

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

TESTIMONY OF FREDERICK J. WENTZ, JR.

I. QUALIFICATIONS

1. I am a California-registered Civil Engineer and a California-registered Geotechnical Engineer with the firm of Paragon, Inc. ("Paragon"). I have a bachelor of science degree in Civil Engineering from California Polytechnic State University, San Luis Obispo (1988) and a masters of science degree in Civil Engineering from the University of California, Berkeley (1991). I have more than 20 years of experience in geotechnical engineering, earthwork construction and testing and inspection, and have a wide range of project experience including shallow and deep foundation design, underground pipelines, and earth- and rockfill dam design. A true and correct copy of my resume has been submitted as Hidden Lakes Estates ("HLE") Exhibit 40.

II. SUMMARY OF ANALYSIS AND CONCLUSIONS

1. In the Notice of Public Hearing for this proceeding dated November 4, 2009, the State Water Resources Control Board ("State Water Board") identified the following two key issues upon which to receive evidence in this hearing:

(1) Does a misuse of water exist at the Hidden Lakes Estates Homeowners Association's northern lake?

(2) If the Association is misusing water, what corrective actions should the State Water Board require the Association to take, in accordance with what time schedule, to prevent the continued misuse of water?

2. Beginning in February 2007, I was retained by the Hidden Lakes Estates Homeowners Association ("HOA") to conduct an investigation of potential seepage from the northern lake. My scope of work included investigating issues relating to seepage from the Hidden Lakes Estates subdivision's northern lake, including review of existing technical/geologic materials, drilling four exploratory borings in the northern lake dam/berm and one in the southern lake dam/berm, and conducting testing, engineering analysis and groundwater measurements. The results of that investigation is presented in a Report titled

1 Geotechnical Evaluation of Pond Seepage, which is dated May 5, 2008 and has been submitted
2 as HLE Exhibit 16. Paragon has continued monitoring groundwater levels and prepared a
3 supplemental memorandum dated September 14, 2009, which has been submitted as HLE
4 Exhibit 15.

5 3. In my professional judgment, the seepage associated with the northern lake does
6 not constitute a “misuse” of water as I understand the term, which is not commonly used by
7 geotechnical or hydrologic engineers to describe dam seepage. There is some seepage through
8 and beneath the dam. However, a majority of earthen dams seep, and the seepage for this dam
9 is not excessive; in fact, the observed seepage is typical for the vast majority of earthen dams of
10 this type of construction. Laboratory tests of soil samples indicate that the dam soil has a
11 relative compaction on the order of 90 to 91 percent. Although 95 percent compaction was
12 specified on the dam’s as-built drawings, laboratory-measured permeability rates are lower than
13 expected, perhaps due to infiltration of bentonite clay into the embankment materials or
14 application of bentonite to the surface of the dam. Soil samples from higher on the
15 embankment were not wet, though wet soil occurs near the base of the embankment. No
16 indications of embankment instability were observed. (HLE Exhibit 16.) I understand that the
17 State Water Board staff may be concerned about the seepage because of the proximity of the
18 seepage to Lots 71 and 72. In that regard, I and my team made four site visits during March to
19 April of 2007 and saw no obviously wet/saturated ground or standing water, though the ground
20 in the backyard of Lot 71 was quite damp and standing water was in a valve box. Local
21 conditions such as perched groundwater on shallow bedrock due to landscape irrigation or
22 recent rainfall may also explain seasonal dampness on low-lying areas such as Lot 71 and 72.
23 In addition, my review of the as-built subdivision construction drawings show a drainage swale
24 occurring along the property line between Lots 71 and 72, and the swale appeared to have been
25 substantially filled in, particularly in the back portion of the lots. (HLE Exhibits 2 and 16.) If
26 the swale had been in the state shown on the as-built drawing or restored to that condition, the
27 local water table might be lower with a corresponding reduction in dampness in the yards of
28

1 Lots 71 and 72.

2 4. Although I conclude that a misuse of water does not exist due to seepage from
3 the northern lake, there are measures that could be undertaken to reduce the seepage. The most
4 economical fix under the circumstances would entail installing a curtain drain along the
5 downside toe of the existing embankment to capture some of the seepage and pump it back into
6 the lake or downstream of Lots 71 and 72. A curtain drain would be best installed between
7 mid-summer to mid-fall, when precipitation events are least likely.

8 **III. DESCRIPTION OF INVESTIGATION**

9 5. Prior to conducting field and laboratory work on the dam and dam materials, I
10 reviewed selected geological references to familiarize myself with the local geological conditions.
11 The nature of the subsurface conditions in the vicinity of the dam are described on page 6 of HLE
12 Exhibit 16, and consist largely of granodiorite bedrock overlain by loose to medium density silt
13 sands.

14 6. As part of my investigation, I and my team conducted four site visits to the
15 northern dam and environs. We drilled six exploratory borings within and near the northern dam
16 in order to characterize the nature of the materials comprising it: B1, B1A, B2, B2A, B3 and B4.
17 A detailed material description of each of the borings, based on later laboratory analysis and
18 classification, is provided on Plates 5-10 of HLE Exhibit 16.

19 7. Laboratory and field tests indicate that bedrock occurs in the low part of the dam at
20 ranges between about 3 and 9 feet. The soil is relatively well compacted, at a relative compaction
21 of approximately 90 to 91 percent. The results of the permeability tests are shown on page 7 of
22 HLE Exhibit 16. The tests indicate a lower rate of permeability than expected for soil of this
23 relative compaction, which may be due to the infiltration of bentonite clay into the materials.

24 8. Free groundwater was logged in two adjacent borings (B1 and B1A) and wet soil
25 was logged in borings B2 and B4 at the time of drilling. The conditions observed in the borings
26 support the conclusion that water primarily seeps through the dam foundation just above bedrock;
27 samples taken just above bedrock were wet, while higher samples were not. We observed no
28

1 seepage on the downstream face or toe of the dam. (HLE Exhibit 16 at 8.)

2 9 We installed piezometers in the borings to maintain a record of water levels over
3 time. The piezometer readings are depicted in a September 2009 memorandum that has been
4 submitted as HLE Exhibit 15. The piezometer readings near the northern lake have been fairly
5 steady during relatively dry periods such as April 2007 to the winter of 2008. Localized readings
6 varied much more during the wet period from February to May 2009. These fluctuating readings
7 suggest that higher groundwater levels around the northern end of the lake are primarily related to
8 seasonal precipitation, possibly with a limited effect due to higher lake levels.

9 10. In my judgment, the seepage through the dam is not excessive for the type of
10 structure. Rather, the seepage is consistent or even somewhat low compared to what would be
11 expected with the measured level of compaction of the embankment soils. All earth dams seep,
12 and this one does not appear to be performing poorly. (HLE Exhibit 16 at 9.)

13 11. We had a very limited period of access to piezometers installed by others on Lots
14 71 and 72, from early April to the end of July. (The lot owners declined to grant authorization to
15 enter their property for purposes of taking groundwater measurements. HLE Exhibits 23 and 27.)
16 Groundwater levels in the two lots fell fairly significantly from April 1 to July 1, by 9 to 13
17 inches. The levels recovered slightly by July 31, possibly due to localized landscape irrigation.
18 (HLE Exhibit 15.)

19 12. During the four site visits we made to Lots 71 and 72 in the spring of 2007, we did
20 not observe obviously wet or saturated ground. The ground on Lot 71 was quite damp in some
21 locations, and we observed standing water in an irrigation valve box, which would not be
22 unexpected for a well-irrigated yard in shallow bedrock terrain. (HLE Exhibit 16 at 9.)

23 13. Given the shallow bedrock throughout the subdivision, it is reasonable to conclude
24 that perched groundwater is present on Lots 71 and 72 during periods of precipitation and over-
25 irrigation. (HLE Exhibit 16 at 10.)

26 14. In my review of background material prior to investigation of the northern dam
27 and vicinity, I reviewed a Hidden Lakes Estates subdivision plot map showing a “meandering
28

1 drainage easement” on the property boundary between Lots 71 and 72. The drainage swale
2 depicted on the drawing appears to have been substantially filled in, particularly in the backyard
3 area of the lots. The location of the historical drainage swale is consistent with a 16-inch
4 diameter pipe coming from the pond through the north pond and a corresponding 12-inch
5 diameter pipe running along the Lot 71 and 72 property boundary. Presumably, the 12-inch
6 diameter pipe originally carried flow from the 16-inch diameter pipe. (HLE Exhibit 16 at 10.)

7 15. Based on the above, I conclude that the seepage through the northern lake dam is
8 not excessive based on the dam’s construction or its proximity to the residential Lots 71 and 72.

9 **IV. POSSIBLE ACTIONS TO REMEDIATE SEEPAGE**

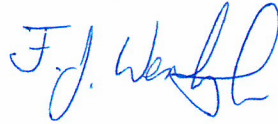
10 16. Although I conclude that seepage through the dam does not constitute a misuse of
11 water, I have identified potential actions to reduce the seepage.

12 17. Cement grout could be injected into the dam, targeted toward zones of relatively
13 low resistivity and/or saturated materials. Injection fixes can be quite involved, given difficulties
14 in predicting the interaction between soil and grout materials, and could cost on the order of
15 \$50,000 to \$250,000. Another possibility would be to drain the lake and line the entire lake
16 footprint.

17 18. In my judgment, the most feasible way to address seepage from the northern dam
18 would be to install a “curtain drain” along the downstream toe of the existing embankment to
19 capture some of the seepage, and pump it back into the lake or downstream of Lots 71 and 72. A
20 mechanical sump pump would be needed convey the collected water into a drainage pipe
21 terminating downstream from Lots 71 and 72. These types of projects would be best installed
22 during the dry season, probably between mid-summer to mid-fall, when precipitation events are
23 least likely.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

Respectfully submitted,



FREDERICK J. WENTZ, JR.