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Ms. Michele Staples
Jackson Tidus
2030 Main Street, 12th Floor
Irvine, CA 92614

Re: Borrego Valley Groundwater Basin; Estimate of Basin Yield by Dudek

Dear Ms. Staples:

The following is a brief summary of the three technical committee meetings that we attended in person or by teleconference. The first meeting was held in Encinitas at Dudek's offices on August 31, 2018. The second meeting was held April 26, 2019, in Escondido. I participated by telephone in a meeting held May 10, 2019.

The purpose of the three meetings was to gain an understanding of the work Dudek prepared to support the GSP under SGMA and to identify key components of the Borrego Valley Groundwater Model (BFGM) prepared by USGS and as updated by Dudek. The most recent two technical meetings were necessary because 1) the model and its supporting documentation was released for a 60 day public review and comment period. This time frame is insufficient for the public to fully understand the magnitude of the work done; the meetings of experienced technical professionals was needed in order to ask specific questions of the authors of the work. 2) Key elements of the model used to establish sustainable pumping were not readily apparent in the model report. For example, the GSP, based on the model establishes a sustainable pumping target of 5,700 acre feet without sufficient justification; there is confusion as to the estimate of natural yield and sustainable yield, and as to the reason findings made by USGS in its 2015 model report, "Hydrogeology, Hydrologic Effects of Development, and Simulation of Groundwater Flow in the Borrego Valley, San Diego County, California, (Faunt, et al 2015) were ignored.

While we have asked several questions about the Dudek model, its inputs, the modifications, assumptions and results, AAWARE's main interest is Dudek's use of 5,700 acre feet as ultimate sustainable yield of the BVGB. San Diego County, Borrego Water District and Dudek have stated that 5,700 acre feet is only a starting point for adaptive management and that the model and sustainable pumping amount will be determined incrementally over time and during the 20 year SGMA rampdown period. In response to our questions as to why they used 5,700 acre feet as the basin yield for groundwater management, we were told that it was a good place to start and that budget and scoping constraints prevented modeling various other target pumping rates for the

BVGB. Further, we were told by Dudek that 5,700 acre feet represented the best available information for estimating the BVGB pumping yield.

According to the USGS, as indicated on Table 19, page 122 the total evapotranspiration of groundwater (7,074 acre feet) under pre-development conditions (1945-2010) is 7,074 acre feet. As this value is equal to the inflow for that period (streamflow and underflow, unsaturated-zone recharge and change in storage), 7,074 acre feet can be assumed to represent the available yield of the BVGB under pre-development conditions.

USGS reports on Table 20, page 122 in its Model Scenario 6 (50% reduction in M&I pumping and 40% reduction in Agricultural pumping) that the target pumping rate was 7,824 acre feet (for 30 years commencing in 2030). The results of this scenario indicated a slowing in the loss of groundwater storage by 2060; if the model run had been extended to 2070, it may well have achieved sustainability. USGS reports on page 4, in reference to Model Scenario 6, "With these reductions, at 2060, recharge approximates discharge." When recharge approximates discharge, the water supply and the water uses are about equal, or, sustainable under the conditions modeled.

Dudek prepared a chart identified as Figure 3.3-2, "BVHM Model Runs Addressing Future Climate and Pumping Reductions" that indicates a net positive change in storage beginning between 2030 and 2035 and continuing until 2070, approximating the sustainability of the BVGB for its target pumping rate of 5,700 acre feet. The chart indicates a range of between 35,000 acre feet and 70,000 acre feet of storage increase in 35 years; about 1,000 to 2,000 acre feet per year. This suggests that the sustainable yield is between 6,700 acre feet and 7,700 acre feet.

Natural yield, the available recharge to a groundwater basin, under pre-development conditions represents the minimum available yield in a groundwater basin. Most of the groundwater adjudications (if not all) in California use a definition of basin yield that includes 3 components 1) Natural Yield; the amount of total recharge including underflow that would exist under pre-development conditions. In the BVGB, this amount is about 7,100 acre feet 2) Developed Yield; developed yield is an amount of water that is developed from pumping the groundwater basin and includes change in storage, and reductions in basin outflow and evapotranspiration; 3) Return flow from pumping.

USGS estimated the combined average natural recharge for the BVGB under pre-development conditions to be approximately 7,100 acre feet per year. Dudek selected a target pumping rate that either ignores or misinterprets what could be considered the best available information; the USGS report and Dudek's modeling output shown on Dudek figure 3.3-2. In addition, as the 7,100 acre foot value above represents pre-development condition, the basin yield might be higher when developed yield (excluding change in storage) and return flow are included.

Dudek reports in Chapter 2 in Section 2.2.3.6 "Sustainable Yield Estimate"

> The average annual natural recharge of water reaching the saturated zone, which includes stream leakage and infiltrating water through the unsaturated zone, was 5,700 AFY for the

> full model simulation period from 1929 to 2010 (USGS 2015). In addition to natural recharge from stream leakage and infiltrating water (mostly from irrigation return flows), the Subbasin received underflow originating from the adjacent watersheds at an average annual rate of 1,400 AFY. Therefore, the combined average annual natural recharge to the BVGB is approximately 7,100 AFY. Recharge in the basin is bimodal, with the majority of recharge occurring on decadal basis in a few very wet years. Most years have significantly less natural recharge than the average. Given that this bimodal pattern introduces a level of uncertainty regarding the actual amount of recharge that could occur over the next 20 years, the GSA has determined that a target pumping rate of 5,700 AFY by 2040 would be consistent with the GSP's sustainability goal (discussed in Chapter 3).

We note that Dudek properly reports the same value for what it calls "combined average annual natural recharge" (7,100 acre feet) as the USGS reported. Also, it is noted that by definition, natural average annual recharge cannot include irrigation return flow (pre-development conditions as indicated by USGS). As noted above, sustainable yield would include, natural recharge, developed yield and return flow. 7,100 acre feet is a reasonable initial "sustainable yield estimate" for the BVGB, as indicated by USGS, and by Dudek's model output (Figure 3.3-2 noted above).

The "bimodal recharge" pattern is a function of desert environments. Multiple successive wet years will provide more than average recharge and multiple successive dry years will provide less than average recharge. Over a long period of time (1929 to 2010) wet and dry cycles will produce an average recharge. The "pattern" of recharge over a long time period, in light of the USGS model's pre-development output of yield, should not be a basis for selecting a non-representative sustainable yield. At a minimum, Dudek should have produced a model run or multiple model runs at varying target pumping rates.

Please contact me if you have any questions in connection with the foregoing.

Very truly yours,

WAGNER & BONSIGNORE
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Robert C. Wagner

Via: Email