



MEMORANDUM

TO: Mr. Robert Elliott
Little Baldy Water Company
PO Box 313
Llano, California 93544

FROM: Jordan Kear, P.G., C.Hg.

KG12-0100

DATE: July 20, 2012

SUBJECT: Reconnaissance Level Hydrogeologic Evaluation,
Little Baldy Water Company
Llano, Los Angeles County, California

This memorandum is intended to transmit our preliminary findings, conclusions, and recommendations following our reconnaissance-level evaluation of the nature and disposition of water sources of Little Baldy Water Company (LBWC) in Los Angeles County, California.

At your direction, Kear Groundwater's (KG) efforts for this project have involved data collection and review; field visits to the LBWC area, reconnaissance of the spring and wells and areas of geologic outcrops, and preparation of this memorandum. The primary goal of this evaluation is to help define and understand the nature and disposition of the source waters to LBWC wells and spring, and the fate of that water both when and when not intercepted by the LBWC system. Using this information, preliminary locations and design discussions for replacement or augmentation wells are provided as well.

To address the nature of LBWC water resources, we briefly discuss herein the primary system components, geology and hydrology of the LBWC area and the larger regional hydrology.

LBWC System Sources

LBWC currently obtains its water via two active wells, and has historically obtained water from a spring, stored water via two dams, and has a third well which is not actively used. Each of these components are within the catchment of Grandview Canyon, south of the LBWC Service area and at higher elevation such that the system is fed via gravity.

Source	Year Developed	Depth	Production Capacity (gpm)	Status
Well No. 1	1937	60	90	Active
Well No. 2	1967	67	90	Active
Well No. 3	Circa 1998	300	5	Standby
Spring 19L1	Circa 1910	--	10	Flowing

All LBWC water sources appear to be primarily recharged by precipitation originating as rain or

snow within the Grandview Canyon catchment area, shown at various scales on Figures 1 through 4. Further discussion of the hydrology and geology of the Grandview Canyon catchment is described below.

KG understands that the relatively simple LBWC system operates as a flow-through system, wherein water is pumped into the transmission system at the source wells area and flows in approximately 8 miles of piping from which a portion of water is used but unused water is allowed to flow out at ground surface near the end(s) of the pipeline(s) where it percolates into the subsurface and effectively returns to the Pearland Subbasin, a sub-unit of the Antelope Groundwater Basin, currently the subject of adjudication. KG further understands that little irrigation is conducted in the LBWC service area and that most, if not all, service connections reach, after use, individual septic systems, resulting in a significant return flow back to the Antelope Groundwater Basin.

Well Nos. 1 and 2 appear to be relatively shallow, extracting groundwater from the shallow alluvial channel in Grandview Canyon. This area has consistently been excluded from the Antelope Groundwater Basin as defined by others (although included within the contributory area to the basin) and appears to be consistent with water flowing in a known and defined channel, bounded by relatively impermeable bedrock. As such, it is our understanding that the wells have been permitted and are operated as "surface water diversions."

Water quality from the wells appears to be consistent with this interpretation, as the character is of calcium-bicarbonate and total dissolved solids (TDS) concentration is in the 400 to 500 mg/l range, similar to the surface water in the creek flowing in Grandview Canyon and as would be expected in the area of marble-rich bedrock provenance.

The LBWC Spring, noted in the table above as 19L1 owing to the section and subsection in which the spring is present, flows up to a reported 10 gpm and yields a much fresher water quality with a TDS concentration of 200 mg/l as measured in the field with KG instrumentation. Although not currently directly connected to the LBWC system, the spring flow emerges from its source and enters the creek in Grandview Canyon where the flow is intercepted by the Well Nos. 1 and 2. Spring 19L1 appears to drain a section of perched older alluvial gravels (Qog on Figure 4) known as Big John Flat. The alluvial sediments of Big John Flat have consistently been mapped within the Antelope Groundwater Basin and therefore Spring 19L1 would have been a discharge point for percolating groundwater. The Antelope Groundwater Basin is currently the subject of adjudication and the Big John Flat area is included therein.

New Well Postulation

KG understands that the existing LBWC Well No. 3 produces limited quantities of groundwater and should be replaced. Should a new well be drilled, KG recommends targeting the central portion of the known and defined channel, maximizing the alluvial thickness and distance from relatively impermeable bedrock of the canyon walls. Depending on property availability, a new LBWC Well could be drilled at any available parcel where setbacks from septic systems and other regulations are met. KG anticipates that the alluvium thickens and widens to the north

within the Grandview Canyon channel. New wells should target the alluvium, and be adequately deep to capture fractured and/or weathered bedrock and be countersunk into the underlying lower permeability material. Well depths on the order of 100 feet appear to be typical. Should another existing well become available for inclusion into the LBWC system, it should be properly evaluated and tested as part of an escrow process.

Grandview Canyon Catchment

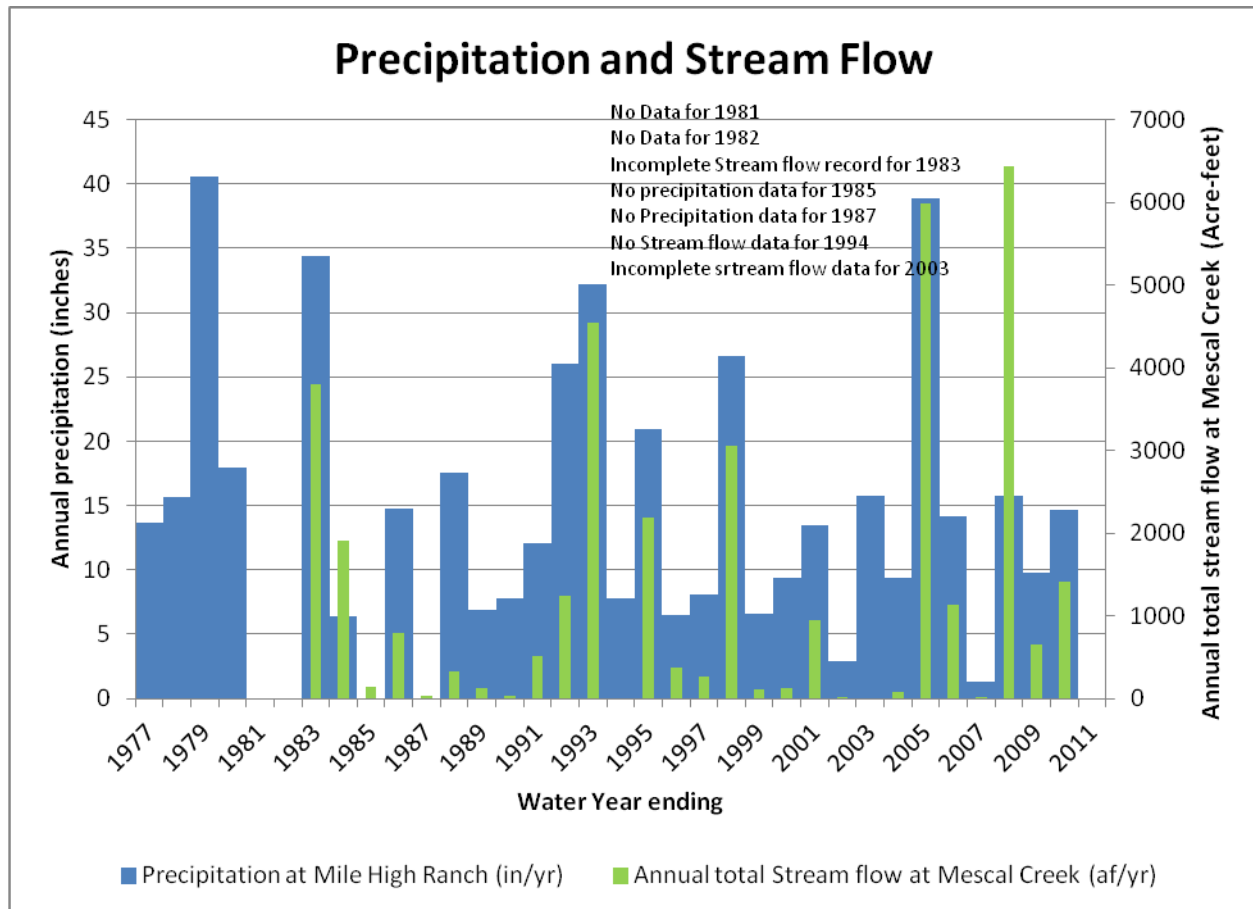
The area tributary to the LBWC system is referred to herein as Grandview Canyon Catchment (GCC), a sub-watershed of approximately 4.65 square miles along the northern front of the San Gabriel Mountains. The GCC ranges in elevation from about 4,500 feet above mean sea level at its northern mouth where it meets the Alluvium of the Antelope Valley to over 7,500 feet above sea level at the southern headwaters along Blue Ridge. Nearly 2 square miles of the GCC is south-southwest of the San Andreas Fault. Further bisection of the GCC includes the presence of alluvial strata of Big John Flat and also in the Mile High area, occupying about 1 square mile of the GCC area. The remainder of the sub-watershed is exposed bedrock and soils thereon and the alluvium in the canyon bottoms.

Precipitation and runoff

Precipitation in the GCC is variable, typically greater in the southern, upper elevations of the catchment and drier in the northern portions. Records from a rain gauge at Mile High Ranch (MHR), nearly midway in elevation and latitude within the GCC, as available from the County of Los Angeles for most years from 1977 to 2010, indicate a range of precipitation from 1.29 inches (2007) to 40.55 inches (1979). Arithmetic mean of the available data set is 15.6 inches annually, with a median value of 13.9 inches. Given the midland location of the MHR gauge, the data point is likely a fair representation of the average precipitation within the GCC as a whole. Hence, over the 4.65 square miles (2976 acres) of the GCC, a 14-inch-per year average precipitation would yield 3,472 acre feet to the catchment. Of this, as is typical in arid environments, over 50 percent, or 1,736 acre feet, is likely lost to evapotranspiration. Fifteen percent may infiltrate to groundwater within the GCC, or 521 acre feet annually, and 35 percent, or 1,215 acre feet, may flow as surface water as an annual average.

A similar catchment, Mescal Creek (just to the east of Grandview Canyon), has had a stream gauge in operation nearly continuously since 1983. This 5.41-square mile drainage appears to be a good proxy for Grandview Canyon, and although the data indicate some anomalies there appears to be a generally good correlation between precipitation measured at Mile High Ranch and runoff from Mescal Creek. Measured runoff has ranged from zero to upwards of 6,000 acre feet in wet years, with a mean value of 1,340 acre feet. This mean runoff value is very similar to the simple estimate presented above for GCC.

The following chart presents a comparison of precipitation at MHR and runoff at Mescal Creek:



Conceptual fate of GCC water

Precipitation that reached the GCC would primarily either evaporate, be transpired by flora, infiltrate into the soil and groundwater, or flow as streams. A portion of the infiltrated water southwest of the San Andreas Fault would likely be impounded on the southwest side of the fault and either emerge as spring flow along the fault or flow in the subsurface toward the west and into the alluvium of the Antelope Groundwater Basin. A portion of the precipitation which would infiltrate alluvium in the Big John Flat or Mile High Ranch areas would either return to the GCC as spring flow (like Spring 19L1) or flow to the east or west directly into other portions of the Antelope Groundwater Basin. Most of the remainder of surface and/or groundwater flow would coalesce in the shallow alluvial channel in Grandview Canyon.

If not extracted by LBWC Wells or other wells in the area, this Grandview Canyon flow would exit the catchment area and likely recharge the Pearland Subbasin of the Antelope Groundwater Basin. As shown on Figure 3, following a 1915 groundwater flow path from that point, the water would flow from the Pearland Subbasin to the Buttes Subbasin to the Lancaster Subbasin, and in the vicinity of Rogers Lake flow to the North Muroc Subbasin. The quantity of the recharge to the Antelope Basin from the GCC is likely on the order of 1,200 acre feet per year, either flowing directly out of the mouth of Grandview Canyon to the north or via the alluvial pathways

higher in the catchment.

Extraction and return of LBWC water

We understand that the LBWC pumps its wells via timers between 6 and 24 hours per day depending on system demands. This typically results in 30,000 to 70,000 gallons per day being pumped, which would equate to a range of 0.1 to 0.2 acre-feet per day being pumped. Annually, this would equate to 36 to 72 acre feet per year being extracted via the wells, but as described above a significant portion of this water returns to the Antelope Groundwater Basin in the vicinity of the properties of overlying landowners whose parcels are served by Little Baldy Water Company.

General Preliminary Conclusions

Based on our reconnaissance-level, preliminary review of available data, it appears that Little Baldy Water Company has been historically producing water either directly or indirectly from percolating groundwater of the Antelope Groundwater Basin and surface waters tributary to the nearly geographically-equal Rogers Lake Basin.

LBWC extraction appears to be on the order of 36 to 72 acre feet per year from a portion of the tributary area which is estimated to contribute about 1,000 acre feet per year of recharge to the Antelope Groundwater Basin. Much of the extracted groundwater/diverted surface water conceptually returns to the Antelope Groundwater Basin elsewhere in the system.

Owing to these factors, the water resources of the Little Baldy Water Company should be quantified and recorded with the State Water Resources Control Board and included in the ongoing Antelope Groundwater Basin adjudication.

Recommendations for further determination

To further substantiate the preliminary conclusions presented herein, KG recommends general approaches inclusive of the following:

Detailed Mapping: Detailed geologic mapping of the alluvial/bedrock contacts, wells, faults, recharge areas, and infrastructure (both abandoned and active) would help to better understand the nature of the hydrology of the LBWC area.

Detailed inflow monitoring: quantification of water discharged via the spring and pumped via wells, would help to substantiate and quantify the water produced by the LBWC.

Detailed outflow monitoring: quantification of the return flow to the Antelope Groundwater Basin via the "end of pipe" discharges and via septic systems. If needed, reporting of quantities of this discharge should be reported to either the State Regional Water Quality Control Board or

State Water Resources Control Board to establish this contribution quantity to recharge to the Antelope Groundwater Basin. Return flow should be quantified as a contribution to recharge in the adjudication.

Detailed water quality sampling and analysis: spring water should be analyzed for general mineral/general physical properties, such that the character of the water and key constituents can be evaluated. Both filtered and unfiltered samples can be analyzed, with the proper sampling procedures for various analytes employed. General mineral, bacteriological, isotopic, and biological constituents can be added to the water quality database for further understanding.

Recordation of Spring and Well use: KG recommends that LBWC record spring and well use with the State Water Resources Control Board. Water quality and reporting of water use should also be recorded with the CDPH.

Statement of Limitations

The services described in this report were performed in a manner consistent with our agreement with the client and in accordance with generally accepted professional consulting principles and practices. Opinions and recommendations contained in this report apply to conditions existing at certain locations when services were performed and are intended only for the specific purposes, locations, time frames, and project parameters indicated. We cannot be responsible for the impact of any changes in standards, practices, or regulations after performance of services. Discussions of faults in this reporting relate only to their hydrogeologic characteristics and are not intended to speak to their potential activity, earthquake potential, geotechnical hazards, etc., or lack thereof.

Hydrogeologic analyses for this report relied solely on available background data obtained from the client, Los Angeles County, the State of California, and published geologic reports. No independent subsurface exploration, laboratory testing, geophysical surveying or well testing was conducted by our firm for this study. No guarantee of water quantity or quality from an attempted well can be offered. Because the efforts to implement recommendations contained herein rely on the skill of outside contractors, our liability is limited to the dollar value of our professional efforts.

Discussions of water rights are presented herein only for general purposes. The client is encouraged to contact a qualified attorney to better review legal issues and obtain a legal opinion.

Any use of this report by a third party is expressly prohibited without a written, specific authorization from the client. Such authorization will require a signed waiver and release agreement.