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8	SUPERIOR COURT OF THE STATE OF CALIFORNIA	
9	COUNTY OF LOS ANGELES	
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11	Coordination Proceeding Special Title (Rule 1550(b))	Judicial Council Coordination Proceeding No. 4408
12	ANTELOPE VALLEY GROUNDWATER	
13	CASES	SUPPLEMENTAL DECLARATION OF BRUCE N. NELSON DE EOD HEADING ON
14		JURISDICTIONAL BOUNDARIES
15	Los Angeles County Waterworks District No. 40 v. Diamond Farming Co.	(U.S. BORAX)
10	County of Los Angeles, Case No. BC 325 201	Time: 10:00 a.m. Dept: 1
18	Los Angeles County Waterworks District No. 40 v. Diamond Farming Co.	
19	Superior Court of California, County of Kern, Case No. S-1500-CV-254-348	
20	Wm. Bolthouse Farms, Inc. v. City of Lancaster	
21	Diamond Farming Co. v. City of Lancaster Diamond Farming Co. v. Palmdale Water Dist.	
22	Superior Court of California, County of Riverside, consolidated actions, Case	
23	Nos. RIC 353 840, RIC 344 436, RIC 344 668	
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I, BRUCE N. NELSON, declare as follows:

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1. I am a consultant and have served as an expert in groundwater hydrology and engineering hydrology. I have been retained in this matter to provide technical assistance with surface and groundwater hydrology, including assessment of the groundwater supply at U.S. Borax's operations in Boron, California.

2. I am a Registered Professional Engineer (#11710) nationally via the National Council of Engineering Examiners, and individually registered in six western states for the past 21 years. I am currently a licensed monitoring well constructor, and a member of the Association of Groundwater Scientists and Engineers, a division of the American Water Well Association. My education includes a Master of Science degree from Montana State University in Civil/Environmental Engineering, specializing in water resources engineering, with a minor in chemistry. My work experience in the field of hydrology and water resources engineering covers the past 24 years, most of which has been in applied hydrology in the industrial sector.

### **Purpose and Background**

3. This declaration is being provided in-lieu of presentation of testimony during the proceedings of October 10-12, 2006. This declaration addresses the pending Court establishment of administrative boundaries to define the extent of the "Antelope Valley Groundwater Adjudication" in southern California. Specifically, this declaration discusses the northeast area of the Antelope Valley Groundwater Basin (AVGB), commonly referred to as the North Muroc area. Several experts have submitted declarations and provided testimony that propose a boundary in the North Muroc area. Though most of these proposals are similar or identical to the boundary proposed in our July 24, 2006 declaration, a few are not. This declaration is provided to address the differences in the proposed boundary for the Muroc area and technical support for the boundary as proposed in the U.S. Borax declaration of July 24, 2006.

4. As an aid to discussion, attached hereto as **Exhibit A**, is a map of the Muroc and 25 adjacent area. This map is based upon Geographical Information Systems (GIS) data and base map, 26 dated May, 2006, obtained from the California Department of Water Resources (DWR). The map 27 also depicts significant cultural features and legal boundaries such as the Public Land Survey (PLS). 28

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The map also shows the Antelope Valley Adjudication area as proposed in this declaration for the North Muroc area.

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### **Basic Hydrogeologic Regime**

5. Investigations conducted by the U.S. Geological Survey and others indicate that the North Muroc Basin is a sub-basin of the greater AVGB and is contained within the Antelope Valley surface watershed (C.E. Lamb, 1980; Leighton et. al, 2003). It is also generally agreed by several hydrogeologic investigations that consolidated rock within the drainage basin, including volcanic, igneous and metamorphic crystalline rock, and consolidated sedimentary rock, are not significant aquifers (Kunkel, 1962; Bloyd, 1967; Carlson et. al., 1988; Leighton et.al., 2003, Phillips, Carlson et. al., 2003). "Significant" is used here to generally refer to the possibility of developing the groundwater in quantities such that it would likely be of potential interest to large water users such as agriculture, industry or municipalities. Groundwater resources of bedrock areas comprising numerous un-named outcrops within the watershed, are not known to be significant groundwater resources.

6. Given that the consolidated rock lacks the hydraulic characteristics which allow significant water development, it would be difficult to impact the consolidated rock aquifer through development and pumping such that there would be measurable or manageable effects on the available water in the unconsolidated aquifer deposits that form the main drainage basin and the principal aquifer system. Therefore, with respect to the function of the consolidated rocks in the groundwater basin, including the North Muroc sub-basin, the consolidated rocks constitute a hydrologic boundary condition to the principal water bearing materials within the Antelope Valley watershed which are unconsolidated alluvial and lakebed sediments (L.C. Dutcher, G.F. Worts, 1963; Bloyd, 1967; Kunkel, 1962).

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## Specific Discussion of Boundary in Vicinity of the North Muroc Sub-basin

7. Given the role of consolidated bedrock vs. unconsolidated sediments in the North Muroc sub-basin, the extent of the adjudication boundary in this area should reflect the extent of the unconsolidated deposits plus known subsurface boundary conditions imposed by bedrock elevational highs that preclude groundwater movement. The DWR Bulletin 118 (2003) map shows the extent of

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the surficial contact of unconsolidated deposits with bedrock. In general this map approximates the 2 extent of the unconsolidated deposits, but does not take into account areas where the subsurface structure (elevation) of bedrock precludes groundwater movement between alluviated areas. For the 4 North Muroc sub-basin, U.S. Borax's proposed boundary takes into account both the surface expression of bedrock and the subsurface bedrock structure and occurrence of developable quantities of water. This boundary is partially based upon drilling conducted in the vicinity of the mine and processing plant area of U.S. Borax's operations.

8. Referring to Exhibit A, U.S. Borax has conducted drilling in the area of T11N, R8W, 9 Sections 9, 16, and 17. This area has been indicated on some area mapping as part of the AVGB and 10 an apparent pathway for water movement from the area labeled on Exhibit A as "North Basin," into the North Muroc Basin. Wells GWM-77, GWM-78, GWM-82, and GWM-81 in this area show the 12 unconsolidated materials to be dry (these well logs have been filed with Kern County and the DWR). 13 In addition, the bedrock in this area is 85 feet below land surface at elevation 2342 feet above mean 14 sea level, whereas the water level in the North Basin, as depicted by the potentiometric isopleths, is approximately 100 feet lower. The potentiometric isopleths in the North Muroc are approximately 16 167 feet lower than the bedrock elevation. Exhibit A also shows that this area is bounded on both sides by consolidated rocks outcropping at land surface at multiple locations, which is additional 18 indication of shallow bedrock. For these reasons, the bedrock in this area whether exposed at the 19 surface or buried at relatively shallow depth form a hydrologic boundary for the unconsolidated 20 materials aquifer.

21 9. In addition to the bedrock elevation and the difference in water elevation between the 22 North Basin and the North Muroc Basin, the water quality is diagnostically different. Water quality 23 data for 2004 available through the U.S. Geological Survey was examined for the North Muroc Basin 24 and the North Basin, supplemented by sampling and analysis conducted by U.S. Borax. This data 25 shows the total dissolved solids concentrations in the North Muroc basin average 542.5 mg/l, whereas 26 the North Basin water averages 720 mg/l—a difference of 177.5 mg/l or about 32.7%. This 27 difference suggests that these waters are chemically independent.

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10. Again referring to Exhibit A, a narrow alluviated gap (T11N, R9W, Sections 11 and 12) leading to the area the area labeled as the Peerless Basin (sometimes also referred to as the Castle Butte Basin), exhibits similar multiple small outcroppings of bedrock within a relatively narrow gap between larger outcrops through a 1.5-mile constricted gap with some unconsolidated in-filling. This is strongly suggestive of similar subsurface shallow bedrock constituting a bedrock-unconsolidated aquifer boundary. Published potentiometric surface mapping of the Peerless Basin suggests either a flat or even a central depression in the potentiometric surface indicating no flow either to or from Peerless to the North Muroc (C.E. Lamb, 1980).

11. Finally, again referring to Exhibit A, another narrow alluviated gap between consolidated rock outcrops exists in T11N, R9W, Sections 17 and 18 leading to the Fremont Basin. This location exhibits similar surface expressions of multiple small bedrock outcrops between major outcrops in a narrow (1.5-mile) gap. This gap has been recognized by past investigators to apparently pass some water from the North Muroc Basin to the Fremont Basin (Leighton et al., 2003) though it is unknown upon what hard data this is based other than apparent water potentiometric trends on either side of the alluviated gaps. Without the data, however, these trends do not of themselves necessarily prove hydraulic communication, only that isopleth lines have been drawn.

12. In conclusion, natural boundary conditions of shallow bedrock in the north eastern boundary of the AVGB, specifically the North Muroc basin, prevent groundwater movement entirely in some areas and provide substantial impediment to flow or an absolute boundary in others. Therefore, it is my opinion that the boundary proposed in Exhibit A, and recommended by several other parties to this adjudication, provides a reasonable management boundary for the AVGB.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed this 18th day of October 2006, at Sheridan, Wyoming.

/s/ Bruce N. Nelson BRUCE N. NELSON, P.E.

# EXHIBIT A – MAP



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# **EXHIBIT B – REFERENCES**

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