Annual Surveillance Report January 2021 to December 2021 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

September 29, 2022
GEI Project No. 1901888

GEI Consultants

Consulting Engineers and Scientists

September 29, 2022
GEI Project No. 1901888

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 2021 to December 2021

Dear Ms. Drake:

GEI Consultants, Inc. (GEI) is pleased to submit this Annual Surveillance Report for Sand Canyon Dam covering January 2021 to December 2021. 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 or Rich Sanchez at 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

List of Tables

List of Figures

Appendix

Acronyms and Abbreviations

AC	asphalt concrete
AF	acre-feet
CML&C	cement-mortar-lined and coated
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
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 2021 through December 2021. 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 2021 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 five years between 1975 and 1995. No surveys were conducted in calendar year 2017 and 2021. A survey was performed in April 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 and 20-inch-diameter outfall line. At approximately 330 ft downstream of the toe of the dam, a 24 and 30-inch-diameter butterfly outlet valve exist along with a 20-inch blowoff gate valve that controls flow into Sand Canyon Wash (Figure 1).

The District provided a Reservoir Dam Valve Exercising summary table which states that on 4/27/2021 the valves were exercised. 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 2011 through December 2021, the reservoir water surface elevation varied from a minimum Elevation of 163.6 ft to a maximum Elevation of 194.1 ft. During the 2021 review period, the reservoir water surface elevation varied from a minimum Elevation of 175.2 ft to a maximum Elevation of 182.9 ft, see Table 2. The reservoir water surface elevations during the 2021 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 2020 through December 2021) of the piezometer data and reservoir water levels. Figures 9 through 13 are historical 10 year graphical plots (since 2011) of the piezometer data and reservoir water levels.

The following is a discussion of the piezometers including the water level measurements during the 2021 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 2021 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 and the ranges between maximum and minimum water levels during the 2021 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	Last 10-year Maximum and Minimum Range (ft)	2021 Review Period Maximum and Minimum Range (ft)	Comment
P-1A	1.3	0.9	Piezometer is dry at elevation 159.3 ft.
P-1B	7.6	1.9	
P-2A	9.4	2.2	Readings from 9/27/2018 and 10/24/2018 omitted due to isolated drops. Water level returned back to trend and historic range values.
P-2B	5.9	2.2	Readings from 8/24/2021 and 9/28/2021 omitted due to isolated spike. Water level returned back to trend and historic range values.
P-3	22.2	5.2	
P-4	6.4	2.0	
P-5	6.7	1.7	
P-6	6.7	1.9	
P-7	12.0	2.1	
P-8A	9.3	2.3	Reading on 3/24/2020 omitted due to isolated spike. Water level returned back to trend and historic range values.
P-8B	11.8	3.7	Reading on 3/27/2019 omitted due to isolated spike. Water level returned back to trend and historic range values.
VBW9A	7.3	0.5	Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger.
VBW9B	7.9	0.7	Piezometer is dry at elevation 160.4 ft. Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger.
VBW/10A	9.0	1.1	Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings due to issues with Data Logger.
VBW/10B	7.0	2.3	Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger.
VBW/11	2.6	0.4	Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger. Readings on 10/26/2017 and 6/28/2018 omitted due to isolated drops. Water level returned back to trend and historic range values.
VBW/12	5.2	0.2	Piezometer is dry at elevation 151.5 ft. Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger.
VBW/13	5.7	0	Readings from 2/27/2019 to 12/29/2020 omitted due to unreliable readings, due to issues with Data Logger.

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-lA and P-1B are located on the crest of the dam, while Piezometer P-6 is near its toe. The tip of Piezometer P- lA (Elevation 159.3 ft) is located within the embankment, while Piezometers P-lB and P-6 have tips within the foundation alluvium (Elevations 132.9 ft and 127.7 ft, respectively). Piezometer P-lA remained fairly consistent during 2021 (Figure 4) and has historically shown slight to no response to the reservoir water level changes (Figure 9). Piezometers P-lB 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 2021 (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 2021 review period, see Figure 5. The exceptions were on August 24, 2021, and September 28, 2021, where the readings in P-2B rose approximately 10 ft beyond its normal range but returned to normal levels after September. GEI believes the unusual rise in readings were due to reading errors. Piezometer VBW/10B had slight fluctuations with a maximum change of 2.3 ft during the review period. P-5 in 2021 had slight fluctuations with a maximum change of 1.6 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 2021 review period.

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 2020 through December 2021 are shown on Figure 6, and graphs for the historical period from January 2011 through December 2021 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 2021 review period. For the 2021 review period, VBW9A was mostly dry, see Figure 6. The water level observed in the piezometers during the 2021 review period was consistent with historical levels (Figure 11). It should be noted that on March 24, 2020, the reading for P-8A shown in Figure 6 appears to be in error with a reading (199.1 ft) of about 5.6 ft above the reservoir level. It was noted there was rain during March 2020 that could potentially have impacted the reading. The level of P-8A returned to historic levels during April 2020. 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 appear related to rainwater. During the review period, VBW9B and VBW/11 had minor fluctuations and the range between maximum and minimum levels were 0.7 ft and 0.4 ft respectively. The water levels observed in these

piezometers during this 2021 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 2020 through December 2021 are shown on Figure 7, and those for the historical period from January 2011 through December 2021 are shown on Figure 12. The tips of these piezometers are set below the base of the embankment, and possibly into bedrock. During the 2021 review period and historically, both piezometers tracked the reservoir levels closely. The water levels observed in these piezometers during this 2021 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 2020 through December 2021 are shown on Figure 8, and those for the historical period from January 2011 through December 2021 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 2021 review period, both piezometers were dry, except for VBW/12 on September 28, 2021, which had a water level rise of 0.21 ft. Both piezometers appear to be following historical trends, 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 2020 through December 2021. Figure 15 covers the historical period from January 2011 through December 2021. 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).

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 April 26, 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. 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 April 18, 2022

A field evaluation and inspection were performed by Richard Sanchez, Lorena Manriquez and Emerson Revolorio of GEI, Bill Wesson, Danielle Drake and Harry Cho of the District on April 18, 2022. The reservoir level was reported to be at Elevation 186 ft and 7.5 ft below the spillway crest. Weather conditions were clear and sunny. 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 4. GEI also observed brush growing on the upstream slope within the reservoir near the water line, see Photo 4. The downstream toe area, downstream embankment slope, and both groin areas were inspected. No signs of surficial movement, instability, or wet spots were seen.

The downstream slope grass had overgrown since the last inspection, see Photos 5 and 6. No active rodent activity was seen on the dam. During the inspection, GEI discovered that most of the rodent control feeder boxes on the dam had little to no poison, see Photo 7. No signs of live seepage were seen on the downstream slope face.

3.1.2 Spillway

The approach and ungated ogee section open channel spillway were clear, see Photos 8 through 10. 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. Minor brush/tule growth was noticed at the end of the stilling basin, see Photo 11. The District is aware this vegetation growth has to be monitored continuously and cut as required. During this inspection along with previous inspections, the right spillway concrete wall in the upper section of the spillway channel had a vertical wall joint with approximately a 1-inch offset between concrete wall section, see Photo 9. No signs of active movement were seen. Under high spillway flows this offset could potentially result in some concrete damage along joint. During the 2022 inspection, GEI observed that the spillway wall appeared to be unchanged when compared to GEI's previous inspections.

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 exercised on April 27, 2021. Based on the District's report, and observations of the control equipment; the outlet works for the dam appeared fully operational, see Photos 12 through 14. 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 is a 30-inch and 24-inch outlet valve and a 20-inch blowoff gate valve for lowering the reservoir level in an emergency, see Photo 14. 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, see Photo 15.

3.1.4 Seepage

Seepage flow rates continue to be monitored and measured monthly by District staff. A small seepage flow, estimated at 1.0 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 16.

3.2 DSOD Inspection on June 13, 2022

A field evaluation and inspection was conducted by DSOD and the District on June 13, 2022. GEI was not in attendance during the inspection. During the inspection, the District saw cracks along the downstream face of the dam, see Photo 17. GEI has reviewed the photo and the cracking appears to be from desiccation of the surface soil. This is due to having inspections during different times of the year.

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, all vibrating wire piezometers appear to now be working.
3) Piezometer P-2B's August 24, 2021, reading of 149.6 ft and September 28, 2021, reading of 149.2 ft appears to have been recorded in error since it results in a piezometer level increase of about 10 ft (during a period when the reservoir level is being lowered) and then returns to normal levels.
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 dam grass cover has slightly overgrown since the last inspection.
7) There was a lack of poison at most rodent control feeder boxes.
8) The exposed AC-liner on the upstream slope of the dam had some vegetation and long-standing transverse and longitudinal shrinkage-expansion cracking.
9) Brush was growing on the upstream slope within the reservoir near the water line.
10) Brush/tule growth was sprouting at the end of the spillway stilling basin. The District recognizes and maintains as needed.
11) The AC pavement on the dam crest has minor temperature expansion cracking.
12) All outlet valves were not exercised during the inspection. Per the District, the outlet valves were last exercised on April 27, 2021. Based on visual observations of exposed control equipment and District's comments, the outlet facilities remain fully functional.
13) The area surrounding the 30-inch blowoff outfall has significant overgrown vegetation and the outfall could not be located.
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.

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 overgrown grass cover on the downstream slope surface needs to be mowed to a grass height between 2 to 4 inches and maintained continuously.
4) 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.
5) The outlet controls shall continue to be fully exercised annually.
6) 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.
7) 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.
8) 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.
9) 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 to the engineer immediately.
10) GEI recommends an inspection and evaluation of the dam immediately after any earthquake with a Magnitude of 4.0 or greater within a 50-mile radius of the dam.

Sand Canyon Dam Action Item Summary

Item	Location	Maintenance	Measures
Rodent control feeder boxes	Throughout dam	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
Grass cover	Dam downstream face	Slight overgrowth	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
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 engineer if the wall continues to deflect.

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 express or implied.

6.0 References

DSOD (California Department of Water Resources, Division of Safety of Dams) 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
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PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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SAND CANYON DAM
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JANUARY 2007 THROUGH DECEMBER 2021

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

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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

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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

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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:
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3. Piezometer data based on NGVD 29 datum.

TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	131.8
2/28/2007	177.60		31.7	169.5	9.6	141.1	9.3	142.2	25.4	132.0
3/29/2007	177.10		31.9	169.3	10.4	140.3	9.6	141.9	25.6	131.8
4/27/2007	176.60		32.1	169.1	10.5	140.2	9.5	142.0	25.7	131.7
5/24/2007	176.80		32.7	168.5	10.7	140.0	9.8	141.7	26.0	131.4
6/27/2007	179.90		30.0	171.2	11.0	139.7	9.6	141.9	26.0	131.4
7/27/2007	177.80		30.8	170.4	11.5	139.2	9.8	141.7	26.4	131.0
8/28/2007	177.20		31.5	169.7	11.8	138.9	10.2	141.3	26.4	131.0
9/26/2007	177.00		30.5	170.7	11.9	138.8	10.2	141.3	26.1	131.3
10/30/2007	175.50		31.9	169.3	12.3	138.4	10.3	141.2	26.0	131.4
11/27/2007	175.90		31.8	169.4	12.6	138.1	10.3	141.2	25.5	131.9
12/27/2007	178.20		30.3	170.9	12.6	138.1	10.6	140.9	25.4	132.0
1/30/2008	184.40		27.2	174	10.8	139.9	10.3	141.2	24.2	133.2
2/26/2008	186.10		25.6	175.6	9.7	141.0	9.2	142.3	23.6	133.8
3/26/2008	188.00		24.4	176.8	10.0	140.7	9.0	142.5	23.4	134.0
4/25/2008	191.00		22.2	179.0	10.2	140.5	8.9	142.6	23.1	134.3
5/28/2008	190.93		21.9	179.3	10.2	140.6	8.9	142.6	22.6	134.8
6/25/2008	189.50		22.2	179.0	10.2	140.5	8.9	142.6	22.8	134.6
7/29/2008	185.10		24.5	176.7	10.3	140.4	9.0	142.5	23.1	134.3
7/30/2008	185.10	0.00	24.4	176.8	10.3	140.4	8.9	142.6	23.0	134.4
8/27/2008	178.00	0.00	29.3	171.9	10.5	140.2	9.2	142.3	24.0	133.4
9/25/2008	176.80	0.00	30.3	170.9	10.7	140.0	8.9	142.6	24.6	132.8
10/28/2008	175.20	0.00	36.6	164.6	11.0	139.7	9.1	142.4	25.2	132.2
11/25/2008	175.80	1.82	31.5	169.7	11.3	139.4	9.2	142.3	25.3	132.1
12/30/2008	181.70	2.91	27.5	173.7	10.9	139.8	9.2	142.3	24.1	133.3
1/29/2009	182.20	0.39	27.1	174.1	10.9	139.8	9.1	142.4	24.0	133.4
2/25/2009	185.70	3.10	25.1	176.1	10.8	139.9	9.1	142.4	23.5	133.9

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	134.0
4/28/2009	189.30	0.00	22.4	178.8	10.9	139.8	9.1	142.4	23.1	134.3
5/18/2009	188.50	0.00	22.8	178.4	10.9	139.8	9.2	142.3	23.2	134.2
5/27/2009	188.10	0.00	23.0	178.2	10.9	139.8	9.2	142.3	23.2	134.2
6/30/2009	188.60	0.10	22.8	178.4	11.0	139.7	9.0	142.5	23.7	133.7
7/30/2009	184.80	0.00	24.7	176.5	11.0	139.7	9.1	142.4	23.4	134.0
8/26/2009	176.60	0.00	29.2	172.0	11.1	139.6	9.1	142.4	24.2	133.2
9/30/2009	174.50	0.00	32.1	169.1	11.3	139.4	9.2	142.3	25.3	132.1
10/28/2009	175.30	0.29	31.8	169.4	11.5	139.2	8.3	143.2	25.6	131.8
12/1/2009	176.40	0.00	31.5	169.7	11.9	138.8	9.5	142.0	25.7	131.7
12/28/2009	178.80	2.75	29.9	171.3	11.3	139.4	9.5	142.0	24.9	132.5
1/26/2010	191.30	4.15	22.8	178.4	9.9	140.8	9.2	142.3	23.8	133.6
2/24/2010	193.60	2.29	20.3	180.9	9.8	140.9	7.9	143.6	22.0	135.4
3/29/2010	193.50	1.18	19.7	181.5	8.5	142.2	8.2	143.3	22.0	135.4
4/4/2010	193.50		19.8	181.4	8.7	142.0	8.2	143.3	22.1	135.3
4/27/2010	193.90	1.66	19.5	181.7	8.9	141.8	7.8	143.7	22.0	135.4
5/27/2010	192.90	0.03	19.9	181.3	9.2	141.5	7.8	143.7	22.0	135.4
6/29/2010	191.60	0.00	20.6	180.6	9.5	141.2	7.7	143.8	22.0	135.4
7/28/2010	187.50	0.00	22.6	178.6	9.8	140.9	7.8	143.7	22.4	135.0
8/31/2010	179.20	0.00	27.9	173.3	10.2	140.5	8.0	143.5	23.6	133.8
9/29/2010	175.60	0.00	31.2	170.0	10.6	140.1	8.1	143.4	24.9	132.5
10/26/2010	178.20	2.93	30.5	170.7	10.8	139.9	9.7	141.8	24.9	132.5
11/30/2010	178.80	1.14	30.2	171.0	11.6	139.1	8.3	143.2	25.0	132.4
12/30/2010	193.90	9.95	20.4	180.8	8.6	142.1	5.9	145.6	22.0	135.4
1/27/2011	194.00	0.86	20.0	181.2	9.3	141.4	6.2	145.4	22.0	135.4
2/23/2011	193.80	1.02	20.0	181.3	9.5	141.2	5.9	145.6	22.0	135.4
3/29/2011	193.90	2.38	19.6	181.6	8.9	141.8	6.7	144.8	21.7	135.7
4/27/2011	193.60	0.56	19.7	181.5	9.0	141.7	7.0	144.5	22.0	135.4

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JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	135.5
6/28/2011	192.00	0.00	20.7	180.5	9.3	141.4	7.2	144.3	22.0	135.4
7/27/2011	186.75	0.00	23.5	177.8	9.4	141.4	7.1	144.4	22.4	135.0
8/25/2011	176.30	0.00	29.7	171.5	9.7	141.0	7.2	144.3	23.6	133.8
9/28/2011	176.00	0.06	24.7	176.5	10.5	140.3	7.6	143.9	24.9	132.5
10/25/2011	176.50	0.89	31.7	169.5	11.0	139.7	8.1	143.4	25.2	132.2
11/22/2011	177.20	1.31	31.7	169.6	11.1	139.7	8.2	143.4	25.2	132.2
12/22/2011	176.70	0.20	31.7	169.5	11.5	139.2	8.2	143.3	25.4	132.0
1/25/2012	178.60	0.84	30.8	170.4	11.7	139.0	8.3	143.2	25.0	132.4
2/28/2012	179.20	0.68	30.5	170.7	11.7	139.0	8.5	143.0	25.0	132.4
3/27/2012	180.60	1.73	29.7	171.5	11.5	139.2	8.4	143.1	24.8	132.7
6/27/2012	180.70	0.00	28.0	173.2	10.3	140.4	8.8	142.7	24.9	132.5
7/26/2012	179.20	0.10	29.8	171.5	10.9	139.8	8.8	142.7	25.1	132.3
8/8/2012	178.50	0.10	30.1	171.1	10.8	139.9	8.6	142.9	25.3	132.1
8/28/2012	177.10	0.00	31.0	170.2	11.2	139.5	8.7	142.8	25.6	131.8
8/29/2012	177.10	0.00	30.8	170.4	11.0	139.7	8.5	143.0	25.5	131.9
9/25/2012	175.30	0.00	32.2	169.0	11.6	139.1	8.8	142.7	26.1	131.3
10/30/2012	176.00	0.19	32.0	169.2	12.1	138.6	8.9	142.6	26.3	131.1
11/27/2012	175.80	0.69	32.2	169.0	12.4	138.3	9.4	142.1	26.0	131.4
12/12/2012	176.10	1.40	31.9	169.3	12.5	138.2	9.5	142.0	25.8	131.6
1/22/2013	177.20	1.20	31.3	169.9	12.5	138.2	9.6	141.9	25.1	132.3
2/27/2013	178.20	0.31	30.7	170.5	12.2	138.5	9.3	142.2	24.7	132.7
3/28/2013	178.20	0.71	31.0	170.2	12.1	138.6	9.5	142.0	24.7	132.7
4/25/2013	177.30	0.03	31.6	169.6	12.2	138.6	9.6	141.9	25.1	132.3
5/22/2013	177.60	0.00	31.4	169.8	12.1	138.6	9.6	141.9	25.3	132.1
6/25/2013	177.50	0.00	31.4	169.9	12.2	138.6	9.6	141.9	25.5	132.0
7/23/2013	175.70	0.00	32.4	168.8	12.3	138.4	9.7	141.8	25.9	131.5
8/21/2013	174.50	0.00	32.8	168.4	12.5	138.2	9.7	141.8	26.3	131.1

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Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	130.9
10/29/2013	176.00	0.00	32.2	169.0	13.0	137.7	10.2	141.3	26.3	131.2
11/27/2013	176.50	0.44	31.8	169.4	12.9	137.8	10.0	141.5	25.9	131.5
12/19/2013	176.80	0.53	31.7	169.5	13.1	137.6	10.2	141.3	25.8	131.6
1/28/2014	176.80	0.00	32.0	169.2	13.0	137.7	10.3	141.2	25.5	131.9
2/25/2014	176.70	0.72	32.2	169.0	12.8	137.9	10.3	141.2	25.4	132.1
3/25/2014	178.50		30.9	170.3	8.1	142.6	10.2	141.3	24.9	132.5
3/29/2014	178.40	1.44	31.1	170.1	8.2	142.5	10.3	141.2	24.9	132.5
4/25/2014	177.40	0.74	31.5	169.7	8.9	141.8	10.2	141.3	25.0	132.4
5/28/2014	176.40	0.00	32.4	168.8	9.7	141.0	10.3	141.3	25.7	131.7
6/25/2014	176.10	0.00	32.2	169.0	10.3	140.4	10.2	141.3	26.3	131.1
7/30/2014	177.30	0.00	31.6	169.6	10.7	140.1	10.2	141.3	26.4	131.0
8/26/2014	176.10	0.03	32.1	169.1	11.0	139.7	10.2	141.3	26.4	131.0
9/23/2014	175.90	0.00	32.0	169.2	11.4	139.3	10.3	141.2	26.7	130.8
10/30/2014	176.30	0.00	32.1	169.1	11.9	138.8	10.5	141.0	26.5	130.9
11/21/2014	176.20	0.25	31.8	169.4	12.1	138.6	10.5	141.0	26.2	131.2
12/30/2014	178.90	3.37	30.3	170.9	11.9	138.8	10.5	141.0	25.2	132.2
1/27/2015	179.60	0.89	29.9	171.3	11.9	138.8	10.5	141.1	24.8	132.6
2/27/2015	180.00	0.46	29.7	171.5	11.9	138.8	10.5	141.0	24.6	132.8
3/26/2015	179.60	0.45	30.0	171.2	11.9	138.8	10.4	141.1	24.5	132.9
4/29/2015	178.20	0.24	30.8	170.4	11.9	138.8	10.6	140.9	24.9	132.5
5/27/2015	179.00	1.04	30.8	170.4	12.0	138.7	10.4	141.1	24.9	132.5
6/25/2015	179.60	0.00	29.8	171.4	12.0	138.7	10.3	141.2	25.0	132.4
7/29/2015	178.10	0.00	30.8	170.4	12.3	138.4	10.4	141.1	25.3	132.1
8/26/2015	176.20	0.00	31.9	169.3	12.3	138.4	10.4	141.1	25.6	131.8
9/22/2015	178.20	1.64	31.0	170.2	9.3	141.4	10.5	141.0	25.3	132.1
10/27/2015	176.90	0.10	31.4	169.8	9.9	140.8	10.5	141.0	25.3	132.1
11/24/2015	176.30	0.17	32.5	168.7	10.4	140.3	10.6	140.9	25.7	131.7

Notes:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	132.2
1/27/2016	180.10	2.86	30.2	171.0	10.2	140.5	10.5	141.0	24.5	132.9
2/25/2016	181.60	0.20	29.2	172.0	10.6	140.1	9.9	141.6	24.2	133.2
3/24/2016	184.80		27.6	173.6	10.1	140.6	9.8	141.7	24.0	133.4
3/31/2016	184.50	1.51	27.6	173.6	10.2	140.5	9.8	141.7	24.1	133.3
4/28/2016	183.60	0.04	27.8	173.4	10.4	140.3	9.8	141.7	24.3	133.1
5/25/2016	182.50	0.13	28.4	172.8	10.6	140.1	9.8	141.7	24.4	133.0
6/28/2016	180.70	0.00	29.3	171.9	11.0	139.7	9.9	141.6	24.9	132.5
7/27/2016	178.40	0.00	30.7	170.5	11.1	139.6	9.9	141.6	25.5	131.9
8/24/2016	176.40	0.00	32.1	169.2	11.4	139.3	10.0	141.5	25.6	131.8
9/27/2016	175.80	0.00	32.7	168.5	11.8	138.9	10.1	141.4	26.4	131.0
10/26/2016	178.60	0.64	31.0	170.2	11.2	139.5	10.2	141.3	25.4	132.0
11/22/2016	178.30	1.11	31.2	170.0	12.2	138.5	10.3	141.3	26.1	131.3
12/28/2016	184.80	4.01	29.3	172.0	12.3	138.4	10.3	141.2	25.5	132.0
1/25/2017	193.30	6.33	22.5	178.7	11.0	139.7	7.1	144.4	22.6	134.8
2/28/2017	193.90	3.27	21.4	179.8	9.3	141.4	6.7	144.8	21.1	136.3
3/29/2017	193.70	0.08	21.2	180.0	9.1	141.6	7.2	144.3	21.4	136.0
4/27/2017	192.90	0.04	21.5	179.7	9.0	141.7	7.2	144.3	21.4	136.0
5/23/2017	187.90	33.00	23.8	177.4	9.1	141.6	7.3	144.2	21.9	135.5
6/21/2017	182.50	0.00	27.0	174.2	9.3	141.4	7.3	144.2	22.6	134.8
7/26/2017	163.60	0.00	34.6	166.6	9.7	141.0	8.3	143.3	24.4	133.0
8/30/2017	163.60	0.00	37.8	163.4	10.5	140.2	7.2	144.3	25.9	131.5
9/28/2017	163.60	0.00	40.2	161.0	11.4	139.3	10.5	141.0	26.9	130.5
10/26/2017	171.80	0.00	41.4	159.8	11.7	139.0	10.6	140.9	27.3	130.1
11/29/2017	177.20	0.08	33.1	168.1	12.3	138.4	10.9	140.6	27.1	130.3
12/27/2017	176.70	0.00	32.6	168.6	12.7	138.0	11.1	140.4	27.1	130.3
1/24/2018	178.10	1.67	31.8	169.4	13.0	137.7	11.1	140.4	27.1	130.3
2/21/2018	177.80	0.27	31.8	169.4	13.2	137.5	11.1	140.4	26.6	130.8

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	131.3
4/27/2018	184.30	0.05	27.9	173.3	13.4	137.3	11.3	140.2	25.9	131.5
5/30/2018	183.10	0.13	28.2	173.0	13.5	137.2	11.7	139.8	25.7	131.7
6/28/2018	181.70	0.00	29.2	172.0	13.4	137.3	11.2	140.3	25.7	131.7
7/26/2018	180.00	0.00	30.4	170.8	13.4	137.3	11.2	140.3	24.7	132.7
8/28/2018	177.30	0.00	31.8	169.4	13.7	137.0	11.2	140.3	26.6	130.8
9/27/2018	178.10	0.00	32.0	169.2	13.8	136.9	11.3	140.2	26.7	130.7
10/24/2018	178.00	0.66	31.7	169.5	14.0	136.7	11.3	140.2	26.6	130.8
11/29/2018	177.50	1.60	31.8	169.4	14.5	136.2	11.4	140.1	26.6	130.8
12/20/2018	181.40	2.39	29.3	171.9	13.7	137.0	11.4	140.1	25.5	131.9
1/30/2019	189.40	4.56	24.4	176.8	11.4	139.3	9.3	142.2	24.0	133.4
2/27/2019	194.10	7.48	21.5	179.7	10.3	140.4	7.0	144.5	21.4	136.0
3/27/2019	194.00	1.27	21.2	180.0	9.9	140.8	7.4	144.1	21.5	135.9
4/24/2019	193.60	0.07	21.05	180.2	9.80	140.9	7.50	144.0	21.70	135.7
5/30/2019	191.40	0.73	22.20	179.0	9.70	141.0	5.00	146.5	21.90	135.5
6/26/2019	190.80	0.02	22.30	178.9	9.70	141.0	7.60	143.9	22.00	135.4
7/5/2015	190.40	0.00	22.60	178.6	9.70	141.0	7.60	143.9	22.10	135.3
7/30/2019	188.95	0.00	22.90	178.3	9.90	140.8	7.60	143.9	22.40	135.0
8/27/2019	187.40	0.00	24.10	177.1	10.50	140.2	8.10	143.4	22.70	134.7
9/26/2019	186.20	0.00	23.80	177.4	10.10	140.6	7.30	144.2	21.90	135.5
10/22/2019	185.20	0.00	25.50	175.7	10.80	139.9	8.00	143.5	23.50	133.9
11/26/2019	183.50	2.66	26.20	175.0	10.80	139.9	8.15	143.4	23.50	133.9
12/18/2019	186.80	4.44	24.50	176.7	10.70	140.0	8.20	143.3	22.85	134.6
1/28/2020	192.00	0.24	20.10	181.1	9.90	140.8	7.70	143.8	21.70	135.7
2/25/2020	192.10	0.49	21.00	180.2	9.20	141.5	7.60	143.9	21.60	135.8
3/24/2020	194.00	3.89	20.70	180.5	9.80	140.9	7.40	144.1	21.20	136.2
4/29/2020	193.50	4.59	19.25	182.0	8.15	142.6	6.75	144.8	20.60	136.8
5/27/2020	193.10	0.03	19.80	181.4	8.50	142.2	7.00	144.5	20.70	136.7
6/24/2020	190.00	0.00	20.70	180.5	8.70	142.0	7.30	144.2	20.60	136.8

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PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			3		4		5		6	
Top of Well Elevation --->			201.2		150.7		151.5		157.4	
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	136.1
8/27/2020	185.90	0.00	24.00	177.2	9.10	141.6	7.20	144.3	21.60	135.8
9/29/2020	183.10	0.00	26.10	175.1	9.35	141.4	7.30	144.2	22.25	135.2
10/29/2020	180.30	0.00	27.80	173.4	9.60	141.1	7.40	144.1	23.00	134.4
11/24/2020	179.00	0.65	27.00	174.2	9.80	140.9	7.60	143.9	23.70	133.7
12/29/2020	179.00	1.03	29.10	172.1	10.10	140.6	7.90	143.6	24.10	133.3
1/26/2021	180.50	2.39	28.60	172.6	10.30	140.4	8.00	143.5	24.00	133.4
2/25/2021	182.10	0.03	27.50	173.7	10.40	140.3	8.90	142.6	23.70	133.7
3/23/2021	182.90	1.15	27.20	174.0	10.50	140.2	8.10	143.4	23.60	133.8
4/27/2021	182.00	0.04	27.70	173.5	10.70	140.0	8.20	143.3	24.00	133.4
5/26/2021	181.00	0.11	28.20	173.0	10.80	139.9	8.30	143.2	24.10	133.3
6/30/2021	179.00	0.00	29.40	171.8	11.00	139.7	8.40	143.1	24.40	133.0
7/27/2021	177.10	0.08	30.50	170.7	11.20	139.5	8.70	142.8	24.80	132.6
8/24/2021	175.40	0.00	31.80	169.4	11.40	139.3	8.90	142.6	25.20	132.2
9/28/2021	175.20	0.06	32.40	168.8	11.70	139.0	9.50	142.0	25.30	132.1
10/27/2021	177.20	0.80	31.40	169.8	12.00	138.7	9.60	141.9	25.50	131.9
11/23/2021	177.80	0.00	30.40	170.8	12.20	138.5	9.60	141.9	25.40	132.0
12/21/2021	180.50	5.86	29.20	172.0	12.30	138.4	9.70	141.8	24.90	132.5

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	161.3	35.8	166.5	46.9	155.3	22.5	161.5
2/28/2007	177.60		8.1	161.6	36.3	166.0	47.0	155.2	23.1	160.9
3/29/2007	177.10		8.3	161.4	36.3	166.0	47.2	155.0	23.3	160.7
4/27/2007	176.60		8.7	161.0	36.2	166.1	47.0	155.2	23.2	160.8
5/24/2007	176.80		9.4	160.3	36.6	165.7	47.3	154.9	23.4	160.6
6/27/2007	179.90		8.2	161.5	36.0	166.3	46.1	156.1	23.2	160.8
7/27/2007	177.80		7.8	161.9	35.9	166.4	46.5	155.7	23.1	160.9
8/28/2007	177.20		8.6	161.1	36.0	166.3	46.7	155.5	23.0	161.0
9/26/2007	177.00		7.5	162.2	36.0	166.3	46.5	155.7	23.1	160.9
10/30/2007	175.50		8.0	161.7	36.3	166.0	47.2	155.0	23.3	160.7
11/27/2007	175.90		7.9	161.8	36.6	165.7	47.2	155.0	23.5	160.5
12/27/2007	178.20		7.4	162.3	36.4	165.9	46.6	155.6	23.4	160.6
1/30/2008	184.40		6.7	163.0	35.6	166.8	45.0	157.3	23.3	160.7
2/26/2008	186.10		5.8	163.9	34.5	167.8	44.1	158.1	22.7	161.3
3/26/2008	188.00		5.4	164.3	33.5	168.8	43.7	158.5	22.3	161.7
4/25/2008	191.00		4.5	165.2	32.2	170.1	42.6	159.6	21.7	162.3
5/28/2008	190.93		4.5	165.2	31.4	170.9	42.3	159.9	21.2	162.8
6/25/2008	189.50		5.0	164.7	31.9	170.4	42.6	159.6	20.8	163.2
7/29/2008	185.10		6.9	162.8	32.0	170.3	43.3	158.9	20.9	163.1
7/30/2008	185.10	0.00	4.9	164.8	31.9	170.4	43.3	158.9	20.8	163.2
8/27/2008	178.00	0.00	6.3	163.4	33.6	168.7	45.6	156.6	21.4	162.6
9/25/2008	176.80	0.00	6.9	162.8	34.8	167.5	46.0	156.2	22.1	161.9
10/28/2008	175.20	0.00	7.4	162.3	35.6	166.7	46.8	155.4	22.5	161.5
11/25/2008	175.80	1.82	7.7	162.0	36.1	166.2	47.0	155.2	22.8	161.2
12/30/2008	181.70	2.91	6.5	163.2	35.6	166.7	45.1	157.1	22.8	161.2
1/29/2009	182.20	0.39	6.0	163.7	34.9	167.4	44.7	157.5	22.7	161.3
2/25/2009	185.70	3.10	5.8	163.9	34.6	167.7	43.9	158.3	22.4	161.6

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JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	164.7	33.0	169.3	43.1	159.1	21.9	162.1
4/28/2009	189.30	0.00	3.7	166.0	31.9	170.4	42.7	159.5	21.4	162.6
5/18/2009	188.50	0.00	4.5	165.2	31.9	170.4	42.7	159.5	21.0	163.0
5/27/2009	188.10	0.00	4.6	165.1	31.9	170.4	42.9	159.3	21.0	163.0
6/30/2009	188.60	0.10	4.3	165.4	31.7	170.6	42.6	159.6	21.0	163.0
7/30/2009	184.80	0.00	4.5	165.2	32.0	170.3	43.2	159.0	20.9	163.1
8/26/2009	176.60	0.00	5.8	163.9	33.3	169.0	45.1	157.1	21.4	162.6
9/30/2009	174.50	0.00	7.7	162.0	35.1	167.2	46.6	155.6	22.2	161.8
10/28/2009	175.30	0.29	7.8	161.9	35.6	166.7	46.7	155.5	22.5	161.5
12/1/2009	176.40	0.00	7.7	162.0	36.1	166.2	46.9	155.3	22.8	161.2
12/28/2009	178.80	2.75	6.8	162.9	36.0	166.3	46.0	156.2	23.0	161.1
1/26/2010	191.30	4.15	5.5	164.2	35.4	166.9	43.2	159.0	22.9	161.1
2/24/2010	193.60	2.29	3.2	166.5	31.8	170.5	41.5	160.7	21.6	162.4
3/29/2010	193.50	1.18	3.4	166.3	31.3	171.0	41.2	161.0	20.2	163.8
4/4/2010	193.50		3.6	166.1	30.2	172.1	41.1	161.1	20.3	163.7
4/27/2010	193.90	1.66	3.4	166.3	29.8	172.5	41.0	161.2	19.5	164.5
5/27/2010	192.90	0.03	3.4	166.3	29.8	172.5	41.0	161.2	19.4	164.6
6/29/2010	191.60	0.00	3.1	166.6	29.9	172.4	41.2	161.0	19.4	164.6
7/28/2010	187.50	0.00	3.3	166.4	30.6	171.7	42.6	159.6	19.8	164.2
8/31/2010	179.20	0.00	4.6	165.1	32.6	169.7	44.4	157.8	21.0	163.0
9/29/2010	175.60	0.00	6.3	163.4	34.2	168.1	45.8	156.4	21.5	162.5
10/26/2010	178.20	2.93	6.8	162.9	35.2	167.1	45.8	156.4	22.3	161.7
11/30/2010	178.80	1.14	6.4	163.3	35.7	166.6	45.8	156.4	22.8	161.2
12/30/2010	193.90	9.95	4.1	165.6	33.8	168.5	41.3	160.9	19.6	164.4
1/27/2011	194.00	0.86	2.9	166.8	30.3	172.0	41.0	161.2	19.2	164.8
2/23/2011	193.80	1.02	2.8	166.9	29.5	172.9	40.7	161.5	18.7	165.4
3/29/2011	193.90	2.38	2.7	167.0	28.8	173.5	40.4	161.8	16.3	167.7
4/27/2011	193.60	0.56	2.8	167.0	29.0	173.3	40.5	161.7	18.2	165.9

Notes:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	167.2	29.4	172.9	40.6	161.6	18.8	165.2
6/28/2011	192.00	0.00	2.5	167.2	29.6	172.7	40.9	161.3	19.2	164.8
7/27/2011	186.75	0.00	2.9	166.8	30.7	171.6	42.1	160.1	19.7	164.3
8/25/2011	176.30	0.00	4.7	165.0	32.7	169.6	44.8	157.4	20.9	163.1
9/28/2011	176.00	0.06	6.6	163.1	34.9	167.4	46.0	156.2	22.1	161.9
10/25/2011	176.50	0.89	6.7	163.0	35.8	166.5	46.1	156.1	22.5	161.5
11/22/2011	177.20	1.31	6.7	163.1	36.0	166.4	46.2	156.0	22.8	161.2
12/22/2011	176.70	0.20	6.3	163.4	35.9	166.4	45.9	156.3	22.9	161.1
1/25/2012	178.60	0.84	6.5	163.2	35.7	166.6	45.5	156.7	22.8	161.2
2/28/2012	179.20	0.68	6.4	163.3	35.9	166.4	45.6	156.6	22.8	161.2
3/27/2012	180.60	1.73	6.3	163.4	35.6	166.7	45.0	157.2	23.0	161.1
6/27/2012	180.70	0.00	5.9	163.8	34.4	167.9	44.6	157.6	22.4	161.6
7/26/2012	179.20	0.10	6.3	163.4	35.0	167.3	45.1	157.1	22.5	161.5
8/8/2012	178.50	0.10	6.2	163.5	34.8	167.5	45.2	157.0	22.4	161.6
8/28/2012	177.10	0.00	6.5	163.2	35.3	167.0	45.6	156.6	22.6	161.4
8/29/2012	177.10	0.00	6.4	163.3	35.0	167.3	45.5	156.7	22.3	161.7
9/25/2012	175.30	0.00	7.0	162.7	35.7	166.6	46.3	155.9	22.8	161.2
10/30/2012	176.00	0.19	7.0	162.7	36.3	166.0	46.4	155.8	23.2	160.8
11/27/2012	175.80	0.69	7.0	162.7	36.4	165.9	46.5	155.7	23.3	160.7
12/12/2012	176.10	1.40	6.9	162.8	36.3	166.0	46.3	155.9	23.1	160.9
1/22/2013	177.20	1.20	6.4	163.3	36.4	165.9	45.8	156.4	23.3	160.7
2/27/2013	178.20	0.31	6.1	163.6	36.0	166.3	45.4	156.8	23.1	160.9
3/28/2013	178.20	0.71	6.4	163.3	36.0	166.3	45.5	156.7	23.3	160.7
4/25/2013	177.30	0.03	6.6	163.1	36.1	166.2	45.8	156.4	23.3	160.8
5/22/2013	177.60	0.00	6.6	163.1	36.1	166.2	45.7	156.5	23.2	160.8
6/25/2013	177.50	0.00	6.5	163.2	36.2	166.1	45.7	156.5	23.3	160.7
7/23/2013	175.70	0.00	6.8	162.9	36.3	166.0	46.3	156.0	23.3	160.7
8/21/2013	174.50	0.00	7.0	162.7	38.0	164.3	46.5	155.7	23.3	160.7

Notes:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	162.9	36.2	166.1	46.3	155.9	23.4	160.6
10/29/2013	176.00	0.00	6.5	163.2	36.6	165.7	46.2	156.0	23.5	160.6
11/27/2013	176.50	0.44	6.1	163.6	36.4	165.9	45.9	156.3	23.3	160.7
12/19/2013	176.80	0.53	6.2	163.5	36.3	166.0	45.8	156.4	23.2	160.8
1/28/2014	176.80	0.00	6.2	163.5	36.5	165.8	45.9	156.3	23.5	160.5
2/25/2014	176.70	0.72	6.3	163.5	36.5	165.8	45.9	156.3	23.5	160.5
3/25/2014	178.50		6.0	163.8	36.2	166.1	45.4	156.9	23.4	160.6
3/29/2014	178.40	1.44	5.9	163.8	36.4	165.9	45.5	156.7	23.5	160.5
4/25/2014	177.40	0.74	6.1	163.6	36.1	166.2	45.5	156.7	23.3	160.7
5/28/2014	176.40	0.00	6.6	163.1	36.3	166.0	46.0	156.2	23.3	160.7
6/25/2014	176.10	0.00	6.4	163.3	36.4	165.9	44.9	157.3	23.3	160.7
7/30/2014	177.30	0.00	6.2	163.5	36.3	166.0	45.6	156.7	23.2	160.9
8/26/2014	176.10	0.03	6.1	163.6	36.2	166.1	45.6	156.6	23.6	160.4
9/23/2014	175.90	0.00	6.0	163.7	36.4	166.0	45.7	156.5	23.3	160.8
10/30/2014	176.30	0.00	5.9	163.8	36.3	166.0	45.8	156.4	23.3	160.7
11/21/2014	176.20	0.25	5.8	163.9	36.3	166.0	45.5	156.7	23.2	160.8
12/30/2014	178.90	3.37	5.3	164.4	36.0	166.3	44.9	157.3	23.1	160.9
1/27/2015	179.60	0.89	5.2	164.5	35.8	166.5	44.6	157.6	23.2	160.9
2/27/2015	180.00	0.46	5.2	164.5	35.2	167.1	44.3	157.9	22.8	161.2
3/26/2015	179.60	0.45	5.3	164.4	35.3	167.0	44.4	157.8	22.8	161.2
4/29/2015	178.20	0.24	5.6	164.1	35.3	167.0	44.8	157.4	22.6	161.4
5/27/2015	179.00	1.04	5.8	163.9	35.7	166.6	45.0	157.2	22.9	161.1
6/25/2015	179.60	0.00	5.2	164.5	35.2	167.1	44.5	157.7	23.0	161.0
7/29/2015	178.10	0.00	5.4	164.3	35.3	167.0	44.8	157.4	22.6	161.4
8/26/2015	176.20	0.00	5.6	164.1	35.6	166.7	45.2	157.0	22.7	161.3
9/22/2015	178.20	1.64	5.6	164.1	35.8	166.5	44.9	157.3	22.9	161.1
10/27/2015	176.90	0.10	5.4	164.3	35.8	166.5	45.0	157.2	22.5	161.5
11/24/2015	176.30	0.17	5.6	164.1	35.8	166.5	45.3	156.9	23.2	160.8

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	164.2	35.8	166.5	44.9	157.3	22.9	161.1
1/27/2016	180.10	2.86	5.3	164.4	36.0	166.3	44.7	157.5	23.5	160.5
2/25/2016	181.60	0.20	5.0	164.7	34.9	167.4	43.8	158.4	23.5	160.5
3/24/2016	184.80		4.8	164.9	34.5	167.8	43.3	158.9	23.4	160.6
3/31/2016	184.50	1.51	4.7	165.0	34.4	167.9	43.1	159.1	23.3	160.7
4/28/2016	183.60	0.04	4.8	164.9	33.8	168.5	43.2	159.0	23.2	160.8
5/25/2016	182.50	0.13	4.7	165.0	34.1	168.2	43.6	158.6	22.9	161.1
6/28/2016	180.70	0.00	4.8	164.9	34.3	168.0	43.9	158.3	23.1	160.9
7/27/2016	178.40	0.00	5.1	164.6	34.6	167.7	44.6	157.6	23.2	160.8
8/24/2016	176.40	0.00	5.7	164.0	35.3	167.0	45.1	157.1	23.4	160.6
9/27/2016	175.80	0.00	6.1	163.6	35.8	166.5	45.5	156.7	23.5	160.5
10/26/2016	178.60	0.64	5.3	164.4	35.8	166.5	44.8	157.4	23.6	160.4
11/22/2016	178.30	1.11	5.6	164.2	35.7	166.6	44.8	157.4		
12/28/2016	184.80	4.01	5.2	164.5	35.5	166.8	44.0	158.2	23.4	160.6
1/25/2017	193.30	6.33	3.9	165.8	33.9	168.4	41.1	161.1	22.3	161.7
2/28/2017	193.90	3.27	3.2	166.5	30.7	171.6	40.5	161.7	21.2	162.8
3/29/2017	193.70	0.08	3.0	166.7	30.0	172.3	40.3	161.9	20.5	163.5
4/27/2017	192.90	0.04	2.7	167.0	29.7	172.6	40.0	162.2	20.4	163.6
5/23/2017	187.90	33.00	3.0	166.7	30.5	171.8	41.2	161.0	23.4	160.6
6/21/2017	182.50	0.00	3.5	166.2	31.9	170.4	42.6	159.6	21.3	162.7
7/26/2017	163.60	0.00	5.8	163.9	34.5	167.8	46.7	155.5	22.8	161.3
8/30/2017	163.60	0.00	8.7	161.0	36.4	165.9	48.6	153.6	23.5	160.5
9/28/2017	163.60	0.00	12.6	157.1	37.5	164.8	49.7	152.5	23.6	160.4
10/26/2017	171.80	0.00	14.5	155.2	37.7	164.6	48.8	153.4	23.6	160.4
11/29/2017	177.20	0.08	9.7	160.0	37.2	165.1	46.3	155.9	23.6	160.4
12/27/2017	176.70	0.00	7.6	162.1	36.7	165.6	46.1	156.1	23.6	160.4
1/24/2018	178.10	1.67	7.7	162.0	36.3	166.0	45.4	156.8	23.6	160.4
2/21/2018	177.80	0.27	6.8	162.9	36.1	166.2	45.3	156.9	23.6	160.4

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	163.8	35.6	166.7	44.0	158.2	23.3	160.7
4/27/2018	184.30	0.05	5.2	164.5	34.8	167.5	43.5	158.7	23.6	160.4
5/30/2018	183.10	0.13	5.3	164.4	34.2	168.1	43.6	158.6	23.3	160.8
6/28/2018	181.70	0.00	5.7	164.0	34.2	168.1	44.0	158.2	23.3	160.7
7/26/2018	180.00	0.00	6.0	163.7	34.5	167.8	44.4	157.8	23.9	160.1
8/28/2018	177.30	0.00	6.7	163.0	35.2	167.2	45.3	156.9	23.4	160.6
9/27/2018	178.10	0.00	7.0	162.7	35.5	166.8	45.5	156.7	23.6	160.4
10/24/2018	178.00	0.66	6.2	163.5	35.6	166.7	45.3	156.9	23.6	160.4
11/29/2018	177.50	1.60	6.9	162.8	35.5	166.8	45.5	156.7	23.6	160.4
12/20/2018	181.40	2.39	6.6	163.1	35.3	167.0	44.4	157.8	23.6	160.4
1/30/2019	189.40	4.56	5.0	164.7	33.6	168.7	41.8	160.4	23.4	160.6
2/27/2019	194.10	7.48	3.5	166.2	30.8	171.5	39.7	162.5	20.1	
3/27/2019	194.00	1.27	3.9	165.8	29.6	172.7	34.3	167.9	20.9	
4/24/2019	193.60	0.07	4.25	165.5	29.40	172.9	39.30	162.9	20.10	
5/30/2019	191.40	0.73	4.60	165.1	29.90	172.4	39.90	162.3	20.50	
6/26/2019	190.80	0.02	4.50	165.2	30.30	172.0	40.20	162.0	20.70	
7/5/2015	190.40	0.00	4.40	165.3	30.50	171.8	40.30	161.9	20.80	
7/30/2019	188.95	0.00	4.70	165.0	30.70	171.6	40.50	161.7	21.00	
8/27/2019	187.40	0.00	4.70	165.0	31.10	171.2	41.20	161.0	2.31	
9/26/2019	186.20	0.00	4.70	165.0	31.50	170.8	41.20	161.0	21.70	
10/22/2019	185.20	0.00	5.00	164.7	32.40	169.9	42.00	160.2	22.00	
11/26/2019	183.50	2.66	5.10	164.6	32.70	169.6	42.50	159.7	8804.00	
12/18/2019	186.80	4.44	4.80	164.9	32.60	169.7	41.65	160.6	8803.00	
1/28/2020	192.00	0.24	4.00	165.7	30.50	171.8	39.40	162.8	23.30	
2/25/2020	192.10	0.49	4.00	165.7	30.30	172.0	39.10	163.1	87.67	
3/24/2020	194.00	3.89	4.00	165.7	3.20		39.10	163.1	8760.00	
4/29/2020	193.50	4.59	3.30	166.4	28.70	173.6	37.90	164.3	8719.457	
5/27/2020	193.10	0.03	3.00	166.7	29.00	173.3	38.10	164.1	8736.785	
6/24/2020	190.00	0.00	2.80	166.9	29.70	172.6	38.40	163.8	8749.643	

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			7		8A		8B		VBW9A	
Top of Well Elevation --->			169.7		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	166.8	30.30	172.0	39.40	162.8	8763.9	
8/27/2020	185.90	0.00	3.30	166.4	31.10	171.2	40.30	161.9	8779.345	
9/29/2020	183.10	0.00	4.20	165.5	32.40	169.9	41.55	160.7	8796.117	
10/29/2020	180.30	0.00	5.00	164.7	33.40	168.9	42.60	159.6	8808.922	
11/24/2020	179.00	0.65	5.70	164.0	34.00	168.3	43.30	158.9	8817.643	
12/29/2020	179.00	1.03	5.90	163.8	34.50	167.8	43.30	158.9	8824.287	
1/26/2021	180.50	2.39	4.80	164.9	34.70	167.6	43.00	159.2	23.3	160.7
2/25/2021	182.10	0.03	5.60	164.1	34.10	168.2	41.90	160.3	23.10	160.9
3/23/2021	182.90	1.15	5.40	164.3	33.80	168.5	41.40	160.8	23.20	160.8
4/27/2021	182.00	0.04	5.60	164.1	34.00	168.3	42.10	160.1	23.20	160.8
5/26/2021	181.00	0.11	5.70	164.0	34.20	168.1	42.40	159.8	23.60	160.4
6/30/2021	179.00	0.00	6.00	163.7	34.60	167.7	43.20	159.0	23.40	160.6
7/27/2021	177.10	0.08	6.50	163.2	35.00	167.3	43.90	158.3	23.50	160.5
8/24/2021	175.40	0.00	6.80	162.9	35.40	166.9	44.60	157.6	23.50	160.5
9/28/2021	175.20	0.06	6.90	162.8	35.90	166.4	45.10	157.1	23.60	160.4
10/27/2021	177.20	0.80	6.60	163.1	36.10	166.2	44.80	157.4	23.60	160.4
11/23/2021	177.80	0.00	6.20	163.5	35.70	166.6	44.20	158.0	23.60	160.4
12/21/2021	180.50	5.86	5.90	163.8	35.60	166.7	43.50	158.7	23.60	160.4

Notes:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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	138.8	8.4	157.2
2/28/2007	177.60		28.5	155.7	19.3	164.1	45.2	138.6	9.2	156.4
3/29/2007	177.10		28.6	155.6	19.3	164.1	45.6	138.2	8.4	157.2
4/27/2007	176.60		28.5	155.7	19.3	164.1	45.4	138.4	9.3	156.3
5/24/2007	176.80		28.6	155.6	19.3	164.1	45.9	137.9	9.2	156.4
6/27/2007	179.90		28.4	155.8	19.2	164.2	45.4	138.4	8.2	157.4
7/27/2007	177.80		28.5	155.7	19.3	164.1	46.5	137.3	9.2	156.4
8/28/2007	177.20		28.3	155.9	19.4	164.0	46.4	137.4	8.0	157.6
9/26/2007	177.00		28.4	155.8	19.4	164.0	46.5	137.3	9.3	156.3
10/30/2007	175.50		28.7	155.5	19.4	164.0	46.6	137.2	9.3	156.3
11/27/2007	175.90		28.8	155.4	19.5	163.9	46.6	137.2	9.3	156.3
12/27/2007	178.20		28.9	155.3	19.5	163.9	45.5	138.3	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:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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

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JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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

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PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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	136.2	10.2	155.4
2/21/2018	177.80	0.27	29.8	154.4	24.7	158.7	47.6	136.2	10.2	155.4

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JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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	136.2	10.2	155.4
4/27/2018	184.30	0.05	29.4	154.8	24.4	159.0	47.6	136.2	10.2	155.4
5/30/2018	183.10	0.13	29.2	155.0	24.4	159.0	47.6	136.2	10.2	155.4
6/28/2018	181.70	0.00	29.0	155.2	23.6	159.8	47.6	136.2	28.2	137.4
7/26/2018	180.00	0.00	29.1	155.1	23.5	159.9	47.6	136.2	10.0	155.6
8/28/2018	177.30	0.00	29.2	155.0	23.5	159.9	47.6	136.2	9.9	155.7
9/27/2018	178.10	0.00	29.4	154.8	23.7	159.7	47.6	136.2	10.0	155.6
10/24/2018	178.00	0.66	29.4	154.8	23.9	159.5	47.6	136.2	10.1	155.5
11/29/2018	177.50	1.60	29.6	154.6	24.2	159.2	47.6	136.2	10.2	155.4
12/20/2018	181.40	2.39	29.5	154.7	24.1	159.3	46.8	137.0	10.1	155.5
1/30/2019	189.40	4.56	28.9	155.3	25.8	157.6	45.6	138.2	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:
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3. Piezometer data based on NGVD 29 datum.

TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

Monitoring Well --->			VBW9B		VBW/10A		VBW/10B		VBW/11	
Top of Well Elevation --->			184.2		183.4		183.8		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	138.30	10.10	155.50
2/25/2021	182.10	0.03	28.90	155.3	23.30	160.1	45.30	138.50	9.80	155.80
3/23/2021	182.90	1.15	28.90	155.3	23.30	160.1	45.40	138.40	10.00	155.60
4/27/2021	182.00	0.04	28.90	155.3	23.20	160.2	45.80	138.00	10.00	155.60
5/26/2021	181.00	0.11	28.90	155.3	23.28	160.1	46.58	137.22	9.90	155.70
6/30/2021	179.00	0.00	29.10	155.1	23.40	160.0	46.80	137.00	10.00	155.60
7/27/2021	177.10	0.08	29.20	155.0	23.50	159.9	46.80	137.00	9.90	155.70
8/24/2021	175.40	0.00	29.20	155.0	23.50	159.9	46.80	137.00	9.90	155.70
9/28/2021	175.20	0.06	29.50	154.7	23.80	159.6	47.40	136.40	10.08	155.52
10/27/2021	177.20	0.80	29.50	154.7	24.00	159.4	47.40	136.40	10.10	155.50
11/23/2021	177.80	0.00	29.60	154.6	24.30	159.1	47.60	136.20	10.20	155.40
12/21/2021	180.50	5.86	29.40	154.8	24.30	159.1	46.80	137.00	10.10	155.50

Notes:
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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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TABLE 2
SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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

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SAND CANYON DAM
PIEZOMETER AND SUBDRAIN MEASUREMENTS
JANUARY 2007 THROUGH DECEMBER 2021

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 2021

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
7/5/2015	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 2021

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

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

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

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

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

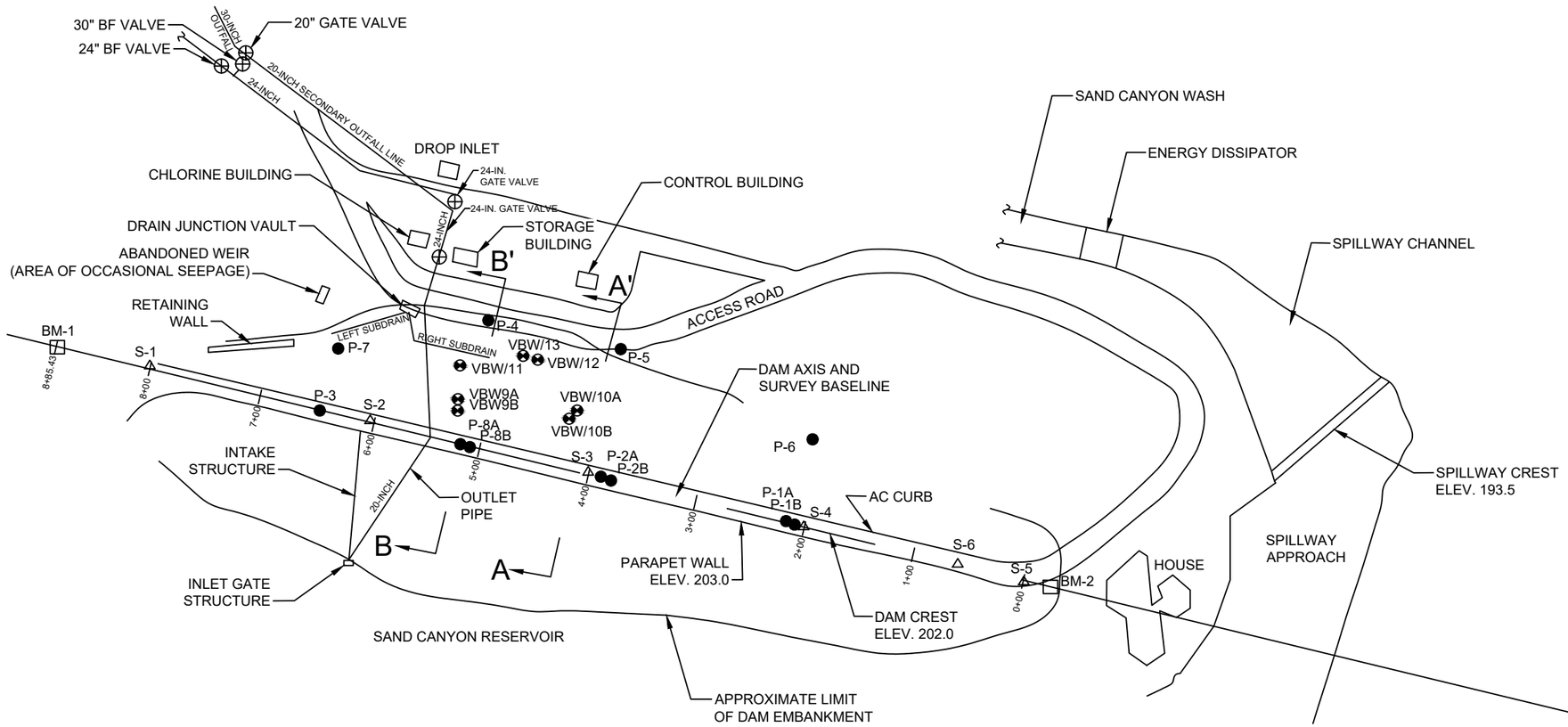
1969 THROUGH 2022

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

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. 2021
Sand Canyon Dam
Irvine, CA

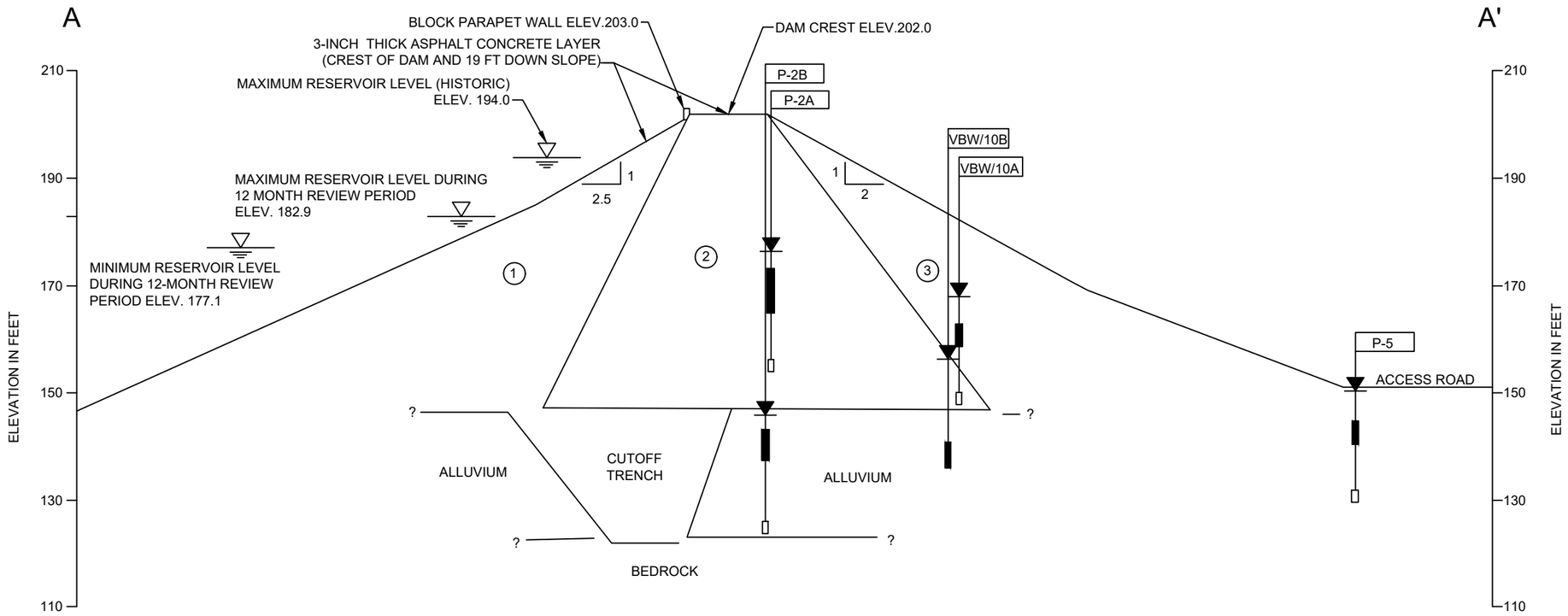
Irvine Ranch Water District
Irvine, CA

GEI Consultants

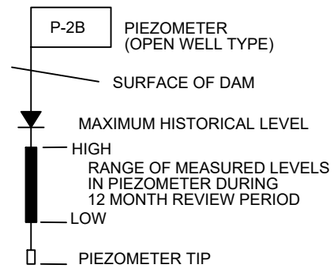
Project 1901888

SITE AND INSTRUMENTATION PLAN

September 2022 Fig. 1



LEGEND



NOTE: QUESTIONABLE READINGS
ARE NOT SHOWN

MATERIALS

1. SELECTED IMPERVIOUS
2. RANDOM
3. UNSELECTED PERVIOUS

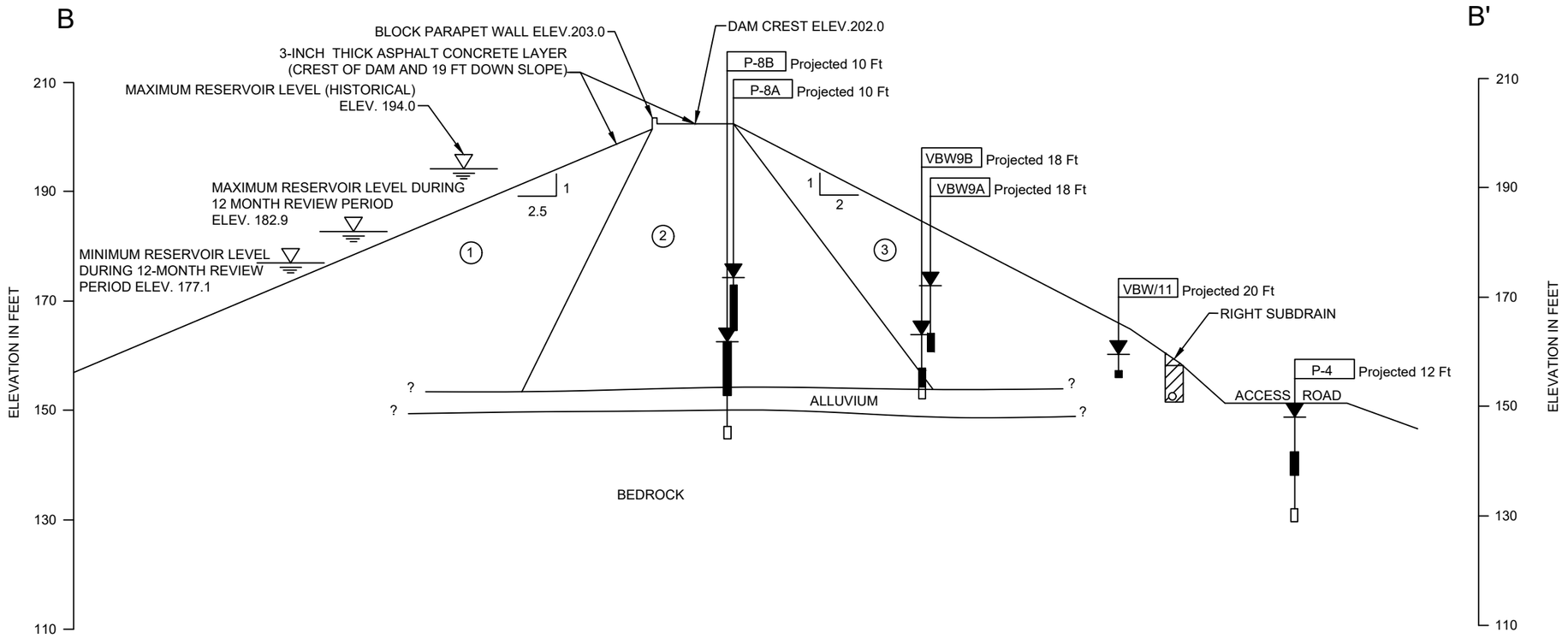
NOTES:

(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. 2021 Sand Canyon Dam Irvine, CA	GEI Consultants	SECTION A-A'
Irvine Ranch Water District Irvine, CA	Project 1901888	September 2022 Fig. 2



MATERIALS

1. SELECTED IMPERVIOUS
2. RANDOM
3. UNSELECTED PERVIOUS

LEGEND

- P-8B — 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. 2021
Sand Canyon Dam
Irvine, CA

Irvine Ranch Water District
Irvine, CA

GEI Consultants

SECTION B-B'

Project 1901888 | September 2022 | 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 2020 THROUGH DECEMBER 2021

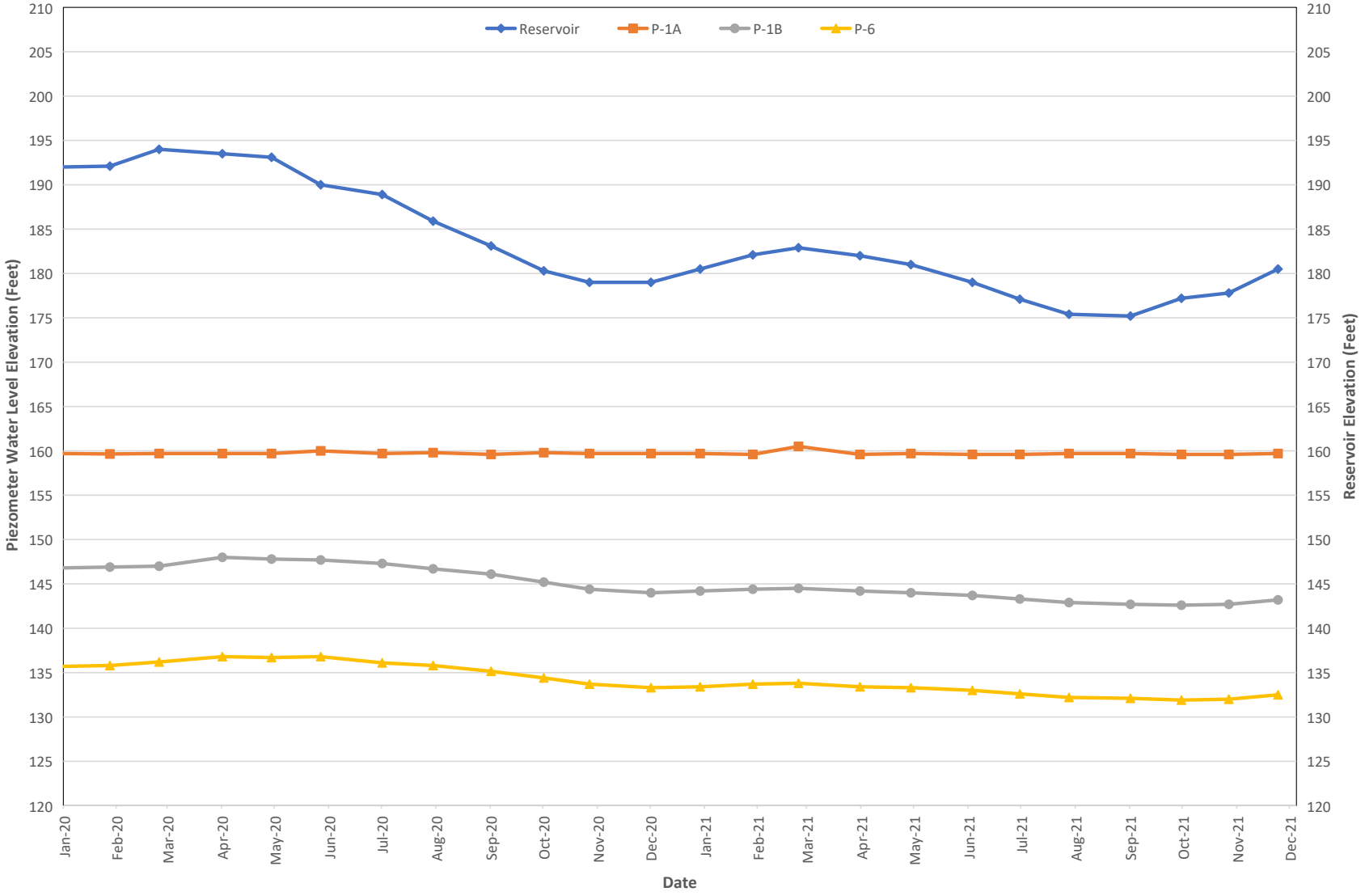


Figure 5
SAND CANYON DAM
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
PIEZOMETERS P-2A, P-2B, P-5, VBW/10A, AND VBW/10B
JANUARY 2020 THROUGH DECEMBER 2021

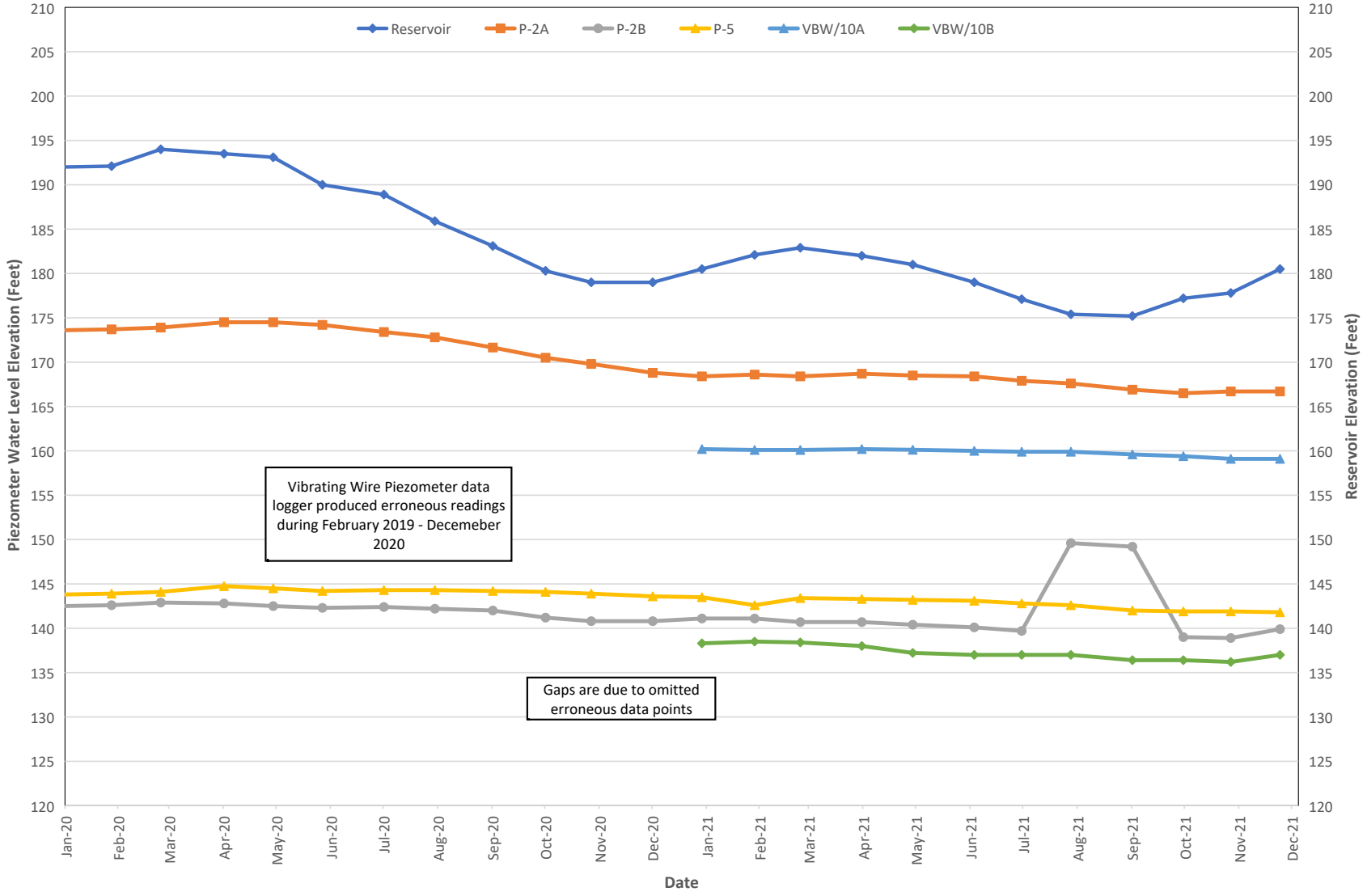


Figure 6
SAND CANYON DAM
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
PIEZOMETERS P-4, P-8A, P-8B, VBW9A, VBW9B, AND VBW/11
JANUARY 2020 THROUGH DECEMBER 2021

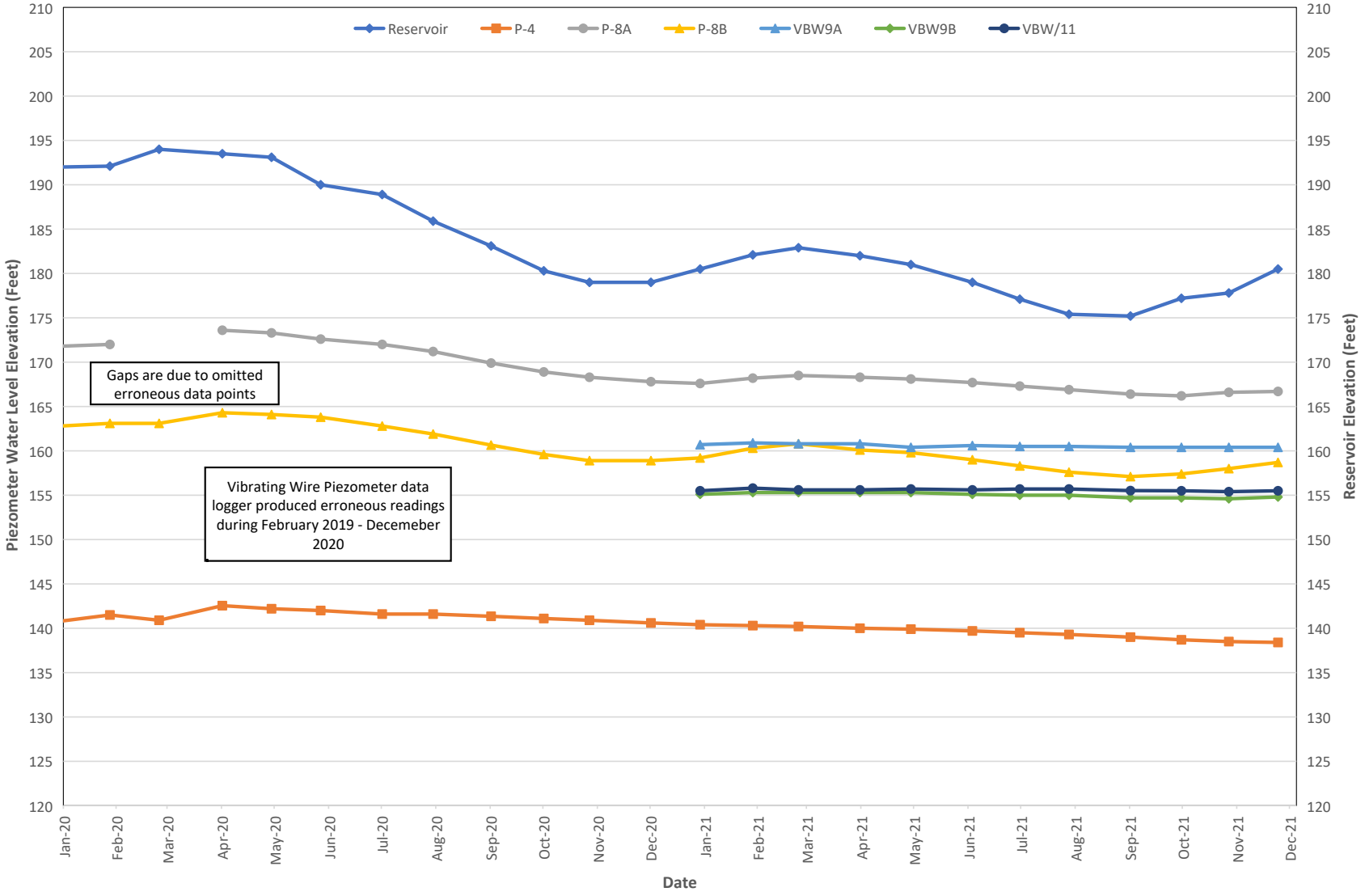


Figure 7
SAND CANYON DAM
2-YR OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
OPEN WELL PIEZOMETERS P-3, AND P-7
JANUARY 2020 THROUGH DECEMBER 2021

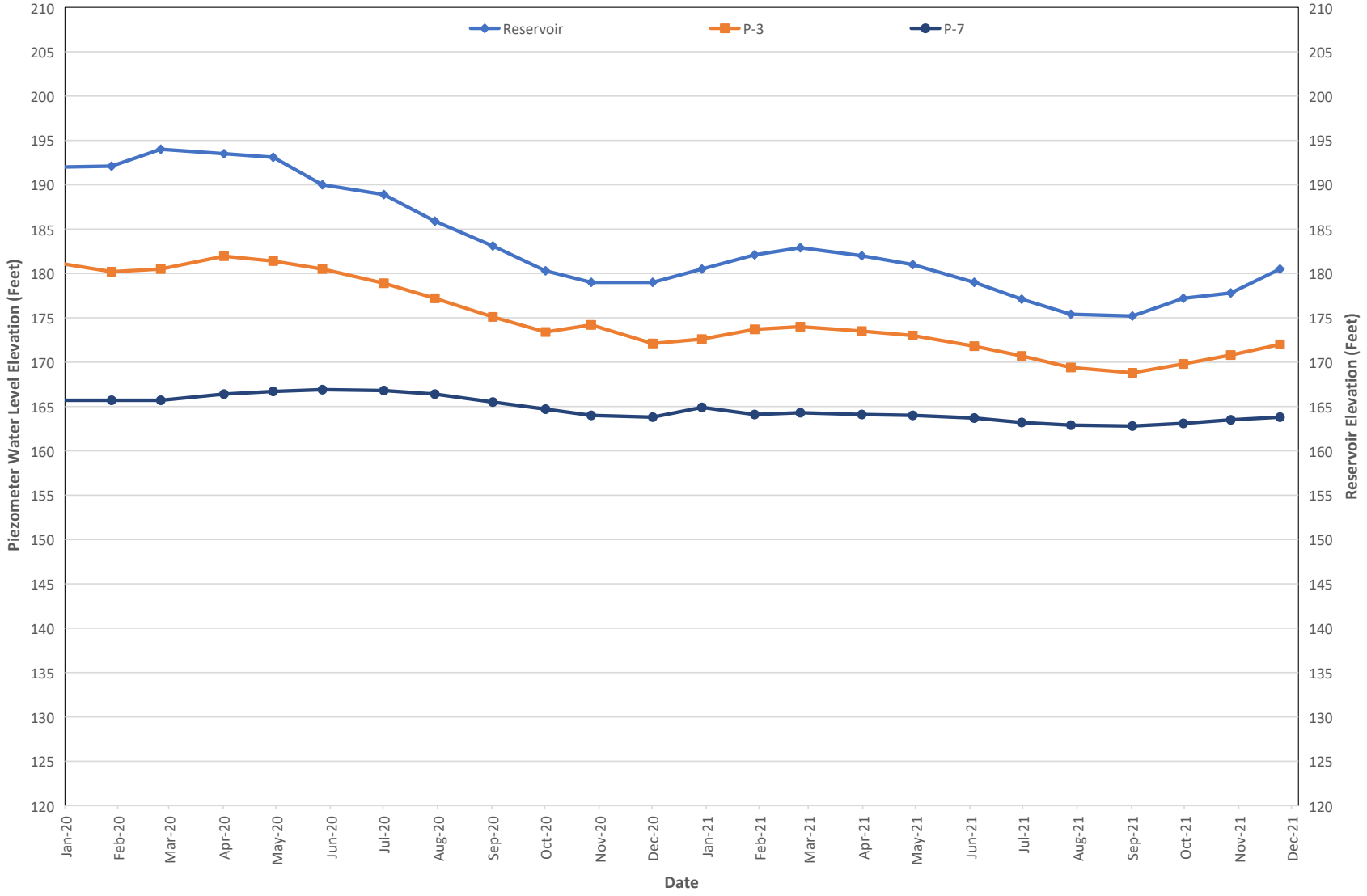


Figure 8
SAND CANYON DAM
2-YR VIBRATING WIRE PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
VIBRATING WIRE PIEZOMETERS VBW/12, AND VBW/13
JANUARY 2020 THROUGH DECEMBER 2021

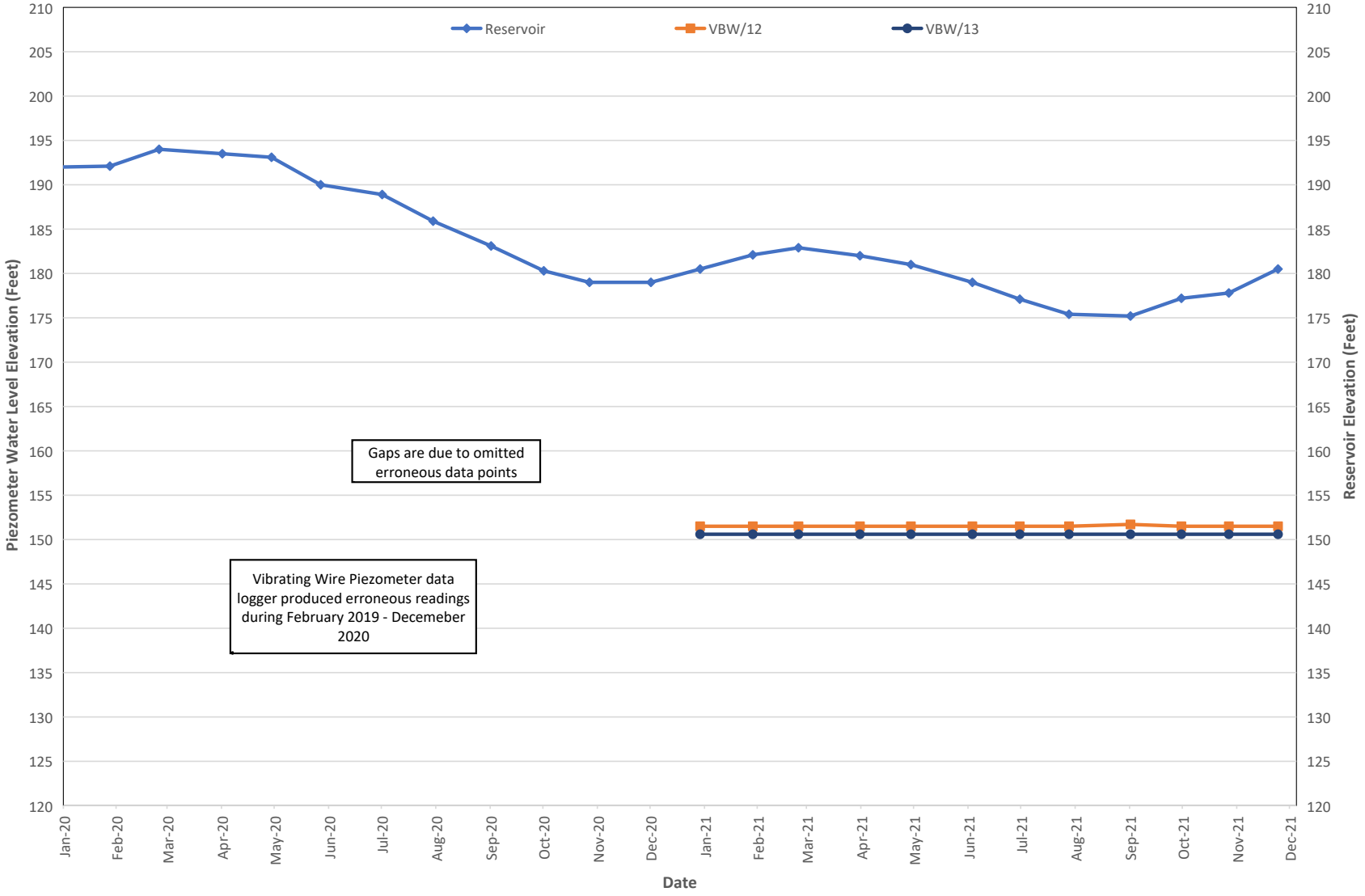


Figure 9
SAND CANYON DAM
HISTORICAL OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
OPEN WELL PIEZOMETERS P-1A, P-1B, AND P-6
JANUARY 2011 THROUGH DECEMBER 2021

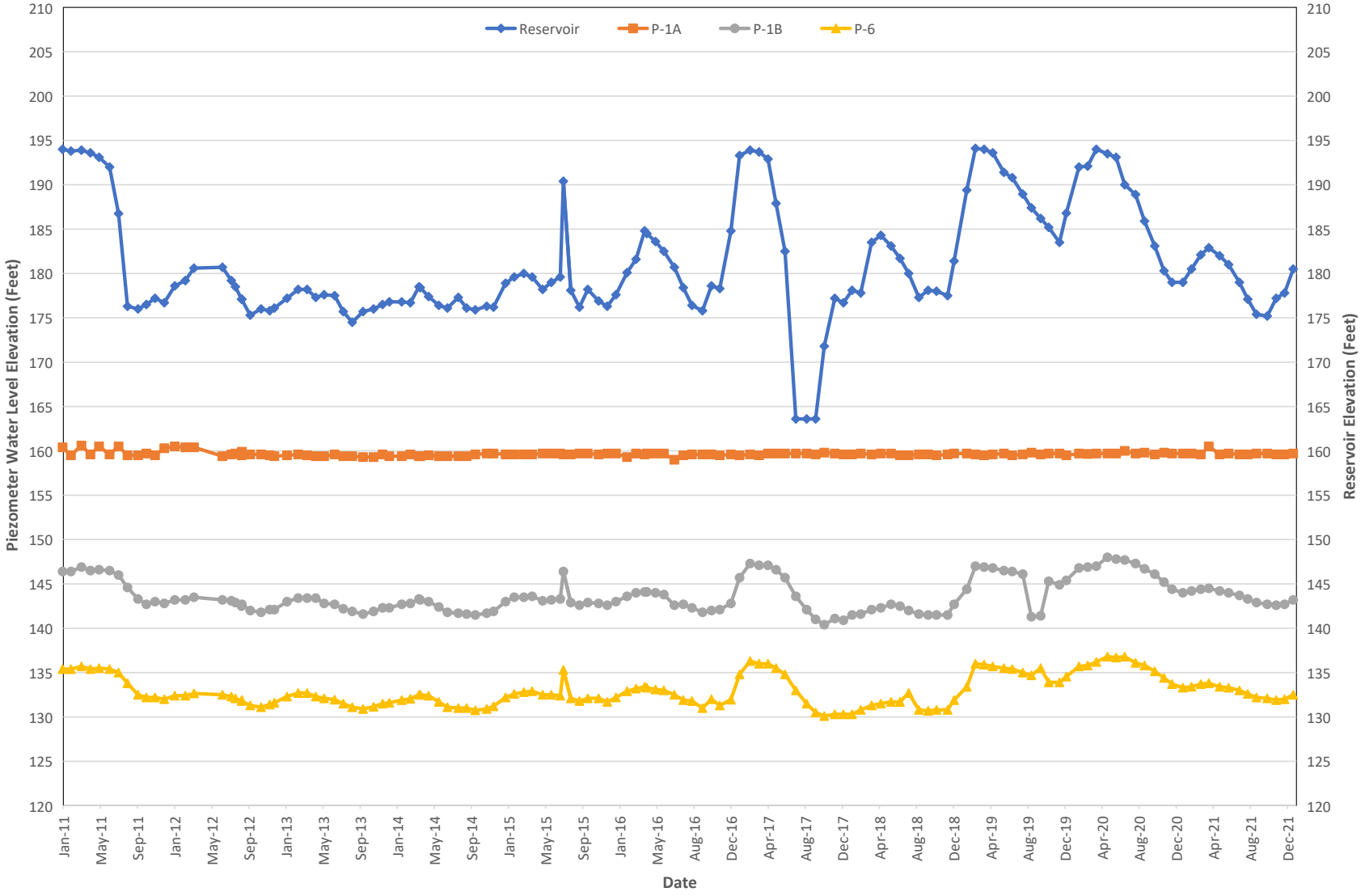


Figure 10
SAND CANYON DAM
HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
PIEZOMETERS P-2A, P-2B, P-5, VBW/10A, AND VBW/10B
JANUARY 2011 THROUGH DECEMBER 2021

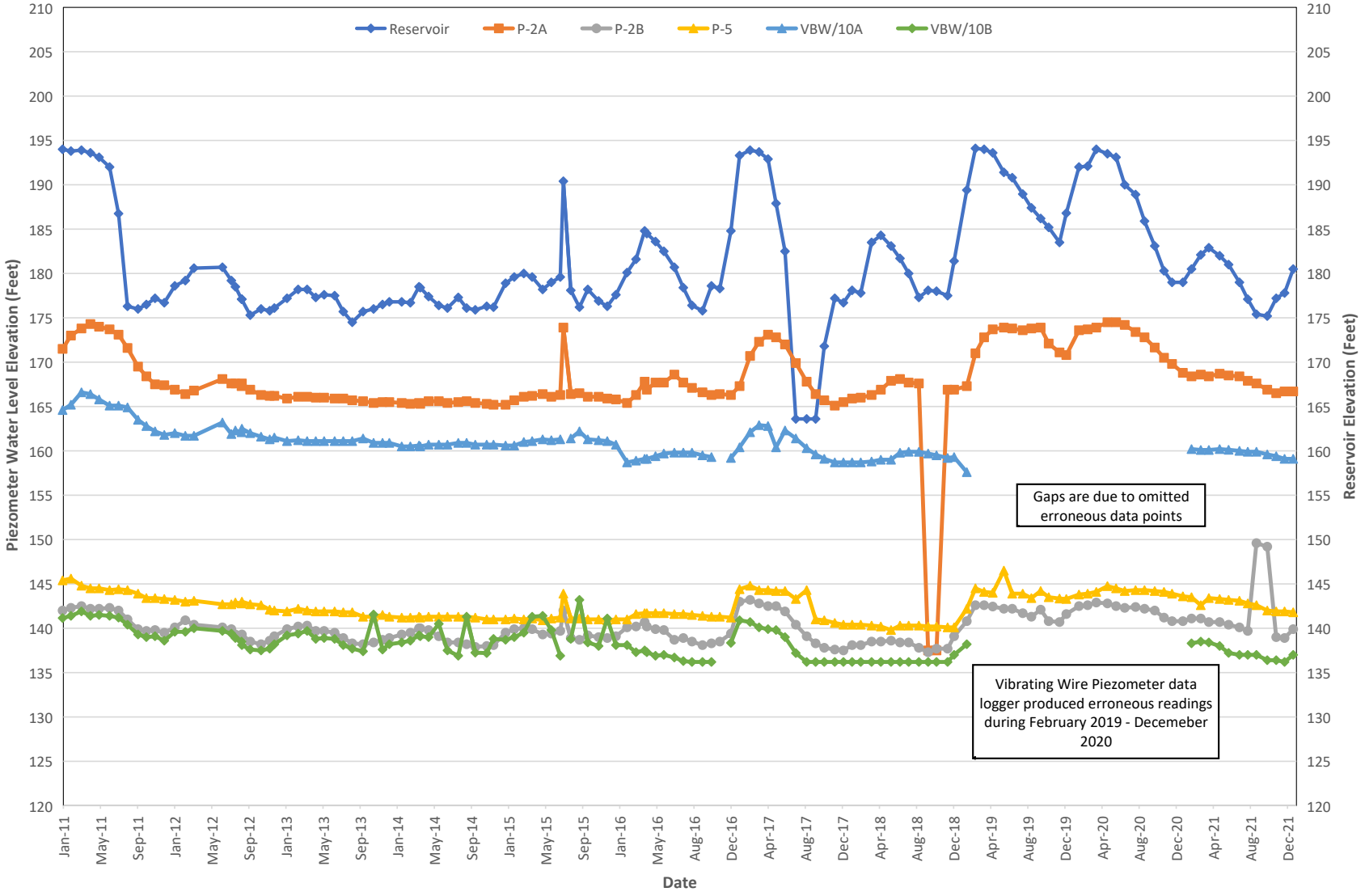


Figure 11
SAND CANYON DAM
HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
PIEZOMETERS P-4, P-8A, P-8B, VBW9A, VBW9B, AND VBW/11
JANUARY 2011 THROUGH DECEMBER 2021

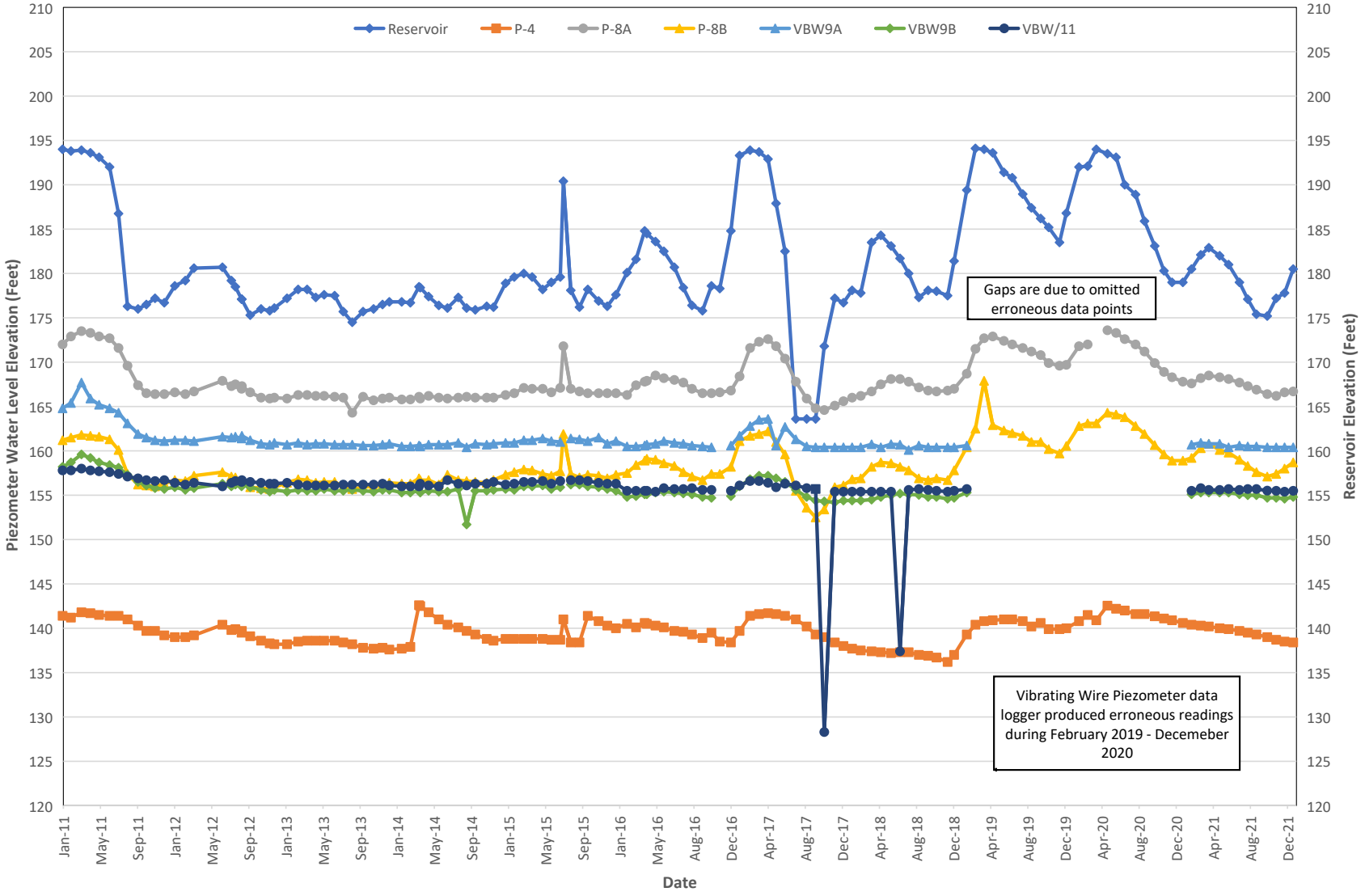


Figure 12
SAND CANYON DAM
HISTORICAL OPEN WELL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
OPEN WELL PIEZOMETERS P-3, AND P-7
JANUARY 2011 THROUGH DECEMBER 2021

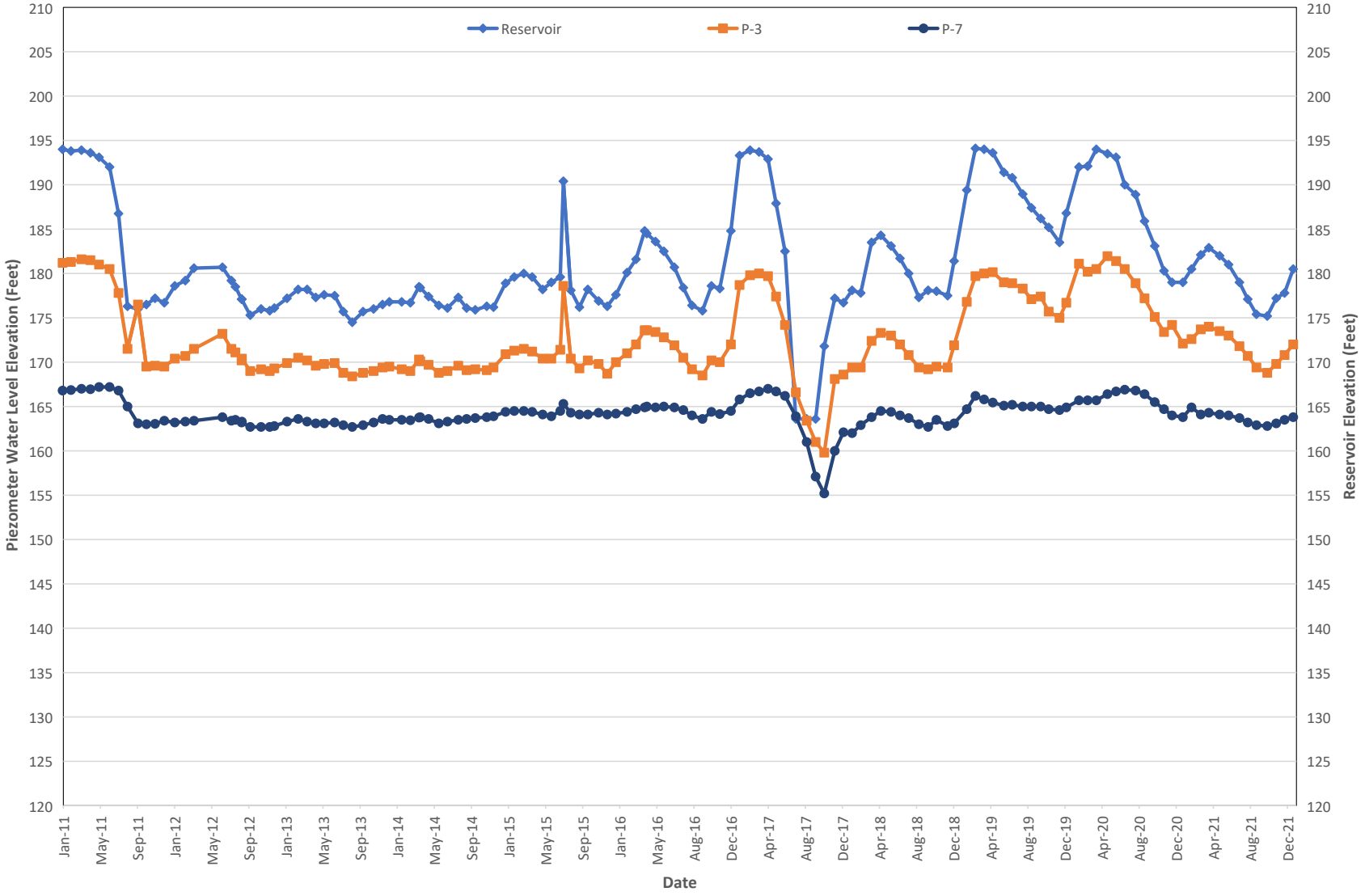


Figure 13
SAND CANYON DAM
HISTORICAL VIBRATING WIRE PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS
VIBRATING WIRE PIEZOMETERS VBW/12, AND VBW/13
JANUARY 2011 THROUGH DECEMBER 2021

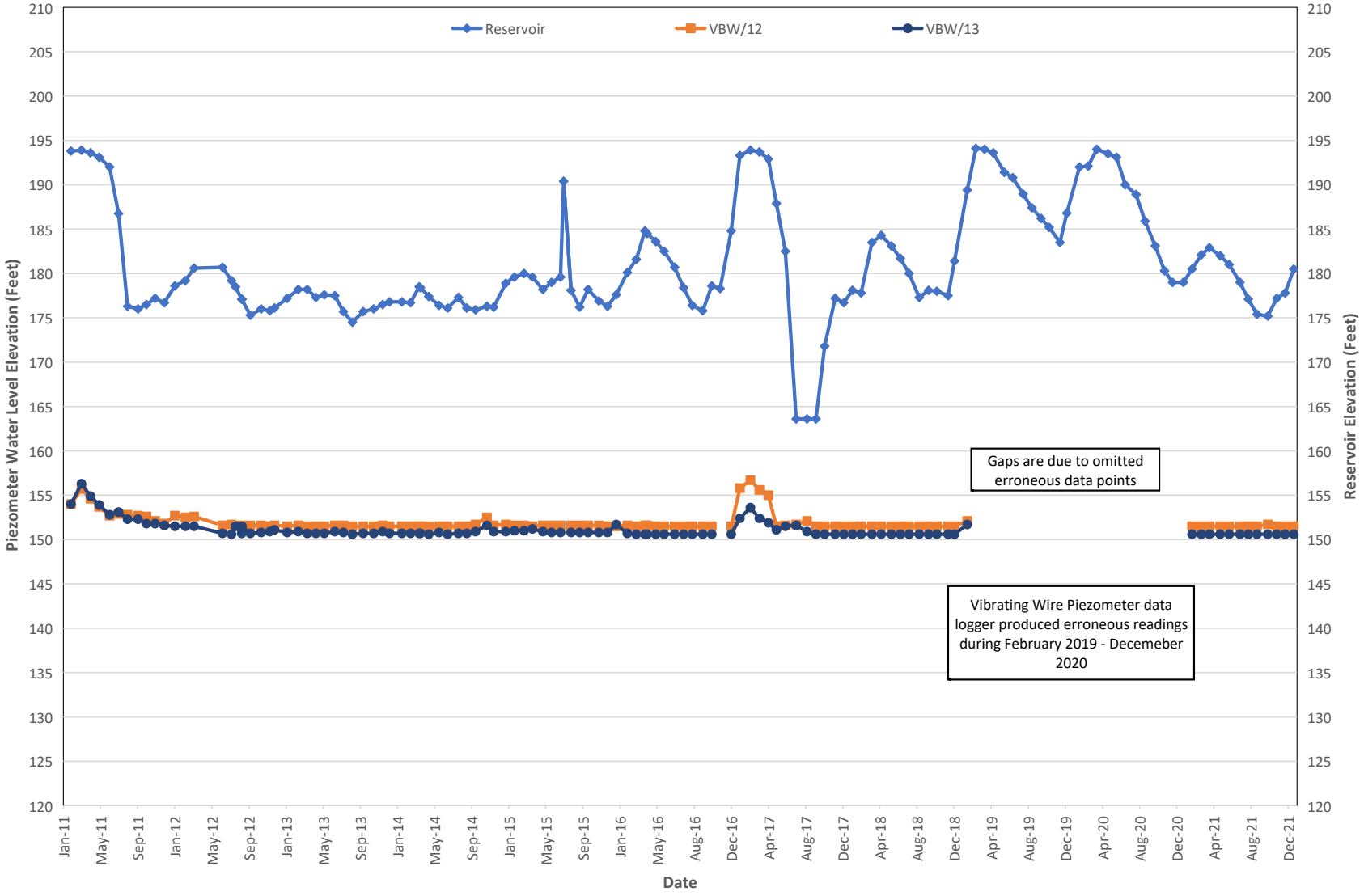


Figure 14
SAND CANYON DAM
2-YR SEEPAGE, RESERVOIR WATER SURFACE ELEVATIONS AND RAINFALL
JANUARY 2020 THROUGH DECEMBER 2021

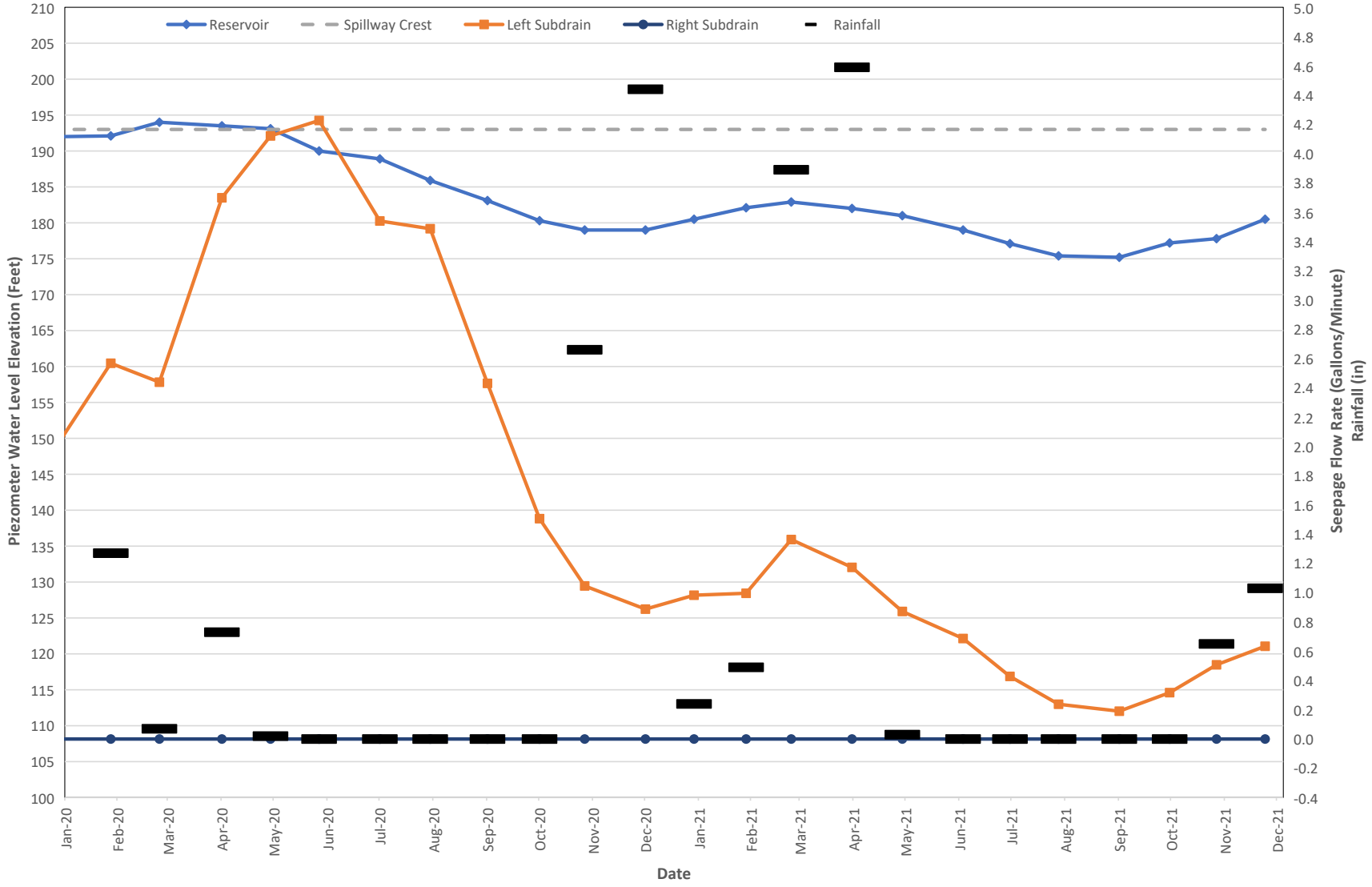


Figure 15
SAND CANYON DAM
HISTORICAL SEEPAGE FLOW RATES AND RESERVOIR WATER SURFACE ELEVATIONS
JANUARY 2011 THROUGH DECEMBER 2021

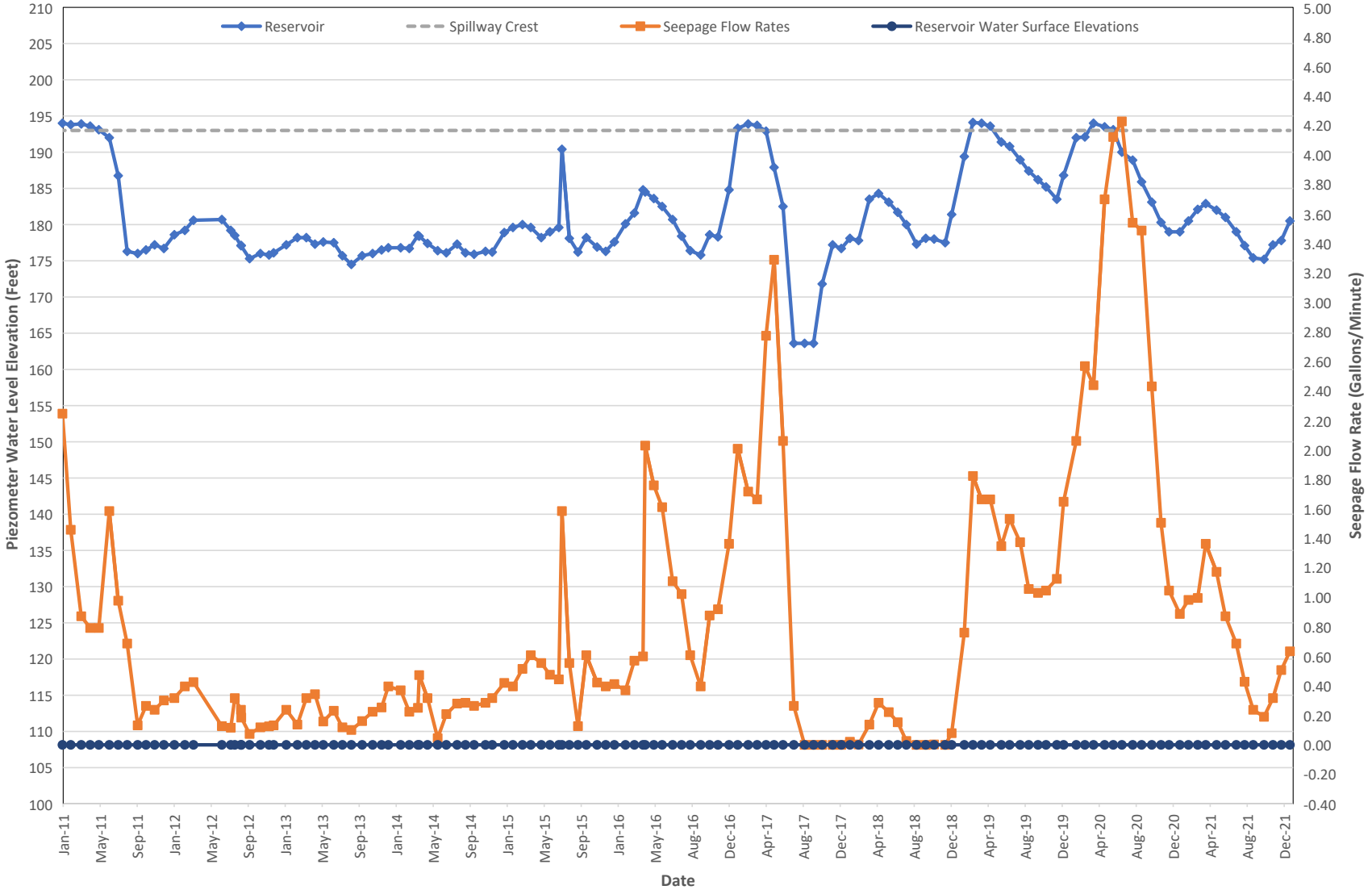


Figure 16
SAND CANYON DAM
HISTORICAL CUMMULATIVE HORIZONTAL DISPLACEMENT
SURVEY MONUMENTS S-1, S-2, S-3, S-4, S-5, S-6
JANUARY 1995 THROUGH April 2022

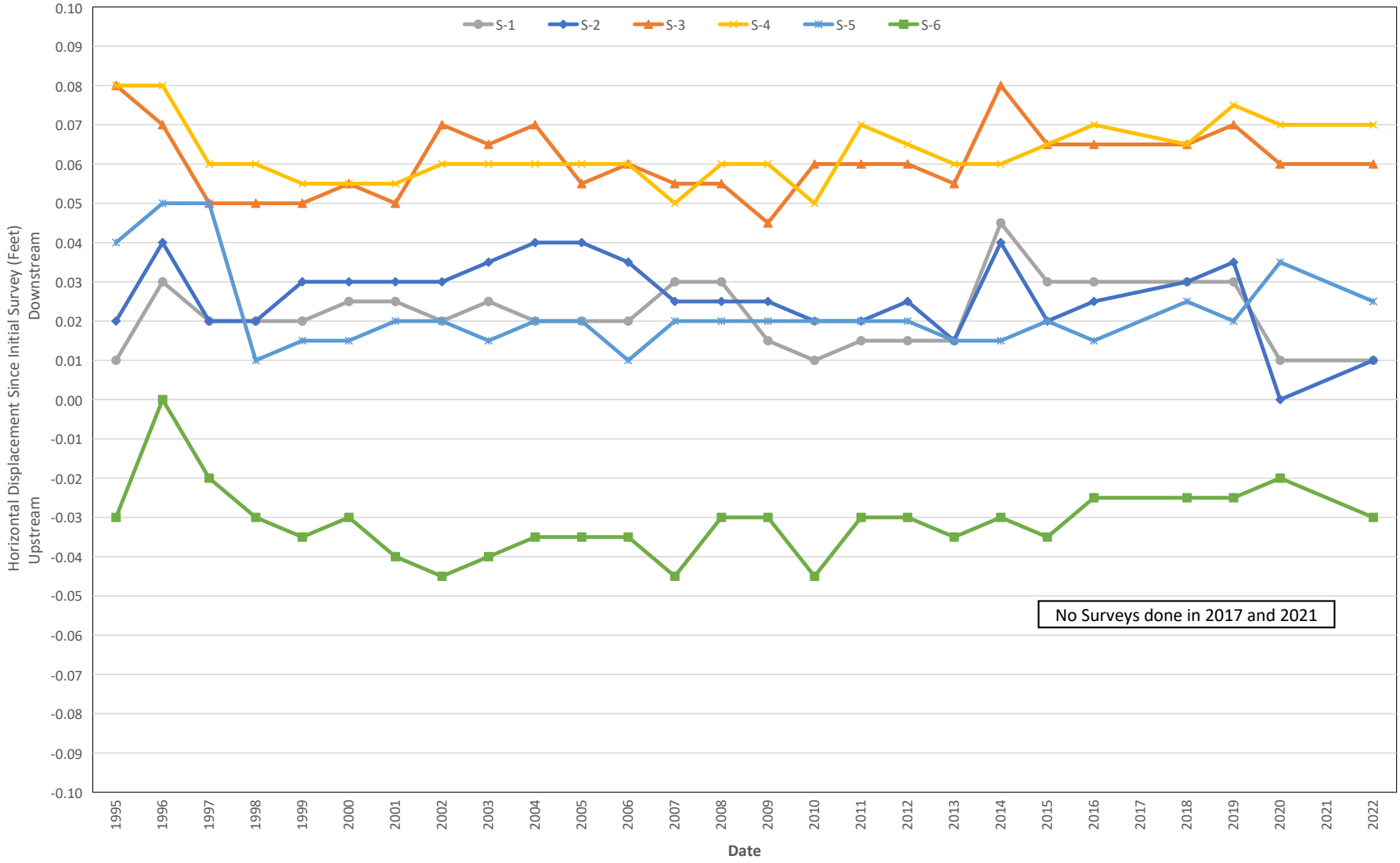
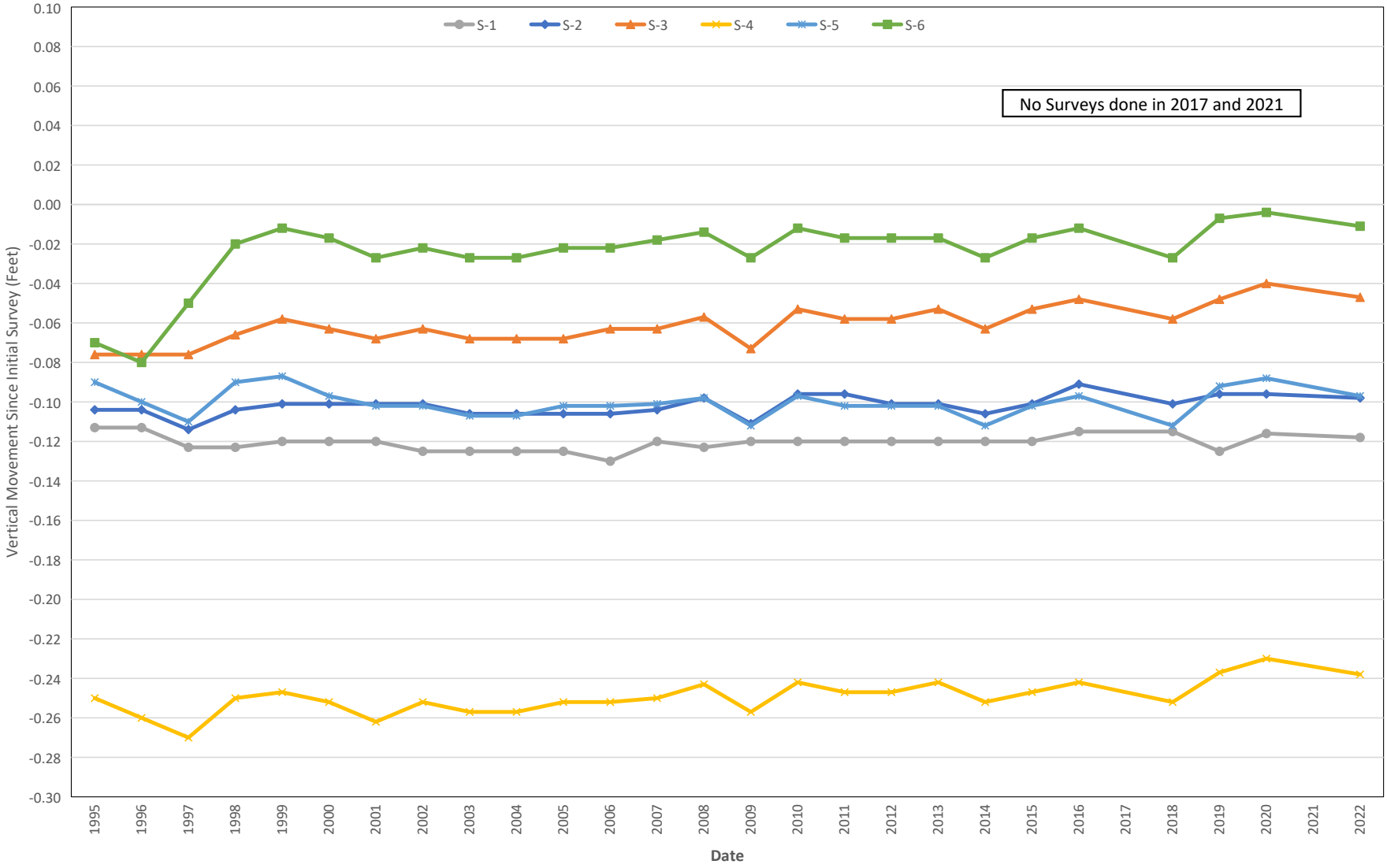


Figure 17
SAND CANYON DAM
HISTORICAL CUMMULATIVE VERTICAL MOVEMENT
SURVEY MONUMENTS S-1, S-2, S-3, S-4, S-5, S-6
JANUARY 1995 THROUGH April 2022



Appendix

Inspection Photographs of
Sand Canyon Dam
April 18, 2022, and
June 13, 2022 (DSOD)

Reservoir Dam Valve
Exercising Table

CNC Survey Report

Inspection Photographs of Sand Canyon Dam

April 18, 2022 and
June 13, 2022 (DSOD)

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) Minor AC paving temperature related cracking looking towards the right abutment.

Photo 4) AC-lined upstream face looking towards right abutment. Note cracks and brush in reservoir.

Photo 5) Downstream face looking towards the left abutment.

Photo 6) Downstream face looking towards the right abutment.

Photo 7) Empty rodent control feeder box near inactive rodent holes.

Photo 8) Close view of the spillway control ogee section and approach.

Photo 9) Spillway channel looking downstream, note vertical right wall joint offset.

Photo 10) Spillway channel concrete walls and rock floor looking upstream.

Photo 11) Close up view of spillway stilling basin, note brush/tule growth downstream.

Photo 12) Outlet upstream valves' operating equipment.

Photo 13) Outlet valve controls and stems.

Photo 14) Location of downstream outlet control valves.

Photo 15) Overgrown vegetation at 30-inch blowoff discharge outfall.

Photo 16) Seepage at left subdrain.

Photo 17) Soil desiccation cracking near piezometer P-7. Photo taken by IRWD on 6/13/2022 DSOD inspection.

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%

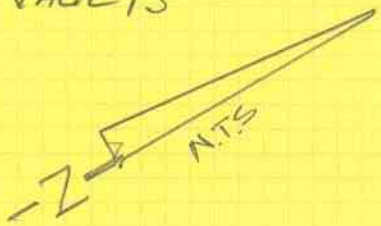
CNC Survey Report

Prepared by:

CNC
ENGINEERING | SURVEYING | CONSTRUCTION
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: 4-26-2022 SHEET 1 OF 2

MONUMENT	STA.	OFFSET	DESC.
		HOLD FOR LINE	
BM-1	8+85.360		BRASS DISK/PUNCH IN WELL NEAR VAULTS
S-1	8+00.229	0.060	
S-2	6+00.199	0.070	
S-3	4+00.127	0.110	
S-4	2+00.188	0.110	
S-6	0+61.430	0.120	
S-5	0+00.086	0.025	
BM-2	-0+15.380 HOLD STA		HOLD FOR LINE BRASS DISK/PUNCH IN WELL



PTS S-1 - S-6 ARE "+" ON BRASS DISK IN WELLS

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Date: 4/26/2022

SURVEY LEVELING NOTES

PROJECT: IRWD / Sand Canyon Reservoir – Level Report

STATION	B.S.	HI	F.S.	ELEVATION	SURVEY LEVELING NOTES
BM1				204.167	Brass CAP w/punch in well
	3.755	207.922			
S-1			7.077	200.845	"S" points are "+ "on Brass Disc in Well
	6.500	207.345			
S-2			6.291	201.054	
	6.764	207.817			
S-3			7.237	200.581	
	7.229	207.809			
S-4			7.141	200.668	
	6.967	207.636			
S-6			6.864	200.771	
	6.671	207.443			
S-5			6.776	200.667	
	7.307	207.974			
BM2			6.276	201.698	Brass CAP w/punch in well
	5.801	207.500			
E			4.289	203.210	"E" points are Nail and Square Washer on Top of Wall
	4.406	207.617			
E-1			4.387	203.229	
	4.559	207.788			
E-2			4.521	203.267	
	4.589	207.855			
E-3			4.456	203.399	
	3.907	207.306			
E-4			3.783	203.524	
	4.253	207.777			
BM1			3.606	204.167	Brass CAP w/punch in well
					ALL ELEVATIONS ARE ADJUSTED