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Dear Mary:

I am writing on behalf of the University of California Groundwater Cooperative Extension Program. The program assists local, state, and federal agencies, the agricultural sector, consultants, non-for-profit organizations, the environmental stakeholder community, and the public in better understanding and managing groundwater resources and groundwater quality in rural and agricultural regions of California. We provide shortcourses, workshops, and conferences. As Groundwater Cooperative Extension Specialist, I have been and am involved in various roles and through diverse educational, advisory, and applied research programs as independent scientific and technical advisor on many local, state, and federal groundwater issues. Among others, I have been involved in groundwater resources modeling studies of various subregions in the Central Valley (Tulare, Kings, Fresno, and Madera County), in Salinas Valley (Monterey County), and in Scott River Valley (Siskiyou County), all of which have heavily relied on the ready availability of historic and/or current groundwater level information from the California Department of Water Resources (DWR). I have also been a scientific advisor to and provided educational events for the Watershed Council of the Scott River Valley regarding the groundwater level status of the Scott River Valley.

The following are technical comments on the Draft CASGEM-DWR Groundwater Elevation Monitoring Guidelines that DWR published in October 2010.

Page 1: After the Section " Purpose of Guidelines for DWR Monitoring" and immediately before the Section "Network Design Concept" insert a new Section "Guiding Objectives for the Design and Implementation of Groundwater Level Monitoring".

The current guideline – just like the statutes spelled out in SBx7-6 – is missing clearly defined objectives to drive a groundwater level monitoring effort. The objectives are merely implied in the suggested design guidelines. However, in my interpretation of SBx7-6, the legislature, by giving DWR the authority to setup guidelines for groundwater level monitoring, has also authorized and, in fact, mandated that DWR clearly identifies the critical objectives that drive the design of a groundwater level monitoring program:

While the original statutes themselves lack a clear definition of the objectives of a statewide groundwater level monitoring program, the statutes do identify, in Section 10933, groundwater reliance of the "population", "public supply wells", and "irrigation acreage" in a basin as a key concern as well as "Any documented impacts on the groundwater within the basin or subbasin, including overdraft, subsidence, saline intrusion, and other water quality degradation." (Section 10933.b.7). The statutes further specifically defer to DWR's expertise in identifying additional groundwater level concerns by directing DWR to consider "(8) Any other information determined to be relevant by the department" (Section 10933b.8).

The current guidelines lack clear objectives and are prone to lead to conflict over the appropriate design of a groundwater level monitoring program. DWR should therefore clearly identify the ultimate objectives to be met by the groundwater monitoring level program. Defining such objectives is critical to guide the design of groundwater level monitoring.

I am not in a position to suggest what these objectives should be. The following are merely examples of how these monitoring level program objectives may be formulated and a final set may be any one or a combination of similar sets of objectives:

- to determine the long-term (five-yearly/decadal/multi-decadal) average basin groundwater level trend (or total basin groundwater storage)
- to determine the annual minimum and maximum average groundwater level/depth to groundwater (or total basin groundwater storage), representative of XX% of the basin
- to prepare maps of depth to groundwater/groundwater level elevation that are representative for typical low and high water level conditions experienced in representative areas across the basin during any six month/one year period (define "representative areas" – 1 square mile, 10 square miles, 100 square miles? Hydrogeologically defined subareas within a basin?)
- to meet the objectives of the groundwater management plans, where such plans are available
- to ensure that water level changes do not adversely affect groundwater quality or surface water quality
- to determine groundwater – surface water interaction/overdraft/saline intrusion/subsidence at sufficient spatial and temporal resolution to guide local or state regulatory/programmatic efforts

The spatial density (laterally and vertically) and temporal frequency of groundwater level monitoring measurements largely depends on which of the above (or other) objectives must be met by the local groundwater level monitoring program. DWR may defer to the local agency to identify such objectives, but should clearly do so, and set minimum guidelines for a key set of such objectives (e.g., the above list of choices).

Page 2: delete last paragraph (NAWQA program) and Table 1: While this reference is very exhaustive, it should be deleted from this guideline as the NAWQA program guidelines were merely intended for collecting representative groundwater quality information in a basin, and not groundwater level information. But the guidelines may serve DWR as a template to define its own guidelines for various possible groundwater level monitoring objectives that are as clearly defined as the water quality monitoring objectives in Table 1 (study unit survey vs. landuse studies vs. flowpath studies). The guideline should not leave the interpretation of Table 1 to local agencies. DWR must take the leadership to define a broad set of objectives and associated gruidelines similar to what NAWQA did for its own program.

Page 7, Figure 1 – add further discussion and tie to objectives. Figure 1 is illustrative in showing the effects of the density of monitoring points with respect to the ability to contour water levels in the basin. But the viewer may ask: so what? In other words: without clear objectives that identify what needs to be achieved with the groundwater level monitoring program, there is no way to judge the "goodness" or appropriateness of any one of the four contour level maps. In fact, any one of these may be good enough. Again, DWR first needs to define clear objectives, then tie in its guidelines to these objectives (or a choice set of objectives, see above).

Page 8, Figure 2 – add further discussion and tie to objectives. The same comment made for Figure 1 applies to Figure 2. For example, if the objective is to determine long-term (e.g., multi-year, decadal) trends and fluctuations in groundwater storage in a basin, biannual (or even annual) measurement of water level is completely appropriate – the red line would be sufficient information to establish such long-term changes. But if the objective is to provide a means to the community on how deep they may to drill their supply wells to collect sufficient groundwater, a monthly or daily groundwater level monitoring program may be needed depending on the accuracy necessary for planning purposes.

Page 9, Table 3 – Daily measurement frequency suggested for most wells in agricultural regions of California. Irrigated groundwater basins of California (e.g., Central Valley, Salinas Valley, most coastal basins in southern and central California) typically have annual recharge of 5 inches and greater due to irrigation returns. In most of these basins, the aquifer layers supplying water to agricultural and municipal wells will be of relatively high hydraulic conductivity (100 – 300 ft/d), particularly if this measure is applied strictly to the sandy/gravelly substrata tapped by most wells in California's agricultural basins.

Rigorously interpreting the criteria in Table 3 will mean daily water level measurements throughout these agriculture dominated groundwater basins. I suggest that daily water level measurements are unnecessary for all but a few potential groundwater level monitoring objectives. Even monthly measurements may not be needed depending on the specific objectives to be met by the groundwater level monitoring program (see comment in the previous paragraph).

Remove exclusion of public water supply wells from the groundwater level monitoring program. Finally, one comment on the Draft CASGEM Procedures for Monitoring Entity Reporting published in October 2010: I understand the legal requirements that preclude public disclosure of the location of pubic water supply wells in the State of California (see page 15). Not only for implementation of the groundwater level monitoring program, these requirements are extremely unfortunate. CDPH and its associated local agencies collect groundwater level, groundwater monitoring, and groundwater well construction data on over 15,000 wells across the state. These data are extremely useful and important to the groundwater level monitoring program.

I therefore strongly suggest that DWR, working within the requirements currently set forth by CDPH, develop and allow a procedure that lets local monitoring entities and/or DWR personnel use public water supply well water level data that are collected in accordance with the level monitoring guidelines to be used in the preparation of groundwater level contouring maps. CDHP does allow the display of the location of public water supply wells on maps, as done for example in the SWRCB online Geotracker database, if these locations are adequately fuzzied (e.g., by choosing a symbol size exceeding the 1 mile scale or by fuzzying the location of the symbol to within a required distance (~ 1mile). The fuzzied *display* of the monitoring point does *NOT* preclude the use of the *exact* location in the preparation of water level maps or water level hydrographs. Please adjust these requirements

Let me know if I can be of further assistance.

Regards,

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