State of California | California Natural Resources Agency

Memorandum

Date: May 26, 2017

To: Erdom Abraham
Civil Engineering and Surveillance Section
Engineering Branch
Delta Field Division
Division of Operations and Maintenance

Tim Wehling, Chief
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Geotechnical and Engineering Services Branch
Division of Engineering

From: **Department of Water Resources**

Subject: Clifton Court Forebay—Landowner Seepage Concerns

Introduction

On May 8, 2017, I received a voicemail and email message from you asking for assistance in responding to a landowner's formal complaint about nuisance water in agricultural fields south of Clifton Court Forebay. The complaint letter, dated April 11, 2017, from Suzanne Womack to Acting Director Croyle, suggests that the nuisance water is caused by seepage from the adjacent Clifton Court Forebay (CCF) and is hampering her tenants' crop production. Ms. Womack's letter asks several questions about the CCF facility. You asked the Dams and Canals Section to answer the following three specific questions from her letter:

- *Question 1: Why is "seep 6" sufficient seepage control for the mile plus of CCF banks that border our [Clifton Court, L.P.] CCLP fields?*
- *Question 2: Where is the cutoff wall along the south banks of the CCF that border our property?*
- *Question 3: If there is no cutoff wall, how can DWR prove that seepage is not coming from CCF?*

As requested, we reviewed DWR documentation on CCF, other documents from Ms. Womack you emailed us this week, and previous complaints by Ms. Womack to DWR we found on the internet. On May 23, 2017, we performed a site visit from the Clifton Court Forebay embankment to observe the site. This memo provides a civil engineering perspective in helping to answer the questions above.

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DWR 155 (Rev 11/04)	5/24/17	5/26/17		

Background

CCF is located in Contra Costa County approximately 11 miles northwest of Tracy, California. The Forebay is a shallow reservoir with a nominal capacity of 29,000 acre-feet and a surface area of approximately 2,000 acres. CCF is charged from Old River through a control structure with five radial gates in the southeast corner of the Forebay. Water flows out of CCF through the Skinner Fish Facility, and into the Intake Channel of the Harvey O. Banks Delta Pumping Plant (DWR, 2015a).

CCLP purchased their 1,100 acre farm in 1961 (CCLP, 2016), which the State Water Project condemned in 1966. After an agreement was reached to purchase some of the property in 1967, construction began and was completed on December 17, 1969 (DWR, 1970a). "Seep 6" was originally constructed during the Clifton Court Forebay construction at approximate station 100+00. "Seep 6" was originally labeled Pump 4, but was changed to Pump 6 in 1982 when additional pumps were added at Clifton Court Road (DWR, 2006). It appears that the additional pumps are not believed to collect any dam seepage, but instead control surface drainage (from rainfall and irrigation) adjacent to the road (DWR, 1989 and 2016).

Pump 6 collects embankment toe water from approximately 2.4 miles of embankment (DWR, 2016). Reservoir seepage has been observed since at least April, 1979 (DWR, 2006) on the northern side of the reservoir. The original pump and motor were rated at 900 gpm and 1,200 rpm, respectively, though we had trouble verifying the current equipment. In general, the drainage and pump system controls the surface water immediately around the Forebay.

In December of 2016, 25 acres of CCLP farmland were reportedly lost and another 15 acres were marginally productive due to excessive water (CCLP, 2017). The property is located on the south side of the Forebay, over 4,000 feet from Pump 6, at an unknown distance from the reservoir. The property owner is concerned that the Forebay is the source of the excessive water.

Responses

Based on our site visit and review of project documents, we prepared the following responses to the landowner questions.

Question 1

Based on DWR's recent geologic report (DWR, 2015b), the majority of the reservoir is constructed out of fine grained soils, the majority of which are clay. Clay generally has the lowest hydraulic conductivity of soil-like material (sand, clay, silt, etc.). The hydraulic head within the Forebay appears to be on the order of three to seven feet. This amount of hydraulic head is quite low, meaning there is very little driving pressure to cause seepage (DWR, 2016). Therefore, the seepage from the Forebay through the clay embankment should be very small and well within the capacity of Pump 6.

The site performance also appears to show that the capacity of Pump 6 is adequate. See our response to Question 3 for further discussion.

Question 2

The Forebay embankments do not include cutoff walls. However, many modern embankment structures do not include cutoff walls.

Question 3

During our site visit, we did not see any evidence of seepage from the Forebay. Low spots that appeared to have been wet are now dry. The fields appeared to be moist where irrigated and dry at the fallowed fields, field perimeters, and access roads. Neither Pump 6 nor the private drainage pump were running because the water surface in the drainage ditches was several feet below the adjacent ground surface. It appeared that any Forebay seepage is either captured by the drainage ditches or low enough that evaporation and evapotranspiration are sufficient to remove it.

Once a seepage path exists, it requires corrective action to repair. The only way seepage may disappear seasonally is for the water source to change. For example, if the Forebay level raises and lowers seasonally, the seepage may only be present at the high stages. However, based on the Forebay elevation instrumentation data and our understanding of the Forebay operation, the Forebay has been operated consistently and within the Forebay's operational limits. Therefore, if the nuisance water observed in December was seepage related to the Forebay, the seepage should still be present and clearly visible. Given that the seepage is no longer visible, the majority of the nuisance water was not from the Forebay.

Based on the 2009 topographic LiDAR data collected by DWR, the CCLP property appears to slope gently from an elevation of 7 feet in the southwest to -4 feet in the northeast. Given the historically wet winter, we believe the observed nuisance water was ponded rainfall. The ponding was most prominent in the low spots, near the Forebay embankments.

Recommendations

If the answers above are insufficient for Operation and Maintenance or the landowner, we recommend an investigation to address the questions more conclusively. Below, we've listed preliminary investigation recommendations, which are organized in our preferred completion order. We would be happy to complete a formal scoping document, as you see fit.

- Perform a site visit with the landowner present to the precise locations of the reported seepage.

  - The evidence of the reported seepage, such as an actively flowing seep or boil, should be clearly visible, if seepage is the root cause.
  - If signs of seepage are not visible, people on-site should look for a leaky pipe, inadequate drainage ditches, improper grading, etc.

- Perform a utility clearance between the embankment and seepage using USA and a private utility locator. Depending on the distance and area, this could be a relatively inexpensive investigation and may locate a leaking water pipe.
- Perform a dive inspection to look for suction or sinkholes within the reservoir.
- Add dye or other tracer to look for hydraulic communication between the Forebay and seepage.
- Check if the existing two monitoring wells are functional and begin a monitoring program.
- Perform chemical analysis of the Forebay and seepage water to potentially rule out the possibility of one being the source of the other if their fluid characteristics are dissimilar.
- Consider installing additional monitoring wells or piezometers to clarify the relationship between groundwater and the Forebay water.
- Inspect the Forebay embankment frequently, given that it is a relatively homogeneous clay embankment (DWR, 1970b). Between the desiccation cracking, animal burrows, and potential piping, it is entirely possible for a new seep to appear.
- Suggest that the landowner add drainage ditches, improve grading, or install other drainage features at the low spots at the northern end of the property. Suggest that the landowner confirm their pumps are functioning properly.

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