ERIC L. GARNER, Bar No. 130665
JEFFREY V. DUNN, Bar No. 131926
MARC S. EHRLICH, Bar No. 198112
JILL N. WILLIS, Bar No. 200121
BEST BEST & KRIEGER LLP
5 Park Plaza, Suite 1500
Irvine, California 92614
Telephone: (949) 263-2600
Telecopier: (949) 260-0972

Attorneys for Cross-Complainant
ROSAMOND COMMUNITY SERVICES
DISTRICT AND LOS ANGELES COUNTY
WATERWORKS DISTRICT NO. 40

EXEMPT FROM FILING FEES UNDER GOVERNMENT CODE SECTION 6103

SUPERIOR COURT OF THE STATE OF CALIFORNIA

COUNTY OF LOS ANGELES

Coordination Proceeding Special Title (Rule 1550(b)) ANTELOPE VALLEY GROUNDWATER CASES Included Actions: Los Angeles County Waterworks District No. 40 v. Diamond Farming Co. Superior Court of California, County of Los Angeles, Case No. BC 325 201 Los Angeles County Waterworks District No. 40 v. Diamond Farming Co. Superior Court of California, County of Kern, Case No. S-1500-CV-254-348 Wm. Bolthouse Farms, Inc. v. City of Lancaster Diamond Farming Co. v. City of Lancaster Diamond Farming Co. v. Palmdale Water Dist. Superior Court of California, County of Riverside, consolidated actions, Case Nos. RIC 353 840, RIC 344 436, RIC 344 668, ROSAMOND COMMUNITY SERVICES DISTRICT; LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 40;	Judicial Council Coordination Proceeding No. 4408 DECLARATION OF JOSEPH C. SCALMANINI, P.E., REGARDING THE BOUNDARIES OF THE ANTELOPE VALLEY FOR ADJUDICATION PURPOSES – KERN AND LOS ANGELES COUNTIES, CALIFORNIA

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PALMDALE WATER DISTRICT;
CITY OF LANCASTER;
CITY OF PALMDALE,
LITTLEROCK CREEK IRRIGATION DISTRICT,
PALM RANCH IRRIGATION DISTRICT;
QUARTZ HILL DISTRICT;
CALIFORNIA WATER SERVICE COMPANY,

Cross-Complainants,

v.

DIAMOND FARMING COMPANY; et al.,

Cross-Defendants.

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IRVINE, CALIFORNIA 92614

Declaration of Joseph C. Scalmanini, P.E.
Regarding the Boundaries of the Antelope Valley for Adjudication Purposes
Kern and Los Angeles Counties, California

I, Joseph C. Scalmanini, hereby declare:

I am a registered Civil Engineer in California and president of Luhdorff and Scalmanini, Consulting Engineers, Inc. which specializes in geologic, hydrologic and engineering work associated with the investigation, assessment, development and management of groundwater resources throughout California, and which also specializes in water resources engineering work for municipal, agricultural, and industrial water supply throughout California. I have conducted and directed ground-water assessments and investigations, developed and implemented ground-water monitoring and management programs, designed ground-water development projects, and conducted and directed water resources engineering projects throughout California over the last 39 years. Prior to the founding of Luhdorff and Scalmanini, Consulting Engineers in 1980, I was a Development Engineer at the University of California, Davis, where I directed applied research in ground water and taught classes in Hydraulics and Principles of Ground-Water Management; my association with the University continues as an instructor in a University Extension class on Ground-Water Hydrology and Law. A copy of my resume, which accurately states my education and experience, is attached to this declaration as Attachment 1.

I have prepared this declaration regarding boundaries of the Antelope Valley for adjudication purposes at the request of several municipal water purveyors in the Antelope Valley including Antelope Valley Water District (California Water Service Co.), the City of Lancaster, Los Angeles County, Palmdale Water District, Quartz Hill Water District, and Rosamond Community Services District. This declaration is organized into four parts to first discuss my understanding of the fundamental issue in the Antelope Valley adjudication as a basis for considering and recommending boundaries; to then delineate a number of physical, hydraulic and other factors that might be considered in selecting boundaries; to describe and illustrate my conclusions regarding boundaries for purposes of the adjudication; and finally to discuss some other considerations, most notably the sources and locations of groundwater recharge as they relate to the selection of adjudication boundaries.

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Antelope Valley Adjudication

My understanding of the Antelope Valley adjudication is that it is intended to adjudicate rights to groundwater in the Antelope Valley or, perhaps more precisely, rights to pump or otherwise extract groundwater from the Antelope Valley. My further understanding is that this adjudication is not, at least as filed, to adjudicate rights to all the waters (e.g. surface water, groundwater, imported water, treated waste water) that originate in, or otherwise enter, the Antelope Valley.

The balance of this declaration is based on the preceding understandings. As a result, it addresses what I would consider to be the most appropriate area for adjudication, most of the Antelope Valley Groundwater Basin, because that would comprise the area where, for practical purposes, all the significant and substantial groundwater pumping can occur. However, recognizing that there may be issues that relate to waters which originate outside the groundwater basin, in particular such as any of those waters contribute to recharge in the groundwater basin, I have included a discussion of the various components of groundwater recharge that occur in the

Antelope Valley, first to place them in a context, but primarily to note how they are accounted in determining groundwater basin yield, which in turn is the foundation of adjudication or otherwise allocating rights to pump from the basin.

Boundary Criteria

In a traditional sense, a groundwater basin can be considered to consist of one or more aquifers which can be developed (usually by wells) to provide a substantial water supply; the "basin" would extend spatially and vertically to some limits defined by physical, hydraulic, or other conditions. In the most general and traditional sense, the limits or boundaries of a groundwater basin may be envisioned as the locations where water-bearing subsurface materials end (the sands, gravels, and other "unconsolidated" materials that comprise most aquifers) and non-water bearing materials begin (so-called basement or other rock, i.e. "consolidated" materials, including fractured or weathered rock which may have some water-bearing capability, but usually to a very limited degree).

The technical literature does not extensively define what is meant by "groundwater basin", or what comprises one. In the second edition of his seminal textbook **"Groundwater Hydrology"**, Todd notes that "(a) *groundwater basin* may be defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers. Such a basin may or may not coincide with a physiographic unit" (Todd, 1980). A footnote in Todd qualifies the definition "(i)n practice the term *groundwater basin* is loosely defined; however, it implies an area containing a groundwater reservoir capable of furnishing a substantial water supply." In **Groundwater Rights in California, Background and Issues** (Schneider, 1977), the Appendix addresses common ground-water terms and concepts, and includes a listing of a number of vertical and lateral physical, hydraulic, and political boundaries that might be used to define a ground-water basin (citing Richter, "California Ground Water Geology" in University of California, Davis Extension, **Concepts of Ground Water Management**, 1974). The latter

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reference defines a ground-water basin as an area underlain by one or more permeable formations capable of furnishing a substantial water supply. That reference goes on to note that ground-water basins are separated from each other, or may be subdivided into ground-water subbasins, by one or more different types of lateral or vertical boundaries, which can be grouped into physical, hydraulic and political categories. "Lateral" boundaries refer to the edges of a basin or separations between basins abutting one another on a (more or less) vertical plane, while "vertical" boundaries refer to the extent (depth) of a basin along a (more or less) horizontal plane. The types of potential lateral boundaries of a groundwater basin or subbasin include, by respective category:

Lateral Groundwater Basin Boundary Criteria

Physical	Hydraulic	Political
bedrock contact [n] zone of low permeability [n] fault [n, r] syncline rim [n] buried bedrock ridge [r] constriction in permeable materials [r] deep underflow constrictions [r] aquifer contacts [r] crest of anticline [r] alluvial embayment [f] topographic ridge or divide [f]	groundwater divide [f] limit of pressure area [f] shoreline of ocean or lake [f] center of river or stream [f] unlined canal or reservoir [f]	state [f] county [f] city [f] irrigation district [f] federal installation [f] park district [f]

n – no appreciable movement of groundwater
r – restricted movement of groundwater
f – free, unimpeded movement of groundwater

The types of potential vertical boundaries of groundwater basin or subbasin more simply include:

Vertical Groundwater Basin Boundary Criteria

Physical	Hydraulic	Political
bedrock contact base of fresh water-bearing materials upper, intermediate, and lower confining beds	water table base of fresh water	not applicable

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In considering the potential application of any of the above boundary criteria for basin delineation purposes, it is appropriate to consider whether any or all of them should be used for accurate depiction of a basin. In the Richter reference cited above, potential lateral basin boundaries are divided into three types: 1) those with no appreciable underflow, 2) those with restricted underflow, and 3) those with free underflow. A key factor in determining the applicability of any of the above boundary criteria is whether it affects, and to what degree, the movement of ground water; the greater the probability for flow across a potential boundary, the less likely that feature truly constitutes a boundary.

All potential lateral boundaries which do not impede or obstruct the movement of ground water were noted by Richter to be inappropriate selections for a basin (or subbasin) boundary. Examples of such non-boundaries include: a ground-water divide; the limit of a confined aquifer (transition from confined to unconfined conditions); an alluvial embayment; a topographic ridge or divide; the shoreline of an ocean, bay, or lake; a river, stream, or unlined canal; and political boundaries. Many of these examples are present in the greater Antelope Valley area; however, in light of their uniform characteristic that they do not impede or obstruct ground-water flow, they should not be considered viable basin boundaries. As discussed in detail below, that has been the case in the historical mapping and description of the Antelope Valley Groundwater Basin, and it is continued in the mapping and boundary description in this declaration, with one minor exception.

The two remaining types of potential ground-water basin boundaries are those with no appreciable underflow or with restricted underflow. Those with no appreciable underflow were noted by Richter, and are generally recognized, to be most desirable for delineating basin boundaries because they are often definable over considerable distances, and they do not appreciably affect the movement of ground water. It is appropriate to note that qualifiers like "appreciable" are included to recognize that almost nothing in nature, particularly around unconsolidated aquifer materials, is truly impermeable; hence while materials like bedrock may

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have some small porosity and permeability, it is so low that such materials substantially retard groundwater flow into or out of adjoining aquifer materials. That said, boundary types with no appreciable underflow include bedrock contacts, zones of low permeability, faults (in this case, where they form substantially impermeable barriers), and syncline rims.

With regard to potential basin boundaries with restricted underflow, Richter noted that they "should be used with caution" because they may not be definable over considerable distances and may not affect the movement of groundwater. In other words, the mere presence of such potential boundaries does not necessarily define the boundaries of a ground-water basin; some "caution" (which can be interpreted as the need for technical support to show that the "boundary" effectively impedes or obstructs the movement of ground water) should be exercised in selecting any of them as a viable ground-water basin boundary. Potential basin boundaries with restricted underflow include: buried bedrock ridges, constrictions in permeable materials, faults (in this case, where they retard rather than fully impede ground-water flow), deep underflow constrictions, aquifer contacts, and crests of anticlines. Again as discussed in detail below, the historical mapping and description of the Antelope Valley Groundwater Basin has apparently considered these factors; and they continue to be considered in the mapping and boundary description in this declaration.

The preceding discussion of groundwater basin criteria derives from the most lengthy and best illustrated discussion of that topic in the literature. It was originally prepared as part of an extensive teaching syllabus for the State Department of Water Resources (DWR) by Richter who, coincidentally, was a co-investigator of water supply conditions in the Antelope Valley Groundwater Basin by DWR in 1947. Over 30 years later, in its 2003 Update of Bulletin 118, **California's Groundwater**, DWR defined a groundwater basin as "an alluvial aquifer or a stacked series of alluvial aquifers with reasonably well-defined boundaries in a lateral direction and a definable bottom. Lateral boundaries are features that significantly impede groundwater flow, such as rock or sediments with very low permeability or a geologic structure such as a fault.

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Bottom boundaries would include rock or sediments of very low permeability if no aquifers occur below those sediments within the basin".

In its efforts to map groundwater basins in Bulletin 118 (2003), DWR listed five of the boundary criteria detailed above as the primary factors in delineating basins: impermeable bedrock, constrictions in permeable materials, faults (noted to not necessarily act as groundwater flow barriers), low permeability zones (noted to not form basin boundaries), and groundwater divides (noted to be movable and thus less useful as boundaries). DWR also listed adjudicated basin boundaries as having affected the natural boundaries of adjoining basins.

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One final general comment about basin boundary criteria is that published mapping of the Antelope Valley Groundwater Basin's lateral boundaries includes faults, a narrow ground-water divide, exposed contacts between water bearing and non-water bearing rocks or sediments, and the estimated contact between the water table (the ground-water body) and non-water bearing bedrock. Strictly speaking, this latter boundary does not conform to any of the potential ground-water basin boundary criteria listed above. While it recognizes the physical extent of materials containing groundwater at some particular time, it has the disadvantage of being a movable boundary as groundwater levels and storage change. The boundaries mapped and described in this declaration extend to the mapped extent of unconsolidated aquifer materials, except where truncated by other boundary criteria, and thus capture all the aquifer materials that have groundwater in storage, as well as those aquifer materials that could have groundwater in storage. Thus, the selected boundaries are not subject to change as groundwater levels change.

Adjudication Boundaries

Based on my understanding of the intent of the Antelope Valley adjudication, to adjudicate rights to pump or otherwise extract groundwater from the Valley, my opinion is that the most appropriate area for adjudication is most of the Antelope Valley Groundwater Basin because that is the area where, for practical purposes, all the significant and substantial groundwater pumping can occur. In other words, it is the area where a sufficiently productive aquifer system is present and can be developed to provide significant and substantial water supplies. That area is illustrated in Figures 1 and 2, both of which show the same boundaries but on different base maps, one to illustrate surface geologic features and the other to illustrate topographic features. Following is a description of the boundaries illustrated in Figures 1 and 2, including discussion of features of the boundaries at various locations around the basin.

In drafting the boundaries illustrated and described herein, my primary considerations were the extent of aquifer materials and the physical, hydraulic or other features that limit their extent. Fundamentally, the boundaries reflected herein attempt to comply with the appropriate criteria discussed above. For example, most of those boundaries are comprised of bedrock contacts that abut the unconsolidated alluvial aquifer materials beneath the Valley. However, as with almost all natural systems, the aquifer system beneath the Antelope Valley is not perfectly bounded by the kinds of features listed as preferable boundaries above. Where bedrock contacts are not present, for example, other features have been employed for boundary purposes. The following description of the boundaries, and the associated illustrations in Figures 1 and 2, includes discussion of those areas where less desirable criteria were applied, and why.

Beginning in the southeast corner of the basin (where "basin" is intended to mean adjudication area for purposes of this part of my declaration), and proceeding clockwise around the area, the southerly boundary is largely comprised of the mapped extent of bedrock contact to the north of, and generally parallel to the San Andreas Fault. Along the entire southerly boundary, it cuts across two locations where surface drainage occurs above alluvium that is narrowly connected to the main Antelope Valley and/or is known or thought to be very thin or limited in extent. Thus, that alluvium is neither significantly productive nor conductive of significant groundwater flow into the main valley. Those two locations are at the mouth of Soledad Canyon and the mouth of Leona Valley.

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From the southwesterly corner of the basin, the westerly boundary is entirely comprised of the mapped extent of bedrock contact to the southeast of, and roughly parallel to the Garlock Fault complex.

The northwesterly corner of the basin is at the intersection of the Cottonwood Fault and the bedrock contact that forms the western boundary of the basin. From that northwesterly corner, the basin is bounded on the north by the mapped Cottonwood Fault and Willow Springs-Rosamond Fault to the intersection of the latter fault with the bedrock contact of the Rosamond Hills at the northwest corner of the dry Rosamond Lake bed. The Cottonwood-Willow Springs-Rosamond Fault complex represents the most significant departure between the boundaries described and illustrated herein, and the basin boundary as mapped by DWR in its Bulletin 118 (2003). The Fault complex is included herein because it is a mapped feature, in contrast to DWR's arbitrary line in the general vicinity of a creek (Oak Creek) farther to the north in the Fremont Valley. Data are limited, particularly throughout the Cottonwood Fault area; however, the limited available data near the Willow Springs-Rosamond Fault shows a significant groundwater level difference, where the Fault substantially impedes groundwater flow across the Fault as evidenced by a steep difference of about three hundred feet of water level across the Fault (higher in the north). There are no comparable features associated with the arbitrary line to the north, which has been termed a "groundwater divide". Unfortunately, there are no data to support the existence of a groundwater divide anywhere in that area (where a groundwater divide is defined by DWR in its Bulletin 118 (2003) to "have noticeably divergent groundwater flow directions on either side of the divide with the water table sloping away from the divide"). As noted above, DWR also notes that the location of a groundwater divide may change as water levels change, making the selection of a groundwater divide as a basin boundary, if one were to exist, a movable boundary. As a result of the foregoing factors, the mapped fault location, with limited but substantial measured water level differences across it, is a preferable boundary to one that lacks any physical or hydraulic significance, any firm location, or any permanence. The Fault complex is also mapped as the northern boundary along the west side of the basin in

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essentially every historical analysis of geology, groundwater, and water supply conditions in the Antelope Valley.

From the northwest corner of Rosamond Lake (dry), the basin predominately follows bedrock contact along the Rosamond and Bissell Hills, generally on the west side of Edwards Air Force Base, to the Muroc Fault where it follows the Fault/bedrock contact. The boundary arbitrarily crosses some narrow gaps between rock outcrops in the Rosamond and Bissell Hills, where the gaps represent small connections with the Fremont Valley Groundwater Basin to the west. Similarly, to the north of Edwards AFB and on the east side of Rogers Dry Lake, the boundary arbitrarily crosses some narrow gaps between rock outcrops, the most notable of which is a narrow neck that isolates the Peerless Valley to the north. Limited data suggest that there has been some small irrigated agricultural land use in the Peerless Valley, and some groundwater use for that water supply. A small gradient for groundwater flow toward the Peerless Valley has been present, but any outflow from the Antelope Valley would appear to be at great depth, and also small as a result of the relatively flat gradient and the narrow width through which flow can occur.

On the east side of the Antelope Valley, the basin is bounded by bedrock contacts along the entire so-called Hi-Vista area of bedrock outcrops. Where that contact reaches the Los Angeles-San Bernardino County line along the southeast side of the basin, the groundwater basin is arbitrarily bounded by the County line for a couple of reasons. First, while the County line is a political boundary with no technical or physical significance relative to groundwater, it is also the western boundary of the adjudicated Mojave Water Agency area in San Bernardino County. As such, where used as a boundary of the Antelope Valley Basin, it separates the Antelope and Mojave areas at a location where unconsolidated aquifer materials in them are physically connected. Second, although groundwater data is not extensive in that area, examination of available data suggests that there is little or no gradient for groundwater flow between the Antelope and Mojave areas in the vicinity of the County line. This is consistent with previous mapping of the Antelope Valley Groundwater basin in the literature where the lack of gradient for flow between the Antelope and Mojave areas has been called a groundwater divide and been cited as the basis for bounding the Antelope Valley Basin at about that location (i.e. the County line).

Other Considerations

I understand from legal counsel that a potential issue in the establishment of boundaries for the adjudication might arise with respect to waters that originate outside the groundwater basin but enter the basin and become groundwater recharge. Specifically mentioned have been Little Rock Creek and Big Rock Creek, which have been noted to be perennial streams that contribute a large fraction to total recharge to the groundwater basin. In the event that the court needs to consider sources of groundwater recharge in the purvue of the Antelope Valley adjudication, and if the court thus needs to consider boundaries beyond the aquifer system in order to include the areas of origin of various sources of recharge, I have extended this declaration to describe the various sources of groundwater recharge in the Antelope Valley, and to discuss the potential implications on boundaries that could otherwise focus on that area which comprises the aquifer system where all significant and substantial groundwater pumping can occur.

First, the above-noted mention of Little Rock Creek and Big Rock Creek was because those two creeks are perennial and because surface water flow in them represents a sizable fraction (on the order of 80 percent) of the basin's recharge. Regardless of the exact fraction of recharge that results from flow in those two creeks, the fundamental consideration of surface water possibly being included in the adjudication begs the questions: what surface flows warrant inclusion, and what surface flows need not be included?

Prior to the importation of supplemental surface water into the Antelope Valley, which has been continuously ongoing since 1972, various investigators had estimated the amount of

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surface water runoff into the Valley from the surrounding mountains, parts of which were gaged on Little Rock Creek (where records are both incomplete and capture only part of the flow in the creek; additional runoff enters the creek below the gage location) and on Big Rock Creek (where records also capture only part of the flow in the creek because additional runoff enters the creek below the gage location). Results of various reported analyses prior to the importation of supplemental surface water are summarized in the attached Table 1. As can be seen in Table 1, the above-noted Little Rock and Big Rock Creeks were the only (partially) gaged flows at those times, and constituted about 50 percent of total estimated runoff reaching the Valley. If recharge sources need to be included in the adjudication, that fraction would not seem to warrant their inclusion to the exclusion of the other sources of recharge that originate as runoff.

In the bigger picture of groundwater recharge in the Antelope Valley, there are fundamentally four "sources" of water that potentially contribute to recharge of the groundwater basin: precipitation on the Valley floor; mountain runoff onto the Valley floor; drainage, or dewatering, from confining clays in the aquifer system beneath the Valley; and supplemental water imported into the Valley. For consideration in the question of boundaries, each is briefly described as follows.

Precipitation on the Valley Floor – Average precipitation on the Valley floor ranges from about 5 to 8 inches per year, depending on location. Historical analyses have recognized that a small fraction of that precipitation, depending on when it occurs during the year, might be beneficially used by crops; however, almost all the precipitation on the Valley floor is too small to exceed a combination of evaporation from the soil and/or consumptive use by vegetation. Thus, for all practical purposes, incident precipitation on the Valley floor does not contribute to recharge of the underlying aquifer system. From a boundary perspective, independent of the magnitude of recharge from incident precipitation, the selection of adjudication boundaries that include the Valley floor will include analysis and accounting of incident precipitation and its fate, including its potential contribution to groundwater recharge.

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Mountain Runoff – Runoff that originates as precipitation on the mountains and hills around the Antelope Valley has long been reported as the only source of "native" (originating in the watersheds that surround the Valley and its underlying aquifer system) water that contributes to groundwater recharge. Some of the surface water runoff that reaches the Valley floor has historically been diverted for water supply, and some of those diversions continue. Most of the balance of mountain runoff that reaches the Valley floor continues to be the most significant, if not the only, source of "native" water that recharges the aquifer system beneath the Valley. From a boundary perspective, mountain runoff can be addressed in two ways. One way would be to recognize that, as described earlier, any complete analysis of groundwater basin yield will include the components of groundwater recharge that derive from surface water inflows such as mountain runoff. Thus, such as the adjudication of groundwater rights is then based on the yield of the groundwater basin, it would include the recharge that originates as precipitation in the mountains and hills surrounding the Valley.

A second way to address mountain runoff from a boundary perspective would be to expand boundaries to include the areas of precipitation and runoff. As summarized in Table 1, such an expansion would embrace a number of mostly ungaged streams and their respective watersheds, presumably leading toward "adjudication" of surface flows as well as groundwater pumping. Such would be unique compared to other groundwater adjudications, would lead to great technical challenge in quantifying such a large amount of ungaged water, and would enter into potential overlap of the Antelope Valley adjudication and the existing permitting procedure for diversion of surface water administered by the State Water Resources Control Board.

Clay Dewatering – There have been substantial historical declines in groundwater levels in parts of the Antelope Valley Groundwater Basin. The largest of those declines has been in the general area between Edwards Air Force Base and Lancaster, which area is also characterized by the presence of substantially thick clay in the underlying aquifer system. The extent of predominant clays in the Edwards AFB-Lancaster area is outlined in Figures 1 and 2. The

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substantial lowering of groundwater levels adjacent to those clays has, in turn, resulted in a condition whereby water in the clays has slowly drained out of them (into the coarser-grained aquifer materials above and/or below them). This drainage represents a non-renewable, one-time (albeit slow) source of "recharge" to the overall aquifer system. The ultimate result of that drainage is the phenomenon of consolidation of the clay and its expressions at the land surface, which are subsidence and ground fissuring. From a boundary perspective, if there is a need to include sources of "recharge" within the boundaries of the adjudication, any set of boundaries that includes that portion of the Valley aquifer system where the significant clays are present will include the component of recharge that derives from drainage from those clays.

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Supplemental Imported Water – Since 1972, supplemental water has been imported into the Antelope Valley via the State Water Project (SWP) to augment the local groundwater supply. Prior to the introduction of SWP water, the only other importation of supplemental water had been via some small releases from the Los Angeles Aqueduct for surface spreading in the Kings Canyon area. That practice took advantage of surplus capacity in the Los Angeles Aqueduct for a brief period; however, apparently because there has been no surplus for several decades, there has been no recharge of water from that source since the late 1940's. The SWP deliveries continue, however, through the three State Water Contractors in the Valley (Antelope Valley-East Kern Water Agency, or AVEK; Palmdale Water District, and Littlerock Creek Irrigation District), who collectively have current contracts for SWP water up to 161,000 acre-feet per year. Imported SWP water is used in the Valley for both municipal and agricultural purposes. As a result, the imported water either directly (through deep percolation of some of the applied irrigation) or indirectly (through discharge of treated municipal waste water) contribute to recharge of the aquifer system beneath the Valley.

From a boundary perspective, if there is a need to include sources of "recharge" within the boundaries of the adjudication, it is difficult to concisely describe how the State Water Project and features that surround it might be included in such a set of boundaries. Originally called the

Feather River Project, the State Water Project has its source of supply in the watershed above Lake Oroville on the Feather River, some 400 miles from Antelope Valley. From Lake Oroville, SWP water is transported through a complex system of rivers, natural channels in the Sacramento-San Joaquin Delta, and an aqueduct and tunnel system before delivery in the Antelope Valley. Along that route, numerous natural and anthropogenic activities impact the yield of the SWP and thus, to some extent, that fraction of SWP supply that contributes to recharge of the aquifer system beneath the Antelope Valley. Over the last 30 years, SWP water has contributed an increasing amount of water supply to the Antelope Valley, a fraction of which has contributed to groundwater recharge. As with mountain runoff, any complete analysis of groundwater basin yield will include components of groundwater recharge that derive from imported water as a function of how it is used in the Valley, e.g. deep percolation of applied irrigation, deep percolation of waste water discharges, etc. Under almost any foreseeable set of conditions, it is reasonable to expect that amount of recharge to further increase in the future, to potentially equal or exceed local or "native" sources of recharge. Thus, if it is determined that the adjudication boundaries need to include sources of recharge, it would appear that SWP water would need to be considered at a level comparable to native waters. It is possible to envision how boundaries might be defined to include native sources like mountain runoff as described above, but it is almost incomprehensible to envision how they might be defined to include supplemental sources like the SWP.

Ultimately, while basically never overtly discussed, a reason that other groundwater adjudications have been limited to groundwater basins is that the flows of water, whether native or foreign to the watershed, can be accounted with respect to their effects on groundwater supply. A further reason is that, with the predominant need for supplemental water to effect groundwater sustainability (e.g. "physical solution") in a basin that warrants adjudication in the first place, it exceeds practicality to attempt to include such substantial yet far reaching components of supplemental water supply as the State Water Project.

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Other forms of "recharge" to the aquifer system beneath the Valley include the aforementioned discharges of treated municipal wastewater, deep percolation of water applied for irrigation, and subsurface inflows from surrounding bedrock or across other boundary features, e.g. faults. Strictly speaking, neither of the first two forms of recharge is a "source" of water. Rather, both represent methods of water use or discharge that result in water physically recharging the aquifer system; however, both methods make use of water from other sources and, as a result, do not introduce any new water to the overall system. In effect, treated municipal waste water originates as either groundwater from the basin or imported supplemental water, both of which are already accounted above. Similarly, applied irrigation originates as either groundwater from the basin or imported supplemental water (there is also a small use of treated waste water for irrigation), both of which are already accounted above. Thus, while treated waste water discharges and irrigation operations are both practices that result in some water recharging the aquifer system, neither practice introduces any new water to the system.

Finally, whether any subsurface inflows to the aquifer system, across any of its boundaries, constitute "recharge" is largely a matter of terminology. In most, if not all, accountings of water budget terms in a groundwater system, subsurface boundary flows are recognized as inflows and outflows as appropriate. They are not typically classified as "recharge" (inflow) or "discharge" (outflow). Ultimately, particularly at basin scale, one of the objectives in selecting basin boundaries is, as discussed above, to try to utilize features which substantially impede or restrict flow across the boundaries. Thus, as a result of such boundary selection, the subsurface inflow and outflow components are relatively small. The net result is that, whether termed subsurface inflow as is the usual approach, or whether included as a form of "recharge", the subsurface inflow to the aquifer system is relatively small and not in need of exhaustive attention in whatever solution is derived for adjudication of groundwater rights.

Conclusion

As introduced above, my understanding of the Antelope Valley adjudication is that it is intended to adjudicate rights to extract groundwater from the Valley. Based on that understanding, I would consider the most appropriate area for a groundwater adjudication in the Antelope Valley to be most of its groundwater basin, as described and illustrated herein, most notably because that represents the area where, for practical purposes, all the significant and substantial groundwater pumping can occur. I understand that there may be issues with regard to waters that originate outside the groundwater basin, but which enter the basin and contribute to groundwater recharge. Consideration of those waters in the adjudication can lead to some complex and impractical issues if the boundaries of the adjudication were to be expanded to include the various sources of water that ultimately contribute to groundwater recharge in the Antelope Valley. However, in light of the fact that the yield of the groundwater basin can (and should) be analyzed to include all sources of recharge, it is also my opinion that there is no technical need to expand boundaries for the sake of including the recharge effects of those various waters on the adjudication of groundwater in the Antelope Valley.

I declare under penalty of perjury that the above is true and correct.

Executed this 26th day of June, 2006, at Woodland, California.

Joseph C. Scalmanini

LAW OFFICES OF
BEST BEST & KRIEGER LLP
5 PARK PLAZA, SUITE 1500
IRVINE, CALIFORNIA 92614