



TECHNICAL MEMORANDUM

To: County of Lake, Community Development Department
From: Annjanette Dodd, PhD, CA PE #77756 Exp. 6/30/2023
Date: February 3, 2022
Subject: Response to Appeal Comments – UP 19-36 Lake Vista Farms, LLC
2050 and 2122 Ogulin Canyon Road, Clearlake, (APNs 010-053-01 and 010-053-02)

On November 24, 2021, an appeal to the Use Permit approved by the Lake County Planning Commission on November 18, 2021, for the proposed subject cannabis project, was submitted to the Lake County Board of Supervisors. The appellant filed the appeal on behalf of at least 12 residents located in the Burns Valley Groundwater Basin (BVGB) area southwest of the subject property.

A Groundwater Hydrology Technical Memorandum was prepared for UP 19-36 on August 19, 2021 and submitted to the Planning Commission that addressed groundwater recharge and cumulative impacts and concluded the project's water use would not likely have a cumulative impact on the surrounding area for the following reasons:

- Replacing the 13.6 acres of hops with 15.0 acres of cannabis would reduce the average annual irrigation demand from 57.6 acre-feet to 38.9 acre-feet because the irrigation demand of hops is almost double compared to the irrigation demand of cannabis;
- The cannabis demand is only 1.8% of the usable storage capacity in the BVGB; and
- There is sufficient recharge over the project's recharge area to meet the project's demand during average and dry years.

GROUNDWATER USE AND TRENDS IN BVGB

Review of Google Earth Imagery shows extensive agricultural development, in the form of walnut/pear orchards and vineyards, in the BVGB since at least 1985. Existing orchards and vineyards established prior to 2003 should have been included as part of the groundwater irrigation demand in the Lake County Groundwater Management Plan, however, this does not appear to be the case. According to the Lake County Water Demand Forecast, the average annual water demand for vineyards and walnut/pear orchards in Lake County is 0.5 acre-feet per acre and 2.2 acre-feet per acre, respectively. Using current Google Earth imagery, there are roughly 450 acres of existing vineyards and 150 acres of orchards in Burns Valley. Orchard production in the valley has decreased over time. Accounting for existing vineyards and orchards, the approximate agricultural demand in the valley is about 555 acre-feet per year which is supplied via existing groundwater wells. The 2006 Lake County Groundwater Management Plan stated that the agricultural demand in the BVGB during an average year is 105 acre-feet, with 14 acre-feet of this supplied from groundwater, which appears to be an underestimate of the existing groundwater agricultural demand. The estimate of existing agricultural demand of 555 acre-feet per year is likely a high estimate because most of the orchards and some of the vineyards are likely being dry farmed.

The northern residential district of the City of Clearlake relies on groundwater wells as the main source of water. The Highlands Mutual Water Company supplies the majority of residents in the lower part of the BVGB (Figure 8). According to the Lake County Agency Formation Commission 2021 Report on Clearlake Water Providers ([ClearlakeH2O MSR-SOI 2021EDIT-2. cl docx \(lakelafco.org\)](#)), the Highlands Mutual



Water Company serves 6,072 people with water via 2,568 services connections using water drawn from Clear Lake. Approximately 120 residential parcels are not served by HMWC and are assumed to rely on groundwater wells. According to the Environmental Protection Agency (EPA, <https://www.epa.gov/watersense/how-we-use-water>), the average American family uses 300 gallons of water per day, which equates to an annual demand of 40 acre-feet per year for 120 residences.

The main sources of groundwater in the BVGB are within the *Quaternary Alluvium Formation* and the *Lower Lake Formation*. The *Quaternary Alluvium* dominates the southwestern portion of the BVGB, where both residential development and well development are most dense (Figure 1 and Figure 2). The alluvium has a thickness of up to 50 feet; groundwater in this formation is unconfined and typically provides water for domestic use. Wells screened in unconfined aquifers are more directly influenced by lack of rain than those screened in deeper, confined aquifers. The *Lower Lake Formation* underlies the alluvial deposits in the BVGB. This formation has low permeability and provides water to wells at up to a few hundred gallons per minute and is the dominant source of agricultural water demand in the BVGB. Note that the existing vineyards and the existing and proposed cannabis projects are located outside of the alluvial valley in the upper half of the BVGB (Figure 1).

Fortunately, there is a California Statewide Groundwater Elevation Monitoring (CASGEM) Program well located within the BVGB that has been used to monitor long-term groundwater trends (CASGEM well ID: 39925, Lat/Long: 38.96535, -122.63186, Figure 3) for over 50 years. The CASGEM well is drilled 177 feet below ground surface (bgs) into the deeper *Lower Lake Formation*. Groundwater levels in the CASGEM well are measured twice annually, approximately every April and November, to visualize the fall drawdown (November) and spring recharge (April). In general, since 1952, there appears to be an increasing trend in groundwater levels in the BVGB (Figure 4). However, a vertical shift is apparent and occurs in about 1980. Since it is unknown if this is a natural shift in the data or a shift due to change in measurement, data prior to 1980 was removed. Since 1980, the data indicate that the long-term groundwater trend has been relatively stable (Figure 5), with consistent recharge during each annual wet season, even during years with low annual precipitation and accounting for the existing and historical agricultural demand.

The appellant has indicated that many of the wells in the BVGB have been adversely impacted by development, the vineyards, and other cannabis projects. No information was provided by the appellant regarding the impacted wells. However, during the September 20, 2022 City of Clearlake City Council Meeting, multiple residents of the City spoke up regarding groundwater well issues (e.g., low well production) and stated well depths less than 100 feet and likely in the shallow alluvial aquifer located in the central portion of the BVGB. Verbal correspondence with the City and Lake County have indicated anecdotal evidence of lower well production and possibly dry wells in the BVGB, however, without specific context and data, it is not possible to ascertain what is causing problems with individual wells, since there are many reasons why a well loses production. In addition, according to the Statewide Summary of Household Water Supply Shortage Reportage System reports (<https://mydrywell.water.ca.gov/report/publicpage>), no wells have been reported as going dry in the BVGB.

Well production loss in the Alluvium Formation is not surprising as Lake County has experienced a severe drought, with driest levels occurring fall of 2021. As stated above, wells screened in the shallower, unconfined aquifer, would be more directly influenced by the lack of rain and likely to lose production or go dry. There is also a likelihood that shallow groundwater in the southern portion of Burns Valley is hydrologically coupled to surface water levels in Clear Lake. As a result of the drought, surface water levels in the lake recorded in August through October of 2021 were the lowest on record since 2000, which could



have a direct impact on shallow groundwater well production (Figure 6). Additional monitoring and reporting within the *Quaternary Alluvium* are recommended and would be helpful in understanding shallow groundwater trends in the BVGB.

FUTURE GROUNDWATER USE AND SUPPLY

The potential cumulative effects of the project were addressed in the August 19, 2021 Ordinance 3106 Hydrology Report Technical Memorandum prepared for Lake Vista Farms. However, more detailed information is presented herein to further support the conclusions made in the original Technical Memorandum.

As discussed above, the current groundwater agricultural demand in the BVGB is roughly 555 acre-feet per year. Approximately 225 acre-feet is from existing vineyards in the upper portion of the BVGB and 330 acre-feet is from orchards located within the lower portion the BVGB. The current residential demand, located in the central portion of the BVGB, is approximately 40 acre-feet per year. A summary of proposed cannabis projects and the approximate annual water demand is provided in Table 1. All the proposed projects are located in the upper portion of the BVGB east of State Highway 53 (Figure 1).

Table 1. Approximate water demand of proposed cannabis projects within the BVGB (information obtained from the City of Clearlake and Lake County websites and CEQAnet Database). Refer to Figure 1 for approximate locations.

Location (jurisdiction)	APN(s)	Parcel Area (acres)	Cultivation (Acres)	Cultivation % of Parcel Area	Approximate Annual Water Demand (acre-feet)
1756 Ogulin Canyon Road (County) (Blue Oak Farms)	010-055-46	46.5	2.0	4.3	3.3
2050 Ogulin Canyon Road (County) (Lake Vista Farms)	010-053-01 & 02	302.4	15.0	5.0	24.9
2185 Ogulin Canyon Road (City)	010-044-17	21.3	0.5	2.3	1.8
2160 Ogulin Canyon Road (City)	010-044-21	9.6	0.2	2.1	1.7
2560 Highway 53 (City)	010-048-05	15.4	1.3	8.4	4.3
2250 Ogulin Canyon Road (City)	010-044-19	13.0	0.4	3.1	1.0
Total		408.2	19.4	n/a	37.0

Table 2: Base zones designations, total areas associated with each base zone designation, parcel count, and base zone eligibility for potential cannabis cultivation within the Burns Valley Groundwater Basin.

Zone	Description	Total Parcel Area (acres)*	# of Parcels
RL	Rural Lands	1105.9	18
RR	Rural Residential	677.3	18
Split	Combined Zoning (Dominant Zones are A and RL)	136.5	4
City	Cannabis District	242	23

*This is the total area of the parcel, not just the portion within the BVGB



To assess the potential for additional cannabis cultivation within the BVGB, not included in Table 1, a parcel inventory analysis was completed (Figure 7 and Table 2) to identify those parcels that meet requirements for potential cannabis cultivation with an approved permit from the Lake County or the City of Clearlake (City).

The Lake County Zoning Ordinance allows 1-acre of outdoor canopy for each 20 acres of parcel size for these zones. There are 40 parcels that are within or intersect the BVGB with a cumulative parcel area of about 1920 acres (total parcel area, not the intersected area, was used for conservativeness). Of these parcels, 10 parcels or 596 acres are existing vineyards and 2 parcels, or 349 acres have proposed cultivation shown in Table 1. Excluding these parcels, there are 28 parcels or 975 acres of base zoning that could be eligible for outdoor cultivation with a County permit. Thus, there is the potential for up to 48 acres of potentially new outdoor cultivation (the County allows only 1-acre of cultivation for each 20 acres of parcel area). However, accounting for existing development, steep topography, waterbody setbacks, flood zones, residential setbacks, and parcel setbacks, there is limited area for development and only approximately 10 to 20 acres of new outdoor cultivation would likely be possible. The increased irrigation demand could be up to approximately 33.1 acre-feet per year assuming 3,000 gallons per day per acre for 180 days. This does not account for the fact that the project at 2050 Ogulin Canyon Road is replacing a 13.6-acre hops farm that utilized approximately 43.6 acre-feet per year of water, creating a reduction in water use of 18.7 acre-feet per year.

The City of Clearlake Zoning Ordinance allows for mixed-light/indoor cultivation in the BVGB, with a City Cannabis Permit, on 23 parcels with a total area of 242 acres. Accounting for the proposed projects listed in Table 1, existing development, steep topography, waterbody setbacks, and flood zones, only approximately 18 to 20 acres of this area could have the potential for mixed-light/indoor cultivation. The increased irrigation demand could be up to approximately 55.2 acre-feet assuming 3,000 gallons per day per acre for 300 days.

The total potential demand from both the County and City for cannabis cultivation could be up to 125.3 acre-feet per year, which includes the proposed projects listed in Table 1 and a conservative (high) estimate of total potential cultivation.

Thus, the total potential agricultural demand within the BVGB is existing, 555 acre-feet, plus proposed, 125.3 acre-feet, is approximately 680.3 acre-feet per year, with residential demand, the total groundwater demand is approximately 720.3 acre-feet per year. The dominant demand in the BVGB is associated with residential development and orchards in the lower part of BVGB and vineyards in the upper part of the BVGB.

The estimated storage capacity of the BVGB is 4,000 AF, with a usable storage capacity of 1,400 AF. The total potential demand is 51% of the usable storage capacity. According to DWR, groundwater in the BVGB is derived from rain that falls within the 12.5 square mile Burns Valley Watershed drainage area. Recharge estimates provided in Hydrology Reports for 1756 Ogulin Canyon Road, 2160 Ogulin Canyon Road, 2185 Ogulin Canyon Road, and Lake Vista Farms demonstrated that there is sufficient recharge over each project's contributing recharge area (a small fraction of the entire Burns Valley Watershed area) to meet each project's demand during both average and dry years. Overall, the proposed projects in Table 1 represent 2.6% of the usable storage capacity in the BVGB and only 5.1% of the existing demand in the BVGB.



SUMMARY AND DISCUSSION

- A Hydrology Technical Memorandum was prepared for Lake Vista Farms on August 19, 2021 and submitted to the Lake County Planning Commission that addressed groundwater recharge and cumulative impacts and concluded that not only is there sufficient recharge and supply to meet the project's demand during average and dry years, the project would use less water than the prior agricultural activities on the property, and therefore would not likely have a cumulative impact on the surrounding area.
- The existing demand associated with vineyards and orchards is likely higher than reported in the 2006 Lake County Groundwater Management Plan. The higher estimate has been incorporated herein, along with estimated residential demand.
- The main sources of groundwater in the BVGB are within the *Quaternary Alluvium Formation* and the *Lower Lake Formation*. The *Quaternary Alluvium* dominates the southwestern portion of the BVGB, where both residential development and well development are most dense. The alluvium has a thickness of up to 50 feet; groundwater in this formation is unconfined and typically provides water for domestic use. Wells screened in unconfined aquifers are more directly influenced by lack of rain than those screened in deeper, confined aquifers.
- The *Lower Lake Formation* underlies the alluvial deposits in the BVGB. This formation has low permeability and provides water to wells at up to a few hundred gallons per minute and is the dominant source of agricultural water demand in the BVGB.
- Groundwater storage capacity is estimated to be 4,000 acre-feet based on an area of 1,000 acres, a saturated thickness of 50 feet, and a specific yield of 8 percent, which represents only the *Alluvium Formation* and does not account for groundwater storage capacity in the deeper *Lower Lake Formation*. Thus, the usable storage capacity is most likely an underestimate of the overall capacity of the BVGB, which has a surface area of 2,900 acres.
- Long-term groundwater monitoring in the BVGB shows a stable trend in groundwater levels within the deeper formation, with consistent recharge during each annual wet season, even during years with low annual precipitation and accounting for the existing vineyard and orchard demand that has occurred over this time.
- Although there has been anecdotal evidence of wells going dry in the BVGB, no information regarding these wells was provided so that they could be adequately assessed. These wells are located in the shallower alluvium formation and are more directly influenced by lack of rain and the low water levels in Clear Lake. No wells within the BVGB were reported to the State Water Supply Shortage Reporting System. Additional monitoring and reporting within the *Quaternary Alluvium* are recommended and would be helpful in understanding shallow groundwater trends in the basin.
- The existing vineyards and the existing and proposed cannabis projects are located outside of the alluvial valley in the upper half of the BVGB.
- The dominant demand in the BVGB is associated with residential development and orchards in the lower part of BVGB and vineyards in the upper part of the BVGB. The Highlands Mutual Water Company supplies the majority of residents in the lower part of the BVGB using surface water drawn from Clear Lake. The total groundwater demand, accounting for existing agriculture, residential use, and potential cannabis projects, is approximately 720.3 acre-feet per year. The estimated storage capacity of the BVGB is 4,000 AF, with a usable storage capacity of 1,400 AF. The total potential future agricultural demand is 51% of the usable storage capacity. Thus, there is sufficient storage capacity to meet existing and proposed demand.



- Recharge estimates provided in the Hydrology Reports for 1756 Ogulin Canyon Road (Blue Oak Farms), 2050 Ogulin Canyon Road (Lake Vista Farms), 2160 Ogulin Canyon Road, and 2185 Ogulin Canyon Road, demonstrated that there is sufficient recharge over each project's contributing recharge area (a small fraction of the entire Burns Valley Watershed area) to meet each project's demands during both average and dry years.
- Overall, the proposed projects in Table 1 represent 2.6% of the usable storage capacity in the BVGB and only 6.7% of the existing demand for irrigation of existing vineyards and orchards.
- The demand associated with Lake Vista Farms represents only a fraction, 1.8% of the usable storage capacity of the BVGB, 3.5% of the total potential future demand in the BVGB, the total demand associated with the proposed projects listed in Table 1 is only 2.6% of the usable storage capacity of the BVGB and 5.1% of the potential future demand in the BVGB. Thus, it is unlikely that these projects, in combination with the 2185 Ogulin Canyon Road project, will adversely impact wells in the lower portion of the BVGB.

ATTACHMENTS

- Figure 1. Local geology (source: <https://pubs.usgs.gov/imap/2362/>), cultivation well locations, and CASGEM well location. QTc = Clear Lake Cache Formation, 'tb' = nonmarine terrace deposits, and 'al' = alluvium.
- Figure 2. Map of # (n) of Well Completion Reports (WCRs) with in each Public Land Survey System (PLSS) grid along with average well depth. The Burns Valley Groundwater Basin is outlined in red. Parcel coloring is provided in Figure 7.
- Figure 3. CASGEM Monitoring well location.
- Figure 4. CASGEM Monitoring Well data from 1952 to 2020.
- Figure 5. CASGEM Monitoring Well data from 1980 to 2020.
- Figure 6. Clear Lake stage height 2000 through 2021.
- Figure 7. City of Clearlake Cannabis District and Lake County parcel base zoning designations.
- Figure 8. Water Systems within the City of Clearlake Boundary (Source: [ClearlakeH2O MSR-SOI 2021EDIT-2. cl docx \(lakelafco.org\)](#))

QUALIFICATIONS OF AUTHOR

I have a PhD in Water Resources Engineering. In addition, I am a registered Professional Engineer with the State of California with 30-years of experience practicing and teaching Water Resources Engineering, including over 15 years of teaching, practicing, and modeling surface and groundwater hydrology.

LIMITATIONS

The study of groundwater hydrology is very complex and often relies on limited data, especially in rural areas. Recommendations and conclusions provided herein are based on professional judgment made using information of the groundwater systems and geology in Lake County, which is limited and allows only for a general assessment of groundwater aquifer conditions and recharge. NorthPoint Consulting Group, Inc. is making analyses, recommendations, and conclusions based on readily available data, including studies and reports conducted by other professionals, Lake County, the State of California, and other consultants hired by the project proponent to prepare technical studies for the proposed project. If additional information or data becomes available for the project area, the recommendations and conclusions presented herein may be subject to change.



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FIGURES



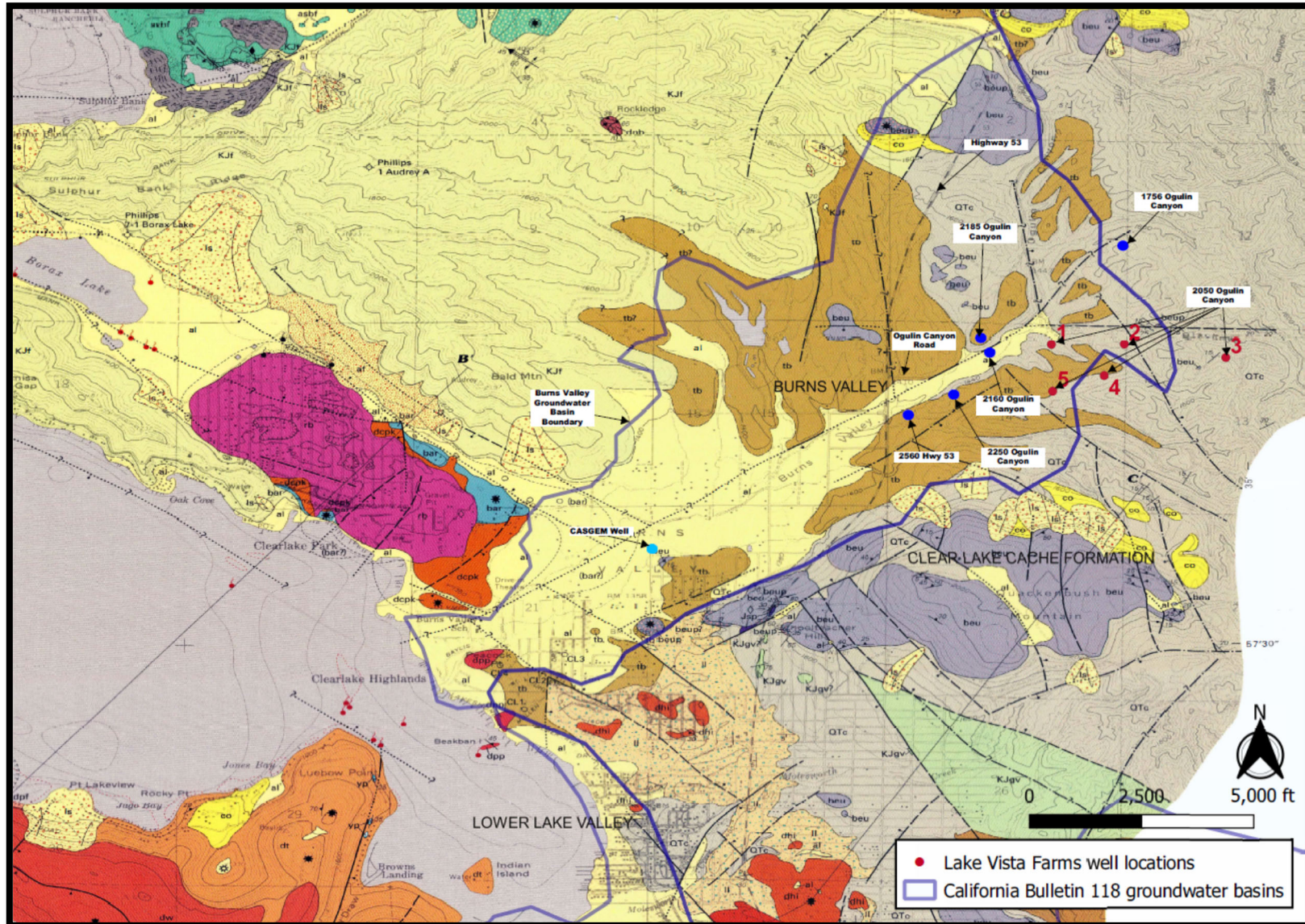


Figure 1. Burns Valley Groundwater Basin local geology (source: <https://pubs.usgs.gov/imap/2362/>), cultivation well locations, and CASGEM well location. QTc = Clear Lake Cache Formation, 'tb' = nonmarine terrace deposits, and 'al' = alluvium.

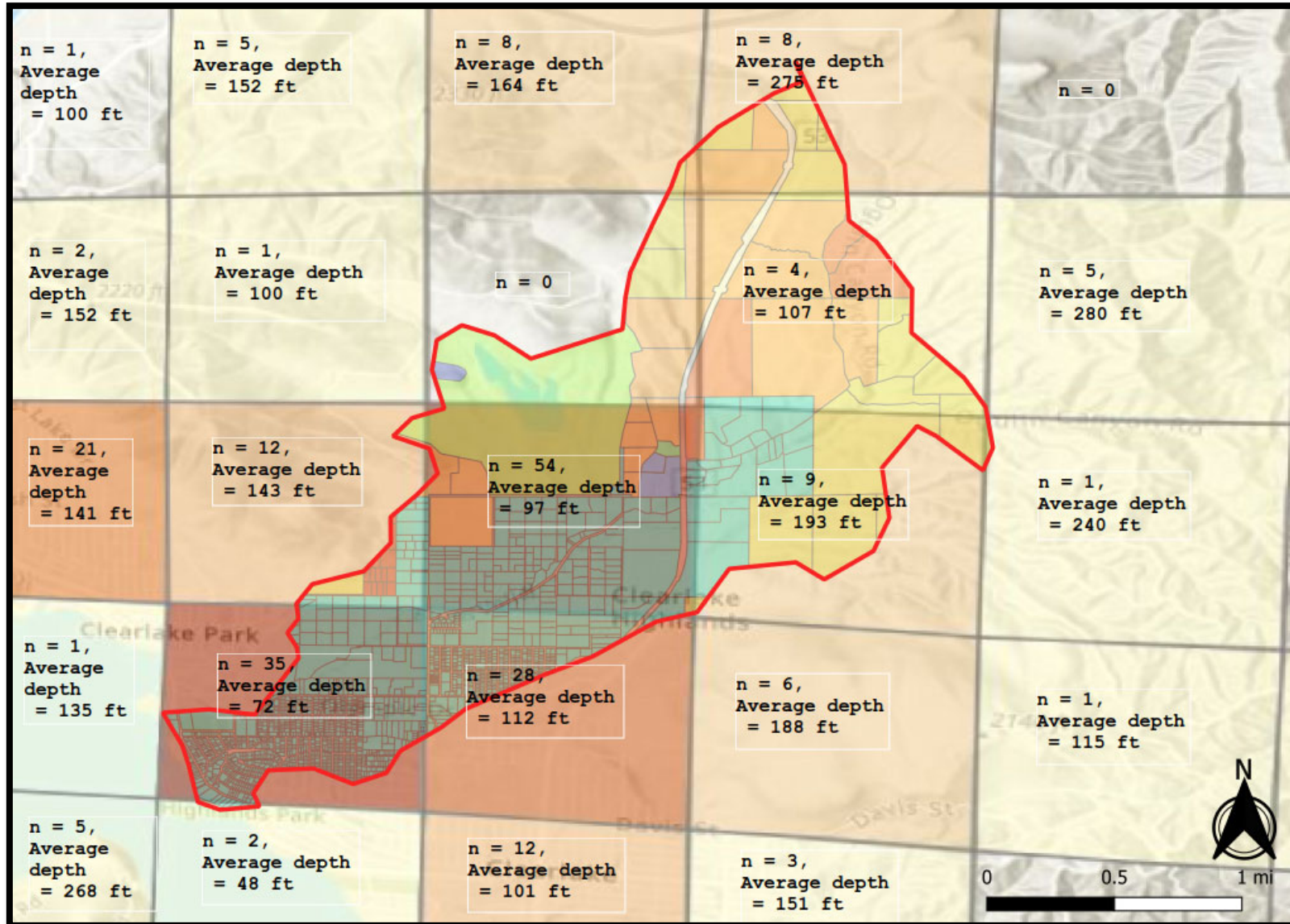


Figure 2. Map of # (n) of Well Completion Reports (WCRs) within each Public Land Survey System (PLSS) grid along with average well depth. The Burns Valley Groundwater Basin is outlined in red. Parcel coloring is provided in Figure 7.

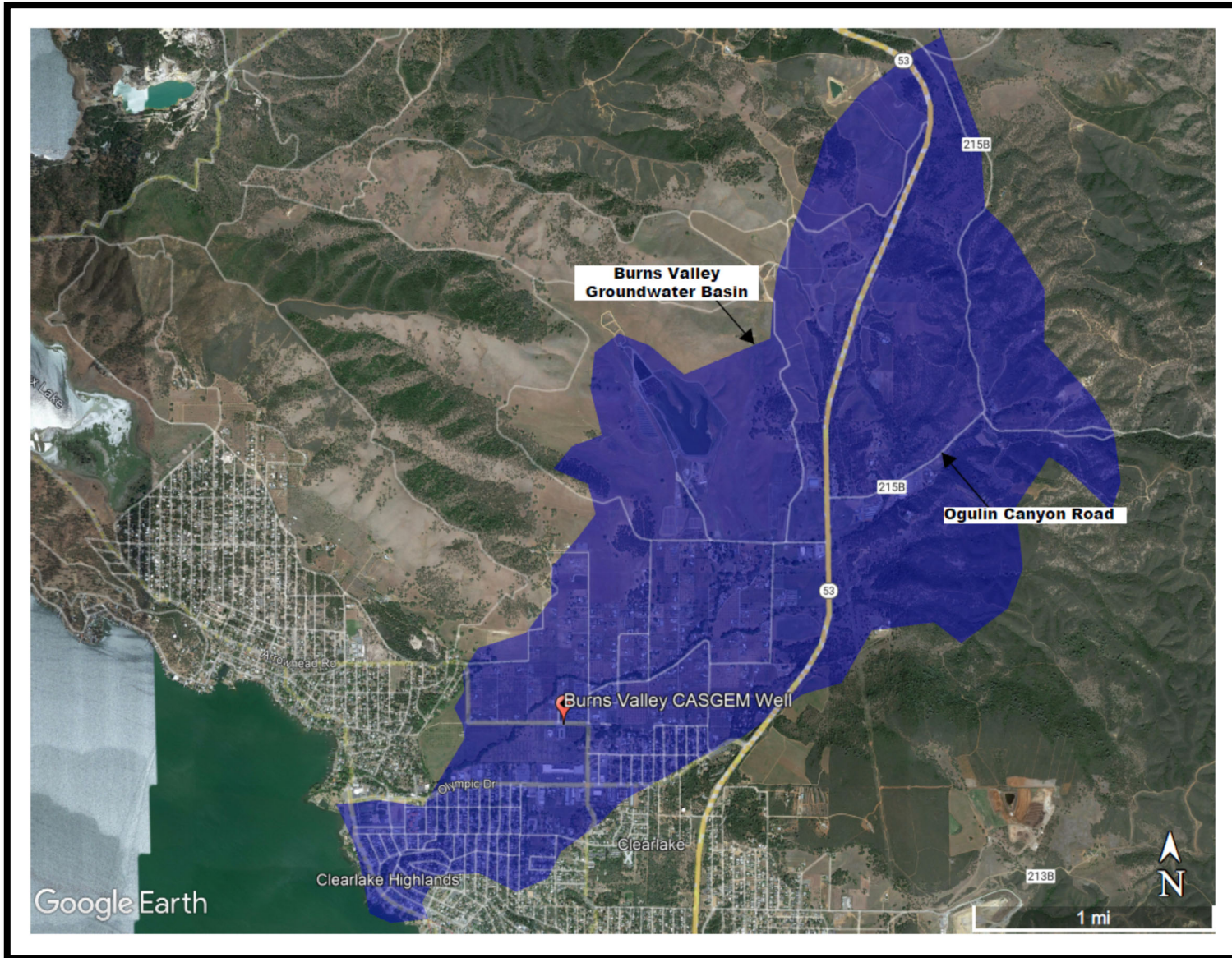


Figure 3. CASGEM Monitoring well location.

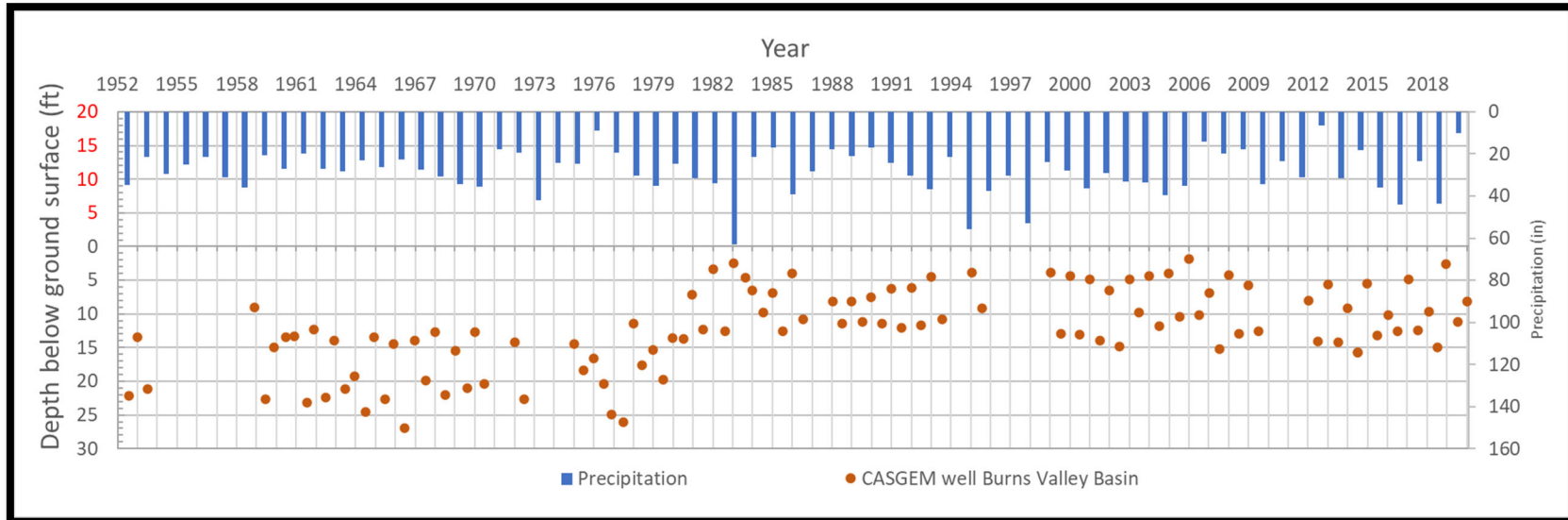


Figure 4. CASGEM Monitoring Well data from 1952 to 2020.

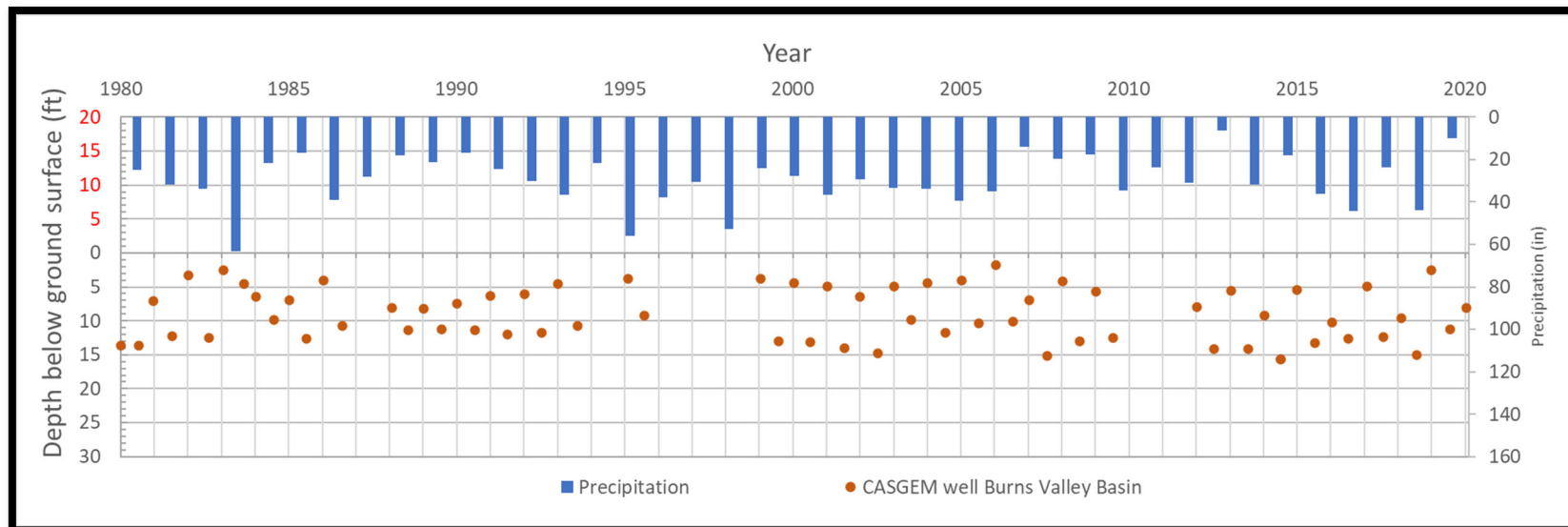


Figure 5. CASGEM Monitoring Well data from 1980 to 2020.

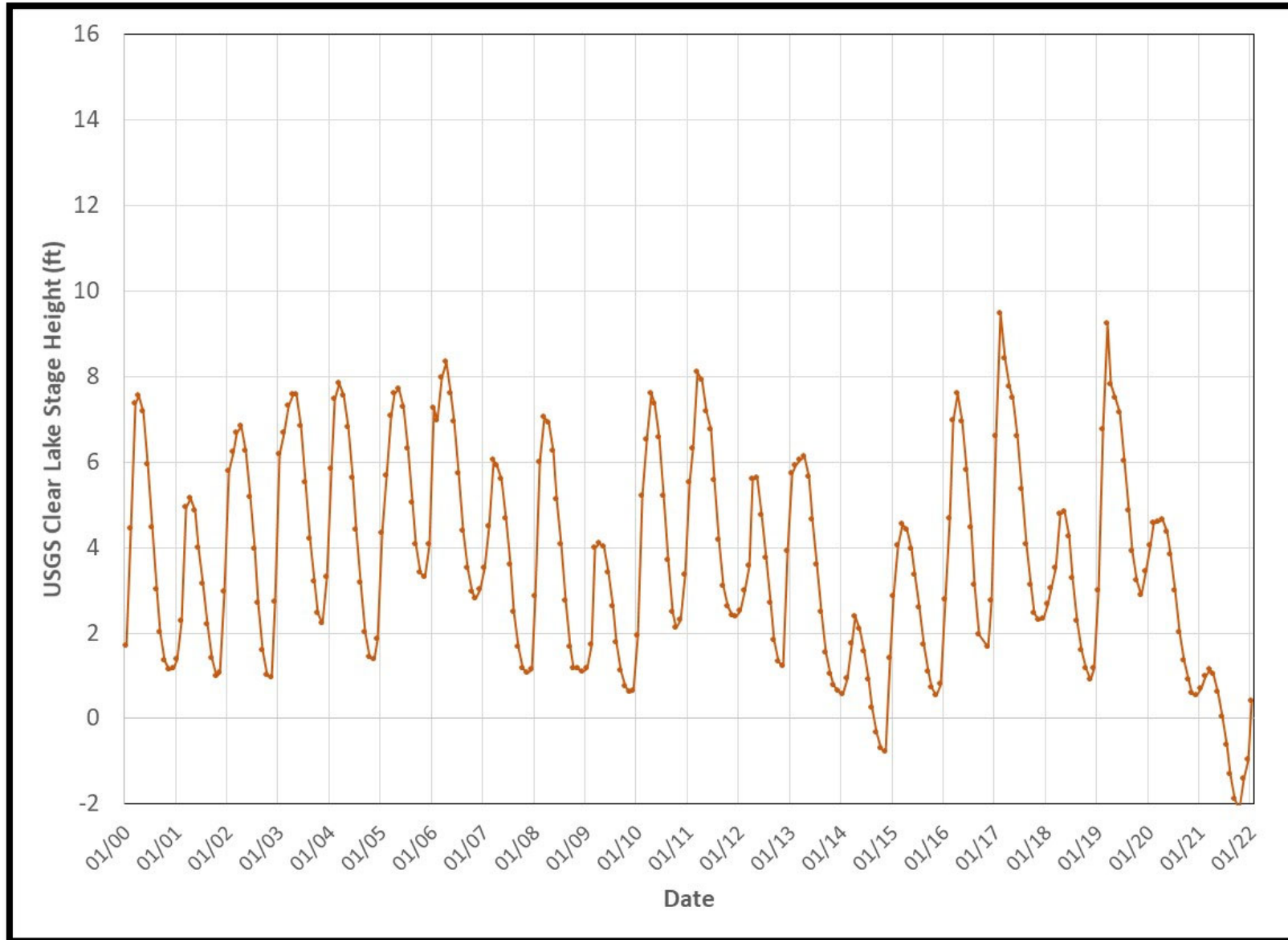


Figure 6. Clear Lake stage height 2000 through 2021.

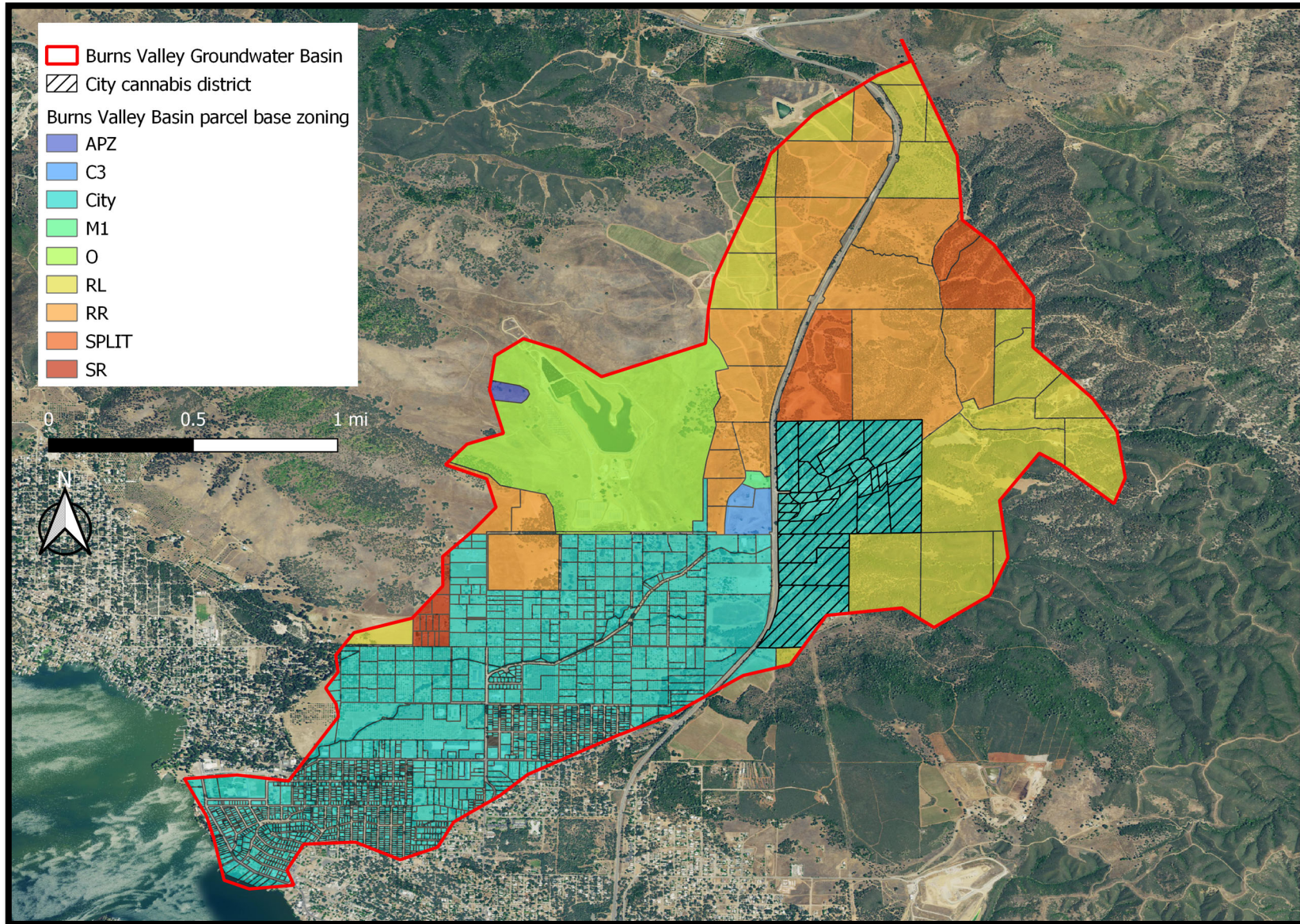


Figure 7. City of Clearlake Cannabis District and Lake County parcel base zoning designations.

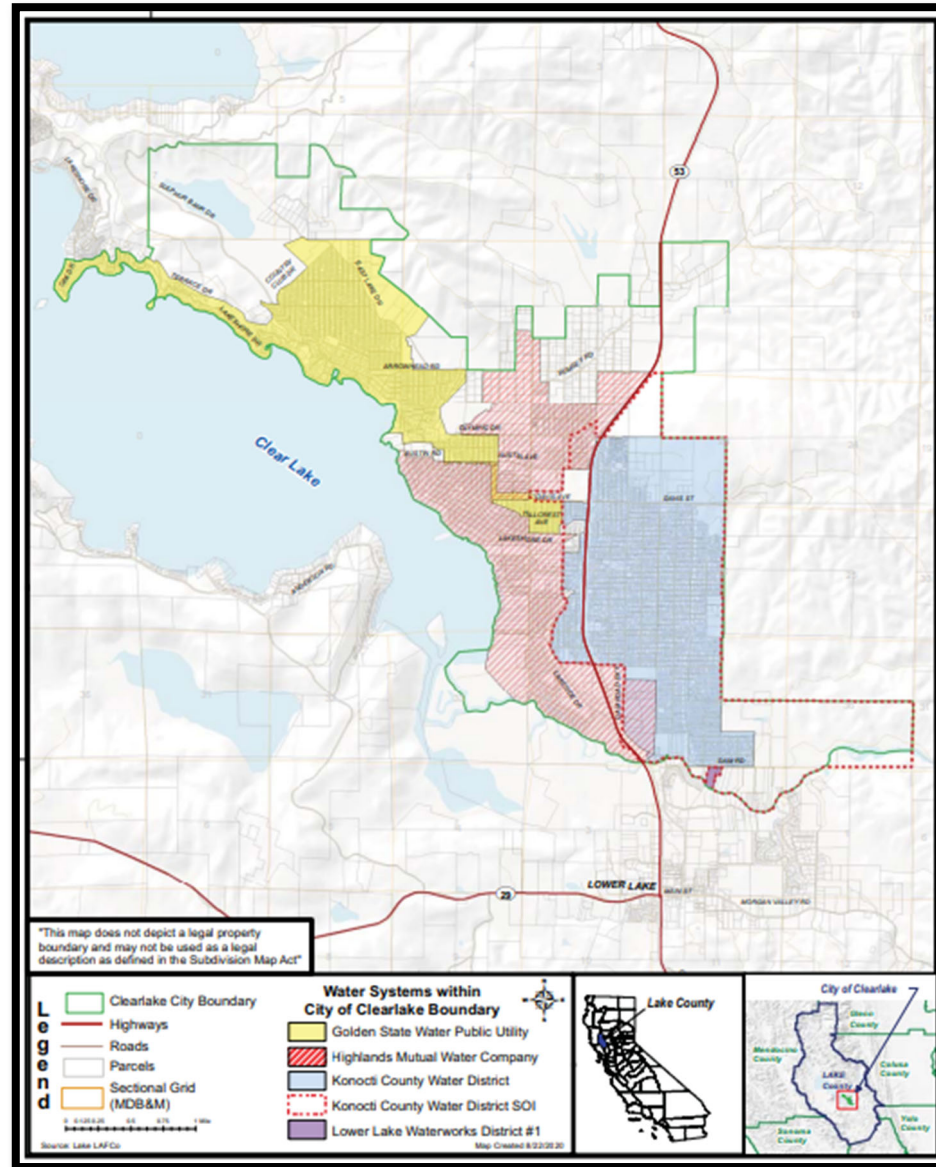


Figure 8. Water Systems within the City of Clearlake Boundary (Source: [ClearlakeH2O MSR-SOI 2021EDIT-2. cl docx \(lakelafco.org\)](#))