

**APPENDIX D:  
TULARE LAKE BED DE-DESIGNATION:  
DIRECTIONS OF GROUNDWATER FLOW NEAR URBAN AREAS  
(MUNICIPAL WELL ZONE OF CAPTURE ANALYSIS)**

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Mr. J.J. Westra  
Assistant Manager  
Tulare Lake Basin WSD  
1001 Chase Avenue  
Corcoran, CA 93212

Re: Lakebed De-Designation

Dear J.J.:

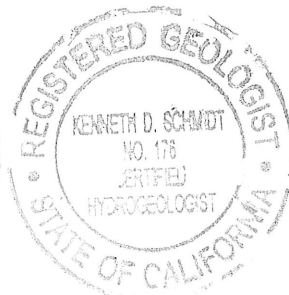
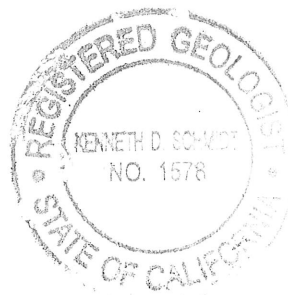
Submitted herewith is our enhanced discussion of potential groundwater flow near the urban areas.

Sincerely Yours,



Kenneth D. Schmidt  
Geologist No. 1578  
Certified Hydrogeologist  
No. 176

KDS/td



## TULARE LAKEBED DE-DESIGNATION

### DIRECTIONS OF GROUNDWATER FLOW NEAR URBAN AREAS

This section provides a discussion of the direction of groundwater flow at and in the vicinity of the four urban areas surrounding the Project Study Area. In addition, the potential of pumping for these areas to change the direction of groundwater flow near the proposed de-designated area boundaries is evaluated.

#### Stratford

Data for the primary public supply well (Attachment D) in Stratford indicates that it is perforated from 660 to 1,170 feet in depth and taps strata below the Corcoran Clay. The deposits above the Corcoran Clay are sealed off in this well. There are two other wells in Stratford, but they are standby and aren't pumped significantly. The direction of shallow groundwater flow is indicated to be to the south, based primarily on monitoring at the Westlake Farms North Evaporation Basins and on the topography. The proposed de-designation in this area is to a depth of 75 feet. Pumpage from the Stratford supply well would not influence the direction of groundwater flow above the Corcoran Clay because of the intervening clays layers below the base of the de-designated strata and above the top of the perforations and opposite the annular seal nor would these wells draw groundwater from beneath the areas proposed for de-designation. In addition, this well is located more than half a mile from the proposed delisted area.

#### Alpaugh

The primary supply well in Alpaugh is perforated from 1,025 to 1,210 feet in depth and taps strata below the Corcoran Clay. This well is sealed off opposite all strata above a depth of 900 feet (Attachment D). This well is more than a mile from the nearest boundary of the area proposed for de-designation, and the interval to be de-designated is above a depth of 110 feet. The direction of shallow groundwater flow near Alpaugh is indicated to be to the west, based on topography. The annular seal in this well would preclude any influence on the direction of groundwater flow in shallow strata due to pumping of the well. This is because of the extensive clay layers between 110 feet and 900 feet in depth in the vicinity of the well.

The two Angiola W.D. wells (G-30 and W-18), which could be used for Alpaugh, are perforated from 260 to 500 feet in depth

and tap strata above the Corcoran Clay. These wells have annular seals extending from the surface to at least 220 feet in depth. These wells are located about one mile east of the proposed de-designation boundary. The proposed de-designation in this area is for the interval above 110 feet in depth. The direction of shallow groundwater flow in that area (between Avenues 104 and 112 and Roads 32 and 40) is indicated to be to the west, based on topography. Each of these wells is sealed opposite three clay layers between 115 feet and 220 feet in depth. These clay layers would preclude the pumping of the wells from affecting the direction of groundwater flow in strata above a depth of 100 feet. Additionally, these wells would not draw groundwater from beneath the areas proposed for de-designation.

#### Kettleman City

There are two active public supply wells in Kettleman City, and they range from about 550 feet to 700 feet deep. A third well (school well) is used only for landscape irrigation due to high arsenic levels (Attachment D). These wells tap strata only above the Corcoran Clay, which is indicated to be below a depth of about 800 feet near Kettleman City. The direction of shallow groundwater flow is indicated to be to the northeast, based primarily on the topography and the direction of groundwater flow at the Westlake Farms South Evaporation Basins. These public supply wells are located outside of the proposed de-designation boundary by 0.6 to 1.0 mile. A zone of capture evaluation was conducted to evaluate the extent that the Kettleman City pumpage could reverse the direction of groundwater flow in strata above the Corcoran Clay. The slope of the land surface between the two wells and the Blakely Canal to the northeast averages about 60 feet per mile. This is the best estimate of the water-level slope for strata above the Corcoran Clay. An aquifer test was conducted on the Kettleman City CSD Maud Street Well in 1995. This well was perforated from 250 to 545 feet in depth. The pumping rate was about 500 gpm and a transmissivity of 9,000 gpd per foot was indicated by the pump test. The measured annual pumping for Kettleman City during 2013-15 ranged from only 27 to 29 acre-feet per year. A zone of capture evaluation was done. The distance between the wells and the stagnation point is the downgradient extent of the cone of depression due to pumping of the wells. The distance to the stagnation point is determined from the following equation from Fetter (1994):

$$X_o = \frac{Q}{2\pi K b i}$$

Where  $X_0$  : distance to stagnation point (feet)

Q: pumping rate (ft<sup>3</sup>/day)

K: hydraulic conductivity (ft/day)

b: aquifer initial thickness (ft)

i: hydraulic gradient (unitless).

Q = 0.26 acre-foot per day or 11,230 cubic feet per day

K = 9,000 gpd/ft divided by 335 feet = 27 gpd/ft<sup>2</sup> divided by 7.48  
= 3.6 feet per day.

b = 335 feet.

$$I = \frac{60 \text{ feet/mile}}{5,280 \text{ feet per mile}} = 0.0144.$$

$$X_0 = \frac{11,230}{86} = 130 \text{ feet.}$$

This indicates that even if the water-level slope was greater, the cone of depression would only extend less than 200 feet northeast of the well. Both wells are located west of Highway 41 and are more than 0.6 mile upgradient of the proposed de-designation boundary. Thus there would be no impact on the direction of groundwater flow near the de-designation boundary, nor would these wells draw groundwater from beneath the areas proposed for de-designation.

#### City of Corcoran

Active City of Corcoran public supply wells are located east of 5th Avenue and north of Orange Avenue. All of these wells are located more than two miles outside of the proposed de-designation boundary. None of the active City wells located between Orange and Niles Avenues and 4-1/2 and 5th Avenues is pumped significantly. The City has another well (4-B), which is located farther to the northeast, between 4th and 4 1/2th Avenues. This well is perforated from 235 to 485 feet in depth, and is heavily pumped. Thus most of the upper aquifer City pumpage closest to the de-designation area is from Well No. 4-B, which is located about two and a half miles from the de-designation boundary. The remaining City wells are located either east of 4th Avenue or farther north, much farther distant from the proposed de-designation area.

Water-level maps for the period 1997-2003 were generally based on more measurements near Corcoran, and are thus considered more representative. These maps consistently indicate a southwesterly direction of groundwater flow toward the central part of the lake-

bed. Because the proposed de-designation area southwest of Corcoran extends to the top of the Corcoran Clay, a zone of capture evaluation was done for City Well No. 4B. The annual pumpage from Well 4-B was 1,330 acre-feet in 2015. Aquifer tests were conducted on five upper aquifer City of Corcoran wells in 1993. The hydraulic conductivities averaged about 250 gpd per square foot. The saturated thickness of the upper aquifer tapped by Well No. 4B and is 275 feet. The lateral hydraulic conductivity of 250 gpd per square foot is equal to 33.4 feet per day.

The distance from Well 4-B to the downgradient stagnation point is as follows:

$$X_o = \frac{160,700 \text{ ft}^3/\text{day}}{2\pi(33.4 \text{ ft}/\text{day})(275 \text{ ft}) 0.00144}$$

$$X_o = \frac{160,700 \text{ ft}^3/\text{day}}{83.07 \text{ ft}^2/\text{day}}$$

$$X_o = 1,934 \text{ feet.}$$

The depression cone from pumping this well could extend about 1,900 feet to the southwest of the well, but would still be about two miles from the proposed de-designation boundary. Thus pumping of the City of Corcoran wells wouldn't influence the direction of groundwater flow in the area proposed for de-designation, nor would these wells draw groundwater from beneath the areas proposed for de-designation.