

# Dr. Dennis Williams rebuttal to Cadiz Water Project Opponent Study of Bonanza Spring

Comment on Andy Zdon et al study of Mojave Desert Springs/ Bonanza Spring

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Summary:

Zdon et al (2018) attempts to draw the conclusions that groundwater discharge at Bonanza Spring has a source in the Providence Mountains to the northeast. This is in an attempt to conclude that the Bonanza Spring is hydraulically connected with the Fenner Valley aquifer and as such, could be impacted by pumping for the Cadiz Water Project. We find this conclusion to be in error and not consistent with current geologic mapping made available via field work performed by Dr. Miles Kenney PhD and watershed analysis performed by Terry Foreman after the Zdon study. Zdon also is limited by geochemical analysis of water samples and doesn't adequately survey and incorporate physical geologic evidence.

Specific response to primary arguments made are as follows:

1. First, he notes that the Bonanza Spring Watershed is smaller than most, then notes that groundwater from the spring is warmer than average ambient atmospheric temperature which he states is indicative of a deep source (750 feet deep).
  - a. Rebuttal- Zdon begins with a poor premise estimating the average ambient atmospheric temperature by using Needles station and Mitchell Caverns and then takes an average. This methodology is incorrect!
  - b. Temperature from numerous stations at various elevations should be considered before estimating and projecting a temperature at the spring without a weather station.
  - c. Therefore, the determination that warmer than ambient temperature is likely also incorrect. Our recent work indicates that Bonanza Spring water temperature (26.7 C) is warmer than Vontrigger Spring (24.3 C) and warmer than Hummingbird Spring cited in the report as 23.8 C. However, warmer temperatures are common in groundwater adjacent to faults. Therefore, this is consistent with the extensive faulting that has formed the catchment watershed of Bonanza Spring.
  
2. Zdon concludes that the Bonanza Spring is unique in that the delta deuterium value ( $\delta D$ ) is similar to water from the northeast and not the local springs.
  - a. Rebuttal: However, the Rose (2017) work cited in the report contradicts this conclusion. In fact, the Bonanza Spring  $\delta D$  values are within the range of values for the Clipper Mountains as a whole. The report does not provide the supporting data to support the broad and general conclusions.

3. Zdon argues the watershed tributary to Bonanza Spring is very small (50 acres).
  - a. Rebuttal: the assumed small water shed (50 acres) is wholly inconsistent with recent mapping conducted by Kenney and Foreman (2018) of a catchment watershed to Bonanza Spring of 2,350 acres. When accepting the actual watershed area, which contributes to Bonanza Spring, the data cited by Zdon becomes consistent with site conditions.
  - b. Further, Zdon provides No data to support hydraulic connection between Bonanza Spring discharge at 2,100 ft amsl and the groundwater surface in Fenner Valley at an elevation 700 ft lower.
  - c. In fact, the report notes that discharge from the main spring percolates and then rises forming the Lower Bonanza Spring. This confirms observations made by Kenney/Foreman (2018) that bedrock is shallow. Flow from the spring does not percolate in the bedrock, but rather rises and is consumed by riparian vegetation of evaporates.
4. Zdon concludes recommending monitoring of the watershed and Springs.
  - a. Comment: We generally agree with Zdon's recommendations and add that the suggested monitoring has been a part of the Project Groundwater Management, Monitoring and Mitigation Plan (GMMMP) for many years.
5. Zdon summary/conclusion bullet No. 1 states that:

*“Bonanza Spring – water within Bonanza Spring is from a basin-fill water source, deriving its water from recharge north of the Clipper Mountains, such as the Providence and New York Mountains, and could be impacted if groundwater levels decrease at, or near, the spring (as estimated in Santa Margarita Water District (2012). Groundwater from these northern regional sources (such as the New York and Providence Mountains) moves southward toward Fenner Valley, generally around the Clipper Mountains, but also seeping through the subsurface within the volcanic rocks of the range, only to resurface at the spring. This conclusion is based on the following data: groundwater elevations in the basin-fill north of the Clipper Mountains is at higher elevations than Bonanza Spring (Geoscience Support Services, 2011);”*

- a. Rebuttal: This is not true! As shown in the Figure 2 of GEOSCIENCE 2011 report, the water level in the north of Clipper Mountains is about 1800 ft amsl. This is much lower than the elevation of 2105 ft amsl for the Bonanza Spring. Zdon et al misuses the water level elevation data to establish the groundwater pathway from the Providence and New York Mountains to the Bonanza Spring. Furthermore, there will be no water level impact in the area north of Bonanza Spring under ANY modeling scenarios as shown in the modeling results.

Conclusion:

Zdon's analysis is not credible as to any interaction between Cadiz Water Project pumping and Bonanza spring flow.

