

JULY 28, 2012
Kennedy GeoScience
JN 716-10

RESPONSE TO MARBLE MOUNTAIN SPRINGS LIUNA COMMENTS
CADIZ VALLEY WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT

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Subject: Response letter regarding basin groundwater
conductivity of four springs/seeps in the Marble
Mountains and the Cadiz Groundwater Basin, San
Bernardino County.

Per your request, Kennedy GeoScience (KGS) provides this response letter addressing comments for the Cadiz Valley Water Project Final EIR provided to Mr. Dan Ferons with the Santa Margarita Water District Board of Directors regarding four springs in the Marble Mountains, San Bernardino. The comment letter was provided by Laborers' International Union of North America (LIUNA), Local Union No. 783 provided by Lozeau Drury LLP. The LIUNA comment letter dated July 25, 2012 indicates that four perennial water sources occur in the Marble Mountains that are extremely important to bighorn sheep. The LIUNA letter provided the below information regarding the location of the four perennial water sources in the Marble Mountains:

1. VernAndyLes Spring (UTM Zone 11, Easting 622690, Northing 3839850, elevation ~2575)
2. Teresa Spring (UTM Zone 11, Easting 623770, Northing 3838280, elevation ~2450)
3. McLaren Seep (UTM coordinates not available, but in the same general area as the previous two), and
4. Castle Mine (UTM, approximate Easting 628579, approximate Northing 3835524, elevation 2190)

KGS performed mapping in the region of these springs in November of 2011. The KGS mapping was greatly assisted by information from Mr. Bill Tuck with the Society for the Conservation of Bighorn Sheep (SCBS) that provided the locations and general descriptions for the four springs and/or seeps indicated above. Mr. Tuck provided a map showing the locations of the VernAndyLes, Theresa and Castle Mine spring/seep sites with a Google Earth base map, photographs of the VernAndyLes and Theresa Springs, and a letter with locations and generalized descriptions of the springs/seeps. However, Mr. Tuck indicated that the SCBS did not want us to publish the locations of the springs in any way. Thus, the KGS report provided in the Draft EIR, Appendix 4, purposely did not include specific information regarding spring locations and local geologic stratigraphy and structure in the regions of the mapped springs per the request of Mr. Tuck. The motivation for not presenting the spring/seep locations was to protect them. Therefore, considerable geologic data was collected by KGS in November, 2011 in the area of the



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identified springs/seeps but was purposely not published. However, during our mapping, it was clear that we positively identified the VernAndyLes, and Theresa Springs based on the provided photographs, and the Castle Mine site based on provided GPS coordinates.

The four springs/seeps are discussed separately below.

VernAndyLes Spring:

The VernAndyLes Spring occurs within a narrow drainage. The spring is natural in the sense that groundwater emanates to the surface; however, a small basin has been dug out and an upstream wall constructed upstream in order to produce a small pond of water. Miocene age volcanic rocks exist essentially at the surface where the spring water emerges within the drainage. Thus, alluvial sediments are less than 1 foot thick. The spring is located at a contact between a fine-grained "white" volcanic member (layer), and a dark green mafic member that may be impermeable. The fine-grained white member, which is upslope from the green mafic member, is essentially the same volcanic layer as that observed at the Theresa Spring. These volcanic units dip 20 to over 60 degrees toward the northeast. Groundwater emanating from the spring appears to be pushed toward the surface along bedding planes and in particular, along the contact between the dark green mafic member which may be impermeable, and the white fine-grained volcanic member.

Numerous folds and small-scale faults occur in the area of the spring. More importantly, a prominent northwest trending fault zone exists approximately 300 feet southwest of the VernAndyLes Spring. This fault zone continues further to the northwest and also bound the Theresa Spring discussed below. The fault zone is over 100 feet wide as is a major structural zone likely associated with Miocene extension. The fault zone dips nearly vertically, suggesting it may have actually exhibited primarily lateral motion. Individual faults within this zone exhibit clay gouge zones over 1-foot thick and in places is over 8-feet thick. These clay laden zones likely act as a groundwater barrier assisting in the creation of the VernAndyLes Spring upslope from the fault zone.

Based on these data, it appears unlikely that the groundwater emanating from the VernAndyLes Spring is connected to groundwater within the Cadiz Groundwater Basin.

Theresa Spring

The Theresa Spring occurs within a small drainage. Water seeps out of very thin alluvium deposits less than 1 to 1.5 feet thick within the wash in addition to directly from volcanic rocks on the east side of the north to south flowing wash. The spring appears natural and has saturated the thin alluvial deposits in the wash where short green grasses grow. Water with sufficient depth to drink occurs in foot-print depressions within the boggy soil. However, this water is drained/or pumped, to a water tank that exhibits a pool of water in which animals can drink.

The spring occurs within the same fine-grained white volcanic layer as that observed at the VernAndyLes Spring discussed above. The volcanic rocks at the spring and upslope from the spring dip 30 to over 50 degrees toward the northeast. These rocks exhibit several gentle folds but all the bedding planes dip toward the northeast north of the spring for at least 200 feet. A northwest trending fault zone exists within several feet to a few tens of feet southwest of the spring, which is part of the northwest trending



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fault zone discussed for the VernAndyLes Spring above. In addition, another fault that is part of this prominent northwest trending fault zone occurs northeast of the Teresa Spring approximately 250 to 350 feet. Hence, the Teresa Spring is fault bounded. Bedding dip directions vary across these faults; however, the volcanic bedding in the fault block containing the Teresa Spring dip toward the northeast (upslope).

Clay fault gouge zones are similar in the area of the Teresa Spring as described for the VernAndyLes Spring above. Based on these data, it appears unlikely that the groundwater emanating from the Teresa Spring is connected to groundwater within the Cadiz Groundwater Basin.

McLaren Seep

KGS was not provided GPS coordinates or photographs of the McLaren Seep by Mr. Tuck. However, documents that Mr. Tuck provides indicates that the McLaren Seep is located in a *"steep ravine above Theresa Spring, below a high point, look for pink/white wedge out of hill. Sheep don't like the confined visibility"*. KGS did not identify or map in the area of the McLaren Seep. However, it is clear that this spring occurs upslope from the Theresa Spring, and thus upslope from the northwest-trending fault zone that is likely a groundwater barrier. Based on these data, it appears unlikely that the groundwater emanating from the McLaren Seep is connected to groundwater within the Cadiz Groundwater Basin.

Castle Mine Spring

As described by the documentation provided by Mr. Tuck, the Castle Mine occurs in dense brush above a house (abandoned) that also exhibits a well above two large water tanks. Additionally, this documentation indicated that no water was observed and recommended that the site be observed during a wet year and that work be conducted at the site, presumably to increase surface water availability with anthropogenic involvement.

This area was mapped by KGS in November 2011 and did not identify any water. A small drainage was identified in the thick brush that appears to flow presumably during local precipitation and a 1 to 1.5 feet deep, 8-inch diameter hole excavated within the axis of the wash, which was also dry at the base. Near this boring, a cave extended into the soils greater than 8-feet deep and just a few feet high. The cave may be the "tunnel" referred to in the LIUNA comment letter dated July 25th (page 43). The LIUNA letter also indicates that this site *"has been developed to provide a perennial source of water this is used by bighorn sheep in the central part of the Marble Mountains"*. It is possible that the shallow boring excavated just outside of the cave entrance may be associated with the "development to provide a perennial source of water" indicated in the LIUNA letter. Regardless, no water was identified within the cave or the shallow boring during KGS mapping in November 2011.

The strongly vegetated area immediately above the abandoned home is a landslide developed in volcanic rocks. The head-scarp of the landslide is approximately 150 to 200 feet up slope from the abandoned home located essentially in the wash near the toe of the slide. The thick vegetation occurs on the disrupted landslide soils. Bedding within the volcanic rocks is out-of-slope (a component of dip toward the northwest). The presence of the landslide is consistent with groundwater flowing at depth, and facilitating the development of the slide in addition to the out-of-slope bedding. Hence, the existence of the landslide suggests that groundwater likely occurs at fairly shallow depths locally; however, no water



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was observed during our investigation. The cave area described in the previous paragraph occurs within the landslide mass.

The well located approximately 350 to 400 feet up the hill from the two large water tanks (dry), consisted of a vertical shaft of unknown depth. A wood ladder extended into the shaft in addition to wood support beams. The well was constructed on a cut pad excavated into the local volcanic rocks and surficial slope sediments. No water was observed in this area.

Based on these data, the Castle Mine is not a spring or seep. In addition, no standing water was observed within the tunnel, boring or well structures.



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