

6-AVEK-9

Testimony of Robert C. Wagner, P.E.

Antelope Valley Groundwater Cases
October 13, 2015

EXHIBIT 6-AVEK-9

Assignment

- Review source documents regarding historic water production by Parties identified on “Exhibit 4” to the [PROPOSED] Judgment and Physical Solution (including the State of California and the City of Lancaster)
- Evaluate beneficial uses of water by the Parties
- Consider reasonableness of water application in relation to cultural practices, time periods, expected application rates for crops and other beneficial uses of water
- Report in the aggregate on the recent reasonable and beneficial uses in the Antelope Valley

Qualifications

- Bachelor of Science Civil Engineering, CSUS 1988
- Registered Civil Engineer in California and Nevada
- More than 25 years experience in water resources evaluations
 - Water right investigations
 - Adjudications
 - Water Board permitting, licensing, riparian and pre-1914 analysis, groundwater surface water interactions, water supply and water availability issues
 - Land use evaluations for beneficial uses
- Engineer for Mojave Basin Area Watermaster for 19 years

Qualifications

- Investigate and verify annual water production for parties subject to the Mojave Basin Adjudication
 - Prepare Annual Report to the Court regarding Watermaster activities and matters affecting water supply use and disposal including:
 - Total water use
 - Evaluation of various types of use in the basin area
 - State of the Basin
 - Change in Storage (mass balance)
 - Water level changes
 - Changes in land use
 - Estimates of consumptive use of water for various applications
 - Compliance with Judgment

Methodology

- Site inspections in the Antelope Valley spanning many years
 - Knowledge of geography, geology and hydrology in Antelope Valley
- Phase IV Stipulations, Declarations, Affidavits and Court ordered Discovery Responses were obtained from Parties
 - Over 3,700 files, within nearly 500 folders made up the document repository for the review process
- Additionally, more than 600 files were downloaded from the Court's website
- Documents were organized, information compiled and reviewed
- The review process began with the most recent document

Methodology

- Documents reviewed were those sworn to and submitted to the Court by various Parties
- Accompanying documentation included:
 - Pump tests
 - Electrical records
 - Diesel records
 - Meter records
 - Aerial photography
 - Groundwater Recordation Notices submitted to the State Water Resources Control Board
- Calculations based on Summary Expert Report crop duty and irrigated acreage

Methodology

- A summary spreadsheet was created to compile and organize the reported data for each Party for the years 2000-2004, 2011-2012:
 - Type of use (e.g. Domestic, Industrial, Agricultural, etc.)
 - Crop type and acreage, as applicable
 - Groundwater production
 - Imported water
 - Reclaimed water
 - Type of supporting documentation
- Review of authoritative sources
- Evaluation of record of total water use

Authoritative Sources

- Superior Court of California, County of Santa Clara. (2012, 2013). *Antelope Valley Groundwater Cases, Phases I through V*.
- State Water Resources Control Board and Regional Water Quality Control Boards. (2015). California Code of Regulations. Title 23. *Waters*.
- Beeby, R. et al. (2010). *Summary Expert Report, Phase III - Basin Yield and Overdraft, Antelope Valley Area of Adjudication*.
- Orloff, S., Hanson, B., & Lanphier, T. (1989). *High-Desert Irrigation Study, Water Application Rates for Maximum Profit* (High Desert Research Results, Alfalfa and Other Forages, 1989). University of California, Cooperative Extension.

Authoritative Sources

- State Water Resources Control Board, Division of Water Rights. (1999, 2007, 2008). Relied on guidance from *Annual Notice of Extraction and Diversion of Water*, Table II – Average Depth of Water to Irrigate Each Crop Worksheet.
- Department of Water Resources. (1975). *Vegetative Water Use in California*, 1974 (Bulletin 113-3).
- Department of Water Resources. (1986). *Crop Water Use in California* (Bulletin 113-4).
- Antelope Valley East-Kern Water Agency (2012). *WSSP-1 Calandri “Stoner 1” Parcel* (AVEK Customer Water Use Report – 2010 thru 2013 (Est)).
- California Irrigation Management Information System (CIMIS). (1998-2012). Retrieved 2012.

Authoritative Sources

- U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey. (n.d.). Retrieved 2014.
- Allen, R., Pereira, L., Raes, D., & Smith, M. (1998). *Crop evapotranspiration: Guidelines for computing crop requirements* (Irrigation and Drainage Paper No. 56). FAO.
- Department of Water Resources Consumptive Use Program +M (CUP+M), Version 4.1.
- Mojave Water Agency. (2014). Reported Water Production for Various Producers.
- Superior Court of California, County of Riverside. (1996). *Judgment After Trial* (Mojave Basin Area Adjudication).

Basis of Beneficial Use

EXHIBIT 6-AVEK-5a

California Code of
Regulations, Title 23
List of common
beneficial uses

Domestic Uses	Recreational Use
Irrigation Use	Aquaculture Use
Power Use	Stockwatering Use
Municipal Use	Water Quality Use
Mining Use	Frost Protection Use
Industrial Use	Heat Control Use
Fish and Wildlife Preservation and Enhancement Use	

Source: Chapter 2 Appropriation of Water, Subarticle 2, Beneficial Uses, §660-§672, California Water Boards, California Code of Regulations, Title 23. Waters,
Division 3. State Water Resources Control Board and Regional Water Quality Control Boards, January 2015.

Basis of Beneficial Use

EXHIBIT 6-AVEK-5b

List of common
beneficial uses in
Antelope Valley

Domestic Uses	Recreational Use
Irrigation Use	Dairy
Power Use	Stockwatering Use
Municipal Use	Water Quality Use
Mining Use	
Industrial Use	
Fish and Wildlife Preservation and Enhancement Use	

Summary of Irrigation Uses

EXHIBIT 6-AVEK-6

Ranges of Typical Applied Crop Water Duty

(all values in acre-feet per acre)

Source	Alfalfa	Onions	Carrots	Grain	Potato	Pistachios	Jujubes	Pasture	Turfgrass
Summary Expert Report, Phase 3 ⁽¹⁾	6.5	4.5	3.9	2.6	2.8	4.9 (Orchard)	-	6.7	-
High Desert Research Results ⁽²⁾	4 - 10+	-	-	-	-	-	-	-	-
Groundwater Recordation Notice, 2008 ⁽³⁾	7.6	-	-	-	-	-	-	7.4	-
Groundwater Recordation Notice, 2007 ⁽⁴⁾	5.5 - 6.0	-	-	-	-	-	-	5.5 - 6.0	-
Groundwater Recordation Notice, 1999 ⁽⁵⁾	4.0 - 6.0	-	-	-	-	-	-	5.0 - 7.0	-
DWR Bulletin 113-4 ⁽⁶⁾	5.1 - 6.5	2.7 - 3.7 (Other Field)	2.7 - 3.7 (Other Field)	0.5 - 2.2	2 - 2.5 (Other Truck)	3.1	-	7.0 - 7.2	-
Wagner & Bonsignore Analysis, Antelope Valley ⁽⁷⁾	6.2	4.2	5.1	1.8	2.4	-	-	6.1	4.3 - 13.4
Wagner & Bonsignore Analysis, Mojave Area ⁽⁸⁾	7.1 - 8.1	-	-	-	-	5.0	4.0	-	-
WSSP-1, Calandri "Stoner 1" Parcel, 2013 ⁽⁹⁾	7.1	-	-	-	-	-	-	-	-
Actual Farming Practices, Mojave Area, 2013 ⁽¹⁰⁾	6.8	-	-	3.6	-	1.7	-	4.2	-

Summary of Irrigation Uses

EXHIBIT 6-AVEK-6 Notes

- (1) Summary Expert Report, Phase 3 - Basin Yield and Overdraft, Antelope Valley Area of Adjudication, Beeby, R. et al, July 2010. Values includes irrigation efficiencies.
- (2) "Currently, the amount of water high-desert alfalfa growers are applying to their fields varies considerably, ranging from 4 acre feet to over 10 acre feet per acre per year." High-Desert Irrigation Study, Water Application Rates for Maximum Profit, High Desert Research Results, Alfalfa and Other Forages, Orloff, S. et al, 1989.
- (3) Agricultural Water Use Worksheet, Table II: Average Depth of Water Applied to Irrigate Each Crop, Antelope Valley, 2008 Annual Notice of Extraction and Diversion of Water (Groundwater Recordation Program), State Water Resources Control Board, Division of Water Rights.
- (4) Agricultural Water Use Worksheet, Table II: Average Depth of Water Applied to Irrigate Each Crop, Antelope Valley, 2007 Annual Notice of Extraction and Diversion of Water (Groundwater Recordation Program), State Water Resources Control Board, Division of Water Rights.
- (5) Agricultural Water Use Worksheet, Table II: Average Depth of Water Applied to Irrigate Each Crop, Antelope Valley, 1999 Annual Notice of Extraction and Diversion of Water (Groundwater Recordation Program), State Water Resources Control Board, Division of Water Rights.
- (6) Table 1, Estimated 1980 County Average Unit Application Water, Crop Water Use in California, Bulletin 113-4, Department of Water Resources, April 1986. Values are for Kern County and Los Angeles County.

Summary of Irrigation Uses

EXHIBIT 6-AVEK-6 Notes

⁽⁷⁾ Turfgrass is average of 2005 through 2012, from analysis of crop evapotranspiration of applied water (ET_{AW}) output values from California DWR's CUP+ program based on daily climate measurements from Palmdale CIMIS Station supplemented by Victorville CIMIS Station, crop development data from FAO Irrigation and Drainage Paper No. 56 by R. Allen et al, and soil properties found using USDA Natural Resources Conservation Service Web Soil Survey program, and estimated irrigation efficiency of 80% based on Solid Set or Permanent Sprinkler Irrigation as described in "Irrigation Systems and Water Application Efficiencies" by Kenneth H. Solomon, CA State University, Fresno. High turfgrass value based on Oasis Effect, as described on Figure 46 of FAO Irrigation and Drainage Paper No. 56. All other crops are average of 1998 through 2012, from analysis of crop ET_{AW} output values from California DWR's CUP+ program based on daily climate measurements from CIMIS Victorville Station in San Bernardino County supplemented by measurements from CIMIS Barstow NE Station, soil properties from USDA's NRCS Web Soil Survey, and crop properties from FAO Irrigation and Drainage Paper No. 56, with growing seasons as reported in Appendix D-3: Tables 1 through 3, from Appendix D, Land Use, Water Requirements and Water Supplies, Antelope Valley Area of Adjudication, and irrigation efficiencies reported in Appendix D-3: Table 4 Applied Crop Water Duties and Irrigation Efficiency Values from Appendix D, Land Use, Water Requirements and Water Supplies, Antelope Valley Area of Adjudication.

Summary of Irrigation Uses

EXHIBIT 6-AVEK-6 Notes

- (8) Average 1997 through 2013. Analysis of crop evapotranspiration of applied water (ET_{AW}) output values from California DWR's CUP+ v3.1 program based on daily climate measurements from CIMIS Barstow NE Station in San Bernardino County (supplemented by CIMIS Victorville station), soil properties from USDA's NRCS Web Soil Survey, and crop properties from FAO Irrigation and Drainage Paper No. 56 (Allen, R.K., L.S. Pereira, D. Raes, and M. Smith, 1998). Daily weather data from CIMIS was used by CUP+ to compute daily ET_o using the Penman-Montieth equation. Lower range based on default K_C values for CUP+ program averaged for all cutting cycles throughout each year. K_C values assumed to be 1.00 for all growing stages with adjustments according to climatological effects. Upper range based on Assumed $K_{C_{ini}}$ effects of pivot sprinkler irrigation. $K_{C_{ini}}$ adjustment per FAO No. 56 Figure 30b based on less than 24 hour wetting interval. Assumes seven cutting and growing cycles. Growing cycle K_C assumed to be $K_{C_{ini}}$ of 1.10, $K_{C_{mid}}$ of 1.2, $K_{C_{end}}$ of 1.15. Includes an irrigation efficiency of 85% for center pivot irrigation based on a potential range of 75-95% as indicated in Irrigation Efficiency by T. Howell, USDA, 2003.
- (9) *WSSP-1 Calandri "Stoner 1" Parcel* (AVEK Customer Water Use Report - 2010 thru 2013 (Est)), dated November 18, 2013, received from Tom Burns via electronic communication. AVEK water deliveries for 2013 were 2,268 acre-feet (November and December were estimated), applied to 320 acres of alfalfa. 2,268 acre-feet divided by 320 acres equals a water duty of 7.1 acre-feet per acre.

Summary of Irrigation Uses

EXHIBIT 6-AVEK-6 Notes

⁽¹⁰⁾ Reported water production and acreage for 13 alfalfa farms and 8 grain farms in 2013. Water production divided by acreage equals applied water.

Total Water Use by Mutual Water Companies

EXHIBIT 6-AVEK-7

Mutual Water Company Total Water Use

Entity	Total Water Use			[PROPOSED] Judgment	
	2000-2004 Average	2011	2012	Pre- Rampdown	Post- Rampdown
Antelope Park Mutual Water Company	168.76	244.70	172.80	208.75	169.89
Aqua-J Mutual Water Company	67.06	42.50	47.30	44.90	44.35
Averydale Mutual Water Company	334.88	247.90	268.00	257.95	254.35
Baxter Mutual Water Company	49.09	44.90	44.60	44.75	35.02
Big Rock Mutual Water Company	0	0	0	0	0
Bleich Flat Mutual Water Company	26.74	21.90	24.80	33.50	33.50
Colorado Mutual Water Company	36.30	24.10	27.70	25.90	25.54
El Dorado Mutual Water Company	409.90	272.00	280.10	276.05	272.16
Evergreen Mutual Water Company	82.20	66.40	72.60	69.50	68.54
First Mutual Water Company	15.62	15.62	15.62	15.62	5.25
Land Projects Mutual Water Co.	848.20	621.00	624.00	622.50	613.54
Landale Mutual Water Co.	261.10	146.50	181.80	157.75	155.57
Llano Del Rio Water Company	1,176.06	598.20	547.12	572.65	279.00
Llano Mutual Water Company	0	0	0	0	0
Shadow Acres Mutual Water Company	367.60	273.30	248.60	52.60	51.74
Sheep Creek Water Co.	0	0	0	0	0
Sundale Mutual Water Company	638.40	430.70	457.80	472.23	472.23
Sunnyside Farms Mutual Water Company, Inc.	417.04	228.40	239.20	75.40	74.26
Tierra Bonita Mutual Water Company	55.34	43.00	38.50	40.75	40.32
West Side Park Mutual Water Co.	343.14	294.00	267.50	280.75	276.86
White Fence Farms Mutual Water Co.	1,073.32	939.50	980.70	783.05	772.13
William Fisher Memorial Water Company	13.49	13.49	13.49	4.53	4.53
Total	6,384.24	4,568.11	4,552.23	4,039.13	3,648.78

Summary of Industrial Uses

Industrial uses

Include but are not limited to:

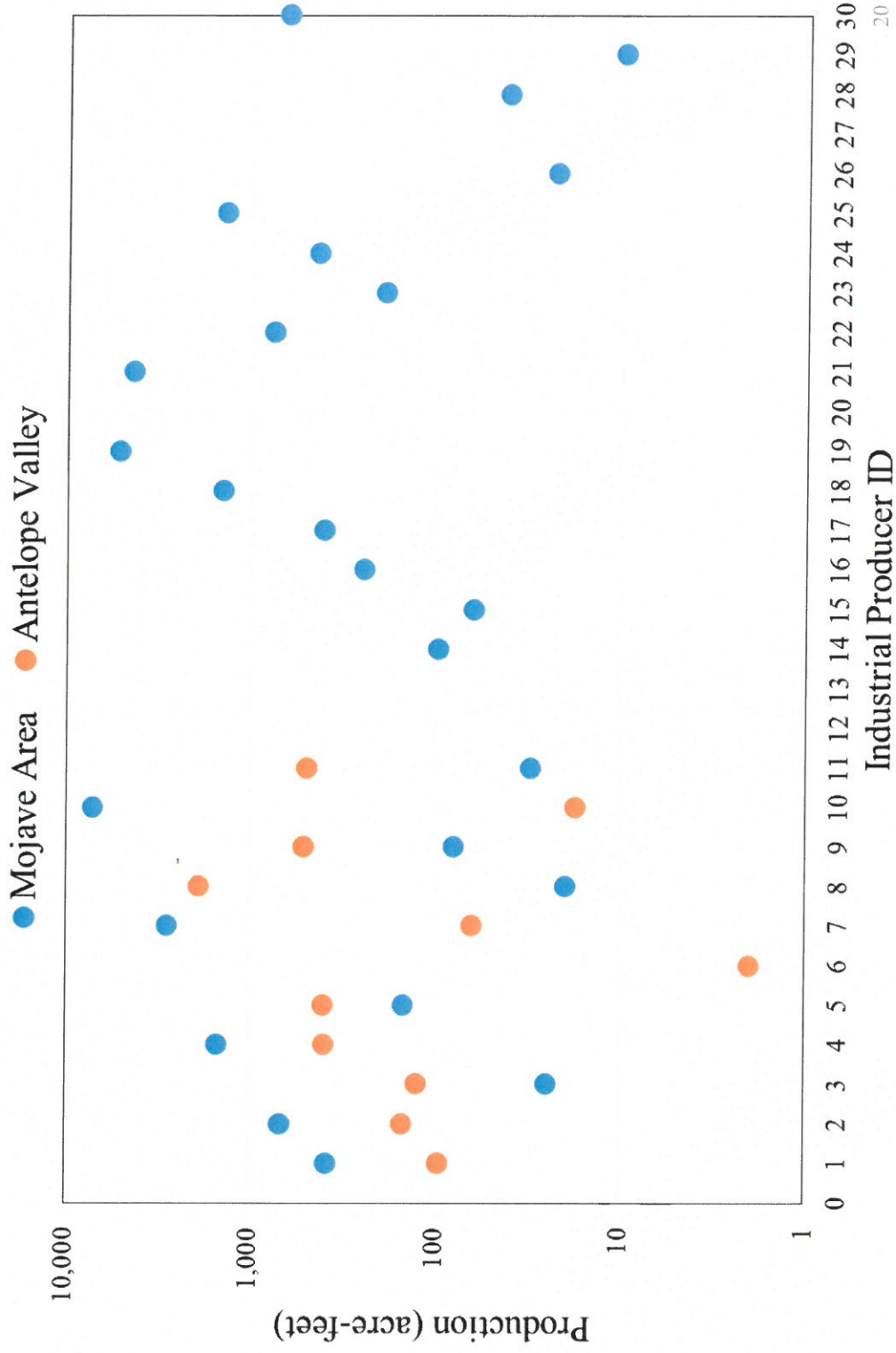
- Aggregate mining
- Cooling water
- Dust Control
- Re-use

Amounts reported by industrial users in Antelope Valley are commensurate with amounts used by industrial users in the Mojave Basin Area Adjudication (*Barstow v. Adelanto*). Mojave industrial uses and amounts considered reasonable and beneficial by the Court in the Judgment After Trial, January 10, 1996.

EXHIBIT 6- AVEK-8

Industrial Use Comparison

Production for Industrial Use



Notes
Mojave Area Production is Base Annual
Production as outlined by the Judgment After
Trial, Mojave Basin Area Adjudication, January
10, 1996.
Antelope Valley production is Pre-Rampdown
Production.