STATE OF CALIFORNIA
CALIFORNIA NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Phoenix Lake Dam No. 33-3 County Marin
Type of Dam ERTH Type of Spillway Concrete weir and chute
Water is 0.1 feet above the spillway crest and 15.1 feet below the dam crest.

Weather Conditions Clear and mild
Contacts Made Alex Anaya and Ronnie Chasteen during the inspection
Reason for Inspection Periodic Evaluation

Important Observations, Recommendations or Actions Taken

As discussed in the April 25, 2013 inspection report, several deep erosion gullies occupy the lower level of both groins, and repairs are required to fill the gullies and to minimize or prevent future damage to the embankment. I directed Mr. Anaya to develop and implement a plan to address the erosion.

Conclusions

From the known information and visual inspection, the dam, reservoir, and the appurtenances are judged safe for continued use.

Observations and Comments

Dam

The visible portion of the upstream face, crest, downstream face, and abutments are in generally satisfactory condition, with no indication of deep seated distress or instability. Several deep erosion gullies occupy the lower level of both groins, and repairs are required to fill the gullies and to minimize or prevent future damage to the embankment. I directed Mr. Anaya to develop and implement a plan to address the erosion.

Vegetation control is generally satisfactory, but the entire upstream face and the upper five feet of the downstream face should be mowed to remove tall and dense non-woody vegetation. Newly emerging woody bushes, and tule along the waterline, should also be cleared, and overhanging trees and bushes should be trimmed along the right downstream groin.

Similar to recent past inspections rodent control remains satisfactory and few to no indications of rodent activity were observed.

Spillway

The spillway control section and exit channel were clear and unobstructed; the entrance is occupied with young cattails which are cleared each fall in anticipation of the winter storm season. The concrete walls, floor, and support piers of the spillway remain in good condition with no significant cracks or spalls indicative of excessive stress or deterioration.

Total freeboard is 15.2 feet and the residual freeboard for the design storm is 3.4 feet. Freeboard is satisfactory.

Outlet

Plans show the normally unpressurized outlet to consist of a cast iron pipe with a concrete cap. While most of the cap is unreinforced, a short section of the cap near the upstream end of the outlet is reinforced. Upstream outlet control is provided by two vertically mounted hydraulically operated 20-inch sluice gates; a 30-inch diameter butterfly valve provides downstream control.

All upstream and downstream outlet controls were partially cycled during this inspection and all were

Photos taken? Yes X No
cc for Owner/Book

Inspected by J. Lowe 8 Apr 2016
Date of Inspection 7 April 2016
Date of Report 8 April 2016 4/11/16 4/12/16

Observations and Comments

found to be in satisfactory operating condition. All outlet controls were fully cycled during the March 5, 2015 inspection.

Seepage — The downstream face, groins, and abutments were dry and free of any indication of seepage. Horsetails which are normally scattered across the upper half of the downstream face were absent.

Instr. — Instrumentation consists of the following:

- Ten (10) operable piezometers designated 5-1, 5-2, 6-1, 6-2, 7, 7A, B-3, B-4, B-5, and B-6, installed to monitor the phreatic surface within the embankment. Piezometers are monitored monthly.
- Three (3) crest survey monuments (M-3, M-4 and M-5) installed to monitor settlement and/or displacement of the crest. Monuments are monitored on a roughly five year basis.

The complete piezometer history is somewhat complicated and is not covered in this report. A detailed review of the piezometer history is presented in the April 25, 2013 inspection report. Since the 2013 inspection four additional piezometers, designated B-3, B-4, B-5, and B-6, were installed in November of 2014.

The latest instrumentation data was received from the owner on December 16, 2015. Piezometer data covers the period between January 2006 and July 2015. Piezometer 6-1 has gone dry and data for 6-1 is not presented. For the period reviewed all of the remaining piezometers follow historic patterns, and no long-term indication of a change of the phreatic surface within the embankment is indicated.

Settlement data covers the period between December 2005 and June 2015. The measured maximum total settlement is 0.346 feet (4.2") for monument M-5 on November 12, 2015. Monuments M-3 and M-4 show maximum total settlements of 1" and 2", respectively.

Alignment data covers the period between January 1982 and August 2015. There is nothing of note since the previous instrumentation report of April 2013, except for a small downstream displacement of all three survey monuments following the August 24, 2014 Napa Earthquake. Monument M-5 moved an additional 0.9" for a total historic total downstream displacement of 3.2". Monuments M-3 and M-4 moved an additional 0.3" and 0.4", resulting in total downstream displacements of 1.2" and 1.9", respectively.

Spillway crack data covers the period between December 2005 and June 2015. Crack monitors indicate horizontal displacements are cyclic, with up to 5 mm displacement during the winter storm season, returning to essentially zero during the dry season. Vertical displacements, in contrast, are cumulative, and continue to increase over time. Total vertical settlement to date is on the order of 1.2 mm.

In their December 16, 2015 instrumentation data submittal letter, the owner reports, *"Except for piezometer 6.1, the Phoenix Lake piezometer readings are consistent with historic readings. Phoenix Lake Dam piezometer 6.1 is no longer valid (it is dry); and is not shown on the chart; it is isolated from its surroundings; the readings are not indicative of the general conditions within the bank.*

The Phoenix Lake Dam spillway crack monitors indicate horizontal displacements up to 5 mm. The horizontal displacement diurnal pattern reaches a peak in the winter and falls back to zero in the

Observations and Comments

summer. The vertical displacements range from +1.19 to -1.23 mm with a general trend line down of approximately 1.6 cm since installation.

Phoenix Lake dam is trending toward stabilization: settlement of -0.35 ft (maximum) and alignment of -0.27 ft. (downstream direction; maximum)."

Based on the submitted data, the dam is performing satisfactorily. No additional instrumentation is believed necessary at this time.

The upstream face as viewed from the right abutment. Tule and cattails along the upstream face waterline should be cleared before the next periodic inspection. The location of the spillway entrance is circled.

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The downstream face looking towards the spillway adjacent to the left abutment, above, and towards the right abutment, below. The spillway crack monitoring instrumentation is contained within in the box circled in the photo above. Overhanging trees and bushes should be trimmed along the right downstream groin (below).

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The raised portion of the spillway, above, and the extensometers monitoring movement along a crack through the spillway foundation, below. The location of the instrumentation is circled in the top photograph.

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Looking down the raised spillway section, above. The spillway channel outfall and the outlet box are shown below.