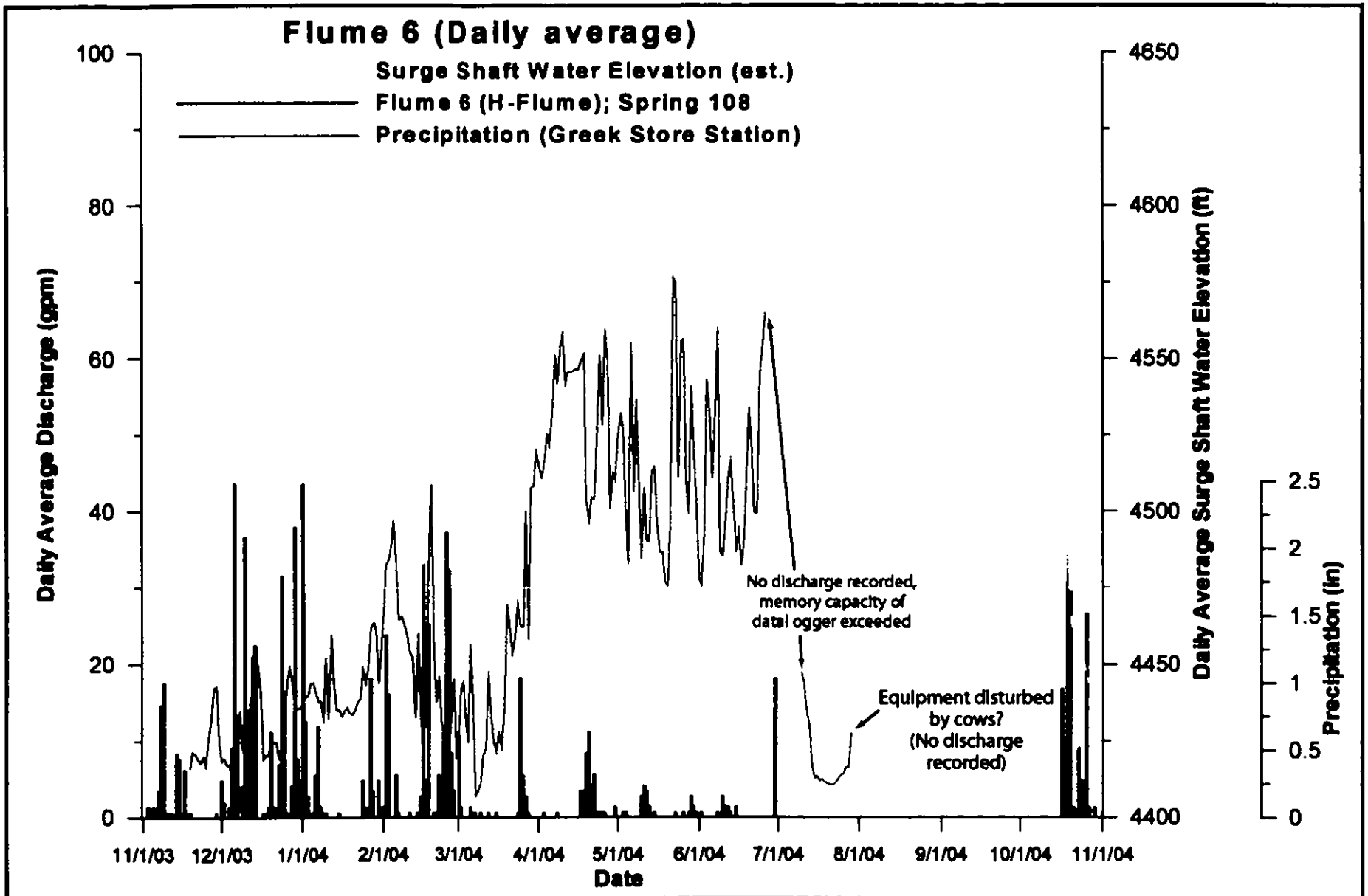

PGS PG&E	**FLUME 6 DISCHARGE FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 7
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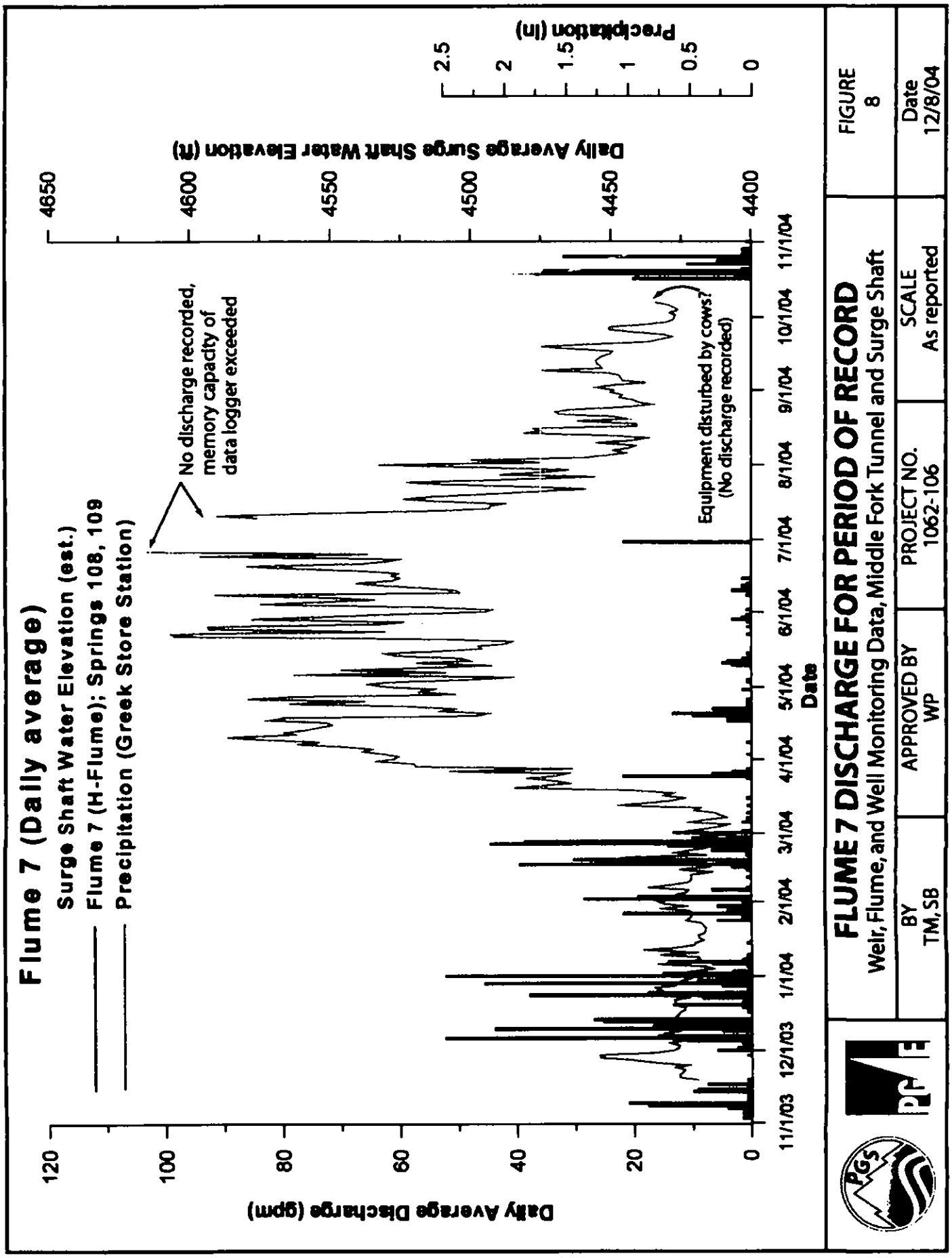
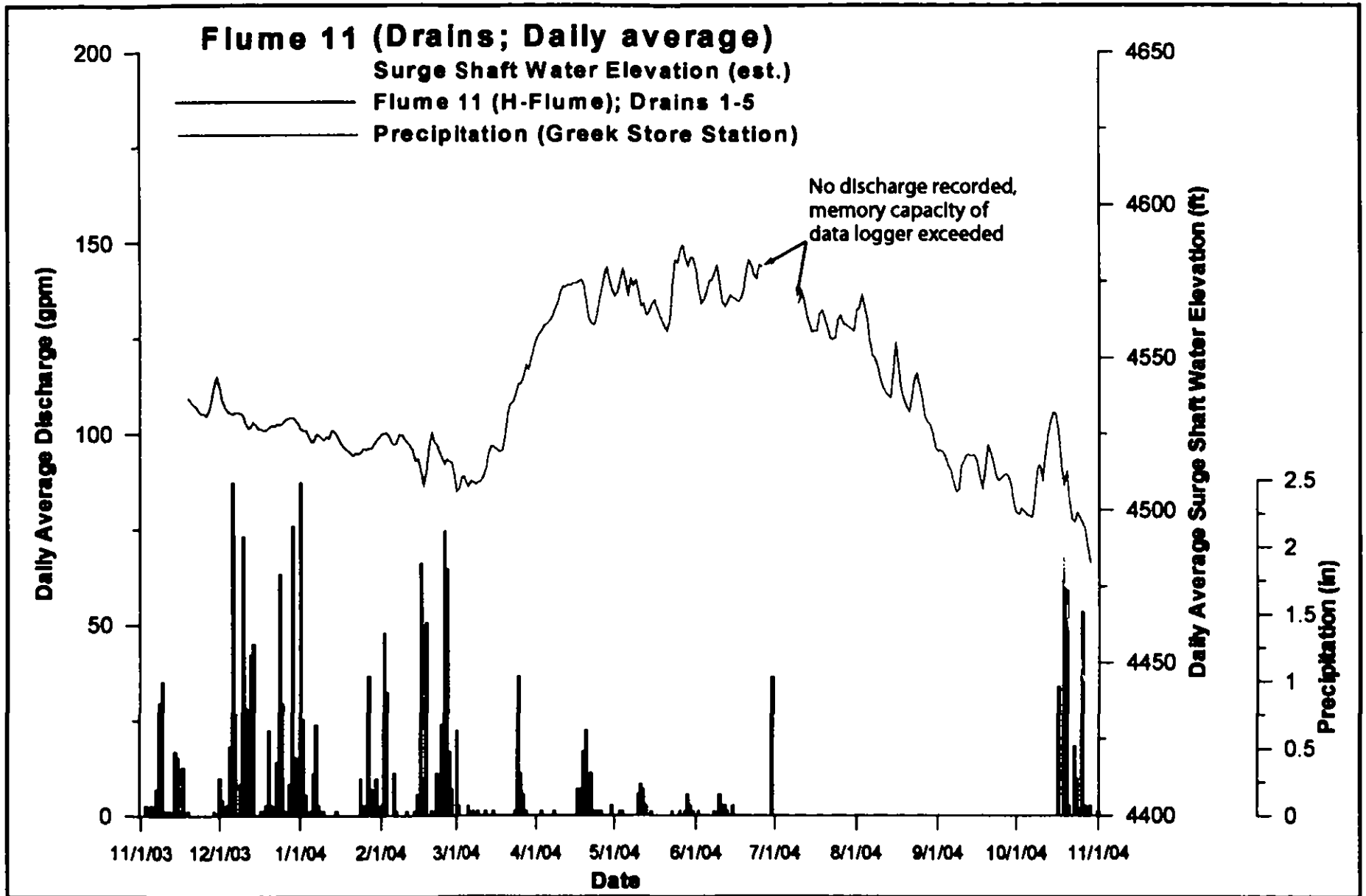


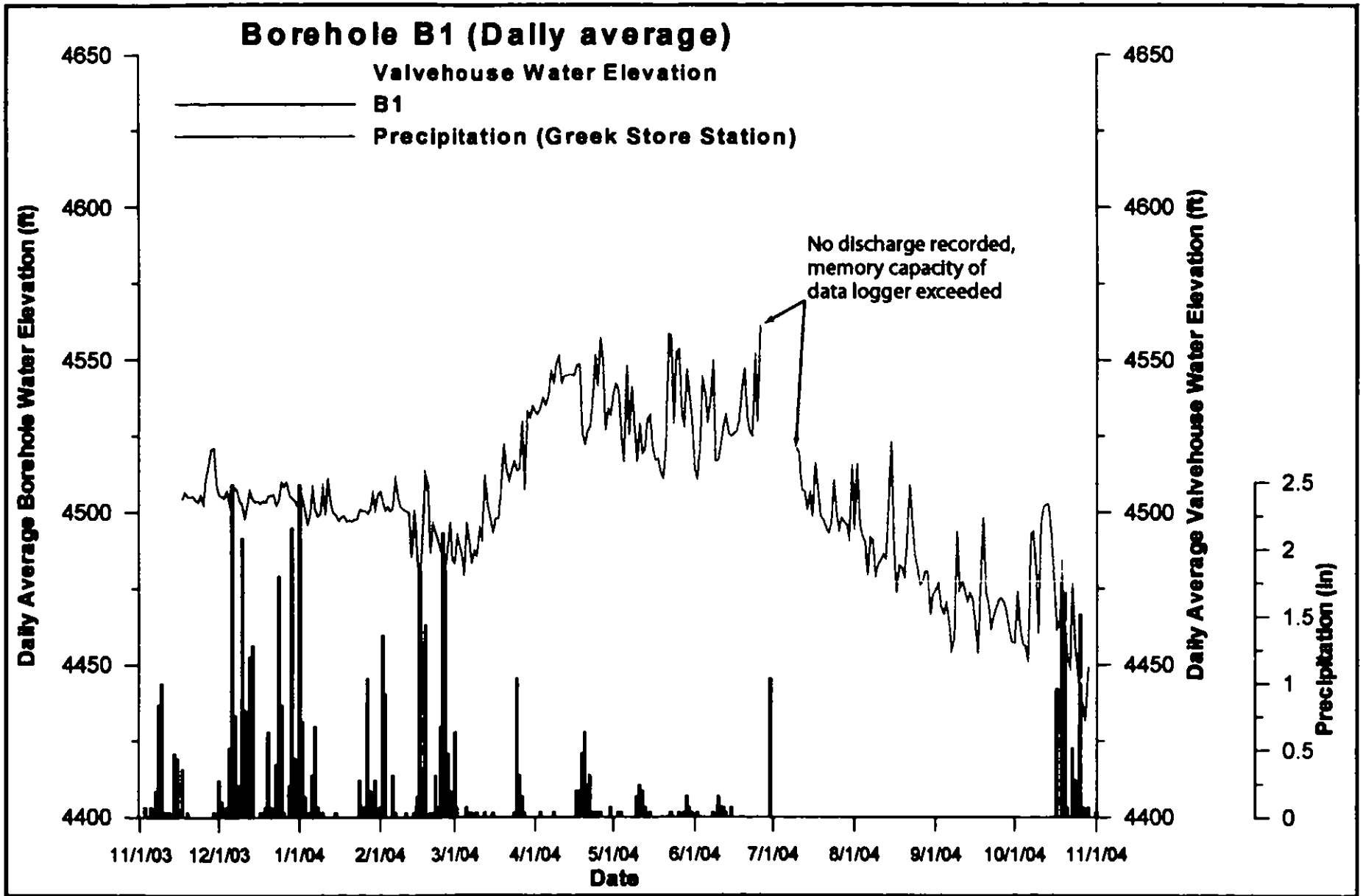


FLUME 11 DISCHARGE FOR PERIOD OF RECORD

Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft

FIGURE 9

BY	APPROVED BY	PROJECT NO.	SCALE	Date
TM, SB	WP	1062-106	As reported	12/8/04

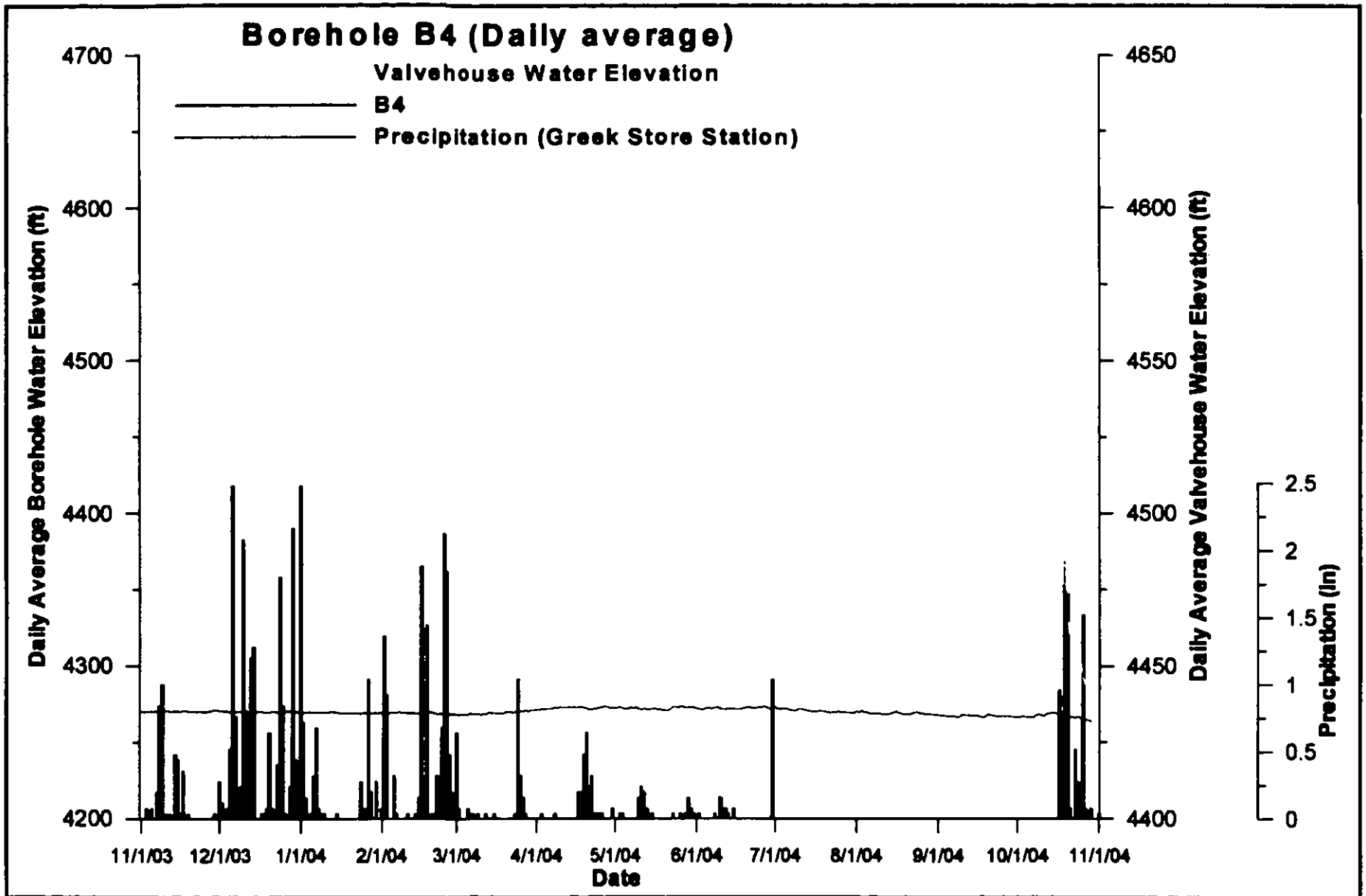


B1 WATER ELEVATIONS FOR PERIOD OF RECORD

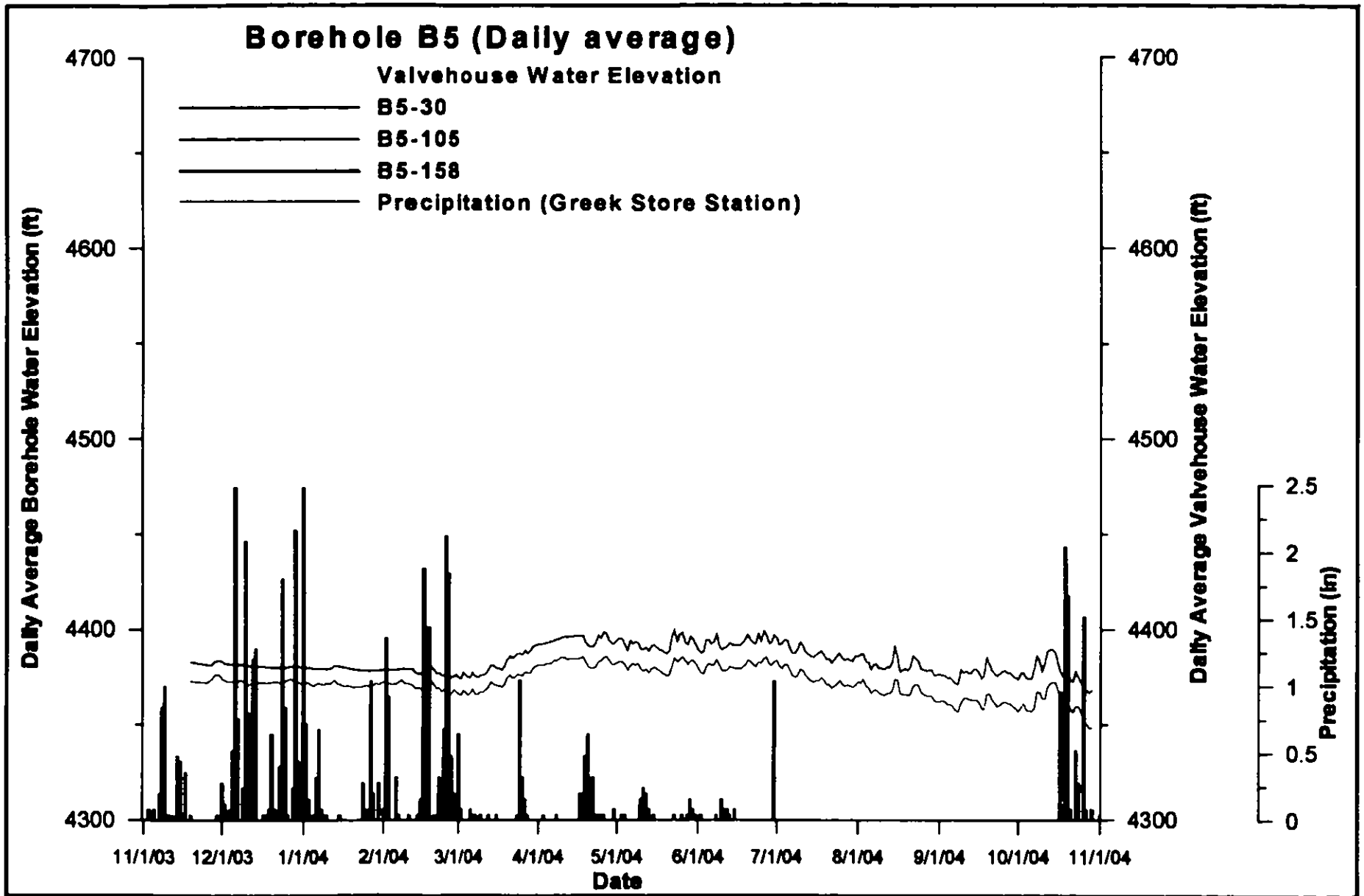
Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft

FIGURE 10

BY	APPROVED BY	PROJECT NO.	SCALE	Date
TM, SB	WP	1062-106	As reported	12/8/04



B4 WATER ELEVATIONS FOR PERIOD OF RECORD Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft				FIGURE 11
BY TM, SB	APPROVED BY WP	PROJECT NO. 1062-106	SCALE As reported	Date 12/8/04



PGS PE	**B5 WATER ELEVATIONS FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 12
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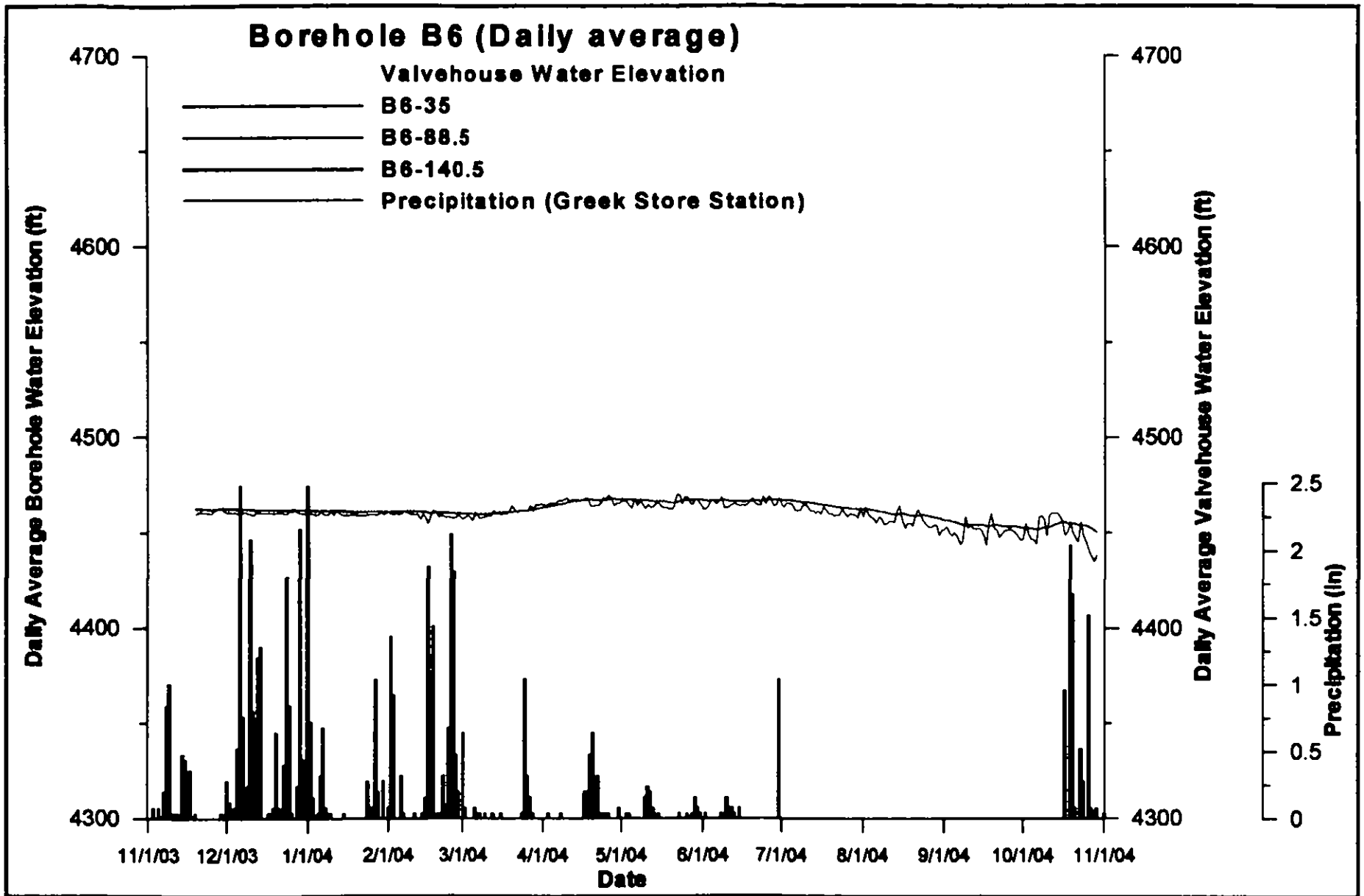

PGS PE	**B6 WATER ELEVATIONS FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 13
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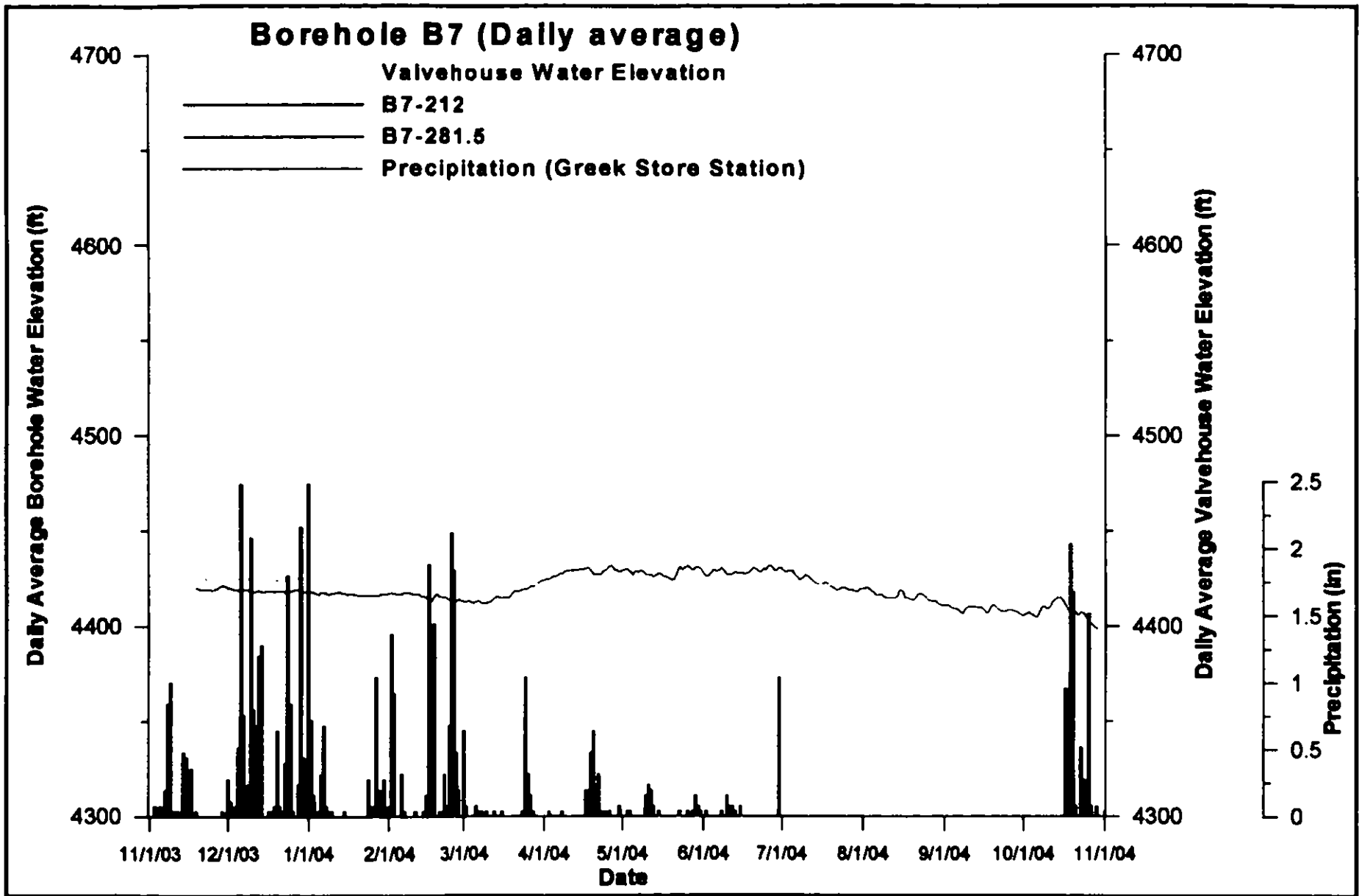

PGS PG&E	**B7 WATER ELEVATIONS FOR PERIOD OF RECORD** Weir, Flume, and Well Monitoring Data, Middle Fork Tunnel and Surge Shaft			FIGURE 14
	BY TM, SB	APPROVED BY WP	PROJECT NO. 1062-106	SCALE As reported	Date 12/8/04

APPENDIX A

WEIR, FLUME, AND PIEZOMETER MONITORING DATA

(see CD-ROM in back-cover pocket)