From: "John Fio" <jlfio@hydrofocus.com>
To: <Dale_Shileikis@URSCorp.com>, "'Bill Pfanner'" <Bpfanner@energy.state.ca...
CC: "'Christopher Dennis'" <CDennis@energy.state.ca.us>, "'Caryn Holmes'" <C...
Date: 6/11/2008 5:10 PM
Subject: RE: CPV Sentinel Groundwater Questions & Responses

DOCKET
07-AFC-3
DATE JUN 1 1 2008
RECD. JUN 1 2 2008

Dear Dale,

Thank-you for the prompt reply to our questions. After review of the model files provided, and your responses to our questions below, I have additional comments and questions you might consider addressing during tomorrow's workshop.

1) The model includes time-variant constant heads (Scen_1A.CHD). The report does not mention the use of constant head boundaries. I ran the model, reviewed the list file, and recognize these cells are not removing significant quantities of water. However, an explanation regarding where these cells are located and what they represent is needed.

2) The specified transmissivity distribution appears to be anisotropic (the input parameter HANI in Scen_1A.LPF is 5, which is the ratio between conductivity along columns and conductivity along rows). Anisotropic conditions are not described in Tyley or in the URS modeling report. An explanation of how a ratio of 5 was selected and its influence on simulated drawdown is needed.

3) Model tests using ½ of the Tyley transmissivity distribution are not considered extreme (i.e., decreasing transmissivity by a factor of 2 does not encompass the potential uncertainty in transmissivity indicated by previous investigations). In regards to the data used to develop his distribution, Tyley stated "many of the transmissivity estimates based on these logs represent only an order-of-magnitude figure". Although Tyley cites more than 400 driller's logs were used to calculate transmissivity, he does not report how many of those logs were used to develop the distribution in the Mission Springs subbasin (one of 4 subbasins considered in the study). Tyley maps a range in transmissivity of about 270 to 27,000 ft2/day; the PSOMAS model reports a transmissivity range of about 1,300 to 61,000 ft2/day; and, the model calibration reported by Mayer et. al. (2007) report a transmissivity range of about 170 to 2,700 ft2/day. Decreasing transmissivity by at least a factor of 10 seems more representative of the uncertainty in transmissivity reported by Tyley and indicated by more recent modeling investigations.

4) Question 4 below was not answered (report the simulated volumetric budget). Although most of the water inflow and outflow is represented by specified recharge and pumping, the net change in groundwater storage is

also relevant to document. I ran the SCEN_1A model and extracted the cumulative budget from the list file. The results indicate an average annual net decline in groundwater storage of about 50 acre-feet per year over the 31-year simulation period. This storage decline is attributed partially to cumulative recharge being less than cumulative pumpage (i.e., recharge occurs for 30 years due to the 1-year lag, whereas pumping occurs for 31 years), and the remaining storage decline is attributed to the dewatering that occurs as a result of the pumping and the new hydraulic head distribution (i.e., drawdown). These drawdown and storage reduction effects are small relative to annual recharge and pumping rates of 1,100 acre-feet per year, but they are additive to the cumulative effects of all water management activities contributing to water level and storage declines in the subbasin and therefore should be reported.

5) The answer to question 5 below is incomplete ("What is the physical basis for the general-head boundaries"). Explain why this type of boundary was selected and the physical basis for the transmissivity and length terms used to calculate the conductance terms (the prescribed head is understandably specified the same as within the model domain). Review of the list file for Scen_1A confirms the amount of water contributed and removed by these boundaries is small in the Scen_1A model run.

6) In the CPV model, the simulated head changes that change the net hydraulic gradient across the Banning Fault are probably small, and its possible net flow across the fault can indeed be ignored. However, the model calibration reported by Mayer et. al. (2007) indicated outflow from the Misson Creek subbasin across the Banning Fault is significant and represented 33% of the total 1998 subbasin outflow. It therefore seems the possible effects of the fault on net water level and groundwater storage changes simulated by this superposition model should be explored and documented.

John Fio

HydroFocus, Inc.

(Dixon) 707-678-6458

(Davis) 530-756-2840

From: Dale_Shileikis@URSCorp.com [mailto:Dale_Shileikis@URSCorp.com]
Sent: Tuesday, June 10, 2008 6:35 PM
To: Bill Pfanner
Cc: Christopher Dennis; Caryn Holmes; Dale Edwards; John Fio; mdonovan@psomas.com; George_Muehleck@URSCorp.com; Jim_Zhang@URSCorp.com; mturner@cpv.com; MICHAEL.CARROLL@LW.com; bhren@cpv.com; KrisHelm1@aol.com; Kathy_Rushmore@URSCorp.com
Subject: CPV Sentinel Groundwater Questions & Responses

Bill & John,

Attached are our responses to the CEC/HydroFocus questions emailed to me on Friday, June 6, 2008. Our responses are highlighted in blue following each of the HydroFocus questions as listed:

1. Report observed long-term water level trends: overall Mission Creek Subbasin and local conditions near site (if available). This is necessary to place simulated water level changes into the context of basin conditions.

Observed long-term trends in the Mission Creek Subbasin (Subbasin) indicate that water levels have been declining due to significant groundwater pumping. Comparisons of water level contour contour maps provided in Tyley 1974 and PSOMAS 2007 and in hydrographs included in PSOMAS 2007 - Appendix A, indicate water level declines have ranged from 20 to 50 feet with some local overdraft areas (MSWD Wells 28/30 Area). This makes little difference in the CPV Groundwater Flow Model (CPV Model) as the January 2008 sensitivity runs (1/2 of Tyley 1974 Transmissivity) consider this in the extreme. Transmissivity only changes slightly as it is based on aquifer thickness x hydraulic conductivity. If water levels drop the T value drops. Because the saturated aquifer thickness is reported to be over 1,000 feet, water level declines of 20 to 50 feet would only decrease the aquifer transmissivity by 2 to 5%. The only site-specific information is water level data from an existing well (now called OBS-1). Current water level measurements from OBS-1 indicate a water level of ~330-feet below ground surface (bgs). After extensive inquiries, it appears that no drillers report was ever filed for OBS-1, so a drillers or geologic log is not available.

Note that the CPV Model is a "superposition" model, that simulates NET changes in water levels (caused by project-specific pumping and project-specific recharge). As such the simulated water level changes (drawdown and mounding) are independent of the effects non-project related stresses (pumping or recharge) have on water levels within the Subbasin. The simulated NET changes of water level (caused by project-specific pumping) only depend on the transmissivity and storage coefficient (in this case specific yield due to the unconfined aquifer system). In the context of long-term water level trends and Subbasin conditions, transmissivity values used in the Tyley 1974 model (and adopted for use in the CPV Model) would only change slightly for reasons stated above. In any case, the project-specific water level changes as simulated in the CPV Model are dramatically less than those that have been historically induced or would be expected in the future by existing pumping operations in the Subbasin.

2. Summarize recent aquifer test results and compare to distribution simulated by model (i.e., transmissivity and storage coefficient data that has been developed for the Mission Creek Subbasin since 1974). Compare data to transmissivity distribution simulated by model.

Transmissivity values were only available from various model reports (PSOMAS etc.) but pumping test data was not documented. While our efforts have been exhaustive, whatever pumping test data there is has not been made available due to either pending lawsuits or because the information is proprietary. In any event the transmissivity values used in the CPV Model sensitivity runs are in the range of those included in other models. All indications from our research indicate that the Tyley 1974 transmissivity and specific yield values are still resonable. We note that the CPV Model is not a regeneration of the Tyley 1974 analog model. The CPV Model was developed after extensive review of existing reports. The CPV Model only adopted Tyley 1974 Transmissivity and specific yield values as they seemed to make the most sense with respect to the distribution of geologic materials in the Subbasin. Tyley 1974 used data from long term research and over 400 well logs and well tests.

3. Report numerical solver and closure criterion; document closure criterion was met in every time-step (i.e., the model converged in every time step).

Numerical solver used is PCG2 (Preconditioned Conjugate Gradient, version 2), which has the advantages of leading to fast convergence and needing low computer memory. Head change criterion for convergence is 0.01 ft, and residual criterion for convergence is 0.01 ft^3/day which are very strict.. Both criteria are satisfied for each time step in the CPV Model. For mass balance, the discrepancy for mass balance is 0.11% for the 1st stress period (first month), and 0.03%-0.04% for the remaining stress periods. Discrepancies of 0.03% - 0.04% (or even 0.11%) are very small numbers and are well accepted in numerical simulations.

4. Report simulated volumetric water budget. This is important to assess the reasonableness of the model and the simulated water level changes.

Since both left (west) and right (east) boundaries are far away from the DWA basin and the project site, where recharge and pumping are modeled respectively, recharge at the DWA basin and pumping from the project site have only minor effects on groundwater conditions near those boundaries (see the contour maps of simulated groundwater level changes in the CPV Model report). That is, the left and right boundaries have little effect on groundwater conditions within the CPV Model domain. Consequently, the volumetric water budget is the recharge and pumping amounts and the change in aquifer storage (i.e., the difference between the volume of recharge and pumping). As such the inflow/outflow from the left and right boundaries of the CPV Model are near insignificant.

5. Report physical basis for the general head boundaries. Document the conductance and head values employed and how they were determined. How sensitive are model results to the input parameters specified for the general head boundaries.

Based on the above, both the left and right boundaries have little effect on groundwater conditions for this superposition model. Consequently, almost any boundary condition could be used with insignificant effects.

6. Report specified initial head values.

In the superposition model, a steady-state static initial flow condition can be used with appropriate boundary conditions. In the CPV Model, a saturated thickness of 1,000 ft was assumed for the entire model domain (i.e., initial head of 900 ft was used across the model domain, and bottom elevation was specified to be -100 ft), and K distribution was determined based on Tyley's T distribution and the uniform saturated thickness of 1,000 ft for the entire model domain. Note that difference initial head distributions make no difference as long as the same saturated thickness of 1,000 feet is used in the CPV Model (i.e., if we used initial head of 400 feet and bottom elevation of -400 feet our results would have been the same).

7. Report uncertainty in simulated water levels due to possible changes in the conceptual model:
a. New information on transmissivity and/or storage coefficient distributions.

The sensitivity runs were conducted by reducing the transmissivity by one half which is considered an extreme case. No sensitivity runs were performed with respect to storage coefficient because storage coefficient (specific yield in this case) has less variation and Tyley's storage coefficient distributions are believed to be reliable.

b. Boundary Conditions – a no-flow boundary is employed to simulate Banning Fault. However, Figure 16 from Tyley (1974) and recent Mission Creek Springs modeling (Mayer et. al., 2007) indicate significant outflow from Mission Springs Subbasin across Banning Fault and into Garnet Hill Subbasin. What effect does ignoring outflow across the fault have on simulated trends in water level changes?

It seems the Banning Fault acts approximately as a no-flow boundary condition (only small amount of flow passes through the fault). Figures 12 and 13 from Tyley report (water level of 1951 and 1967, respectively) show significant differences across Banning fault (200-400 ft), indicating very low permeability of Banning fault, blocking flow from Mission Creek Subbasin to Garnet Hill Subbasin. It is similar for Mission Creek Fault. Note that the CPV model included general head boundaries to the west and east and no-flow boundaries to the north (Mission Creek Fault) and south (Banning Fault). In any event, in the CPV superposition model, using a no-flow boundary condition for the Banning and Mission Creek faults is more conservative. Specifically, allowing groundwater inflow/outflow at the Banning and Mission Creek faults would actually lead to smaller groundwater elevation changes caused by project-specific DWA recharge and pumping.

Please call George Muehleck or me if you have any additional questions.

Regards,
Dale

Dale Shileikis
Vice President
Manager, Major Environmental Programs
URS Corporation
221 Main Street, Suite 600
San Francisco, CA 94105-1917
415-243-3708 (Direct)
415-509-3708 (Cell)
415-882-9261 (Fax)
dale_shileikis@urscorp.com