

**Annual Surveillance Report**  
**January 2018 through December 2018**  
**Syphon Canyon Dam**  
DSOD Dam No. 1029-004  
Irvine, CA  
June 26, 2019



**Prepared By:**

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**Prepared For:**

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Field Operations Department  
P. O. Box 57000  
Irvine, CA 92619-7000





**GENTERRA**  
**CONSULTANTS, INC.**  
ENGINEERING & GEOTECHNICAL SERVICES

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
FOR  
SYPHON CANYON DAM  
DSOD DAM NO. 1029-004  
IRVINE, CALIFORNIA**

**Submitted To:**

**Irvine Ranch Water District  
Field Operations Department  
P. O. Box 57000  
Irvine, CA 92619-7000**

**Prepared By:**

**GENTERRA Consultants, Inc.  
15375 Barranca Pkwy., Bldg. L  
Irvine, California 92618**

**Project No. 397D-IRW**

**June 26, 2019**

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Project No. 397D-IRW

Irvine Ranch Water District  
P. O. Box 57000  
Irvine, CA 92619-7000

Attention: Mr. Malcolm A. Cortez, P.E.

Subject: Syphon Canyon Dam, DSOD Dam No. 1029-004,  
Annual Surveillance Report from January 2018 through December 2018

Dear Mr. Cortez:

GENTERRA Consultants, Inc. (GENTERRA) is pleased to submit this Annual Surveillance Report for Syphon Canyon Dam covering the period from January 2018 through December 2018. This report is part of the scope of work described in our proposal dated October 14, 2015, and as authorized by the Irvine Ranch Water District (District) in Purchase Order No. 527854 dated December 22, 2015.

We appreciate this opportunity to provide the District with our services during this annual surveillance program. Please contact either of the undersigned with any questions.

Sincerely,  
**GENTERRA CONSULTANTS, INC.**



Douglas A. Harriman, P.E.  
Principal Engineer  
P.E. 55620



Joseph J. Kulikowski, P.E., G.E.  
President and Senior Principal Engineer  
P.E. 17478, G.E. 491



Enclosure

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**TABLE OF CONTENTS**

---

<b>SECTION 1: INTRODUCTION AND BACKGROUND .....</b>	<b>1</b>
1.1    GENERAL .....	1
1.2    DAM AND RESERVOIR.....	1
1.3    SPILLWAY .....	2
1.4    OUTLET WORKS.....	2
<b>SECTION 2: FIELD MEASUREMENTS.....</b>	<b>3</b>
2.1    GENERAL .....	3
2.2    PIEZOMETERS .....	3
2.3    SEEPAGE FLOW .....	6
<b>SECTION 3: FIELD EVALUATIONS.....</b>	<b>7</b>
3.1    FIELD EVALUATION OF MAY 2, 2018.....	7
3.1.1    DAM .....	7
3.1.2    RESERVOIR .....	7
3.1.3    SPILLWAY .....	7
3.1.4    OUTLET WORKS.....	8
3.1.5    SEEPAGE .....	8
3.2    FIELD EVALUATION OF DECEMBER 20, 2018 .....	8
3.2.1    DAM .....	8
3.2.2    RESERVOIR .....	9
3.2.3    SPILLWAY .....	9
3.2.4    OUTLET WORKS.....	9
3.2.5    SEEPAGE .....	9
<b>SECTION 4: CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>11</b>
4.1    CONCLUSIONS.....	11
4.2    RECOMMENDATIONS.....	12
<b>SECTION 5: LIMITATIONS.....</b>	<b>14</b>
<b>SECTION 6: REFERENCES .....</b>	<b>15</b>



**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**TABLE OF CONTENTS (Continued)**

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**TABLES**

Table 1	Piezometer Details
Table 2	Piezometer Water Levels and Seepage Measurements, January 2009 through December 2018

**FIGURES**

Figure 1	Site and Instrumentation Plan
Figure 2	Section A-A'
Figure 3A	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-1A, P-1B, and P-9, January 2017 through December 2018
Figure 3B	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-2A, P-2B, and P-6, January 2017 through December 2018
Figure 3C	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-3A and P-3B, January 2017 through December 2018
Figure 3D	2-Yr Piezometer and Reservoir Water Surface Elevations, Piezometers P-4, P-5, P-7, and P-8, January 2017 through December 2018
Figure 4A	10-Yr Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-1A, P-1B, and P-9, January 2009 through December 2018
Figure 4B	10-Yr Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-2A, P-2B, and P-6, January 2009 through December 2018
Figure 4C	10-Yr Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-3A and P-3B, January 2009 through December 2018
Figure 4D	10-Yr Historical Piezometer and Reservoir Water Surface Elevations, Piezometers P-4, P-5, P-7, and P-8, January 2009 through December 2018
Figure 5	2-Yr Seepage Measurements, Seepage Flow Point, January 2017 through December 2018
Figure 6	10-Yr Historical Seepage Measurements, Seepage Flow Point, January 2009 through December 2018

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**SECTION 1: INTRODUCTION AND BACKGROUND**

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**1.1 GENERAL**

This report presents the results of the dam safety monitoring and surveillance program for Syphon Canyon Dam and Reservoir conducted by the Irvine Ranch Water District (District) and GENTERRA Consultants, Inc. (GENTERRA) for the 12-month period from January 2018 through December 2018. It includes a compilation of the field measurements, observations, and conclusions related to the general condition of the dam. In addition, recommendations are provided for continued operation, surveillance, and monitoring of the dam. This report is being submitted as part of the jurisdictional requirements of the State of California, Department of Water Resources, Division of Safety of Dams (DSOD).

This surveillance report includes two-year graphical summaries of the field measurements of water levels in the piezometers, seepage flow rate at a seepage collection point, and reservoir water levels at Syphon Canyon Dam. Historical (10-year) graphical and tabular summaries of piezometer water levels, seepage flow rate at a seepage collection point, and reservoir water surface elevations are also included. GENTERRA reviewed the historical data to evaluate the long-term performance of the dam and reservoir and to identify any adverse trends or significant deviations from normal conditions. Water levels in the piezometers and seepage flow rates are presented with corresponding reservoir water surface elevations for the 10-year period from January 2009 through December 2018.

**1.2 DAM AND RESERVOIR**

Syphon Canyon Dam is a homogeneous earthfill embankment dam built in 1949 in Irvine, California. The District took over operation of the Syphon Canyon Dam and Reservoir on January 4, 2010 from The Irvine Company. The Irvine Company provided limited operational data to the District and, as a result, there are some gaps in the historical data.

The vertical datum used for the original dam design and construction, which has continued to be used for the dam safety monitoring program, is the National Geodetic Vertical Datum of 1929 (NGVD29).

According to DSOD (2000) and the as-built plans, the dam crest is at an elevation of 385.0 feet and has a crest width of 10 feet. The height of the dam is 59 feet and it has a crest length of 843 feet. The crest of the dam is surfaced with soil and gravel.

The original construction of the dam consisted of a 2.5H:1V (Horizontal:Vertical) slope gradient for the upstream slope from the dam crest to an elevation of 345.0 feet, and then a flatter 6H:1V slope gradient down to the upstream toe (AECOM, 2016). The downstream face of the dam consisted of a uniform 2.5H:1V slope gradient. No benches were originally constructed on either face of the dam.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

At some time in the past while the dam was owned by The Irvine Company, modifications to both the upstream and downstream faces of the dam were undertaken. The current configuration of the dam consists of the following:

- Upstream Face of the Dam: The upper portion of the upstream face is covered with vegetation from the crest of the dam to a bench at an elevation of approximately 378.0 feet, and it has a slope gradient of 1.2H:1V. From the bench down to an elevation of approximately 370.0 feet, the slope gradient is 1.4H:1V and it has a layer of riprap for slope protection. Below an elevation of 370.0 feet, the slope flattens to 6H:1V and it is covered with some vegetation. This lower portion is usually submerged under the water contained in the reservoir.
- Downstream Face of the Dam: The downstream face is covered with vegetation and it has a slope gradient of 2.5H:1V. There is a bench at an elevation of approximately 340.0 feet.

According to a DSOD report titled “*Dams within the Jurisdiction of the State of California*” (DSOD, July 2000), the reservoir has a storage capacity of 500 acre-feet. However, based on the data presented in an updated version of the DSOD report titled “*Dams within Jurisdiction of the State of California*” (DSOD, September 2018) and the area-capacity data shown on the as-built plans, the capacity of the reservoir at the spillway crest elevation is 578 acre-feet.

### **1.3 SPILLWAY**

The spillway consists of an approach, channel, and downstream exit located on the left abutment. The spillway channel is a 12.5-foot-wide (bottom width) open trapezoidal channel with a broad-crested weir. The spillway crest is at an elevation of 378.0 feet, which provides 7 feet of freeboard. The original construction of the spillway channel included a gunite lining on the channel walls, but since that time shotcrete has occasionally been applied as a protective lining and/or to repair cracked area on the side walls (AECOM, 2016). In 2017, a portion of the left spillway wall that had been damaged due to cracking was patched with shotcrete. The repaired area remains in good condition.

### **1.4 OUTLET WORKS**

The outlet works, located near the right abutment, currently consist of a 15-inch-diameter reinforced concrete pipe (RCP) with an upstream and a downstream valve. In 2015, the 15-inch slide gate at the upstream inlet was replaced with a 12-inch-diameter valve. The invert of the inlet is at an elevation of 336 feet, approximately.

On the downstream side of the dam, the 15-inch-diameter RCP transitions to an older 16-inch-diameter metallic pipe. A 16-inch butterfly valve is on the metallic pipe. The 16-inch metallic pipe joins a 16-inch-diameter, cement-mortar-lined and -coated (CML&C) steel pipe which serves as a reservoir drain line that connects to the Interim Facility. A valve on the outlet pipeline that serves as an emergency blowoff can be opened as needed to release water from the reservoir. The outflow from the blowoff discharges downstream into the underground stormwater drainage system.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

## **SECTION 2: FIELD MEASUREMENTS**

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### **2.1 GENERAL**

The District has been taking field measurements at Syphon Canyon Dam on a regular basis ever since January 4, 2010 when it took over the operation of the dam. Monthly readings by the District include water levels in 12 piezometers located on the dam crest, downstream slope, and toe of the dam; and the seepage flow rate which is measured at a seepage collection point downstream of the toe. Precipitation is measured using an onsite rain gage.

Figure 1 is a Site and Instrumentation Plan showing the layout of the dam and appurtenances, as well as the locations of the piezometers and the seepage collection point. Figure 2 shows Section A-A', which is located approximately at the maximum section of the dam. As used in this report, the left and right designations are as viewed looking downstream.

During December 2010, a slope failure involving surficial sloughing of soil occurred on the downstream slope in the area just above the previous bench on the downstream face of the dam. Based on the results of a limited geotechnical investigation performed by GENTERRA, a slope repair was recommended (GENTERRA, March 9, 2011). The slope repair plans (GENTERRA, June 2011) were approved by the DSOD in July 2011. Rock Structures Construction Company (Lic. No. 596470A) performed the slope repair work under contract to the District. Construction began on August 15, 2011. The backfilling and compaction processes were completed on August 25, 2011.

### **2.2 PIEZOMETERS**

Water levels in the piezometers are usually measured monthly by District personnel. The reservoir water level is also recorded at the time of the field measurements.

During this annual review period, the reservoir water surface elevation varied between 348.6 feet and 367.1 feet. In comparison, the spillway crest is at an elevation of 378.0 feet and the crest of the dam is at an elevation of 385.0 feet.

A piezometer is a small diameter well used mainly to measure water levels. 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 water 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. The tip of each piezometer is generally placed at its own discrete depth range within the outer well casing. The outer well casing is perforated along the vertical zones corresponding to the depths of the piezometer tips. At this facility, Piezometers P-1, P-2, and P-3 each have two piezometers in them, designated as A and B. Table 1 presents detailed information about the piezometers, including the material in which the piezometer tips are founded.

In December 2015, the District converted Piezometers P-2A, P-2B, P-4, P-5, P-6, P-7, P-8, and P-9 to vibrating wire piezometers. A vibrating wire piezometer contains a high tensile steel wire



**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

attached at one end to a diaphragm. The wire is electronically plucked to make it vibrate, and its resonant frequency is proportional to the tension in the wire. The frequency of vibration in the wire induces an alternating electrical current in a coil. The magnitude of the current is detected, and the frequency reading is then converted to a pressure. The pressure fluctuates with changes in water levels in the immediate vicinity of the piezometer tip.

The location of each piezometer is shown in Figure 1. Figure 2 illustrates selected piezometers along a cross-section through the maximum section of the dam (Section A-A'). For each piezometer shown on the cross-section, the maximum water level during the most-recent 10-year period are indicated on the Figure. The maximum and minimum piezometric levels that were recorded during the current year (2018) are also shown. Please note that the phreatic water surface within the dam, at the locations of the piezometers, are normally assumed to be same as the water levels in the piezometers. In general, the phreatic water surface within the dam is higher than the water levels recorded in the piezometers.

Table 2 lists piezometer water levels for the 10-year period from January 2009 through December 2018. Figures 3A through 3D are graphical plots of water levels based on the monthly piezometer readings during the two-year period from January 2017 through December 2018. The reservoir water level that was measured on the same date as each set of piezometer readings is also shown on the Figures. Similarly, Figures 4A through 4D are graphical plots of the piezometer water levels and reservoir water surface elevations during the 10-year period from January 2009 through December 2018.

The following is a summary of the water level measurements taken during the 12-month review period and a discussion of the historical trends and any questionable or erroneous measurements that were noted.

Nested Piezometers P-1, P-2, and P-3 are located on the crest of the dam. P-1 is located on the right side of the dam crest, P-2 is located near the maximum section of the dam, and P-3 is located on the left side of the dam crest. Piezometer P-1A is nested in the same well as Piezometer P-1B. The tip of P-1A is located within the dam embankment at an elevation of 365.7 feet, while P-1B has its tip within the dam foundation at an elevation of 345.7 feet. Piezometer P-1A consistently remains dry or nearly dry and does not respond to fluctuations in the reservoir water level. The water levels in P-1B generally respond to reservoir water surface fluctuations, and the water levels recorded during the review period were within the historical range (Figures 3A and 4A).

Piezometer P-2A is nested in the same well as Piezometer P-2B on the crest near the maximum section of the dam. The tip of P-2A is located within the dam embankment at an elevation of 342.2 feet, while P-2B has a tip within the dam foundation at an elevation of 309.4 feet. Piezometer P-2A had shown little or no response to the fluctuations in the reservoir prior to emptying of the reservoir and after its refilling (Figure 4B). In July 2015, the District performed a maintenance cleaning of P-2A. The reservoir was refilled after that maintenance cleaning, and the water level readings in P-2A have exhibited fluctuations within the historical range (Figures 3B and 4B).

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

Apparently erroneous readings have been recorded in Piezometer P-2B ever since the vibrating wire instrument was installed in December 2015. In 2016, GENTERRA notified the District about the unreliable readings. The District determined that the vibrating wire instrument is providing faulty data that causes the readings to be much higher than they should be. The District attempted a repair of the instrument, but this effort was unsuccessful. On February 16, 2017, the District performed a maintenance cleaning of P-2B, but this effort resulted in a new reported bottom elevation of 304.0 feet, five feet deeper than the elevation prior to the cleaning, which indicates the possibility of damage to the piezometer tip area. Accordingly, GENTERRA has updated the tip elevation that is shown in Tables 1 and 2. However, the data being collected in P-2B continues to be considered as unreliable.

Piezometer P-3A is nested in the same well as Piezometer P-3B on the left portion of the crest of the dam. The tips of both P-3A and P-3B are located within the dam embankment at elevations of 362.3 and 340.3 feet, respectively. Water levels in P-3A remained dry or nearly dry throughout the review period, while P-3B showed water levels that generally responded to reservoir water level fluctuations (Figures 3C and 4C).

Piezometer P-4 is located on the downstream face, near the maximum section of the dam. P-5 is located at the downstream toe, also near the maximum section of the dam. The tips of both P-4 and P-5 are located within the dam foundation at elevations of 314.7 and 314.0 feet, respectively. Water levels in P-5 were generally responsive to reservoir water surface fluctuations and responded to the reservoir being refilled in early 2016. During the months of June through August 2012, Mr. Ken Pfister of the District indicated that Piezometer P-4 was missing its top cap. As a result, water and other debris could have entered the piezometer and caused the abnormally high readings observed during those months. The cap was replaced in August 2012, and the readings returned to the previously recorded range (Figures 3D and 4D). The top of casings for P-4 and P-5 were raised on June 23, 2015 and August 25, 2015, respectively (Table 2). During this review period, P-4 had a historically high water level of 332.6 feet. Since the vibrating wire instruments were installed in December 2015 for P-4 and P-5, water level readings had reached historical highs and P-5 seems to fluctuate with reservoir water level fluctuations, and water levels in Piezometer P-4 seems to be controlled by other factors. P-5 has a casing that extends approximately 3 feet above the ground surface. The maximum historic water level ever recorded for P-5 was apparently above the ground surface by a small amount but did not rise to the top of the casing. Water level readings in P-5 indicate that the water table in the dam toe areas is only about 1 to 2 feet below the existing grade, and this can cause potential issues to the dam because this area was mapped to have potential for liquefaction during a significant seismic event.

Piezometers P-6, P-7, and P-8 are located on the downstream face of the dam, near the maximum section of the dam. The tips of all three piezometers are located within the dam embankment at elevations of 360.6, 338.1, and 336.8 feet, respectively. On June 23, 2015, the tops of casings for all three piezometers were raised from 1.2 feet to as high as 3.0 feet (Table 2). Water levels in all three piezometers showed no apparent response to reservoir water surface fluctuations (Figures 4B and

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

4D). In July 2015, the District performed a maintenance cleaning of P-7. Since the installation of vibrating wire instruments in P-6, P-7, and P-8 during December 2015, the water level readings have not fluctuated at all. The readings obtained from P-6 are particularly questionable because corresponding water levels in P-6 should not be higher than the water levels observed in the dam crest piezometers. It is our opinion that Piezometers P-6, P-7 and P-8 should be dry during the review period, and the bottom caps of these may not have the required perforation to reach the dry condition if the vibrating wire readings are correct. It is necessary to verify whether the vibrating wire instruments in Piezometers P-6, P-7 and P-8 provide dry readings or constant water level readings by doing manual measurements.

Piezometer P-9 is located on the downstream face of the dam, on the right side of the dam. The tip of P-9 is located within the dam foundation at an elevation of 335.4 feet. On June 23, 2015, the top of casing for P-9 was raised 3.5 feet (Table 2). The readings obtained from P-9 showed no apparent response to reservoir water surface fluctuations (Figure 4A). Since the vibrating wire instrument was installed in December 2015 for P-9, water level readings have not fluctuated.

Based on GENTERRA's review of the piezometer data, there are no indications of any ongoing adverse conditions in the dam embankment, abutments, or foundation. It would be prudent to keep the water table in the toe area to be below the sand layers of the foundation to avoid or minimize the potential for liquefaction and to avoid associated lateral spreading of the foundation and dam embankment during a significant seismic event. Each of the piezometers with vibrating wire instruments should be checked and calibrated or replaced as needed. In addition, manual readings should be taken for comparison until the readings are reasonably in agreement, as close as possible but no more than 0.1-foot difference from each other. The District should have the elevations of the tops of casings surveyed and should measure the depth to the bottom of each piezometer periodically to verify that the casings are open (not blocked) to their entire as-built depth.

## **2.3 SEEPAGE FLOW**

Seepage through the dam and/or foundation is collected in the subsurface seepage collection point which is accessed through a vault that is located downstream of the toe of the dam (Figure 1). There is one seepage subdrain outlet in the seepage collection vault. The flow rate at the seepage collection point is measured monthly by District personnel.

The seepage flow rates that have been measured over the past 10 years are presented in Table 2. The graph on Figure 5 displays the seepage flow rates along with reservoir water levels for the period from January 2017 through December 2018. The graph on Figure 6 covers a 10-year historical period from January 2009 through December 2018.

When the reservoir water level is below an elevation of approximately 355 feet, the seepage flow rate typically decreases to little or no flow. During the 12-month review period, the seepage flow rate ranged from a high of 5.8 gallons per minute on March 28, 2018 to a low of no flow (0.0 gallons per minute) from October through December 2018 (Figure 5).

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**SECTION 3: FIELD EVALUATIONS**

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**3.1 FIELD EVALUATION OF MAY 2, 2018**

A field evaluation of Syphon Canyon Dam on May 2, 2018 was performed by Douglas A. Harriman, P.E. and J. Will Kulikowski of GENTERRA; Steve Habiger and Tyler Dillman of the District; and Philip Lee of DSOD. The reservoir water surface was at an elevation of 366.9 feet at the time of the field visit. Photographs were taken and are in the project files at GENTERRA for comparison with previous and future field evaluations.

**3.1.1 DAM**

The crest of the dam is surfaced with soil and gravel. It was in satisfactory condition with no signs of settlement or instability. The small crack observed during a previous field evaluation in 2016 was no longer present. That crack was approximately four feet in length and one quarter inch in width and was located on the upstream edge of the crest of the dam, running parallel to the crest of the dam, on the left side of the dam. The District should monitor this area for the appearance of additional cracks and the reappearance of the crack mentioned above. There was no rodent activity observed on the crest of the dam.

The upper portion of the upstream face of the dam was surfaced with vegetation to a bench at an elevation of approximately 378.0 feet. Between the bench and an elevation of approximately 370.0 feet, there was a layer of riprap for slope protection. The area submerged below the water surface could not be examined. There were no signs of settlement or instability on the upstream slope. There was no rodent activity observed on the upstream face of the dam.

The downstream face of the dam is covered with vegetation. The vegetation was maintained at a good height at the time of this field evaluation. The downstream slope was in satisfactory condition, with no signs of settlement or instability. There was no rodent activity observed on the downstream face of the dam.

**3.1.2 RESERVOIR**

A visual observation of the reservoir area was performed during this field evaluation. No odors or other unusual conditions were observed. The aeration lines previously installed at the reservoir are still present and operating. These aeration lines are powered by an air compressor located in a structure at the downstream toe of the dam.

**3.1.3 SPILLWAY**

In 2017, a portion of the left spillway wall was repaired/patched with shotcrete. Since the previous field evaluation on December 21, 2017, no changes or modifications have been made to the spillway. The repaired area remains in good condition.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

### **3.1.4 OUTLET WORKS**

DSOD recommends that the outlet and the emergency blowoff valves be exercised and documented in a log at least once per year to confirm operability. DSOD requires the valves be exercised once every three years in the presence of a DSOD representative.

The three outlet valves (12-inch-diameter and 16-inch-diameter outlet valves as well as the 16-inch-diameter blowoff valve) were exercised during this field evaluation on May 2, 2018 in the presence of Philip Lee, the DSOD representative.

### **3.1.5 SEEPAGE**

No measurement of seepage flow rate was taken during this field evaluation. On April 25, 2018 when the seepage flow rate was last measured prior to this field evaluation by the District, the flow rate was 3.4 gallons per minute, which is consistent with historical trends.

District personnel regularly observe the downstream slope and toe ground surface for seepage whenever they visit the dam. No signs of seepage were observed on the downstream slope or in the area downstream of the dam during this field evaluation.

## **3.2 FIELD EVALUATION OF DECEMBER 20, 2018**

A field evaluation of Syphon Canyon Dam on December 20, 2018 was performed by Soma Balachandran, Ph. D., P.E., G.E. and J. Will Kulikowski of GENTERRA; and Bill Wesson of the District. The reservoir water surface was at an elevation of 348.9 feet at the time of the field visit. Photographs were taken and are in the project files at GENTERRA for comparison with previous and future field evaluations.

### **3.2.1 DAM**

The crest of the dam is surfaced with soil and gravel. Tire ruts with maximum depths of about 18 inches were observed along the dam crest, and loose gravel on the dam crest should be properly compacted to repair the existing ruts and to avoid development of further tire ruts. Erosion gullies were observed along the upstream edge of the dam crest. The small crack that was reported as observed on the upstream edge of the crest of the dam during previous field evaluations was no longer present. GENTERRA recommends that the District monitor the condition of the tire ruts along the dam crest. A few rodent holes were observed on the crest of the dam close to the right abutment. There is no sign of instability in the dam crest portion, but we were unable to comment on any settlement issue because uneven tire ruts prevent to make a good evaluation of any ongoing settlement at the dam crest. The downstream edge of the dam crest should be carefully observed during routine site visit by the District field personnel.

The upper portion of the upstream face of the dam was surfaced with vegetation to a bench at an elevation of approximately 378.0 feet. Between the bench and an elevation of approximately 370.0 feet, there was a layer of riprap for slope protection. Below an elevation of approximately 370.0 feet, the slope was surfaced with soil and vegetation. The area submerged below the water surface

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

could not be examined. The upstream face of the dam was in satisfactory condition, with no signs of settlement or instability. There was no rodent activity observed on the upstream face of the dam.

The downstream face of the dam is covered with vegetation. The vegetation was maintained at a good height at the time of this field evaluation and no excessive vegetation growth was observed on the downstream slope. Minor rodent activity was present on the downstream face of the dam. GENTERRA recommend the District continue to implement their effective rodent abatement program. Erosion gullies were observed along the access ramp. The upper portion of the upstream slope near the right abutment should be carefully observed during routine site visit by the District staff. The downstream slope was in satisfactory condition, with no signs of settlement or instability.

The abutments appeared to be in good condition, but rodent holes were observed in the abutment areas and should be repaired.

### **3.2.2 RESERVOIR**

A visual observation of the reservoir area was performed during this field evaluation. The reservoir level was very low. No odors or other unusual conditions were observed. The aeration lines previously installed at the reservoir are still present and operating. These aeration lines are powered by an air compressor located in a structure at the downstream toe of the dam.

### **3.2.3 SPILLWAY**

In 2017, a portion of the left spillway wall was repaired using shotcrete. An erosion gully was observed behind the right spillway wall which has one to two inches of vertical offset. Existing bulges on the spillway walls should be repaired. Undermining of the spillway wall was observed and should be repaired. Most weep holes are clogged and to be repaired. Vegetation growth in the spillway structure and around the spillway structure should be removed. All existing erosion gullies around the spillway structure should be repaired.

There is no well-defined spillway channel downstream of the spillway structure to convey any spillway flow away from the dam. The downstream slope of the dam can be easily eroded and undermined by the spillway flow with high velocity.

### **3.2.4 OUTLET WORKS**

The three outlet valves: the 12-inch-diameter valve on the upstream side, the 16-inch-diameter outlet valve on the downstream side, and the 16-inch-diameter blow off valve, were exercised during the previous field evaluation on May 2, 2018 in the presence of a DSOD representative.

### **3.2.5 SEEPAGE**

Seepage flow rates are measured monthly by District personnel in the seepage collection vault located downstream of the dam. No measurements were taken during this field evaluation. On November 28, 2018 when the seepage flow rate was last measured prior to this field evaluation by the District, the seepage flow rate was zero. The concrete cover of the seepage vault should be repaired.



**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

It is our understanding that the District personnel observe the downstream slope and ground surface in the toe area for seepage during their routine visits to the dam site. No signs of seepage were observed on the downstream slope or in the area downstream of the dam during this field evaluation.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**SECTION 4: CONCLUSIONS AND RECOMMENDATIONS**

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**4.1 CONCLUSIONS**

- 4.1.1** Based on the available data, the dam appears to be performing satisfactorily.

The water table in the dam toe areas is only about 1 to 2 feet below the existing grade, and this can cause potential issues to the dam because this area had been mapped to have a potential for liquefaction during a significant seismic event.

- 4.1.2** Piezometers with vibrating wire instruments (Piezometers P-2A, P-2B, P-4, P-5, P-6, P-7, P-8, and P-9) should be checked and calibrated or replaced as needed. As a minimum, vibrating wire instruments for Piezometers P-2B, P-6, P-7, and P-8 should be checked along with manual measurements of the readings.

It is our opinion that Piezometers P-6, P-7 and P-8 should be dry during the review period, and the bottom caps of these may not have the required perforation to reach the dry condition if the vibrating wire readings are assumed to be correct. It is necessary to verify whether the vibrating wire instruments in Piezometers P-6, P-7 and P-8 provide dry readings or constant water level readings by doing manual measurements.

- 4.1.3** There are tire ruts along the dam crest.

- 4.1.4** Minor rodent activity was observed on the downstream face of the dam, on the dam crest near the right abutment area, in the abutments, and around the spillway structure.

- 4.1.5** In 2017, a portion of the left spillway channel wall that had been damaged due to cracking was repaired with shotcrete. The repaired area remains in good condition. Some maintenance work is required to fix existing vertical cracks, bulges, undermining, and erosion gullies. Most weep holes are clogged and in need of repair. Vegetation growth exists in the spillway structure and around the spillway structure.

Spillway flow could affect the downstream slope of the dam since a spillway channel downstream of the spillway structure was not included in the original design.

Since there is no well-defined spillway channel downstream of the spillway structure to convey any spillway flow away from the dam, the downstream slope of the dam can be easily eroded and undermined by the spillway flow with high velocity.

- 4.1.6** The three outlet valves were fully exercised on May 2, 2018 in the presence of a DSOD representative.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**4.2 RECOMMENDATIONS**

- 4.2.1** The District should check and calibrate each of the vibrating wire instruments in the piezometers in order to confirm if the readings are reliable. In addition, manual readings should be taken for comparison until the readings are reasonably in agreement, as close as possible but no more than 0.1-foot difference from each other. The District should have the elevations of the top of casings surveyed and should measure the depth to the bottom of each piezometer periodically to verify that the casings are open (not blocked) to their entire as-built depth. The performance of Piezometers P-2B, P-6, P-7 and P-8 should be investigated as soon as possible. After the functionality of these piezometers has been verified or they have been replaced as needed, then we anticipate that reliable data can be obtained from them.

GENTERRA recommends that the District bail out Piezometer P-5 and take manual readings to check whether the water level is recharging back into the piezometer. As part of the bail-out testing program, reservoir water level and the depth to water level in the piezometer should be recorded before bailing out the water then, after bailing water to a depth of 20 feet below the existing grade, the District should start taking daily readings for 14 days, daily readings should include reservoir water level, depth to water level in the piezometer, depth to the tip of the piezometer, and any daily rainfall readings. During this bail-out testing program, the District should take additional regular readings on Piezometers P-4 and P-9 to determine any trend between Piezometers P-4, P-5 and P-5. The results from this bail-out testing will help to make a decision regarding the level of the water table in the dam toe area and the functionality of the Piezometer P-5.

To provide increased stability for the dam during and/or immediately after a significant earthquake, improvement to the liquefiable foundation materials may be needed. This can be achieved using ground improvement techniques such as stone-columns or deep soil mixing using cement and/or bentonite.

- 4.2.2** The District should consider repairing existing tire ruts along the dam crest. Loose gravel layer on the dam crest should be properly compacted to repair the existing ruts and to avoid development of further tire ruts. Timely repair of these ruts will prevent costly repair later and will also enhance the dam safety monitoring and safety of the dam. By properly mixing and compacting the soil and gravel on the crest of the dam, the District will be better able to monitor the condition of the dam crest and to more easily detect any cracks in the soil that may form in the future.
- 4.2.3** The District should continue to implement an effective rodent abatement program to prevent damage to the dam crest, slopes of the dam and abutments.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

- 4.2.4** The shotcrete-lined portion of the spillway structure should continue to be monitored, and the District should consider clearing the weep holes and repairing them as needed, removing vegetation growth, and improving the entire existing spillway structure to fix the existing issues such as vertical cracking, bulges, and undermining that were discussed in this report.

If the District is not planning to construct a spillway channel to safely convey any spillway flow, it is prudent to add erosion protection such as a riprap layer to the downstream slope to prevent erosion and undermining during spillway flow.

- 4.2.5** District personnel should observe the condition of the dam and appurtenances, looking for signs of distress or movement, increased seepage, or other unusual conditions, and verifying that the critical facilities are functional. Any unusual observations should be reported immediately to a District supervisor and the District's Dam Safety Consultant at the time.
- 4.2.6** GENTERRA recommends the District continue its program of performing a special evaluation of the dam immediately after any earthquake with a Magnitude of 4.5 or greater within a 50-mile radius of the dam, and/or any seismic event that would cause heavy furniture overturning in areas near the dam and reservoir.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**SECTION 5: LIMITATIONS**

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This report represents the results of our surveillance program for Syphon Canyon Dam, covering the period from January 2018 through December 2018. Professional services were provided to evaluate the performance of the existing dam based upon review of previous data, field evaluations, instrumentation readings, and surveys.

The conclusions and professional opinions presented herein were developed by GENTERRA 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.

**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**SECTION 6: REFERENCES**

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**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**TABLES**

**TABLE 1  
SYPHON CANYON DAM  
PIEZOMETER DETAILS**

Piezometer ID	Location and Approximate Station	Original			Modified Unknown Date			2015 - Current			Material at Tip (if known)	Installation or First Reading
		Top Elev. (ft)	Tip Elev. (ft)	Depth (ft)	Top Elev. (ft)	Tip Elev. (ft)	Depth (ft)	Top Elev. (ft)	Tip Elev. (ft)	Depth (ft)		
P-1A	Dam Crest, Station 6+90	385.1	365.7	19.4	385.1	365.7	19.4	385.1	365.7	19.4	Dam Embankment	Before 2003
P-1B	Dam Crest, Station 6+90	385.1	345.7	39.4	385.1	345.7	39.4	385.1	345.7	39.4	Dam Foundation	Before 2003
P-2A	Dam Crest, Station 4+90	385.9	342.2	43.7	385.9	342.2	43.7	385.9	342.2	43.7	Dam Embankment	Before 2003
P-2B	Dam Crest, Station 4+90	385.0	309.4	75.6	385.0	309.4	75.6	385.0	304.0	81.0	Dam Foundation	Before 2003
P-3A	Dam Crest, Station 3+00	385.6	362.3	23.3	385.6	362.3	23.3	385.6	362.3	23.3	Dam Embankment	Before 2003
P-3B	Dam Crest, Station 3+00	385.6	340.3	45.3	385.6	340.3	45.3	385.6	340.3	45.3	Dam Embankment	Before 2003
P-4	Downstream Slope, Station 5+00	340.0	314.7	25.3	340.0	314.7	25.3	342.8	314.7	28.1	Dam Foundation	Before 2003
P-5	Downstream Toe, Station 4+60	330.7	314.0	16.7	330.7	314.0	16.7	333.7	314.0	19.7	Dam Foundation	Before 2003
P-6	Downstream Slope, Station 4+90	370.2	360.6	9.6	370.2	360.6	9.6	371.4	360.6	10.8	Dam Embankment	1/19/2011
P-7	Downstream Slope, Station 4+90	349.7	338.1	11.6	349.7	338.1	11.6	351.3	338.1	13.2	Dam Embankment	1/19/2011
P-8	Downstream Slope, Station 4+90	343.4	336.8	6.6	345.3	336.8	8.5	346.4	336.8	9.6	Dam Embankment	1/19/2011
P-9	Downstream Slope, Station 6+70	342.9	335.4	7.5	344.9	335.4	9.5	346.4	335.4	11.0	Dam Foundation	1/19/2011

Notes:

- 1) Top "Reference" Elevation and Depth for Piezometers P-1A to P-5 are based on The Irvine Company (2009), and for Piezometers P-6 to P-9 on GENTERRA (2013).
- 2) Information concerning changes to the Top "Reference" Elevation due to the standpipe modifications was provided by the District.
- 3) The District extended the standpipe for Piezometers P-4 and P-6 to P-9 on 6/23/2015 and for Piezometer P-5 on 8/25/2015.
- 4) Material at the piezometer tip is estimated from the as-built topographic map and sections presented by Browning (1949).
- 5) The District provided an E-Mail indicating a maintenance cleaning of Piezometer P-2B was performed on 2/16/2017 with a new bottom elevation.
- 6) Elevations are in feet relative to NGVD29 datum.
- 7) Elev. = Elevation; ft = feet.

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-1A			P-1B			P-2A			P-2B		
Top of Well Elevation -->			385.1			385.1			385.9			385.0		
Bottom of Well Elevation -->			365.7			345.7			342.2			309.4    304.0 Maint. 2/16/2017		
Depth of Well -->			19.4			39.4			43.7			75.6    81.0		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2009	364.50		19.4	365.7		33.4	351.7		28.7	357.2		46.6	338.4	
2/24/2009	364.50		19.4	365.7		33.4	351.7		28.7	357.2		46.6	338.4	
3/23/2009	368.50		19.4	365.7		30.8	354.3		28.7	357.2		44.6	340.4	
4/27/2009	367.50		19.4	365.7		30.8	354.3		28.7	357.2		45.0	340.0	
5/22/2009	367.00		19.4	365.7		31.4	353.7		28.7	357.2		45.0	340.0	
6/29/2009	372.00		19.4	365.7		26.8	358.3		27.7	358.2		43.0	342.0	
7/31/2009	371.00		19.4	365.7		28.8	356.3		28.7	357.2		45.0	340.0	
8/26/2009	370.00		19.4	365.7		29.4	355.7		28.7	357.2		45.6	339.4	
9/29/2009	369.50		19.4	365.7		29.8	355.3		28.7	357.2		46.0	339.0	
10/30/2009	369.00		19.4	365.7		29.4	355.7		27.7	358.2		45.0	340.0	
11/30/2009	368.00		19.4	365.7		29.4	355.7		27.1	358.8		45.0	340.0	
12/30/2009	368.00		19.4	365.7		29.4	355.7		27.1	358.8		45.0	340.0	
3/1/2010	368.00		19.9	365.2	Dry	28.2	356.9		26.3	359.6		44.0	341.0	
3/30/2010	368.00		19.9	365.2	Dry	28.5	356.6		26.2	359.7		44.2	340.8	
4/4/2010	368.70		19.8	365.3	Dry	28.5	356.6		26.1	359.8		44.3	340.7	
4/27/2010	368.40		19.7	365.4		28.8	356.3		26.0	359.9		44.2	340.8	
5/26/2010	367.84		19.9	365.2	Dry	29.1	356.0		26.1	359.8		44.6	340.4	
6/29/2010	367.00		19.6	365.5	Dry	29.5	355.6		26.2	359.7		44.8	340.2	
7/27/2010	367.00		19.8	365.3	Dry	29.9	355.2		26.4	359.5		45.1	339.9	
8/27/2010	366.80		19.6	365.5	Dry	30.3	354.8		26.6	359.3		45.4	339.6	
9/28/2010	366.40		19.7	365.4	Dry	30.7	354.4		26.6	359.3		45.6	339.4	
10/26/2010	368.50		19.7	365.4	Dry	31.0	354.1		27.0	358.9		45.8	339.2	
11/30/2010	371.40		19.6	365.5		29.5	355.6		27.2	358.7		44.7	340.3	
12/28/2010	374.70		19.7	365.4	Dry	27.2	357.9		27.2	358.7		43.1	341.9	
1/4/2011	374.80		19.7	365.4	Dry	27.0	358.1		27.4	358.5		43.1	341.9	
1/6/2011	374.80		19.5	365.6	Dry	27.0	358.1		27.1	358.8		43.1	342.0	
1/7/2011	374.80		19.7	365.4	Dry	26.9	358.2		27.1	358.8		43.0	342.0	
1/8/2011	374.80		19.7	365.4	Dry	27.2	357.9		27.3	358.6		43.4	341.6	
1/9/2011	374.80		19.7	365.4	Dry	27.2	357.9		27.3	358.6		43.5	341.5	
1/10/2011	374.80		19.5	365.6	Dry	27.0	358.1		27.1	358.8		43.3	341.7	
1/11/2011	374.80		19.7	365.4	Dry	27.1	358.1		27.1	358.8		43.2	341.8	
1/17/2011	374.80		19.6	365.5	Dry	27.1	358.0		27.0	358.9		43.3	341.7	
1/19/2011	374.70		19.7	365.4	Dry	27.2	357.9		27.0	358.9		43.4	341.6	
1/21/2011	374.80		19.5	365.6	Dry	27.2	357.9		26.9	359.0		43.3	341.7	
1/27/2011	374.60		19.7	365.4	Dry	27.2	357.9		26.8	359.1		43.4	341.6	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-1A			P-1B			P-2A			P-2B		
Top of Well Elevation -->			385.1			385.1			385.9			385.0		
Bottom of Well Elevation -->			365.7			345.7			342.2			309.4    304.0    Maint. 2/16/2017		
Depth of Well -->			19.4			39.4			43.7			75.6    81.0		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
2/3/2011	374.60		19.5	365.6	Dry	27.5	357.6		26.7	359.2		43.6	341.4	
2/8/2011	374.70		19.5	365.6	Dry	27.5	357.6		26.7	359.2		43.6	341.4	
2/28/2011	373.70		19.7	365.4	Dry	28.0	357.1		26.2	359.7		43.8	341.2	
3/28/2011	372.50	2.35	19.6	365.5		28.9	356.2		26.2	359.7		44.2	340.8	
4/28/2011	372.10	0.27	19.8	365.3	Dry	28.8	356.3		24.2	361.7		44.6	340.4	
5/18/2011	371.80	0.03	19.7	365.4	Dry	29.4	355.7		26.4	359.5		44.4	340.6	
5/25/2011	371.70	0.30	19.7	365.4	Dry	29.4	355.7		26.4	359.5		44.3	340.7	
6/28/2011	370.90	0.03	19.7	365.4	Dry	29.7	355.4		26.5	359.4		44.5	340.5	
7/26/2011	370.30	0.03	19.7	365.4	Dry	30.2	354.9							
8/24/2011	369.60	0.03	19.6	365.5	Dry	30.6	354.5		26.8	359.1		44.8	340.2	
8/30/2011	369.40		19.9	365.2		30.9	354.2		27.1	358.8		45.0	340.0	
9/13/2011	364.30	0.00	19.8	365.3	Dry	33.6	351.5		27.2	358.7		47.1	337.9	
9/27/2011	361.90		19.7	365.4	Dry	36.5	348.6		27.2	358.7		49.6	335.4	
10/11/2011	358.50	1.03	19.6	365.5	Dry	39.6	345.5		27.3	358.6		51.9	333.1	
10/25/2011	356.00	1.03	19.7	365.4	Dry	39.6	345.5		27.7	358.2		53.2	331.8	
11/29/2011	355.00	1.51	19.7	365.4	Dry	39.6	345.5		26.3	359.6		54.2	330.8	
12/28/2011	355.00	0.28	19.8	365.3	Dry	39.7	345.4		28.8	357.1		54.8	330.3	
1/26/2012	355.00	1.05	19.7	365.4	Dry	39.5	345.6		29.0	356.9		54.9	330.1	
2/28/2012	355.00	0.73	19.7	365.4	Dry	39.5	345.6		29.3	356.6		55.2	329.8	
3/27/2012	352.40	0.73	19.9	365.2		39.8	345.3		29.8	356.1		55.3	329.7	
4/23/2012	352.10	1.35	19.7	365.4		39.6	345.5		29.8	356.1		55.2	329.8	
5/30/2012	352.20	0.07	19.7	365.4		39.7	345.4		30.0	355.9		55.6	329.4	
6/13/2012	352.20		19.6	365.5		39.6	345.5		30.2	355.7		55.7	329.3	
6/26/2012	352.20	0.00	19.7	365.4		39.5	345.6		30.3	355.6		56.0	329.0	
7/24/2012	352.20	0.23	19.6	365.5		39.6	345.5		30.5	355.4		53.4	331.6	
8/8/2012	352.20	0.23	19.8	365.3		39.8	345.3		30.5	355.4		53.6	331.4	
8/28/2012	351.80	0.00	19.6	365.5		39.5	345.6		30.6	355.3		54.5	330.5	
8/29/2012	351.80	0.00	19.8	365.3		39.7	345.4		30.8	355.1		54.8	330.2	
9/25/2012	351.30	0.00	19.6	365.5		39.5	345.6		30.9	355.0		55.1	329.9	
10/31/2012	351.00	0.09	19.6	365.5		39.5	345.6		30.9	355.0		55.9	329.1	
11/27/2012	351.00	0.87	19.6	365.5		39.5	345.6		31.2	354.7		56.3	328.7	
12/12/2012	351.00	1.13	19.7	365.4		39.6	345.5		31.2	354.7		56.3	328.7	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-1A			P-1B			P-2A			P-2B		
Top of Well Elevation -->			385.1			385.1			385.9			385.0		
Bottom of Well Elevation -->			365.7			345.7			342.2			309.4    304.0    Maint. 2/16/2017		
Depth of Well -->			19.4			39.4			43.7			75.6    81.0		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/29/2013	366.10	1.30	19.8	365.3		39.9	345.2		31.2	354.7		46.3	338.7	
2/21/2013	372.10	0.42	19.8	365.3		35.8	349.3		32.7	353.2		43.9	341.1	
3/28/2013	371.90	0.79	19.7	365.4		32.9	352.2		31.5	354.4		42.2	342.8	
4/25/2013	371.40	0.00	19.6	365.5		33.0	352.1		31.4	354.5		42.2	342.8	
5/22/2013	370.90	0.00	19.8	365.3		32.9	352.2		31.4	354.5		42.7	342.3	
6/25/2013	370.20	0.00	19.7	365.4		33.2	351.9		30.7	355.2		42.8	342.2	
7/23/2013	369.40	0.00	19.7	365.4	Dry	33.6	351.5		30.5	355.4		43.2	341.8	
8/21/2013	368.60	0.00	19.7	365.4	Dry	34.1	351.0		30.4	355.5		43.8	341.3	
9/25/2013	367.70	0.00	19.7	365.4	Dry	34.6	350.5		30.2	355.7		44.1	340.9	
10/30/2013	366.90	0.00	19.7	365.4	Dry	35.3	349.8		30.3	355.6		44.8	340.2	
11/26/2013	366.50	0.59	19.7	365.4	Dry	35.6	349.5		30.3	355.6		45.1	339.9	
12/17/2013	366.20	0.70	19.7	365.4	Dry	35.8	349.3		30.4	355.5		45.5	339.5	
1/28/2014	365.50	0.00	19.7	365.4	Dry	36.1	349.0		30.6	355.3		45.9	339.1	
2/25/2014	365.40	0.76	19.8	365.3	Dry	36.6	348.6		30.8	355.1		46.2	338.9	
3/25/2014	365.30		19.8	365.3	Dry	36.4	348.7		30.8	355.1		45.9	339.1	
3/28/2014	365.30	2.02	19.7	365.4		36.5	348.6		30.7			45.9		
4/25/2014	364.50	0.52	19.7	365.4		36.6	348.5		30.8	355.1		46.1	338.9	
5/28/2014	363.80	0.00	19.8	365.3	Dry	37.1	348.0		30.9	355.0		46.5	338.5	
6/25/2014	363.00	0.00	19.9	365.2	Dry	37.7	351.5		31.2	358.7		47.0	337.9	
7/30/2014	361.90	0.00	19.9	365.2	Dry	38.0	348.6		31.1	358.7		47.2	335.4	
8/27/2014	361.10	0.04	19.7	365.4	Dry	38.6	346.5		31.3	354.6		47.9	337.1	
9/23/2014	360.50	0.00	19.5	365.6	Dry	39.1	346.0		31.3	354.6		48.3	336.7	
10/29/2014	359.50	0.00	19.8	365.3	Dry	39.7	345.4		31.8	354.1		49.0	336.0	
11/24/2014	359.40	0.32	19.7	365.4	Dry	39.6	345.5		31.6	354.3		49.4	335.6	
12/30/2014	359.40	3.98	19.7	365.4	Dry	39.7	345.4		31.8	354.1		49.9	335.1	
1/27/2015	359.00	1.42	19.7	365.4	Dry	39.8	345.3		32.1	353.8		49.8	335.2	
2/26/2015	358.60	0.46	19.7	365.4	Dry	39.6	345.5		31.8	354.1		50.1	334.9	
3/27/2015	358.00	0.63	19.7	365.4	Dry	39.5	345.6		32.3	353.6		51.3	333.8	
4/26/2015	331.00	0.22	19.8	365.3	Dry	39.6	345.5	Dry	32.1	353.8		56.5	328.5	
5/27/2015	332.00	1.79	19.8	365.3	Dry	39.6	345.5	Dry	32.2	353.7		56.3	328.7	
6/23/2015	331.00	0.00	19.7	365.4	Dry	39.8	345.3	Dry	32.3	353.6		60.4	324.6	
7/30/2015	331.00	0.00	19.7	365.4	Dry	39.6	345.5	Dry	31.1	354.8	In July maint. cleaned	61.4	323.6	
8/25/2015	331.00	0.00	19.6	365.5	Dry	39.6	345.5	Dry	32.8	353.1	Dry	62.1	322.9	
9/30/2015	331.00	1.97	19.1	366.0	Dry	39.8	345.3	Dry	32.1	353.8		62.4	322.6	
10/29/2015	331.00	0.18	19.7	365.4	Dry	39.7	345.4	Dry	33.2	352.7		62.4	322.6	
11/25/2015	331.00	0.17	19.7	365.4	Dry	39.7	345.4	Dry	33.3	352.6		63.1	321.9	
12/30/2015	331.00	1.42	19.7	365.4	Dry	39.7	345.4	Dry	33.4	352.5	VW installed	63.6	321.4	VW installed

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-1A			P-1B			P-2A			P-2B		
Top of Well Elevation -->			385.1			385.1			385.9			385.0		
Bottom of Well Elevation -->			365.7			345.7			342.2			309.4    304.0    Maint. 2/16/2017		
Depth of Well -->			19.4			39.4			43.7			75.6    81.0		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2016	343.70	2.97	19.6	365.5	Dry	39.6	345.5	Dry	32.3	353.6		46.1	338.9	
2/24/2016	363.80	0.26	20.6	364.5	Dry	39.6	345.5	Dry	32.5	353.5		31.4	353.6	Erroneous
3/29/2016	374.90	1.50	19.6	365.5	Dry	38.4	346.7		32.7	353.2		23.3	361.7	Erroneous
4/28/2016	375.50	0.09	19.7	365.4	Dry	32.4	352.7		32.6	353.3		23.9	361.1	Erroneous
5/24/2016	374.40	0.13	19.5	365.6	Dry	30.8	354.3		31.7	354.2		21.7	363.3	Erroneous
6/29/2016	373.70	0.00	19.5	365.6	Dry	30.8	354.3		30.6	355.3		21.6	363.4	Erroneous
7/28/2016	372.20	0.00	19.7	365.4	Dry	30.7	354.4		30.0	355.9		23.9	361.1	Erroneous
8/25/2016	367.10	0.00	19.7	365.4	Dry	32.2	352.9		29.5	356.4		26.1	358.9	Erroneous
9/27/2016	363.30	0.00	19.6	365.5		34.6	350.5		29.7	356.2		28.2	356.8	Erroneous
10/25/2016	362.10	0.82	19.6	365.5	Dry	35.9	349.2		29.5	356.4		28.5	356.5	Erroneous
11/22/2016	361.80	1.69	19.7	365.4	Dry	36.9	348.2				VW was not logging			VW was not logging
12/28/2016	368.55	3.61	19.7	365.4	Dry	36.9	348.2		30.0	355.9		25.0	360.0	Erroneous
1/25/2017	375.80	6.48	19.8	365.3	Dry	32.5	352.6		29.9	356.0		34.2	350.8	Measured w/sounder
2/28/2017	375.90	3.95	19.6	365.5	Dry	28.2	356.9		29.9	356.0		34.0	351.0	Measured w/sounder
3/15/2017	375.80	3.61	19.8	365.3	Dry	28.4	356.7		28.4	357.5		34.2	350.8	Measured w/sounder
3/28/2017	375.50	0.09	19.7	365.4		27.9	357.2		28.2	357.7		13.2	371.8	Erroneous
4/26/2017	375.00	0.04	19.8	365.3	Dry	27.6	357.5		27.6	358.3		34.0	351.0	Measured w/sounder
5/23/2017	374.60	35.00	19.7	365.4	Dry	28.0	357.1		27.2	358.7		8.3	376.7	Erroneous
6/22/2017	373.80	0.00	19.7	365.4	Dry	28.2	356.9		27.0	358.9		2.0	383.0	Erroneous
7/26/2017	371.40	0.00	19.7	365.4	Dry	29.7	355.4		26.9	359.0		4.1	380.9	Erroneous
8/30/2017	368.60	0.00	19.7	365.4	Dry	31.1	354.0		27.2	358.7		6.0	379.0	Erroneous
9/28/2017	364.80	0.00	19.6	365.5	Dry	33.2	351.9		27.2	358.7		8.1	376.9	Erroneous
10/26/2017	359.00	0.00	19.7	365.4	Dry	34.4	350.7		27.3	358.6		11.6	373.4	Erroneous
11/29/2017	357.80	0.15	19.5	365.6	Dry	39.5	345.6		28.2	357.7		12.9	372.1	Erroneous
12/27/2017	357.30	0.00	19.7	365.4	Dry	39.0	346.1		28.5	357.4		13.3	371.7	Erroneous
1/24/2018	357.30	1.84	19.7	365.4	Dry	39.3	345.8		28.9	357.0		13.5	371.5	Erroneous
2/21/2018	361.00	0.18	19.4	365.7	Dry	38.0	347.1		29.2	356.7		11.6	373.4	Erroneous
3/28/2018	366.90	2.19	19.6	365.5	Dry	33.9	351.2		29.5	356.4		9.2	375.8	Erroneous
4/25/2018	367.00	0.05	19.6	365.5		33.3	351.8		29.6	356.3		4.0	381.0	Erroneous
5/30/2018	366.40	0.36	19.4	365.7	Dry	33.1	352.0		29.7	356.2		1.0	384.0	Erroneous
6/28/2018	365.60	0.00	19.4	365.7	Dry	33.1	352.0		29.5	356.4		1.4	383.6	Erroneous
7/25/2018	363.20	0.00	19.6	365.5	Dry	34.5	350.6		29.4	356.5		2.7	382.3	Erroneous
8/28/2018	357.30	0.00	19.6	365.5	Dry	38.0	347.1		29.4	356.5		5.9	379.1	Erroneous
9/27/2018	354.60	0.00	19.5	365.6	Dry	39.6	345.5		29.3	356.6		7.4	377.6	Erroneous
10/24/2018	351.90	1.49	19.8	365.3	Dry	39.6	345.5		29.8	356.1		10.4	374.6	Erroneous
11/28/2018	348.60	0.56	19.6	365.5	Dry	39.6	345.5		30.1	355.8		11.4	373.6	Erroneous
12/21/2018	348.80	2.04	19.7	365.4	Dry	39.8	345.3		29.9	356.0		11.1	373.9	Erroneous

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire



**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-3A			P-3B			P-4		
Top of Well Elevation -->			385.6			385.6			340.0	342.8	Raised 6/23/2015
Bottom of Well Elevation -->			362.3			340.3			314.7		
Depth of Well -->			23.3			45.3			25.3	28.1	
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2009	364.50		23.3	362.3		40.3	345.3		14.3	325.7	
2/24/2009	364.50		23.3	362.3		40.3	345.3		14.3	325.7	
3/23/2009	368.50		23.3	362.3		38.7	346.9		14.3	325.7	
4/27/2009	367.50		23.3	362.3		39.3	346.3		14.3	325.7	
5/22/2009	367.00		23.3	362.3		39.3	346.3		14.3	325.7	
6/29/2009	372.00		23.3	362.3		36.7	348.9		14.3	325.7	
7/31/2009	371.00		23.3	362.3		38.3	347.3		15.3	324.7	
8/26/2009	370.00		23.3	362.3		38.3	347.3		15.3	324.7	
9/29/2009	369.50		23.3	362.3		39.3	346.3		15.3	324.7	
10/30/2009	369.00		23.3	362.3		38.3	347.3		14.3	325.7	
11/30/2009	368.00		23.3	362.3		38.3	347.3		14.3	325.7	
12/30/2009	368.00		23.3	362.3		38.3	347.3		14.3	325.7	
3/1/2010	368.00		23.0	362.6		37.4	348.2		13.5	326.5	
3/30/2010	368.00		23.1	362.5		37.7	347.9		13.5	326.5	
4/4/2010	368.70		22.9	362.7		37.7	347.9		13.5	326.5	
4/27/2010	368.40		22.8	362.8		37.8	347.8		13.4	326.6	
5/26/2010	367.84		22.9	362.7		37.9	347.7		13.6	326.4	
6/29/2010	367.00		23.0	362.6		38.1	347.5		13.6	326.4	
7/27/2010	367.00		23.6	362.0		38.3	347.3		13.6	326.4	
8/27/2010	366.80		23.4	362.2		38.1	347.5		13.8	326.2	
9/28/2010	366.40		23.0	362.6		38.6	347.0		13.6	326.4	
10/26/2010	368.50		23.1	362.5		38.7	346.9		13.6	326.4	
11/30/2010	371.40		23.0	362.6		37.8	347.8		13.7	326.3	
12/28/2010	374.70		23.2	362.4		36.6	349.0		13.5	326.5	
1/4/2011	374.80		23.4	362.2		36.5	349.1		13.4	326.6	
1/6/2011	374.80		23.4	362.2		36.5	349.2		13.4	326.6	
1/7/2011	374.80		23.4	362.2		36.5	349.1		13.5	326.5	
1/8/2011	374.80		23.6	362.0		36.8	348.8		13.6	326.4	
1/9/2011	374.80		23.4	362.2		36.8	348.8		13.7	326.3	
1/10/2011	374.80		23.4	362.2		36.6	349.0		13.6	326.4	
1/11/2011	374.80		23.2	362.4		36.8	348.8		13.4	326.6	
1/17/2011	374.80		23.4	362.2		36.7	348.9		13.5	326.6	
1/19/2011	374.70		23.4	362.2		36.8	348.8		13.5	326.5	
1/21/2011	374.80		23.4	362.2		36.9	348.7		13.5	326.5	
1/27/2011	374.60		23.0	362.6		37.0	348.6		13.5	326.5	

**Notes:**

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ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-3A			P-3B			P-4		
Top of Well Elevation -->			385.6			385.6			340.0	342.8	Raised 6/23/2015
Bottom of Well Elevation -->			362.3			340.3			314.7		
Depth of Well -->			23.3			45.3			25.3	28.1	
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
2/3/2011	374.60		23.4	362.2		37.2	348.4		13.5	326.5	
2/8/2011	374.70		23.4	362.2		37.2	348.4		13.5	326.5	
2/28/2011	373.70		22.9	362.7		37.4	348.2		13.5	326.5	
3/28/2011	372.50	2.35	23.0	362.6		37.5	348.1		13.5	326.5	
4/28/2011	372.10	0.27	23.2	362.4		37.9	347.7		13.7	326.3	
5/18/2011	371.80	0.03	23.1	362.5		37.9	347.7		13.5	326.5	
5/25/2011	371.70	0.30	23.0	362.6		37.9	347.7		13.7	326.3	
6/28/2011	370.90	0.03	22.9	362.7		38.0	347.6		13.6	326.4	
7/26/2011	370.30	0.03	23.0	362.7		38.2	347.4		13.7	326.3	
8/24/2011	369.60	0.03	23.7	361.9		38.3	347.3		16.0	324.0	
8/30/2011	369.40		23.1	362.5		38.6	347.0		16.0	324.0	
9/13/2011	364.30	0.00	23.0	362.6		40.4	345.2		15.9	324.1	
9/27/2011	361.90		23.0	362.6		43.1	342.5		16.1	323.9	
10/11/2011	358.50	1.03	23.0	362.6		44.1	341.5		16.1	323.9	
10/25/2011	356.00	1.03	22.9	362.7		45.3	340.3		16.3	323.7	
11/29/2011	355.00	1.51	23.7	361.9		45.5	340.1		16.8	323.2	
12/28/2011	355.00	0.28	23.7	361.9		45.6	340.0		17.4	322.7	
1/26/2012	355.00	1.05	23.6	362.0		45.6	340.0		17.5	322.5	
2/28/2012	355.00	0.73	23.6	362.0		45.6	340.0		17.9	322.1	
3/27/2012	352.40	0.73	23.6	362.0		45.7	339.9		18.4	321.6	
4/23/2012	352.10	1.35	23.6	362.0		45.7	339.9		18.3	321.7	
5/30/2012	352.20	0.07	23.7	361.9		45.6	340.0		18.6	321.4	
6/13/2012	352.20		23.7	361.9		45.6	340.0		18.7	321.3	
6/26/2012	352.20	0.00	23.6	362.0		45.5	340.1		2.8	337.2	Cap was off, bad read
7/24/2012	352.20	0.23	23.6	362.0		45.6	340.0		4.2	335.8	Cap was off, bad read
8/8/2012	352.20	0.23	23.7	361.9		45.7	339.9		4.7	335.3	Cap was off, bad read
8/28/2012	351.80	0.00	23.6	362.0		45.5	340.1		19.2	320.8	
8/29/2012	351.80	0.00	23.8	361.8		45.7	339.9		18.9	321.1	
9/25/2012	351.30	0.00	23.7	361.9		45.6	340.0		19.4	320.6	
10/31/2012	351.00	0.09	23.6	362.0		45.6	340.0		19.6	320.4	
11/27/2012	351.00	0.87	23.6	362.0		45.5	340.1		19.2	320.8	
12/12/2012	351.00	1.13	23.6	362.0		45.6	340.0		19.0	321.0	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

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**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-3A			P-3B			P-4		
Top of Well Elevation -->			385.6			385.6			340.0	342.8	Raised 6/23/2015
Bottom of Well Elevation -->			362.3			340.3			314.7		
Depth of Well -->			23.3			45.3			25.3	28.1	
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/29/2013	366.10	1.30	23.8	361.8		46.0	339.6		19.0	321.0	
2/21/2013	372.10	0.42	23.4	362.2		42.9	342.7		18.8	321.2	
3/28/2013	371.90	0.79	23.7	361.9		41.1	344.5		18.1	321.9	
4/25/2013	371.40	0.00	23.6	362.0		41.0	344.6		17.8	322.2	
5/22/2013	370.90	0.00	23.8	361.8		41.1	344.5		17.7	322.3	
6/25/2013	370.20	0.00	23.6	362.0		41.0	344.6		17.0	323.0	
7/23/2013	369.40	0.00	23.6	362.0	Dry	41.3	344.3		16.8	323.2	
8/21/2013	368.60	0.00	23.7	361.9	Dry	41.7	343.9		16.6	323.4	
9/25/2013	367.70	0.00	23.7	361.9	Dry	42.0	343.6		16.3	323.7	
10/30/2013	366.90	0.00	23.7	361.9	Dry	42.7	342.9		16.1	323.9	
11/26/2013	366.50	0.59	23.6	362.0	Dry	42.6	343.0		15.9	324.1	
12/17/2013	366.20	0.70	23.7	361.9	Dry	43.0	342.6		15.9	324.1	
1/28/2014	365.50	0.00	23.8	361.8	Dry	43.7	341.9		15.7	324.3	
2/25/2014	365.40	0.76	23.8	361.8	Dry	44.0	341.6		15.9	324.2	
3/25/2014	365.30		23.8	361.8	Dry	43.9	341.7		16.0	324.0	
3/28/2014	365.30	2.02	23.6	362.0		43.9	341.7		15.6	324.5	
4/25/2014	364.50	0.52	23.6	362.0		44.1	341.5		15.5	324.5	
5/28/2014	363.80	0.00	23.7	361.9	Dry	44.4	341.2		15.5	324.5	
6/25/2014	363.00	0.00	23.7	361.9		45.0	345.2		15.7	324.3	
7/30/2014	361.90	0.00	23.7	361.9	Wet	45.1	342.5		15.4	324.6	
8/27/2014	361.10	0.04	23.6	362.0	Dry	45.6	340.0	Wet	15.5	324.5	
9/23/2014	360.50	0.00	23.6	362.0	Wet	45.5	340.1	Wet	13.5	326.5	
10/29/2014	359.50	0.00	23.6	362.0	Dry	45.8	339.8	Dry	15.6	324.4	
11/24/2014	359.40	0.32	23.7	361.9	Dry	45.6	340.0	Dry	15.7	324.3	
12/30/2014	359.40	3.98	23.7	361.9	Dry	45.8	339.8	Dry	15.8	324.2	
1/27/2015	359.00	1.42	23.6	362.0	Wet	45.6	340.0	Dry	15.9	324.1	
2/26/2015	358.60	0.46	23.6	362.0	Wet	45.5	340.1	Wet	15.9	324.1	
3/27/2015	358.00	0.63	23.7	361.9		45.9	339.7	Dry	16.0	324.0	
4/26/2015	331.00	0.22	23.6	362.0		45.6	340.0	Dry	16.2	323.8	
5/27/2015	332.00	1.79	23.6	362.0	Dry	45.6	340.0	Dry	16.1	323.9	
6/23/2015	331.00	0.00	23.6	362.0	Wet	45.7	339.9	Wet	20.5	322.3	Extended casing
7/30/2015	331.00	0.00	23.7	361.9	Dry	45.6	340.0	Dry	20.6	322.2	
8/25/2015	331.00	0.00	23.5	362.1	Dry	45.5	340.1	Dry	21.5	321.3	Wet
9/30/2015	331.00	1.97	23.7	361.9	Dry	45.7	339.9	Dry	22.5	320.3	
10/29/2015	331.00	0.18	23.7	361.9	Dry	45.7	339.9	Dry	22.9	319.9	
11/25/2015	331.00	0.17	23.7	361.9	Dry	45.5	340.1	Dry	23.4	319.4	
12/30/2015	331.00	1.42	23.7	361.9	Dry	45.5	340.1	Dry	23.8	319.0	VW installed

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-3A			P-3B			P-4		
Top of Well Elevation -->			385.6			385.6			340.0	342.8	Raised 6/23/2015
Bottom of Well Elevation -->			362.3			340.3			314.7		
Depth of Well -->			23.3			45.3			25.3	28.1	
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2016	343.70	2.97	23.6	362.0	Dry	45.6	340.0	Dry	17.9	325.0	
2/24/2016	363.80	0.26	23.7	361.9	Dry	45.7	339.9	Dry	18.1	324.7	
3/29/2016	374.90	1.50	23.6	362.0		41.9	343.7		17.1	325.7	
4/28/2016	375.50	0.09	23.6	362.0		37.7	347.9		15.6	327.2	
5/24/2016	374.40	0.13	23.3	362.3		38.0	347.6		14.2	328.6	
6/29/2016	373.70	0.00	23.3	362.3		38.1	347.5		14.3	328.5	
7/28/2016	372.20	0.00	23.6	362.0	Dry	38.5	347.1		14.4	328.4	
8/25/2016	367.10	0.00	23.7	361.9	Dry	40.9	344.7		14.5	328.3	
9/27/2016	363.30	0.00	23.8	361.8	Wet	41.8	343.8		14.6	328.2	
10/25/2016	362.10	0.82	23.6	362.0	Wet	42.8	342.8		14.1	328.7	
11/22/2016	361.80	1.69	23.7	361.9	Dry	43.0	342.6				VW was not logging
12/28/2016	368.55	3.61	23.7	361.9		40.7	344.9		13.5	329.3	
1/25/2017	375.80	6.48	23.6	362.0	Dry	36.4	349.2		12.9	329.9	
2/28/2017	375.90	3.95	23.6	362.0	Dry	35.3	350.4		12.6	330.2	
3/15/2017	375.80	3.61	23.7	361.9	Dry	35.7	349.9		12.2	330.6	
3/28/2017	375.50	0.09	23.9	361.7	Dry	35.0	350.6		12.1	330.7	
4/26/2017	375.00	0.04	23.7	361.9	Dry	35.2	350.4		11.9	330.9	
5/23/2017	374.60	35.00	23.6	362.0		35.6	350.0		11.5	331.3	
6/22/2017	373.80	0.00	23.7	361.9		28.2	357.4	Erroneous	11.3	331.5	
7/26/2017	371.40	0.00	23.5	362.1	Dry	36.7	348.9		11.1	331.7	
8/30/2017	368.60	0.00	23.7	361.9	Dry	38.1	347.5		11.1	331.7	
9/28/2017	364.80	0.00	23.5	362.1	Dry	40.1	345.5		10.9	331.9	
10/26/2017	359.00	0.00	23.6	362.0	Dry	42.1	343.5		11.0	331.8	
11/29/2017	357.80	0.15	23.6	362.0	Dry	45.6	340.0	Dry	11.0	331.8	
12/27/2017	357.30	0.00	23.6	362.0	Dry	44.6	341.0		11.0	331.8	
1/24/2018	357.30	1.84	23.6	362.0	Dry	44.8	340.8		11.0	331.8	
2/21/2018	361.00	0.18	23.3	362.3	Wet	43.7	341.9		11.0	331.8	
3/28/2018	366.90	2.19	23.6	362.0		40.7	344.9		11.6	331.2	
4/25/2018	367.00	0.05	23.6	362.0	Wet	40.2	345.4		11.4	331.4	
5/30/2018	366.40	0.36	23.3	362.3	Wet	40.4	345.2		11.6	331.2	
6/28/2018	365.60	0.00	23.5	362.1		40.7	344.9		11.5	331.3	
7/25/2018	363.20	0.00	23.7	361.9	Dry	41.5	344.1		11.6	331.2	
8/28/2018	357.30	0.00	23.6	362.0	Dry	44.3	341.4		11.7	331.1	
9/27/2018	354.60	0.00	23.5	362.1		45.4	340.2		11.8	331.0	
10/24/2018	351.90	1.49	23.6	362.0		45.6	340.0		12.0	330.8	
11/28/2018	348.60	0.56	23.5	362.1	Dry	45.5	340.1		12.3	330.5	
12/21/2018	348.80	2.04	23.6	362.0	Dry	45.7	339.9	Dry	12.2	330.6	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-5			P-6			P-7		
Top of Well Elevation -->			330.7	333.7	Raised 8/25/2015	370.2	371.4	Raised 6/23/2015	349.7	351.3	Raised 6/23/2015
Bottom of Well Elevation -->			314.0			360.6			338.1		
Depth of Well -->			16.7			9.5			11.5		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2009	364.50		5.7	325.0							
2/24/2009	364.50		5.7	325.0							
3/23/2009	368.50		5.7	325.0							
4/27/2009	367.50		5.2	325.5							
5/22/2009	367.00		5.2	325.5							
6/29/2009	372.00		4.1	326.6							
7/31/2009	371.00		5.1	325.6							
8/26/2009	370.00		5.1	325.6							
9/29/2009	369.50		5.7	325.0							
10/30/2009	369.00		4.7	326.0							
11/30/2009	368.00		4.1	326.6							
12/30/2009	368.00		4.1	326.6							
3/1/2010	368.00		3.0	327.7							
3/30/2010	368.00		3.2	327.5							
4/4/2010	368.70		3.3	327.4							
4/27/2010	368.40		3.2	327.5							
5/26/2010	367.84		3.4	327.3							
6/29/2010	367.00		3.5	327.2							
7/27/2010	367.00		3.6	327.1							
8/27/2010	366.80		3.6	327.1							
9/28/2010	366.40		3.7	327.0							
10/26/2010	368.50		2.5	328.2							
11/30/2010	371.40		3.3	327.4							
12/28/2010	374.70		2.6	328.1							
1/4/2011	374.80		2.3	328.4							
1/6/2011	374.80		2.5	328.2							
1/7/2011	374.80		2.7	328.0							
1/8/2011	374.80		3.1	327.6							
1/9/2011	374.80		3.1	327.6							
1/10/2011	374.80		3.0	327.8							
1/11/2011	374.80		2.7	328.0							
1/17/2011	374.80		3.0	327.8							
1/19/2011	374.70		2.8	327.9		9.4	360.7		6.9	342.8	
1/21/2011	374.80		2.8	327.9		9.6	360.6		7.0	342.6	
1/27/2011	374.60		2.9	327.8		9.5	360.7		7.2	342.4	

**Notes:**

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**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-5			P-6			P-7		
Top of Well Elevation -->			330.7	333.7	Raised 8/25/2015	370.2	371.4	Raised 6/23/2015	349.7	351.3	Raised 6/23/2015
Bottom of Well Elevation -->			314.0			360.6			338.1		
Depth of Well -->			16.7			9.5			11.5		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
2/3/2011	374.60		3.2	327.5		9.5	360.7		7.7	342.0	
2/8/2011	374.70		3.3	327.4		9.5	360.7		7.7	342.0	
2/28/2011	373.70		2.9	327.8		9.7	360.5	Dry	8.4	341.3	
3/28/2011	372.50	2.35	3.0	327.7		9.6	360.6		5.0	344.7	
4/28/2011	372.10	0.27	3.8	326.9		9.6	360.6		8.6	341.1	
5/18/2011	371.80	0.03	3.4	327.3		9.6	360.6		8.8	340.9	
5/25/2011	371.70	0.30	3.5	327.2		9.6	360.6		9.1	340.6	
6/28/2011	370.90	0.03	3.5	327.2		9.5	360.7		10.0	339.7	
7/26/2011	370.30	0.03	3.9	326.8		9.5	360.7		9.3	340.4	
8/24/2011	369.60	0.03	3.5	327.2		9.5	360.7		9.2	340.5	
8/30/2011	369.40		3.6	327.1		9.8	360.4		10.2	339.5	
9/13/2011	364.30	0.00	4.0	326.7		9.6	360.6		10.1	339.6	
9/27/2011	361.90		5.0	325.7		9.5	360.7		10.0	339.7	
10/11/2011	358.50	1.03	5.6	325.1		9.5	360.7		9.5	340.2	
10/25/2011	356.00	1.03	6.5	324.2		9.5	360.7		9.9	339.8	
11/29/2011	355.00	1.51	7.2	323.5		9.5	360.7		9.8	339.9	
12/28/2011	355.00	0.28	7.6	323.1		9.7	360.5		9.4	340.3	
1/26/2012	355.00	1.05	7.8	322.9		9.5	360.7		10.1	339.6	
2/28/2012	355.00	0.73	7.9	322.8		9.6	360.6		10.6	339.1	
3/27/2012	352.40	0.73	8.3	322.4		9.8	360.4		10.3	339.4	
4/23/2012	352.10	1.35	8.1	322.6		9.7	360.5		10.5	339.2	
5/30/2012	352.20	0.07	8.4	322.3		9.6	360.6		9.9	339.8	
6/13/2012	352.20		8.6	322.1		9.7	360.5		10.4	339.3	
6/26/2012	352.20	0.00	8.7	322.0		9.7	360.5		10.5	339.2	
7/24/2012	352.20	0.23	7.8	323.0		9.6	360.6		10.5	339.2	
8/8/2012	352.20	0.23	7.5	323.2		9.8	360.4		10.7	339.0	
8/28/2012	351.80	0.00	7.9	322.8		9.6	360.6		10.1	339.6	
8/29/2012	351.80	0.00	8.2	322.5		9.8	360.4		10.3	339.4	
9/25/2012	351.30	0.00	8.4	322.3		9.5	360.7		9.9	339.8	
10/31/2012	351.00	0.09	8.9	321.8		9.6	360.6		10.3	339.4	
11/27/2012	351.00	0.87	9.2	321.5		9.6	360.6		10.2	339.5	
12/12/2012	351.00	1.13	9.2	321.5		9.5	360.7		10.5	339.2	

## Notes:

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ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-5			P-6			P-7		
Top of Well Elevation -->			330.7	333.7	Raised 8/25/2015	370.2	371.4	Raised 6/23/2015	349.7	351.3	Raised 6/23/2015
Bottom of Well Elevation -->			314.0			360.6			338.1		
Depth of Well -->			16.7			9.5			11.5		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/29/2013	366.10	1.30	5.4	325.3		9.7	360.5		11.0	338.7	
2/21/2013	372.10	0.42	4.3	326.4		9.7	360.5		11.2	338.5	
3/28/2013	371.90	0.79	3.1	327.6		9.6	360.6		10.8	338.9	
4/25/2013	371.40	0.00	2.7	328.0		9.4	360.8		10.3	339.4	
5/22/2013	370.90	0.00	2.9	327.8		9.8	360.4		11.2	338.5	
6/25/2013	370.20	0.00	2.5	328.2		9.7	360.5		10.9	338.8	
7/23/2013	369.40	0.00	2.7	328.0		9.6	360.6	Dry	11.1	338.6	
8/21/2013	368.60	0.00	2.8	327.9		9.7	360.5	Dry	11.0	338.7	
9/25/2013	367.70	0.00	2.8	327.9		9.6	360.6	Dry	11.1	338.6	
10/30/2013	366.90	0.00	3.0	327.7		9.7	360.5	Dry	11.1	338.6	
11/26/2013	366.50	0.59	3.0	327.7		9.7	360.5	Dry	11.1	338.6	Wet
12/17/2013	366.20	0.70	3.2	327.5		9.7	360.5	Dry	10.9	338.8	
1/28/2014	365.50	0.00	3.4	327.3		9.7	360.5	Dry	10.3	339.4	
2/25/2014	365.40	0.76	3.7	327.1		9.8	360.4	Dry	11.2	338.5	Wet
3/25/2014	365.30		3.4	327.3		9.6	360.6	Dry	10.8	338.9	
3/28/2014	365.30	2.02	3.4	327.3		9.6	360.6	Dry	11.1	338.6	
4/25/2014	364.50	0.52	3.5	327.2		9.6	360.6	Dry	10.7	339.0	
5/28/2014	363.80	0.00	3.7	327.0		9.7	360.5	Dry	10.8	338.9	
6/25/2014	363.00	0.00	3.9	326.8		9.8	360.4	Dry	10.3	339.4	
7/30/2014	361.90	0.00	3.9	326.8		9.8	360.4	Dry	10.5	339.2	
8/27/2014	361.10	0.04	4.3	326.4		9.7	360.5	Dry	11.1	338.6	Wet
9/23/2014	360.50	0.00	4.2	326.5		9.6	360.6	Dry	11.1	338.6	Wet
10/29/2014	359.50	0.00	4.5	326.2		9.7	360.5	Dry	11.1	338.6	Wet
11/24/2014	359.40	0.32	4.6	326.1		9.7	360.5	Dry	10.9	338.8	Wet
12/30/2014	359.40	3.98	4.7	326.0		9.7	360.5	Dry	10.5	339.2	Wet
1/27/2015	359.00	1.42	4.7	326.0		9.7	360.5	Dry	10.9	338.8	
2/26/2015	358.60	0.46	4.8	325.9		9.7	360.5	Dry	11.1	338.6	Wet
3/27/2015	358.00	0.63	5.3	325.4		9.7	360.5	Dry	11.2	338.5	Wet
4/26/2015	331.00	0.22	8.0	322.7		9.6	360.6	Dry	11.1	338.6	Wet
5/27/2015	332.00	1.79	7.9	322.8		9.6	360.6	Dry	11.1	338.6	Wet
6/23/2015	331.00	0.00	12.3	318.4		10.8	360.6	Dry; Extended casing	12.3	339.0	Extended casing
7/30/2015	331.00	0.00	13.7	317.0		10.4	361.0	Dry	11.0	340.3	Wet
8/25/2015	331.00	0.00	17.6	316.1	Extended casing	10.8	360.6	Dry	12.5	338.8	Wet
9/30/2015	331.00	1.97	18.3	315.4		10.9	360.5	Dry	12.6	338.7	Wet
10/29/2015	331.00	0.18	18.4	315.3		10.8	360.6	Dry	12.5	338.8	
11/25/2015	331.00	0.17	19.5	314.2	Dry	10.9	360.5	Dry	12.7	338.6	Dry
12/30/2015	331.00	1.42	19.5	314.2	Dry; VW installed	10.9	360.5	Dry; VW installed	12.7	338.6	Dry; VW installed

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-5			P-6			P-7		
Top of Well Elevation -->			330.7	333.7	Raised 8/25/2015	370.2	371.4	Raised 6/23/2015	349.7	351.3	Raised 6/23/2015
Bottom of Well Elevation -->			314.0			360.6			338.1		
Depth of Well -->			16.7			9.5			11.5		
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment
1/26/2016	343.70	2.97	16.1	317.6		10.8	360.6	Dry	12.5	338.8	
2/24/2016	363.80	0.26	9.9	323.8		10.9	360.5	Dry	12.5	338.8	Dry
3/29/2016	374.90	1.50	5.4	328.3		10.9	360.5		12.5	338.8	
4/28/2016	375.50	0.09	4.3	329.4		10.9	360.5		12.5	338.8	
5/24/2016	374.40	0.13	4.0	329.7		10.9	360.5		12.5	338.8	
6/29/2016	373.70	0.00	4.1	329.6		10.9	360.5		12.5	338.8	
7/28/2016	372.20	0.00	4.1	329.6		10.9	360.5		12.5	338.8	
8/25/2016	367.10	0.00	4.7	329.0		10.9	360.5		12.5	338.8	
9/27/2016	363.30	0.00	5.3	328.4		10.9	360.5		12.5	338.8	
10/25/2016	362.10	0.82	5.0	328.7		10.9	360.5		12.5	338.8	
11/22/2016	361.80	1.69			VW was not logging			VW was not logging			VW was not logging
12/28/2016	368.55	3.61	3.0	330.7		10.9	360.5		12.5	338.8	
1/25/2017	375.80	6.48	1.3	332.4		10.8	360.6		12.5	338.8	
2/28/2017	375.90	3.95	1.2	332.5		10.9	360.5		12.5	338.8	
3/15/2017	375.80	3.61	1.1	332.6		10.9	360.5		12.5	338.8	
3/28/2017	375.50	0.09	1.1	332.6		10.9	360.5		12.5	338.8	
4/26/2017	375.00	0.04	1.1	332.6		10.9	360.5		12.5	338.8	
5/23/2017	374.60	35.00	1.1	332.6		10.9	360.5		12.5	338.8	
6/22/2017	373.80	0.00	1.4	332.3		10.9	360.5		12.5	338.8	
7/26/2017	371.40	0.00	2.0	331.7		10.9	360.5		12.5	338.8	
8/30/2017	368.60	0.00	2.9	330.8		10.9	360.5		12.5	338.8	
9/28/2017	364.80	0.00	3.5	330.2		10.9	360.5		12.5	338.8	
10/26/2017	359.00	0.00	4.8	328.9		10.9	360.5		12.5	338.8	
11/29/2017	357.80	0.15	5.8	327.9		10.9	360.5		12.5	338.8	
12/27/2017	357.30	0.00	5.9	327.8		10.9	360.5		12.5	338.8	
1/24/2018	357.30	1.84	6.1	327.6		10.9	360.5		12.5	338.8	
2/21/2018	361.00	0.18	5.6	328.1		10.9	360.5		12.5	338.8	
3/28/2018	366.90	2.19	5.0	328.7		10.9	360.5		12.5	338.8	
4/25/2018	367.00	0.05	4.9	328.8		10.9	360.5		12.5	338.8	
5/30/2018	366.40	0.36	5.1	328.6		10.9	360.5		12.5	338.8	
6/28/2018	365.60	0.00	5.2	328.5		10.9	360.5		12.5	338.8	
7/25/2018	363.20	0.00	5.5	328.2		10.9	360.5		12.5	338.8	
8/28/2018	357.30	0.00	6.4	327.3		10.9	360.5		12.5	338.8	
9/27/2018	354.60	0.00	6.9	326.8		10.9	360.5		12.5	338.8	
10/24/2018	351.90	1.49	7.6	326.1		10.9	360.5		12.5	338.8	
11/28/2018	348.60	0.56	8.6	325.1		10.9	360.5		12.5	338.8	
12/21/2018	348.80	2.04	8.3	325.4		10.9	360.5		12.5	338.8	

## Notes:

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire



**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-8			P-9			Seepage Flow Point		
Top of Well Elevation -->			345.3	346.4	Raised 6/23/2015	344.9	346.4	Raised 6/23/2015	(liter/min)		
Bottom of Well Elevation -->			336.8			335.4					
Depth of Well -->			8.5	9.6		9.5	11.0				
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading		Comment
									(liter/min)	(gal/min)	
1/26/2009	364.50								32.0	8.5	
2/24/2009	364.50								32.0	8.5	
3/23/2009	368.50								37.9	10.0	
4/27/2009	367.50								37.9	10.0	
5/22/2009	367.00								32.0	8.5	
6/29/2009	372.00								56.8	15.0	
7/31/2009	371.00								37.9	10.0	
8/26/2009	370.00								56.8	15.0	
9/29/2009	369.50								45.4	12.0	
10/30/2009	369.00								37.9	10.0	
11/30/2009	368.00								37.9	10.0	
12/30/2009	368.00								37.9	10.0	
3/1/2010	368.00								131.0	34.6	
3/30/2010	368.00								46.8	12.4	
4/4/2010	368.70								38.4	10.1	
4/27/2010	368.40								40.2	10.6	
5/26/2010	367.84								37.5	9.9	
6/29/2010	367.00								39.0	10.3	
7/27/2010	367.00								31.5	8.3	
8/27/2010	366.80								31.2	8.3	
9/28/2010	366.40								31.6	8.3	
10/26/2010	368.50								35.3	9.3	
11/30/2010	371.40								37.5	9.9	
12/28/2010	374.70								75.0	19.8	
1/4/2011	374.80								69.0	18.2	
1/6/2011	374.80										
1/7/2011	374.80										
1/8/2011	374.80								30.3	8.0	
1/9/2011	374.80								31.2	8.2	
1/10/2011	374.80										
1/11/2011	374.80								28.6	7.5	
1/17/2011	374.80								26.9	7.1	
1/19/2011	374.70		3.9	341.4		4.5	340.4		33.8	8.9	
1/21/2011	374.80		4.2	341.2		4.8	340.1				
1/27/2011	374.60		4.2	341.1		4.9	340.0		45.0	11.9	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-8			P-9			Seepage Flow Point		
Top of Well Elevation -->			345.3	346.4	Raised 6/23/2015	344.9	346.4	Raised 6/23/2015	(liter/min)		
Bottom of Well Elevation -->			336.8			335.4					
Depth of Well -->			8.5			9.5					
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading		Comment
									(liter/min)	(gal/min)	
2/3/2011	374.60		4.4	340.9		5.3	339.6				
2/8/2011	374.70		4.5	340.9		5.3	339.6				
2/28/2011	373.70		4.8	340.5		5.6	339.3		34.3	9.1	
3/28/2011	372.50	2.35	4.0	341.3		4.9	340.0		52.9	14.0	
4/28/2011	372.10	0.27	4.5	340.8		5.9	339.0		11.7	3.1	
5/18/2011	371.80	0.03	4.2	341.1		6.5	338.4		16.6	4.4	
5/25/2011	371.70	0.30	4.6	340.8		6.9	338.0		13.0	3.4	
6/28/2011	370.90	0.03	6.1	339.2		7.4	337.5		29.1	7.7	
7/26/2011	370.30	0.03	6.3	339.0		7.4	337.5		3.6	1.0	
8/24/2011	369.60	0.03	8.4	336.9		9.5	335.4		7.0	1.8	
8/30/2011	369.40		8.4	336.9		9.5	335.4		7.0	1.8	
9/13/2011	364.30	0.00	7.7	337.6		9.5	335.4		31.5	8.3	
9/27/2011	361.90		7.7	337.6		9.5	335.4		0.1	0.0	
10/11/2011	358.50	1.03	7.0	338.3		9.3	335.6		0.1	0.0	
10/25/2011	356.00	1.03	7.1	338.2		9.5	335.4		0.0	0.0	Reservoir was low
11/29/2011	355.00	1.51	7.5	337.8		9.6	335.3		0.0	0.0	Reservoir was low
12/28/2011	355.00	0.28	6.9	338.4		9.6	335.3		0.0	0.0	Reservoir was low
1/26/2012	355.00	1.05	7.4	337.9		9.4	335.5		0.0	0.0	Reservoir was low
2/28/2012	355.00	0.73	7.8	337.5		9.4	335.5		0.0	0.0	Reservoir was low
3/27/2012	352.40	0.73	7.9	337.4		9.6	335.3		0.0	0.0	Reservoir was low
4/23/2012	352.10	1.35	7.9	337.4		9.4	335.5		0.0	0.0	Reservoir was low
5/30/2012	352.20	0.07	7.8	337.5		9.4	335.5		0.0	0.0	Reservoir was low
6/13/2012	352.20		7.7	337.6		9.4	335.5		0.0	0.0	Reservoir was low
6/26/2012	352.20	0.00	7.6	337.7		9.5	335.4		0.0	0.0	Reservoir was low
7/24/2012	352.20	0.23	8.1	337.2		9.4	335.5		0.0	0.0	Reservoir was low
8/8/2012	352.20	0.23	8.3	337.0		9.6	335.3		0.0	0.0	Reservoir was low
8/28/2012	351.80	0.00	7.6	337.7		9.4	335.5		0.0	0.0	Reservoir was low
8/29/2012	351.80	0.00	8.0	337.3		9.7	335.2		0.0	0.0	Reservoir was low
9/25/2012	351.30	0.00	7.4	337.9		9.4	335.5		0.0	0.0	Reservoir was low
10/31/2012	351.00	0.09	7.6	337.7		9.4	335.5		0.0	0.0	Reservoir was low
11/27/2012	351.00	0.87	7.5	337.8		9.5	335.4		0.0	0.0	Reservoir was low
12/12/2012	351.00	1.13	8.0	337.3		9.5	335.4		0.0	0.0	Reservoir was low

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

Monitoring Well -->			P-8			P-9			Seepage Flow Point		
Top of Well Elevation -->			345.3	346.4	Raised 6/23/2015	344.9	346.4	Raised 6/23/2015	(liter/min)		
Bottom of Well Elevation -->			336.8			335.4					
Depth of Well -->			8.5	9.6		9.5	11.0				
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading		Comment
									(liter/min)	(gal/min)	
1/29/2013	366.10	1.30	8.3	337.0		9.5	335.4				Vault is being relocated
2/21/2013	372.10	0.42	8.1	337.2		9.5	335.4				Vault is being relocated
3/28/2013	371.90	0.79	8.3	337.0		9.4	335.5				Vault is being relocated
4/25/2013	371.40	0.00	7.9	337.4		9.4	335.5				Vault is being relocated
5/22/2013	370.90	0.00	8.5	336.8		9.6	335.3				Vault is being relocated
6/25/2013	370.20	0.00	8.3	337.0		9.4	335.5				Vault is being relocated
7/23/2013	369.40	0.00	8.3	337.0		9.4	335.5				Vault is being relocated
8/21/2013	368.60	0.00	8.3	337.0	Wet	9.5	335.4				Vault is being relocated
9/25/2013	367.70	0.00	8.3	337.0	Dry	9.5	335.5				Vault is being relocated
10/30/2013	366.90	0.00	8.4	336.9	Dry	9.1	335.8		23.6	6.2	
11/26/2013	366.50	0.59	8.3	337.0	Wet	10.9	334.0	Wet, Erroneous	22.2	5.9	
12/17/2013	366.20	0.70	8.3	337.0	Wet	9.5	335.4		23.6	6.2	
1/28/2014	365.50	0.00	8.4	336.9		9.5	335.4		18.4	4.9	
2/25/2014	365.40	0.76	8.4	336.9	Wet	9.6	335.3	Dry	15.0	4.0	
3/25/2014	365.30		8.3	337.0		9.5	335.4		17.3	4.6	
3/28/2014	365.30	2.02	8.3	337.0		9.4	335.5		11.8	3.1	
4/25/2014	364.50	0.52	8.3	337.0		9.5	335.4		18.0	4.8	
5/28/2014	363.80	0.00	8.1	337.2		9.4	335.5		15.0	4.0	
6/25/2014	363.00	0.00	8.4	336.9		9.6	335.3		14.2	3.7	
7/30/2014	361.90	0.00	8.4	336.9		9.6	335.3		14.7	3.9	
8/27/2014	361.10	0.04	8.3	337.0	Wet	9.5	335.4		15.2	4.0	
9/23/2014	360.50	0.00	8.2	337.1		9.5	335.4	Wet	13.2	3.5	
10/29/2014	359.50	0.00	8.3	337.0		9.4	335.5		12.0	3.2	
11/24/2014	359.40	0.32	8.2	337.1		9.5	335.4		8.7	2.3	
12/30/2014	359.40	3.98	8.3	337.0		9.5	335.4		8.1	2.1	
1/27/2015	359.00	1.42	8.2	337.1		9.5	335.4		6.9	1.8	
2/26/2015	358.60	0.46	8.3	337.0		9.5	335.4		6.4	1.7	
3/27/2015	358.00	0.63	8.3	337.0		9.6	335.3		6.1	1.6	
4/26/2015	331.00	0.22	8.4	336.9	Wet	9.6	335.3	Wet	0.0	0.0	
5/27/2015	332.00	1.79	8.4	336.9	Wet	9.6	335.3	Wet	0.0	0.0	
6/23/2015	331.00	0.00	9.5	336.9	Wet; Extended casing	11.0	335.4	Dry; Extended casing	0.0	0.0	
7/30/2015	331.00	0.00	8.3	338.1	Dry	10.9	335.5	Wet	0.0	0.0	
8/25/2015	331.00	0.00	9.5	336.9	Wet	10.9	335.5	Wet	0.0	0.0	
9/30/2015	331.00	1.97	9.5	336.9	Dry	11.0	335.4	Wet	0.0	0.0	
10/29/2015	331.00	0.18	9.5	336.9	Dry	11.0	335.4	Dry	0.0	0.0	
11/25/2015	331.00	0.17	9.5	336.9	Dry	11.0	335.4	Dry	0.0	0.0	
12/30/2015	331.00	1.42	9.5	336.9	Dry; VW installed	11.0	335.4	Dry; VW installed	0.0	0.0	

**Notes:**

Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

**TABLE 2**  
**SYPHON CANYON DAM**  
**PIEZOMETER WATER LEVELS AND SEEPAGE MEASUREMENTS**  
**JANUARY 2009 THROUGH DECEMBER 2018**

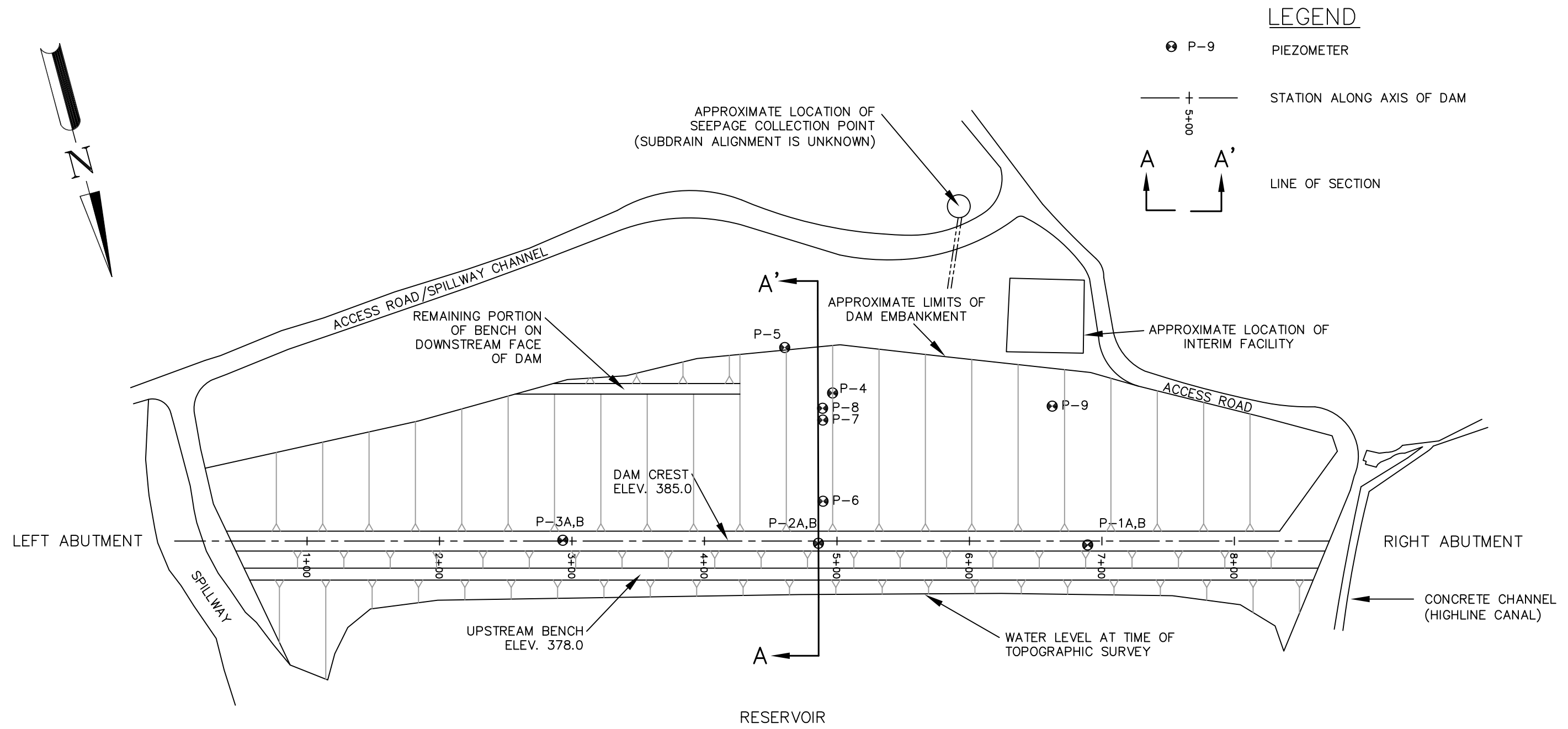
Monitoring Well -->			P-8			P-9			Seepage Flow Point		
Top of Well Elevation -->			345.3	346.4	Raised 6/23/2015	344.9	346.4	Raised 6/23/2015	(liter/min)		
Bottom of Well Elevation -->			336.8			335.4					
Depth of Well -->			8.5	9.6		9.5	11.0				
Date	Reservoir Elevation (ft)	Monthly Rainfall (in.)	Reading (ft)	Elev. (ft)	Comment	Reading (ft)	Elev. (ft)	Comment	Reading		Comment
									(liter/min)	(gal/min)	
1/26/2016	343.70	2.97	9.3	337.1		10.8	335.6		0.0	0.0	
2/24/2016	363.80	0.26	9.5	336.9	Dry	10.9	335.5		0.0	0.0	
3/29/2016	374.90	1.50	9.5	336.9		11.0	335.4		0.9	0.2	
4/28/2016	375.50	0.09	9.5	336.9		11.0	335.4		3.9	1.0	
5/24/2016	374.40	0.13	9.5	336.9		11.0	335.4		4.2	1.1	
6/29/2016	373.70	0.00	9.5	336.9		11.0	335.4		4.6	1.2	
7/28/2016	372.20	0.00	9.5	336.9		11.0	335.4		5.1	1.3	
8/25/2016	367.10	0.00	9.5	336.9		11.0	335.4		3.8	1.0	
9/27/2016	363.30	0.00	9.5	336.9		11.0	335.4		1.8	0.5	
10/25/2016	362.10	0.82	9.5	336.9		10.9	335.5		3.4	0.9	
11/22/2016	361.80	1.69			VW was not logging			VW was not logging	4.9	1.3	
12/28/2016	368.55	3.61	9.5	336.9		11.0	335.4		6.1	1.6	
1/25/2017	375.80	6.48	9.5	336.9		10.8	335.6		22.0	5.8	
2/28/2017	375.90	3.95	9.5	336.9		11.0	335.4		22.3	5.9	
3/15/2017	375.80	3.61	9.5	336.9		11.0	335.4		22.3	5.9	
3/28/2017	375.50	0.09	9.5	336.9		11.0	335.4		25.7	6.8	
4/26/2017	375.00	0.04	9.5	336.9		11.0	335.4		28.0	7.4	
5/23/2017	374.60	35.00	9.5	336.9		11.0	335.4		16.3	4.3	
6/22/2017	373.80	0.00	9.5	336.9		11.0	335.4		30.1	8.0	
7/26/2017	371.40	0.00	9.5	336.9		11.0	335.4		30.6	8.1	
8/30/2017	368.60	0.00	9.5	336.9		11.0	335.4		36.0	9.5	
9/28/2017	364.80	0.00	9.5	336.9		11.0	335.4		16.0	4.2	
10/26/2017	359.00	0.00	9.5	336.9		11.0	335.4		2.8	0.7	
11/29/2017	357.80	0.15	9.5	336.9		11.0	335.4		9.2	2.4	
12/27/2017	357.30	0.00	9.5	336.9		11.0	335.4		6.8	1.8	
1/24/2018	357.30	1.84	9.5	336.9		11.0	335.4		5.7	1.5	
2/21/2018	361.00	0.18	9.5	336.9		11.0	335.4		6.2	1.6	
3/28/2018	366.90	2.19	9.5	336.9		11.0	335.4		22.0	5.8	
4/25/2018	367.00	0.05	9.5	336.9		11.0	335.4		12.8	3.4	
5/30/2018	366.40	0.36	9.5	336.9		11.0	335.4		14.2	3.7	
6/28/2018	365.60	0.00	9.5	336.9		11.0	335.4		11.2	3.0	
7/25/2018	363.20	0.00	9.5	336.9		11.0	335.4		12.8	3.4	
8/28/2018	357.30	0.00	9.5	336.9		11.0	335.4		4.0	1.1	
9/27/2018	354.60	0.00	9.5	336.9		11.0	335.4		1.0	0.3	
10/24/2018	351.90	1.49	9.5	336.9		11.0	335.4		0.0	0.0	
11/28/2018	348.60	0.56	9.5	336.9		11.0	335.4		0.0	0.0	
12/21/2018	348.80	2.04	9.5	336.9		11.0	335.4		0.0	0.0	

**Notes:**

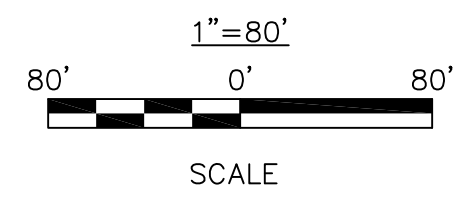
Elevations are in feet relative to NGVD29 datum; Elev. = elevation;  
ft = feet; in. = inches; Maint. = maintenance; VW = Vibrating Wire

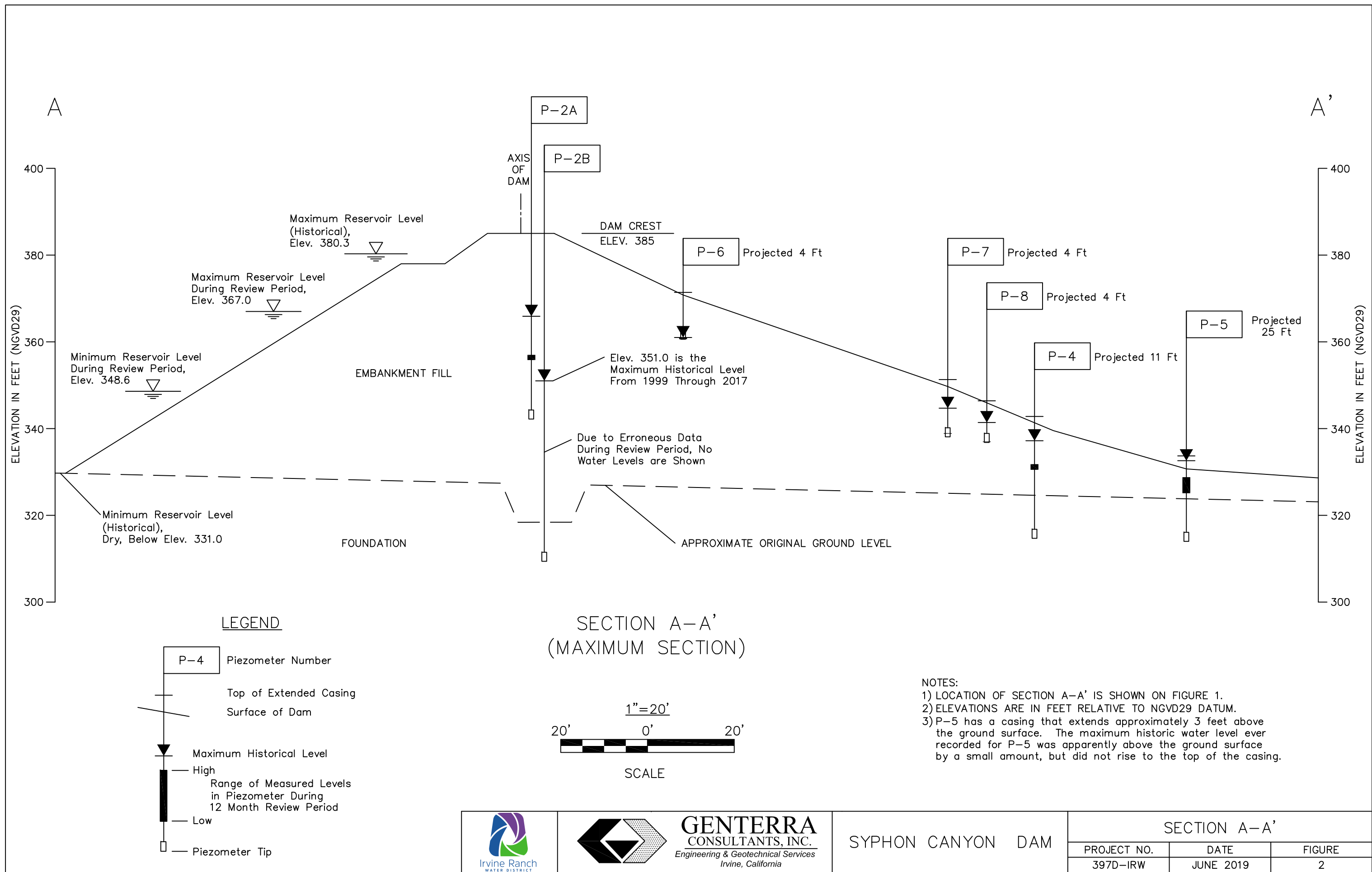
**ANNUAL SURVEILLANCE REPORT  
JANUARY 2018 THROUGH DECEMBER 2018  
SYPHON CANYON DAM, DSOD DAM NO. 1029-004**

**FIGURES**

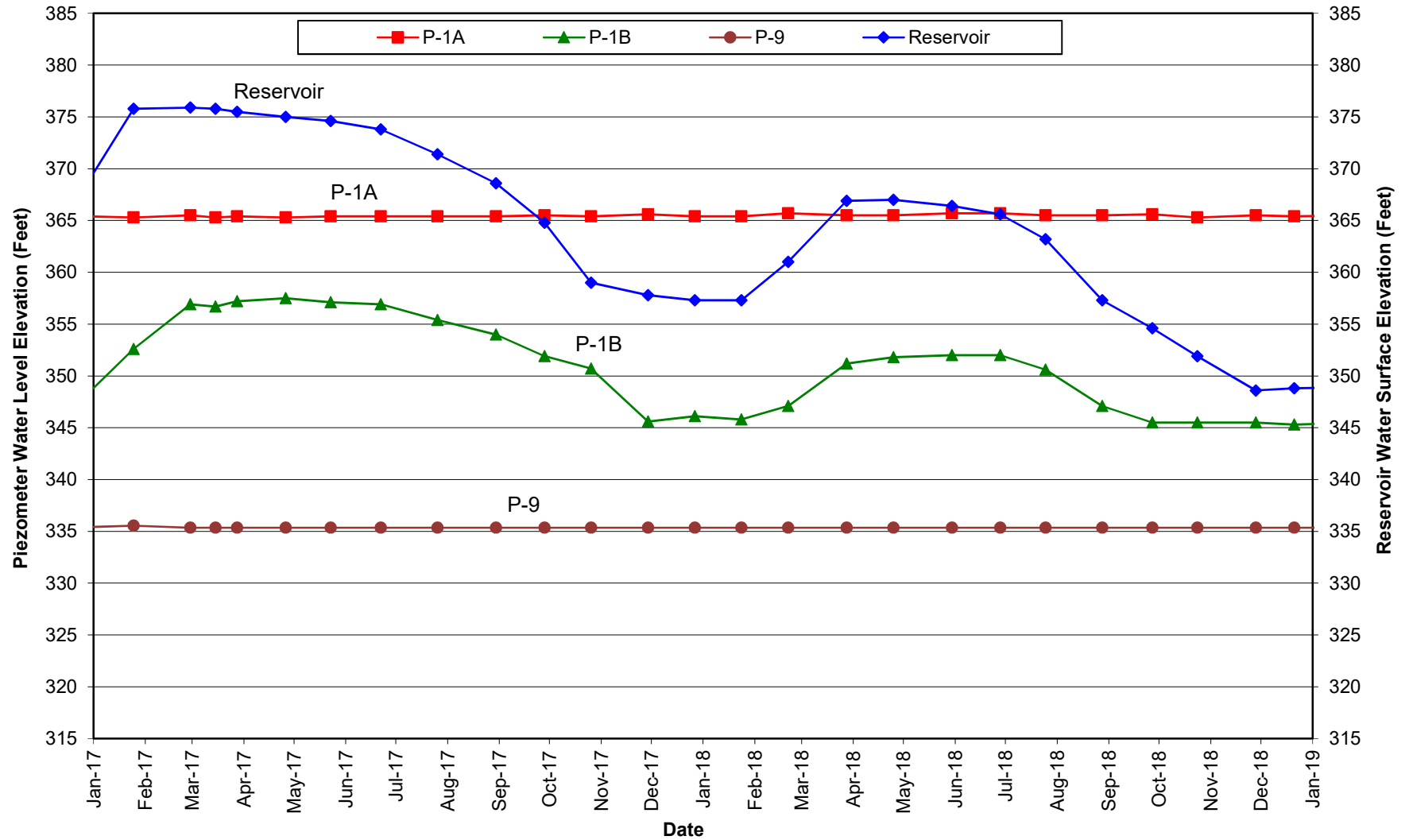


NOTES:  
 1) ELEVATIONS ARE IN FEET RELATIVE TO NGVD29 DATUM.  
 2) SECTION A-A' IS SHOWN ON FIGURE 2.



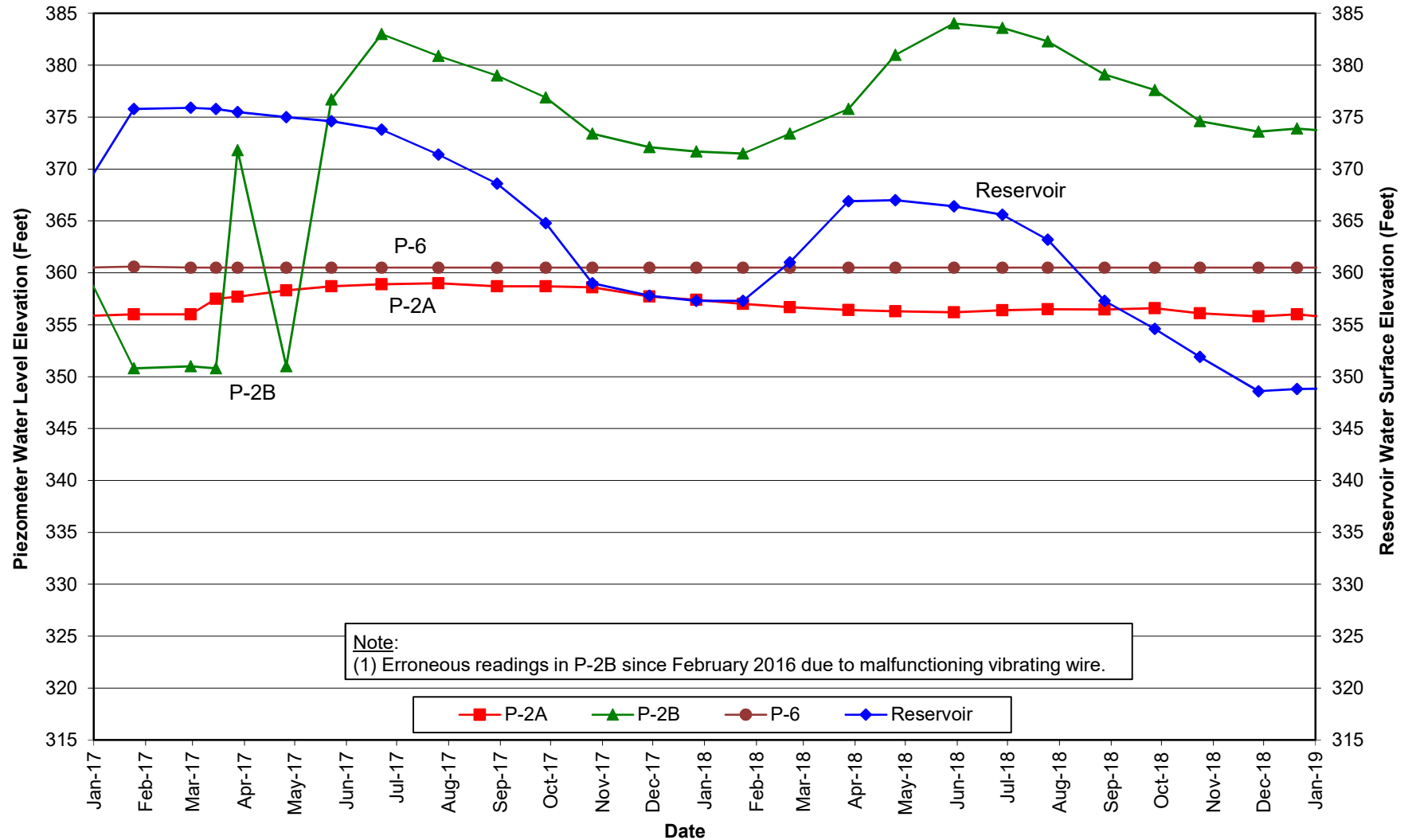


**SYPHON CANYON DAM  
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS  
PIEZOMETERS P-1A, P-1B, AND P-9  
JANUARY 2017 THROUGH DECEMBER 2018**

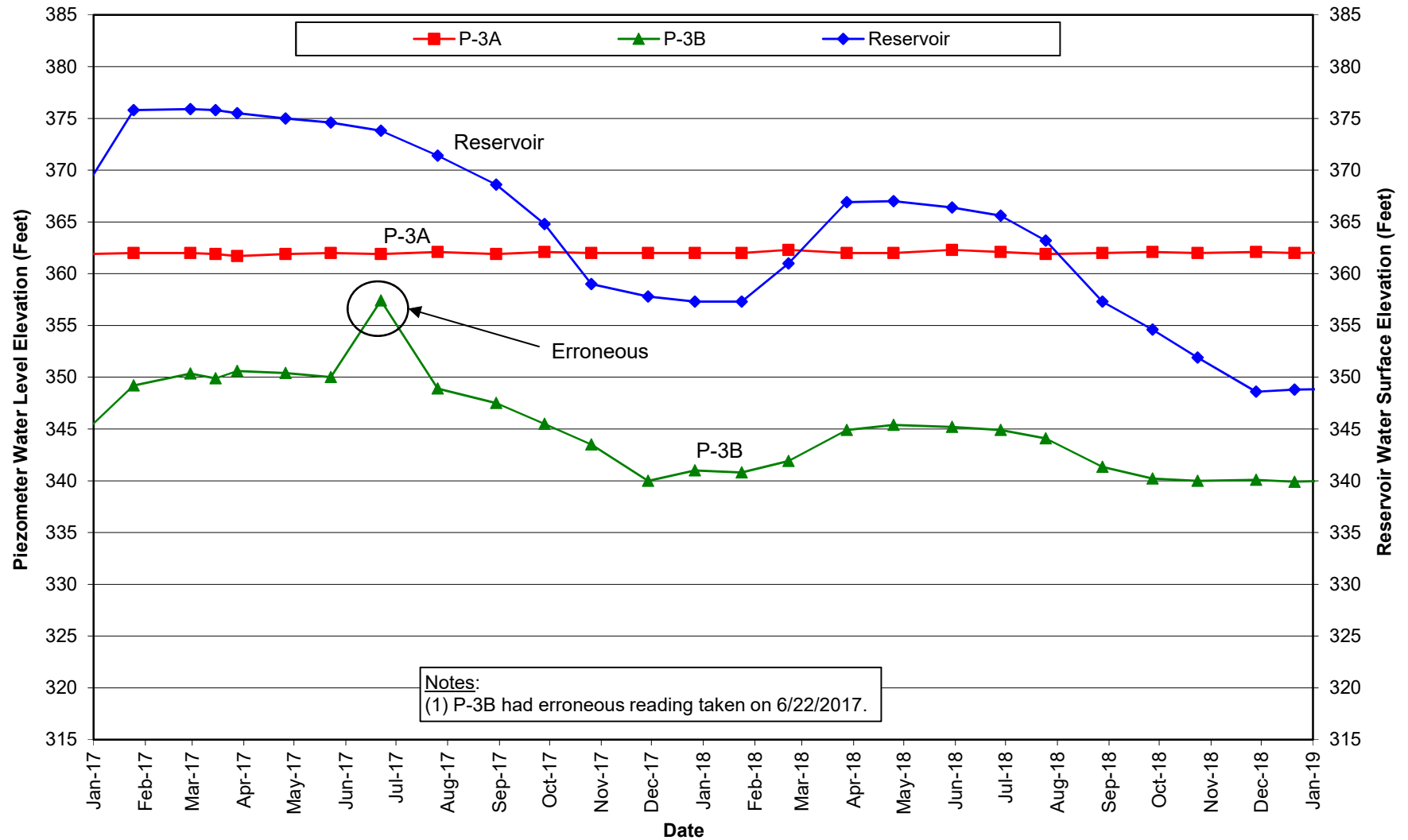




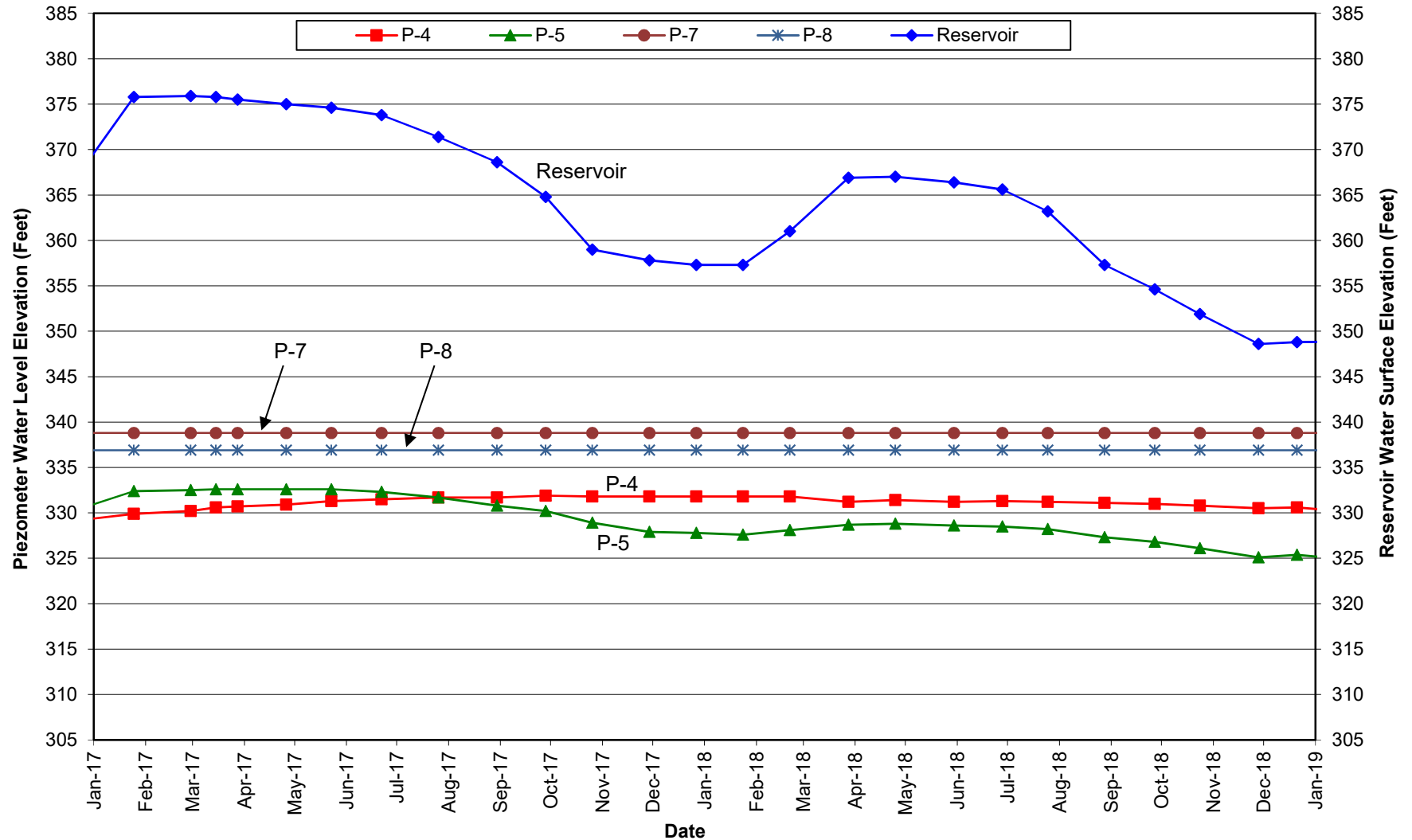
**SYPHON CANYON DAM  
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS  
PIEZOMETERS P-2A, P-2B, AND P-6  
JANUARY 2017 THROUGH DECEMBER 2018**



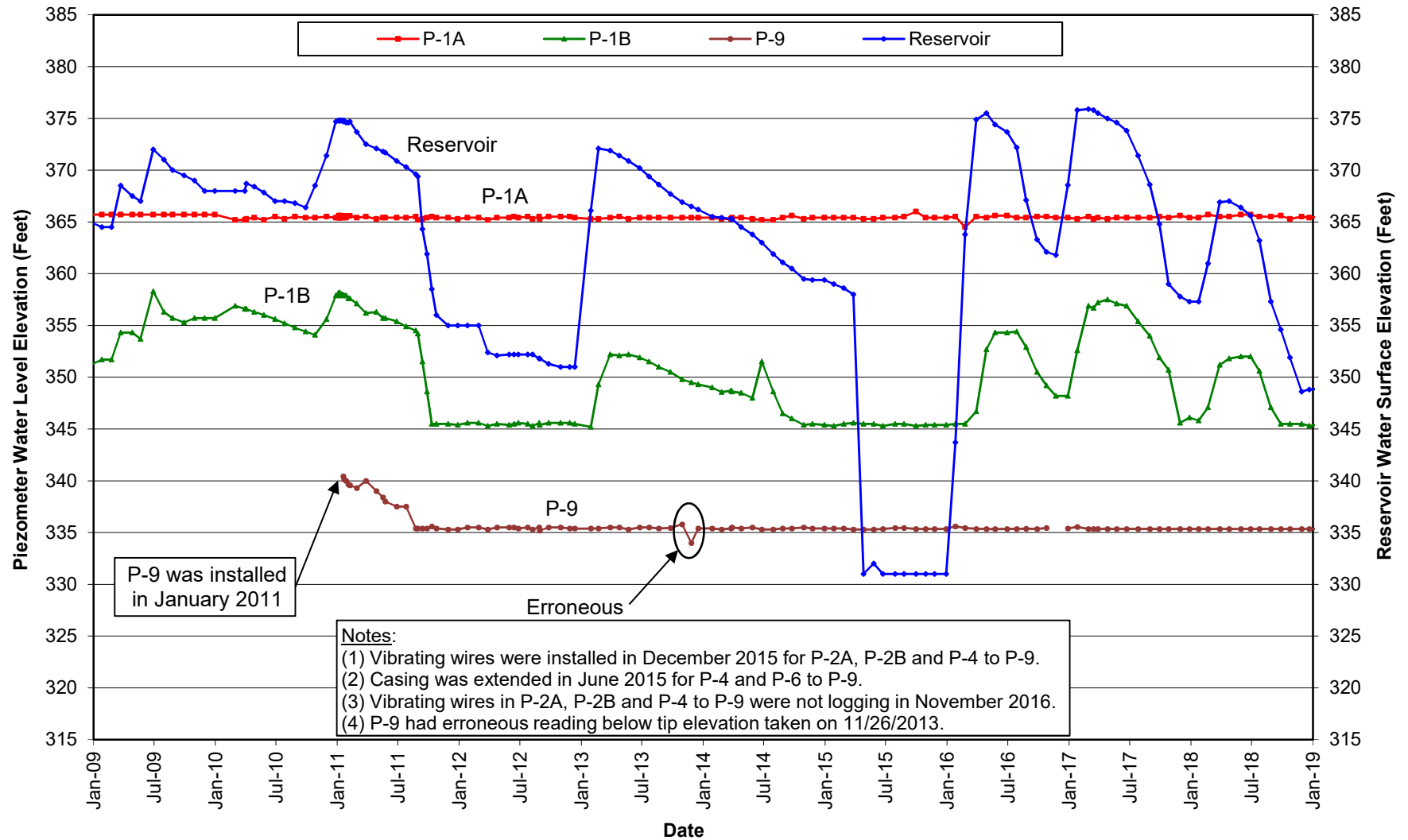
**SYPHON CANYON DAM  
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS  
PIEZOMETERS P-3A AND P-3B  
JANUARY 2017 THROUGH DECEMBER 2018**



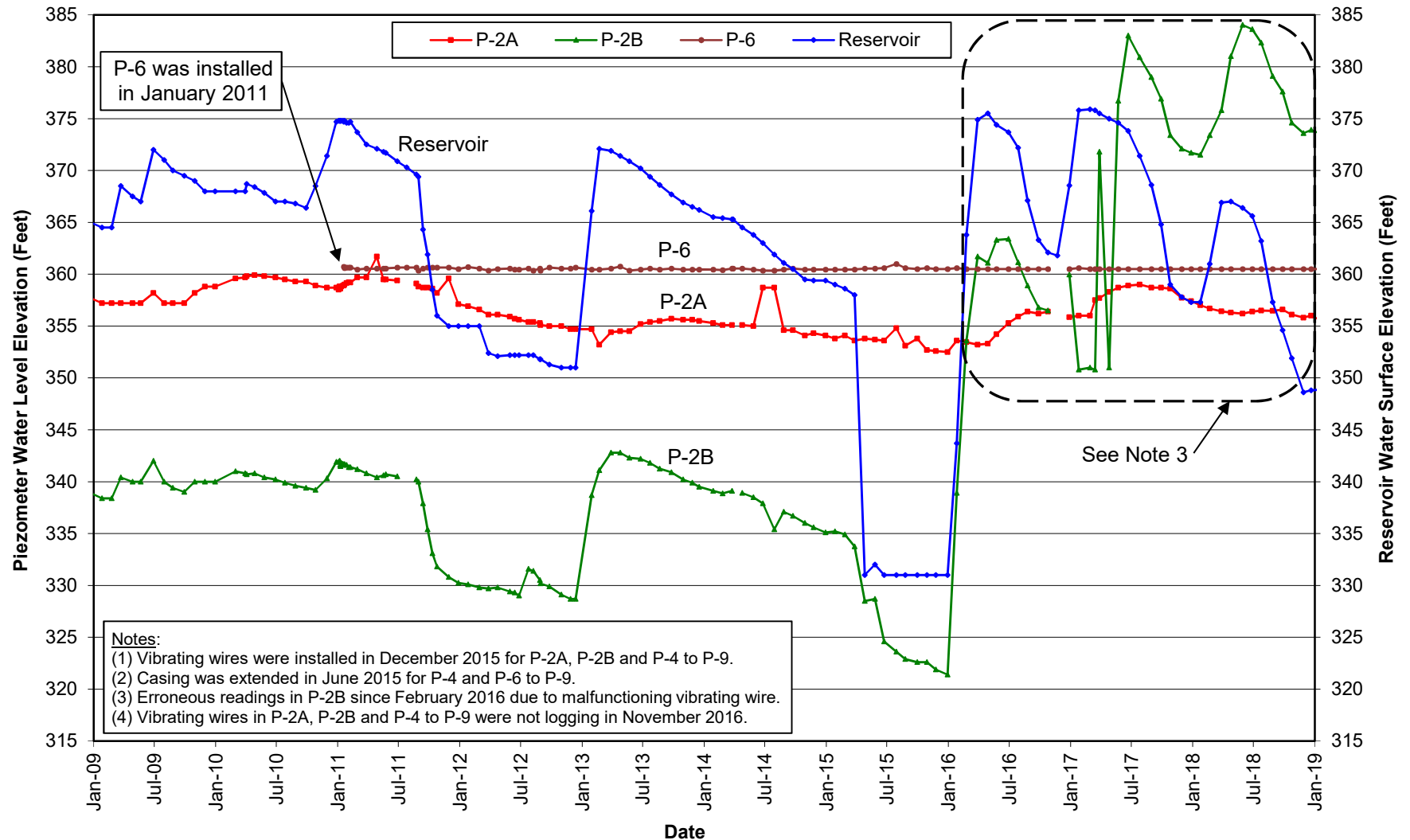
**SYPHON CANYON DAM  
2-YR PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS  
PIEZOMETERS P-4, P-5, P-7, AND P-8  
JANUARY 2017 THROUGH DECEMBER 2018**



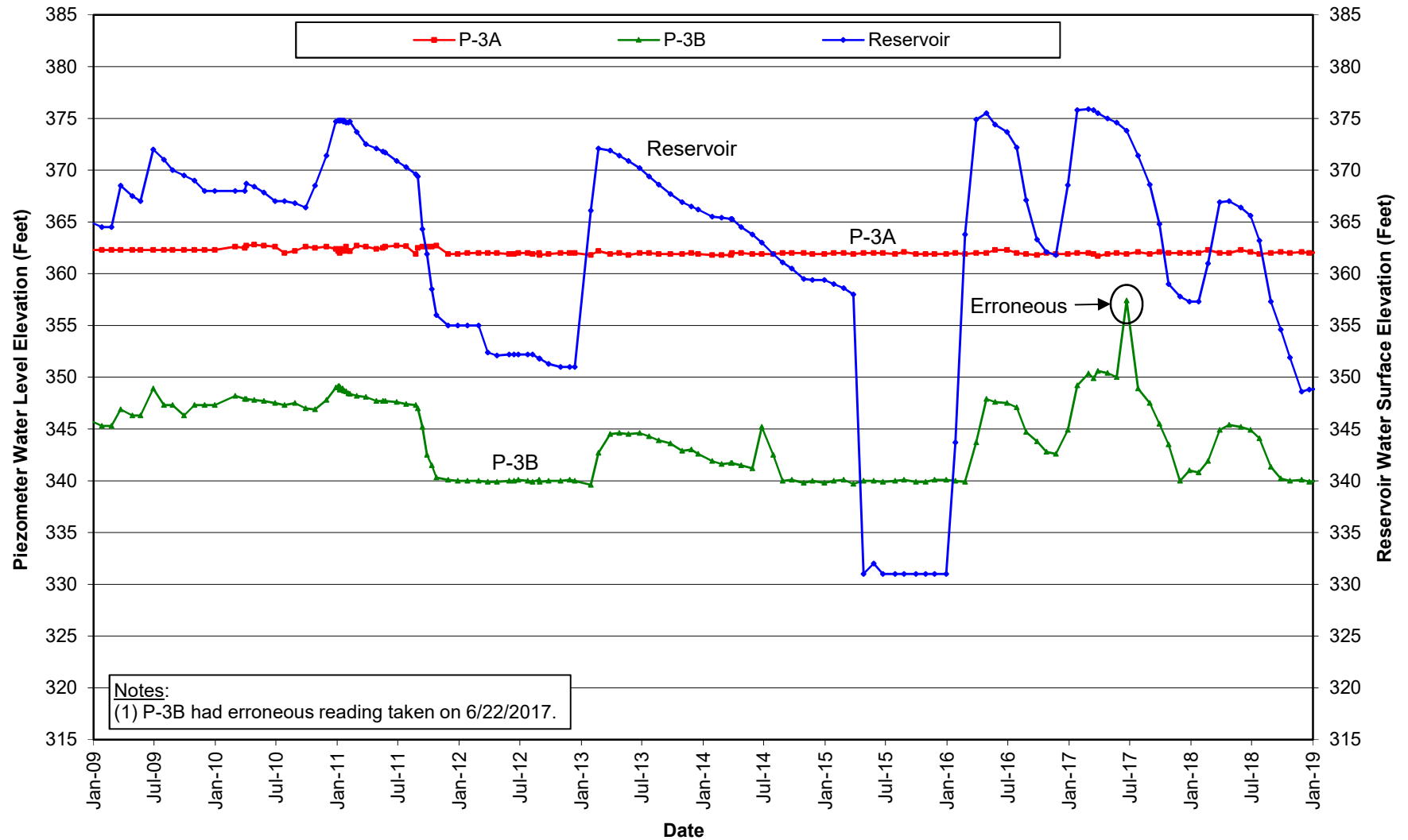
**SYPHON CANYON DAM**  
**10-YR HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-1A, P-1B, AND P-9**  
**JANUARY 2009 THROUGH DECEMBER 2018**



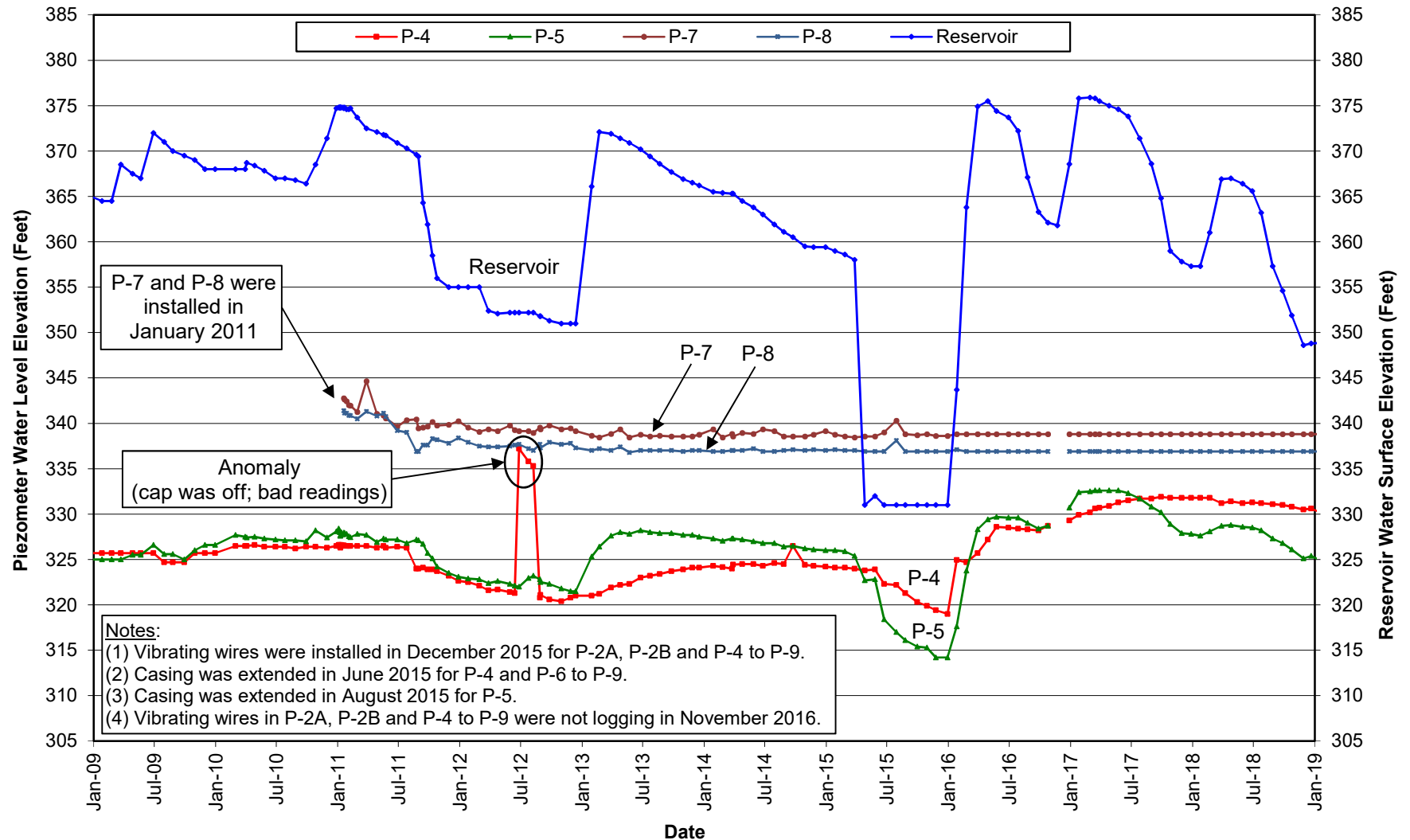
**SYPHON CANYON DAM**  
**10-YR HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-2A, P-2B, AND P-6**  
**JANUARY 2009 THROUGH DECEMBER 2018**



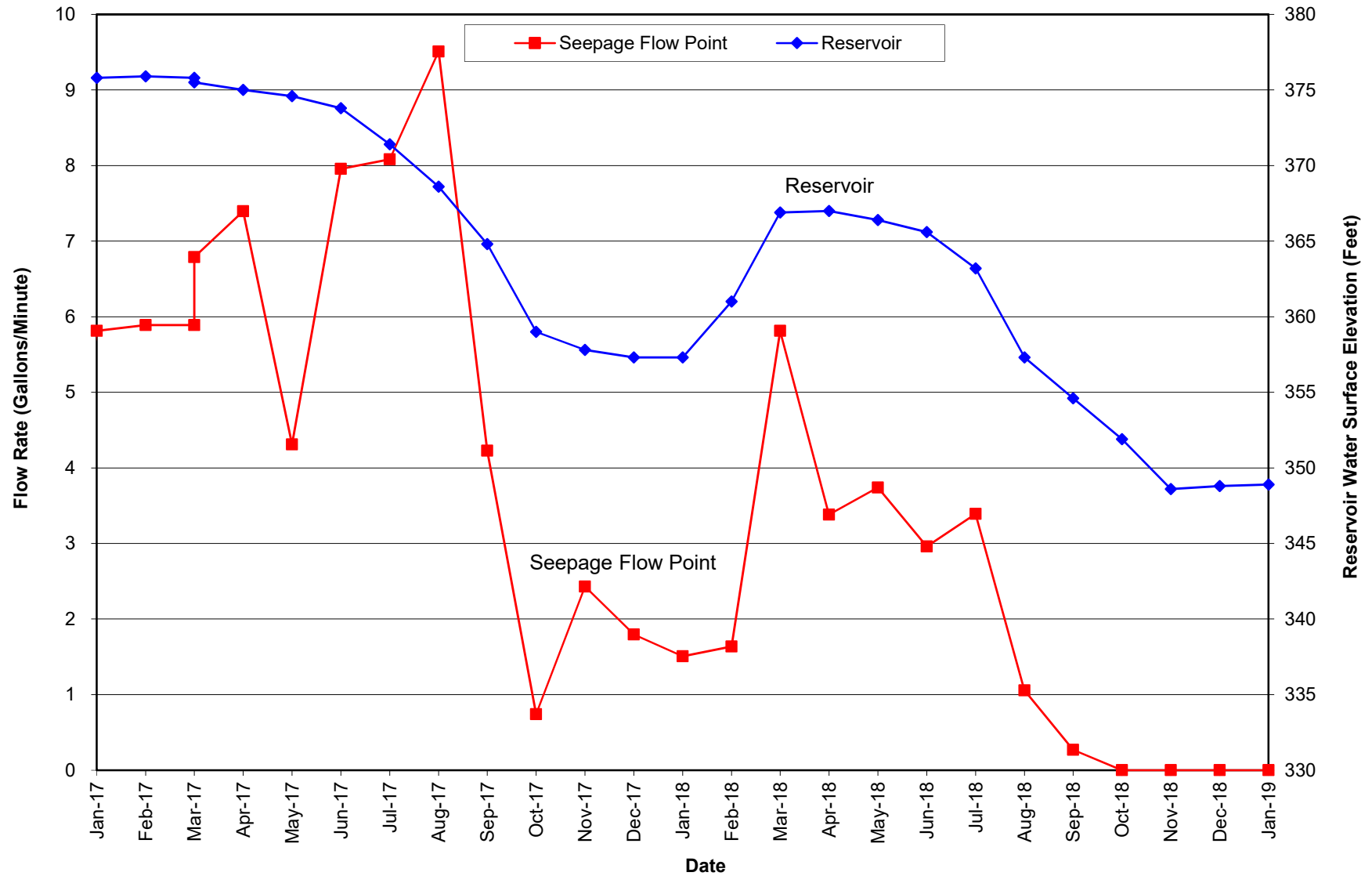
**SYPHON CANYON DAM**  
**10-YR HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-3A AND P-3B**  
**JANUARY 2009 THROUGH DECEMBER 2018**



**SYPHON CANYON DAM**  
**10-YR HISTORICAL PIEZOMETER AND RESERVOIR WATER SURFACE ELEVATIONS**  
**PIEZOMETERS P-4, P-5, P-7, AND P-8**  
**JANUARY 2009 THROUGH DECEMBER 2018**



**SYPHON CANYON DAM  
2-YR SEEPAGE MEASUREMENTS  
SEEPAGE FLOW POINT  
JANUARY 2017 THROUGH DECEMBER 2018**





**SYPHON CANYON DAM  
10-YR HISTORICAL SEEPAGE MEASUREMENTS  
SEEPAGE FLOW POINT  
JANUARY 2009 THROUGH DECEMBER 2018**

