



# Annual Surveillance Report January 2022 to December 2022 for Sand Canyon Dam DSOD Dam No. 1029-002

Irvine, California

Submitted to:  
Irvine Ranch Water District  
Dams & Storage  
15600 Sand Canyon Avenue  
Irvine, CA 92618



Prepared by:  
GEI Consultants Inc.  
5901 Priestly Drive, Suite 301  
Carlsbad, CA 92008  
(760) 613-1429



May 2, 2023  
GEI Project No. 1901888

Consulting May 2, 2023  
Engineers and GEI Project No. 1901888  
Scientists

Ms. Danielle Drake,  
Assistant Engineer – Dams & Storage  
Irvine Ranch Water District  
15600 Sand Canyon Avenue  
Irvine, CA 92618

**Re: Sand Canyon Dam, DSOD Dam No. 1029-002,  
Annual Surveillance Report from January 2022 to December 2022**

Dear Ms. Drake:

GEI Consultants, Inc. (GEI) is pleased to submit this Annual Surveillance Report for Sand Canyon Dam covering January 2022 to December 2022. This report is part of the scope of work described under our Professional Service Agreement between Irvine Ranch Water District (District) and GEI Consultants Inc. (GEI) dated February 11, 2019.

We appreciate this opportunity to provide the District with our services. Please contact Emerson Revolorio at [erevolorio@geiconsultants.com](mailto:erevolorio@geiconsultants.com) or Rich Sanchez at [rsanchez@geiconsultants.com](mailto:rsanchez@geiconsultants.com) with any questions.

Sincerely,

**GEI CONSULTANTS, INC.**



Richard Sanchez, P.E.  
Principal Engineer



Emerson Revolorio, P.E.  
Project Engineer

# Table of Contents

---

<b>1.0 Introduction and Background</b>	<b>1-1</b>
1.1 General	1-1
1.2 Dam and Reservoir	1-1
1.3 Spillway	1-2
1.4 Outlet Works	1-2
1.5 Subdrains	1-3
<b>2.0 Instrumentation Measurements</b>	<b>2-1</b>
2.1 General	2-1
2.2 Piezometers	2-1
2.3 Seepage Flows	2-5
2.4 Movement Surveys	2-6
<b>3.0 Field Evaluations</b>	<b>3-1</b>
3.1 Field Evaluation of December 13, 2022	3-1
3.1.1 Dam	3-1
3.1.2 Spillway	3-1
3.1.3 Outlet Works	3-2
3.1.4 Seepage	3-2
<b>4.0 Conclusions and Recommendations</b>	<b>4-1</b>
4.1 Conclusions	4-1
4.2 Recommendations	4-3
<b>5.0 Limitations</b>	<b>5-1</b>
<b>6.0 References</b>	<b>6-1</b>

## List of Tables

---

Table 1	Piezometers – Maximum and Minimum Water Level Ranges
Table 2	Piezometer and Subdrain Measurements, January 2007 through December 2022
Table 3	Horizontal Movement of Survey Monuments 1975 through 2022
Table 4	Cumulative Horizontal Displacement of Survey Monuments, 1975 through 2022
Table 5	Elevations of Survey Monuments 1968 through 2022
Table 6	Cumulative Vertical Movement of Survey Monuments 1969 through 2022

## List of Figures

---

Figure 1	Site and Instrumentation Plan
Figure 2	Section A-A'
Figure 3	Section B-B'
Figure 4	2-Yr Open Well Piezometer and Reservoir Water Surface Elevations, Open Well Piezometers P-1A, P-1B, and P-6, January 2021 through December 2022
Figure 5	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-2A, P-2B, P-5, VBW/10A and VBW/10B, January 2021 through December 2022
Figure 6	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-4, P-8A, P-8B, VBW9A, VBW9B and VBW/11, January 2021 through December 2022
Figure 7	2-Yr Open Well Piezometer and Reservoir Water Surface Elevations, Open Well Piezometers P-3 and P-7, January 2021 through December 2022
Figure 8	2-Yr Vibrating Wire Piezometer and Reservoir Water Surface Elevations, Vibrating Wire Piezometers VBW/12, and VBW/13, January 2021 through December 2022
Figure 9	Historical Open Well Piezometer and Reservoir Water Surface Elevations, Open Well Piezometers P-1A, P-1B, and P-6, January 2012 through December 2022
Figure 10	Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-2A, P-2B, P-5, VBW/10A and VBW/10B, January 2012 through December 2022

- Figure 11 Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-4, P-8A, P-8B, VBW9A, VBW9B, and VBW/11, January 2012 through December 2022
- Figure 12 Historical Open Well Piezometer and Reservoir Water Surface Elevations, Open Well Piezometers P-3 and P-7, January 2012 through December 2022
- Figure 13 Historical Vibrating Wire Piezometer and Reservoir Water Surface Elevations, Vibrating Wire Piezometers VBW/12 and VBW/13, January 2012 through December 2022
- Figure 14 2-Yr Seepage, Reservoir Water Surface Elevations and Rainfall January 2021 through December 2022
- Figure 15 Historical Seepage Flow Rates and Reservoir Water Surface Elevations, January 2012 through December 2022
- Figure 16 Historical Cumulative Horizontal Displacement, Survey Monuments S-1, S-2, S-3, S-4, S-5, S-6, January 1995 through October 2022
- Figure 17 Historical Cumulative Vertical Movement Survey Monuments S-1, S-2, S-3, S-4, S-5, S-6, January 1995 through October 2022

## **Appendix**

---

Inspection Photographs of Sand Canyon Dam - December 13, 2022

Reservoir Dam Valve Exercising Table

CNC Survey Report

## **Acronyms and Abbreviations**

---

AC	asphalt concrete
AF	acre-feet
CML&C	cement-mortar-lined and coated
CMP	Corrugated Metal Pipe
District	Irvine Ranch Water District
DSOD	State of California, Department of Water Resources, Division of Safety of Dams
El, EL, Elev	elevation
ft	feet
GEI	GEI Consultants, Inc.
gpm	gallons per minute
gal/min	gallons per minute
H:V	Horizontal to Vertical
ID	identification
in.	inches
liter/min	liters per min
MW	monitoring well
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
No.	number
NOAA	National Oceanic and Atmospheric Administration
P.E.	Professional Engineer
P or Piez	Piezometer
RCP	reinforced concrete pipe
Res.	Reservoir
VW or VB	Vibrating Wire
W.S.	water surface
YR	year

## 1.0 Introduction and Background

---

### 1.1 General

This report presents the results of the dam safety monitoring and surveillance for Sand Canyon Dam conducted by the Irvine Ranch Water District (District) and GEI Consultants, Inc. (GEI) covering the period between January 2022 through December 2022. It includes a review of previous surveillance reports, a compilation of the field measurements, observations, and conclusions related to the general condition and safety of the dam. In addition, recommendations are provided for continued operation, surveillance, and monitoring of the dam. This report is submitted as part of the jurisdictional requirements of the State of California, Department of Water Resources, Division of Safety of Dams (DSOD).

Piezometer water levels, reservoir water surface elevations, and seepage flow rates covered in Table 2 are from 2007 to 2022 with representative plots in Figures 4 through 14. Tables 3 through 6 provide annual and cumulative horizontal and vertical movement based on survey data collected at Sand Canyon Dam. Annual (short term) and cumulative (long term) representations of the data help to identify any adverse trends or significant deviations in the data. Survey data tables and figures are presented to show the results of horizontal and vertical movement surveys from 1995 through 2022. Survey data tables also include limited data for years between 1968 and 1995. No surveys were conducted in calendar years 2017 and 2021. A survey was performed in October 2022 and included in this report.

The vertical datum indicated on the as-built plans and project documents for Sand Canyon Dam is National Geodetic Vertical Datum of 1929 (NGVD 29). The reservoir water surface elevation, piezometer instrumentation data and vertical survey data are currently based on NGVD 29.

### 1.2 Dam and Reservoir

Sand Canyon Dam is a 59-foot-high compacted embankment dam located on Sand Canyon Wash in Irvine, California. The dam was completed in 1943. The District took over operation of the Sand Canyon Dam and Reservoir in 1967 from The Irvine Company.

The dam crest is at Elevation 202 ft (NGVD 29). There is a one-foot-high concrete parapet wall (Top of Wall at Elevation 203 ft) along the upstream edge of the crest of the dam (Figures 1 and 2). The watershed drainage area is 6.8 square miles, and the spillway crest is at Elevation 193.5 ft, providing 8.5 ft of freeboard. The reservoir area is 51 acres and the reservoir capacity at the spillway crest elevation is 960 acre-feet upon original construction. The maximum capacity has been reduced from 960 acre-feet to 740 acre-feet due to sedimentation in the reservoir. (Draft Data Summary Report, Sand Canyon Dam, HDR

2021). The dam is 861 ft long with a 10-foot-wide crest. The crest is paved with Asphalt Concrete (AC).

The upstream face of the dam is lined with 3-inch-thick AC extending approximately 19 ft down from the crest of the dam and has a slope of 2.5H:1V. The downstream face of the dam is covered with grass and has a slope of 2H:1V.

The dam is a zoned embankment with an upstream shell zone consisting of "selected impervious" material, a central core zone of "random" material, and a downstream shell zone of "unselected pervious" material. During construction of the dam, test results indicated that the embankment is homogeneous and consists, for the most part, of medium dense sandy clay and clayey sand (DSOD, 1984). The dam was founded on alluvium across the original broad stream channel, and on sandstone of the Santiago Formation at the abutments. A cutoff trench was constructed under portions of the upstream and central zones of embankment material. The trench typically penetrates 2 to 4 ft into the sandstone bedrock but does not extend across the full width of the broad alluvial channel.

### **1.3 Spillway**

The spillway is located about 250 ft to the East from the right end of the dam. There is a rock knob that separates the dam and the spillway. The spillway consists of an approach section, an ungated concrete ogee weir, and a rectangular channel. The channel has 18-foot-high reinforced concrete retaining walls on both sides. The bottom of the channel is mostly unlined and consists of sandstone bedrock with filled-in areas of dental concrete. The channel conveys the water to an energy dissipation reinforced concrete structure that outlets to Sand Canyon Wash. The spillway crest is at Elevation 193.5 ft, which provides 8.5 ft of freeboard.

### **1.4 Outlet Works**

The outlet works consist of a 36-inch-diameter corrugated metal pipe (CMP) controlled by four upstream and three downstream gates. The upstream controls consist of three 24-inch-diameter inlet slide gates at Elevations 169.9, 177.1, and 185.0 ft, and one 20-inch-diameter main gate located near the upstream toe. The inlet gates are manually operated from the hand wheel controls located at the upstream edge of the crest of the dam.

The 36-inch CMP connects to a 20-inch steel outlet pipe under the dam, 260 ft in length and transitions to a 24-inch-diameter distribution line near the downstream toe of the dam. The 24-inch-diameter distribution line splits into a 24-inch-diameter force main and 20-inch-diameter force main. At approximately 330 ft downstream of the toe of the dam, two 24-inch-diameter butterfly outlet valves exist along with a 24-inch butterfly valve that controls flow into Sand Canyon Wash (Figure 1).



The District provided a Reservoir Dam Valve Exercising summary table which states that on 4/14/2022 the valves were exercised. The District also fully exercised the two 24-inch blowoff valves #1 and #2 on October 18, 2022. The table is provided in the Appendix of this report.

## **1.5 Subdrains**

There is no internal drainage system within the embankment installed during the construction of the dam. However, two seepage subdrains referred to as the Left Subdrain and Right Subdrain, were installed at the downstream toe near the left groin (Figure 1). The Left Subdrain consists of a 6-inch pipe with two 4-inch branches, while the Right Subdrain is a 6-inch pipe extending approximately 100 ft parallel to the toe (DSOD, 1984). The two subdrains discharge into a Drain Junction Vault located at the downstream toe of the dam near the left abutment. The flow from the two subdrains is measured at a small Drain Junction Vault by the District staff monthly.

## 2.0 Instrumentation Measurements

---

### 2.1 General

Instrumentation at Sand Canyon Dam includes 18 piezometers, two seepage subdrains, and six survey monuments. District staff measure the water levels in the reservoir, levels in the piezometers, and measure the seepage flow rates monthly and immediately following significant seismic events. The survey monuments are surveyed annually by a licensed surveyor under contract with the District. Precipitation is measured on-site.

Figure 1 is a Site and Instrumentation Plan showing the layout of the dam and appurtenances, as well as the locations of the piezometers, seepage collection subdrains, and survey monuments. The left and right designations are as viewed looking downstream.

Throughout this report, instrumentation measurements and readings that remained within historical limits and followed historical trends will be classified as normal. Historical limit is classified as the range between maximum and minimum water levels within the past ten years.

Based on the ten-year historical data from January 2012 through December 2022, the reservoir water surface elevation varied from a minimum Elevation of 163.6 ft to a maximum Elevation of 194.1 ft. During the 2022 review period, the reservoir water surface elevation varied from a minimum Elevation of 175.3 ft to a maximum Elevation of 187 ft, see Table 2. The reservoir water surface elevations during the 2022 review period remained within historical limits and considered normal.

### 2.2 Piezometers

Originally, the dam had 18 open-well piezometers. An open-well piezometer is a small-diameter well, used mainly to measure the pressure or depth of groundwater. It is typically installed as a casing in a vertical borehole and has a discrete perforated zone near its bottom to enable monitoring of changes in groundwater levels within that zone. More than one piezometer can be installed within a single, larger-diameter outer well casing. These groups of piezometers are often referred to as multi-stage or nested piezometers. Piezometers 1 through 8 remain as open-well piezometers with an A and B designations for nested piezometers (1A & 1B, 2A & 2B, and 8A & 8B). Both A & B are placed in the same hole but at different elevations.

In 2015, the District converted Piezometers 9 through 13 to vibrating wire piezometers. All the vibrating wire piezometers were recording erroneous digital readings from February 2019 until December 2020 (Table 2). The erroneous readings are marked in red as shown in Table 2. The District reported they were having problems with the digital data logger. The District was able to

fix the data logger unit with the help of the manufacturer (Geokon) and provided readings for the 2021 review period. The readings appear to be given as depths and in units of feet and follow the historical trends seen before the data logger malfunction. Vibrating wire piezometers contain a high tensile steel wire attached at one end to a diaphragm. The frequency of vibration in the wire induces an alternating electrical current in a coil. The magnitude of the current is detected, and the reading is then converted to a pressure. The pressure fluctuates with changes in water levels in the immediate vicinity of the piezometer tip. The vibrating wire piezometers at the dam are designated with a V to identify them as such and with an A or B for nested piezometers (VBW9A & 9B and VBW/10A & 10B). Again, both A and B are placed in the same hole.

The location of each piezometer is shown on Figure 1. Thirteen of the 18 piezometers are located either at or near the maximum section of the dam. Three of the remaining five piezometers are in the right portion of the dam and two are in the left portion.

Table 2 lists the reservoir water surface elevations and piezometer water levels from January 2007. Figures 4 through 8 are 2-year graphical plots (January 2021 through December 2022) of the piezometer data and reservoir water levels. Figures 9 through 13 are historical 10-year graphical plots (since 2012) of the piezometer data and reservoir water levels.

The following is a discussion of the piezometers including the water level measurements during the 2022 review period as well as comparisons with historical trends. As noted above the vibrating wire piezometers were producing erroneous digital readings from February 2019 to December 2020. The District provided readings for the vibrating wire piezometers for the 2022 review period, and they follow historical trend.

Table 1 provides the ranges between maximum and minimum water levels in each piezometer based on trends from the ten-year historical data from January 2011 through December 2021, the ranges between maximum and minimum water levels during the 2021 review period, and the ranges between maximum and minimum water levels during the 2022 review period. Outlier readings with isolated spikes or drops were not considered reliable and were not included in the maximum and minimum water level range.

**Table 1. Piezometers – Maximum and Minimum Water Level Ranges**

Piezometer	2011-2021 10-year Maximum and Minimum Range (ft)	2021 Review Period Maximum and Minimum Range (ft)	2022 Review Period Maximum and Minimum Range (ft)	Comment
P-1A	1.3	0.9	0.1	Piezometer water levels have been reported near the bottom of well elevation. It was verified as dry by IRWD staff during inspection.
P-1B	7.6	1.9	5.2	
P-2A	9.4	2.2	5.8	
P-2B	5.9	2.2	11.6	Reading on 9/29/2022 was 6.9 ft above historical max. Reading on 12/29/2022 was 7.4 ft above historical max.
P-3	22.2	5.2	9.8	
P-4	6.4	2.0	2.6	
P-5	6.7	1.7	2.7	
P-6	6.7	1.9	4.1	
P-7	12.0	2.1	3.4	Reading on 12/29/2022 was omitted due to isolated drop. It appears to be a reading error. A reading was taken during the annual inspection to confirm the piezometer water level followed historic range values.
P-8A	9.3	2.3	7.6	Reading on 1/25/2022 was 1.8 ft below historical min. A reading was taken during the annual inspection to confirm the piezometer water level followed historic range values.
P-8B	11.8	3.7	5.6	
VBW9A	7.3	0.5	1.0	Multiple piezometer water levels have been reported at the bottom of the piezometer tip elevation or near the bottom of the piezometer tip elevation.
VBW9B	7.9	0.7	1.1	
VBW/10A	9.0	1.1	1.6	
VBW/10B	7.0	2.3	2.2	Multiple piezometer water levels have been reported at the bottom of the piezometer tip elevation or near the bottom of the piezometer tip elevation.
VBW/11	2.6	0.4	0.6	Multiple piezometer water levels have been reported at the bottom of the piezometer tip elevation or near the bottom of the piezometer tip elevation. The piezometer is considered dry.
VBW/12	5.2	0.2	0.1	All piezometer water levels have been reported at the bottom of the piezometer tip elevation or near the bottom of the piezometer tip elevation. The piezometer is considered dry.
VBW/13	5.7	0	0	All piezometer water levels have been reported at the bottom of the piezometer tip elevation or below the bottom of the piezometer tip elevation. The piezometer is considered dry.

Piezometers P-1A, P-1B, and P-6 are located near the right end of the dam along a similar cross section of the dam. Piezometers P-1A and P-1B are located on the crest of the dam, while Piezometer P-6 is near its toe. The tip of Piezometer P- 1A (Elevation 159.3 ft) is located within the embankment, while Piezometers P-1B and P-6 have tips within the foundation alluvium (Elevations 132.9 ft and 127.7 ft, respectively). Piezometer P-1A remained dry during 2022 (Figure 4) and has historically shown slight to no response to the

reservoir water level changes (Figure 9). Piezometers P-1B and P-6 tracked the reservoir level indicating groundwater levels within the alluvium foundation are responsive to reservoir water levels changes. These piezometers remained within historical limits (Figures 4 and 9).

Piezometers P-2A and P-2B are located on the crest of the dam, Piezometer P-5 is located near the toe of the dam, while Piezometers VBW/10A and VBW/10B are located at the downstream face of the dam. All five piezometers are near the maximum section of the dam. The tips of Piezometer P-2A, P-2B, P-5, VBW/10A, and VBW/10B are at Elevations 153.9 ft, 123.8 ft, 129.6 ft, 148 ft, and 136.1 ft, respectively. Piezometers P-2A installed within the dam embankment, generally tracked the reservoir levels during 2022 (Figure 5). As stated above, Vibrating Wire Piezometers VBW/10A and 10B were producing erroneous digital readings from February 2019 to December 2020. The water level observed in VBW/10A appears to follow the historical trend before the erroneous readings. The water levels observed in piezometers P-2A and VBW/10A remained within historical levels (Figures 5 and 10).

Piezometers P-2B, P-5, and VBW/10B are installed within the foundation alluvium. Piezometer P-2B tracked the reservoir levels slightly during the 2022 review period, see Figure 5. The exceptions were on 9/29/2022 and 12/29/2022, where the readings in P-2B rose approximately 6.9 and 7.4 ft, respectively beyond the historical max but generally remained at normal levels throughout the review period. GEI thinks the unusual rise in readings might be due to an obstruction in the well since readings are near elevation 150 ft. Piezometer VBW/10B had slight fluctuations with a maximum change of 2.2 ft during the review period. Multiple water levels were reported at the bottom of the tip elevation or near the bottom of the tip elevation. P-5 in 2022 had slight fluctuations with a maximum change of 2.7 ft during the review period. The water levels observed in VBW/10B, P-2B, and P-5 piezometers remained within historical levels (Figure 10) during the 2022 review period, with the exceptions stated above and in Table 1.

Piezometers P-4, P-8A, P-8B, VBW9A, VBW9B and VBW/11 are located along another plane near the maximum cross section of the dam. Piezometers P-8A & P-8B are located on the crest of the dam, Piezometer P-4 is located near the toe of the dam, and Piezometers VBW9A & VBW9B are located along the downstream face of the dam along with Piezometer VBW/11. Graphs of the water levels during the two-year period from January 2021 through December 2022 are shown on Figure 6, and graphs for the historical period from January 2012 through December 2022 are shown on Figure 11. Piezometers P-8A, VBW9A, and VBW/11 are installed within the dam embankment. Piezometers P-8A continues to respond to reservoir water surface fluctuations. Vibrating wire piezometers VBW9A, VBW9B, and VBW/11 were producing erroneous digital readings from February 2019 to December 2020. As stated previously, the District fixed the data logger problem and provided readings for the 2022 review period. For the 2022 review period, VBW9A was mostly dry, see Figure 6. The

water level observed in the piezometers during the 2022 review period was consistent with historical levels (Figure 11). Piezometers P-4 and P-8B are installed in foundation bedrock, and VBW9B was installed in foundation alluvium. Piezometers P-8B generally responded to reservoir water surface fluctuations, while fluctuation in Piezometer P-4 appears related to rainwater. During the review period, VBW9B and VBW/11 had minor fluctuations and the range between maximum and minimum levels were 1.1 ft and 0.6 ft respectively. VBW/11 had multiple readings at the bottom of the piezometer tip elevation or near the bottom of the piezometer tip elevation. The water levels observed in these piezometers during this 2022 review period were consistent with historical levels (Figures 6 and 11).

Piezometers P-3 and P-7 are located in the left portion of the dam. Piezometer P-3 is located on the crest of the dam, while Piezometer P-7 is on the downstream face near the left groin. Graphs of the water levels during the two-year period from January 2021 through December 2022 are shown on Figure 7, and those for the historical period from January 2012 through December 2022 are shown on Figure 12. The tips of these piezometers are set below the base of the embankment, and possibly into bedrock. During the 2022 review period and historically, both piezometers tracked the reservoir levels closely. The water levels observed in these piezometers during this 2022 review period were consistent with historical levels (Figures 7 and 12).

Vibrating wire piezometers VBW/12 and VBW/13 are located in the maximum section area of the dam at the downstream toe area. Graphs of the water levels during the two-year period from January 2021 through December 2022 are shown on Figure 8, and those for the historical period from January 2012 through December 2022 are shown on Figure 13. The tip elevation of these two piezometers is within the dam embankment. These two piezometers along with the other vibrating wire piezometers were producing erroneous readings from February 2019 to December 2020. Prior to the start of these piezometers producing erroneous readings, water levels had responded to reservoir water surface fluctuations, and historically these two piezometers were consistent with past levels (Figure 13). During the 2022 review period, both piezometers had readings near the bottom of the piezometer tip elevation or at the piezometer tip elevation. Both piezometers appear to be dry, see Figure 13.

Based on GEI's review, the piezometer data remained normal and consistent with historical levels. Based on the data provided by the District, the vibrating wire piezometer data loggers appear to be working. The new readings appear to be correct and are following the historical trends prior to the data logger producing erroneous readings.

### **2.3 Seepage Flows**

There are no internal drains installed during construction of the dam but because of seepage appearing at the downstream toe soon after filling, the Left Subdrain was installed near the downstream toe at the left groin. In 1976, The Right Subdrain was added.

Figure 14 represents the seepage flow rates from the Left and Right Subdrains versus the reservoir water surface elevations for the two-year period from January 2021 through December 2022. Figure 15 covers the historical period from January 2012 through December 2022. Tabulated data for the seepage flow rates is presented in Table 2.

The range of minimum and maximum flow rate for the Left Subdrain based on trends from the ten-year historical data from January 2011 through December 2021 was between 0 and 4.23 gallons per minute (gpm).

During 2021, the Right Subdrain remained dry, while the Left Subdrain flow rate tracked the reservoir levels and ranged from 0.19 gpm to a maximum flow rate of 1.36 gpm on March 23, 2021. Historically, the left subdrain seepage tracks the reservoir level (Figure 15).

During 2022, the Right Subdrain remained dry, while the Left Subdrain flow rate tracked the reservoir levels and ranged from 0.27 gpm to a maximum flow rate of 1.59 gpm on 1/25/2022 and 2/22/2022. Historically, the left subdrain seepage tracks the reservoir level (Figure 15).

Based on GEI's review of the seepage data, the flow rates continue to be consistent with historical flow rates and there are no indications of unusual conditions or trends. The flows should continue to be observed for clarity to check for the presence of any suspended solids that might indicate a potential piping condition.

## 2.4 Movement Surveys

There are six survey monuments (S-1 through S-6) located on the crest of Sand Canyon Dam spanning from the left abutment to the right abutment (Figure 1). Survey Monuments S-1 through S-5 were initially read on September 15, 1969, while S-6 was initially read on October 20, 1987. Starting in 1995 the monuments are normally surveyed annually by a licensed surveyor under contract with the District.

Table 3 presents the horizontal movement of the survey monuments compared to the baseline measurements, while Table 4 presents the cumulative horizontal displacement of the survey monuments since 1975. Table 5 presents the survey monument elevations from 1968 through 2022, while Table 6 presents the cumulative vertical movement of the survey monuments since 1969. Figures 16 and 17 are graphical presentations of the cumulative horizontal displacement and cumulative vertical movement of the survey monuments since 1995, respectively.

No survey was performed in 2017 and 2021. A survey was performed on October 27, 2022, and has been included with this report. The survey report is provided in the Appendix of this report. The data for 2022 has been reviewed and found within historic limits and trends. The cumulative horizontal (+0.1 inch) and vertical (+0.1 inch) movements show relatively minor changes (Tables 3 thru 6) during the review period and most likely related to temperature and reservoir level changes. The exception was survey monument S-2 which had a horizontal movement of 0.3

inches. This type of movement has been measured in the past and appears to be within historical changes due to survey accuracy, reservoir water level changes and temperature changes. Based on GEI's review of the historical data, the horizontal and vertical movements are judged to be minimal with no unusual movements.



## **3.0 Field Evaluations**

---

### **3.1 Field Evaluation of December 13, 2022**

A field evaluation and inspection were performed by Richard Sanchez and Emerson Revolorio of GEI, Steve Habiger of the District on December 13, 2022. The reservoir level was reported to be at Elevation 185.3 ft and 8.2 ft below the spillway crest. Weather conditions were cool and partly cloudy with temperature in the high 40s to mid-50s. Photos taken by GEI are included in the Appendix of this report.

#### **3.1.1 Dam**

The crest of dam was walked, and the asphalt concrete surface was observed to be in good condition with no signs of movement and significant cracking, see Photos 1 through 3. Minor temperature related AC cracking was observed near the left abutment, see Photos 2 and 3. The exposed upstream AC-lined slope face above the reservoir water level had some long-standing transverse and longitudinal shrinkage-expansion cracking with vegetation growing within the cracks, see Photo 1 and 3. GEI also observed brush growing on the upstream slope within the reservoir near the water line, see Photo 1 and 3. The dam crest and upstream face looked similar to what was observed during the April 2022 inspection. The downstream toe area, downstream embankment slope, and both groin areas were inspected. GEI inspected the previously reported desiccation cracks near piezometer P-7. The cracks appear to have closed and are not considered a dam safety issue. No signs of surficial movement, instability, or wet spots were seen.

The downstream slope grass has been mowed since the last inspection, see Photos 4 and 5. During the inspection, GEI saw active rodent activity along the dam. There were multiple locations that were marked with flags where rodent activity was significant, see Photo 6. There was also lack of poison in the rodent control feeder boxes throughout the dam. No signs of live seepage were seen on the downstream slope face. Overall, the condition of the dam remains largely unchanged from the conditions observed during the April 18, 2022, inspection. Overall, the dam was well maintained with no signs of instability, or distress.

#### **3.1.2 Spillway**

The approach and ungated ogee section open channel spillway were clear, see Photos 7 through 9. Minor brush/tule growth was noticed at the end of the stilling basin, see Photo 15. The District is aware this vegetation growth has to be monitored continuously and cut as required. GEI inspected the right spillway concrete wall in the upper section of the spillway channel that has a vertical wall joint offset between concrete wall section, see Photos 9 and 10. GEI confirmed that there hasn't been any movement since the last inspection. The vertical offset is still

approximately 1-inch. Under high spillway flows this offset could potentially result in some concrete damage along the joint. The expansion joint material between the spillway panels is deteriorating and needs to be repaired, see Photo 11. During the inspection, GEI found undermining of previous localized concrete repair areas in the spillway channel floor on the right side of the spillway. The undermining was approximately 12-inches wide and 9 inches in height, see Photos 12 through 14. Further undermining can occur during high spillway flows and cause damage to the spillway wall foundations. GEI also observed vegetation directly above the spillway channel walls.

The exposed concrete wall surfaces, ogee section, rock/concrete in-fill channel bottom, and stilling basin were inspected, and no unusual conditions were found. No signs of instability were seen.

### **3.1.3 Outlet Works**

The four upstream outlet gates and three downstream blowoff/control valves were not exercised during this inspection. The District reported they were all exercised on April 14, 2022. The District also fully exercised the two 24-inch blowoff valves #1 and #2 on October 18, 2022. Based on the District's report, and observations of the control equipment; the outlet works for the dam appeared fully operational, see Photo 16. Figure 1 shows the locations of the outlet works facilities which consist of three upstream 24-inch outlet gates (Nos. 1, 2, and 3), and one 20-inch diameter main lower outlet slide gate. Downstream of the dam, there are two 24-inch outlet valves and a 24-inch blowoff butterfly valve for lowering the reservoir level in an emergency, see Photos 17 and 18. The outfall is located within the creek area. During the inspection GEI was not able to locate the 30-inch blowoff outfall due to heavy vegetation and water.

### **3.1.4 Seepage**

Seepage flow rates continue to be monitored and measured monthly by District staff. A small seepage flow, estimated at 2.0 gpm, was observed in the Left Subdrain and the Right Subdrain was dry during this inspection. The observed seepage conditions were within past levels and based on past records and observations. Seepage water did not appear to have turbidity and appeared to be clear, see Photo 19.

## 4.0 Conclusions and Recommendations

---

### 4.1 Conclusions

- 1) Based on the review of available instrumentation data and the field inspection, the dam does not appear to have signs of structural deficiencies, seepage, and instability.
- 2) Piezometer water levels were normal during the report period and appear consistent and within historical ranges. As noted above, piezometer P-1A, VBW/11, VBW/12 and VBW/13 are considered dry.
- 3) Piezometer P-2B has had 4 readings near elevation 150 ft in the past 2 years. On 8/24/2021 with a reading of 149.6 ft, 9/28/2021 with a reading of 149.2, 9/29/2022 with a reading of 149.3 ft and 12/29/2022 with a reading of 150.6 ft. The readings appear to be random spikes and might be due to an obstruction in the well since the readings are near elevation 150 ft.
- 4) Seepage flow rates during this review period are within historical values and trends.
- 5) Horizontal and vertical movement are within historical values and trends.
- 6) The downstream face grass cover has been mowed since the April 2022 inspection.
- 7) GEI saw active rodent activity along the dam. There were multiple locations that were marked with flags by the District where rodent activity was significant. There was a lack of poison in the rodent control feeder boxes.
- 8) The District had removed some vegetation along the upstream face of the AC liner. The long-standing transverse and longitudinal shrinkage-expansion cracking appeared similar to what was observed during the April 2022 inspection.
- 9) Brush/tule growth was sprouting at the end of the spillway stilling basin.
- 10) The AC pavement on the dam crest has minor temperature expansion cracking.
- 11) All outlet valves were not exercised during the inspection. Per the District, the outlet valves were last exercised on 10/18/2022. The District tested the operation of the valves and flowed water through them. Based on visual observations of exposed control equipment and District's comments, the outlet facilities remain fully functional.
- 12) The area surrounding the 30-inch blowoff outfall has significant overgrown vegetation and the outfall could not be located.
- 13) GEI was not able to confirm the location of the downstream control valves and utility lines because the existing as-built plans do not match the actual conditions of the area.
- 14) The spillway was found clear and with no obstructions. Concrete surfaces and exposed rock surfaces had no observed signs of structural deficiencies. GEI did examine and

noted that the longstanding one-inch vertical joint offset at the right spillway concrete wall had not changed from GEI's past observations. The expansion joint material between the spillway panels is deteriorating and needs to be repaired.

- 15) GEI found undermining of previous localized concrete repair areas in the spillway channel floor on the right side of the spillway.
- 16) GEI observed vegetation directly above the spillway channel walls.
- 17) GEI inspected the previously reported desiccation cracks near piezometer P-7. The cracks had closed.

## 4.2 Recommendations

- 1) The District needs to fill the rodent control feeder boxes with poison and backfill any new rodent holes observed on the dam.
- 2) Surveyor needs to provide reservoir elevation, reservoir water temperature, air temperature and weather conditions for each survey.
- 3) The District needs to confirm if piezometers P-1A, VBW/11, VBW/12 and VBW/13 are dry.
- 4) The District needs to clean out piezometer P-2B.
- 5) The grass cover on the downstream slope surface needs to be continuously maintained and mowed to a grass height between 2 to 4 inches.
- 6) Repair AC at localized crack areas on the upstream slope and crest of the dam. These cracks should be repaired with a manufacturer recommended AC repair product. Vegetation and brush at the upstream slope need to be removed.
- 7) The outlet controls shall continue to be fully exercised annually.
- 8) The District needs to remove the overgrown vegetation and silt at the 30-inch blowoff line outfall to Sand Canyon Wash and ensure the discharge end is not clogged or blocked by debris or vegetation.
- 9) The District needs to locate the downstream control valves and utility lines near the outlet fall and provide updated as-built plans.
- 10) The District needs to continue monitoring brush/tule growth at the spillway stilling basin and cut when appropriate to avoid any damage to spillway concrete or impacts to spillway operability.
- 11) The right spillway concrete wall vertical joint offset had not changed from the previous inspections. The vertical wall offset needs to be examined and measured during District inspections and after spillway flows for further movement and evaluation. The vertical joint also needs to be kept well sealed with a flexible joint sealant.
- 12) The expansion joint material between the spillway wall panels needs to be repaired with a flexible joint sealant.
- 13) The District needs to repair the undermining of previous localized concrete repair areas in the spillway channel.
- 14) GEI recommends clearing the vegetation directly above the spillway channel walls.
- 15) GEI recommends continuously monitoring the desiccation cracks near piezometer P-7.

- 16) Continued careful monitoring by the District staff of the condition of the dam, appurtenances and instrumentation is essential. Staff needs to be inspecting for signs of distress or movement, increased seepage, or any other unusual conditions including instrumentation readings during their periodic inspections. Any unusual observations should be reported immediately to the Dam Safety Engineer.
- 17) GEI recommends continuing following IRWD's Dam Safety Program Guidelines after a 4.0 earthquake.

**Sand Canyon Dam Action Item Summary**

<b>Item</b>	<b>Location</b>	<b>Maintenance</b>	<b>Measures</b>
Rodent activity	Throughout dam	Active rodent holes and lack of poison in rodent control feeder boxes	Place poison in all the rodent control feeder boxes.
Movement Surveys	Throughout dam	Need additional information	Provide reservoir elevation, reservoir water temperature, air temperature and weather conditions for each survey.
Piezometers P-1A, VBW/11, VBW/12, and VBW/13	Throughout dam	N/A	Confirm if piezometers are dry.
Piezometer P-2B	Dam crest	Possible obstruction in piezometer	Clean out piezometer.
Grass cover	Dam downstream face	Continuous	Continuously maintain and mow grass cover to a height of 2 to 3 inches.
AC pavement	Dam crest	Shrinkage-expansion temperature cracking	Repair AC pavement by filling in cracks and creating a smooth surface.
AC Liner	Upstream face	Shrinkage-expansion temperature cracking and vegetation growth in cracks	Repair areas with large cracks by filling in and creating a smooth surface. Remove vegetation.
AC Liner	Upstream face near water line	Overgrown brush within the reservoir near the water line	Remove brush.
30-inch blowoff outfall	Downstream of dam	Significant overgrown vegetation	Remove overgrown vegetation around blowoff discharge.
Downstream control valves and utility lines	Downstream of dam	Unable to locate	Locate control valves and utility lines and provide updated as-built plans.
Stilling basin	Spillway stilling basin	Brush/tule growth	Cut and maintain.
Spillway channel wall	Right spillway concrete wall vertical joint	Vertical wall joint with approximately a 1-inch offset between concrete wall sections	Continue to monitor. The offset needs to be examined and measured during periodic inspections and after spillway flows. Report to Dam Safety Engineer if the wall continues to deflect.

Item	Location	Maintenance	Measures
Spillway channel wall	Right spillway concrete wall vertical joint	Expansion joint material between spillway wall panels is deteriorating	Repair with flexible joint sealant.
Spillway channel walls	Spillway	Overgrown vegetation above spillway channel walls	Remove vegetation directly above the spillway channel walls.



## 5.0 Limitations

---

This report presents observations made, conclusions drawn, and opinions formed from (1) a visual inspection of the Sand Canyon Dam and its appurtenant structures, and (2) a review of instrumentation data, including piezometer levels and seepage, collected by the District and reported since 1975. The purpose of the inspection and review is to assess the safety of the structure for continuing operation. Reuse of this report for any other purposes, in part or in whole, is at the sole risk of the user.

In the context intended above, the term "safety" is interpreted to be restricted specifically to major structural and control features of the project in regard to their adequacy against possible catastrophic failure due to natural or operational events. No consideration is given herein to those public safety aspects related to voluntary occupancy or use of project features in such manner as to result in personal mishaps.

The undersigned who performed the inspection and reviewed the instrumentation data and prepared this report, desire that it be clearly understood that the conclusions regarding the condition and safety of the dam and related facilities are not guaranteed but do represent our best judgment. Inevitably, such judgment must be recognized to be affected to an uncertain degree by the practical limitations that affect all dam evaluations, relative principally to approximate knowledge of the existing properties of the structures and their foundations, the potential for storm or seismic damage, and the uncertainties that are known to exist in estimating margins of safety.

The conclusions and professional opinions presented herein were developed by GEI Consultants, Inc. for the Irvine Ranch Water District in accordance with generally accepted engineering principles and practices. We make no other warranty, either expressed or implied.

## 6.0 References

---

California Department of Water Resources, Division of Safety of Dams (DSOD), 1984, Sand Canyon Dam, 1029-2, Safety Review Report; safety Review Report; by DSOD; date April 1984.

California Department of Water Resources, DSOD, 2020, Inspection of Dam and Reservoir in Certified Status report; October 19, 2020.

HDR. 2021, Draft Data Summary Report, Sand Canyon Dam, July 2021

## Tables

---

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
1/31/2007	176.80		41.6	160.3	59.1	142.7	35.2	166.7	62.7	139.3
2/28/2007	177.60		42.5	159.4	59.2	142.6	35.5	166.4	62.6	139.4
3/29/2007	177.10		42.3	159.6	59.2	142.6	35.6	166.3	62.6	139.4
4/27/2007	176.60		42.3	159.6	59.3	142.5	35.3	166.6	62.8	139.2
5/24/2007	176.80		42.3	159.6	59.7	142.1	35.9	166.0	63.1	138.9
6/27/2007	179.90		42.5	159.4	59.6	142.2	35.3	166.6	63.4	138.6
7/27/2007	177.80		42.4	159.5	60.0	141.8	35.8	166.1	64.0	138.0
8/28/2007	177.20		42.4	159.5	60.1	141.7	35.5	166.4	64.1	137.9
9/26/2007	177.00		42.5	159.4	59.7	142.1	35.7	166.2	63.8	138.2
10/30/2007	175.50		42.5	159.4	59.6	142.2	36.0	165.9	63.9	138.1
11/27/2007	175.90		42.5	159.4	59.9	141.9	36.3	165.6	63.9	138.1
12/27/2007	178.20		42.6	159.3	59.5	142.3	36.4	165.5	63.0	139.0
1/30/2008	184.40		42.4	159.5	57.7	144.1	35.8	166.1	61.0	141.1
2/26/2008	186.10		42.4	159.5	57.0	144.8	34.9	167.0	60.7	141.3
3/26/2008	188.00		42.6	159.3	56.6	145.2	33.8	168.1	60.8	141.2
4/25/2008	191.00		42.4	159.5	56.5	145.3	32.7	169.2	61.0	141.0
5/28/2008	190.93		41.4	160.6	55.9	145.9	31.3	170.6	60.3	141.7
6/25/2008	189.50		42.3	159.6	56.1	145.7	30.7	171.2	60.5	141.5
7/29/2008	185.10		41.4	160.5	56.6	145.2	30.9	171.0	61.0	141.0
7/30/2008	185.10	0.00	41.5	160.4	56.5	145.3	30.7	171.2	60.9	141.1
8/27/2008	178.00	0.00	41.7	160.2	57.6	144.2	32.1	169.8	61.7	140.3
9/25/2008	176.80	0.00	42.5	159.4	58.4	143.4	33.1	168.8	62.4	139.6
10/28/2008	175.20	0.00	44.4	157.5	58.8	143.0	34.3	167.6	62.9	139.1
11/25/2008	175.80	1.82	42.4	159.5	58.9	142.9	35.2	166.7	63.0	139.0
12/30/2008	181.70	2.91	42.6	159.3	57.7	144.1	35.2	166.7	61.4	140.6
1/29/2009	182.20	0.39	42.4	159.5	57.5	144.3	34.8	167.1	61.3	140.7
2/25/2009	185.70	3.10	42.0	159.9	57.0	144.8	34.1	167.8	59.9	142.1

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/26/2009	188.40	0.10	42.4	159.5	56.9	144.9	33.2	168.7	61.0	141.0
4/28/2009	189.30	0.00	42.4	159.5	56.7	145.1	32.0	169.9	61.3	140.7
5/18/2009	188.50	0.00	41.3	160.6	56.6	145.2	31.4	170.5	61.0	141.0
5/27/2009	188.10	0.00	42.2	159.7	56.7	145.1	31.2	170.7	61.0	141.0
6/30/2009	188.60	0.10	42.4	159.5	56.7	145.1	31.2	170.7	61.3	140.7
7/30/2009	184.80	0.00	42.3	159.6	56.9	144.9	30.9	171.0	61.3	140.7
8/26/2009	176.60	0.00	41.5	160.4	57.8	144.0	31.6	170.3	61.8	140.2
9/30/2009	174.50	0.00	42.2	159.7	59.0	142.8	33.3	168.6	62.8	139.2
10/28/2009	175.30	0.29	42.6	159.3	59.2	142.6	34.2	167.7	63.0	139.0
12/1/2009	176.40	0.00	42.0	159.9	59.4	142.4	35.2	166.7	63.3	138.7
12/28/2009	178.80	2.75	42.5	159.5	58.6	143.3	35.5	166.5	62.2	139.8
1/26/2010	191.30	4.15	42.4	159.5	57.3	144.5	34.9	167.0	60.6	141.4
2/24/2010	193.60	2.29	42.4	159.5	55.4	146.4	32.5	169.4	59.8	142.2
3/29/2010	193.50	1.18	42.2	159.7	55.4	146.4	29.9	172.0	60.0	142.0
4/4/2010	193.50		41.5	160.4	55.5	146.3	25.5	176.4	60.0	142.0
4/27/2010	193.90	1.66	42.3	159.6	55.4	146.4	29.2	172.7	59.9	142.1
5/27/2010	192.90	0.03	41.4	160.5	55.4	146.4	28.7	173.2	59.9	142.1
6/29/2010	191.60	0.00	41.4	160.5	55.4	146.4	28.7	173.2	59.7	142.3
7/28/2010	187.50	0.00	42.3	159.6	55.9	145.9	29.1	172.8	60.4	141.6
8/31/2010	179.20	0.00	41.5	160.4	57.3	144.5	30.8	171.1	61.4	140.6
9/29/2010	175.60	0.00	41.2	160.7	58.5	143.3	31.7	170.2	62.0	140.0
10/26/2010	178.20	2.93	41.4	160.5	58.6	143.2	33.0	168.9	61.9	140.1
11/30/2010	178.80	1.14	42.6	159.3	58.8	143.0	34.4	167.5	62.4	139.6
12/30/2010	193.90	9.95	42.4	159.5	55.4	146.4	33.8	168.1	59.5	142.5
1/27/2011	194.00	0.86	41.5	160.4	55.4	146.4	30.4	171.5	60.0	142.0
2/23/2011	193.80	1.02	42.4	159.5	55.5	146.4	28.9	173.0	59.7	142.3
3/29/2011	193.90	2.38	41.3	160.6	54.9	146.9	28.1	173.8	59.5	142.5
4/27/2011	193.60	0.56	42.3	159.6	55.3	146.5	27.6	174.3	59.8	142.2

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
5/25/2011	193.10	0.51	41.4	160.5	55.2	146.6	27.9	174.0	59.8	142.2
6/28/2011	192.00	0.00	42.3	159.6	55.3	146.5	28.2	173.7	59.7	142.3
7/27/2011	186.75	0.00	41.5	160.5	55.8	146.0	28.9	173.1	60.0	142.0
8/25/2011	176.30	0.00	42.4	159.5	57.2	144.6	30.3	171.6	61.0	141.0
9/28/2011	176.00	0.06	42.4	159.5	58.6	143.3	32.5	169.5	62.1	139.9
10/25/2011	176.50	0.89	42.2	159.7	59.1	142.7	33.5	168.4	62.3	139.7
11/22/2011	177.20	1.31	42.4	159.5	58.9	143.0	34.4	167.5	62.2	139.8
12/22/2011	176.70	0.20	41.6	160.3	59.0	142.8	34.5	167.4	62.5	139.5
1/25/2012	178.60	0.84	41.4	160.5	58.6	143.2	35.0	166.9	61.9	140.1
2/28/2012	179.20	0.68	41.5	160.4	58.6	143.2	35.5	166.4	61.1	140.9
3/27/2012	180.60	1.73	41.5	160.4	58.4	143.5	35.1	166.8	61.6	140.4
6/27/2012	180.70	0.00	42.5	159.4	58.6	143.2	33.8	168.1	61.9	140.1
7/26/2012	179.20	0.10	42.3	159.6	58.7	143.1	34.3	167.6	62.1	139.9
8/8/2012	178.50	0.10	42.2	159.7	58.9	142.9	34.3	167.6	62.7	139.3
8/28/2012	177.10	0.00	42.4	159.5	59.3	142.5	34.6	167.3	62.9	139.1
8/29/2012	177.10	0.00	42.0	159.9	59.1	142.7	34.3	167.6	62.7	139.3
9/25/2012	175.30	0.00	42.3	159.6	59.8	142.0	35.0	166.9	63.5	138.5
10/30/2012	176.00	0.19	42.3	159.6	60.0	141.8	35.6	166.3	63.8	138.2
11/27/2012	175.80	0.69	42.4	159.5	59.7	142.1	35.8	166.2	63.4	138.6
12/12/2012	176.10	1.40	42.5	159.4	59.7	142.1	35.7	166.2	62.9	139.1
1/22/2013	177.20	1.20	42.4	159.5	58.8	143.0	36.0	165.9	62.1	139.9
2/27/2013	178.20	0.31	42.3	159.6	58.4	143.4	35.8	166.1	61.8	140.2
3/28/2013	178.20	0.71	42.4	159.5	58.4	143.4	35.8	166.1	61.7	140.3
4/25/2013	177.30	0.03	42.5	159.4	58.4	143.4	35.9	166.0	62.4	139.7
5/22/2013	177.60	0.00	42.5	159.4	59.0	142.8	35.9	166.0	62.3	139.7
6/25/2013	177.50	0.00	42.3	159.6	59.2	142.7	36.0	165.9	62.5	139.5
7/23/2013	175.70	0.00	42.5	159.4	59.6	142.2	36.0	165.9	63.1	138.9
8/21/2013	174.50	0.00	42.5	159.4	59.9	141.9	36.2	165.7	63.7	138.3

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
9/25/2013	175.70	0.00	42.6	159.3	60.2	141.6	36.3	165.6	63.8	138.2
10/29/2013	176.00	0.00	42.6	159.3	59.9	141.9	36.5	165.4	63.6	138.4
11/27/2013	176.50	0.44	42.3	159.6	59.5	142.3	36.4	165.5	63.3	138.7
12/19/2013	176.80	0.53	42.5	159.4	59.5	142.3	36.4	165.5	63.1	138.9
1/28/2014	176.80	0.00	42.5	159.4	59.1	142.7	36.5	165.4	62.7	139.3
2/25/2014	176.70	0.72	42.3	159.6	59.0	142.8	36.6	165.3	62.5	139.5
3/25/2014	178.50		42.5	159.4	58.5	143.3	36.5	165.4	62.0	140.0
3/29/2014	178.40	1.44	42.5	159.4	58.6	143.2	36.6	165.3	62.0	140.0
4/25/2014	177.40	0.74	42.4	159.5	58.8	143.0	36.3	165.6	62.2	139.8
5/28/2014	176.40	0.00	42.5	159.4	59.4	142.4	36.3	165.6	62.9	139.1
6/25/2014	176.10	0.00	42.5	159.4	60.0	141.8	36.5	165.4	63.6	138.4
7/30/2014	177.30	0.00	42.5	159.4	60.1	141.7	36.4	165.5	63.7	138.4
8/26/2014	176.10	0.03	42.5	159.4	60.2	141.6	36.3	165.6	63.8	138.2
9/23/2014	175.90	0.00	42.3	159.6	60.3	141.5	36.5	165.4	64.2	137.9
10/30/2014	176.30	0.00	42.2	159.7	60.1	141.7	36.6	165.3	64.0	138.0
11/21/2014	176.20	0.25	42.2	159.7	59.9	141.9	36.7	165.2	63.9	138.1
12/30/2014	178.90	3.37	42.3	159.6	58.8	143.0	36.7	165.2	62.5	139.5
1/27/2015	179.60	0.89	42.3	159.6	58.3	143.5	36.2	165.7	62.2	139.9
2/27/2015	180.00	0.46	42.3	159.6	58.3	143.5	35.8	166.1	62.0	140.0
3/26/2015	179.60	0.45	42.3	159.6	58.2	143.6	35.7	166.2	62.1	139.9
4/29/2015	178.20	0.24	42.2	159.7	58.7	143.1	35.5	166.4	62.7	139.3
5/27/2015	179.00	1.04	42.2	159.7	58.6	143.2	35.8	166.1	62.6	139.4
6/25/2015	179.60	0.00	42.2	159.7	58.5	143.3	35.6	166.3	62.3	139.7
7/29/2015	178.10	0.00	42.3	159.6	58.9	142.9	35.5	166.4	63.1	138.9
8/26/2015	176.20	0.00	42.2	159.7	59.2	142.6	35.4	166.5	63.3	138.7
9/22/2015	178.20	1.64	42.2	159.7	58.9	142.9	35.8	166.1	62.8	139.2
10/27/2015	176.90	0.10	42.3	159.6	59.0	142.8	35.8	166.1	63.0	139.0
11/24/2015	176.30	0.17	42.2	159.7	59.2	142.6	36.0	165.9	63.1	138.9

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
12/22/2015	177.60	0.72	42.3	159.7	58.9	143.0	36.1	165.8	62.9	139.1
1/27/2016	180.10	2.86	42.6	159.3	58.2	143.6	36.5	165.4	61.9	140.1
2/25/2016	181.60	0.20	42.2	159.7	57.8	144.0	35.6	166.3	61.8	140.2
3/24/2016	184.80		42.3	159.6	57.7	144.1	34.1	167.8	61.3	140.7
3/31/2016	184.50	1.51	42.2	159.7	57.7	144.1	35.0	166.9	61.8	140.2
4/28/2016	183.60	0.04	42.2	159.7	57.8	144.0	34.3	167.7	62.1	139.9
5/25/2016	182.50	0.13	42.2	159.7	58.0	143.8	34.2	167.7	62.2	139.8
6/28/2016	180.70	0.00	42.9	159.0	59.2	142.6	33.3	168.6	63.3	138.7
7/27/2016	178.40	0.00	42.4	159.5	59.1	142.7	34.2	167.7	63.1	138.9
8/24/2016	176.40	0.00	42.3	159.6	59.6	142.3	34.8	167.1	63.5	138.5
9/27/2016	175.80	0.00	42.3	159.6	60.0	141.8	35.3	166.6	63.9	138.1
10/26/2016	178.60	0.64	42.3	159.6	59.8	142.0	35.6	166.3	63.7	138.3
11/22/2016	178.30	1.11	42.4	159.5	59.7	142.1	35.5	166.4	63.5	138.5
12/28/2016	184.80	4.01	42.3	159.6	59.0	142.8	35.6	166.3	62.6	139.4
1/25/2017	193.30	6.33	42.4	159.5	56.1	145.7	34.6	167.3	59.0	143.0
2/28/2017	193.90	3.27	42.3	159.6	54.5	147.3	31.2	170.7	58.8	143.2
3/29/2017	193.70	0.08	42.4	159.5	54.7	147.1	29.6	172.3	59.2	142.8
4/27/2017	192.90	0.04	42.2	159.7	54.7	147.1	28.8	173.1	59.5	142.5
5/23/2017	187.90	33.00	42.2	159.7	55.2	146.6	29.1	172.8	59.5	142.5
6/21/2017	182.50	0.00	42.2	159.7	56.1	145.7	29.9	172.0	60.1	141.9
7/26/2017	163.60	0.00	42.2	159.7	58.2	143.6	32.0	169.9	61.6	140.4
8/30/2017	163.60	0.00	42.2	159.7	59.7	142.1	34.1	167.8	62.9	139.1
9/28/2017	163.60	0.00	42.3	159.6	60.8	141.0	35.5	166.4	63.7	138.3
10/26/2017	171.80	0.00	42.1	159.8	61.4	140.4	36.2	165.7	64.2	137.8
11/29/2017	177.20	0.08	42.2	159.7	60.7	141.1	36.8	165.1	64.4	137.6
12/27/2017	176.70	0.00	42.3	159.6	60.9	140.9	36.4	165.5	64.5	137.5
1/24/2018	178.10	1.67	42.3	159.6	60.3	141.5	36.0	165.9	63.9	138.1
2/21/2018	177.80	0.27	42.2	159.7	60.2	141.6	35.9	166.0	63.9	138.1

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.



**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/28/2018	183.50	1.23	42.3	159.6	59.7	142.1	35.6	166.3	63.5	138.5
4/27/2018	184.30	0.05	42.2	159.7	59.5	142.3	35.0	166.9	63.5	138.5
5/30/2018	183.10	0.13	42.2	159.7	59.1	142.7	34.0	167.9	63.4	138.6
6/28/2018	181.70	0.00	42.4	159.5	59.3	142.5	33.8	168.1	63.6	138.4
7/26/2018	180.00	0.00	42.4	159.5	59.8	142.0	34.2	167.7	63.6	138.4
8/28/2018	177.30	0.00	42.3	159.6	60.2	141.6	34.3	167.6	64.2	137.8
9/27/2018	178.10	0.00	42.3	159.6	60.3	141.5	64.4	137.5	64.7	137.3
10/24/2018	178.00	0.66	42.4	159.5	60.3	141.5	64.4	137.5	64.3	137.7
11/29/2018	177.50	1.60	42.3	159.6	60.3	141.5	35.0	166.9	64.3	137.7
12/20/2018	181.40	2.39	42.2	159.7	59.1	142.7	35.0	166.9	62.9	139.1
1/30/2019	189.40	4.56	42.2	159.7	57.4	144.4	34.6	167.3	61.2	140.8
2/27/2019	194.10	7.48	42.3	159.6	54.8	147.0	30.9	171.0	59.4	142.6
3/27/2019	194.00	1.27	42.4	159.5	54.9	146.9	29.1	172.8	59.4	142.6
4/24/2019	193.60	0.07	42.30	159.6	55.00	146.8	28.20	173.7	59.55	142.5
5/30/2019	191.40	0.73	42.20	159.7	55.30	146.5	28.00	173.9	59.80	142.2
6/26/2019	190.80	0.02	42.40	159.5	55.40	146.4	28.10	173.8	59.80	142.2
7/5/2015	190.40	0.00	42.30	159.6	55.40	146.4	28.00	173.9	60.00	142.0
7/30/2019	188.95	0.00	42.30	159.6	55.70	146.1	28.30	173.6	60.30	141.7
8/27/2019	187.40	0.00	42.10	159.8	60.50	141.3	28.10	173.8	60.70	141.3
9/26/2019	186.20	0.00	42.30	159.6	60.40	141.4	28.00	173.9	59.90	142.1
10/22/2019	185.20	0.00	42.20	159.7	56.50	145.3	29.80	172.1	61.20	140.8
11/26/2019	183.50	2.66	42.20	159.7	56.90	144.9	30.80	171.1	61.30	140.7
12/18/2019	186.80	4.44	42.40	159.5	56.40	145.4	31.10	170.8	60.40	141.6
1/28/2020	192.00	0.24	42.20	159.7	55.00	146.8	28.30	173.6	59.50	142.5
2/25/2020	192.10	0.49	42.25	159.7	54.90	146.9	28.20	173.7	59.40	142.6
3/24/2020	194.00	3.89	42.20	159.7	54.80	147.0	28.00	173.9	59.10	142.9
4/29/2020	193.50	4.59	42.20	159.7	53.80	148.0	27.40	174.5	59.20	142.8
5/27/2020	193.10	0.03	42.20	159.7	54.00	147.8	27.40	174.5	59.50	142.5
6/24/2020	190.00	0.00	41.90	160.0	54.10	147.7	27.70	174.2	59.70	142.3

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			1A		1B		2A		2B	
Top of Well Elevation --->			201.9		201.8		201.9		202	
Bottom of Well Elevation --->			159.3		132.9		153.9		123.8	
Depth of Well --->			42.6		68.9		48		78.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
7/29/2020	188.90	0.00	42.20	159.7	54.50	147.3	28.50	173.4	59.60	142.4
8/27/2020	185.90	0.00	42.10	159.8	55.10	146.7	29.10	172.8	59.80	142.2
9/29/2020	183.10	0.00	42.30	159.6	55.70	146.1	30.25	171.7	60.00	142.0
10/29/2020	180.30	0.00	42.10	159.8	56.60	145.2	31.40	170.5	60.80	141.2
11/24/2020	179.00	0.65	42.20	159.7	57.40	144.4	32.10	169.8	61.20	140.8
12/29/2020	179.00	1.03	42.20	159.7	57.80	144.0	33.10	168.8	61.20	140.8
1/26/2021	180.50	2.39	42.20	159.7	57.60	144.2	33.50	168.4	60.90	141.1
2/25/2021	182.10	0.03	42.30	159.6	57.40	144.4	33.30	168.6	60.90	141.1
3/23/2021	182.90	1.15	41.40	160.5	57.30	144.5	33.50	168.4	61.30	140.7
4/27/2021	182.00	0.04	42.30	159.6	57.60	144.2	33.20	168.7	61.30	140.7
5/26/2021	181.00	0.11	42.20	159.7	57.80	144.0	33.40	168.5	61.60	140.4
6/30/2021	179.00	0.00	42.30	159.6	58.10	143.7	33.50	168.4	61.90	140.1
7/27/2021	177.10	0.08	42.30	159.6	58.50	143.3	34.00	167.9	62.30	139.7
8/24/2021	175.40	0.00	42.20	159.7	58.90	142.9	34.30	167.6	52.40	149.6
9/28/2021	175.20	0.06	42.20	159.7	59.10	142.7	35.00	166.9	52.80	149.2
10/27/2021	177.20	0.80	42.30	159.6	59.20	142.6	35.40	166.5	63.00	139.0
11/23/2021	177.80	0.00	42.30	159.6	59.10	142.7	35.20	166.7	63.10	138.9
12/21/2021	180.50	5.86	42.20	159.7	58.60	143.2	35.20	166.7	62.10	139.9
1/25/2022	187.00	0.08	42.20	159.7	54.20	147.6	29.30	172.6	59.70	142.3
2/22/2022	186.60	0.18	42.30	159.6	57.30	144.5	33.30	168.6	60.90	141.1
3/28/2022	186.60	1.38	42.30	159.6	56.70	145.1	30.90	171.0	60.10	141.9
4/26/2022	186.60	0.01	42.20	159.7	57.20	144.6	32.00	169.9	61.10	140.9
5/25/2022	185.30	0.05	42.30	159.6	57.70	144.1	31.90	170.0	61.30	140.7
6/28/2022	182.70	0.00	42.30	159.6	58.00	143.8	32.20	169.7	61.70	140.3
7/26/2022	179.70	0.00	42.30	159.6	58.50	143.3	32.60	169.3	62.30	139.7
8/30/2022	178.30	0.13	42.20	159.7	59.10	142.7	33.30	168.6	62.70	139.3
9/29/2022	175.80	0.24	42.20	159.7	59.40	142.4	34.10	167.8	52.70	149.3
10/26/2022	175.30	0.26	42.20	159.7	59.40	142.4	34.70	167.2	63.00	139.0
11/22/2022	179.40	1.46	42.30	159.6	59.10	142.7	35.10	166.8	62.60	139.4
12/29/2022	185.70	2.21	42.30	159.6	58.00	143.8	34.20	167.7	51.40	150.6

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
1/31/2007	176.80		31.9	169.3	9.4	141.3	9.2	142.3	25.6	141.8
2/28/2007	177.60		31.7	169.5	9.6	141.1	9.3	142.2	25.4	142.0
3/29/2007	177.10		31.9	169.3	10.4	140.3	9.6	141.9	25.6	141.8
4/27/2007	176.60		32.1	169.1	10.5	140.2	9.5	142.0	25.7	141.7
5/24/2007	176.80		32.7	168.5	10.7	140.0	9.8	141.7	26.0	141.4
6/27/2007	179.90		30.0	171.2	11.0	139.7	9.6	141.9	26.0	141.4
7/27/2007	177.80		30.8	170.4	11.5	139.2	9.8	141.7	26.4	141.0
8/28/2007	177.20		31.5	169.7	11.8	138.9	10.2	141.3	26.4	141.0
9/26/2007	177.00		30.5	170.7	11.9	138.8	10.2	141.3	26.1	141.3
10/30/2007	175.50		31.9	169.3	12.3	138.4	10.3	141.2	26.0	141.4
11/27/2007	175.90		31.8	169.4	12.6	138.1	10.3	141.2	25.5	141.9
12/27/2007	178.20		30.3	170.9	12.6	138.1	10.6	140.9	25.4	142.0
1/30/2008	184.40		27.2	174	10.8	139.9	10.3	141.2	24.2	143.2
2/26/2008	186.10		25.6	175.6	9.7	141.0	9.2	142.3	23.6	143.8
3/26/2008	188.00		24.4	176.8	10.0	140.7	9.0	142.5	23.4	144.0
4/25/2008	191.00		22.2	179.0	10.2	140.5	8.9	142.6	23.1	144.3
5/28/2008	190.93		21.9	179.3	10.2	140.6	8.9	142.6	22.6	144.8
6/25/2008	189.50		22.2	179.0	10.2	140.5	8.9	142.6	22.8	144.6
7/29/2008	185.10		24.5	176.7	10.3	140.4	9.0	142.5	23.1	144.3
7/30/2008	185.10	0.00	24.4	176.8	10.3	140.4	8.9	142.6	23.0	144.4
8/27/2008	178.00	0.00	29.3	171.9	10.5	140.2	9.2	142.3	24.0	143.4
9/25/2008	176.80	0.00	30.3	170.9	10.7	140.0	8.9	142.6	24.6	142.8
10/28/2008	175.20	0.00	36.6	164.6	11.0	139.7	9.1	142.4	25.2	142.2
11/25/2008	175.80	1.82	31.5	169.7	11.3	139.4	9.2	142.3	25.3	142.1
12/30/2008	181.70	2.91	27.5	173.7	10.9	139.8	9.2	142.3	24.1	143.3
1/29/2009	182.20	0.39	27.1	174.1	10.9	139.8	9.1	142.4	24.0	143.4
2/25/2009	185.70	3.10	25.1	176.1	10.8	139.9	9.1	142.4	23.5	143.9

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/26/2009	188.40	0.10	23.3	177.9	10.8	139.9	9.2	142.3	23.4	144.0
4/28/2009	189.30	0.00	22.4	178.8	10.9	139.8	9.1	142.4	23.1	144.3
5/18/2009	188.50	0.00	22.8	178.4	10.9	139.8	9.2	142.3	23.2	144.2
5/27/2009	188.10	0.00	23.0	178.2	10.9	139.8	9.2	142.3	23.2	144.2
6/30/2009	188.60	0.10	22.8	178.4	11.0	139.7	9.0	142.5	23.7	143.7
7/30/2009	184.80	0.00	24.7	176.5	11.0	139.7	9.1	142.4	23.4	144.0
8/26/2009	176.60	0.00	29.2	172.0	11.1	139.6	9.1	142.4	24.2	143.2
9/30/2009	174.50	0.00	32.1	169.1	11.3	139.4	9.2	142.3	25.3	142.1
10/28/2009	175.30	0.29	31.8	169.4	11.5	139.2	8.3	143.2	25.6	141.8
12/1/2009	176.40	0.00	31.5	169.7	11.9	138.8	9.5	142.0	25.7	141.7
12/28/2009	178.80	2.75	29.9	171.3	11.3	139.4	9.5	142.0	24.9	142.5
1/26/2010	191.30	4.15	22.8	178.4	9.9	140.8	9.2	142.3	23.8	143.6
2/24/2010	193.60	2.29	20.3	180.9	9.8	140.9	7.9	143.6	22.0	145.4
3/29/2010	193.50	1.18	19.7	181.5	8.5	142.2	8.2	143.3	22.0	145.4
4/4/2010	193.50		19.8	181.4	8.7	142.0	8.2	143.3	22.1	145.3
4/27/2010	193.90	1.66	19.5	181.7	8.9	141.8	7.8	143.7	22.0	145.4
5/27/2010	192.90	0.03	19.9	181.3	9.2	141.5	7.8	143.7	22.0	145.4
6/29/2010	191.60	0.00	20.6	180.6	9.5	141.2	7.7	143.8	22.0	145.4
7/28/2010	187.50	0.00	22.6	178.6	9.8	140.9	7.8	143.7	22.4	145.0
8/31/2010	179.20	0.00	27.9	173.3	10.2	140.5	8.0	143.5	23.6	143.8
9/29/2010	175.60	0.00	31.2	170.0	10.6	140.1	8.1	143.4	24.9	142.5
10/26/2010	178.20	2.93	30.5	170.7	10.8	139.9	9.7	141.8	24.9	142.5
11/30/2010	178.80	1.14	30.2	171.0	11.6	139.1	8.3	143.2	25.0	142.4
12/30/2010	193.90	9.95	20.4	180.8	8.6	142.1	5.9	145.6	22.0	145.4
1/27/2011	194.00	0.86	20.0	181.2	9.3	141.4	6.2	145.4	22.0	145.4
2/23/2011	193.80	1.02	20.0	181.3	9.5	141.2	5.9	145.6	22.0	145.4
3/29/2011	193.90	2.38	19.6	181.6	8.9	141.8	6.7	144.8	21.7	145.7
4/27/2011	193.60	0.56	19.7	181.5	9.0	141.7	7.0	144.5	22.0	145.4

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
5/25/2011	193.10	0.51	20.2	181.0	9.2	141.5	7.0	144.5	21.9	145.5
6/28/2011	192.00	0.00	20.7	180.5	9.3	141.4	7.2	144.3	22.0	145.4
7/27/2011	186.75	0.00	23.5	177.8	9.4	141.4	7.1	144.4	22.4	145.0
8/25/2011	176.30	0.00	29.7	171.5	9.7	141.0	7.2	144.3	23.6	143.8
9/28/2011	176.00	0.06	24.7	176.5	10.5	140.3	7.6	143.9	24.9	142.5
10/25/2011	176.50	0.89	31.7	169.5	11.0	139.7	8.1	143.4	25.2	142.2
11/22/2011	177.20	1.31	31.7	169.6	11.1	139.7	8.2	143.4	25.2	142.2
12/22/2011	176.70	0.20	31.7	169.5	11.5	139.2	8.2	143.3	25.4	142.0
1/25/2012	178.60	0.84	30.8	170.4	11.7	139.0	8.3	143.2	25.0	142.4
2/28/2012	179.20	0.68	30.5	170.7	11.7	139.0	8.5	143.0	25.0	142.4
3/27/2012	180.60	1.73	29.7	171.5	11.5	139.2	8.4	143.1	24.8	142.7
6/27/2012	180.70	0.00	28.0	173.2	10.3	140.4	8.8	142.7	24.9	142.5
7/26/2012	179.20	0.10	29.8	171.5	10.9	139.8	8.8	142.7	25.1	142.3
8/8/2012	178.50	0.10	30.1	171.1	10.8	139.9	8.6	142.9	25.3	142.1
8/28/2012	177.10	0.00	31.0	170.2	11.2	139.5	8.7	142.8	25.6	141.8
8/29/2012	177.10	0.00	30.8	170.4	11.0	139.7	8.5	143.0	25.5	141.9
9/25/2012	175.30	0.00	32.2	169.0	11.6	139.1	8.8	142.7	26.1	141.3
10/30/2012	176.00	0.19	32.0	169.2	12.1	138.6	8.9	142.6	26.3	141.1
11/27/2012	175.80	0.69	32.2	169.0	12.4	138.3	9.4	142.1	26.0	141.4
12/12/2012	176.10	1.40	31.9	169.3	12.5	138.2	9.5	142.0	25.8	141.6
1/22/2013	177.20	1.20	31.3	169.9	12.5	138.2	9.6	141.9	25.1	142.3
2/27/2013	178.20	0.31	30.7	170.5	12.2	138.5	9.3	142.2	24.7	142.7
3/28/2013	178.20	0.71	31.0	170.2	12.1	138.6	9.5	142.0	24.7	142.7
4/25/2013	177.30	0.03	31.6	169.6	12.2	138.6	9.6	141.9	25.1	142.3
5/22/2013	177.60	0.00	31.4	169.8	12.1	138.6	9.6	141.9	25.3	142.1
6/25/2013	177.50	0.00	31.4	169.9	12.2	138.6	9.6	141.9	25.5	142.0
7/23/2013	175.70	0.00	32.4	168.8	12.3	138.4	9.7	141.8	25.9	141.5
8/21/2013	174.50	0.00	32.8	168.4	12.5	138.2	9.7	141.8	26.3	141.1

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
9/25/2013	175.70	0.00	32.4	168.8	12.9	137.8	10.2	141.3	26.5	140.9
10/29/2013	176.00	0.00	32.2	169.0	13.0	137.7	10.2	141.3	26.3	141.2
11/27/2013	176.50	0.44	31.8	169.4	12.9	137.8	10.0	141.5	25.9	141.5
12/19/2013	176.80	0.53	31.7	169.5	13.1	137.6	10.2	141.3	25.8	141.6
1/28/2014	176.80	0.00	32.0	169.2	13.0	137.7	10.3	141.2	25.5	141.9
2/25/2014	176.70	0.72	32.2	169.0	12.8	137.9	10.3	141.2	25.4	142.1
3/25/2014	178.50		30.9	170.3	8.1	142.6	10.2	141.3	24.9	142.5
3/29/2014	178.40	1.44	31.1	170.1	8.2	142.5	10.3	141.2	24.9	142.5
4/25/2014	177.40	0.74	31.5	169.7	8.9	141.8	10.2	141.3	25.0	142.4
5/28/2014	176.40	0.00	32.4	168.8	9.7	141.0	10.3	141.3	25.7	141.7
6/25/2014	176.10	0.00	32.2	169.0	10.3	140.4	10.2	141.3	26.3	141.1
7/30/2014	177.30	0.00	31.6	169.6	10.7	140.1	10.2	141.3	26.4	141.0
8/26/2014	176.10	0.03	32.1	169.1	11.0	139.7	10.2	141.3	26.4	141.0
9/23/2014	175.90	0.00	32.0	169.2	11.4	139.3	10.3	141.2	26.7	140.8
10/30/2014	176.30	0.00	32.1	169.1	11.9	138.8	10.5	141.0	26.5	140.9
11/21/2014	176.20	0.25	31.8	169.4	12.1	138.6	10.5	141.0	26.2	141.2
12/30/2014	178.90	3.37	30.3	170.9	11.9	138.8	10.5	141.0	25.2	142.2
1/27/2015	179.60	0.89	29.9	171.3	11.9	138.8	10.5	141.1	24.8	142.6
2/27/2015	180.00	0.46	29.7	171.5	11.9	138.8	10.5	141.0	24.6	142.8
3/26/2015	179.60	0.45	30.0	171.2	11.9	138.8	10.4	141.1	24.5	142.9
4/29/2015	178.20	0.24	30.8	170.4	11.9	138.8	10.6	140.9	24.9	142.5
5/27/2015	179.00	1.04	30.8	170.4	12.0	138.7	10.4	141.1	24.9	142.5
6/25/2015	179.60	0.00	29.8	171.4	12.0	138.7	10.3	141.2	25.0	142.4
7/29/2015	178.10	0.00	30.8	170.4	12.3	138.4	10.4	141.1	25.3	142.1
8/26/2015	176.20	0.00	31.9	169.3	12.3	138.4	10.4	141.1	25.6	141.8
9/22/2015	178.20	1.64	31.0	170.2	9.3	141.4	10.5	141.0	25.3	142.1
10/27/2015	176.90	0.10	31.4	169.8	9.9	140.8	10.5	141.0	25.3	142.1
11/24/2015	176.30	0.17	32.5	168.7	10.4	140.3	10.6	140.9	25.7	141.7

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
12/22/2015	177.60	0.72	31.2	170.0	10.7	140.0	10.5	141.0	25.2	142.2
1/27/2016	180.10	2.86	30.2	171.0	10.2	140.5	10.5	141.0	24.5	142.9
2/25/2016	181.60	0.20	29.2	172.0	10.6	140.1	9.9	141.6	24.2	143.2
3/24/2016	184.80		27.6	173.6	10.1	140.6	9.8	141.7	24.0	143.4
3/31/2016	184.50	1.51	27.6	173.6	10.2	140.5	9.8	141.7	24.1	143.3
4/28/2016	183.60	0.04	27.8	173.4	10.4	140.3	9.8	141.7	24.3	143.1
5/25/2016	182.50	0.13	28.4	172.8	10.6	140.1	9.8	141.7	24.4	143.0
6/28/2016	180.70	0.00	29.3	171.9	11.0	139.7	9.9	141.6	24.9	142.5
7/27/2016	178.40	0.00	30.7	170.5	11.1	139.6	9.9	141.6	25.5	141.9
8/24/2016	176.40	0.00	32.1	169.2	11.4	139.3	10.0	141.5	25.6	141.8
9/27/2016	175.80	0.00	32.7	168.5	11.8	138.9	10.1	141.4	26.4	141.0
10/26/2016	178.60	0.64	31.0	170.2	11.2	139.5	10.2	141.3	25.4	142.0
11/22/2016	178.30	1.11	31.2	170.0	12.2	138.5	10.3	141.3	26.1	141.3
12/28/2016	184.80	4.01	29.3	172.0	12.3	138.4	10.3	141.2	25.5	142.0
1/25/2017	193.30	6.33	22.5	178.7	11.0	139.7	7.1	144.4	22.6	144.8
2/28/2017	193.90	3.27	21.4	179.8	9.3	141.4	6.7	144.8	21.1	146.3
3/29/2017	193.70	0.08	21.2	180.0	9.1	141.6	7.2	144.3	21.4	146.0
4/27/2017	192.90	0.04	21.5	179.7	9.0	141.7	7.2	144.3	21.4	146.0
5/23/2017	187.90	33.00	23.8	177.4	9.1	141.6	7.3	144.2	21.9	145.5
6/21/2017	182.50	0.00	27.0	174.2	9.3	141.4	7.3	144.2	22.6	144.8
7/26/2017	163.60	0.00	34.6	166.6	9.7	141.0	8.3	143.3	24.4	143.0
8/30/2017	163.60	0.00	37.8	163.4	10.5	140.2	7.2	144.3	25.9	141.5
9/28/2017	163.60	0.00	40.2	161.0	11.4	139.3	10.5	141.0	26.9	140.5
10/26/2017	171.80	0.00	41.4	159.8	11.7	139.0	10.6	140.9	27.3	140.1
11/29/2017	177.20	0.08	33.1	168.1	12.3	138.4	10.9	140.6	27.1	140.3
12/27/2017	176.70	0.00	32.6	168.6	12.7	138.0	11.1	140.4	27.1	140.3
1/24/2018	178.10	1.67	31.8	169.4	13.0	137.7	11.1	140.4	27.1	140.3
2/21/2018	177.80	0.27	31.8	169.4	13.2	137.5	11.1	140.4	26.6	140.8

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/28/2018	183.50	1.23	28.8	172.4	13.3	137.4	11.2	140.3	26.1	141.3
4/27/2018	184.30	0.05	27.9	173.3	13.4	137.3	11.3	140.2	25.9	141.5
5/30/2018	183.10	0.13	28.2	173.0	13.5	137.2	11.7	139.8	25.7	141.7
6/28/2018	181.70	0.00	29.2	172.0	13.4	137.3	11.2	140.3	25.7	141.7
7/26/2018	180.00	0.00	30.4	170.8	13.4	137.3	11.2	140.3	24.7	142.7
8/28/2018	177.30	0.00	31.8	169.4	13.7	137.0	11.2	140.3	26.6	140.8
9/27/2018	178.10	0.00	32.0	169.2	13.8	136.9	11.3	140.2	26.7	140.7
10/24/2018	178.00	0.66	31.7	169.5	14.0	136.7	11.3	140.2	26.6	140.8
11/29/2018	177.50	1.60	31.8	169.4	14.5	136.2	11.4	140.1	26.6	140.8
12/20/2018	181.40	2.39	29.3	171.9	13.7	137.0	11.4	140.1	25.5	141.9
1/30/2019	189.40	4.56	24.4	176.8	11.4	139.3	9.3	142.2	24.0	143.4
2/27/2019	194.10	7.48	21.5	179.7	10.3	140.4	7.0	144.5	21.4	146.0
3/27/2019	194.00	1.27	21.2	180.0	9.9	140.8	7.4	144.1	21.5	145.9
4/24/2019	193.60	0.07	21.05	180.2	9.80	140.9	7.50	144.0	21.70	145.7
5/30/2019	191.40	0.73	22.20	179.0	9.70	141.0	5.00	146.5	21.90	145.5
6/26/2019	190.80	0.02	22.30	178.9	9.70	141.0	7.60	143.9	22.00	145.4
7/5/2015	190.40	0.00	22.60	178.6	9.70	141.0	7.60	143.9	22.10	145.3
7/30/2019	188.95	0.00	22.90	178.3	9.90	140.8	7.60	143.9	22.40	145.0
8/27/2019	187.40	0.00	24.10	177.1	10.50	140.2	8.10	143.4	22.70	144.7
9/26/2019	186.20	0.00	23.80	177.4	10.10	140.6	7.30	144.2	21.90	145.5
10/22/2019	185.20	0.00	25.50	175.7	10.80	139.9	8.00	143.5	23.50	143.9
11/26/2019	183.50	2.66	26.20	175.0	10.80	139.9	8.15	143.4	23.50	143.9
12/18/2019	186.80	4.44	24.50	176.7	10.70	140.0	8.20	143.3	22.85	144.6
1/28/2020	192.00	0.24	20.10	181.1	9.90	140.8	7.70	143.8	21.70	145.7
2/25/2020	192.10	0.49	21.00	180.2	9.20	141.5	7.60	143.9	21.60	145.8
3/24/2020	194.00	3.89	20.70	180.5	9.80	140.9	7.40	144.1	21.20	146.2
4/29/2020	193.50	4.59	19.25	182.0	8.15	142.6	6.75	144.8	20.60	146.8
5/27/2020	193.10	0.03	19.80	181.4	8.50	142.2	7.00	144.5	20.70	146.7
6/24/2020	190.00	0.00	20.70	180.5	8.70	142.0	7.30	144.2	20.60	146.8

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.



**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		167.4	
Bottom of Well Elevation --->			155.8		129.1		129.6		127.7	
Depth of Well --->			45.4		21.6		21.9		39.7	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
7/29/2020	188.90	0.00	22.30	178.9	9.10	141.6	7.20	144.3	21.30	146.1
8/27/2020	185.90	0.00	24.00	177.2	9.10	141.6	7.20	144.3	21.60	145.8
9/29/2020	183.10	0.00	26.10	175.1	9.35	141.4	7.30	144.2	22.25	145.2
10/29/2020	180.30	0.00	27.80	173.4	9.60	141.1	7.40	144.1	23.00	144.4
11/24/2020	179.00	0.65	27.00	174.2	9.80	140.9	7.60	143.9	23.70	143.7
12/29/2020	179.00	1.03	29.10	172.1	10.10	140.6	7.90	143.6	24.10	143.3
1/26/2021	180.50	2.39	28.60	172.6	10.30	140.4	8.00	143.5	24.00	143.4
2/25/2021	182.10	0.03	27.50	173.7	10.40	140.3	8.90	142.6	23.70	143.7
3/23/2021	182.90	1.15	27.20	174.0	10.50	140.2	8.10	143.4	23.60	143.8
4/27/2021	182.00	0.04	27.70	173.5	10.70	140.0	8.20	143.3	24.00	143.4
5/26/2021	181.00	0.11	28.20	173.0	10.80	139.9	8.30	143.2	24.10	143.3
6/30/2021	179.00	0.00	29.40	171.8	11.00	139.7	8.40	143.1	24.40	143.0
7/27/2021	177.10	0.08	30.50	170.7	11.20	139.5	8.70	142.8	24.80	142.6
8/24/2021	175.40	0.00	31.80	169.4	11.40	139.3	8.90	142.6	25.20	142.2
9/28/2021	175.20	0.06	32.40	168.8	11.70	139.0	9.50	142.0	25.30	142.1
10/27/2021	177.20	0.80	31.40	169.8	12.00	138.7	9.60	141.9	25.50	141.9
11/23/2021	177.80	0.00	30.40	170.8	12.20	138.5	9.60	141.9	25.40	142.0
12/21/2021	180.50	5.86	29.20	172.0	12.30	138.4	9.70	141.8	24.90	142.5
1/25/2022	187.00	0.08	22.50	178.7	9.70	141.0	7.20	144.3	21.60	145.8
2/22/2022	186.60	0.18	25.60	175.6	11.40	139.3	9.30	142.2	23.60	143.8
3/28/2022	186.60	1.38	23.90	177.3	10.70	140.0	8.20	143.3	22.40	145.0
4/26/2022	186.60	0.01	25.70	175.5	11.20	139.5	9.10	142.4	23.70	143.7
5/25/2022	185.30	0.05	26.20	175.0	11.10	139.6	9.10	142.4	23.90	143.5
6/28/2022	182.70	0.00	27.40	173.8	11.30	139.4	9.20	142.3	24.30	143.1
7/26/2022	179.70	0.00	29.20	172.0	11.40	139.3	9.30	142.2	24.80	142.6
8/30/2022	178.30	0.13	30.70	170.5	11.70	139.0	9.50	142.0	25.40	142.0
9/29/2022	175.80	0.24	31.60	169.6	12.10	138.6	9.70	141.8	25.70	141.7
10/26/2022	175.30	0.26	32.30	168.9	12.20	138.5	9.70	141.8	25.70	141.7
11/22/2022	179.40	1.46	30.20	171.0	12.30	138.4	9.90	141.6	25.40	142.0
12/29/2022	185.70	2.21	26.00	175.2	12.00	138.7	9.90	141.6	24.30	143.1

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			<b>7</b>		<b>8A</b>		<b>8B</b>		<b>VBW9A</b>	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
1/31/2007	176.80		8.4	160.8	35.8	166.5	46.9	155.3	22.5	161.5
2/28/2007	177.60		8.1	161.1	36.3	166.0	47.0	155.2	23.1	160.9
3/29/2007	177.10		8.3	160.9	36.3	166.0	47.2	155.0	23.3	160.7
4/27/2007	176.60		8.7	160.5	36.2	166.1	47.0	155.2	23.2	160.8
5/24/2007	176.80		9.4	159.8	36.6	165.7	47.3	154.9	23.4	160.6
6/27/2007	179.90		8.2	161.0	36.0	166.3	46.1	156.1	23.2	160.8
7/27/2007	177.80		7.8	161.4	35.9	166.4	46.5	155.7	23.1	160.9
8/28/2007	177.20		8.6	160.6	36.0	166.3	46.7	155.5	23.0	161.0
9/26/2007	177.00		7.5	161.7	36.0	166.3	46.5	155.7	23.1	160.9
10/30/2007	175.50		8.0	161.2	36.3	166.0	47.2	155.0	23.3	160.7
11/27/2007	175.90		7.9	161.3	36.6	165.7	47.2	155.0	23.5	160.5
12/27/2007	178.20		7.4	161.8	36.4	165.9	46.6	155.6	23.4	160.6
1/30/2008	184.40		6.7	162.5	35.6	166.8	45.0	157.3	23.3	160.7
2/26/2008	186.10		5.8	163.4	34.5	167.8	44.1	158.1	22.7	161.3
3/26/2008	188.00		5.4	163.8	33.5	168.8	43.7	158.5	22.3	161.7
4/25/2008	191.00		4.5	164.7	32.2	170.1	42.6	159.6	21.7	162.3
5/28/2008	190.93		4.5	164.7	31.4	170.9	42.3	159.9	21.2	162.8
6/25/2008	189.50		5.0	164.2	31.9	170.4	42.6	159.6	20.8	163.2
7/29/2008	185.10		6.9	162.3	32.0	170.3	43.3	158.9	20.9	163.1
7/30/2008	185.10	0.00	4.9	164.3	31.9	170.4	43.3	158.9	20.8	163.2
8/27/2008	178.00	0.00	6.3	162.9	33.6	168.7	45.6	156.6	21.4	162.6
9/25/2008	176.80	0.00	6.9	162.3	34.8	167.5	46.0	156.2	22.1	161.9
10/28/2008	175.20	0.00	7.4	161.8	35.6	166.7	46.8	155.4	22.5	161.5
11/25/2008	175.80	1.82	7.7	161.5	36.1	166.2	47.0	155.2	22.8	161.2
12/30/2008	181.70	2.91	6.5	162.7	35.6	166.7	45.1	157.1	22.8	161.2
1/29/2009	182.20	0.39	6.0	163.2	34.9	167.4	44.7	157.5	22.7	161.3
2/25/2009	185.70	3.10	5.8	163.4	34.6	167.7	43.9	158.3	22.4	161.6

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			<b>7</b>		<b>8A</b>		<b>8B</b>		<b>VBW9A</b>	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/26/2009	188.40	0.10	5.0	164.2	33.0	169.3	43.1	159.1	21.9	162.1
4/28/2009	189.30	0.00	3.7	165.5	31.9	170.4	42.7	159.5	21.4	162.6
5/18/2009	188.50	0.00	4.5	164.7	31.9	170.4	42.7	159.5	21.0	163.0
5/27/2009	188.10	0.00	4.6	164.6	31.9	170.4	42.9	159.3	21.0	163.0
6/30/2009	188.60	0.10	4.3	164.9	31.7	170.6	42.6	159.6	21.0	163.0
7/30/2009	184.80	0.00	4.5	164.7	32.0	170.3	43.2	159.0	20.9	163.1
8/26/2009	176.60	0.00	5.8	163.4	33.3	169.0	45.1	157.1	21.4	162.6
9/30/2009	174.50	0.00	7.7	161.5	35.1	167.2	46.6	155.6	22.2	161.8
10/28/2009	175.30	0.29	7.8	161.4	35.6	166.7	46.7	155.5	22.5	161.5
12/1/2009	176.40	0.00	7.7	161.5	36.1	166.2	46.9	155.3	22.8	161.2
12/28/2009	178.80	2.75	6.8	162.4	36.0	166.3	46.0	156.2	23.0	161.1
1/26/2010	191.30	4.15	5.5	163.7	35.4	166.9	43.2	159.0	22.9	161.1
2/24/2010	193.60	2.29	3.2	166.0	31.8	170.5	41.5	160.7	21.6	162.4
3/29/2010	193.50	1.18	3.4	165.8	31.3	171.0	41.2	161.0	20.2	163.8
4/4/2010	193.50		3.6	165.6	30.2	172.1	41.1	161.1	20.3	163.7
4/27/2010	193.90	1.66	3.4	165.8	29.8	172.5	41.0	161.2	19.5	164.5
5/27/2010	192.90	0.03	3.4	165.8	29.8	172.5	41.0	161.2	19.4	164.6
6/29/2010	191.60	0.00	3.1	166.1	29.9	172.4	41.2	161.0	19.4	164.6
7/28/2010	187.50	0.00	3.3	165.9	30.6	171.7	42.6	159.6	19.8	164.2
8/31/2010	179.20	0.00	4.6	164.6	32.6	169.7	44.4	157.8	21.0	163.0
9/29/2010	175.60	0.00	6.3	162.9	34.2	168.1	45.8	156.4	21.5	162.5
10/26/2010	178.20	2.93	6.8	162.4	35.2	167.1	45.8	156.4	22.3	161.7
11/30/2010	178.80	1.14	6.4	162.8	35.7	166.6	45.8	156.4	22.8	161.2
12/30/2010	193.90	9.95	4.1	165.1	33.8	168.5	41.3	160.9	19.6	164.4
1/27/2011	194.00	0.86	2.9	166.3	30.3	172.0	41.0	161.2	19.2	164.8
2/23/2011	193.80	1.02	2.8	166.4	29.5	172.9	40.7	161.5	18.7	165.4
3/29/2011	193.90	2.38	2.7	166.5	28.8	173.5	40.4	161.8	16.3	167.7
4/27/2011	193.60	0.56	2.8	166.5	29.0	173.3	40.5	161.7	18.2	165.9

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
5/25/2011	193.10	0.51	2.5	166.7	29.4	172.9	40.6	161.6	18.8	165.2
6/28/2011	192.00	0.00	2.5	166.7	29.6	172.7	40.9	161.3	19.2	164.8
7/27/2011	186.75	0.00	2.9	166.3	30.7	171.6	42.1	160.1	19.7	164.3
8/25/2011	176.30	0.00	4.7	164.5	32.7	169.6	44.8	157.4	20.9	163.1
9/28/2011	176.00	0.06	6.6	162.6	34.9	167.4	46.0	156.2	22.1	161.9
10/25/2011	176.50	0.89	6.7	162.5	35.8	166.5	46.1	156.1	22.5	161.5
11/22/2011	177.20	1.31	6.7	162.6	36.0	166.4	46.2	156.0	22.8	161.2
12/22/2011	176.70	0.20	6.3	162.9	35.9	166.4	45.9	156.3	22.9	161.1
1/25/2012	178.60	0.84	6.5	162.7	35.7	166.6	45.5	156.7	22.8	161.2
2/28/2012	179.20	0.68	6.4	162.8	35.9	166.4	45.6	156.6	22.8	161.2
3/27/2012	180.60	1.73	6.3	162.9	35.6	166.7	45.0	157.2	23.0	161.1
6/27/2012	180.70	0.00	5.9	163.3	34.4	167.9	44.6	157.6	22.4	161.6
7/26/2012	179.20	0.10	6.3	162.9	35.0	167.3	45.1	157.1	22.5	161.5
8/8/2012	178.50	0.10	6.2	163.0	34.8	167.5	45.2	157.0	22.4	161.6
8/28/2012	177.10	0.00	6.5	162.7	35.3	167.0	45.6	156.6	22.6	161.4
8/29/2012	177.10	0.00	6.4	162.8	35.0	167.3	45.5	156.7	22.3	161.7
9/25/2012	175.30	0.00	7.0	162.2	35.7	166.6	46.3	155.9	22.8	161.2
10/30/2012	176.00	0.19	7.0	162.2	36.3	166.0	46.4	155.8	23.2	160.8
11/27/2012	175.80	0.69	7.0	162.2	36.4	165.9	46.5	155.7	23.3	160.7
12/12/2012	176.10	1.40	6.9	162.3	36.3	166.0	46.3	155.9	23.1	160.9
1/22/2013	177.20	1.20	6.4	162.8	36.4	165.9	45.8	156.4	23.3	160.7
2/27/2013	178.20	0.31	6.1	163.1	36.0	166.3	45.4	156.8	23.1	160.9
3/28/2013	178.20	0.71	6.4	162.8	36.0	166.3	45.5	156.7	23.3	160.7
4/25/2013	177.30	0.03	6.6	162.6	36.1	166.2	45.8	156.4	23.3	160.8
5/22/2013	177.60	0.00	6.6	162.6	36.1	166.2	45.7	156.5	23.2	160.8
6/25/2013	177.50	0.00	6.5	162.7	36.2	166.1	45.7	156.5	23.3	160.7
7/23/2013	175.70	0.00	6.8	162.4	36.3	166.0	46.3	156.0	23.3	160.7
8/21/2013	174.50	0.00	7.0	162.2	38.0	164.3	46.5	155.7	23.3	160.7

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			<b>7</b>		<b>8A</b>		<b>8B</b>		<b>VBW9A</b>	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
9/25/2013	175.70	0.00	6.8	162.4	36.2	166.1	46.3	155.9	23.4	160.6
10/29/2013	176.00	0.00	6.5	162.7	36.6	165.7	46.2	156.0	23.5	160.6
11/27/2013	176.50	0.44	6.1	163.1	36.4	165.9	45.9	156.3	23.3	160.7
12/19/2013	176.80	0.53	6.2	163.0	36.3	166.0	45.8	156.4	23.2	160.8
1/28/2014	176.80	0.00	6.2	163.0	36.5	165.8	45.9	156.3	23.5	160.5
2/25/2014	176.70	0.72	6.3	163.0	36.5	165.8	45.9	156.3	23.5	160.5
3/25/2014	178.50		6.0	163.3	36.2	166.1	45.4	156.9	23.4	160.6
3/29/2014	178.40	1.44	5.9	163.3	36.4	165.9	45.5	156.7	23.5	160.5
4/25/2014	177.40	0.74	6.1	163.1	36.1	166.2	45.5	156.7	23.3	160.7
5/28/2014	176.40	0.00	6.6	162.6	36.3	166.0	46.0	156.2	23.3	160.7
6/25/2014	176.10	0.00	6.4	162.8	36.4	165.9	44.9	157.3	23.3	160.7
7/30/2014	177.30	0.00	6.2	163.0	36.3	166.0	45.6	156.7	23.2	160.9
8/26/2014	176.10	0.03	6.1	163.1	36.2	166.1	45.6	156.6	23.6	160.4
9/23/2014	175.90	0.00	6.0	163.2	36.4	166.0	45.7	156.5	23.3	160.8
10/30/2014	176.30	0.00	5.9	163.3	36.3	166.0	45.8	156.4	23.3	160.7
11/21/2014	176.20	0.25	5.8	163.4	36.3	166.0	45.5	156.7	23.2	160.8
12/30/2014	178.90	3.37	5.3	163.9	36.0	166.3	44.9	157.3	23.1	160.9
1/27/2015	179.60	0.89	5.2	164.0	35.8	166.5	44.6	157.6	23.2	160.9
2/27/2015	180.00	0.46	5.2	164.0	35.2	167.1	44.3	157.9	22.8	161.2
3/26/2015	179.60	0.45	5.3	163.9	35.3	167.0	44.4	157.8	22.8	161.2
4/29/2015	178.20	0.24	5.6	163.6	35.3	167.0	44.8	157.4	22.6	161.4
5/27/2015	179.00	1.04	5.8	163.4	35.7	166.6	45.0	157.2	22.9	161.1
6/25/2015	179.60	0.00	5.2	164.0	35.2	167.1	44.5	157.7	23.0	161.0
7/29/2015	178.10	0.00	5.4	163.8	35.3	167.0	44.8	157.4	22.6	161.4
8/26/2015	176.20	0.00	5.6	163.6	35.6	166.7	45.2	157.0	22.7	161.3
9/22/2015	178.20	1.64	5.6	163.6	35.8	166.5	44.9	157.3	22.9	161.1
10/27/2015	176.90	0.10	5.4	163.8	35.8	166.5	45.0	157.2	22.5	161.5
11/24/2015	176.30	0.17	5.6	163.6	35.8	166.5	45.3	156.9	23.2	160.8

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
12/22/2015	177.60	0.72	5.5	163.7	35.8	166.5	44.9	157.3	22.9	161.1
1/27/2016	180.10	2.86	5.3	163.9	36.0	166.3	44.7	157.5	23.5	160.5
2/25/2016	181.60	0.20	5.0	164.2	34.9	167.4	43.8	158.4	23.5	160.5
3/24/2016	184.80		4.8	164.4	34.5	167.8	43.3	158.9	23.4	160.6
3/31/2016	184.50	1.51	4.7	164.5	34.4	167.9	43.1	159.1	23.3	160.7
4/28/2016	183.60	0.04	4.8	164.4	33.8	168.5	43.2	159.0	23.2	160.8
5/25/2016	182.50	0.13	4.7	164.5	34.1	168.2	43.6	158.6	22.9	161.1
6/28/2016	180.70	0.00	4.8	164.4	34.3	168.0	43.9	158.3	23.1	160.9
7/27/2016	178.40	0.00	5.1	164.1	34.6	167.7	44.6	157.6	23.2	160.8
8/24/2016	176.40	0.00	5.7	163.5	35.3	167.0	45.1	157.1	23.4	160.6
9/27/2016	175.80	0.00	6.1	163.1	35.8	166.5	45.5	156.7	23.5	160.5
10/26/2016	178.60	0.64	5.3	163.9	35.8	166.5	44.8	157.4	23.6	160.4
11/22/2016	178.30	1.11	5.6	163.7	35.7	166.6	44.8	157.4		
12/28/2016	184.80	4.01	5.2	164.0	35.5	166.8	44.0	158.2	23.4	160.6
1/25/2017	193.30	6.33	3.9	165.3	33.9	168.4	41.1	161.1	22.3	161.7
2/28/2017	193.90	3.27	3.2	166.0	30.7	171.6	40.5	161.7	21.2	162.8
3/29/2017	193.70	0.08	3.0	166.2	30.0	172.3	40.3	161.9	20.5	163.5
4/27/2017	192.90	0.04	2.7	166.5	29.7	172.6	40.0	162.2	20.4	163.6
5/23/2017	187.90	33.00	3.0	166.2	30.5	171.8	41.2	161.0	23.4	160.6
6/21/2017	182.50	0.00	3.5	165.7	31.9	170.4	42.6	159.6	21.3	162.7
7/26/2017	163.60	0.00	5.8	163.4	34.5	167.8	46.7	155.5	22.8	161.3
8/30/2017	163.60	0.00	8.7	160.5	36.4	165.9	48.6	153.6	23.5	160.5
9/28/2017	163.60	0.00	12.6	156.6	37.5	164.8	49.7	152.5	23.6	160.4
10/26/2017	171.80	0.00	14.5	154.7	37.7	164.6	48.8	153.4	23.6	160.4
11/29/2017	177.20	0.08	9.7	159.5	37.2	165.1	46.3	155.9	23.6	160.4
12/27/2017	176.70	0.00	7.6	161.6	36.7	165.6	46.1	156.1	23.6	160.4
1/24/2018	178.10	1.67	7.7	161.5	36.3	166.0	45.4	156.8	23.6	160.4
2/21/2018	177.80	0.27	6.8	162.4	36.1	166.2	45.3	156.9	23.6	160.4

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2  
SAND CANYON DAM  
PIEZOMETER AND SUBDRAIN MEASUREMENTS  
JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			<b>7</b>		<b>8A</b>		<b>8B</b>		<b>VBW9A</b>	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/28/2018	183.50	1.23	5.9	163.3	35.6	166.7	44.0	158.2	23.3	160.7
4/27/2018	184.30	0.05	5.2	164.0	34.8	167.5	43.5	158.7	23.6	160.4
5/30/2018	183.10	0.13	5.3	163.9	34.2	168.1	43.6	158.6	23.3	160.8
6/28/2018	181.70	0.00	5.7	163.5	34.2	168.1	44.0	158.2	23.3	160.7
7/26/2018	180.00	0.00	6.0	163.2	34.5	167.8	44.4	157.8	23.9	160.1
8/28/2018	177.30	0.00	6.7	162.5	35.2	167.2	45.3	156.9	23.4	160.6
9/27/2018	178.10	0.00	7.0	162.2	35.5	166.8	45.5	156.7	23.6	160.4
10/24/2018	178.00	0.66	6.2	163.0	35.6	166.7	45.3	156.9	23.6	160.4
11/29/2018	177.50	1.60	6.9	162.3	35.5	166.8	45.5	156.7	23.6	160.4
12/20/2018	181.40	2.39	6.6	162.6	35.3	167.0	44.4	157.8	23.6	160.4
1/30/2019	189.40	4.56	5.0	164.2	33.6	168.7	41.8	160.4	23.4	160.6
2/27/2019	194.10	7.48	3.5	165.7	30.8	171.5	39.7	162.5	20.1	
3/27/2019	194.00	1.27	3.9	165.3	29.6	172.7	34.3	167.9	20.9	
4/24/2019	193.60	0.07	4.25	165.0	29.40	172.9	39.30	162.9	20.10	
5/30/2019	191.40	0.73	4.60	164.6	29.90	172.4	39.90	162.3	20.50	
6/26/2019	190.80	0.02	4.50	164.7	30.30	172.0	40.20	162.0	20.70	
7/5/2015	190.40	0.00	4.40	164.8	30.50	171.8	40.30	161.9	20.80	
7/30/2019	188.95	0.00	4.70	164.5	30.70	171.6	40.50	161.7	21.00	
8/27/2019	187.40	0.00	4.70	164.5	31.10	171.2	41.20	161.0	2.31	
9/26/2019	186.20	0.00	4.70	164.5	31.50	170.8	41.20	161.0	21.70	
10/22/2019	185.20	0.00	5.00	164.2	32.40	169.9	42.00	160.2	22.00	
11/26/2019	183.50	2.66	5.10	164.1	32.70	169.6	42.50	159.7	8804.00	
12/18/2019	186.80	4.44	4.80	164.4	32.60	169.7	41.65	160.6	8803.00	
1/28/2020	192.00	0.24	4.00	165.2	30.50	171.8	39.40	162.8	23.30	
2/25/2020	192.10	0.49	4.00	165.2	30.30	172.0	39.10	163.1	87.67	
3/24/2020	194.00	3.89	4.00	165.2	3.20		39.10	163.1	8760.00	
4/29/2020	193.50	4.59	3.30	165.9	28.70	173.6	37.90	164.3	8719.457	
5/27/2020	193.10	0.03	3.00	166.2	29.00	173.3	38.10	164.1	8736.785	
6/24/2020	190.00	0.00	2.80	166.4	29.70	172.6	38.40	163.8	8749.643	

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.2		202.3		202.2		184	
Bottom of Well Elevation --->			152.7		164.3		144.5		160.4	
Depth of Well --->			16.5		38		57.7		23.6	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
7/29/2020	188.90	0.00	2.90	166.3	30.30	172.0	39.40	162.8	8763.9	
8/27/2020	185.90	0.00	3.30	165.9	31.10	171.2	40.30	161.9	8779.345	
9/29/2020	183.10	0.00	4.20	165.0	32.40	169.9	41.55	160.7	8796.117	
10/29/2020	180.30	0.00	5.00	164.2	33.40	168.9	42.60	159.6	8808.922	
11/24/2020	179.00	0.65	5.70	163.5	34.00	168.3	43.30	158.9	8817.643	
12/29/2020	179.00	1.03	5.90	163.3	34.50	167.8	43.30	158.9	8824.287	
1/26/2021	180.50	2.39	4.80	164.4	34.70	167.6	43.00	159.2	23.3	160.7
2/25/2021	182.10	0.03	5.60	163.6	34.10	168.2	41.90	160.3	23.10	160.9
3/23/2021	182.90	1.15	5.40	163.8	33.80	168.5	41.40	160.8	23.20	160.8
4/27/2021	182.00	0.04	5.60	163.6	34.00	168.3	42.10	160.1	23.20	160.8
5/26/2021	181.00	0.11	5.70	163.5	34.20	168.1	42.40	159.8	23.60	160.4
6/30/2021	179.00	0.00	6.00	163.2	34.60	167.7	43.20	159.0	23.40	160.6
7/27/2021	177.10	0.08	6.50	162.7	35.00	167.3	43.90	158.3	23.50	160.5
8/24/2021	175.40	0.00	6.80	162.4	35.40	166.9	44.60	157.6	23.50	160.5
9/28/2021	175.20	0.06	6.90	162.3	35.90	166.4	45.10	157.1	23.60	160.4
10/27/2021	177.20	0.80	6.60	162.6	36.10	166.2	44.80	157.4	23.60	160.4
11/23/2021	177.80	0.00	6.20	163.0	35.70	166.6	44.20	158.0	23.60	160.4
12/21/2021	180.50	5.86	5.90	163.3	35.60	166.7	43.50	158.7	23.60	160.4
1/25/2022	187.00	0.08	3.20	166.0	39.90	162.4	39.60	162.6	23.60	160.4
2/22/2022	186.60	0.18	4.70	164.5	33.00	169.3	40.50	161.7	23.10	160.9
3/28/2022	186.60	1.38	4.60	164.6	32.30	170.0	41.50	160.7	22.80	161.2
4/26/2022	186.60	0.01	4.50	164.7	33.20	169.1	40.50	161.7	22.73	161.3
5/25/2022	185.30	0.05	4.60	164.6	32.60	169.7	41.00	161.2	22.70	161.3
6/28/2022	182.70	0.00	5.00	164.2	33.20	169.1	41.90	160.3	22.80	161.2
7/26/2022	179.70	0.00	5.40	163.8	33.90	168.4	43.00	159.2	23.00	161.0
8/30/2022	178.30	0.13	6.10	163.1	34.60	167.7	43.90	158.3	23.40	160.6
9/29/2022	175.80	0.24	6.40	162.8	35.30	167.0	44.70	157.5	23.70	160.3
10/26/2022	175.30	0.26	6.60	162.6	35.80	166.5	45.20	157.0	23.60	160.4
11/22/2022	179.40	1.46	6.00	163.2	35.90	166.4	44.30	157.9	23.60	160.4
12/29/2022	185.70	2.21	45.00		34.00	168.3	41.90	160.3	23.60	160.4

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.



**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
1/31/2007	176.80		28.9	155.3	19.4	164.0	45.0	138.7	8.4	157.2
2/28/2007	177.60		28.5	155.7	19.3	164.1	45.2	138.5	9.2	156.4
3/29/2007	177.10		28.6	155.6	19.3	164.1	45.6	138.1	8.4	157.2
4/27/2007	176.60		28.5	155.7	19.3	164.1	45.4	138.3	9.3	156.3
5/24/2007	176.80		28.6	155.6	19.3	164.1	45.9	137.8	9.2	156.4
6/27/2007	179.90		28.4	155.8	19.2	164.2	45.4	138.3	8.2	157.4
7/27/2007	177.80		28.5	155.7	19.3	164.1	46.5	137.2	9.2	156.4
8/28/2007	177.20		28.3	155.9	19.4	164.0	46.4	137.3	8.0	157.6
9/26/2007	177.00		28.4	155.8	19.4	164.0	46.5	137.2	9.3	156.3
10/30/2007	175.50		28.7	155.5	19.4	164.0	46.6	137.1	9.3	156.3
11/27/2007	175.90		28.8	155.4	19.5	163.9	46.6	137.1	9.3	156.3
12/27/2007	178.20		28.9	155.3	19.5	163.9	45.5	138.2	9.5	156.1
1/30/2008	184.40		28.6	155.6	19.4	164.1	43.6	140.3	9.4	156.2
2/26/2008	186.10		28.2	156.0	19.4	164.0	43.2	140.6	9.3	156.3
3/26/2008	188.00		27.7	156.5	19.3	164.1	43.4	140.4	9.1	156.5
4/25/2008	191.00		27.1	157.1	19.5	163.9	42.8	141.0	8.9	156.7
5/28/2008	190.93		26.7	157.5	19.6	163.8	42.9	141.0	8.3	157.3
6/25/2008	189.50		26.5	157.7	19.8	163.6	42.8	141.0	8.3	157.3
7/29/2008	185.10		26.5	157.7	19.2	164.2	42.8	141.0	8.2	157.4
7/30/2008	185.10	0.00	26.5	157.7	19.3	164.1	42.7	141.1	7.8	157.8
8/27/2008	178.00	0.00	26.9	157.3	19.4	164.0	44.2	139.6	8.3	157.3
9/25/2008	176.80	0.00	27.6	156.6	19.3	164.1	45.0	138.8	8.1	157.5
10/28/2008	175.20	0.00	28.1	156.1	21.0	162.4	45.3	138.5	8.0	157.6
11/25/2008	175.80	1.82	28.4	155.8	21.4	162.0	45.4	138.4	9.0	156.6
12/30/2008	181.70	2.91	28.2	156.0	21.7	161.7	43.9	139.9	9.0	156.6
1/29/2009	182.20	0.39	28.2	156.0	21.5	161.9	43.9	139.9	9.1	156.5
2/25/2009	185.70	3.10	28.0	156.2	21.4	162.0	43.0	140.8	8.9	156.7

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/26/2009	188.40	0.10	27.5	156.7	20.9	162.5	43.6	140.2	8.8	156.8
4/28/2009	189.30	0.00	27.1	157.1	20.2	163.2	43.7	140.1	8.5	157.1
5/18/2009	188.50	0.00	26.8	157.4	19.6	163.8	43.4	140.4	8.4	157.2
5/27/2009	188.10	0.00	26.8	157.4	19.4	164.0	43.6	140.2	8.4	157.2
6/30/2009	188.60	0.10	26.7	157.5	19.2	164.2	43.7	140.1	8.4	157.2
7/30/2009	184.80	0.00	26.7	157.5	19.2	164.2	43.9	139.9	8.3	157.3
8/26/2009	176.60	0.00	27.0	157.2	19.5	163.9	44.1	139.7	8.3	157.3
9/30/2009	174.50	0.00	27.7	156.5	20.4	163.0	45.1	138.7	8.7	156.9
10/28/2009	175.30	0.29	28.0	156.2	20.8	162.6	44.4	139.4	8.9	156.7
12/1/2009	176.40	0.00	28.4	155.8	21.0	162.4	45.0	138.8	9.0	156.6
12/28/2009	178.80	2.75	28.5	155.8	21.8	161.6	44.5	139.3	9.2	156.5
1/26/2010	191.30	4.15	28.3	155.9	21.5	161.9	43.0	140.8	8.1	157.5
2/24/2010	193.60	2.29	27.2	157.0	20.5	162.9	42.4	141.4	8.3	157.3
3/29/2010	193.50	1.18	26.1	158.1	19.1	164.3	42.4	141.4	8.1	157.5
4/4/2010	193.50		26.0	158.2	18.7	164.7	42.6	141.2	8.2	157.4
4/27/2010	193.90	1.66	25.8	158.4	18.4	165.0	42.5	141.3	8.0	157.6
5/27/2010	192.90	0.03	25.7	158.5	18.2	165.2	42.4	141.4	7.8	157.8
6/29/2010	191.60	0.00	25.8	158.4	18.1	165.3	42.2	141.6	7.9	157.7
7/28/2010	187.50	0.00	26.1	158.1	18.3	165.1	42.9	140.9	8.0	157.6
8/31/2010	179.20	0.00	26.8	157.4	18.9	164.5	42.9	140.9	7.9	157.7
9/29/2010	175.60	0.00	27.2	157.0	19.3	164.1	44.0	139.8	8.0	157.6
10/26/2010	178.20	2.93	27.8	156.4	20.3	163.1	44.3	139.5	8.6	157.0
11/30/2010	178.80	1.14	28.4	155.8	21.3	162.1	44.6	139.2	8.9	156.7
12/30/2010	193.90	9.95	27.0	157.2	19.5	163.9	42.1	141.7	7.5	158.1
1/27/2011	194.00	0.86	26.0	158.2	18.8	164.6	42.7	141.2	7.8	157.8
2/23/2011	193.80	1.02	25.6	158.7	18.2	165.2	42.4	141.4	7.9	157.8
3/29/2011	193.90	2.38	24.6	159.6	16.8	166.6	41.9	141.9	7.6	158.0
4/27/2011	193.60	0.56	25.0	159.2	17.0	166.4	42.4	141.4	7.8	157.8

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
5/25/2011	193.10	0.51	25.5	158.7	17.6	165.8	42.3	141.5	7.9	157.7
6/28/2011	192.00	0.00	25.8	158.4	18.3	165.1	42.4	141.4	8.0	157.6
7/27/2011	186.75	0.00	26.1	158.1	18.4	165.1	42.6	141.2	8.2	157.4
8/25/2011	176.30	0.00	26.9	157.3	18.5	164.9	43.4	140.4	8.5	157.1
9/28/2011	176.00	0.06	27.7	156.5	20.0	163.5	44.5	139.3	8.7	156.9
10/25/2011	176.50	0.89	28.1	156.1	20.6	162.8	44.8	139.0	8.9	156.7
11/22/2011	177.20	1.31	28.4	155.8	21.2	162.2	44.7	139.1	9.0	156.6
12/22/2011	176.70	0.20	28.5	155.7	21.6	161.8	45.2	138.6	8.9	156.7
1/25/2012	178.60	0.84	28.3	155.9	21.4	162.0	44.2	139.6	9.2	156.4
2/28/2012	179.20	0.68	28.6	155.6	21.7	161.7	44.2	139.6	9.4	156.2
3/27/2012	180.60	1.73	28.4	155.8	21.8	161.7	43.8	140.0	9.2	156.4
6/27/2012	180.70	0.00	27.9	156.3	20.2	163.2	44.1	139.7	9.6	156.0
7/26/2012	179.20	0.10	28.2	156.0	21.5	161.9	44.4	139.4	9.2	156.4
8/8/2012	178.50	0.10	28.0	156.2	21.1	162.3	44.9	138.9	9.0	156.6
8/28/2012	177.10	0.00	28.2	156.0	21.3	162.1	45.3	138.5	9.1	156.5
8/29/2012	177.10	0.00	27.8	156.4	20.9	162.5	45.7	138.1	8.9	156.7
9/25/2012	175.30	0.00	28.3	155.9	21.4	162.0	46.2	137.6	9.1	156.5
10/30/2012	176.00	0.19	28.6	155.6	21.8	161.6	46.3	137.5	9.2	156.4
11/27/2012	175.80	0.69	28.8	155.4	22.1	161.3	46.1	137.7	9.3	156.3
12/12/2012	176.10	1.40	28.6	155.6	22.0	161.5	45.6	138.2	9.3	156.3
1/22/2013	177.20	1.20	28.8	155.4	22.3	161.1	44.6	139.2	9.2	156.4
2/27/2013	178.20	0.31	28.6	155.6	22.2	161.2	44.4	139.4	9.4	156.2
3/28/2013	178.20	0.71	28.7	155.5	22.3	161.1	44.1	139.7	9.5	156.1
4/25/2013	177.30	0.03	28.7	155.5	22.3	161.1	45.0	138.8	9.5	156.1
5/22/2013	177.60	0.00	28.5	155.7	22.3	161.1	44.9	138.9	9.5	156.1
6/25/2013	177.50	0.00	28.7	155.5	22.4	161.1	45.0	138.8	9.6	156.1
7/23/2013	175.70	0.00	28.7	155.5	22.3	161.1	45.7	138.1	9.5	156.2
8/21/2013	174.50	0.00	28.6	155.6	22.3	161.1	46.1	137.7	9.4	156.2

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
9/25/2013	175.70	0.00	28.7	155.5	22.0	161.4	46.4	137.4	9.4	156.2
10/29/2013	176.00	0.00	28.8	155.4	22.5	160.9	42.3	141.6	9.4	156.2
11/27/2013	176.50	0.44	28.6	155.6	22.5	160.9	46.2	137.6	9.3	156.3
12/19/2013	176.80	0.53	28.6	155.6	22.5	160.9	45.6	138.2	9.5	156.1
1/28/2014	176.80	0.00	28.9	155.3	22.9	160.5	45.4	138.4	9.6	156.0
2/25/2014	176.70	0.72	28.9	155.3	22.9	160.5	45.2	138.6	9.6	156.0
3/25/2014	178.50		28.8	155.5	22.9	160.6	44.6	139.2	9.6	156.0
3/29/2014	178.40	1.44	28.9	155.3	22.9	160.5	44.7	139.1	9.3	156.3
4/25/2014	177.40	0.74	28.7	155.5	22.7	160.7	44.8	139.0	9.5	156.1
5/28/2014	176.40	0.00	28.8	155.4	22.7	160.7	43.3	140.5	9.6	156.0
6/25/2014	176.10	0.00	28.8	155.4	22.7	160.7	46.3	137.5	8.9	156.7
7/30/2014	177.30	0.00	28.6	155.7	22.6	160.9	46.9	136.9	9.3	156.3
8/26/2014	176.10	0.03	32.5	151.7	22.5	160.9	42.5	141.3	9.5	156.1
9/23/2014	175.90	0.00	28.7	155.5	22.7	160.7	46.6	137.3	9.4	156.3
10/30/2014	176.30	0.00	28.7	155.5	22.7	160.7	46.6	137.2	9.3	156.3
11/21/2014	176.20	0.25	28.6	155.6	22.7	160.7	45.0	138.8	9.1	156.5
12/30/2014	178.90	3.37	28.5	155.7	22.8	160.6	45.1	138.7	9.4	156.2
1/27/2015	179.60	0.89	28.6	155.6	22.8	160.6	44.8	139.0	9.3	156.3
2/27/2015	180.00	0.46	28.2	156.0	22.4	161.0	44.3	139.5	9.1	156.5
3/26/2015	179.60	0.45	28.2	156.0	22.3	161.1	42.5	141.3	9.1	156.5
4/29/2015	178.20	0.24	28.1	156.1	22.1	161.3	42.4	141.4	9.0	156.6
5/27/2015	179.00	1.04	28.5	155.7	22.2	161.2	44.0	139.8	9.3	156.3
6/25/2015	179.60	0.00	28.3	155.9	22.1	161.3	46.9	136.9	9.0	156.6
7/29/2015	178.10	0.00	28.0	156.2	22.0	161.4	45.0	138.8	8.9	156.7
8/26/2015	176.20	0.00	28.0	156.2	21.2	162.2	40.6	143.2	8.9	156.7
9/22/2015	178.20	1.64	28.2	156.0	22.1	161.3	45.4	138.4	9.0	156.6
10/27/2015	176.90	0.10	28.3	155.9	22.2	161.2	45.8	138.0	9.2	156.4
11/24/2015	176.30	0.17	28.5	155.7	22.3	161.1	42.7	141.1	9.3	156.3

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
12/22/2015	177.60	0.72	28.7	155.5	22.7	160.7	45.7	138.1	9.3	156.3
1/27/2016	180.10	2.86	29.4	154.8	24.7	158.7	45.7	138.1	10.1	155.5
2/25/2016	181.60	0.20	29.3	154.9	24.6	158.9	46.5	137.3	10.1	155.5
3/24/2016	184.80		29.1	155.1	24.3	159.1	46.3	137.5	10.1	155.5
3/31/2016	184.50	1.51	29.1	155.1	24.3	159.1	46.5	137.3	10.1	155.5
4/28/2016	183.60	0.04	28.9	155.3	24.0	159.4	46.9	136.9	10.2	155.4
5/25/2016	182.50	0.13	28.8	155.4	23.7	159.7	46.8	137.0	9.8	155.8
6/28/2016	180.70	0.00	28.9	155.3	23.6	159.8	47.1	136.7	9.9	155.7
7/27/2016	178.40	0.00	29.0	155.2	23.6	159.8	47.5	136.3	9.9	155.7
8/24/2016	176.40	0.00	29.1	155.1	23.6	159.8	47.6	136.2	9.8	155.8
9/27/2016	175.80	0.00	29.4	154.8	23.9	159.5	47.6	136.2	10.0	155.6
10/26/2016	178.60	0.64	29.5	154.7	24.1	159.3	47.6	136.2	10.0	155.6
11/22/2016	178.30	1.11								
12/28/2016	184.80	4.01	29.3	154.9	24.2	159.2	45.5	138.4	10.1	155.5
1/25/2017	193.30	6.33	28.2	156.0	23.0	160.4	42.9	140.9	9.5	156.1
2/28/2017	193.90	3.27	27.4	156.8	21.3	162.1	43.1	140.7	9.0	156.6
3/29/2017	193.70	0.08	27.0	157.2	20.5	162.9	43.7	140.1	9.0	156.6
4/27/2017	192.90	0.04	27.0	157.2	20.6	162.8	43.9	139.9	9.2	156.4
5/23/2017	187.90	33.00	27.3	156.9	23.0	160.4	44.0	139.8	9.7	155.9
6/21/2017	182.50	0.00	27.7	156.5	21.1	162.3	44.8	139.0	9.3	156.3
7/26/2017	163.60	0.00	28.6	155.6	22.0	161.4	46.6	137.2	9.5	156.1
8/30/2017	163.60	0.00	29.4	154.8	23.1	160.3	47.6	136.2	9.8	155.8
9/28/2017	163.60	0.00	29.8	154.4	23.8	159.6	47.6	136.2	9.9	155.7
10/26/2017	171.80	0.00	29.9	154.3	24.3	159.1	47.6	136.2	37.3	128.3
11/29/2017	177.20	0.08	30.0	154.2	24.7	158.7	47.6	136.2	10.2	155.4
12/27/2017	176.70	0.00	29.8	154.4	24.7	158.7	47.6	136.2	10.2	155.4
1/24/2018	178.10	1.67	29.8	154.4	24.7	158.7	47.6	136.1	10.2	155.4
2/21/2018	177.80	0.27	29.8	154.4	24.7	158.7	47.6	136.1	10.2	155.4

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
3/28/2018	183.50	1.23	29.7	154.5	24.6	158.8	47.6	136.1	10.2	155.4
4/27/2018	184.30	0.05	29.4	154.8	24.4	159.0	47.6	136.1	10.2	155.4
5/30/2018	183.10	0.13	29.2	155.0	24.4	159.0	47.6	136.1	10.2	155.4
6/28/2018	181.70	0.00	29.0	155.2	23.6	159.8	47.6	136.1	28.2	137.4
7/26/2018	180.00	0.00	29.1	155.1	23.5	159.9	47.6	136.1	10.0	155.6
8/28/2018	177.30	0.00	29.2	155.0	23.5	159.9	47.6	136.1	9.9	155.7
9/27/2018	178.10	0.00	29.4	154.8	23.7	159.7	47.6	136.1	10.0	155.6
10/24/2018	178.00	0.66	29.4	154.8	23.9	159.5	47.6	136.1	10.1	155.5
11/29/2018	177.50	1.60	29.6	154.6	24.2	159.2	47.6	136.1	10.2	155.4
12/20/2018	181.40	2.39	29.5	154.7	24.1	159.3	46.8	136.9	10.1	155.5
1/30/2019	189.40	4.56	28.9	155.3	25.8	157.6	45.6	138.1	9.9	155.7
2/27/2019	194.10	7.48	17.8		33.9		41.8		6.1	
3/27/2019	194.00	1.27	26		20.5		43.7		9.1	
4/24/2019	193.60	0.07	29.40		20.30		43.80		9.20	
5/30/2019	191.40	0.73	26.90		20.50		44.10		9.30	
6/26/2019	190.80	0.02	27.00		20.60		44.00		9.40	
7/5/2015	190.40	0.00	27.10		20.60		44.20		10.20	
7/30/2019	188.95	0.00	17.80		34.90		42.40		7.30	
8/27/2019	187.40	0.00	18.03		35.11		42.62		7.73	
9/26/2019	186.20	0.00	18.20		34.90		42.80		8.06	
10/22/2019	185.20	0.00	27.90		21.30		45.80		9.70	
11/26/2019	183.50	2.66	8743.00		8514.00		8702.00		8316.00	
12/18/2019	186.80	4.44	8741.00		8511.00		8665.00		8308.00	
1/28/2020	192.00	0.24	29.14		23.80		45.60		9.80	
2/25/2020	192.10	0.49	87.16		8488.50		8635.60		8296.30	
3/24/2020	194.00	3.89	8712.80		8481.00		8636.60		8300.80	
4/29/2020	193.50	4.59	8678.46		8455.261		8641.121		8286.36	
5/27/2020	193.10	0.03	8695.179		8468.494		8646.494		8295.486	
6/24/2020	190.00	0.00	8704.683		8475.23		8651.577		8304.142	

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.7		165.6	
Bottom of Well Elevation --->			151.7		148		136.1		155.4	
Depth of Well --->			32.5		35.4		47.6		10.2	
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Reading	Elev.	Reading	Elev.
	Elevation	Rainfall								
7/29/2020	188.90	0.00	8718.148		8484.906		8654.388		8309.247	
8/27/2020	185.90	0.00	8726.589		8495.277		8663.389		8316.309	
9/29/2020	183.10	0.00	8737.937		8507.042		8659.805		8314.927	
10/29/2020	180.30	0.00	8747.634		8518.862		8682.145		8317.247	
11/24/2020	179.00	0.65	8753.042		8531.034		8686.862		8318.992	
12/29/2020	179.00	1.03	8757.986		8545.635		8683.545		8319.8	
1/26/2021	180.50	2.39	29.10	155.1	23.20	160.2	45.50	138.20	10.10	155.50
2/25/2021	182.10	0.03	28.90	155.3	23.30	160.1	45.30	138.40	9.80	155.80
3/23/2021	182.90	1.15	28.90	155.3	23.30	160.1	45.40	138.30	10.00	155.60
4/27/2021	182.00	0.04	28.90	155.3	23.20	160.2	45.80	137.90	10.00	155.60
5/26/2021	181.00	0.11	28.90	155.3	23.28	160.1	46.58	137.12	9.90	155.70
6/30/2021	179.00	0.00	29.10	155.1	23.40	160.0	46.80	136.90	10.00	155.60
7/27/2021	177.10	0.08	29.20	155.0	23.50	159.9	46.80	136.90	9.90	155.70
8/24/2021	175.40	0.00	29.20	155.0	23.50	159.9	46.80	136.90	9.90	155.70
9/28/2021	175.20	0.06	29.50	154.7	23.80	159.6	47.40	136.30	10.08	155.52
10/27/2021	177.20	0.80	29.50	154.7	24.00	159.4	47.40	136.30	10.10	155.50
11/23/2021	177.80	0.00	29.60	154.6	24.30	159.1	47.60	136.10	10.20	155.40
12/21/2021	180.50	5.86	29.40	154.8	24.30	159.1	46.80	136.90	10.10	155.50
1/25/2022	187.00	0.08	28.80	155.4	23.60	159.8	45.40	138.30	10.10	155.50
2/22/2022	186.60	0.18	28.80	155.4	23.60	159.8	45.40	138.30	10.10	155.50
3/28/2022	186.60	1.38	28.50	155.7	22.70	160.7	45.70	138.00	10.20	155.40
4/26/2022	186.60	0.01	28.40	155.8	22.70	160.7	45.50	138.20	9.80	155.80
5/25/2022	185.30	0.05	28.40	155.8	22.50	160.9	46.10	137.60	9.80	155.80
6/28/2022	182.70	0.00	28.60	155.6	22.60	160.8	46.50	137.20	9.60	156.00
7/26/2022	179.70	0.00	28.80	155.4	22.70	160.7	46.80	136.90	9.60	156.00
8/30/2022	178.30	0.13	29.10	155.1	23.20	160.2	47.10	136.60	9.80	155.80
9/29/2022	175.80	0.24	29.30	154.9	23.60	159.8	47.50	136.20	9.90	155.70
10/26/2022	175.30	0.26	29.40	154.8	23.80	159.6	47.60	136.10	9.90	155.70
11/22/2022	179.40	1.46	29.50	154.7	24.09	159.3	46.95	136.75	10.03	155.57
12/29/2022	185.70	2.21	29.30	154.9	24.10	159.3	45.80	137.90	9.90	155.70

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
1/31/2007	176.80		8.2	152.3	8.6	151.5	0.00	0.0
2/28/2007	177.60		8.4	152.1	5.7	154.4	0.00	0.0
3/29/2007	177.10		8.7	151.8	9.2	150.9	0.00	0.0
4/27/2007	176.60		8.8	151.7	8.9	151.2	0.00	0.0
5/24/2007	176.80		8.9	151.6	9.3	150.8	0.00	0.0
6/27/2007	179.90		8.7	151.8	9.1	151.0	0.00	0.0
7/27/2007	177.80		8.8	151.7	9.4	150.7	0.00	0.0
8/28/2007	177.20		8.9	151.6	9.2	150.9	0.00	0.0
9/26/2007	177.00		8.9	151.6	9.2	150.9	0.00	0.0
10/30/2007	175.50		8.9	151.6	9.2	150.9	0.00	0.0
11/27/2007	175.90		9.0	151.5	9.3	150.8	0.00	0.0
12/27/2007	178.20		9.0	151.5	9.4	150.7	0.00	0.0
1/30/2008	184.40		6.5	154.0	6.3	153.8	0.16	0.0
2/26/2008	186.10		7.6	152.9	7.7	152.4	0.36	0.0
3/26/2008	188.00		8.0	152.5	8.6	151.5	0.84	0.0
4/25/2008	191.00		8.9	151.6	9.0	151.1	1.59	0.0
5/28/2008	190.93		8.6	151.9	9.0	151.1	1.98	0.0
6/25/2008	189.50		8.3	152.2	8.7	151.4	1.59	0.0
7/29/2008	185.10		7.9	152.6	8.4	151.7	1.74	0.0
7/30/2008	185.10	0.00	7.6	152.9	8.6	151.5	2.06	0.0
8/27/2008	178.00	0.00	8.2	152.3	8.3	151.8	0.79	0.0
9/25/2008	176.80	0.00	8.2	152.3	8.1	152.0	0.29	0.0
10/28/2008	175.20	0.00	8.4	152.1	8.6	151.5	0.03	0.0
11/25/2008	175.80	1.82	8.6	151.9	8.7	151.4	0.04	0.0
12/30/2008	181.70	2.91	8.0	152.5	7.8	152.3	0.63	0.0
1/29/2009	182.20	0.39	8.6	151.9	8.5	151.6	0.68	0.0
2/25/2009	185.70	3.10	7.7	152.8	7.5	152.6	1.06	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.



**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
3/26/2009	188.40	0.10	8.5	152.0	8.5	151.6	1.59	0.0
4/28/2009	189.30	0.00	8.6	151.9	8.9	151.2	2.26	0.0
5/18/2009	188.50	0.00	7.8	152.7	9.0	151.1	2.18	0.0
5/27/2009	188.10	0.00	8.7	151.8	9.1	151.0	1.98	0.0
6/30/2009	188.60	0.10	7.8	152.7	8.6	151.5	2.98	0.0
7/30/2009	184.80	0.00	8.1	152.4	8.4	151.7	2.26	0.0
8/26/2009	176.60	0.00	8.0	152.5	8.1	152.0	0.63	0.0
9/30/2009	174.50	0.00	7.9	152.6	8.4	151.7	0.01	0.0
10/28/2009	175.30	0.29	8.0	152.5	8.5	151.6	0.00	0.0
12/1/2009	176.40	0.00	8.0	152.5	8.7	151.4	0.00	0.0
12/28/2009	178.80	2.75	8.2	152.3	8.6	151.5	0.21	0.0
1/26/2010	191.30	4.15	5.6	154.9	4.9	155.2	1.06	0.0
2/24/2010	193.60	2.29	7.1	153.4	6.7	153.4	2.88	0.0
3/29/2010	193.50	1.18	7.3	153.2	6.8	153.3	1.82	0.0
4/4/2010	193.50		7.5	153.0	7.0	153.1	2.54	0.0
4/27/2010	193.90	1.66	7.3	153.2	6.8	153.3	0.75	0.0
5/27/2010	192.90	0.03	7.4	153.1	7.5	152.6	3.17	0.0
6/29/2010	191.60	0.00	7.7	152.8	8.6	151.5	2.38	0.0
7/28/2010	187.50	0.00	7.5	153.0	7.1	153.0	1.59	0.0
8/31/2010	179.20	0.00	7.4	153.1	7.7	152.4	0.98	0.0
9/29/2010	175.60	0.00	7.3	153.2	7.3	152.8	0.13	0.0
10/26/2010	178.20	2.93	7.5	153.0	7.6	152.5	0.20	0.0
11/30/2010	178.80	1.14	8.0	152.5	8.6	151.5	0.32	0.0
12/30/2010	193.90	9.95	4.6	155.9	3.7	156.4	2.51	0.0
1/27/2011	194.00	0.86	6.4	154.2	5.9	154.2	2.25	0.0
2/23/2011	193.80	1.02	6.5	154.0	6.1	154.0	1.46	0.0
3/29/2011	193.90	2.38	4.8	155.7	3.8	156.3	0.87	0.0
4/27/2011	193.60	0.56	6.0	154.6	5.2	154.9	0.79	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
5/25/2011	193.10	0.51	6.8	153.7	6.2	153.9	0.79	0.0
6/28/2011	192.00	0.00	7.8	152.7	7.3	152.8	1.59	0.0
7/27/2011	186.75	0.00	7.7	152.9	7.0	153.1	0.98	0.0
8/25/2011	176.30	0.00	7.7	152.8	7.8	152.3	0.69	0.0
9/28/2011	176.00	0.06	7.8	152.7	7.9	152.3	0.13	0.0
10/25/2011	176.50	0.89	7.9	152.6	8.3	151.8	0.26	0.0
11/22/2011	177.20	1.31	8.4	152.1	8.4	151.8	0.24	0.0
12/22/2011	176.70	0.20	8.7	151.8	8.5	151.6	0.30	0.0
1/25/2012	178.60	0.84	7.8	152.7	8.6	151.5	0.32	0.0
2/28/2012	179.20	0.68	8.0	152.5	8.6	151.5	0.40	0.0
3/27/2012	180.60	1.73	7.9	152.6	8.6	151.5	0.43	0.0
6/27/2012	180.70	0.00	8.9	151.6	9.4	150.7	0.13	0.0
7/26/2012	179.20	0.10	8.8	151.7	9.5	150.6	0.12	0.0
8/8/2012	178.50	0.10	8.9	151.6	8.6	151.5	0.32	0.0
8/28/2012	177.10	0.00	8.9	151.6	9.4	150.7	0.24	0.0
8/29/2012	177.10	0.00	9.2	151.3	8.6	151.5	0.18	0.0
9/25/2012	175.30	0.00	8.9	151.6	9.4	150.7	0.07	0.0
10/30/2012	176.00	0.19	8.9	151.6	9.3	150.8	0.12	0.0
11/27/2012	175.80	0.69	9.0	151.5	9.2	150.9	0.13	0.0
12/12/2012	176.10	1.40	9.0	151.6	9.0	151.1	0.13	0.0
1/22/2013	177.20	1.20	9.0	151.5	9.3	150.8	0.24	0.0
2/27/2013	178.20	0.31	8.9	151.6	9.2	150.9	0.14	0.0
3/28/2013	178.20	0.71	9.0	151.5	9.4	150.7	0.32	0.0
4/25/2013	177.30	0.03	9.0	151.5	9.4	150.7	0.34	0.0
5/22/2013	177.60	0.00	9.0	151.5	9.4	150.7	0.16	0.0
6/25/2013	177.50	0.00	8.9	151.6	9.2	150.9	0.23	0.0
7/23/2013	175.70	0.00	8.9	151.6	9.3	150.8	0.12	0.0
8/21/2013	174.50	0.00	9.0	151.5	9.5	150.6	0.10	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
9/25/2013	175.70	0.00	9.0	151.5	9.4	150.7	0.16	0.0
10/29/2013	176.00	0.00	9.0	151.5	9.4	150.7	0.22	0.0
11/27/2013	176.50	0.44	8.9	151.6	9.2	150.9	0.25	0.0
12/19/2013	176.80	0.53	9.0	151.5	9.4	150.7	0.40	0.0
1/28/2014	176.80	0.00	9.0	151.5	9.4	150.7	0.37	0.0
2/25/2014	176.70	0.72	9.0	151.5	9.4	150.7	0.22	0.0
3/25/2014	178.50		9.0	151.5	9.4	150.7	0.25	0.0
3/29/2014	178.40	1.44	9.0	151.5	9.4	150.7	0.47	0.0
4/25/2014	177.40	0.74	9.0	151.5	9.5	150.6	0.32	0.0
5/28/2014	176.40	0.00	9.0	151.5	9.3	150.8	0.04	0.0
6/25/2014	176.10	0.00	9.0	151.5	9.5	150.6	0.21	0.0
7/30/2014	177.30	0.00	9.0	151.5	9.4	150.7	0.28	0.0
8/26/2014	176.10	0.03	9.0	151.5	9.4	150.7	0.29	0.0
9/23/2014	175.90	0.00	8.9	151.7	9.2	150.9	0.26	0.0
10/30/2014	176.30	0.00	8.0	152.5	8.5	151.6	0.29	0.0
11/21/2014	176.20	0.25	8.9	151.6	9.2	150.9	0.32	0.0
12/30/2014	178.90	3.37	8.8	151.7	9.2	150.9	0.42	0.0
1/27/2015	179.60	0.89	8.9	151.6	9.1	151.0	0.40	0.0
2/27/2015	180.00	0.46	8.9	151.6	9.1	151.0	0.52	0.0
3/26/2015	179.60	0.45	9.0	151.5	8.9	151.2	0.61	0.0
4/29/2015	178.20	0.24	8.9	151.6	9.2	150.9	0.55	0.0
5/27/2015	179.00	1.04	8.9	151.6	9.3	150.8	0.48	0.0
6/25/2015	179.60	0.00	8.9	151.6	9.3	150.8	0.44	0.0
7/29/2015	178.10	0.00	8.9	151.6	9.3	150.8	0.55	0.0
8/26/2015	176.20	0.00	8.9	151.6	9.3	150.8	0.13	0.0
9/22/2015	178.20	1.64	8.9	151.6	9.3	150.8	0.61	0.0
10/27/2015	176.90	0.10	8.9	151.6	9.3	150.8	0.42	0.0
11/24/2015	176.30	0.17	9.0	151.5	9.3	150.8	0.40	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
12/22/2015	177.60	0.72	9.0	151.5	8.4	151.7	0.41	0.0
1/27/2016	180.10	2.86	8.9	151.6	9.4	150.7	0.37	0.0
2/25/2016	181.60	0.20	9.0	151.5	9.5	150.6	0.57	0.0
3/24/2016	184.80		8.9	151.6	9.5	150.6	0.60	0.0
3/31/2016	184.50	1.51	8.9	151.6	9.5	150.6	2.03	0.0
4/28/2016	183.60	0.04	9.0	151.5	9.5	150.6	1.76	0.0
5/25/2016	182.50	0.13	9.0	151.5	9.5	150.6	1.61	0.0
6/28/2016	180.70	0.00	9.0	151.5	9.5	150.6	1.11	0.0
7/27/2016	178.40	0.00	9.0	151.5	9.5	150.6	1.02	0.0
8/24/2016	176.40	0.00	9.0	151.5	9.5	150.6	0.61	0.0
9/27/2016	175.80	0.00	9.0	151.5	9.5	150.6	0.40	0.0
10/26/2016	178.60	0.64	9.0	151.5	9.5	150.6	0.88	0.0
11/22/2016	178.30	1.11					0.92	0.0
12/28/2016	184.80	4.01	9.0	151.5	9.5	150.6	1.36	0.0
1/25/2017	193.30	6.33	4.7	155.8	7.7	152.4	2.01	0.0
2/28/2017	193.90	3.27	3.8	156.7	6.5	153.6	1.72	0.0
3/29/2017	193.70	0.08	4.9	155.6	7.7	152.4	1.66	0.0
4/27/2017	192.90	0.04	5.5	155.0	8.2	151.9	2.77	0.0
5/23/2017	187.90	33.00	9.0	151.5	9.0	151.1	3.29	0.0
6/21/2017	182.50	0.00	8.9	151.6	8.6	151.5	2.06	0.0
7/26/2017	163.60	0.00	8.8	151.7	8.5	151.6	0.26	0.0
8/30/2017	163.60	0.00	8.4	152.1	9.2	150.9	0.00	0.0
9/28/2017	163.60	0.00	9.0	151.5	9.5	150.6	0.00	0.0
10/26/2017	171.80	0.00	9.0	151.5	9.5	150.6	0.00	0.0
11/29/2017	177.20	0.08	9.0	151.5	9.5	150.6	0.00	0.0
12/27/2017	176.70	0.00	9.0	151.5	9.5	150.6	0.00	0.0
1/24/2018	178.10	1.67	9.0	151.5	9.5	150.6	0.02	0.0
2/21/2018	177.80	0.27	9.0	151.5	9.5	150.6	0.00	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
3/28/2018	183.50	1.23	9.0	151.5	9.5	150.6	0.14	0.0
4/27/2018	184.30	0.05	9.0	151.5	9.5	150.6	0.29	0.0
5/30/2018	183.10	0.13	9.0	151.5	9.5	150.6	0.22	0.0
6/28/2018	181.70	0.00	9.0	151.5	9.5	150.6	0.15	0.0
7/26/2018	180.00	0.00	9.0	151.5	9.5	150.6	0.03	0.0
8/28/2018	177.30	0.00	9.0	151.5	9.5	150.6	0.00	0.0
9/27/2018	178.10	0.00	9.0	151.5	9.5	150.6	0.00	0.0
10/24/2018	178.00	0.66	9.0	151.5	9.5	150.6	0.00	0.0
11/29/2018	177.50	1.60	9.0	151.5	9.5	150.6	0.00	0.0
12/20/2018	181.40	2.39	9.0	151.5	9.5	150.6	0.08	0.0
1/30/2019	189.40	4.56	8.4	152.1	8.4	151.7	0.76	0.0
2/27/2019	194.10	7.48	6.5		5.8		1.82	0.0
3/27/2019	194.00	1.27	7.1		7		1.66	0.0
4/24/2019	193.60	0.07	7.60		7.60		1.66	0.0
5/30/2019	191.40	0.73	8.40		8.20		1.35	0.0
6/26/2019	190.80	0.02	7.90		7.90		1.53	0.0
7/5/2019	190.40	0.00	9.00		9.50		1.59	0.0
7/30/2019	188.95	0.00	9.00		9.50		1.37	0.0
8/27/2019	187.40	0.00	9.00		0.00		1.06	0.0
9/26/2019	186.20	0.00	9.00		9.50		1.03	0.0
10/22/2019	185.20	0.00	9.00		9.50		1.05	0.0
11/26/2019	183.50	2.66	8081.00		8358.00		1.13	0.0
12/18/2019	186.80	4.44	8070.00		8344.00		1.65	0.0
1/28/2020	192.00	0.24	8.39		8.40		2.06	0.0
2/25/2020	192.10	0.49	8052.60		8325.60		2.57	0.0
3/24/2020	194.00	3.89	8014.40		8288.70		2.44	0.0
4/29/2020	193.50	4.59	8005.488		8269.357		3.70	0.0
5/27/2020	193.10	0.03	8038.796		8312.104		4.12	0.0
6/24/2020	190.00	0.00	8073.167		8344.973		4.23	0.0

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 2**  
**SAND CANYON DAM**  
**PIEZOMETER AND SUBDRAIN MEASUREMENTS**  
**JANUARY 2007 THROUGH DECEMBER 2022**

Monitoring Well --->			VBW/12		VBW/13		Seepage Flow Point	
Top of Well Elevation --->			160.5		160.1		Drain ID	
Bottom of Well Elevation --->			151.5		150.6			
Depth of Well --->			9		9.5			
Date	Spillway 378'		Reading	Elev.	Reading	Elev.	Seepage Flow Point (Gal / Min)	
	Elevation	Rainfall					Left Subdrain	Right Subdrain
7/29/2020	188.90	0.00	8066.977		8341.389		3.54	0.0
8/27/2020	185.90	0.00	8080.359		8356.421		3.49	0.0
9/29/2020	183.10	0.00	8077.749		8356.66		2.43	0.0
10/29/2020	180.30	0.00	8084.328		8366.622		1.51	0.0
11/24/2020	179.00	0.65	8089.965		8379.636		1.05	0.0
12/29/2020	179.00	1.03	8086.061		8380.184		0.89	0.0
1/26/2021	180.50	2.39	9.00	151.50	9.50	150.60	0.98	0.00
2/25/2021	182.10	0.03	9.00	151.50	9.50	150.60	1.00	0.00
3/23/2021	182.90	1.15	9.00	151.50	9.50	150.60	1.36	0.00
4/27/2021	182.00	0.04	9.00	151.50	9.50	150.60	1.17	0.00
5/26/2021	181.00	0.11	9.00	151.50	9.50	150.60	0.87	0.00
6/30/2021	179.00	0.00	9.00	151.50	9.50	150.60	0.69	0.00
7/27/2021	177.10	0.08	9.00	151.50	9.50	150.60	0.43	0.00
8/24/2021	175.40	0.00	9.00	151.50	9.50	150.60	0.24	0.00
9/28/2021	175.20	0.06	8.79	151.71	9.50	150.60	0.19	0.00
10/27/2021	177.20	0.80	9.00	151.50	9.50	150.60	0.32	0.00
11/23/2021	177.80	0.00	9.00	151.50	9.50	150.60	0.51	0.00
12/21/2021	180.50	5.86	9.00	151.50	9.50	150.60	0.63	0.00
1/25/2022	187.00	0.08	9.00	151.50	9.50	150.60	1.59	0.00
2/22/2022	186.60	0.18	9.00	151.50	9.50	150.60	1.59	0.00
3/28/2022	186.60	1.38	9.00	151.50	9.50	150.60	1.33	0.00
4/26/2022	186.60	0.01	9.00	151.50	9.50	150.60	1.35	0.00
5/25/2022	185.30	0.05	9.20	151.30	9.90	150.20	1.30	0.00
6/28/2022	182.70	0.00	9.00	151.50	9.50	150.60	1.19	0.00
7/26/2022	179.70	0.00	9.00	151.50	9.50	150.60	0.76	0.00
8/30/2022	178.30	0.13	9.00	151.50	9.50	150.60	0.57	0.00
9/29/2022	175.80	0.24	9.50	151.00	10.00	150.10	0.32	0.00
10/26/2022	175.30	0.26	9.00	151.50	9.50	150.60	0.27	0.00
11/22/2022	179.40	1.46	9.00	151.50	9.50	150.60	0.49	0.00
12/29/2022	185.70	2.21	8.90	151.60	9.80	150.30	1.37	0.00

Notes:

1. Readings in red are classified as erroneous
2. Elevation calculations between 2/27/2019 and 12/29/2020 were not included due to issues with data logger.
3. Piezometer data based on NGVD 29 datum.

**TABLE 3**  
**SAND CANYON DAM**  
**HORIZONTAL MOVEMENT OF SURVEY MONUMENTS**  
**1975 THROUGH 2022**

Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1968													
1969													
1975	9/15/1975	0.050	0.600	0.060	0.720	0.050	0.600	0.040	0.480			0.000	0.000
1976													
1977													
1978													
1979													
1980													
1981	12/15/1981	0.070	0.840	0.080	0.960	0.080	0.960	0.040	0.480			0.100	1.200
1982	6/15/1982	0.030	0.360	0.070	0.840	0.100	1.200	0.080	0.960			0.050	0.600
1983													
1984													
1985	10/20/1985	0.070	0.840	0.090	1.080	0.120	1.440	0.130	1.560			0.060	0.720
1986													
1987	10/20/1987	0.080	0.960	0.120	1.440	0.110	1.320	0.110	1.320	0.150	1.800	0.060	0.720
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995	5/8/1995	0.060	0.720	0.080	0.960	0.130	1.560	0.120	1.440	0.120	1.440	0.040	0.480
1996	5/1/1996	0.080	0.960	0.100	1.200	0.120	1.440	0.120	1.440	0.150	1.800	0.050	0.600
1997	5/28/1997	0.070	0.840	0.080	0.960	0.100	1.200	0.100	1.200	0.130	1.560	0.005	0.600

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 3**  
**SAND CANYON DAM**  
**HORIZONTAL MOVEMENT OF SURVEY MONUMENTS**  
**1975 THROUGH 2022**

Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1998	5/11/1998	0.070	0.840	0.080	0.960	0.100	1.200	0.100	1.200	0.120	1.440	0.010	0.120
1999	4/26/1999	0.070	0.840	0.090	1.080	0.100	1.200	0.095	1.140	0.115	1.380	0.015	0.180
2000	6/29/2000	0.075	0.900	0.090	1.080	0.105	1.260	0.095	1.140	0.120	1.440	0.015	0.180
2001	5/2/2001	0.075	0.900	0.090	1.080	0.100	1.200	0.095	1.140	0.110	1.320	0.020	0.240
2002	5/21/2002	0.070	0.840	0.090	1.080	0.120	1.440	0.100	1.200	0.105	1.260	0.020	0.240
2003	5/21/2003	0.075	0.900	0.095	1.140	0.115	1.380	0.100	1.200	0.110	1.320	0.015	0.180
2004	5/18/2004	0.070	0.840	0.100	1.200	0.120	1.440	0.100	1.200	0.115	0.138	0.020	0.240
2005	5/31/2005	0.070	0.840	0.100	1.200	0.105	1.260	0.100	1.200	0.115	1.380	0.020	0.240
2006	5/31/2006	0.070	0.840	0.095	1.140	0.110	1.320	0.100	1.200	0.115	1.380	0.010	0.120
2007	5/15/2007	0.080	0.960	0.085	1.020	0.105	1.260	0.090	1.080	0.105	1.260	0.020	0.240
2008	5/27/2008	0.080	0.960	0.085	1.020	0.105	1.260	0.100	1.200	0.120	1.440	0.020	0.240
2009	6/9/2009	0.065	0.780	0.085	1.020	0.095	1.140	0.100	1.200	0.120	1.440	0.020	0.240
2010	5/24/2010	0.060	0.720	0.080	0.960	0.110	1.320	0.090	1.080	0.105	1.260	0.020	0.240
2011	5/18/2011	0.065	0.780	0.080	0.960	0.110	1.320	0.110	1.320	0.120	1.440	0.020	0.240
2012	5/18/2012	0.065	0.780	0.085	1.020	0.110	1.320	0.105	1.260	0.120	1.440	0.020	0.240
2013	6/6/2013	0.065	0.780	0.105	1.260	0.100	1.200	0.100	1.200	0.115	1.380	0.015	0.180
2014	4/25/2014	0.095	1.140	0.100	1.200	0.130	1.560	0.100	1.200	0.120	1.440	0.015	0.180
2015	6/4/2015	0.080	0.960	0.080	0.960	0.115	1.380	0.105	1.260	0.115	1.380	0.020	0.240
2016	7/25/2016	0.080	0.960	0.085	1.020	0.115	1.380	0.110	1.320	0.125	1.500	0.015	0.180
2017	6/15/2017												
2018	5/31/2018	0.080	0.960	0.090	1.080	0.115	1.380	0.105	1.260	0.125	1.500	0.025	0.300
2019	6/13/2019	0.080	0.960	0.095	1.140	0.120	1.440	0.115	1.380	0.125	1.500	0.020	0.240
2020	10/16/2020	0.060	0.720	0.060	0.720	0.110	1.320	0.110	1.320	0.130	1.560	0.035	0.420
2021													
2022	4/26/2022	0.060	0.720	0.070	0.840	0.110	1.320	0.110	1.320	0.120	1.440	0.025	0.300
2022	10/27/2022	0.07	0.84	0.095	1.14	0.115	1.38	0.095	1.14	0.115	1.38	0.02	0.24

**Note:**

1. Vertical data is referenced in NGVD 29 datum.



**TABLE 4**  
**SAND CANYON DAM**  
**CUMULATIVE HORIZONTAL DISPLACEMENT OF SURVEY MONUMENTS**  
**1975 THROUGH 2022**

Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1968													
1969													
1975	9/15/1975	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000
1976													
1977													
1978													
1979													
1980													
1981	12/15/1981	0.020	0.240	0.020	0.240	0.030	0.360	0.000	0.000			0.100	1.200
1982	6/15/1982	-0.020	-0.240	0.010	0.120	0.050	0.600	0.040	0.480			0.050	0.600
1983													
1984													
1985	10/20/1985	0.020	0.240	0.030	0.360	0.070	0.840	0.090	1.080			0.006	0.720
1986													
1987	10/20/1987	0.030	0.360	0.060	0.720	0.060	0.720	0.070	0.840	0.000	0.000	0.060	0.720
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995	5/8/1995	0.010	0.120	0.020	0.240	0.080	0.960	0.080	0.960	-0.030	-0.360	0.040	0.480
1996	5/1/1996	0.030	0.360	0.040	0.480	0.070	0.840	0.080	0.960	0.000	0.000	0.050	0.600
1997	5/28/1997	0.020	0.240	0.020	0.240	0.050	0.600	0.060	0.720	-0.020	-0.240	0.050	0.600

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 4**  
**SAND CANYON DAM**  
**CUMULATIVE HORIZONTAL DISPLACEMENT OF SURVEY MONUMENTS**  
**1975 THROUGH 2022**

Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1998	5/11/1998	0.020	0.240	0.020	0.240	0.050	0.600	0.060	0.720	-0.030	-0.360	0.010	0.120
1999	4/26/1999	0.020	0.240	0.030	0.360	0.050	0.600	0.055	0.660	-0.035	-0.420	0.015	0.180
2000	6/29/2000	0.025	0.300	0.030	0.360	0.055	0.660	0.055	0.660	-0.030	-0.360	0.015	0.180
2001	5/2/2001	0.025	0.300	0.030	0.360	0.050	0.600	0.055	0.660	-0.040	-0.480	0.020	0.240
2002	5/21/2002	0.020	0.240	0.030	0.360	0.070	0.840	0.060	0.720	-0.045	-0.540	0.020	0.240
2003	5/21/2003	0.025	0.300	0.035	0.420	0.065	0.780	0.060	0.720	-0.040	-0.480	0.015	0.180
2004	5/18/2004	0.020	0.240	0.040	0.480	0.070	0.840	0.060	0.720	-0.035	-0.420	0.020	0.240
2005	5/31/2005	0.020	0.240	0.040	0.480	0.055	0.660	0.060	0.720	-0.035	-0.420	0.020	0.240
2006	5/31/2006	0.020	0.240	0.035	0.420	0.060	0.720	0.060	0.720	-0.035	-0.420	0.010	0.120
2007	5/15/2007	0.030	0.360	0.025	0.300	0.055	0.660	0.050	0.600	-0.045	-0.540	0.020	0.240
2008	5/27/2008	0.030	0.360	0.025	0.300	0.055	0.660	0.060	0.720	-0.030	-0.360	0.020	0.240
2009	6/9/2009	0.015	0.180	0.025	0.300	0.045	0.540	0.060	0.720	-0.030	-0.360	0.020	0.240
2010	5/24/2010	0.010	0.120	0.020	0.240	0.060	0.720	0.050	0.600	-0.045	-0.540	0.020	0.240
2011	5/18/2011	0.015	0.180	0.020	0.240	0.060	0.720	0.070	0.840	-0.030	-0.360	0.020	0.240
2012	5/18/2012	0.015	0.180	0.025	0.300	0.060	0.720	0.065	0.780	-0.030	-0.360	0.020	0.240
2013	6/6/2013	0.015	0.180	0.015	0.180	0.055	0.660	0.060	0.720	-0.035	-0.420	0.015	0.180
2014	4/25/2014	0.045	0.540	0.040	0.480	0.080	0.960	0.060	0.720	-0.030	-0.360	0.015	0.180
2015	6/4/2015	0.030	0.360	0.020	0.240	0.065	0.780	0.065	0.780	-0.035	-0.420	0.020	0.240
2016	7/25/2016	0.030	0.360	0.025	0.300	0.065	0.780	0.070	0.840	-0.025	-0.300	0.015	0.180
2017	6/15/2017												
2018	5/31/2018	0.030	0.360	0.030	0.360	0.065	0.780	0.065	0.780	-0.025	-0.300	0.025	0.300
2019	6/13/2019	0.030	0.360	0.035	0.420	0.070	0.840	0.075	0.900	-0.025	-0.300	0.020	0.240
2020	10/16/2020	0.010	0.120	0.000	0.000	0.060	0.720	0.070	0.840	-0.020	-0.240	0.035	0.420
2021													
2022	4/26/2022	0.010	0.120	0.010	0.120	0.060	0.720	0.070	0.840	-0.030	-0.360	0.025	0.300
2022	10/27/2022	0.02	0.24	0.035	0.42	0.065	0.78	0.055	0.66	-0.035	-0.42	0.02	0.24

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 5**  
**SAND CANYON DAM**  
**ELEVATIONS OF SURVEY MONUMENTS**  
**1968 THROUGH 2022**

Monument ID		S-1	S-2	S-3	S-4	S-6	S-5
Approx . Station		8+00.234	6+00.212	4+00.125	2+00.191	0+61.430	0+00.079
Year	Date	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
1968		200.75	200.33	200.4	200.57		
1969		200.6	200.24	200.29	200.41		
1975	9/15/1975	200.727	200.956	200.534	200.430		200.570
1976							
1977							
1978							
1979							
1980							
1981	12/15/1981	200.750	201.970	200.540	200.630		200.570
1982	6/15/1982	200.800	201.010	200.570	200.660		200.610
1983							
1984							
1985	10/20/1985	200.740	200.960	200.540	200.600		200.550
1986							
1987	10/20/1987	200.790		200.550	200.630	200.760	200.550
1988							
1989							
1990							
1991							
1992							
1993							
1994							
1995	5/8/1995	200.840	201.060	200.610	200.680	200.830	200.660
1996	5/1/1996	200.840	201.060	200.610	200.690	200.840	200.670
1997	5/28/1997	200.850	201.070	200.610	200.700	200.810	200.680

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 5**  
**SAND CANYON DAM**  
**ELEVATIONS OF SURVEY MONUMENTS**  
**1968 THROUGH 2022**

Monument ID		S-1	S-2	S-3	S-4	S-6	S-5
Approx . Station		8+00.234	6+00.212	4+00.125	2+00.191	0+61.430	0+00.079
Year	Date	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
1998	5/11/1998	200.850	201.060	200.600	200.680	200.780	200.660
1999	4/26/1999	200.847	201.057	200.592	200.677	200.772	200.657
2000	6/29/2000	200.847	201.057	200.597	200.682	200.777	200.667
2001	5/2/2001	200.847	201.057	200.602	200.692	200.787	200.672
2002	5/21/2002	200.852	201.057	200.597	200.682	200.782	200.672
2003	5/21/2003	200.852	201.062	200.602	200.687	200.787	200.677
2004	5/18/2004	200.852	201.062	200.602	200.687	200.787	200.677
2005	5/31/2005	200.852	201.062	200.602	200.682	200.782	200.672
2006	5/31/2006	200.857	201.062	200.597	200.682	200.782	200.672
2007	5/15/2007	200.847	201.060	200.597	200.680	200.778	200.671
2008	5/27/2008	200.850	201.054	200.591	200.673	200.774	200.668
2009	6/9/2009	200.847	201.067	200.607	200.687	200.787	200.682
2010	5/24/2010	200.847	201.052	200.587	200.672	200.772	200.667
2011	5/18/2011	200.847	201.052	200.592	200.677	200.777	200.672
2012	5/18/2012	200.847	201.057	200.592	200.677	200.777	200.672
2013	6/6/2013	200.847	201.057	200.587	200.672	200.777	200.672
2014	4/25/2014	200.847	201.062	200.597	200.682	200.787	200.682
2015	6/4/2015	200.847	201.057	200.587	200.677	200.777	200.672
2016	7/25/2016	200.842	201.047	200.582	200.672	200.772	200.667
2017	6/15/2017						
2018	5/31/2018	200.842	201.057	200.592	200.682	200.787	200.682
2019	6/13/2019	200.852	201.052	200.582	200.667	200.767	200.662
2020	10/16/2020	200.843	201.052	200.574	200.660	200.764	200.658
2021							
2022	4/26/2022	200.845	201.054	200.581	200.668	200.771	200.667
2022	10/27/2022	200.842	201.057	200.581	200.669	200.767	200.665

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 6**  
**SAND CANYON DAM**  
**CUMULATIVE VERTICAL MOVEMENT OF SURVEY MONUMENTS**  
**1969 THROUGH 2022**

Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1968													
1969		-0.15	-1.800	-0.09	-1.080	-0.11	-1.32	-0.16	-1.92				
1975	9/15/1975	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000
1976													
1977													
1978													
1979													
1980													
1981	12/15/1981	-0.023	-0.276	-1.014	-12.168	-0.006	-0.072	-0.200	-2.400			0.000	0.000
1982	6/15/1982	-0.073	-0.876	-0.054	-0.648	-0.036	-0.432	-0.230	-2.760			-0.040	-0.480
1983													
1984													
1985	10/20/1985	-0.013	-0.156	-0.004	-0.048	-0.006	-0.072	-0.170	-2.040			0.020	0.240
1986													
1987	10/20/1987	-0.063	-0.756		0.000	-0.016	-0.192	-0.200	-2.400	0.000	0.000	0.020	0.240
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995	5/8/1995	-0.113	-1.356	-0.104	-1.248	-0.076	-0.912	-0.250	-3.000	-0.070	-0.840	-0.090	-1.080
1996	5/1/1996	-0.113	-1.356	-0.104	-1.248	-0.076	-0.912	-0.260	-3.120	-0.080	-0.960	-0.100	-1.200
1997	5/28/1997	-0.123	-1.476	-0.114	-1.368	-0.076	-0.912	-0.270	-3.240	-0.050	-0.600	-0.110	-1.320

Note:

1. Vertical data is referenced in NGVD 29 datum.

**TABLE 6**  
**SAND CANYON DAM**  
**CUMULATIVE VERTICAL MOVEMENT OF SURVEY MONUMENTS**  
**1969 THROUGH 2022**

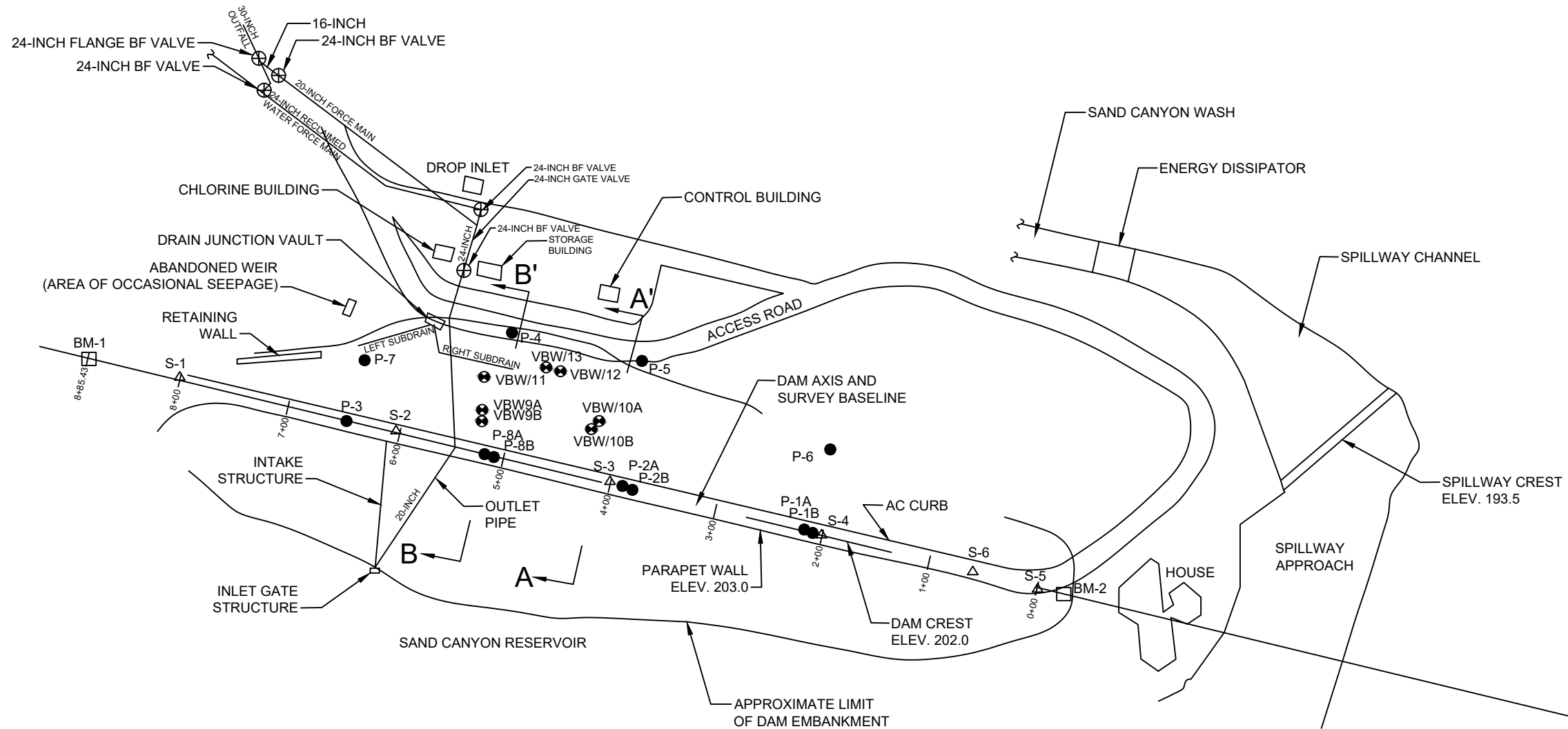
Monument ID		S-1		S-2		S-3		S-4		S-6		S-5	
Approx. Station		8+00.234		6+00.212		4+00.125		2+00.191		0+61.430		0+00.079	
Year	Date	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)	(feet)	(inches)
1998	5/11/1998	-0.123	-1.476	-0.104	-1.248	-0.066	-0.792	-0.250	-3.000	-0.020	-0.240	-0.090	-1.080
1999	4/26/1999	-0.120	-1.440	-0.101	-1.212	-0.058	-0.696	-0.247	-2.964	-0.012	-0.144	-0.087	-1.044
2000	6/29/2000	-0.120	-1.440	-0.101	-1.212	-0.063	-0.756	-0.252	-3.024	-0.017	-0.204	-0.097	-1.164
2001	5/2/2001	-0.120	-1.440	-0.101	-1.212	-0.068	-0.816	-0.262	-3.144	-0.027	-0.324	-0.102	-1.224
2002	5/21/2002	-0.125	-1.500	-0.101	-1.212	-0.063	-0.756	-0.252	-3.024	-0.022	-0.264	-0.102	-1.224
2003	5/21/2003	-0.125	-1.500	-0.106	-1.272	-0.068	-0.816	-0.257	-3.084	-0.027	-0.324	-0.107	-1.284
2004	5/18/2004	-0.125	-1.500	-0.106	-1.272	-0.068	-0.816	-0.257	-3.084	-0.027	-0.324	-0.107	-1.284
2005	5/31/2005	-0.125	-1.500	-0.106	-1.272	-0.068	-0.816	-0.252	-3.024	-0.022	-0.264	-0.102	-1.224
2006	5/31/2006	-0.130	-1.560	-0.106	-1.272	-0.063	-0.756	-0.252	-3.024	-0.022	-0.264	-0.102	-1.224
2007	5/15/2007	-0.120	-1.440	-0.104	-1.248	-0.063	-0.756	-0.250	-3.000	-0.018	-0.216	-0.101	-1.212
2008	5/27/2008	-0.123	-1.476	-0.098	-1.176	-0.057	-0.684	-0.243	-2.916	-0.014	-0.168	-0.098	-1.176
2009	6/9/2009	-0.120	-1.440	-0.111	-1.332	-0.073	-0.876	-0.257	-3.084	-0.027	-0.324	-0.112	-1.344
2010	5/24/2010	-0.120	-1.440	-0.096	-1.152	-0.053	-0.636	-0.242	-2.904	-0.012	-0.144	-0.097	-1.164
2011	5/18/2011	-0.120	-1.440	-0.096	-1.152	-0.058	-0.696	-0.247	-2.964	-0.017	-0.204	-0.102	-1.224
2012	5/18/2012	-0.120	-1.440	-0.101	-1.212	-0.058	-0.696	-0.247	-2.964	-0.017	-0.204	-0.102	-1.224
2013	6/6/2013	-0.120	-1.440	-0.101	-1.212	-0.053	-0.636	-0.242	-2.904	-0.017	-0.204	-0.102	-1.224
2014	4/25/2014	-0.120	-1.440	-0.106	-1.272	-0.063	-0.756	-0.252	-3.024	-0.027	-0.324	-0.112	-1.344
2015	6/4/2015	-0.120	-1.440	-0.101	-1.212	-0.053	-0.636	-0.247	-2.964	-0.017	-0.204	-0.102	-1.224
2016	7/25/2016	-0.115	-1.380	-0.091	-1.092	-0.048	-0.576	-0.242	-2.904	-0.012	-0.144	-0.097	-1.164
2017	6/15/2017												
2018	5/31/2018	-0.115	-1.380	-0.101	-1.212	-0.058	-0.696	-0.252	-3.024	-0.027	-0.324	-0.112	-1.344
2019	6/13/2019	-0.125	-1.500	-0.096	-1.152	-0.048	-0.576	-0.237	-2.844	-0.007	-0.084	-0.092	-1.104
2020	10/16/2020	-0.116	-1.392	-0.096	-1.152	-0.040	-0.480	-0.230	-2.760	-0.004	-0.048	-0.088	-1.056
2021													
2022	4/26/2022	-0.118	-1.416	-0.098	-1.176	-0.047	-0.564	-0.238	-2.856	-0.011	-0.132	-0.097	-1.164
2022	10/27/2022	-0.115	-1.38	-0.101	-1.212	-0.047	-0.564	-0.239	-2.868	-0.007	-0.084	-0.095	-1.14

**Note:**

1. Vertical data is referenced in NGVD 29 datum.

## Figures

---



**LEGEND**

- ⊙ VBW/13 VIBRATING WIRE PIEZOMETER
- P-2A OPEN WELL PIEZOMETER
- △ S-3 SURVEY MONUMENT
- BM-1 BENCH MARK
- A — A' LINE OF SECTION
- OUTLET PIPE
- SEEPAGE SUBDRAIN
- 0+00 — STATION NUMBER

**NOTES:**

- (1) SECTION A-A' IS SHOWN ON FIGURE 2
- (2) SECTION B-B' IS SHOWN ON FIGURE 3
- (3) ELEVATIONS ARE IN FEET RELATIVE TO NGVD29 DATUM
- (4) LOCATIONS OF OUTLET PIPES AND VALVES ARE ESTIMATED

NOT TO SCALE

Annual Surveillance Report from Jan. 2021 to Dec. 2022  
 Sand Canyon Dam  
 Irvine, CA  
 Irvine Ranch Water District  
 Irvine, CA



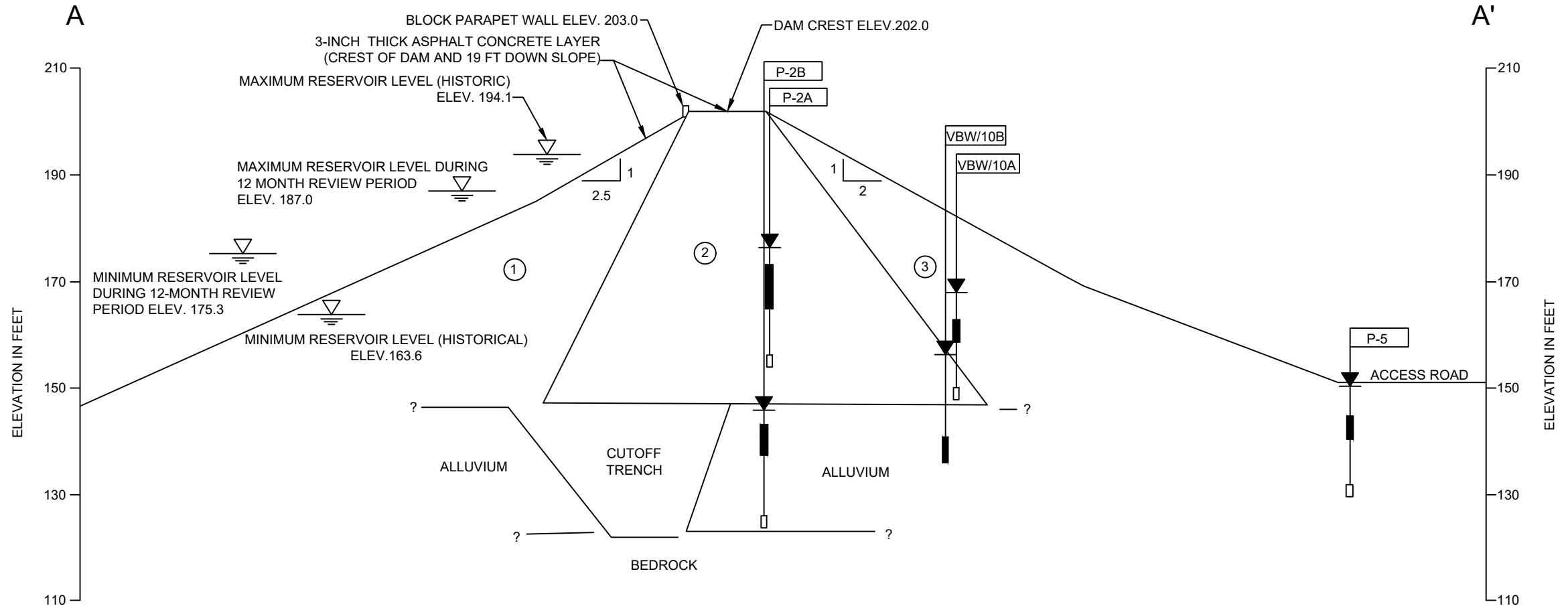
SITE AND INSTRUMENTATION PLAN

Project 1901888

May 2023

Fig. 1





**LEGEND**

**MATERIALS**

- ① SELECTED IMPERVIOUS
- ② RANDOM
- ③ UNSELECTED PERVIOUS

**MONITORING POINTS:**

- P-2B: PIEZOMETER (OPEN WELL TYPE)
- ▲: SURFACE OF DAM
- ▼: MAXIMUM HISTORICAL LEVEL
- ▬: HIGH RANGE OF MEASURED LEVELS IN PIEZOMETER DURING 12 MONTH REVIEW PERIOD
- ▬: LOW
- : PIEZOMETER TIP


NOTE: QUESTIONABLE READINGS ARE NOT SHOWN

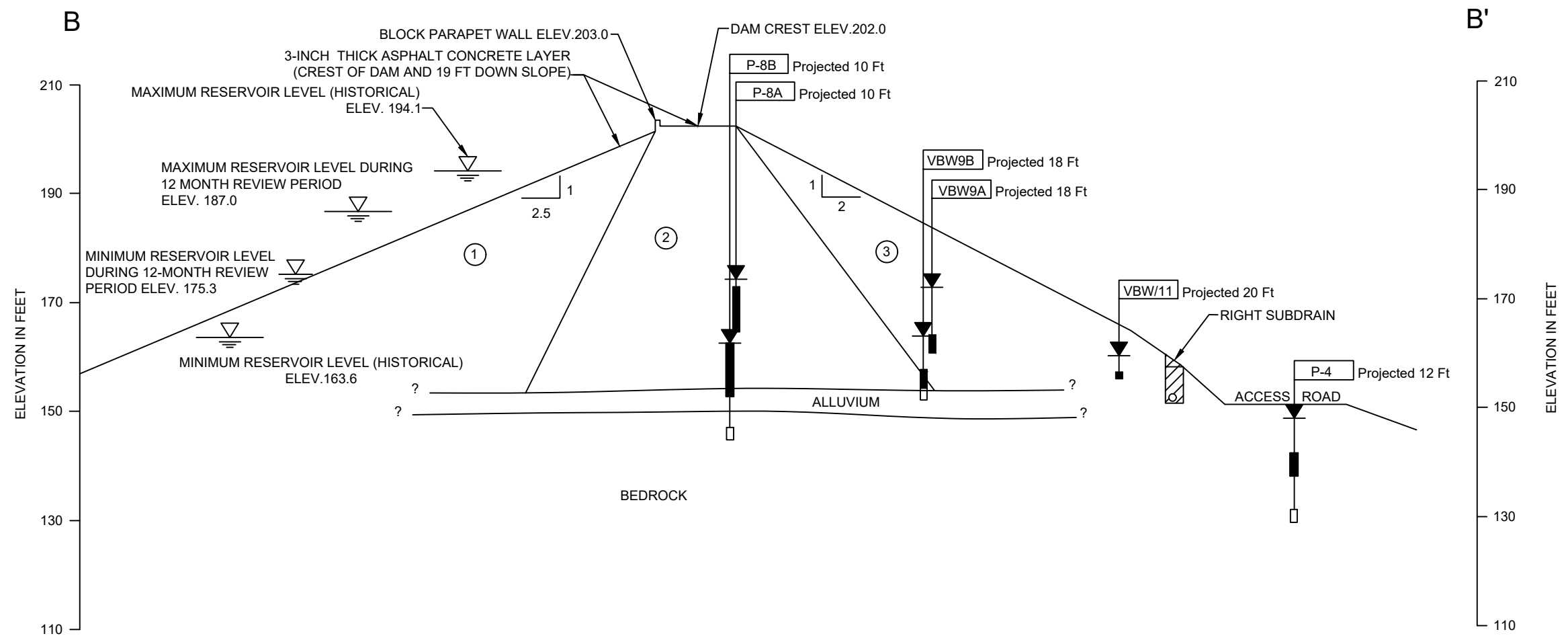
**NOTES:**

(1) SEE FIGURE 1 FOR LOCATION OF SECTION

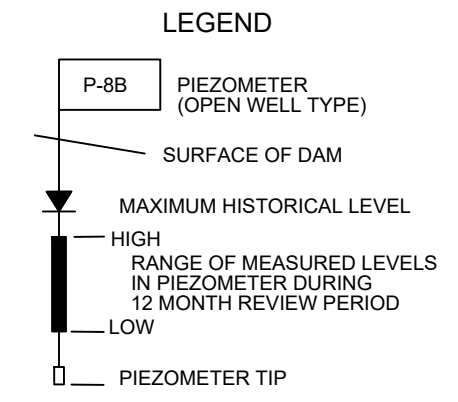
(2) ELEVATIONS ARE IN FEET RELATIVE TO NGVD29

NOT TO SCALE

Annual Surveillance Report from Jan. 2021 to Dec. 2022 Sand Canyon Dam Irvine, CA		SECTION A-A'	
Irvine Ranch Water District Irvine, CA		Project 1901888	May 2023



- MATERIALS**
- ① SELECTED IMPERVIOUS
  - ② RANDOM
  - ③ UNSELECTED PERVIOUS



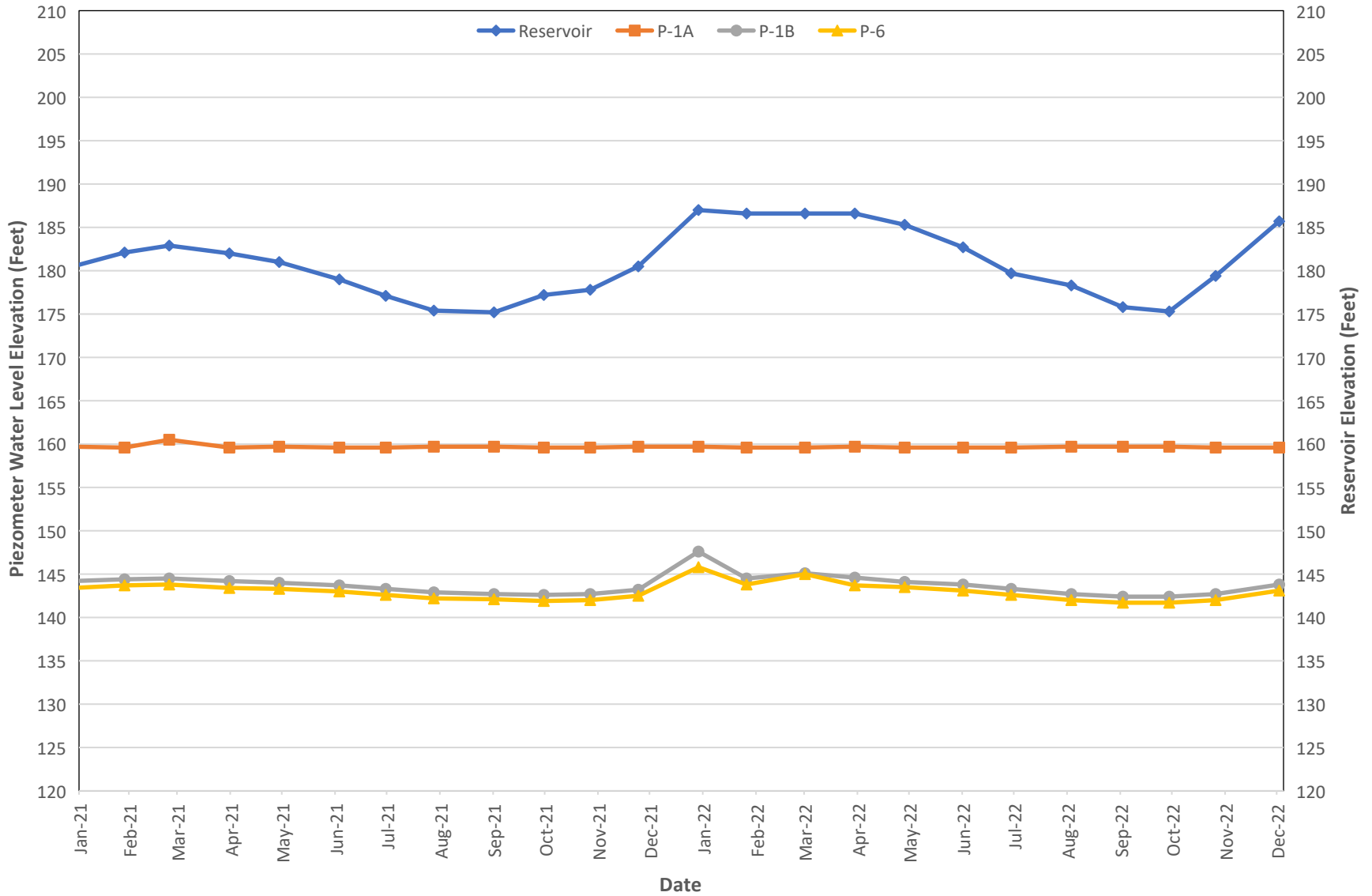
NOTE: QUESTIONABLE READINGS ARE NOT SHOWN

- NOTES:**
- (1) SEE FIGURE 1 FOR LOCATION OF SECTION
  - (2) ELEVATIONS ARE IN FEET RELATIVE TO NGVD29

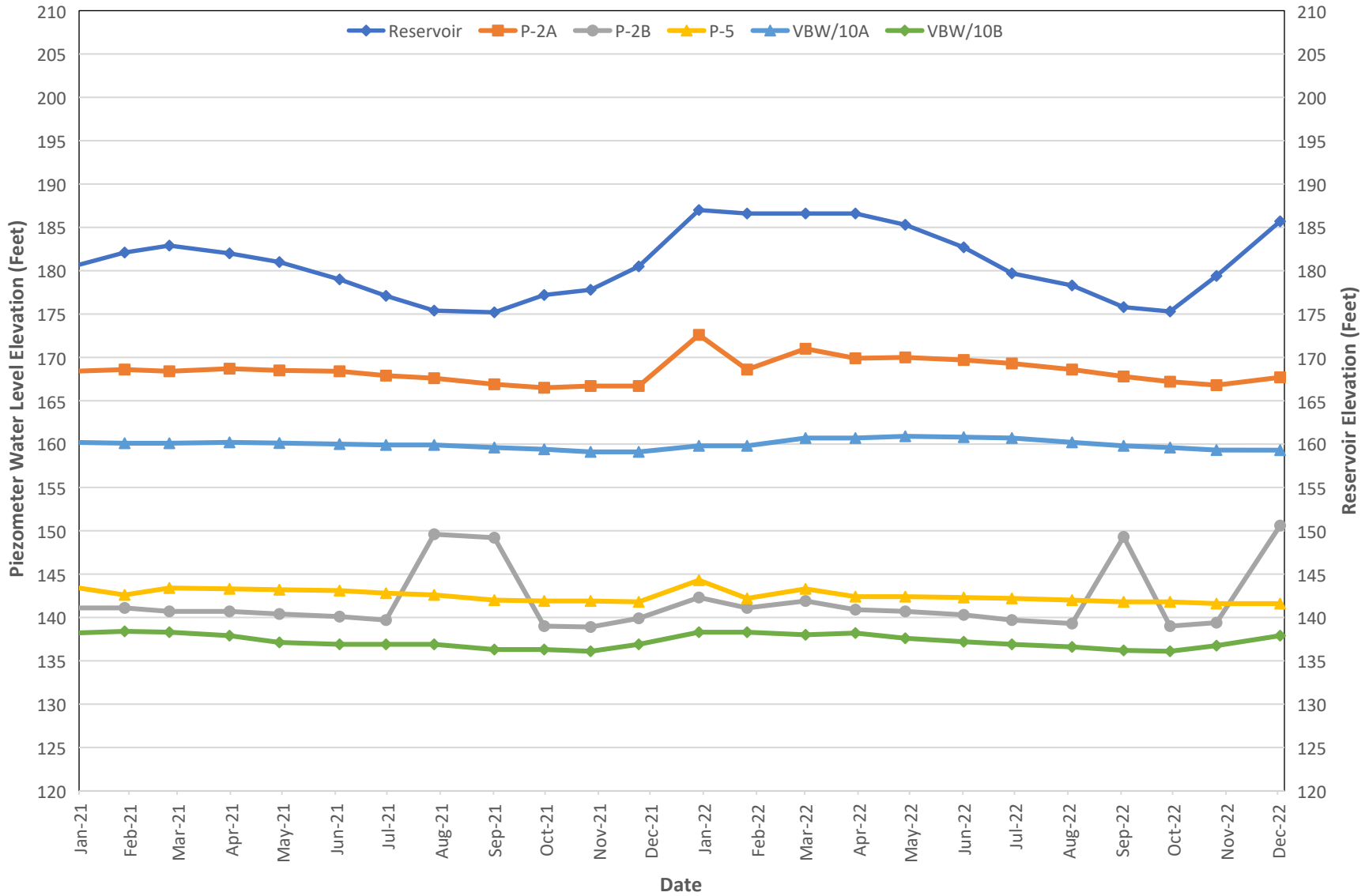
NOT TO SCALE

Annual Surveillance Report from Jan. 2021 to Dec. 2022 Sand Canyon Dam Irvine, CA		SECTION B-B'	
		Irvine Ranch Water District Irvine, CA	Project 1901888
		May 2023	Fig. 3

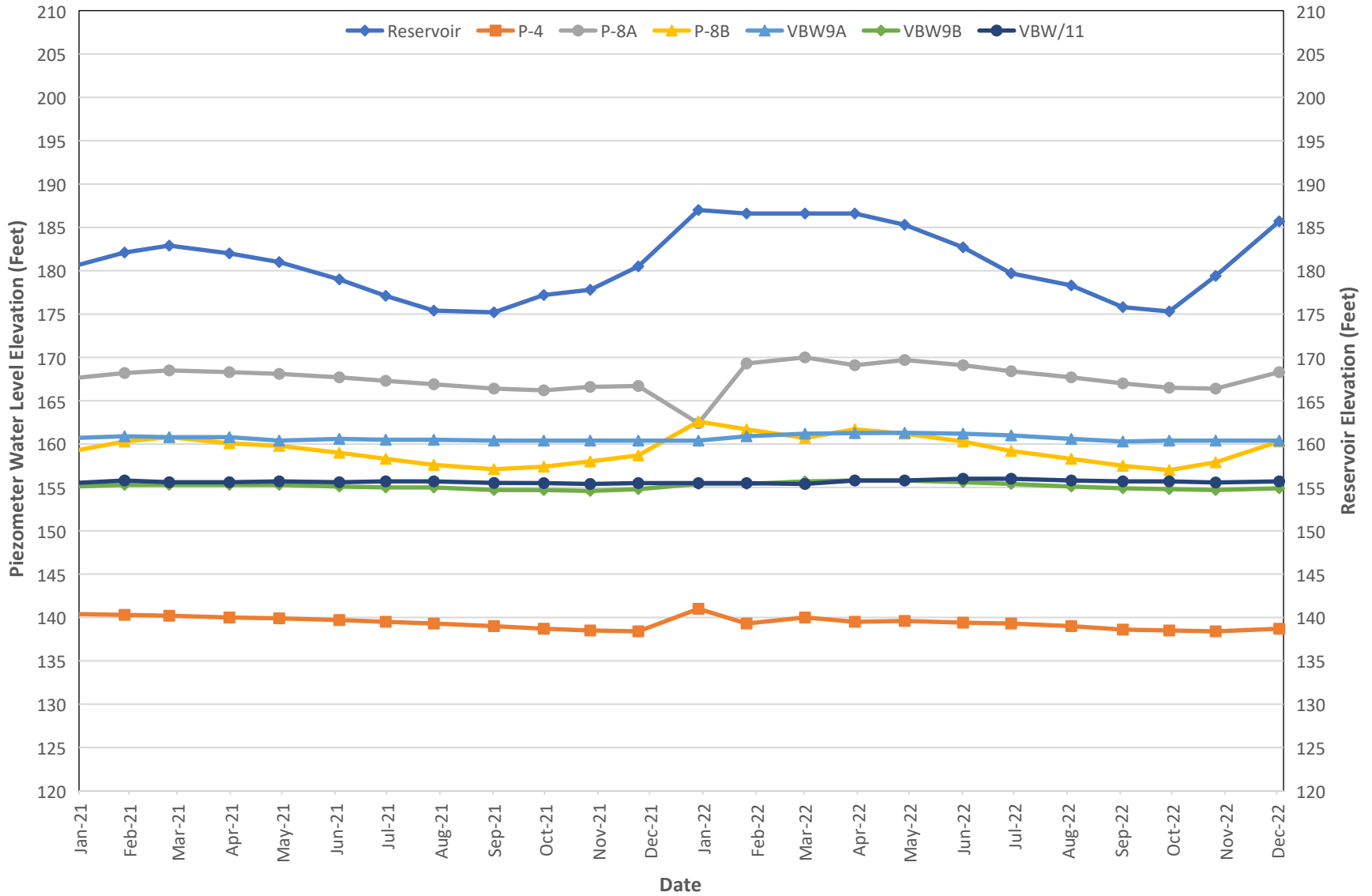
**Figure 4**  
**SAND CANYON DAM**  
**2-YR OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**OPEN WELL PIEZOMETERS P-1A, P-1B, AND P-6**  
**JANUARY 2021 THROUGH DECEMBER 2022**



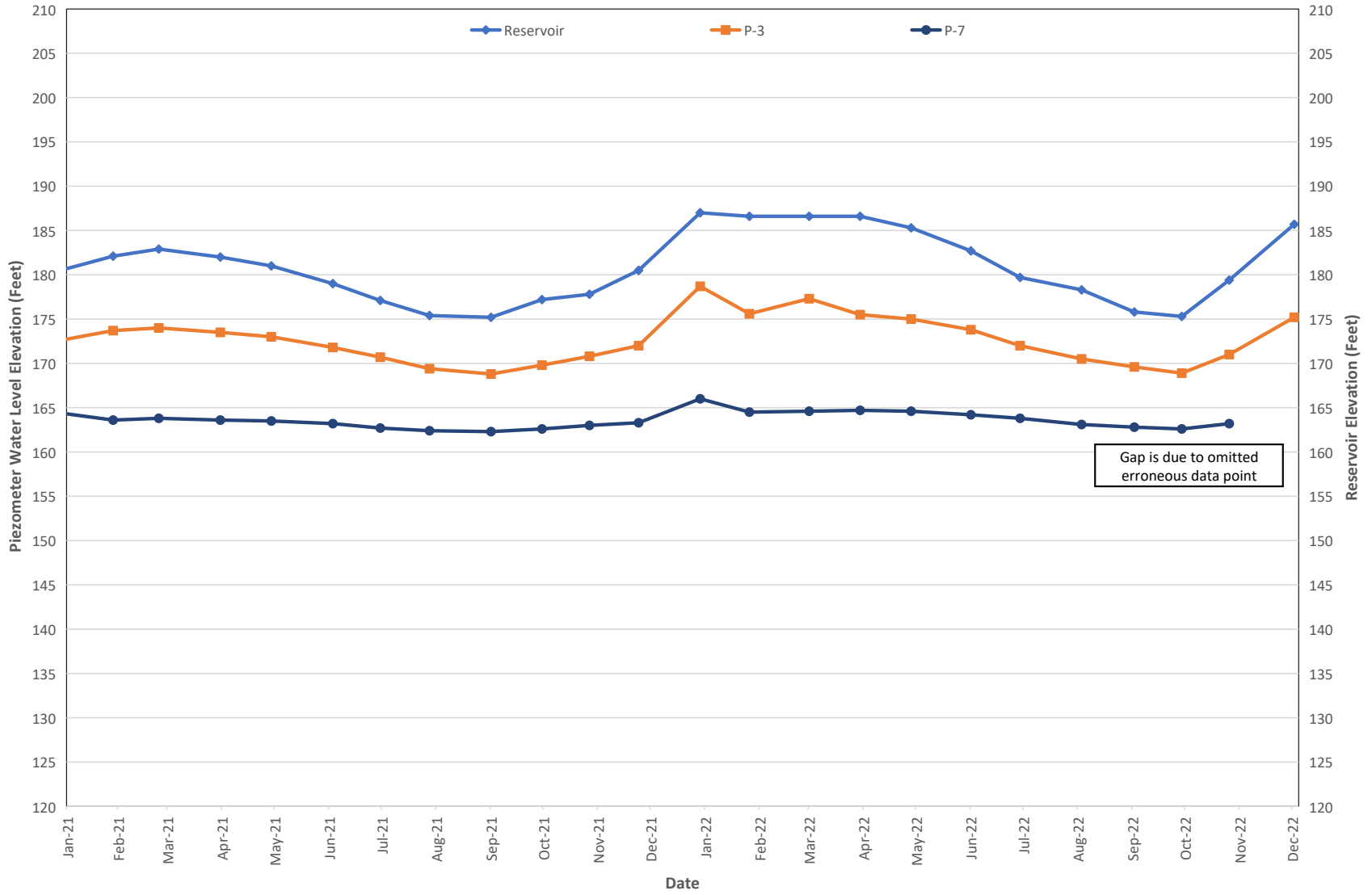
**Figure 5**  
**SAND CANYON DAM**  
**2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-2A, P-2B, P-5, VBW/10A, AND VBW/10B**  
**JANUARY 2021 THROUGH DECEMBER 2022**



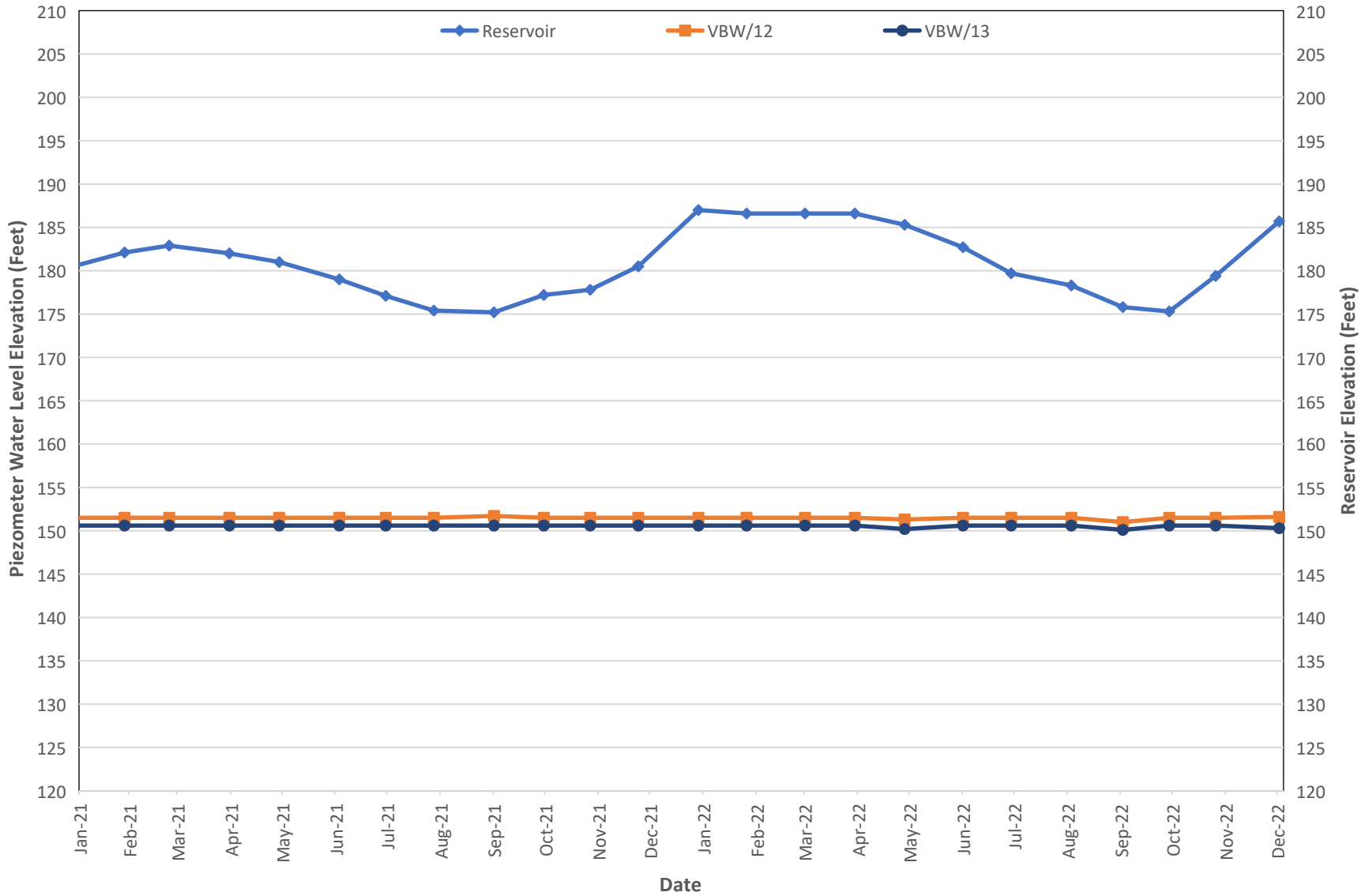
**Figure 6**  
**SAND CANYON DAM**  
**2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-4, P-8A, P-8B, VBW9A, VBW9B, AND VBW/11**  
**JANUARY 2021 THROUGH DECEMBER 2022**



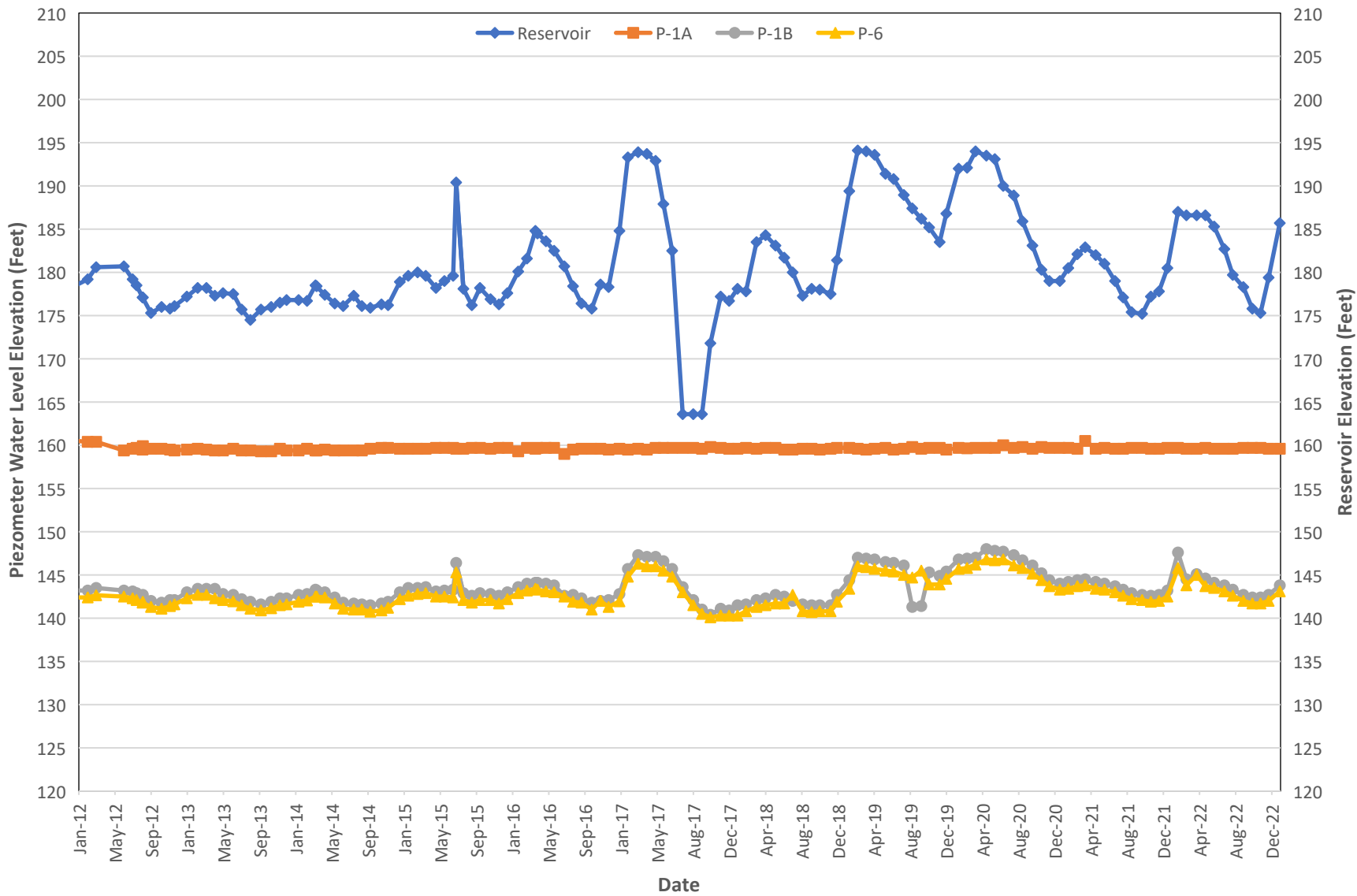
**Figure 7**  
**SAND CANYON DAM**  
**2-YR OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**OPEN WELL PIEZOMETERS P-3, AND P-7**  
**JANUARY 2021 THROUGH DECEMBER 2022**



**Figure 8**  
**SAND CANYON DAM**  
**2-YR VIBRATING WIRE PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**VIBRATING WIRE PIEZOMETERS VBW/12, AND VBW/13**  
**JANUARY 2021 THROUGH DECEMBER 2022**

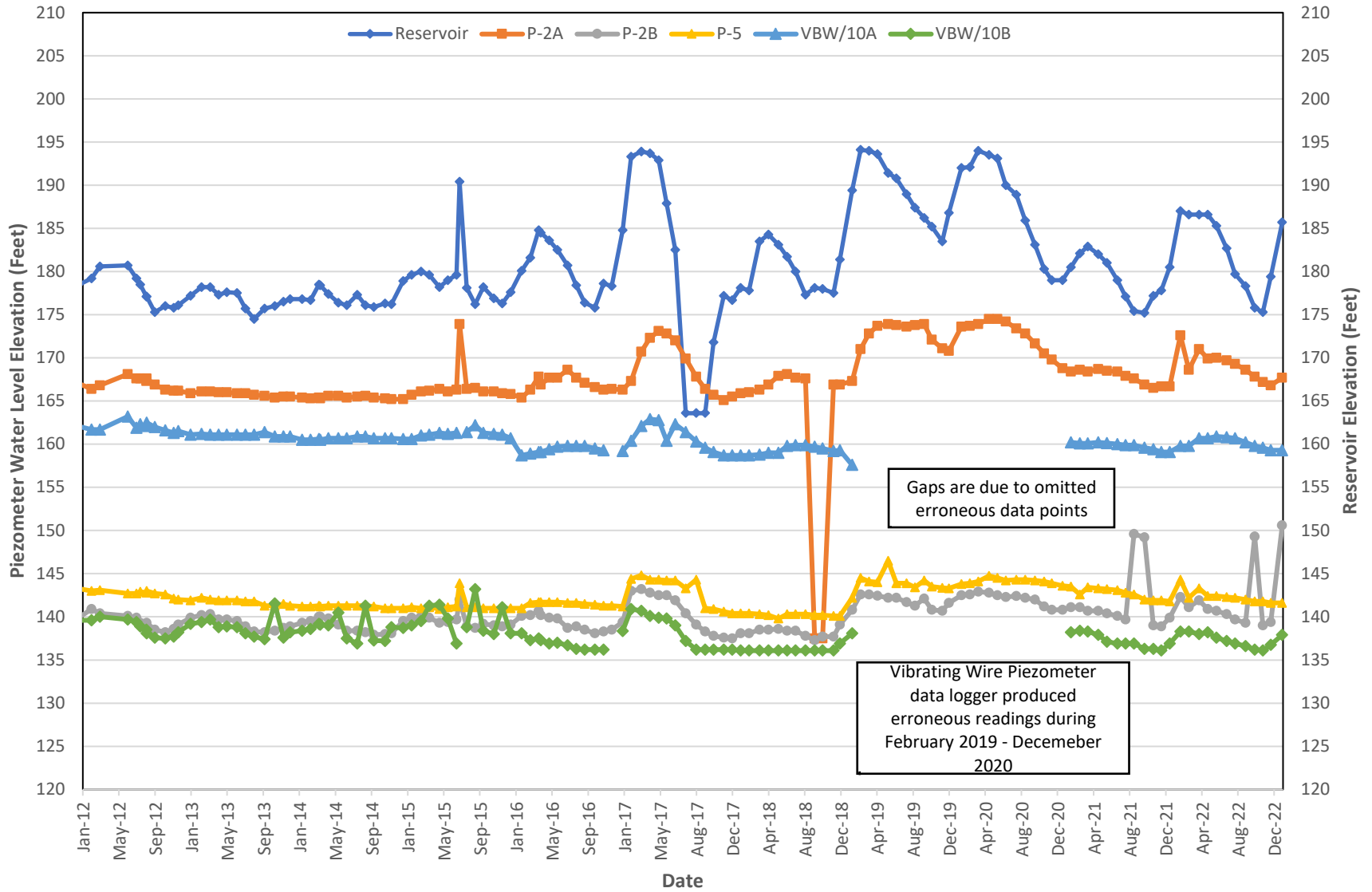


**Figure 9**  
**SAND CANYON DAM**  
**HISTORICAL OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**OPEN WELL PIEZOMETERS P-1A, P-1B, AND P-6**  
**JANUARY 2012 THROUGH DECEMBER 2022**

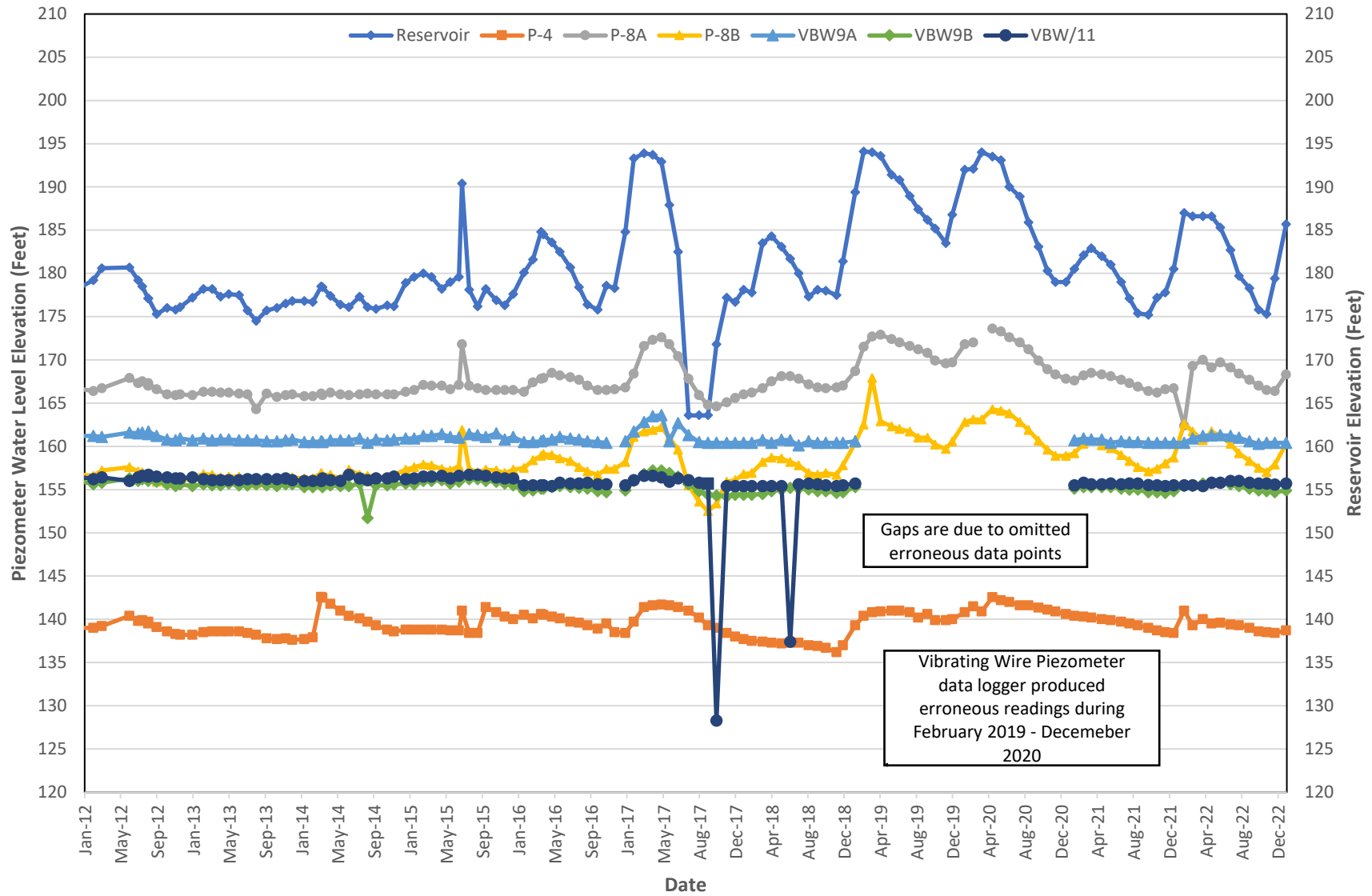




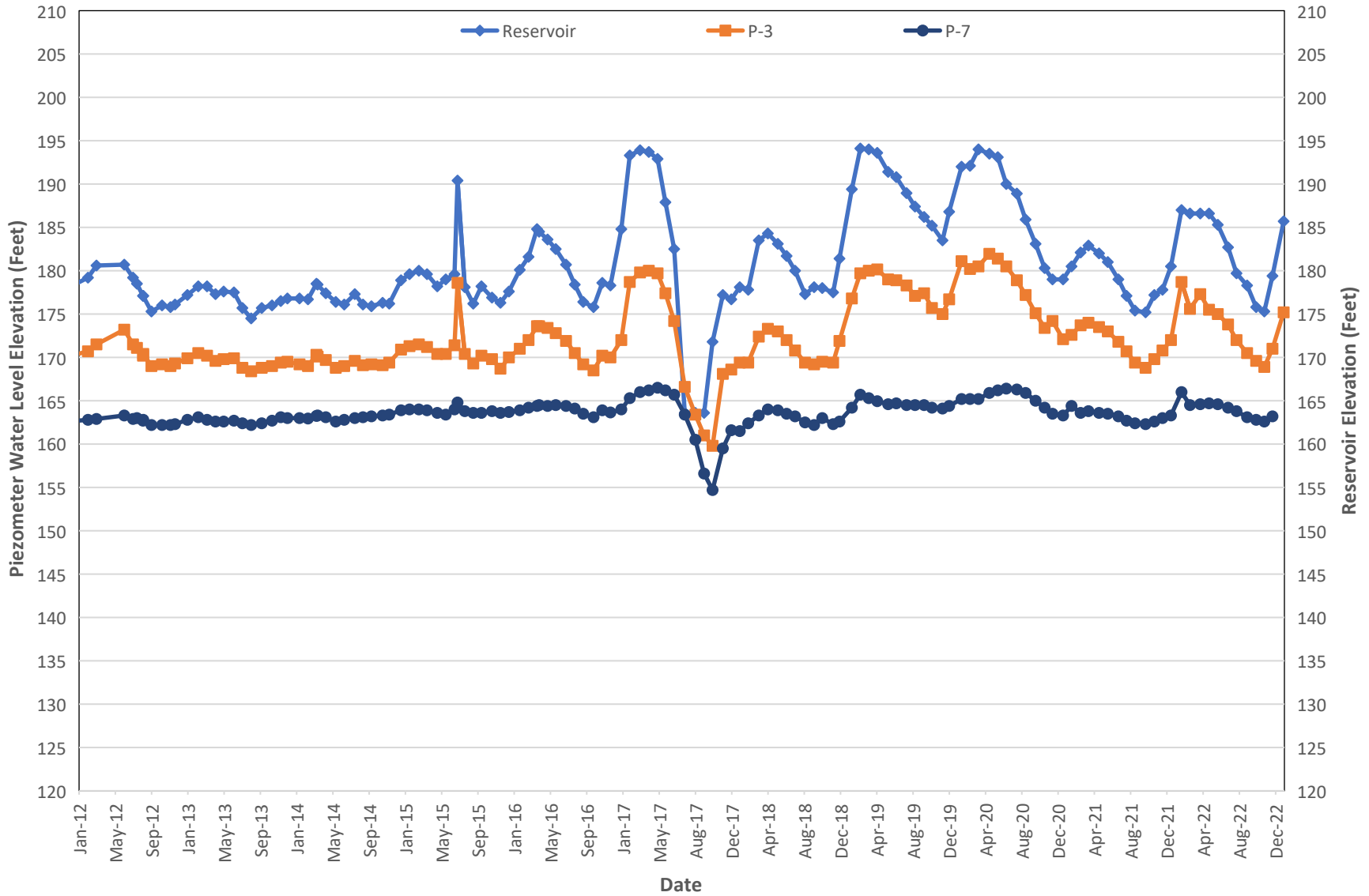
**Figure 10**  
**SAND CANYON DAM**  
**HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-2A, P-2B, P-5, VBW/10A, AND VBW/10B**  
**JANUARY 2012 THROUGH DECEMBER 2022**



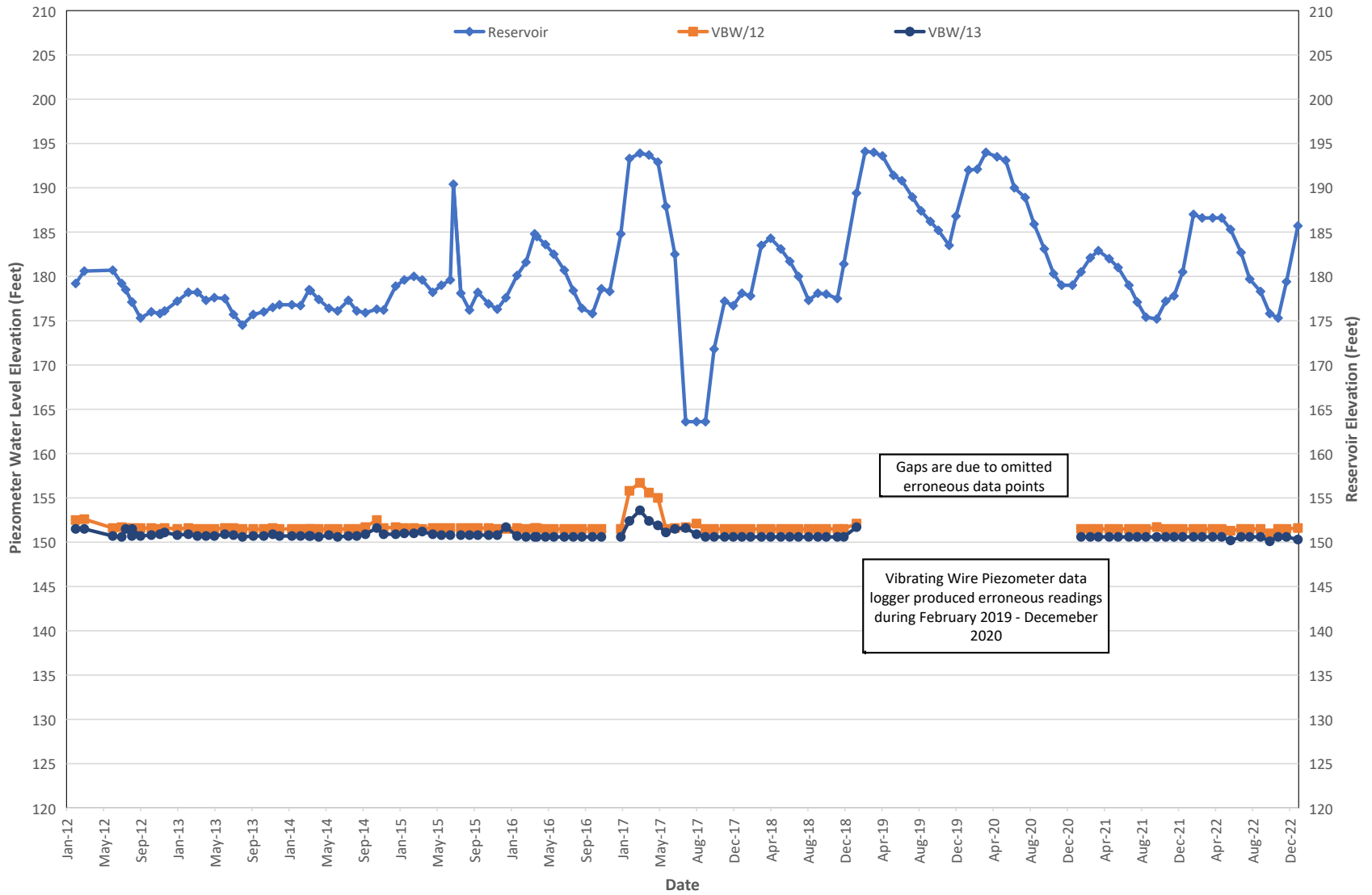
**Figure 11**  
**SAND CANYON DAM**  
**HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-4, P-8A, P-8B, VBW9A, VBW9B, AND VBW/11**  
**JANUARY 2012 THROUGH DECEMBER 2022**



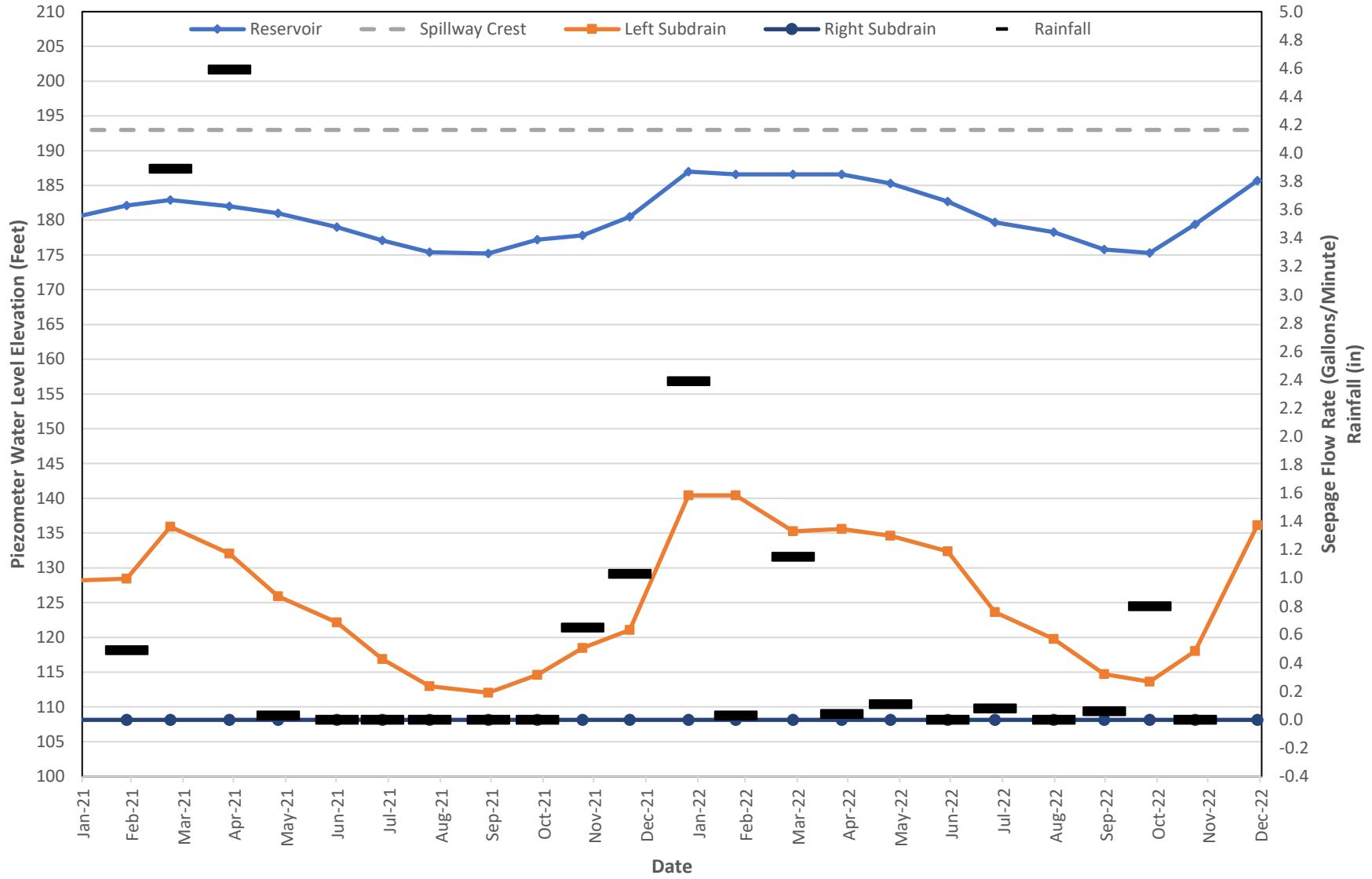
**Figure 12**  
**SAND CANYON DAM**  
**HISTORICAL OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**OPEN WELL PIEZOMETERS P-3, AND P-7**  
**JANUARY 2012 THROUGH DECEMBER 2022**



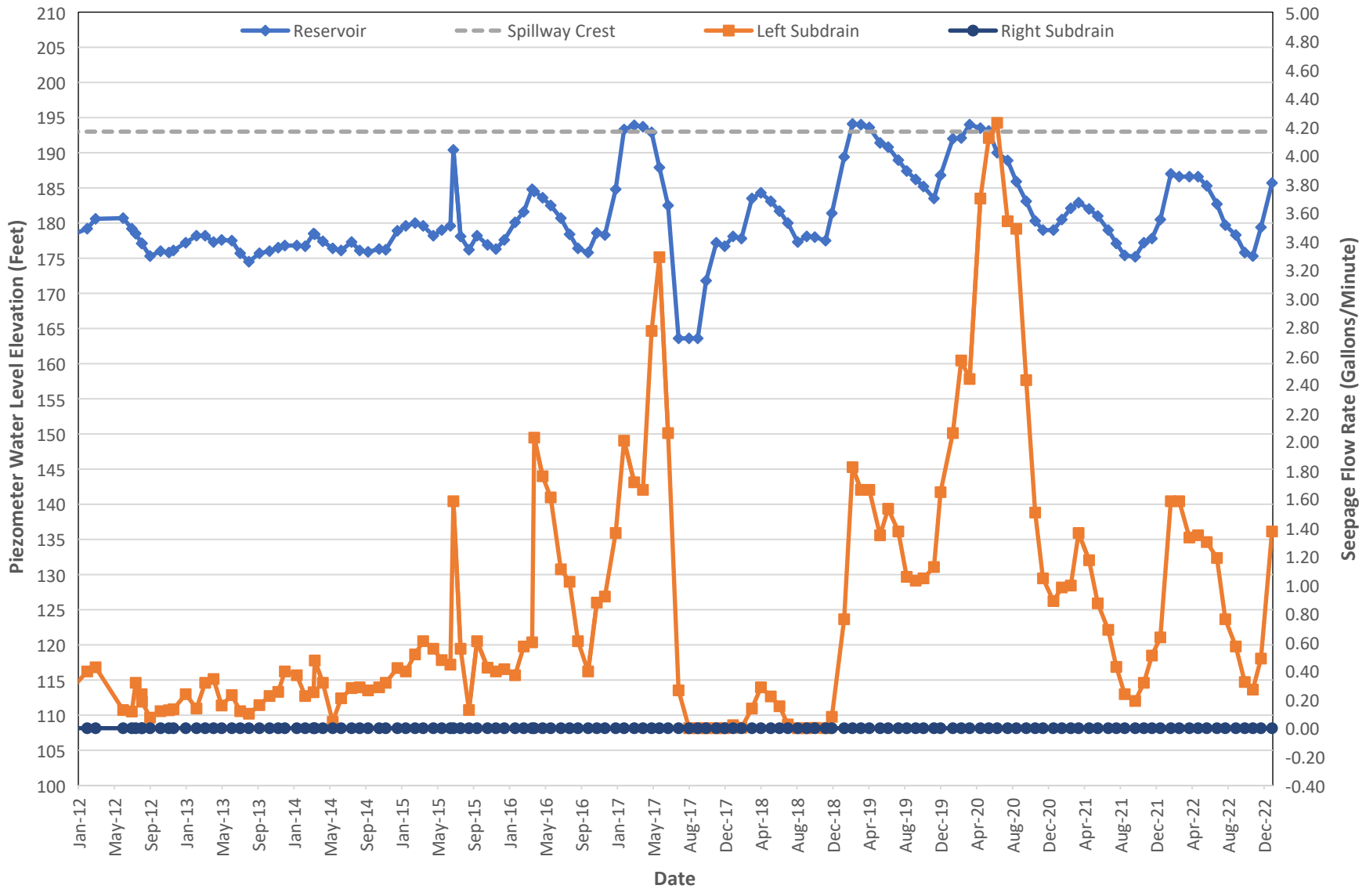
**Figure 13**  
**SAND CANYON DAM**  
**HISTORICAL VIBRATING WIRE PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**VIBRATING WIRE PIEZOMETERS VBW/12, AND VBW/13**  
**JANUARY 2012 THROUGH DECEMBER 2022**



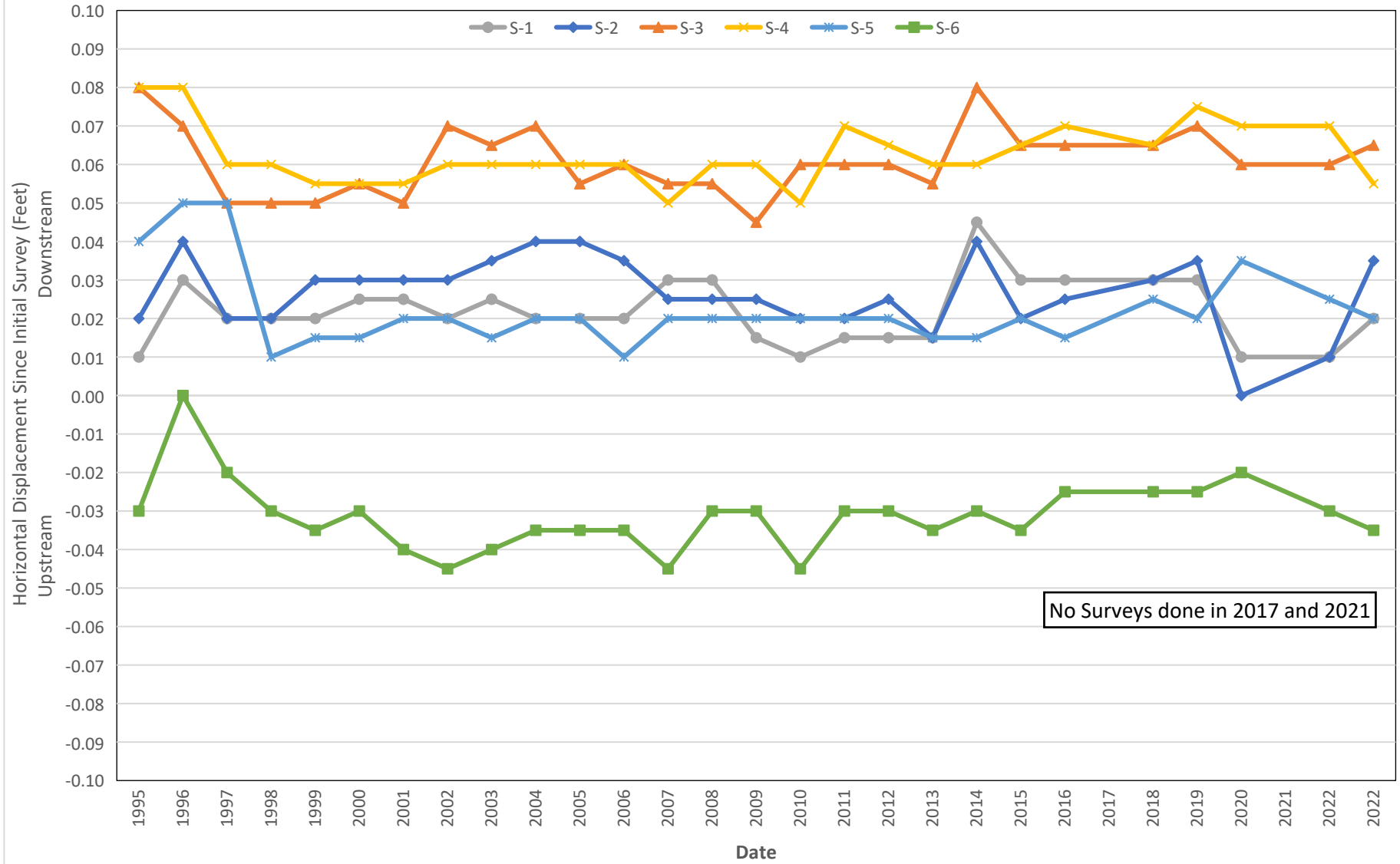
**Figure 14**  
**SAND CANYON DAM**  
**2-YR SEEPAGE, RESERVOIR WATER SURFACE ELEVATIONS AND RAINFALL**  
**JANUARY 2021 THROUGH DECEMBER 2022**



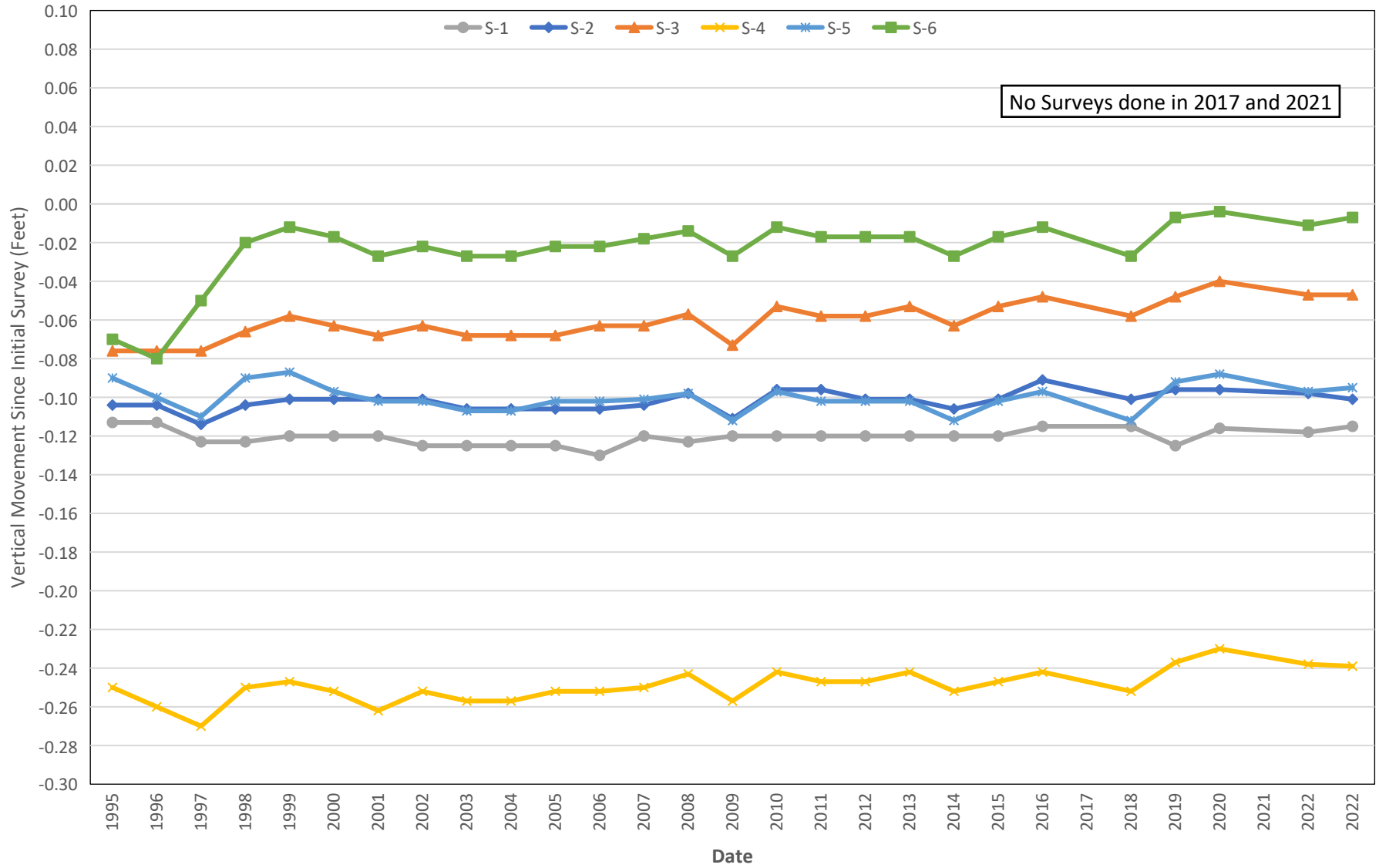
**Figure 15**  
**SAND CANYON DAM**  
**HISTORICAL SEEPAGE FLOW RATES AND RESERVOIR WATER SURFACE ELEVATIONS**  
**JANUARY 2012 THROUGH DECEMBER 2022**



**Figure 16**  
**SAND CANYON DAM**  
**HISTORICAL CUMMULATIVE HORIZONTAL DISPLACEMENT**  
**SURVEY MONUMENTS S-1, S-2, S-3, S-4, S-5, S-6**  
**JANUARY 1995 THROUGH December 2022**



**Figure 17**  
**SAND CANYON DAM**  
**HISTORICAL CUMMULATIVE VERTICAL MOVEMENT**  
**SURVEY MONUMENTS S-1, S-2, S-3, S-4, S-5, S-6**  
**JANUARY 1995 THROUGH December 2022**





## **Appendix**

---

**Inspection Photographs of Sand Canyon Dam - December 13, 2022**  
**Reservoir Dam Valve Exercising Table**  
**CNC Survey Report**

**Inspection Photographs of Sand Canyon Dam**  
**December 13, 2022**



**Photo 1)** AC paved crest and upstream face looking towards the left abutment, including 1-foot-high curb wall.



**Photo 2)** Minor AC paving cracking near left abutment looking towards the right abutment.



**Photo 3)** AC-lined upstream face looking towards right abutment. Note cracks and brush in reservoir.



**Photo 4)** Downstream face looking towards right abutment.



**Photo 5)** Downstream face looking towards the left abutment from dam crest.



**Photo 6)** Downstream face looking towards the right abutment. Note signs of rodent activity and flag markings.



**Photo 7)** Close view of the spillway control ogee section and approach.



**Photo 8)** Spillway channel looking downstream.



**Photo 9)** Spillway channel looking east. Rich Sanchez is inspecting vertical wall joint offset.



**Photo 10)** Approximately 1-inch vertical wall joint offset.



**Photo 11)** Close up view of expansion joint material between the spillway panels.



**Photo 12)** Looking downstream at undermining of previous localized concrete repair areas.





**Photo 13)** Close up view of undermining of recent concrete repair. Undermining is approximately 12-inches wide.



**Photo 14)** Close up view of undermining of recent concrete repair. Undermining is approximately 9-inches in height.



**Photo 15)** Close up view of spillway basin, note brush/tule growth downstream.



**Photo 16)** Outlet valve controls and stems.



**Photo 17)** Location of downstream outlet control valves.



**Photo 18)** Location of downstream outlet control valves.



**Photo 19)** Seepage at left subdrain.

## **Reservoir Dam Valve Exercising Table**

# Reservoir Dam Valve Exercising

## Sand Canyon Dam

Date	Top # of turns	Middle # of turns	Bottom # of turns	Main # of turns	24" Blow off valve #2	24" Blow off valve #1	16" Blow off valve #3
5/6/2013	58	21	48	102		Not Turned	
4/22/2014	58	21	48	102		Not Turned	
4/20/2015 DSOD	58	21	48	102/50%		Not Turned	
5/26/2016 DSOD	58	21	48	30%		Not Turned	
7/20/2016	58	21	48	30%	Installed 2016	Exercised 100%	Replaced 2016
4/5/2017 DSOD	58	21	48	30%	Exercised 100%	Exercised 100%	Exercised 100%
Reservoir was drained and emty from 7/24/2017 to 10/19/2017 for outlet stucture and main valve repairs.							
5/2/2018 DSOD	58	21	48	102	Exercised 100%	Exercised 100%	Exercised 100%
3/28/2019 DSOD	58	21	48	102	Exercised 100%	Exercised 100%	Exercised 100%
1/14/2020 DSOD	58	21	48	102	Exercised 100%	Exercised 100%	Exercised 100%
4/27/2021	58	21	48	102	Exercised 100%	Exercised 100%	Exercised 100%
4/14/2022	58	21	48	102	Exercised 100%	Exercised 100%	Exercised 100%
10/18/2022					Exercised 100%	Exercised 100%	

## **CNC Survey Report**



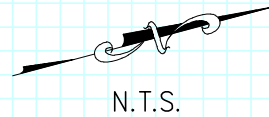
2121 Alton Pkwy | Ste 200  
Irvine | CA | 92606  
P | 949.863.0588  
www.cnc-eng.com

JOB NAME IRWD  
SAND CANYON RESERVOIR  
JOB NO. 22-006 SRN \_\_\_\_\_  
CREW A. MORENO  
R. STEWART  
DATE 10-27-2022 SHEET 1 OF 2

# RESERVOIR MONITORING LAND SURVEYING NOTES

NAME	STA.	OFFSET
BM1	8+85.342	
S-1	8+00.217	0.070'
S-2	6+00.189	0.095'
S-3	4+00.113	0.115'
S-4	2+00.166	0.095'
S-6	0+61.406	0.115'
S-5	0+00.064	0.020'
BM2	-0+15.380	

HOLD FOR LINE.  
BM1-BRASS DISC W/PUNCH MARK IN WELL MONUMENT AT WEST SIDE OF VAULT.

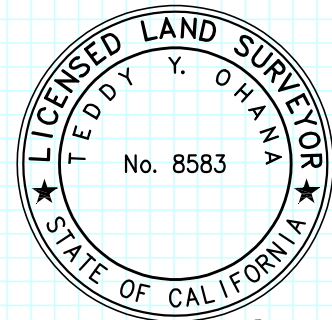


### NOTES:

● S-1 THRU S-6 ARE "+" ON BRASS DISC IN WELL MONUMENT.

INSTRUMENT SETUP

WEATHER CONDITIONS:  
TEMP - 81°  
CLEAR SKIES  
HUMIDITY - 33.40%  
BAROMETRIC PRESSURE (INHG) - 30.28  
RESERVOIR WATER LEVEL ELEVATION - 175.2±



TEDDY Y. OHANA PLS 8583

BM2-BRASS DISC W/PUNCH MARK IN WELL MONUMENT AT EDGE OF CONC. WALK

HOLD FOR LINE





Date: 10/27/2022

 Sheet 2 of 2  
SURVEY LEVELING NOTES
**PROJECT: IRWD / Sand Canyon Reservoir – Level Report**

STATION	B.S.	HI	F.S.	ADJ ELEVATION	SURVEY LEVELING NOTES
BM1				204.167	Brass CAP w/punch in well
	3.646	207.813			
S-1			6.970	200.842	"S" points are "+ "on Brass Disc in Well Monument
	6.565	207.408			
S-2			6.349	201.057	
	6.866	207.925			
S-3			7.340	200.581	
	7.241	207.826			
S-4			7.151	200.669	
	7.010	207.685			
S-6			6.911	200.767	
	6.918	207.692			
S-5			7.020	200.665	
	7.018	207.690			
BM2			5.979	201.704	Brass Disc w/punch in well Monument
	5.973	207.684			
E			4.459	203.217	"E" points are Nail and Square Washer on Top of Wall
	4.451	207.676			
E-1			4.437	203.229	
	4.700	207.939			
E-2			4.661	203.267	
	4.747	208.025			
E-3			4.616	203.397	
	4.035	207.444			
E-4			3.913	203.517	
	4.808	208.339			
BM1			4.158	204.167	Brass Disc w/punch in well Monument