

MEMORANDUM

Date: February 26, 2016
To: Water Right File 65-22979 and 65-23479
From: A. Newbry
Re: Dam Safety Site Visit

On February 26, 2016, I accompanied State Dam Safety Engineer John Falk and Western Region Dam Safety Engineer Erik Boe to the reservoir at Big Willow Ranch (formerly known as Bettis Reservoir) presently owned by JG Schwartz.

Purpose of visit: In 2014, Dry Creek Main dam was raised by 13 feet. A great deal of erosion and leakage was found at the site visit in Feb. 2015. Since that time, the owner has been making repairs to the structures. The system is composed of a Dry Creek Main Dam, Dry Creek Auxiliary Dike, and Dry Creek Diversion & Canal. The purpose of the trip was to view how effective the repairs have been as the reservoir is beginning to fill.



Dry Creek Reservoir was full at the time of the site visit. This was the reservoir view from the Main Dam.



(Left) Dry Creek Reservoir was full and spilling at the spillway near the Dike. (Right) The Diversion Dam storage was nearly full, 10.5 inches from the spillway crest.

No representatives of Big Willow Ranch were available to accompany us during the site visit. During the visit, I had the opportunity to observe and confirm “diversion to storage” and almost “irrigation from storage” occurring. Dry Creek Reservoir was full and spilling over the spillway near Dry Creek Auxiliary Dike. In addition, Dry Creek Diversion Pool (some storage behind diversion dam) was nearly full—about 10.5 inches below the crest of the spillway. The outlet of Dry Creek Main Dam diverts directly into a large subterranean HDPE pipe to the irrigation system. Four large vents at the toe of the Main Dam are plumbed to facilitate diversion directly into the irrigation distribution system. Irrigation was not occurring at the time of the site visit, due to the time of year.



(Left) We observed the four large vents at the toe of the Main Dam. (Right) Farther down the access road, we stopped to look at the outlet valve and vent.

John Falk wrote a trip report which includes greater details about the dams and reservoirs from a Dam Safety perspective (attached).



Dam Safety Section

TRIP REPORT

TO: Nick Miller, Western Region Manager
CC: Erik Boe, Ashley Newbry, Jeff Peppersack
FROM: John Falk, PE
DATE: February 26, 2016
SUBJECT: Dry Creek Diversion Dam
IDWR File: 65-7603 (65-23479 enlargement)

On Friday 2/26/2016, IDWR personnel visited the referenced site following notice by the dam owner, Mr. JG Schwarz (Big Willow Ranch), that the reservoir was nearing the full-pool design elevation 2636.0 feet. The reason for our visit was to observe the first complete filling of the reservoir since construction was completed in autumn, 2014. Although construction activities for enlargement of the Main Dam, the Auxiliary Dike and the Diversion Dam were generally finished in time for last year's spring runoff (2015), the reservoir did not achieve the maximum pool level due to an abnormally dry winter season.

Upon arrival, all three of the earthen embankments were inspected, in keeping with IDWR Dam Safety program schedule. At the time of our visit the weather was clear, warm and dry. The reservoir impounded by the Main Dam and Auxiliary Dike was full, with approximately one-half inch (0.5") depth of flow passing over the crest of the primary emergency spillway (Photo 1). The pool level behind the Diversion Dam was measured 10½ inches below the concrete spillway crest (design elevation 2637.0'). Inspection reports and accompanying photographs for each dam are being finalized; however, they are not included with this summary report which was deemed necessary to describe our unexpected observations of leaking waters flowing in multiple rivulets down the exposed slope of the Diversion Dam (Photo 2-4).

At the Diversion Dam, we observed multiple rivulets at randomly spaced locations across the downstream slopes of the earthen embankment; including several that were flowing measureable quantities of water. The larger source of the water supplying the rivulets likely originates from the reservoir impounded behind the diversion dam. The flow of water was confined to narrow rills which appeared to have been eroded into the earthen soils by the force /velocity /duration of the flow. Of all dozen or so flowing rivulets observed, the greatest flow was estimated to be 2 gallons per minute (Photo 5).

All features exhibited evidence of erosion; however the rate-of-flow was generally too small in most of these to be measured, and instead might well be considered to resemble more of a seep versus a leak. Nonetheless, all of these features were easily viewed due to the depth of the eroded channels (2-5 inches) that had been eroded into the exposed slope, and the distinct dark color associated with the accompanying moisture. Other smaller rills were observed, but all of those which were not wet may have been created by surface runoff and not from water leaking /seeping from out of the slope. Leaking water appeared to be emanating at or near the tops of the rivulets, as a point source, instead of being dispersed equally along the length of the rill.

Further, the uppermost elevation of the rivulets appeared to have a common upper lineal boundary; i.e. the appearance of flow was associated with a horizontal feature, band or layer within the mass of the embankment (Photo 3). The lower portions of the exposed embankment slope were dry except in, or immediately adjacent to, the channels (rills) created by the rivulets. Discharge from the toe drain was significantly less than the sum of the leakage flowing from the rivulets. Such observations suggest that the embankment is not saturated, and that the phreatic line does not daylight high on the slope. An explanation for the numerous rivulets may be the result of a permeable layer of material that was introduced during construction of the embankment, or perhaps due to improperly compacted layers of fill materials in the dam.

Conclusions and Recommendations

Regardless the causes for the multiple leaks witnessed on the exposed slope of the Diversion Dam any appearance of seepage, and especially that of *flowing water*, located anywhere on the downstream face of an earthen dam is reason for concern. Without undue delay, the owner must begin lowering the level of the reservoir to an elevation that results in stoppage of all observed leakage. In the interim, the dam owner and his engineer should begin making necessary arrangements to investigate and positively identify the source of the leak(s). Once identified, the embankment must be repaired in a manner that results in satisfactory resolution of this observed deficiency. Failure to make adequate repair and/or to lower the pool level in a timely manner may result in catastrophic breach of the embankment. The storage certificate for the Diversion Dam expires at the end of the year, 12/31/2016; its existing status and future renewal should be dependent on whether or not this problem is resolved.



Photo 1 – Primary overflow spillway located on the south (right) side of the Auxiliary Dike. This feature regulates the pool level associated with the larger reservoir impounded by the Main Dam and the Auxiliary Dike. Water to fill the 1859 AF reservoir is diverted from Dry Creek via a canal. As shown, the crest of the concrete weir at the Auxiliary Dike defines the maximum pool.



Photo 2 - Downstream, south-facing slope of the Diversion Dam located on Dry Creek. Flowing water was observed in some of the larger features; many of the smaller rills exhibited moisture.



Photo 3 – Similar view illustrating the source of rivulets and deposited soil at the toe of the slope.
Dry Creek Diversion Dam

2/26/2016

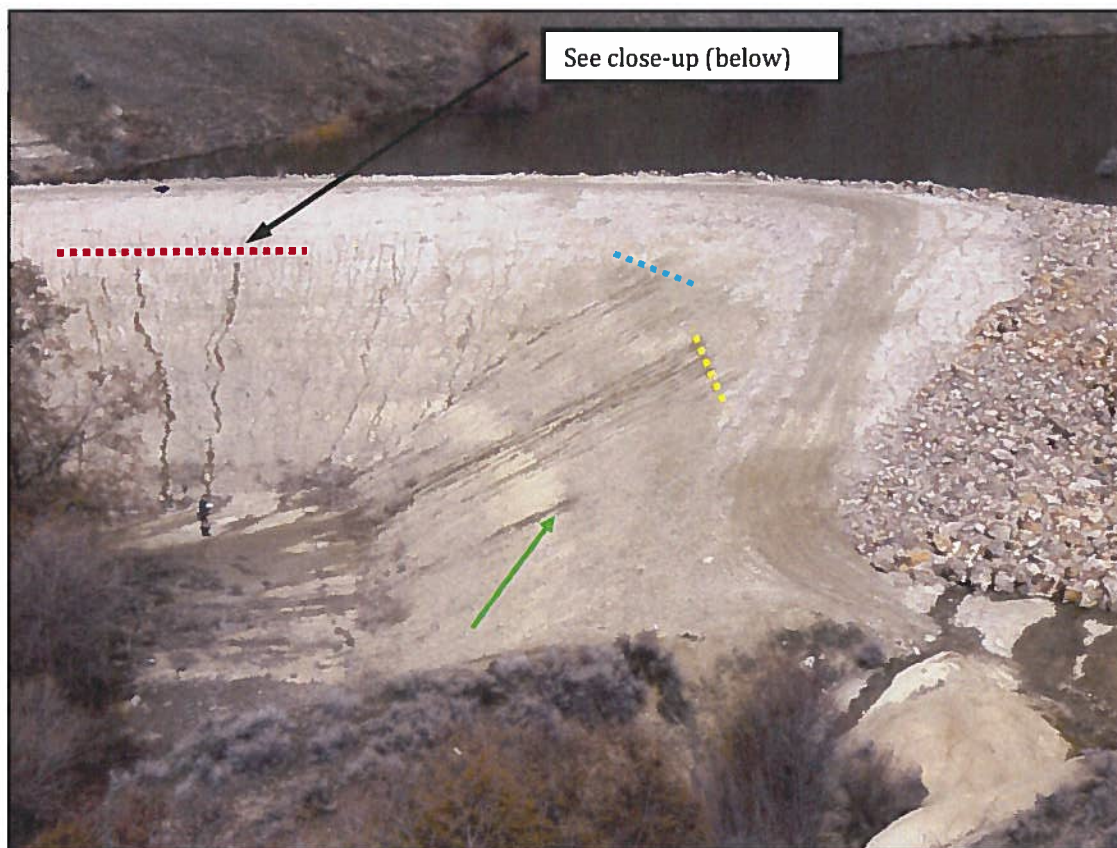


Photo 4 – Reverse view looking westerly at other deeply incised rills on the downstream slope of the Diversion Dam. Note the person at the toe of the slope for scale.



Photo 5 – Close-up showing the origin of one of the larger flowing leaks, estimated @ 2 gpm.

Table 1 - Summary of elevation survey identifying the top(s) of observed rivulets relative to the concrete crest of the overflow spillway.

DRY CREEK DIVERSION DAM - - - IDWR FILE: 65-6703 (NATDAM: ID00544)				2/26/2016 (falk/boe)
INSTRUMENT	ROD (FEET)	STATION	DESCRIPTION	STATION ELEV.
2638.59	1.59	*0 -40	East (left) side, crest of concrete weir defining the overflow spillway	2637.00
2638.59	1.6	*0 +40	West (right) side, crest of concrete weir defining the overflow spillway	2636.99
2638.59	19.01	1	South-facing slope, far east edge, wet area approx. one-half distance down slope	2619.58
2638.59	8.31	2	South-facing slope, top of rivulet #1W	2630.28
2638.59	8.29	3	South-facing slope, top of rivulet #2W	2630.30
2638.59	8.37	4	South-facing slope, top of rivulet #3W	2630.22
2638.59	7.45	5	Center junction between south-facing and east-facing slope; Rivulet #1	2631.14
2638.59	7.25	6	Center junction between south-facing and east-facing slope; Rivulet #2	2631.34
2638.59	7.18	7	Center junction between south-facing and east-facing slope; Rivulet #3	2631.41
2638.59	5.99	8	East-facing slope, top of rivulet #1S	2632.60
2638.59	6.48	9	East-facing slope, top of rivulet #2S	2632.11
2638.59	6.76	10	East-facing slope, top of rivulet #3S	2631.83

Pool Level @ Diversion Dam: 2637.0 feet - 0.875 feet (10-1/2 ") = ±2636.13 feet
 Toe Drain Invert: ±2602 feet (estimated from record drawings)
 * Stationing referenced to Record Drawings, Sheet C301

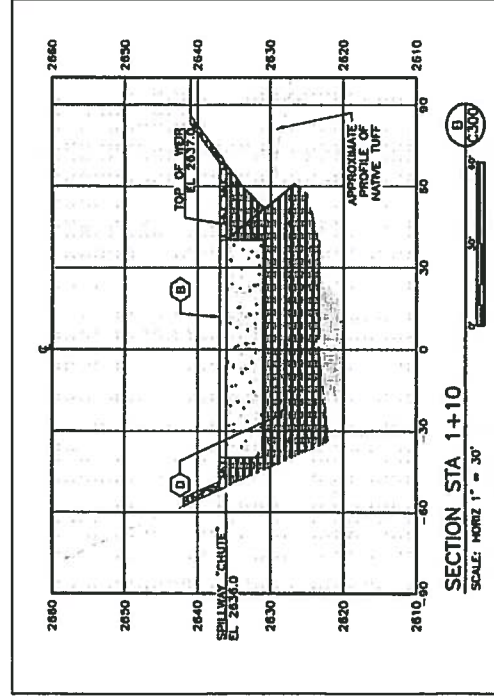


Table 1 (above) – Summary of elevation results from level-line survey performed 2/26/16. All elevations are relative to the crest of the concrete overflow spillway. Station No's 1-10 were arbitrarily assigned to identify the approximate locations of rivulets exhibiting leakage/seepage.

Figure 1 (left) – Reprint from Record Drawings, Sheet C301 illustrating the cross-section of the concrete overflow spillway along the center-line axis. Note the view is in the direction of flow, downstream convention (left = east).

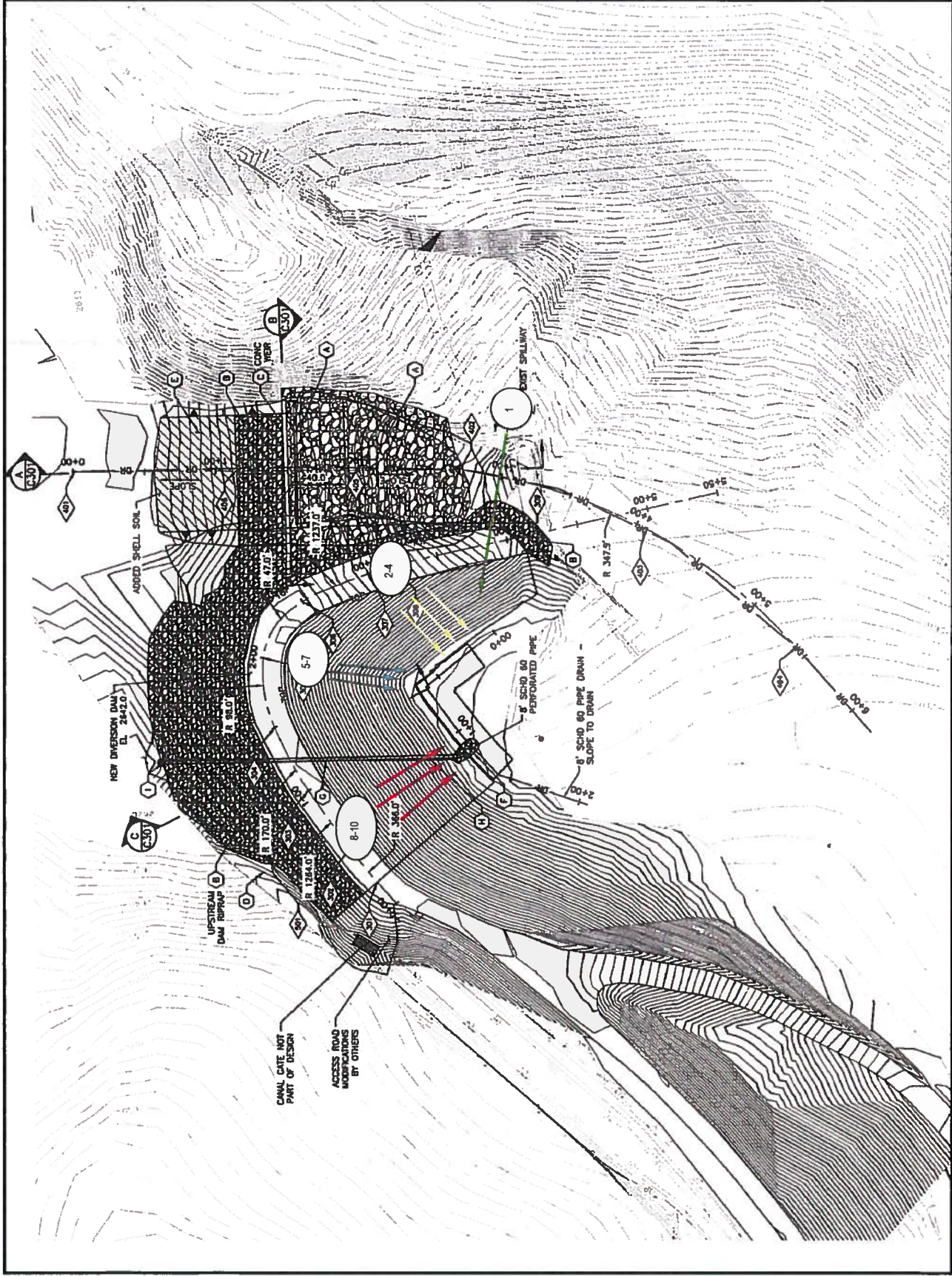


Figure 2 - Copy from Record Drawings-Sheet C300, showing approximate locations of rivulets; identified per Stationing in Table 1 (see photos 2-4).